Product Manual Change Summary

Manual Type		HJ241
Part Number		89241
Revision	R2	30/11/03
Amendment	A47	11/09/14

- Refer to ECN 23256 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.

HamiltonJet

www.hamiltonjet.co.nz

Installation and Service Manual

HJ241

Jet Unit Manual

R2A47

Manual Type		HJ241
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Contents

Appendix

Drawings

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

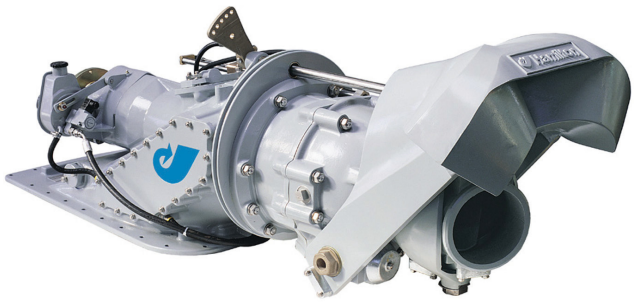
- Introduction and Product Description
- System Operation

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, unrivalled 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 nozzle 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 by a thrust bearing inside a bearing housing attached to 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 water seal which prevents water from entering the vessel and bearing housing.

Coupling

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 component 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 type 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 units 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.

Overflow preventer or hatch extension (optional)

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.

Dry run kit (optional extra on HJ212-HJ362 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.

Note: This image is a pictorial illustration of where the various components are located on the HJ-241 jet unit and is for illustration purposes only.

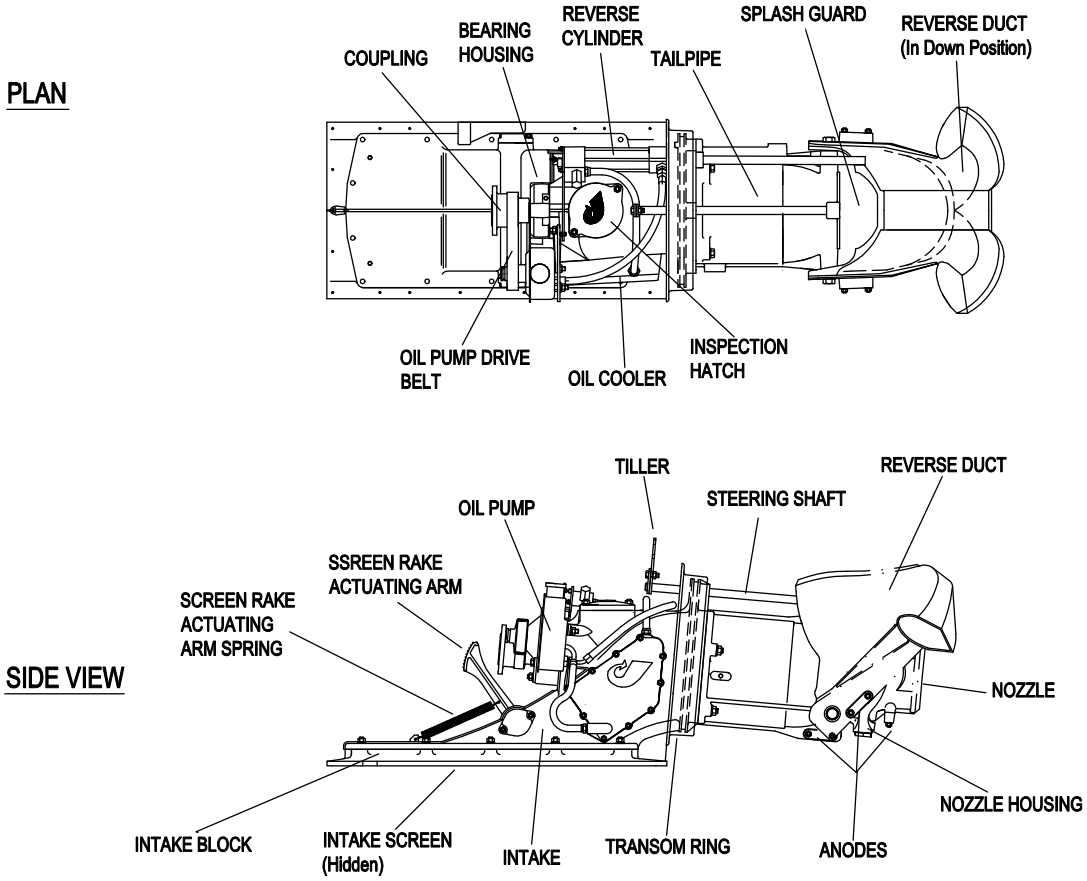


Figure 1: HJ-241 Jet Unit General Arrangement

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.

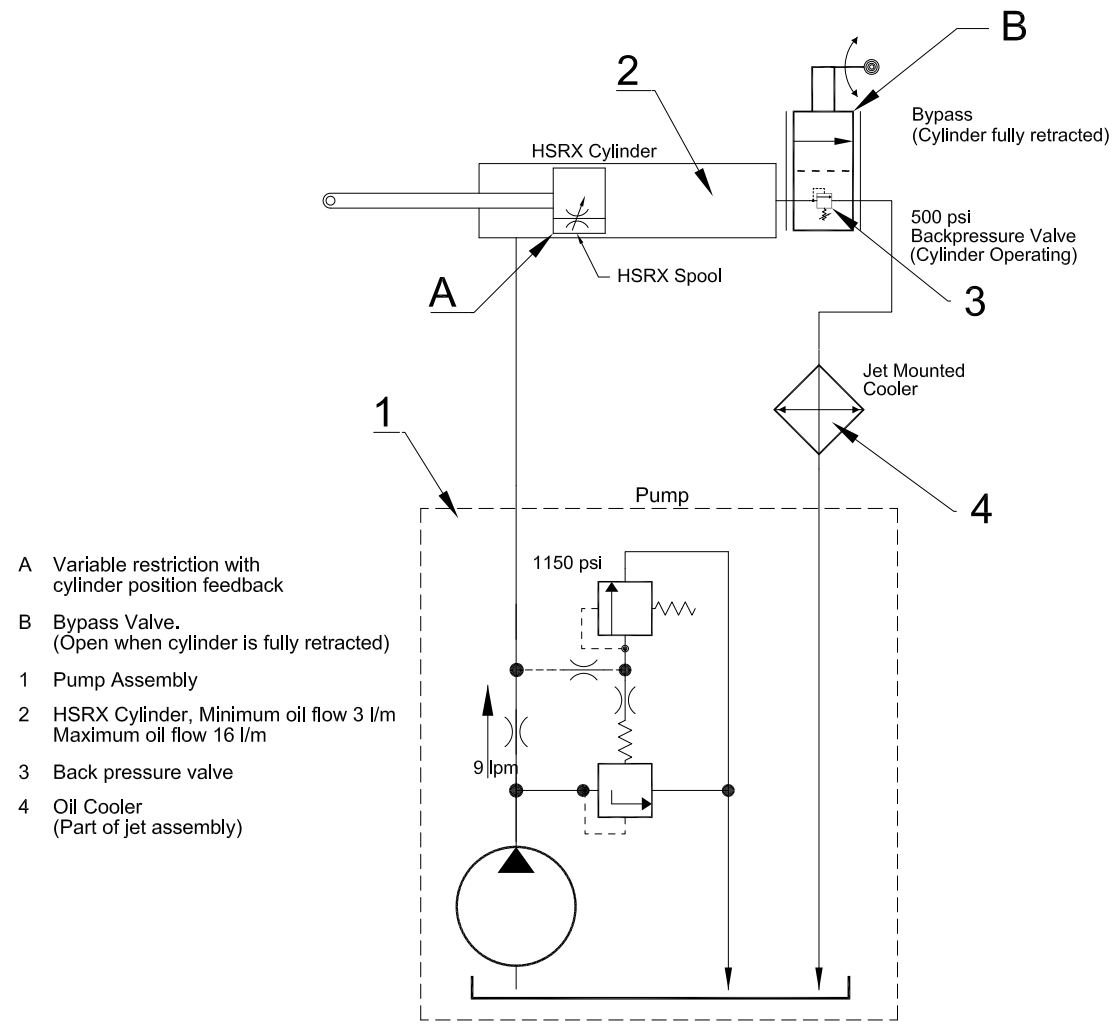


Figure 2: Basic Hydraulic Circuit Diagram

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: If the jet unit is fitted 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 jetstream. If the reverse duct is lowered fully, all of the jetstream is redirected back under the vessel giving "full astern thrust". If the reverse duct is lowered partially the jetstream 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 a jet of water to port or starboard causing the vessel to steer to port or starboard respectively.

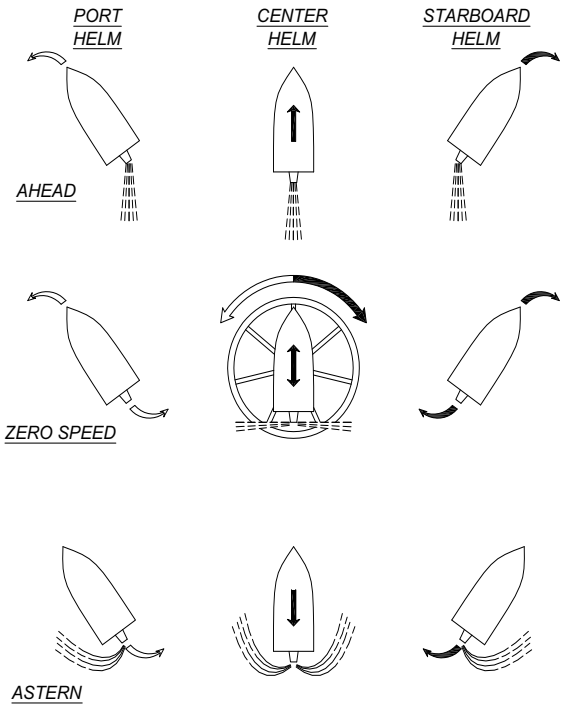


Figure 3: Steering Operation

The following points should be remembered when operating a waterjet steered 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

In the case of a complete failure of the helm wheel or the cable parts of the steering system, the jet may be steered by manually moving the jet tiller:

1. Disconnect the cable from the steering arm.
2. Move the steering arm by hand as required to move the steering nozzle. steering may only be possible at low RPM, unless an emergency steering arm extension is used (not included in CWF Hamilton standard supply).

Emergency manual reverse duct control

The reverse duct can be raised manually and is only necessary if the hydraulic pump has failed.

To raise the reverse duct:

1. Attach a rope to the reverse duct.
2. Take the weight of the reverse duct.
3. Lift the reverse duct and tie off the rope so that the reverse duct is in the raised position and 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 and docking

1. With a single jet unit. The vessel can be partially manoeuvred by raising the reverse duct using a rope and lowering the reverse duct under its own weight. The engine must be kept at idle.
2. With multiple jet units. Shut down the engine that is driving the jet with the faulty reverse system and manoeuvre using the other jet(s).

2.4 Manoeuvring 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 1,200 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 manoeuvering is best carried out using the helm with one hand and both reverse levers with the other hand. ONE AHEAD and ONE ASTERN is NOT AS EFFECTIVE.
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 position.

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.

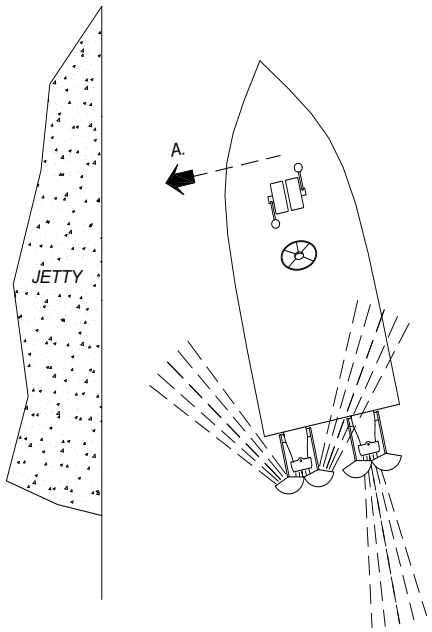


Figure 4: Moving to Port

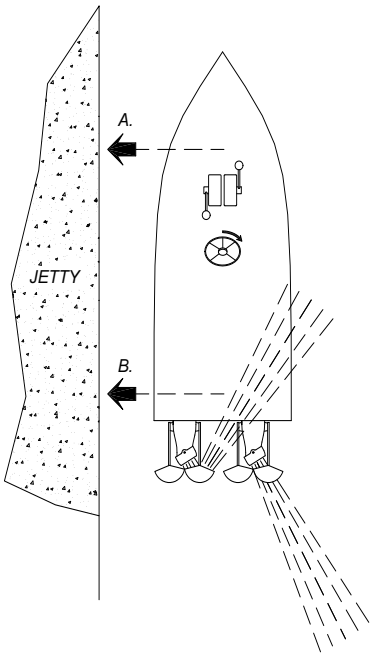


Figure 5: Docking

Docking.
Use the above 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 will give the best results.

1. Set the 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 above, 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: - Ahead position (centred).
   - Throttle: - Idle.
   - Reverse: - Zero speed.

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.

2.5 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. Before accelerating to full speed, all jet units should be cleared of debris. ***Refer to Section*** 2.9 Blockages (Debris in the Jet Unit).
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. ***Section*** 2.9 Blockages (Debris in the Jet Unit) ***refers.***
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 stones, sand etc. through the jet unit as this will blunt and wear the impeller. The following diagrams illustrate good and bad practice:

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

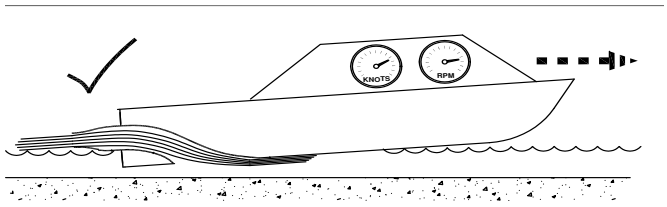


Figure 6: High Speed Planing in Shallow Water

2. At slow displacement speed avoid using high RPM in shallow water.

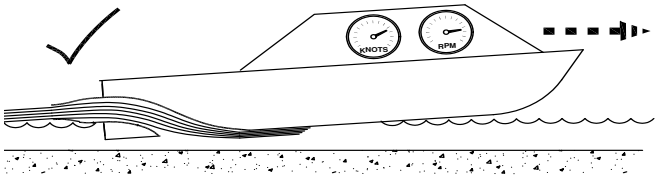


Figure 7: Shallow Water Operation Slow Speed

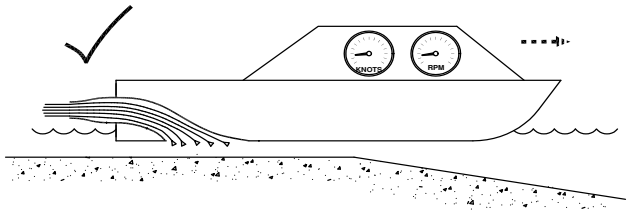


Figure 8: Shallow Water Operation Idle

3. 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 screen.

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 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 ***Item 1***.

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. (e.g. fast flowing rapids or surf) **The following points should be noted:**

1. There may be a loss in thrust due to the jet 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. The operator must be prepared to lose control temporarily in these conditions and should allow margins of safety.

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 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 is moored so it is best to clear the screen in open or clear waters.

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

1. The engine unloading (RPM increases).
2. Lack of jet thrust (vessel speed drops).
3. Excessive 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 if the vessel is still moving forward at speed.
2. BACKFLUSH the blocked jet unit (only possible if a reversible gearbox is used) as shown 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 housing 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 lip of the intake inspection cover.

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

3.Alternatively, an optional extra hatch extension can be fitted to the inspection cover to allow inspection of the intake housing at higher water levels. Refer to Drawing HJ-241-10-004 Hatch Extension.

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 preventer 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 Drawings HJ-241-10-004 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 150 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 (When Fitted)

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 if the jet unit is fitted with an 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 bypass 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 CT-CLV-01-003 Reverse Controller which is included with the Drawings Package.

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 and C.W.F. Hamilton & Co. Ltd 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 9: Loads on the Hull for HJ-241 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).

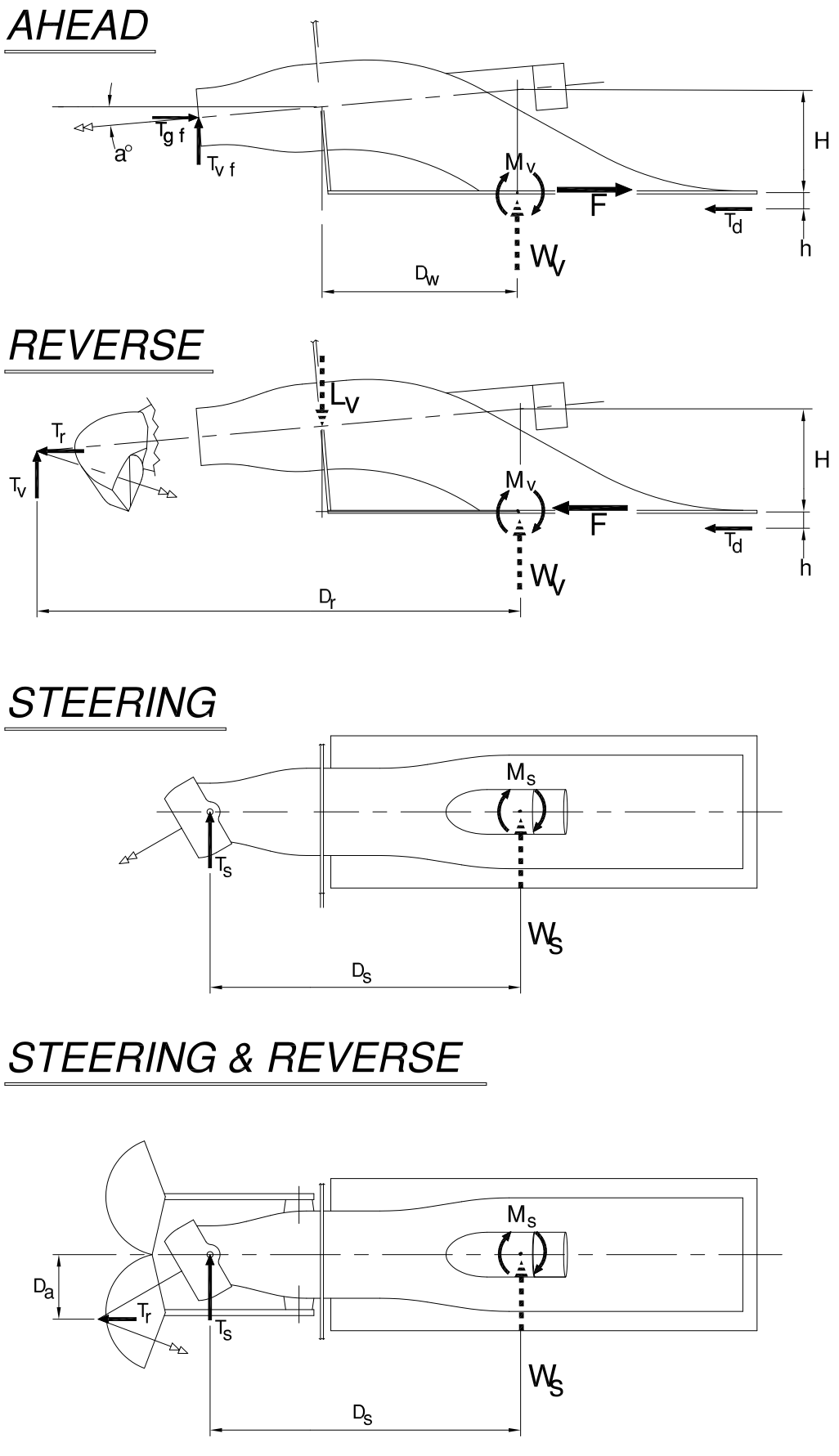


Figure 9: Loads on the Hull for HJ-241 Jet Unit

Table 1: Table of Dimensions for HJ-241 Jet Unit

HJ-241 Jet - Relevant Data			
Description	**Symbol**	**Units**	**Value**
Maximum power	P	Kw	260
Centreline height	H	m	0.284
Mean inlet depth	h	m	0.04
Steering to base centre	D_s	m	0.92
Reverse to base centre	D_r	m	1.25
Transom to base centre	D_w	m	0.415
Centre to reverse arm	D_a	m	0.15
Waterjet angle	a	degrees	5°

Table 2: Table of Hull Reaction Forces for HJ-241 Jet Unit

Hull Reaction Forces - HJ-241 Jet				
Description	**Symbol**	**Units**	**Ahead / steering**	**Reverse**
Axial load in hull bottom	F	kN	9.1	-13.46
Vertical load in base	Wv	kN	1.51	4.51
Side load in base	Ws	kN	7.80	6.37
Vertical moment	M	kN_m	5.39	4.73
Steering moment	Ms	kN_m	7.18	8.84

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) Planning strakes, keelsons, "plank keels" and any other appendage causing turbulent flow into the jet unit(s) must be removed from in front of and closer to the keel than the jet unit intakes. Recommended strakes are shown in the following diagram.

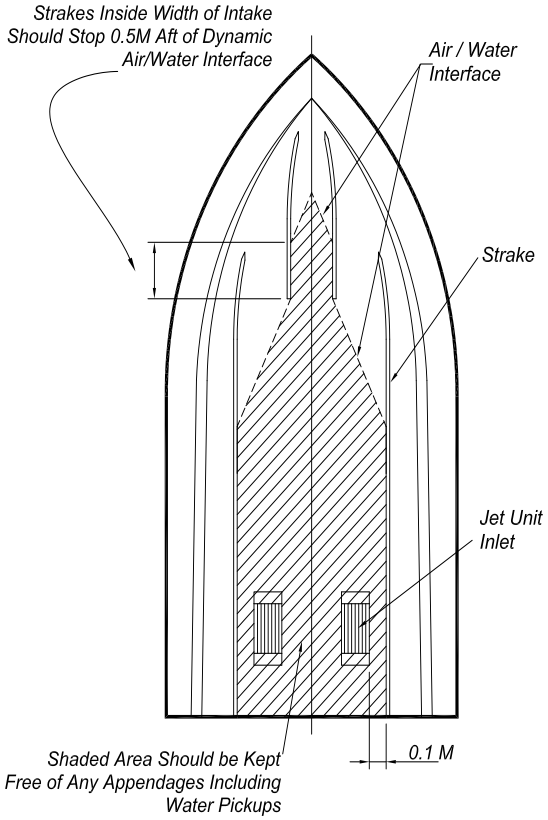


Figure 10: Mono Hull Design Recommendations

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. These do not increase draft or interfere with water flow into the jet intake.
4. Immersion. The jet must be immersed with the water line at least up to the underside of the mainshaft (at the impeller) in order to prime (pump water) when the engine is started.
5. Minimum distances between jets for multiple installations. ***Refer to*** Figure 11: Installation for Multiple Jets.
   a) For dimensions A and B shown in Figure 11: Installation for Multiple Jets for twin and triple jet installations, refer to the installations drawings shown in ***Section*** Section 5 Installation" of this manual.
   b) For applications using more than three Jets, consult C.W.F. Hamilton & Co Ltd for recommended distances between jets.

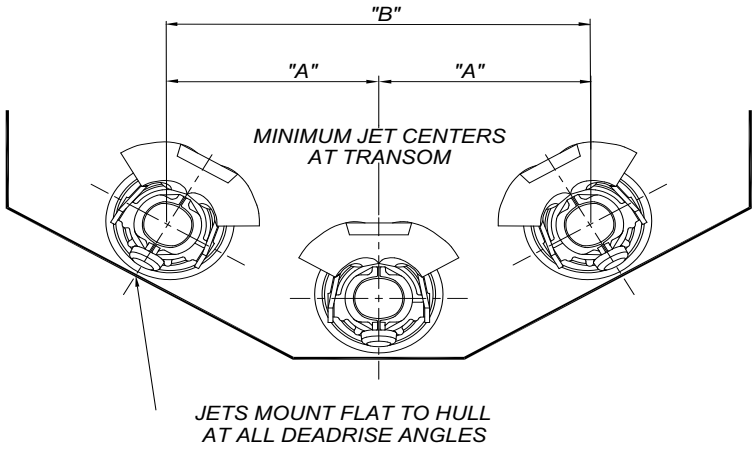


Figure 11: Installation for Multiple Jets

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 units sit well down in the water, as indicated in Figure 12: Hull Design Recommendations for Multi Hull Vessel below. 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 & Co. Ltd in all cases if jet units are proposed in these types of hull.

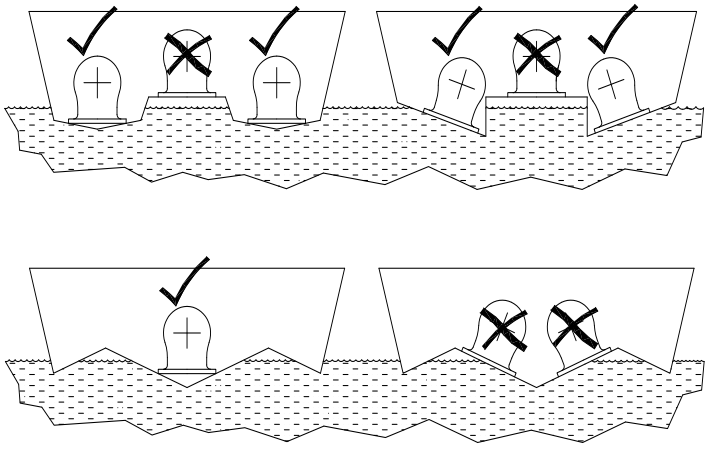


Figure 12: Hull Design Recommendations for Multi Hull Vessel

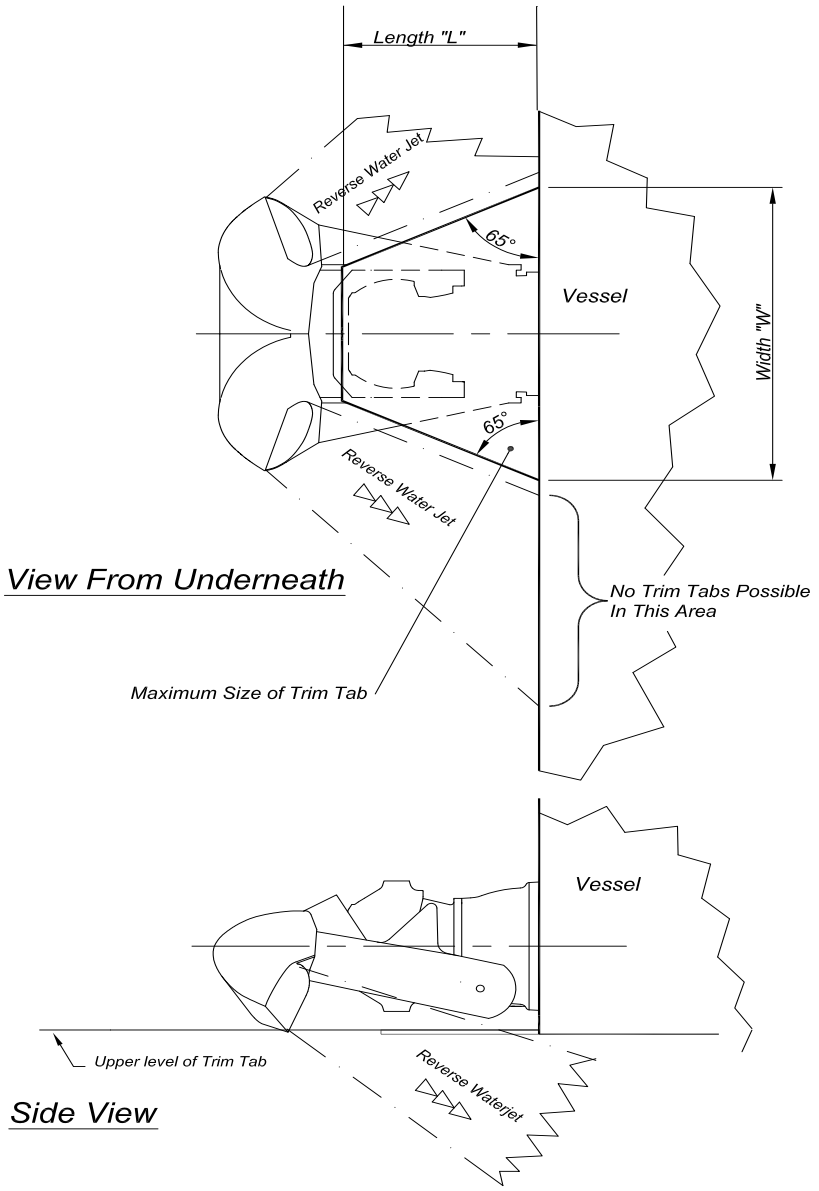
3.2.4 Trim Tabs

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

Trim tabs cannot be mounted directly alongside the jet unit, as when moving astern, the reverse waterjet will hit them and reduce reverse thrust.

It is possible to mount trim tabs under the jet unit with 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 C.W.F Hamilton & Co Ltd 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 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 13: 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 Requirement 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 the driveline supplier. Engine to Jet alignment: Consult C.W.F. Hamilton & Co. Ltd.
3. 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).

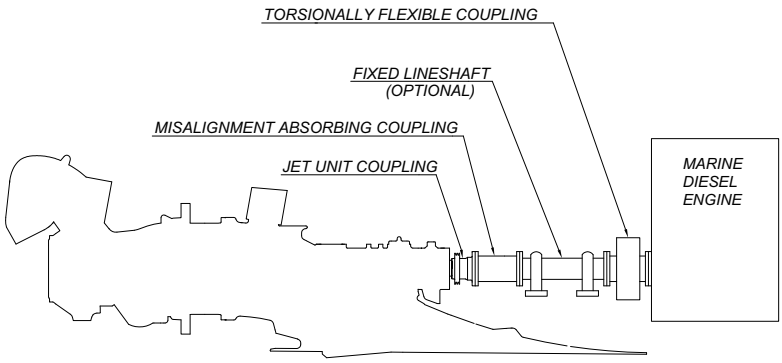


Figure 14: Drive Line Component Description

3.3.3 Drive Shaft Options

The diagrams Figure 15: Double Universal Slip jointed Driveshaft ***and*** Figure 16: Torsionally Flexible Flywheel Coupling show two common driveline components and their arrangements. 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***).***

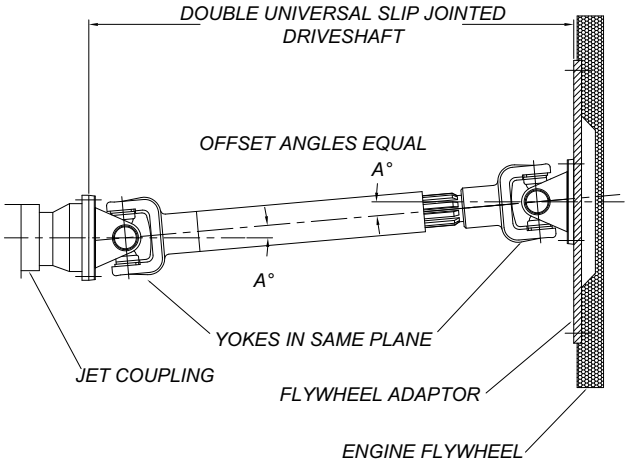


Figure 15: Double Universal Slip jointed Driveshaft

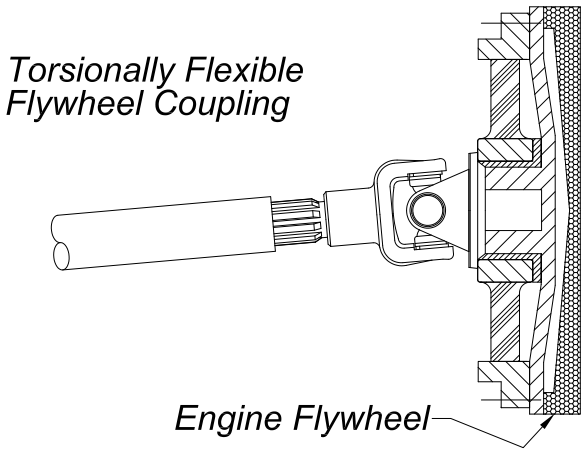


Figure 16: Torsionally Flexible Flywheel Coupling

Torsionally flexible coupling (TFC):

The torsional vibration analysis will determine how many TFC's 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 element 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 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**.**

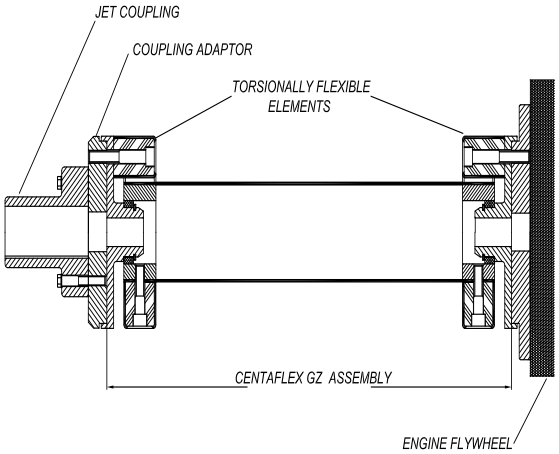


Figure 17: Double Element Torsionally Flexible Coupling

Double element non torsionally flexible couplings:

An example of such a coupling is "Centalink".

Gear couplings:

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 18: 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.

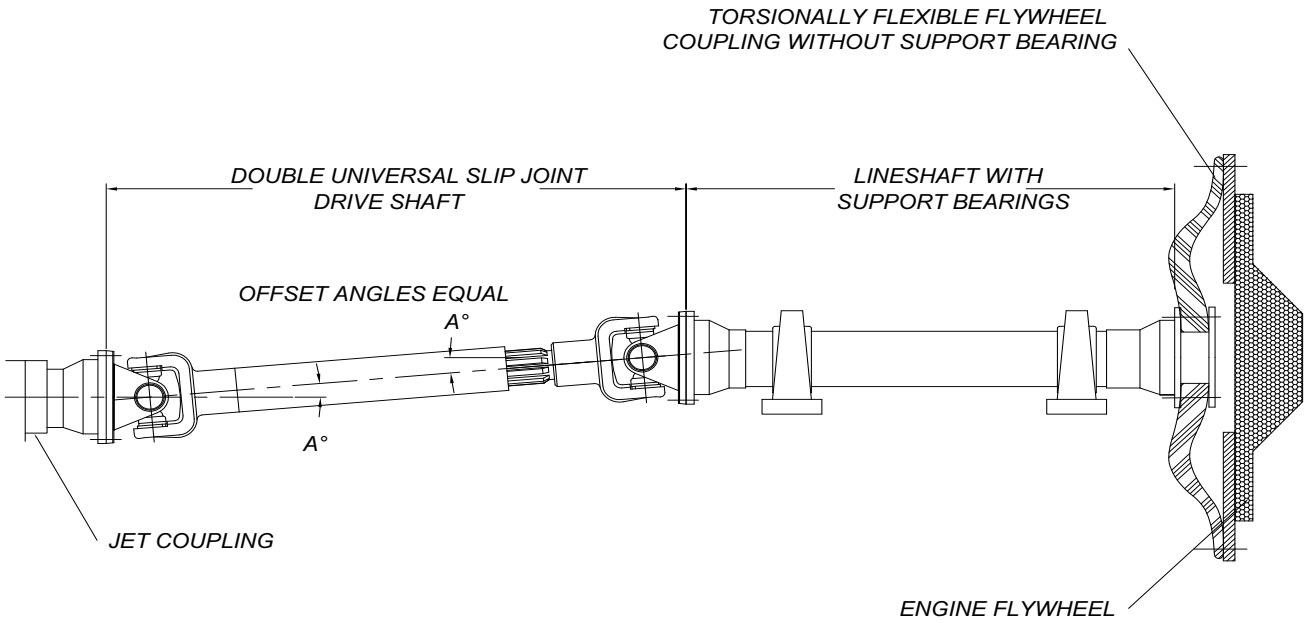


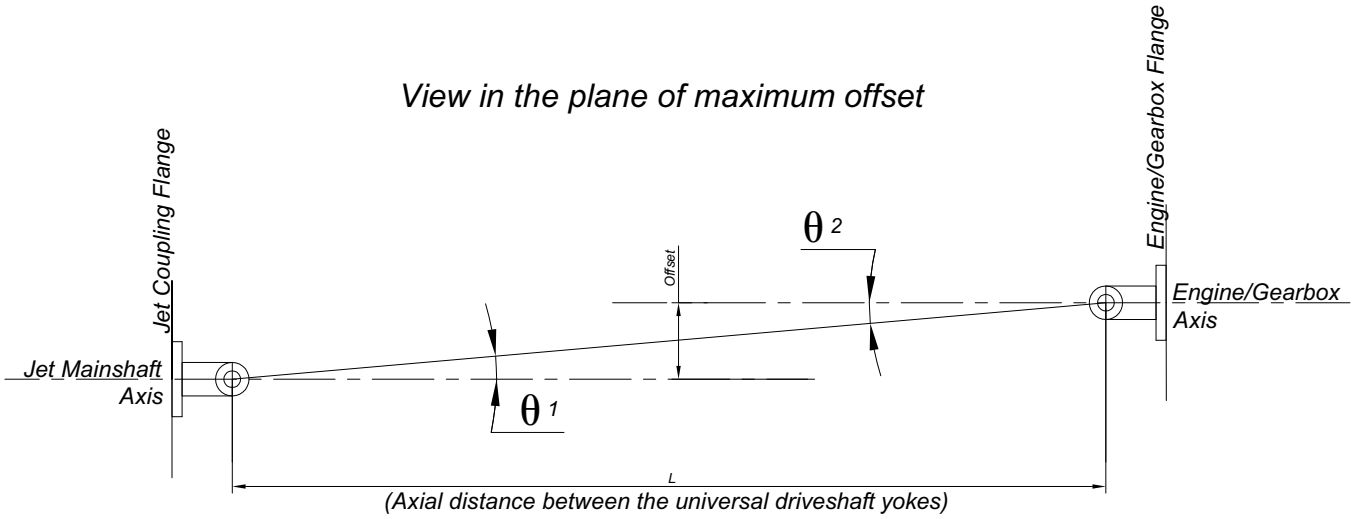
Figure 18: Long Driveshafts

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 19: Z Configuration Coupling and Figure 20: 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. he engine must be positioned so that the universal joints of the driveshaft have equal offset angles. This is most important.
   Refer to the driveshaft manufacturers recommendations for joint angles (typical range is between 1.5 and 5 degrees)

Note:

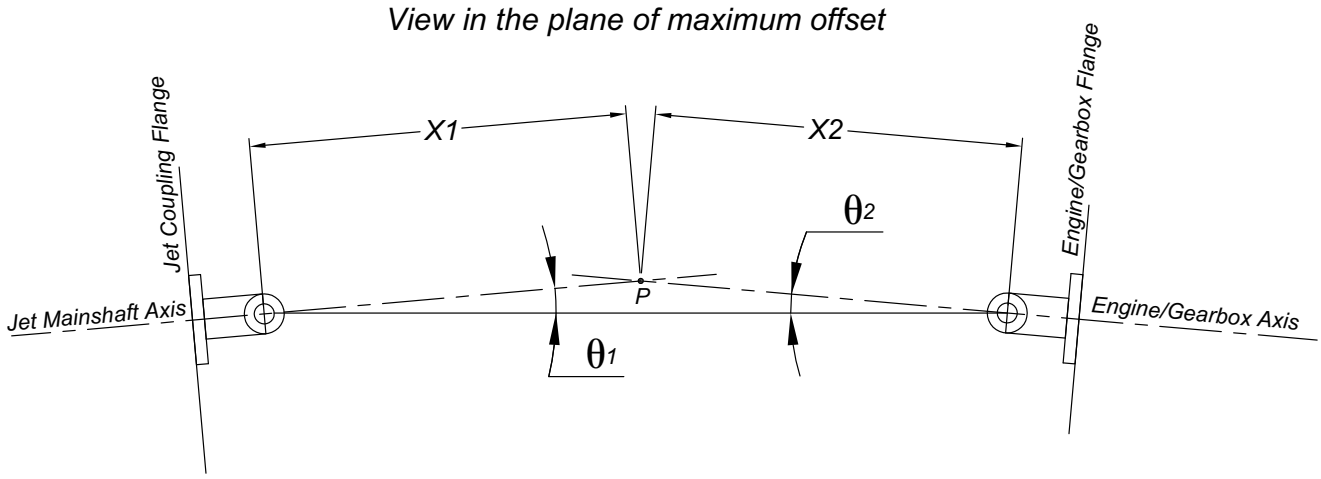
1. When the TFC couples directly to a universal driveshaft, the TFC must provide a bearing to support the universal driveshaft.
2. When the TFC couples directly to a Lineshaft supported on bearings, a support bearing is not required.



Note: θ_1 and θ_2 – must be equal

Offset = L x tan θ

Figure 19: 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 20: W Configuration Coupling

3.3.5 Jet Coupling Flange Details

Refer to Drawing HJ-241-02-001 Couplings and 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 either the engine manufacturer or the flexible coupling manufacturer carries this out.

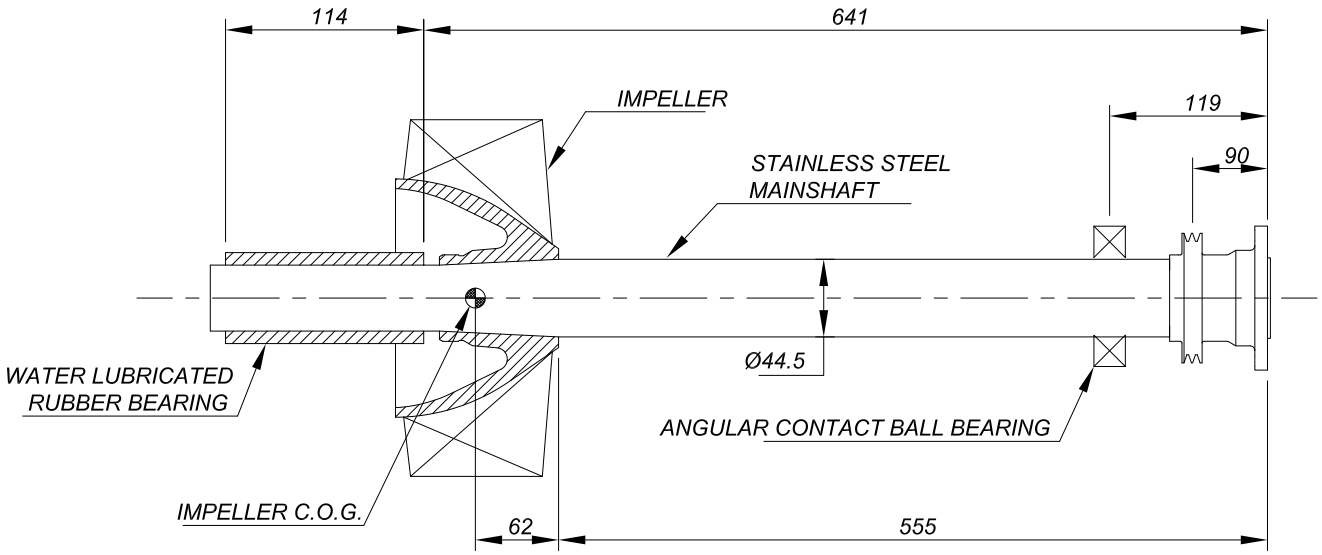
The moment of inertia data for the jet unit is provided below, to enable a torsional vibration analysis to be carried out.

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.



ITEM	Description	MASS (kg)	Polar MoI (kg.m²)
MAINSHAFT	dia 44.5	7.36	0.0018
IMPELLERS	----------	------	-----
4 Blade	TYPE 4.7 TO 3.7	6.9	0.034
5 Blade	TYPE 6.1 TO 5.0	7.0	0.035
6 Blade	Type 7.5 to 6.4	7.1	0.036
Coupling	116 mm	2.4	0.0028

Figure 21: HJ-241 Jet Mainshaft Dimensions

3.4 Jet Mainshaft Alignment

(Port & starboard jets only).

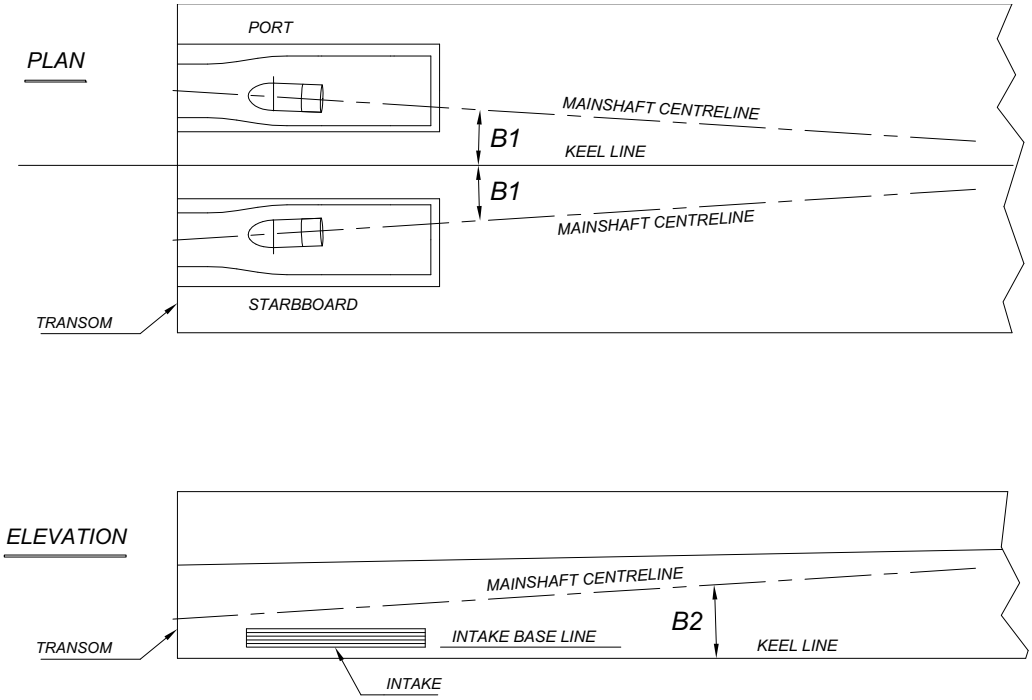
The HJ 241 waterjet mainshaft is inclined at an angle of 5° to the intake base.

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.



HULL DEADRISE ANGLE	MAINSHAFT ANGLE RELATIVE TO KEEL	
	B1	B2
0°	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°

NOTE:

THIS DIAGRAM APPLIES TO JET UNITS WHERE THE MAINSHAFT IS INCLINED AT 5° TO THE INTAKE BASE

Figure 22: Jet Mainshaft Alignment

3.5 Water Off-Take

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 (e.g. for a deck wash). **If it is used as a part of the engine cooling circuit, the designer / builder must satisfy himself that the available flow is sufficient for the cooling requirements.**

The water offtake point is located on the starboard side of the intake. This is fitted with a bung which can be converted to a 24.5mm (1″) dia x 30mm long hose tail by cutting off the end as shown on the basic jet assembly drawing HJ24101000.

This will provide water at a max pressure of 550kPa (80psi) at full power. The water may be fed directly to the engine without the need for a raw water pump provided:-

The pressure from the water offtake at idle is sufficient to cool the engine,

and,

The engine can withstand the full pressure from the jet offtake.

To be sure of correct flow for engine cooling, a conventional water pick-up and the engine raw water pump should be used. The jet water offtake can be used for a deck cleaning hose but the pressure is not high enough to be used 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.

Sandtrap

- (Optional raw water sand filter).

Refer to Drawing 112110 Sandtrap Assembly Sht1.

High pressure water from the jet is piped into the sand trap before feeding into the engine cooling system.

Sea water (raw water) fed into a centrifuge, drops out foreign matter (sand, shells, stones, etc) into a clear perspex bowl, which can be easily, visually inspected. Opening the dump valve, while water is being fed in, drops out the collected material into the dump line which carries any collected material overboard via a skin fitting, through the hull side or transom.

3.6 HSRX Reverse System Description (Where Fitted)

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.

3.6.1 Basic Hydraulic Circuit

Refer to Drawing CT-HSE-12-001 Hose Kits.

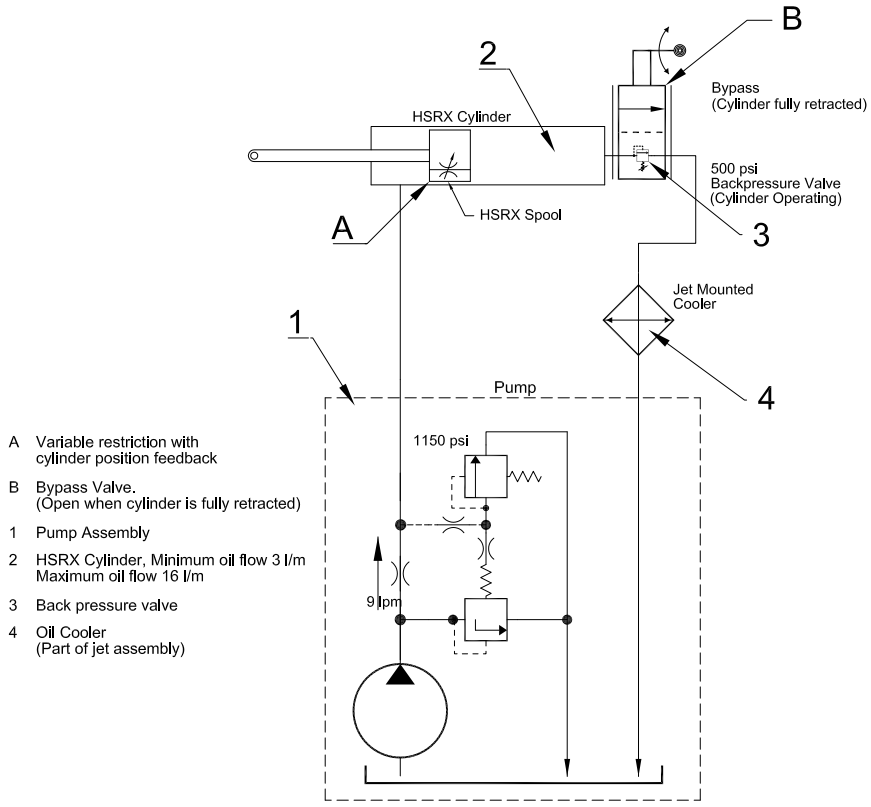


Figure 23: Hydraulic Circuit Diagram

Item No.	Description	Item No.	Description
A	Variable restriction with cylinder position feed-back.	**1**	Pump assembly.
B	Bypass valve. (open when cylinder is fully retracted).	**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).

3.6.2 Layout of Components

Refer to Drawing CT-HPU-01001 Hydraulic Power Unit.

3.6.3 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.

3.7 Engine Location & Mounting

3.7.1 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.

3.7.2 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.

3.7.3 Cooling

Jet unit water offtake:
The jet unit incorporates an inboard water offtake point on the starboard side of the intake. This is fitted with a hosetail / bung which can be cut off and a hose connection fitted to the hosetail. This provides water at pressures as follows:

Typical maximum pressure
550kPa (80 psi) at full power.
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.

3.7.4 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.

3.7.5 Exhaust Systems

The engine exhaust system can be any conventional system approved by the engine manufacturer.

Engine exhausts should be sited above the waterline and away from the jet units.

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

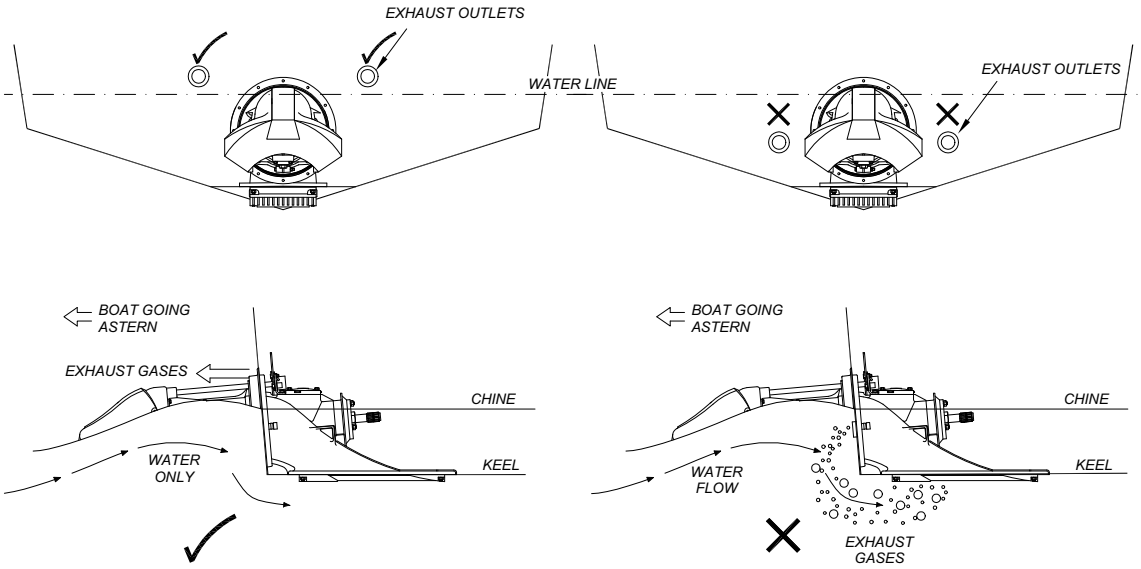


Figure 24: Exhaust System Layout

3.7.6 Governor Settings

Refer to Section 5.6.5 Governor Settings.

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.

The 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 fo 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 water seal. 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. The plastic bearing will turn slightly blue / green after being immersed in sea water,. This is only a surface discolouration and is not detrimental to the performance of the dry run kit system.

3.8.3 Scope of Use

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

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 plastic dry run kit bearing is a compromise for use in both dry and wet running conditions. The best wet running design solution is the use of a rubber marine bearing which cannot be run dry. The plastic dry run kit bearing will wear out far quicker than a standard rubber marine bearing if the dry run system is used constantly in a dirty water environment. When used in silty water, the 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 3: Fault Finding

FAULT	CAUSE	REMEDY
Bearing jambs 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 due to worn bearing.	Replace worn bearing and / or sleeve. Check the wear ring and replace if damaged.
Excessive scouring of water bearing 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 26: 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 / 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.
2. The bearing sleeve is fitted to the mainshaft in the same manner as the bearing sleeve for the rubber marine bearing ***(Refer to Section*** Section 9 Overhaul ***in this Manual).***

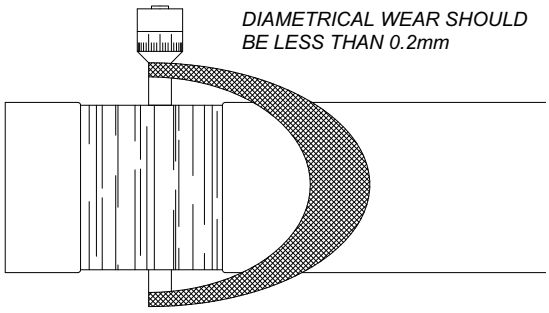


Figure 25: Bearing Sleeve

Note: The bearing sleeve is hardened at one end only. Assemble with the larger diameter end (hardened end) nearest to the impeller

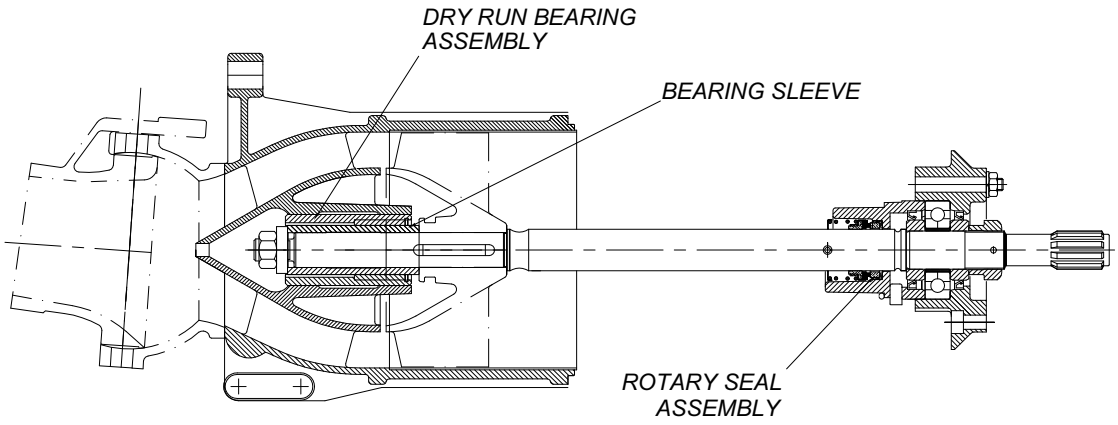


Figure 26: Dry Run Bearing Assembly

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

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.

5.1 Basic Installation Method and Drawing References

Refer to the correct installation drawing at the back of this man

For G.R.P. or wooden hulls:

Refer to Installation Drawings HJ-241-08-001 Installation Details GRP Hull**.**

The aluminium "intake block" [2] supplied with the installation kit for fiberglassing into the G.R.P. and wooden hulls.

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 HJ-241-08-002 Installation Details Aluminium Hull.

The aluminium intake block [2] is supplied ready to weld into a prepared opening in the hull bottom. For further details contact C.W.F. Hamilton & Co. Ltd.

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 that 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 HJ-241-08-003 Installation Details Steel Hull Sht1 & 2.

"Intake block". (Part No. 202402).

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 Hull

G.R.P. hulls or wooden hulls:

Drawing HJ-241-08-001 Installation Details GRP Hull**.**

If possible, tape the intake block into the hull mould prior to moulding the hull. For centre-mounted jets an 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, drill 22 x 9mm 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 the 8mm countersunk screws [11]. Fit the countersunk screws [11], flat washers [6], spring washers [5] and nuts [4], using RTV silicon sealant, [7] provided. Tighten to torque for M8 nuts, ***refer to Drawing*** 85113 Threaded Fastener Tightening Torques**.**

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

Aluminium hulls

Drawing HJ-241-08-002 Installation Details Aluminium Hull.

Once fitted, the intake block becomes part of the hull and is not removed when servicing the jet unit. To assist with the correct alignment of the intake block to the hull bottom, the centreline is marked fore and aft on the intake block.

The intake block is welded into the hull. The intake block base is butt welded flush with the underside of the hull bottom as shown in ***Drawing*** HJ-241-08-002 Installation Details Aluminium Hull.

The protruding weld on the underside of the hull must be as small as possible especially at the forward end. Use the weld procedure shown on ***Drawing*** 85080 Aluminium Weld Procedure.

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

Steel hulls:

Refer to Installation Drawing HJ-241-08-003 Installation Details Steel Hull Sht1 & 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,
3. Drill 22 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.
4. 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.
5. Remove the intake block and clean off all burrs.
6. Drill out the marked positions in the steel edges of the prepared opening to 12 mm to accept the nylon insulating bushes [19]. Remove all burrs.
7. Fit the insulating bushes [19] and trim to the correct length. Remove the insulating bushesfrom the intake
8. Liberally smear both sides of the intake block gasket [17] with RTV sealant [7] 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.

9. Smear RTV sealant [7] on the top of the gasket [17] and run a bead of RTV sealant around the internal corner of the prepared recess.
10. Ensure that all the bolts [18] are liberally smeared with RTV sealant prior to fitting.
11. Install the intake block and secure in 3 positions with bolts [18], nylon insulating bushes [19], flat washers [6], spring washers [5] and nuts [4]. Hand tighten.
12. Check for electrical isolation between the intake block and the vessel hull before fitting the remaining bolts.
13. Fit the remaining bolts [18], nylon insulating bushes [19], flat washers [6], spring washers [5] and nuts [4].
14. Torque load all the bolts and nuts incrementally to the recommended torque.
15. Once the intake block is installed, check again for electrical isolation and then fill any gap at the edges and corners with RTV 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 95° to the jet intake base has to be prepared as shown on the appropriate Installation drawings.

For GRP and wooden hulls:

Drawing HJ-241-08-001 Installation Details GRP Hull**.**

- An area of 95° to the jet intake base has to be prepared as shown on the hull preparation drawing.
- An insert can be taped into the hull mould so the required area at 95° can be moulded with the hull.
- Alternatively, the area to be at 95° 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, then 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 the jet unit 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

Drawing HJ-241-06-000 Steering Assembly General Arrangement Sht1 & 2**.**

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.

If problems occur with installation, ***refer to Section*** 9.4 Steering Assembly Removal and Overhaul ***and Section*** 9.5 Steering Assembly Re-Fitting, ***drawings*** CT-SJK-02-005 Steering Cylinder, Seastar ***and*** CT-HLM-06-002 Helm Wheel Options for removal and refitting instructions.

5.3.2 Reverse Components

Drawings HJ-241-07-001 Reverse Assembly Sht1 & 2 refer**.**

The jet unit is shipped complete with the reverse cylinder and reverse duct attached. If, during installation, the reverse duct needs to be removed, ***refer to Section*** 9.2 Reverse Assembly Removal and Overhaul for the removal and refitting procedure.

1. Remove any position sensors and linkages attached to the inboard end of the reverse cylinder.
2. Take care to label all electrical terminals for correct re-assembly.
3. Make every effort to remove sensors in such a way that they can be replaced with minimum disturbance to their original position. Refer to the controls manual supplied with this jet unit for further information.

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

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.

WARNING

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

Refer to the appropriate hull Installation drawings at the rear of this section.

G.R.P hulls; HJ-241-08-001 Installation Details GRP Hull.
Aluminium hulls; HJ-241-08-002 Installation Details Aluminium Hull.
Steel hulls; HJ-241-08-003 Installation Details Steel Hull Sht1 & 2

Preparation

After mounting the intake block and making the transom hole in the hull:-

1. Ensure that the reverse duct and transom plate have been removed from the jet unit as shown in ***Section*** 9.2.1 Reverse Duct Removal and ***Section*** 9.8 Transom Plate Assembly Overhaul**.** The reverse duct needs to be removed because the jet unit is installed from inside the hull, and the reverse duct cannot fit through the transom hole.
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 intake screen require removal during installation, refer to ***Section*** 9.10.4 Screen Removal.
3. Check that the jet unit is correctly located in relation to the transom hole and that the intake block fits 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

G.R.P hulls; HJ-241-08-001 Installation Details GRP Hull.
Aluminium hulls; HJ-241-08-002 Installation Details Aluminium Hull.
Steel hulls; HJ-241-08-003 Installation Details Steel Hull Sht1& 2.

1. Using approved lifting equipment, lift the jet unit off the hull and move it away from the intake block.
2. Ensure threads of the studs [3] are clean before applying Loctite.
3. Coat the threads of the studs [3] with Loctite 263 provided and tighten the studs into the tapped holes in the intake block [2]. 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.
4. Liberally apply neutral cure R.T.V. silicone sealant [7] to the top of the intake block and the underside of the jet unit flange and around the studs [3].
5. Carefully position the jet unit centrally over the intake base and slowly lower the jet unit flange onto the studs on the intake block.
6. Ensure that the studs fitted to the front of the jet intake, pass through the intake block.
7. Secure the jet unit intake to the intake block with flat washers [14]. spring washers [13] and nuts [12]. Tighten the nuts [12] to the recommended torque as shown on ***Drawing*** 85113 Threaded Fastener Tightening Torques.
8. Remove excess sealant from inside and outside the jet unit.
9. If not already connected, attach the screen rake spring [7] fitted to the screen rake actuator [2], ***refer to Drawing*** HJ-241-09-002 Screen Rake Assembly.

5.4.2 Assembly of the Transom Plate to the Hull

1. Ensure that the reverse duct has been removed from the jet unit. ***Refer to Section*** 9.2.1 Reverse Duct Removal..
2. Place the transom plate over the rear of the jet unit and up against the transom.
3. Centralize the transom plate in relation to the intake.
4. Make small locating dimples in the transom for the 12 securing screws, by using a 9mm diameter drill through the holes in the transom plate.
5. Slide the transom plate back off the tailpipe.
6. Drill 9mm diameter holes through the transom using the dimples to locate.
7. Remove the transom plate and clear away any swarf and burrs.
8. Lubricate the transom seal o-ring [8] with vegetable oil. Fit in place on the intake. Take care not to get any oil on the transom where sealant will be applied.
9. Liberally apply neutral cure RTV silcone sealant [7] (supplied) to the transom plate contact area on the hull and also to the joint face of the transom plate and the heads of the attachment screws [9].
10. Fit the transom plate [1] up over the mainshaft and impeller. Fit over the o-ring [8] fitted to the intake and align into position with the holes already drilled in the transom.
11. Secure the transom plate to the transom using screws [9], nuts [4], flat washers [6] and spring washers [5] as shown in the installation drawing.

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

12. Tighten all the securing screws [9] to the recommended torque as shown in ***Drawing*** 85113 Threaded Fastener Tightening Torques. Wipe off any excess sealant.

5.5 Final Assembly

Refer to Drawings HJ-241-01-000 Basic Jet Assemblies Standard and Dry Run Sht 1 & 2.

5.5.1 Reverse Cylinder Fitting

Refer to Drawing HJ-241-07-001 Reverse Assembly Sht1 & 2. If removed, 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 Reverse Duct Fitting

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

5.5.3 Re-Fitting the Steering Components

Drawing HJ-241-06-000 Steering Assembly General Arrangement Sht1 & 2 ***refer.***

Steering cylinder fitting.

Refer to Section 9.5 Steering Assembly Re-Fitting ***and Drawing*** CT-SJK-02-005 Steering Cylinder, Seastar ***for the re-fitting of steering components.***

1. 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.
2. Refit any sensors attached to the tiller. Refer to the overhaul section of the controls manual.

Push / pull cable system:

Refer to Drawing CT-HLM-06-002 Helm Wheel Options.

1. This is a steering option and is not "standard fit" for the HJ-241 jet unit.
2. If choosing a push/pull cable, use a heavy duty rotary system or a rack and pinion system. 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.
3. 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.

5.5.4 Assembling the Jet Steering Tillers

The jet tiller as supplied, is pre-drilled for 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 5° intervals. ***Refer to Drawing*** CT-SJK-02-005 Steering Cylinder, Seastar ***in the drawings package.***

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. For correct fitting and positioning of the jet unit tillers and tie rods for twin and triple jet applications, ***refer to Drawing*** HJ-241-06-000 Steering Assembly General Arrangement Sht2.

Note: Ensure that the cotter pin is fitted as shown in drawing HJ-241-06-000 Steering Assembly General Arrangement Sht1 for all applications of tiller orientation.

Single jet installations:

Refer to Drawing CT-SJK-02-005 Steering Cylinder, Seastar for steering cylinder attachment.

Assemble the cotter (taper) pin in the steering crank as shown in ***Drawing*** HJ-241-06-000 Steering Assembly General Arrangement Sht1 & 2

Twin jet installation:

Refer to Drawings HJ-241-06-000 Steering Assembly General Arrangement Sht1 & 2.

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

An“adjustable tiller” for tie rods can be fitted to the steering shaft to facilitate steering tiller adjustment to compensate for various hull deadrises.

Triple jet installation:

Refer to Drawings HJ-241-06-000 Steering Assembly General Arrangement Sht1 & 2.

One steering cylinder only is required which should mount on to the “adjustable tiller” fitted to the center jet.

Two swivel ended tie rods are used to interconnect from the “adjustable tiller” fitted to the center jet to “adjustable tillers” fitted to the outer jets.

5.5.5 Centering the Jet(s) Steering

Before mounting the cylinder or 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.

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

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 and also ***Section*** 3.3.3 Drive Shaft 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.

The engine may be cooled conventionally or by making use of the BSP inboard water offtake from the jet. The jet is supplied with the water offtake plugged by a combined plug / hosetail. To convert the plug to a hosetail, the end of the plug is cut off with a hacksaw and the cooling system plumbed from the hosetail. ***Refer to Section*** 3.7.3 Cooling**.**

There is a 1 ¼ " BSP outboard water offtake which provides water at approximately 10 kPa (1 ½ psi) at 600 RPM and up to 31kPa (45 psi) at - 260 Kw (350 hp) - ***refer to Section*** 3.5 Water Off-Take. The water may be fed directly to the engine without the need for a raw water pump, provided that:

4. The pressure from the water offtake at idle is sufficient to cool the engine.
5. 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.

If shallow water operation is anticipated a sand trap should be installed in the cooling line to prevent sand from clogging the cooling system. A sand trap kit can be purchased from C.W.F. Hamilton & Co. Ltd. ***(Drawing*** 112110 Sandtrap Assembly Sht1 ***refers).***

It is common to use a heat exchanger and a separate cooling water circuit for the engine so that the river or seawater does not enter the engine. In this case the cooling water from the jet water offtake goes through the heat exchanger circuit.

5.6.3 Engine Systems

Refer to Section 3.7.4 Engine Systems**.**

5.6.4 Exhaust Systems

Refer to Section 3.7.4 Engine Systems**.**

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 intake block 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*** 3.7.5 Exhaust Systems **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 13: 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** HJ-241-13-002 Anode Locations**).**
3. If antifouling has been applied to the jet unit casing, ensure that it is compatible with aluminium **(i.e. not copper based)**.
4. Check that the main inspection cover o-ring is correctly located and that the securing nuts are tightened to the recommended torque.
5. Check any water offtake connections (if fitted) for correct fitting and security. Check that any unused water offtakes are correctly plugged.
6. Check that the bearing housing has been filled with the recommended grease prior to operating the jet unit for the first time. ***Refer to Section*** 9.6.4 Re-Assembly of the Bearing Housing***, Item 28.***

Driveshaft:

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 <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.

5.8 Installing the HSRX Reverse System

Refer to Drawings HJ-241-07-001 Reverse Assembly Sht1 & 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

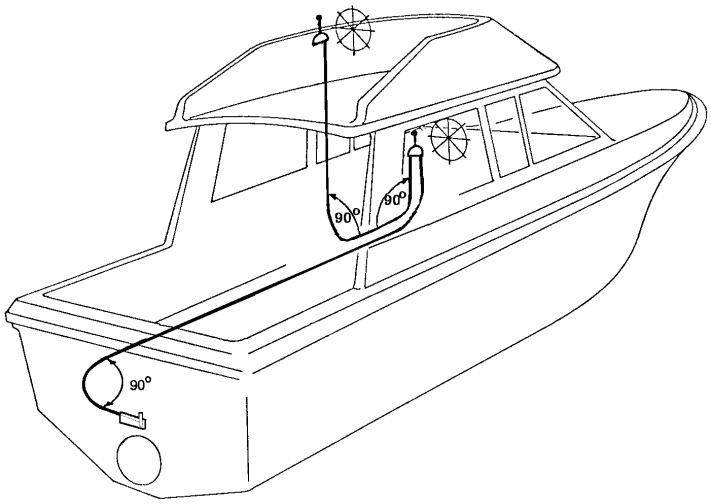


Figure 27: Remote Operating Systems

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** CT-CLV-01-003 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 180°. **Do not exceed 360° 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 HJ-241-07-001 Reverse Assembly Sht1 & 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** CT-HPU-01001 Hydraulic Power Unit **and Section** 8.6.2 HSRX 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.

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. (Do not over grease)***Refer to Section*** 9.6.4"Re-Assembly of the Bearing Housing"***, Item 28.***.
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*** 4.3.2"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"HSRX Controls Servicing Details" Item 3.
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 marine water 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.

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. It should be possible to hold your hand on any component for at least 2-3 seconds.
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 80° 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 not less than 1000 Ohms. **Refer to Section** 4.3.2"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 that is 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 4: Jet Unit Faults

No	Symptoms		
	Possible cause	**Solution**	**Refer**
1	**The engine unloads (RPM increases).**		
	There is some blockage in the jet unit. Air is getting into the jet.	The blockage must be removed. Check water seal, inspection cover, hull design; Consult C.W.F. Hamilton & Co Ltd.	Sect. 2.9 Sect. Section 9 ***Sect. Section 3***
2	**A lack of jet thrust (boat speed drops while RPM is high).**		
	There is some blockage in the jet. Air is getting into the jet.	The blockage must be removed. Check water seal, inspection cover, hull design, Consult C.W.F. Hamilton & Co Ltd.	Sect. 2.9 Sect. 9.6.3 ***Sect. 9.9*** ***Sect. 3.2***
3	**Excessive noise and vibration coming from the jet unit.**		
	Blockage of the jet unit. Blockage of the impeller or stator.	The blockage must be removed. Clear the impeller.	Sect. 2.9 Sect. 8.6.1/1
4	**Water leaking from under the front bearing**		
	Faulty water seal.	Replace the water seal.	Sect. 9.6

Table 4: Jet Unit Faults

No	Symptoms		
	Possible cause	**Solution**	**Refer**
5	**Excessive high pitched rattling, or rattling whine coming from the jet unit.**		
	Blockage of the jet unit.	The blockage must be removed.	Sect. 2.9
	Faulty thrust bearing.	Inspect and repair the thrust bearing.	Sect. 9.6
	Cavitation is occurring.	Blocked intake screen.	Sect. 2.8 Sect. 2.9
		Check for blunt or damaged impeller. Excessive impeller tip clearance. Wrong type of impeller fitted. Vessel overloaded. Weight too far aft.	Sect. 9.7.6 Sect. 9.5.2 Refer Drawing HJ-241-03-001 Impellers
		Bad weather or sea conditions.	
		Poor installation of jet unit into vessel.	Sect. Section 5
6	**Bad vibrations.**		
	Blockage of the jet unit. Worn marine bearing, or marine bearing water drain hole in the tailpipe blocked. Something caught in the impeller.	The blockage must be removed Check and clear the water drain hole in the tailpipe cone, inspect and repair the marine bearing. Check through inspection hatch, clear obstruction.	Sect. 2.9.3 Sect. 9.7.1 Sect. 8.6.1/1
	Worn driveshaft universal joints.	Inspect and repair the driveshaft as per manufacturer's recommendations.	Refer to Manufacturers Manuals.
7	**Engine revolutions gradually increasing over a period of time. Take off performance poor.**		
	Worn or blunt impellers.	Inspect and repair the impeller as well as the wear ring.	Sect. 8.6.1/17a) & 17b). ***Sect. 9.7***
	Excessive impeller tip clearance.	Inspect and repair the impeller as well as the wear ring.	
8	**Sudden increase in engine revolutions with no noticeable decrease in thrust.**		
	Air ingestion, or cavitation.	See No.5 above.	
	Faulty tachometer.	Repair tachometer.	
9	**Excessive engine revolutions, noisy jet unit and aerated water from nozzle.**		
	Screen blocked with wood or debris or rope through screen and wrapped around shaft.	Remove blockage.	Sect. 8.6.1/1 & ***Sect. 2.9***
	Object jammed in stators and / or impeller.	Remove object.	

Table 4: Jet Unit Faults

No	Symptoms		
	Possible cause	**Solution**	**Refer**
10	**Low engine RPM.**		
	Problem with engine.	Investigate the operation of the engine	Refer to engine manufacturers manual.
	Incorrect impeller and nozzle selection.	Contact C.W.F. Hamilton & Co Ltd. for a check to be made.	Refer to Drawings HJ-241-03-001 Impellers *and* HJ-241-06-000 Steering Assembly General Arrangement Sht1 .
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. Section 5 Sect. 9.6

7.2 Reverse System Faults

Table 5: Reverse System Faults

No	Symptoms		
	Possible cause	**Solution**	**Refer**
1	**Reverse duct is not moving.**		
	Reverse duct jammed by debris.	Remove debris and then check for correct operation.	Sect. 9.2.2
2	**Reverse duct does not go fully down or stay down with high engine RPM.**		
	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 HJ-241-07-001 Reverse Assembly Sht1
3	**Reverse duct will not lift out of reverse with high engine RPM. Relief valve blowing.**		
	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 of the jet unit manual).	***Sect. 9.2.4.***
5	**Excessive heat build-up in the hydraulic system.**		
	HSRX lever not touching the stop pin	Adjust HSRX lever	Sect. 5.8.3
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. Split hose. **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 hose. Replace the reverse cylinder rod.	Sect. 5.8. Sect. 9.2.1 Sect. 8.6.2 HJ-241-02-001 Couplings and Belts . CT-HSE-12-001 Hose Kits .

Table 5: Reverse System Faults

No	Symptoms		
	Possible cause	**Solution**	**Refer**
7	**Reverse duct creeping down from the up position**		
	Reverse cylinder seal failure. Suspect seals are: Oil seal [17] Piston seal [21] Bonded seal [33] O-ring [18]	Overhaul reverse cylinder.	Sect. 9.2.4 ***HJ-241-07-001 Reverse Assembly Sht1 & 2***
8	**Reverse cylinder: Oil leaking from the shaft outside the transom.**		
	Reverse cylinder seal failure in the fronthead [15]. Suspect seals are:- Wiper seal [12]. Oil seal [17]. Piston seal [21].	Overhaul the reverse cylinder.	Sect. 9.2.4
9	**Reverse cylinder: Oil leaking from the shaft inside the vessel.**		
	Reverse cylinder seal failure in the backhead [22]. Suspect seals are:- O-ring [24]. O-ring [50]. V-ring [40].	Overhaul the reverse cylinder.	Sect. 9.2.4
10	**Reverse cylinder: Oil leaking from around the backhead / fronthead to cylinder interface inside the transom.**		
	Reverse cylinder seal failure in the backhead [22]. Suspect seals are:- O-ring [18].	Overhaul the reverse cylinder.	Sect. 9.2.4
11	**Reverse cylinder: Oil leaking from the nipple [32].**		
	Bonded seal [33] failure.	Replace the bonded seal [21] fitted to the nipple [22].	Sect. 9.2.4
12	**System losing oil.**		
	Leak in the hydraulics system. Damaged cylinder rod. (Can cause damage to seals). Leaky seals.	Replace or tighten hydraulic connections. Replace the cylinder rod and seals. Replace seals.	

Table 5: Reverse System Faults

No	Symptoms		
	Possible cause	**Solution**	**Refer**
13	**Reverse cylinder: Water Leaking in around the fronthead [15].**		
	Reverse cylinder seal failure: Suspect seals are:- Resilient mounts [14.1] and [14.2]. O-ring [16].	Overhaul the reverse cylinder.	Sect. 9.2.4
14	**Poor reverse thrust.**		
	Reverse duct not travelling fully down.	Determine the reason for limited reverse travel and correct. Check the reverse assembly.	Sect. 9.2
	Reverse flow hitting the trim tabs. Engine exhaust is being ingested into the intake.	Reposition trim tabs below jet centre. Reposition engine exhausts to exhaust above the waterline.	Sect. 3.2.4 and Sect. 3.7.5
15	**Poor forward thrust.**		
	Reverse duct not travelling fully up.	Determine reason for limited travel and correct.	Sect. 9.6.4
16	**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 control lever to the reverse cylinder lever to ensure that cable is not being accidentally bent or crushed and restricting movement. Check cable type, length and route are as specified.	**Refer to** Sect. 5.8 **in this manual.**
17	**Reverse duct lever or cable is stiff to operate.**		
	Reverse control lever or cable is stiff.	Disconnect the reverse control cable at the Lever. Check the controller and control cable movement. Lubricate. 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 cable type, length and route are as specified.	**Refer to** Sect. 5.8 **in this manual.**

Table 5: Reverse System Faults

No	Symptoms		
	Possible cause	**Solution**	**Refer**
18	**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.	
19	**No hydraulic pressure from the jet hydraulic pump unit (Saginaw pump).**		
	Reverse cylinder is not functioning due to little or no hydraulic pressure from the Saginaw pump.	Increase the engine (jet) revolutions in quick bursts to about 1500 RPM until the vanes in the Saginaw pump become freed. (This may cure the problem).	

7.3 Steering System Faults

Table 6: Steering System Faults

No	Symptoms		
	Possible cause	**Solution**	**Refer**
1	**Steering stiff at the helm**		
	Grit jamming nozzle.	Work nozzle from side to side to release grit. Flush out.	Sect. 9.4.3
	Helm wheel or cable system stiff.	Disconnect cable system from the jet. Check, rectify and lubricate as necessary.	Refer to Drawing CT-HLM-06-002 Helm Wheel Options
	Steering tiller shaft stiff.	Disconnect cable system from the steering arm. Check movement of steering shaft, and clearance on steering bushes. Rectify to a loose running fit.	Sect. 9.4
	Grit between nozzle bushes [10], and nozzle.	Remove bolts [11] bushes [10] and sleeves [12]. Check bushes and sleeves for wear. Replace with new parts as necessary.	Sect. 9.4
	Corrosion build-up under steering shaft or nozzle bushes.	Remove bushes, clean out bores and refit using Loctite.	
2	**Steering jamming.**		
	Grit jamming nozzle	Work nozzle from side to side to release grit. Flush out.	Sect. 9.4.3
	Nozzle pivot bolts loose or bent.	Remove, check and replace bolts to the torque specified on the drawing.	Sect. 9.4.3
	Nozzle housing [9] deformed by impact.	Remove, rebuild or replace as necessary. Carry out a thorough check of the steering assembly.	Sect. 9.4 Sect. 8.6.1/6

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 anually as a minimum requirement.

Hydraulic 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.

Warning

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.

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.

Warning

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.

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:

1. Temperature must be between 10ºC and 40ºC and above the "dew point" (i.e. No condensation is allowed to form).
2. It is desirable to keep the bearing housing components coated with grease. Turn the mainshaft 180º 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 cylinders 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:

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

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 the jet unit 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 180º. 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 compound.
   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 operating conditions.
   - Complete jet unit inspection at 5000 hours ***(Refer to Section*** Sect."8.6.1/17***).***
3. Refer to Section 8.6.2 HSRX Controls Servicing Details for servicing of the control system.
4. Servicing intervals (Jet)

Table 7: 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**	**1st 2000 hrs.**	**5000 hrs.**
Intake flow path.	Clear blockages	"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 cable (If fitted)	Check integrity and lubricate	"8.6.1"***/7***		•					•		
Steering crank	Check for wear in crank ball. Grease	"8.6.1"/8							•		
Steering shaft & bushes	Check for wear Grease	"8.6.1"/9							•		
Steering shaft o-ring	Check for wear and leaking	"8.6.1" / ***10***							•		
Steering cylinder & hoses (If fitted)	Check for leaks and condition	"8.6.1"/11	•			•		•			
Nozzle / nozzle housing	Check vertical end float	"8.6.1"/12							•		
Reverse cylinder & hoses	Check for leaks and condition	"8.6.1"/13	•					•			
Reverse cylinder shaft	Grease	"8.6.1"/14				•		•			
Driveshaft universals	Lubricate	"8.6.1"/15	**As recommended by the drive shaft manufacturer.**								
Screen rake & bearings	Check integrity & lubricate	"8.6.1"/ ***16***							•		
Complete jet unit	Examine / Repair as required	"8.6.1"/ ***17***								•	•
Steel hull (only)	Carry out insulation checks	"8.6.1"/ ***17k***						•			

8.5.1 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 8: Hydraulic System Servicing Intervals

Servicing intervals (Hydraulic System)						
Item	**What to do**	**refer to**	**1st 5 hrs.**	**Daily**	**1000hrs.**	**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.

8.5.2 Daily "Pre Use" Servicing Checks

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

Table 9: Daily Servicing Checks (Jet)

Daily Servicing Checks (Jet)	
Area	**Operation**
Intake screen impeller Stator blades	Ensure that the water level is below the inspection hatch or overflow preventer before opening jet inspection hatches. Check via the steering nozzle end of the jet unit that the stator blades are clear of debris. Check for impeller damage.
Reverse hydraulic cylinder and oil lines	Check for oil leaks, especially if oil has been added to a system.
Steering system	Check the freedom of movement of the steering cable. Check for security of attachment of cable outer mount points. Check that the steering cotter pin is securely attached.
Position indicator senders (transmitters)	Check for loose electrical connections, mountings and linkages if fitted on the system.
Bearing housing	Check for signs of water leaking from under the bearing housing. (leaking water seal). If the 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**	**Daily. Check for obstructions inside the intake.** Remove the inspection cover and check around the impeller and intake screen for obstructions and debris. Remove any 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 bearing and does not require attention. ***Do not run the waterjet out of the water as this will damage the bearing and waterseal.***
4	**Waterseal**	**Daily. Check for water leaks daily.** Visually check for water dripping from under the bearing housing. If water is found, the waterseal is defective and should be replaced. ***The Waterseal should only be replaced if it is leaking, or there is insufficient material left to last to the next complete 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.
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.

Note: The HJ-241 steerable nozzle system has been designed with minimum clearances between the nozzle and nozzle housing. This allows optimum steering thrust at any lock with the minimum of loss. It is important to keep the pivot pins and bushes in good condition to maintain clearances. Heavy impacts on the nozzle housing may deform it and cause the steering to jam.

Item No	Item	Operation
6 (contd)	**Steering system (contd)**	**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. ***The maximum clearance between the crank ball and the nozzle bush is 1.2 mm (0.047ins).*** 4. **Steering crank cotter:-** Check that the tapered surface has no indentations. Check for thread damage. Replace if deformed or damaged. Check for security of attachment. 5. **Steering nozzle:-** Check that the steering arm on the top of the nozzle is not bent. If any cracks are visible on the underside of the steering arm, or in the web adjacent to the pivot boss, ***the nozzle must not be used and should be replaced.*** If no faults are found, the underside of the steering arm should be crack tested using a dye penetrant technique to prove the integrity of the steering arm before re-use. ***Carry out a check of the " nozzle vertical end float adjustment", refer to Item 12 below.***
7	**Steering cable** (If Fitted).	**Daily** - Check the cable attachment points, and the cable outer mount points. ***(This check is of particular importance as failures have occurred with these items coming loose)***. **Monthly** - Check the steering cable for freedom of movement. If necessary disconnect to check and grease the cable.
8	**Steering crank**	**Grease - Every 3 months.** Check for security of attachment and grease with water repellent grease. Check for wear in the crank ball and nozzle bush. ***Refer to Section*** 9.4.2 Steering shaft Removal**.**
9	**Steering shaft and bushes**	**Grease - Every 3 months.** Lightly grease the steering shaft and bushes with a water repellant grease. Check the play in the steering shaft, it should be a running fit in the bushes with no binding.
10	**Steering shaft o-ring**	**3 monthly -** Check the steering shaft o-ring by looking for signs of leaking and by assessing lateral play of the steering shaft. Replace the o-ring if excessive lateral play, or signs of leaking around the o-ring are evident.
11	**Steering cylinder & hoses** (If fitted)	**First 5 hours of running -** Methodically check the steering cylinder and hoses for any signs of oil leaks. **Monthly -** Methodically check the steering cylinder and hoses for any signs of oil leaks, damage or corrosion to the fittings. Repair as necessary. Refer to the control manual for hose replacement details.

Item No	Item	Operation
12	**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 0.1 to 0.3 mm.** Measure between the outer shoulder of the steering pivot bush sleeve [22] and the inner face of the thrust washer [23]. ***This should measure between 0.1 and 0.3 mm. Should the "nozzle vertical end float" require adjustment, refer to Section*** 9.5.2 Re-Assemble the Nozzle / Nozzle Housing to the Tail-pipe.
13	**Reverse cylinder & hoses**	**First 5 hours of running -** Check the reverse cylinder and hoses for any signs of oil leaks. **Monthly -** Check the reverse cylinder and hoses for any signs of oil leaks, damage or corrosion to the fittings. Repair as necessary. Refer to the control manual for hose replacement details.
14	**Reverse cylinder shaft**	**Grease - Every 3 months** - Grease the reverse cylinder shaft with a water repellent grease through the nipple on the cylinder fronthead. ***Do Not pump if resistance is felt as this may force the wiper seal out of the cylinder retaining nut.***
15	**Driveshaft universal joints**	**Lubricate every 500 hrs or to suit the manufacturers recommendations.** Follow the manufacturers recommendations for type of driveshaft used.
16	**Screen rake & bearings**	**Grease - 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 rake. Grease the screen rake bearings with a water repellent grease.
17	**Jet unit**	**Carry out internal examination of the jet unit after the first 2000 hrs of 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 at the top and bottom of the impeller).

Impeller radial clearance		
New min clearance	New max clearance	Max wear
0.35	0.65	1.01

Item No	Item	Operation

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.

c) Marine water bearing - Inspect.

- Inspect the marine water bearing for scoring or localised wear. Replace if excessively worn.
- Check the tailpipe cone to ensure that the water drain hole is not blocked. Clear any blockage.

d) Reverse duct - Examine.

- Check that the reverse duct pivot pins are tight and that there is no binding in the bushes. These items are to be removed in accordance with ***Section*** 9.2.2 Reverse Duct Overhaul. Check the reverse duct for any signs of distortion or damage. Repair or replace as required.

e) Splash guard - Check.

- Check that the splash guard is secure and has adequate clearance on the reverse duct.

f) Steering cables (If fitted) - Disconnect and remove.

- These items are to be removed in accordance with ***Section*** 9.4.2 Steering shaft Removal.

g) Tailpipe, nozzle & nozzle housing - Removal.

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

h) Marine water bearing - Inspect.

- Place the bearing sleeve inside the marine water bearing and use feeler gauges to measure the diametrical clearance. Inspect the marine water bearing for scoring or localised wear. Replace if excessively worn.

Water bearing diametrical clearance		
New min clearance	New max clearance	Max wear limit
0.05	0.28	0.5

Item No	Item	Operation
17 (cont'd)	Jet unit (contd)	**i) Jet unit paintwork.**

ANTI FOULING PAINTS

Do not use Copper Oxide based anti-fouling paints. Do not p 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.

- The main body of the jet unit is constructed from Silicon-Aluminium Alloy (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.

j) Refit Components.

- Refit components in accordance with ***Section*** Section 9 Overhaul of this Manual. Follow the recommendations on ***Drawing*** 85113 Threaded Fastener Tightening Torques, and ***Section*** 8.8 Threaded Fasteners, for thread tightening torque's, joint lubrication, thread and joint locking, bearing housing lubricants and hydraulic fluids.

k) Insulation checks (steel hulls only)

- **Monthly**, carry out insulation checks in accordance with ***Section*** 4.3.2 Checking the Insulation.

FOR STEEL HULLS

The jet unit must be totally electrically insulated from the hull. For steel hulls, insulating hardware is supplied with the jet unit. The insulation should be checked before finally bolting the jet unit and transom seal assembly in place and again on completion of the jet unit and transom seal assembly.

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:

- Decrease the time between each maintenance interval the if amount of dirt and sand in the water increases.
- Increase the time between each maintenance interval if amount of dirt and sand in water decreases.
- Decrease interval if excessive wear was found in the jet unit internal inspection **(Item 17 above).**
- Increase interval if minimal wear was found at the jet unit internal inspection **(Item 17 above).**

8.6.2 HSRX Controls Servicing Details

ITEM NO	ITEM	OPERATION
1	**HSRX pump oil 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 an approved oil to the 'MAX' dipstick mark, . 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	**HSRX system hydraulic oil replacement**	**Change the HSRX system 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 HSRX Controls Servicing Details also r***efer to*** Figure 28: HSRX Hose Connection Schematic**.**

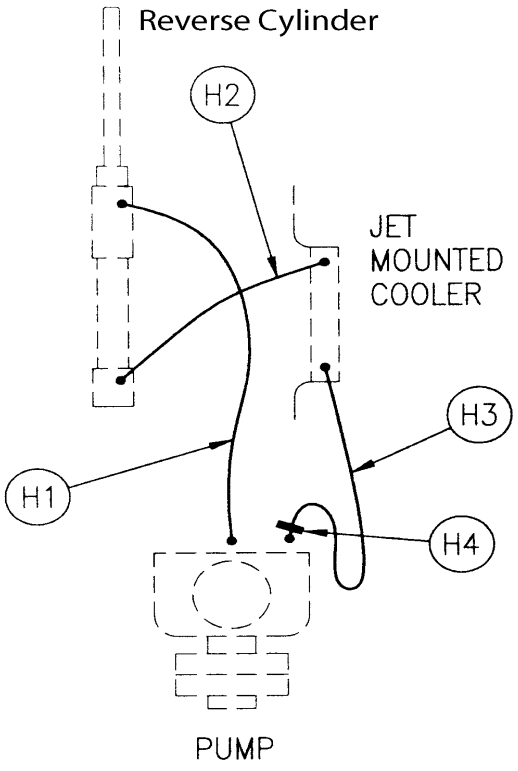


Figure 28: HSRX Hose Connection Schematic

Item No	Item	Operation
3	**Filling the HSRX System with oil**	**The HSRX 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. **Fill the oil cooler:** **Refer to hose connection schematic shown in *Section* 8.6.2 HSRX Controls Servicing Details, Figure 28: HSRX Hose Connection Schematic.** Ensure that the pump is empty of oil. 1. Disconnect the HSRX 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 HSRX Controls Servicing Details.**

Item No	Item	Operation
4	**Purging the HSRX system**	**Whenever maintenance activities have been carried out on the HSRX reverse system, 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 HSRX 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.
5	**HSRX pump drive belts**	**Check the belt tension monthly.** **Refer to Drawing** CT-HPU-01001 Hydraulic Power Unit**.** .  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.
5 (cont.d)	**HSRX pump drive belts (cont.d)**	**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.

Item No	Item	Operation
		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. **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 extension 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, bubber.

8.7.2 Special Tools

Refer to Drawing HJ-241-11-000 Tool Kit.

The following tools are included as part of tool kit (Part No 106013) for the HJ-241 jet unit:

1. Puller, coupling and impeller.
2. Puller, bearing.
3. Reaction arm - coupling.
4. Socket 30mm AF x ¾" sq./dr.
5. Bolts M8 x 55 long zinc plated (2).
6. Nuts M8 zinc plated (2).
7. Bolts M10 x 55 long zinc plated (2).
8. Nuts M10 zinc plated (2).

8.8 Threaded Fasteners

Drawing 85113 Threaded Fastener Tightening Torques.

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:

a) The tightening torque's for standard fasteners are given on the ***Drawing*** 85113 Threaded Fastener Tightening Torques**.**
b) The tightening torque's for special fasteners are shown on the relevant assembly drawings and also at Table 10: Special Fasteners HJ-241 Jet below.
c) Ensure that recommended tightening torque's are always used.

Table 10: Special Fasteners HJ-241 Jet

Items	Torque	
Impeller nut	240 Nm	177 lbs/ft
Bearing retaining nut	240 Nm	177 lbs/ft
Steering nozzle attachment bolts	60 Nm	45 lbs/ft
Reverse duct attachment bolts	60 Nm	45 lbs/ft
Reverse cylinder retaining nut	40 Nm	30 lbs/ft
Reverse cylinder pressure relief valve	40 Nm	30 lbs/ft
Pump tension nuts	12 Nm	9 lbs/ft

Thread locking agents:

Most fasteners require thread locking agents to prevent loosening.

a) Most applications are described in appendix A-2 Loctite Application Guide.
b) 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 11: 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 details 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.

The overhaul section of the controls manuals contains additional information.

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. 9.8″.
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 manufacturers manual).
2. Overhaul the reverse assembly.
3. Overhaul the steering assembly.
4. Overhaul and refit the bearing housing area of the jet unit.
5. Overhaul and refit the tailpipe area of the 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). Refer to manufacturers manual).
10. Removal of the HSRX pump assembly from the jet unit.
11. Refit the HSRX pump assembly to the jet unit.

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

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*** HJ-241-11-000 Tool Kit and ***Section*** 8.7 Tools of this manual.

9.1 General Information

Care of the jet unit paintwork:—All castings on the jet unit are of Silicon - Aluminium Alloy (LM6) which exhibits good resistance to salt water corrosion.

CAUTION

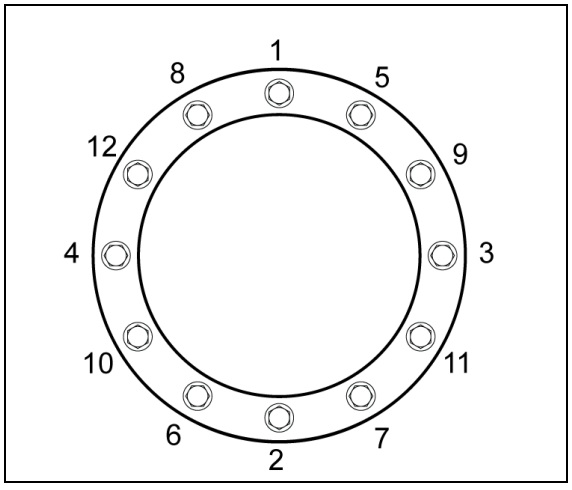
Anti Fouling Paints
Do not use copper oxide based anti-fouling paints. Do not paint over the anodes.

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

9.2.1 Reverse Duct Removal

Refer to Drawings HJ-241-07-001 Reverse Assembly Sht1 & 2.

1. Unscrew and remove the nuts [23] and spring washers [9] from studs [8] retaining the splash guard [7] to the tailpipe.
2. Disconnect the morse cable 33C, ball joint [36] from the HSRX handle [31] located on the forward end of the reverse cylinder.
3. Slacken the 2 nuts [38] that clamp the morse cable to the cable mounting plate [26] and remove the morse cable.
4. Retighten the 2 nuts [38].
5. Unscrew the reverse cylinder retaining nut [11] from the rear of the reverse cylinder and slide the retaining nut and washer [13] rearwards along the reverse shaft.
6. Whilst supporting the reverse duct [1], remove the nyloc nut [42] attaching the reverse cylinder shaft to the reverse duct.
7. Remove the bronze bush [44] from the centre of the shaft [10] and retain.
8. Remove the reverse shaft assembly [10] from stud [41] on the reverse duct, ensuring that the flat washer [43] fitted between the reverse shaft and the reverse duct is also removed.
9. Lower the reverse duct.
10. Remove the bolts[53] and spring washers [29] retaining the reverse pivot link [52] to the tailpipe.
11. Remove the reverse duct pivot bolts [4], spring washers [3], reverse pivot link [52], thrust washer [51] and reverse pivot [2] attaching the reverse duct to the tailpipe.

Note: The reverse pivot [2] has a machined groove around the outer face, should the reverse pivot be difficult to remove, a screwdriver may be inserted into this groove to remove the reverse pivot from the reverse pivot bush [5] fitted in the reverse duct arms.

12. Remove the reverse duct [1] from the jet unit.
13. Check the reverse pivot [2] for excessive wear or damage. Check for deformity of the bolt hole. Replace if worn or damaged.
14. Check the reverse shaft assembly attachment stud [41] fitted to the starboard side of the reverse duct, for security of attachment. Replace if loose or worn.

9.2.2 Reverse Duct Overhaul

Reverse pivot bush [5] and Sleeve [50] replacement:

1. With the reverse duct removed from the jet unit, press out the reverse pivot bush [5] from inside the reverse pivot bush sleeve [50].
2. Inspect the bush [5] and reverse pivot bush sleeve [50] for signs of excessive wear.
3. The reverse pivot bush sleeve [50] should not require replacement.
4. Should the reverse pivot bush sleeve [50] be damaged or worn, press out the reverse pivot bush sleeve [50]. It may be necessary to apply light heat to the reverse duct arms in the area of the reverse pivot bush sleeve [50] to break the Loctite seal.
5. Ensure that the reverse duct arm bores are cleaned of old loctite and paint.
6. Repair the paint finish in the bores.

Note: Activator 7075 must be used to refit the reverse pivot bush sleeve [50] otherwise the Loctite 325 will not cure.

7. Apply Loctite Activator 7075 to the outside of the reverse pivot bush sleeve [50] and allow to dry.

Note: Do Not apply Activator 7075 to the painted reverse duct arm bores.

8. Apply Loctite 325 to the reverse duct arm bores and to the outside of the reverse pivot bush sleeve [50].

Note: There are to be NO dry areas between the reverse pivot bush sleeve [50] and the bores in the reverse duct arms once the reverse pivot bush sleeves are fitted.

9. Press the new reverse pivot bush sleeve [50] into the reverse duct arm bores
10. Rotate the new reverse pivot bush sleeve [50] when fitting to distribute the loctite evenly around the bore.
11. Ensure that the sleeves are pressed in evenly and are fully home in the bores.
12. Clean off any surplus Loctite from around the replacement sleeves.
13. Refit the reverse pivot bush [5] to the reverse pivot bush sleeve [50].

Reverse duct anodes [46] replacement:

Refer to Anode location Drawing HJ-241-13-002 Anode Locations.

1. Check the anodes [46] attached to the outer face of the reverse duct arms.
2. If these anodes are less than half their original size, they should be replaced.
3. To replace the anodes on the reverse duct carry out the following actions:
   a) Unscrew and remove 2 x nuts [23] and spring washers [9] from studs [47], attaching the anode [46] to the reverse duct [1].
   b) Remove the anode [46].
   c) Clean up the contact area where the anode will locate, to remove any corrosion and paint. Repair the paint finish.
   d) Fit a new anode [46] onto studs [47] and secure with spring washers [9] and nuts [23].
   e) Torque load to the recommended torque.
   f) Carry out Items a) to e) for the second anode.
4. If the anode is in good condition, ensure that it has not been painted over.
5. If a coating has built up on the anode, scrub down with a wire brush.

9.2.3 Reverse Cylinder Removal

Refer to Drawing HJ-241-07-001 Reverse Assembly Sht1 & 2.

Also refer to the **Controls Manual Overhaul Section** for information on the reverse assembly.

1. Ensure that the morse ball joint [36] has been disconnected from the HSRX handle [31].
2. Disconnect the hose from the cooler to the reverse cylinder connector [32] fitted to the backhead [22], ***ensuring that the hose is removed from the cooler connector prior to removing the hose from the reverse cylinder at the backhead.***
3. Disconnect the hose from the hydraulic pump to the reverse cylinder at the hose connector [32] fitted to the fronthead [15] on the HSRX reverse cylinder. Fit blanking plugs to the hose connections to prevent the ingress of dirt and moisture.
4. Remove the retaining nut [11] and washer [13] from the reverse cylinder fronthead [15].
5. The reverse cylinder can now be removed from the transom by pushing the cylinder forwards into the vessel and out of the two resilient mounts [14].
6. Refit retaining nut [11] and washer [13] to reverse cylinder fronthead [15].
7. The reverse cylinder can now be removed from the vessel for further in-depth maintenance.

9.2.4 Reverse cylinder Overhaul

Drawings HJ-241-07-001 Reverse Assembly Sht1 & 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 along the piston rod assembly at one end of the cylinder or from the HSRX spool at the other end. This indicates that the 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. Ensure that the clamp [58] and shim [58] have been disconnected from the cable mounting plate [26].
2. Slacken the set screw [30] securing the HSRX handle in position and remove the HSRX handle from the end of the HSRX spool [20].
3. Remove the v-ring [40] from the end of the spool at the backhead end of the reverse cylinder. **Note the correct orientation of the v-ring [40] so that it is refitted correctly.**
4. Remove the pressure relief valve [35] from the backhead [22]. This is done by:-
   a) Unscrewing the knurled nut on the top of the protective cover (55).
   b) Removing the protective cover from over the pressure relief valve. The pressure relief valve can now be unscrewed and removed from the backhead.
5. The nipple [32] and bonded seal [33] fitted to the fronthead [15] and backhead [22] can be left fitted unless they require replacing.
6. Remove the M6 nuts [28] and spring washers [29] securing the cable mount plate [26] to the backhead and remove the cable mount plate from the front of the reverse cylinder.
7. Withdraw the backhead [22] from the reverse cylinder [19].
8. Remove the bearing [25] from the backhead [22].
9. Remove the HSRX spool [20] from the cylinder [19].
10. Remove the cylinder [19] from the fronthead [15].
11. Withdraw the reverse cylinder shaft assembly [10] from the fronthead [15].

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

12. Unscrew the 4 x threaded reverse cylinder tie rods [27] from the fronthead [15].

13. Check the stop pin [39] fitted to the backhead [22], for damage, wear and security of fitment. This pin does not need to be removed unless it is worn, loose or damaged.

14. Remove and discard all o-rings and seals.

15. Thoroughly clean and inspect all components for wear and damage and replace as required. If dimensions do not meet the criteria below, components must be replaced:-
    a) The spool shaft where the rotary shaft seal (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.***

Assembly of the reverse cylinder:

Refer to Drawing HJ-241-07-001 Reverse Assembly Sht1 & 2

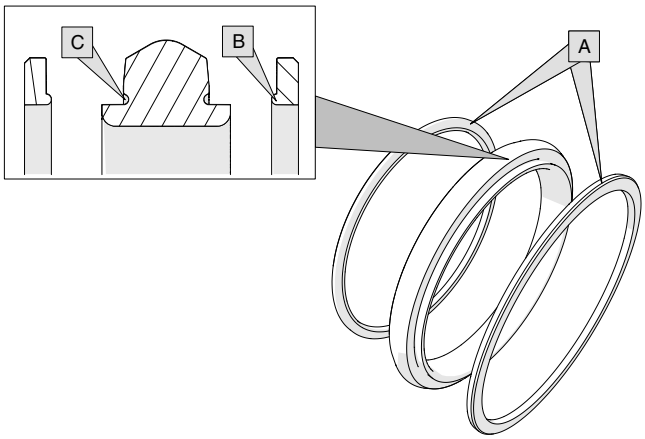
The following oils and greases are recommended for use during the assembly of the H.S.R.X. reverse cylinder assembly.

{A} BP Energrease MM EP2 or equivalent.

{B} Mineral based oil such as recommended hydraulic oil. Refer to *Section* Section 8 Maintenance, in the controls manual).

{C}Non seize compound. (Rocl YIGG, Jet-Lube, Nikal, etc.).

1. Grease o-ring seal [18] {Using A} and fit to the reverse cylinder backhead [22].
2. Grease a second o-ring seal [18] {Using A} and fit to the seal groove in the reverse cylinder fronthead [15].
3. Grease and fit the piston seal [21] to the reverse cylinder shaft assembly [10], ensuring that the scarf Joints on the seal backing rings are correctly mated.



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].

4. Grease and fit the u-seal [17] to the fronthead [15], ensuring that the seal is correctly orientated. Use the installation guide tool, if available. ***Refer to Drawing*** HJ-241-07-001 Reverse Assembly Sht1, for correct positioning of the seal.
5. Grease and fit the o-ring [24] to the backhead [22], ensuring that the o-ring is correctly orientated. ***Refer to Drawing*** HJ-241-07-001 Reverse Assembly Sht1, for correct positioning of the seal.
6. If the stop pin [39] has been removed from the backhead [22], apply 7471 Activator to one end of the stop pin and allow to dry. Apply Loctite 680 (or equivalent) to the same end of the stop pin and fit the stop pin to the backhead [22].
7. Apply Loctite 263 to one end of each of the 4 x threaded reverse cylinder tie rods [27] and tighten into the fronthead [15].
8. Grease both outside ends of the cylinder [19] {Using A} and push fit one end of the cylinder into the fronthead [15].
9. Lubricate the cylinder shaft assembly [10] {Using B} and fit to the fronthead [15]. ***It is critical to protect the oil seal (17), so ensure that the end of the cylinder shaft as well as the hole, are deburred and there are no sharp edges present.***
10. Ensure that the dot on the outer end of the reverse cylinder shaft assembly is positioned uppermost.

Note: If the dot on the reverse cylinder shaft assembly is wrongly positioned, the reverse cylinder will not function correctly.

11. Fit the bearing [25] to the backhead [22].
12. Lubricate the spool [20] {Using B}.

13. Whilst supporting the seal [24] in the backhead, insert the end of the spool [20] fitted in the cylinder, through the bearing [25] and seal [24] already fitted to the backhead. ***It is critical to protect the seal lip from damage, so ensure that the end of the spool shaft is completely deburred and free of any sharp edges.***
14. Grease and fit the o-ring [56] to the forward end of the backhead [22].
15. Assemble the backhead and spool combination onto the cylinder and fronthead combination, noting the correct orientation.
16. Assemble the cable mounting plate [26] to the backhead, ensuring that the cable mounting plate is correctly located over the stop pin [39]. Secure with nuts [28] and spring washers [29].

Note: Ensure that the cable mounting plate [26] is correctly orientated for either left hand or right hand cable fit. Refer to Section 9.3.2 Reverse Duct: Refit to the Jet Unit Sub Section "Reposition the cable mount plate" for information on how to reposition the cable mount plate.

17. Hold the reverse cylinder upright with the reverse shaft assembly at the top. Ensure that the reverse shaft assembly is fully retracted.
18. Rotate the spool [20] through 360° (this will help to centralise the bearing in the backhead).
19. Torque load nuts [28] securing the backhead [22] and cable mount plate [26] to the cylinder.
20. Fit the v-ring [40] to the spool at the backhead end of the reverse cylinder. **Note the correct orientation of the v-ring [40]. (Drawing** HJ-241-07-001 Reverse Assembly Sht1 refers**).**
21. Fit the HSRX handle [31] onto the end of the HSRX spool.
22. Fit Set screw [30] to the HSRX handle using Loctite 263 and tighten to secure the handle in position.
23. Fit the pressure relief valve [35] to the backhead [22] ensuring that the o-ring is fitted around the base of the relief valve.
24. 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.
25. 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.
26. If nipple [32] fitted to the fronthead [15] has been removed during overhaul, refit to the fronthead with a new bonded seal [33] and tighten.
27. If nipple [32] fitted to the backhead [22] has been removed during overhaul, refit to the backhead with a new bonded seal [33] and tighten.
28. Grease a new wiper seal [12] and fit to the retaining nut [11] and loosely refit the retaining nut [11] to the fronthead [15].
29. The HSRX reverse cylinder can now be re-fitted to the jet unit.
30. If possible workshop test the reverse cylinder before reinstalling into the vessel. The workshop test pressure for the cylinder is 1500 psi (103 Bar).

9.3 Reverse Assembly Re-Fitting

9.3.1 Reverse Cylinder: Refit to the Jet Unit

Refer to Drawing HJ-241-07-001 Reverse Assembly Sht1 & 2

1. Remove the reverse cylinder retaining nut [11] and special washer [13] from the reverse cylinder fronthead [15].
2. Ensure that a new o-seal [12] has been correctly fitted to the retaining nut [11].
3. Ensure that a new o-ring [16] has been fitted to the cylinder fronthead [15].
4. Lightly smear the o-ring [16] fitted to the fronthead with a marine grease.
5. Fit the 2 resilient mounts [14] to the transom and retain in position with a smear of marine grease.
6. Check that the cap screw [45] fitted to the starboard side of the jet unit intake flange is securely fitted.
7. From inside the vessel, pass the shaft assembly [10] through the resilient mounts [14] until the shoulder on the fronthead [15] is firmly pressed against the inboard resilient mount.
8. Ensure that the resilient mounts are correctly positioned in the transom.
9. From outside the vessel, fit the special washer [13] and the reverse cylinder retaining nut [11] onto the reverse cylinder shaft [10] and screw onto fronthead by a few threads to retain the reverse cylinder in position until the reverse cylinder is connected to the reverse duct.
10. Reconnect the hydraulic hoses to the reverse cylinder, ensuring that the hose from the cooler to the pushlock connector [32] on the backhead is connected to the connector on the backhead first. Refer to the controls manual, hose connection drawings.

9.3.2 Reverse Duct: Refit to the Jet Unit

Drawings HJ-241-07-001 Reverse Assembly Sht1 & 2 ***refer.***

Reverse duct:

1. Ensure that the threads and surfaces of the pivot pins [4] are clean.
2. Ensure that the pivot sleeves [2] and reverse pivot bushes [5] are clean.
3. Coat the threads of the reverse duct bushes [5], reverse pivots [2] and reverse pivot thrust washers [51] with a recommended marine grease. **Do not grease the threads of bolts [4].**
4. Press the reverse pivot bush [5], into the reverse pivot bush sleeve [50].
5. Fit the reverse pivots [2] through the centre of the pivot bushes [5] ensuring that the groove on the reverse pivots is on the outside of the reverse duct arms.
6. Push the reverse pivots [2] through the reverse duct arms until the inner face of the pivot is flush with the inner face of the reverse duct arms.
7. Position the reverse duct so that the reverse pivots are aligned with the recess in the tailpipe.
8. Press the reverse pivots fully home into the tailpipe recess.
9. Fit thrust washer [51] over the outside of the reverse pivots [2] and up against the rear face of the reverse pivot bush sleeve [50] and reverse pivot bush [5].
10. Fit a spring washer [3] and the reverse pivot link [52] to reverse duct pivot bolt [4].
11. Fit the bolt [4] using Loctite 222 through the reverse pivot [2], ensuring that the other end of the reverse pivot link [52] is fitted over studs [53] on the tailpipe.
12. Loosely secure the forward end of the pivot link [52] wtih bolt [53] and spring washer [29] using loctite 222.
13. Tighten bolts [4] hand tight, ensuring that the reverse pivots [2] are correctly seated and that thrust washers [51] are still located over the end of the reverse pivot [2].

14. Tighten the reverse duct pivot bolts [4] to the recommended torque.
15. Tighten the bolts [53] securing the forward end of the reverse pivot link [52] to the tailpipetailpipe and torque load to the recommended torque.
16. Raise and support the reverse duct and reconnect the reverse shaft [10] to the stud [41] on the reverse duct, ensuring that flat washer [43] is fitted onto the stud [41] first prior to fitting the shaft [10].

Note: Ensure that the centre punch mark on the end of the reverse shaft is at the top of the shaft when reconnecting the shaft to the stud [41] fitted on the reverse duct.

17. With the shaft [10] fitted to the stud [41], insert the bronze bush [44] through the shaft and over the stud [41] and secure with nyloc nut [42]. Torque load to the recommended torque.
18. Remove the reverse cylinder retaining nut [11] from the fronthead [15].
19. Ensure that the threads of the fronthead [15] are clean. Apply Loctite 542 to the threads and fit the reverse cylinder retaining nut [11].
20. Ensure that the cutout in the fronthead [15] engages with the cap screw [45] to prevent the cylinder from rotating.
21. Tighten the reverse cylinder retaining nut [11] onto the fronthead [15] and ***torque load to 40Nm (30 ft/lbs).***
22. Refit the splash guard [7] to the studs [8] fitted to the tailpipe and secure in position using spring washers [9] and nuts [23]. Tighten to the recommended torque.

Morse cable connect:

1. Ensure that the cable mount plate [26] 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 to starboard. ***(See paragraph below for re-positioning the cable mount plate).***
2. Slacken the 2 nuts [38] that clamp the morse cable to the cable mount plate [26] and refit the morse cable through the clamp.
3. Attach the morse cable ball joint [36] to the HSRX handle [31] located on the end of the reverse cylinder and tighten the attachment nut.
4. Retighten the 2 nyloc nuts [38] that attach the clamp bracket on the cable mount plate [26].
5. On completion of the cable connection, carry out a full functional check of the reverse system to ensure correct operation and full range of movement is obtainable.

Repositioning 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 [38] and cable clamp kitset [37] that retain the morse cable to the cable mount plate [26] and remove the morse cable.
2. Slacken set screw [30] from HSRX handle [31] and remove the handle from the backhead [22] end of the spool [20].
3. Remove the v-ring [40] fitted between the HSRX handle [31] and the backhead.
4. Unscrew and remove the 4 nuts [28] and spring washers [29].
5. The cable mount plate [26] can now be removed from the backhead [22], ensuring that the stop pin [39] is not loose.
6. ensure that the o-ring [56] fitted to the front of the backhead is not disturbed.
7. Refit the cable mount plate [26] 180° to the previous position, ensuring that the stop pin [39] in the backhead engages into the correct hole in the cable mount plate [26].

8. Refit the 4 nuts [28] and spring washers [29] that secure the cable mount plate to the backhead and torque load to the correct torque ***Refer to Drawing*** 85018 Recommendations for Lubricants and Oils Sht1.
9. Refit the v-ring [40] to the rear of the backhead. **Note the correct orientation of the 'V' Ring [40]. (Refer to Drawing** HJ-241-07-001 Reverse Assembly Sht1**).**
10. Refit the HSRX handle [31] to the spool [20] at the backhead end of the reverse cylinder.
11. Fit the set screw [30] to the HSRX handle using Loctite 263 and tighten to secure the handle in position, ensuring that the set screw locates into the dimple in the spool shaft. Torque load set screw [30] to the correct torque.
12. Loosely refit cable clamp kitset to the cable mount plate [26].
13. Refit the morse cable through the cable clamp kitset.
14. Connect the morse cable 33C to the HSRX handle [31] and tighten the morse ball joint [36] attachment nut.
15. Retighten the 2 nuts [38] that attach the cable clamp kitset on the cable mount plate [26].

9.4 Steering Assembly Removal and Overhaul

Refer to Drawing HJ-241-06-000 Steering Assembly General Arrangement Sht1 & 2**.**

The steering system 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 on the cylinder.
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

Note: If this jet unit is fitted with the "Seastar" steering cylinder as a steering option, refer to the "Seastar Manual" supplied with the steering cylinder for overhaul information. Also refer to CT-SJK-02-005 Steering Cylinder, Seastar.

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 [16] or the steering shaft [1]. **Refer to the overhaul section of the controls manual**.
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 [16] or steering shaft [1]. (If tiller for tie rods fitted).
4. Remove the steering cylinder from the vessel.
5. Check all components for signs of corrosion, wear and damage. Replace as required. **Refer to the Seastar Manual for information on steering cylinder seal replacement**.

9.4.2 Steering shaft Removal

Drawings HJ-241-06-000 Steering Assembly General Arrangement Sht1 & 2 ***refer.***

1. Remove the splash guard [7] and the reverse duct as shown in ***Section*** 9.2.1 Reverse Duct Removal of this manual.
2. ***If fitted with steering cable option. Also refer to Drawing*** CT-SJK-02-005 Steering Cylinder, Seastar. Disconnect the steering cable from the steering shaft extension / tiller [16].

   OR
3. ***If fitted with steering cylinder and tie rod option. Also refer to Drawing*** CT-HLM-06-002 Helm Wheel Options. Disconnect the steering tie rods and steering cylinder from the steering shaft extension / tiller [16].
4. Remove nut [7], spring washer [8] and special washer [6]. Remove the cotter pin [5] securing the steering crank [4] to the steering shaft [1].
5. Push the steering shaft [1] forwards and slide the steering crank off the end of the steering shaft.
6. Remove the steering crank [4] from the steering crank bush [14].
7. If the steering shaft bushes [3] or o-ring [2] require replacement, remove the steering shaft completely from the jet unit. ***Refer to Drawing*** HJ-241-06-000 Steering Assembly General Arrangement Sht1 for steering shaft bush [3] replacement.
8. Check the following components for wear and damage:-
   a) **Steering shaft bushes [3].** Check for wear or damaged. Replace if worn.
   b) **Centre steering shaft bush sleeve [26].** The steering shaft bush sleeve should not require replacement.
   c) **Forward & aft steering shaft bush sleeves [27].** The steering shaft bush sleeves should not require replacement.
   d) **o-ring [2].** (Fitted to the centre steering shaft bush. Check for deformation, cuts, wear or damaged. Replace if worn or damaged.
   e) **Cotter pin [5].** Check that the tapered surface has no indentations. Check for thread damage. Replace if deformed or damaged.
   f) **Steering shaft [1].** The steering shaft should be checked for straightness, particularly at the crank end of the shaft. If the surface is pitted or damaged replace the steering shaft.
   g) **Steering crank [4].** Check that the crank is not bent or worn. Replace if damaged. The crank ball should be checked for excessive wear. ***The maximum clearance between the crank ball and the nozzle bush is 1.2mm (0.047ins). Replace the steering crank [4] if the diameter of the ball has worn below 20.8mm (0.82ins) (This should be measured at 90° to the shaft axis).***

9.4.3 Nozzle Assembly Removal

Refer to Drawing HJ-241-06-000 Steering Assembly General Arrangement Sht1 & 2.

1. Check the steering crank bush [14] for security and wear. Replace if loose worn or damaged.
2. Rotate the nozzle [15] through its full arc of travel to check for stiffness or wear in the nozzle bushes [10] and pivot sleeves [12].

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

Nozzle and nozzle housing removal:

Drawing HJ-241-01-000 Basic Jet Assemblies Standard and Dry Run Sht 1 & 2 ***refers unless otherwise stated.***

1. To remove the nozzle housing complete with the nozzle still attached, remove the nuts [27] and spring washers [28] from the studs [9], which secure the nozzle housing assembly to the tailpipe.
2. Tap off the nozzle housing using a rubber hammer and remove from the studs [9].
3. Remove the nozzle insert [21] ***(Drawing*** HJ-241-06-000 Steering Assembly General Arrangement Sht1 ***refers)*** from inside the nozzle housing and check for wear and damage. Replace or repair if worn or damaged.

Removing the nozzle from the nozzle housing:

To remove the nozzle from the nozzle housing, carry out the following actions:-

1. Loosen the screws [25] securing the JT steering lip seals [24] to the inner face of the nozzle [15] and ensure that the lip seals are free to move.
2. Whilst supporting the nozzle, unscrew and remove the upper and lower nozzle attachment bolts [11] and remove with the pivot sleeves [12], steering pivot thrust washers [23] and stepped adjusting washer [13]. ***Note that the pivot sleeves [12] are threaded onto the attachment bolts [11].***

Note: If the pivot sleeve [12] is difficult to remove, the nozzle attachment bolt [11] can be threaded partially into the pivot sleeve [12] to extract the pivot sleeve [12].

3. Rotate the nozzle slightly and pull rearwards to remove nozzle [15] from the nozzle housing [9].
4. Clean all parts thoroughly, examine for wear and damage, replace as necessary.

Inspecting the steering nozzle [15] and nozzle housing [9]:

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

1. **Steering nozzle:-** Check that the steering arm on the top of the nozzle is not bent. If any cracks are visible on the underside of the steering arm, or in the web adjacent to the pivot boss, ***the nozzle MUST NOT be used and should be replaced*.** If no faults are found, the underside of the steering arm should be crack tested using a dye penetrant technique to prove the integrity of the steering arm before re-use. ***Carry out a check of the " nozzle vertical end float adjustment", refer to Item 12 below.***
2. **Steering pivot bush sleeves [22].** Replace if any signs of wear, damage or scoring is evident.
3. **Steering pivot bush [10].** Check for wear and damage. Replace.
4. **Steering crank bush [14].** Check for wear or damage. Replace if worn or loose.
5. **Thrust washer [23].** Check for wear and damage. Replace.
6. **Stepped adjusting washer [13].** Check for wear, deformity and damage. Replace.
7. **Pivot sleeve [12].** Check for wear and damage. Check condition of the threads. Replace if worn or damaged.
8. **steering pivot bolts [11].** Check the condition of the threads and bolt. Replace if worn or damaged.
9. **JT steering lip seals [24].** Check the condition and security of the lip seals. Replace if damaged or worn.
10. **Nozzle anode [20].** Check the condition. Replace if more than ½ corroded.

9.4.4 Nozzle Assembly Overhaul

Drawing HJ-241-06-000 Steering Assembly General Arrangement Sht1 ***refers***.

Replacing the JT steering lip seals [24]:

Note: The JT steering lip seals can be replaced without separating the nozzle from the nozzle housing.

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

1. With the JT steering nozzle [15] 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 screws [25] at the rear of the nozzle securing the 2 JT steering lip seals [24] to the rear face of the nozzle.
2. Carefully remove the 2 JT steering lip seals [24] from the rear of the nozzle housing and discard.
3. Replace with 2 new JT steering 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 [15]. ***(Will be facing towards the front of the jet unit when completely assembled to the nozzle housing [9]).***
4. Refit the 2 new JT steering lip seals [24] in position at the rear of the nozzle.
5. Thoroughly clean the threads of the screws [25] and apply Loctite 222.
6. Secure the JT steering lip seals [24] in position hand tight only using screws [25] to allow some movement of the lip seals for adjustment.

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

7. Adjust the lip seal [24] to give a ***0.4mm to 0.6mm*** clearance to the spherical inner surface of the nozzle housing [9].
8. Tightened the screws [25] to the recommended torque to secure the lip seals to the rear of the nozzle.
9. Refit the JT steering nozzle [15] complete with the nozzle housing [9] to the tailpipe as shown in ***Section and Section*** 9.5.2 Re-Assemble the Nozzle / Nozzle Housing to the Tailpipe.

Steering crank bush [14] replacement:

Refer to Drawing HJ-241-06-000 Steering Assembly General Arrangement Sht1.

To replace the steering crank bush [14], carry out the following:-

1. With the nozzle [15] removed from the tailpipe and placed on a workbench, use a hacksaw blade to carefully cut out the old steering crank bush[14]. **Take care that the steering crank bore is not scored or damaged during removal of the steering crank bush [14].**
2. Carefully drift out the pieces of the old steering crank bush.
3. Ensure that the bore in the nozzle boss is cleaned of old loctite and any corrosion.

Note: Do Not paint the bore of the nozzle boss.

4. Apply a thin coating of Loctite Activator 7471 to the outside surface of the steering crank bush [14] and allow to dry. **Do not apply Activator to the bore of the steering arm.**

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

5. Apply Loctite 680 to the bore of the steering arm boss.

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

6. Insert the replacement steering crank bush [14] from the underside of the nozzle and outwards, ensuring that the shoulder of the steering crank bush is hard against the underside of the steering crank before commencing the swaging operation.
7. Using a suitable form tool or press, ***swage the new steering bush to 100 ft/lbs.***
8. Check and ensure that the swaging operation has been performed correctly and that the bush is not loose.

9. Clean off any surplus Loctite from around the replacement swaged steering crank bush [14].

Forward steering shaft bush [3] & steering shaft bush sleeve [27] - replacement:

The steering shaft bush sleeve [27] should not require replacement; However should it be necessary to replace the forward steering shaft bush sleeve [27], the steering shaft should be removed from the jet unit as shown in section 9.4.2 Steering shaft Removal. The steering shaft bush sleeve [27] should be pressed out forwards from the boss mounted on the top of the Intake and a new steering shaft bush sleeve fitted as shown below.

1. With the steering shaft removed from the jet unit, press out the forward steering shaft bush [3] forwards from the steering shaft bush sleeve [27], mounted in the intake boss.
2. Press out the forward steering shaft bush sleeve [27] forwards from the forward boss on the intake.
3. Clean out the bore of old loctite and activator.

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

4. Apply Loctite Activator 7471 to the outside of the replacement rear steering shaft bush sleeve and allow to dry. ***Do not apply Activator 7471 to the forward intake flange bore.***

Note: Loctite Activator 7471 must be used to refit the forward steering shaft bush sleeve [27] otherwise the Loctite 680 will not cure and retain the steering shaft bush sleeve in position.

5. Apply Loctite 680 to the bore of the intake boss.

Note: There are to be NO dry areas between the forward steering shaft bush sleeve [27] and the boss in the intake once the steering shaft bush sleeve is fitted.

6. From the front of the intake, press the forward steering shaft bush sleeve into the bore in the front intake boss ensuring that the sleeve is fully home in the bore.
7. Rotate the sleeve when fitting to evenly distribute the loctite around the bore.
8. Wipe off any excess loctite from around the steering shaft bush sleeve.
9. Refit a new steering shaft bush [3] into the steering shaft bush sleeve ensuring that the bush sits flush with the end face of the steering shaft bush sleeve [27].
10. Refit the steering shaft as shown in ***Section*** 9.5.3 Steering Shaft Re-Fitting.

Centre steering shaft bush [3], steering shaft bush sleeve [26] and o-ring [2] - replacement:

The centre steering shaft bush sleeve [26] should not require replacement; however should it be necessary to replace the centre steering shaft bush sleeve [26], the steering shaft should be removed from the jet unit as shown in Section 9.4.2 Steering shaft Removal. The centre steering shaft bush sleeve [26] should be pressed out rearwards from the rear boss mounted on the top of the Intake and a new steering shaft bush sleeve fitted as shown below.

1. With the steering shaft removed from the jet unit, remove and discard the o-ring [2] from the forward part of the steering shaft bush sleeve [26].
2. Press out the centre steering shaft bush [3] rearwards from the steering shaft bush sleeve [26], mounted at the rear of the intake.
3. Press out the steering shaft bush sleeve [26] rearwards from the centre boss on the intake.
4. Clean out the bore of old loctite and activator.

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

5. Apply Loctite Activator 7471 to the outside of the replacement centre steering shaft bush sleeve [26] and allow to dry. ***Do not apply Activator 7471 to the rear Intake Flange bore.***

Note: Loctite Activator 7471 must be used to refit the centre steering shaft bush sleeve [26] otherwise the Loctite 680 will not cure and retain the centre steering shaft bush sleeve in position.

6. Apply Loctite 680 to the outside of the centre steering shaft bush sleeve [26].

Note: There are to be NO dry areas between the centre steering shaft bush sleeve [26] and the boss in the Intake once the steering shaft bush sleeve is fitted.

7. From the rear of the transom, press the centre steering shaft bush sleeve into the bore in the rear intake boss ensuring that the sleeve is fully home in the bore.
8. Rotate the sleeve when fitting to evenly distribute the loctite around the bore.
9. Wipe off any excess loctite from around the steering shaft bush sleeve.
10. Refit a new steering shaft bush [3] into the steering shaft bush sleeve ensuring that the bush sits flush with the end face of the steering shaft bush sleeve [26]. ***Do not press the steering bush [3] fully into the bore of the steering shaft bush sleeve [26] as the o-ring [2] sits behind the steering bush [3] in the bore of the steering shaft bush sleeve [26].***
11. Smear a new o-ring [2] with marine grease and fit into the space at the front of the centre steering shaft bush [3].
12. Refit the steering shaft as shown in ***Section*** 9.5.3 Steering Shaft Re-Fitting.

Rear steering shaft bush [3] & steering shaft bush sleeve [27] - replacement:

The rear steering shaft bush sleeve [27] should not require replacement; However should it be necessary to replace the rear steering shaft bush sleeve [27], the steering shaft should be removed from the jet unit as shown in section 9.4.2 Steering shaft Removal. The rear steering shaft bush sleeve [27] should be pressed out rearwards from the boss mounted on the top of the tailpipe and a new steering shaft bush sleeve fitted as shown below.

1. With the steering shaft removed from the jet unit, press out the rear steering shaft bush [3] rearwards from the rear steering shaft bush sleeve [27], mounted in the boss at the rear of the tailpipe.
2. Press out the rear steering shaft bush sleeve [27].
3. Clean out the bore of old loctite and activator.

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

4. Apply Loctite Activator 7471 to the outside of the replacement steering shaft bush sleeve [27] and allow to dry. ***Do not apply Activator 7471 to the bore in the tailpipe.***

Note: Loctite Activator 7471 must be used to refit the rear steering shaft bush sleeve [27] otherwise the Loctite 680 will not cure and retain the steering shaft bush sleeve in position.

5. Apply Loctite 680 to the bore of the tailpipe boss.

Note: There are to be NO dry areas between the rear steering shaft bush sleeve [27] and the boss in the tailpipe once the steering shaft bush sleeve is fitted.

6. From the rear of the tailpipe, press the steering shaft bush sleeve into the bore on the tailpipe boss ensuring that the steering shaft bush sleeve is fully home in the bore.
7. Rotate the steering shaft bush sleeve when fitting to evenly distribute the loctite around the bore.
8. Wipe off any excess loctite from around the steering shaft bush sleeve.
9. Refit a new steering shaft bush [3] into the steering shaft bush sleeve ensuring that the bush sits flush with the end face of the steering shaft bush sleeve [27].
10. Refit the steering shaft as shown in ***Section*** 9.5.3 Steering Shaft Re-Fitting.

Steering pivot bush [10] and sleeve [22] replacement:

The nozzle housing is fitted with two stainless steel steering pivot bush sleeves [22] to accommodate the steering pivot bushes [10].

Note: The steering pivot bush sleeves [22] need only be replaced if the spherical surface shows signs of wear or damage.

1. The nozzle housing should be taken to a workshop facility and the nozzle removed from the nozzle housing.
2. The steering pivot bush sleeves [22] are pressed and loctited into the steering housing bores, press out the sleeve [22] from inside the steering housing. It may be necessary to apply light heat to the nozzle housing in the area of the sleeve [22] to break the Loctite seal.
3. Ensure that the nozzle housing bores are cleaned of old loctite and activator and repair the paint finish in the bores as shown on the painting notes. ***Drawing*** HJ-241-06-000 Steering Assembly General Arrangement Sht1 ***refers***.

Note: Activator 7075 must be used to refit the steering pivot bush sleeves [22] otherwise the Loctite 325 will not cure and retain the steering pivot bush sleeves in position.

4. Apply Loctite Activator 7o75 to the outside of the steering pivot bush sleeves [22] and allow to dry. **Do NOT apply Activator 7075 to the painted nozzle housing bores.**
5. Apply Loctite 325 to the outside of the steering pivot bush sleeve [22] and to the nozzle housing bores.

Note: There are to be NO dry areas between the steering pivot bush sleeves [22] and the nozzle housing bores once the steering pivot bush sleeves are fitted.

6. Press the new steering pivot bush sleeve, fully home into the nozzle housing bores, ensuring that the sleeves are pressed in evenly and are fully home in the bores.
7. Clean off any surplus Loctite from around the replacement sleeves.
8. Refit steering pivot bush [10] to the steering pivot bush sleeve [22].

Nozzle anode [20] replacement:

Refer to Drawing HJ-241-13-002 Anode Locations.

1. Check the anode [20] attached to the underside of the nozzle.
2. If this anode is less than half its original size, it should be replaced.
3. To replace the anode on the nozzle, carry out the following actions:
   a) Unscrew and remove 2 x nuts [7] and spring washers [8] from the studs [19], attaching the anode [20] to the nozzle [15].
   b) Remove the anode [20] from the studs [19].
   c) Clean up the contact area where the anode will locate, to remove any corrosion and paint. Repair the paint finish.
   d) Fit a new anode [20] onto the studs [19].
   e) Fit spring washers [8] and nuts [7] onto the studs [19] and torque load to the recommended torque.
4. If the anode is in good condition, ensure that it has not been painted over.
5. If a coating has built up on the anode, scrub the anode down with a wire brush.

9.5 Steering Assembly Re-Fitting

Refer to Drawing HJ-241-06-000 Steering Assembly General Arrangement Sht1 & 2, ***unless otherwise shown.***

CAUTION

The Steering Assembly can be reassembled in several ways. Refer to the Steering Section of the Manual and the relevant Steering Assembly drawings for correct assembly.

9.5.1 Nozzle Assembly Re-Fitting

Refer to Drawing HJ-241-06-000 Steering Assembly General Arrangement Sht1 ***unless otherwise shown. Prior to refitting the nozzle assembly to the jet unit, the nozzle must be assembled to the nozzle housing and the lip seals [24] adjusted.***

Note: Ensure that the nozzle housing is fitted to suit either "nozzle up" or "nozzle down" trim as required. Refer to Drawing HJ-241-06-000 Steering Assembly General Arrangement Sht1 for trim options.

Fitting the nozzle to the nozzle housing:

1. Ensure that the nozzle housing is fitted to suit the correct nozzle trim required. ***("nozzle straight" or "nozzle up" options). Refer to Drawing*** HJ-241-06-000 Steering Assembly General Arrangement Sht1 ***for trim options.***
2. Smear the stepped adjusting washers [13] with marine grease and fit to bolts [11].

Note: Ensure that the stepped adjusting washers [13] are fitted with the step facing inwards.

3. Smear the outside face of the pivot sleeves [12] with marine grease and thread the pivot sleeves [12] fully onto the bolts [11] to retain the stepped adjusting washers [13] in position.
4. With the nose of the nozzle turned either to the left or right of centreline, feed the nozzle into the nozzle housing.
5. Rotate the nozzle to align the upper and lower threaded inserts in the nozzle with the upper and lower steering bushes [10] fitted in the nozzle housing.

Note: The nozzle attachment bolts [11] are fitted using Loctite 222. Do not apply Loctite to the threads of the bolts [11] until “nozzle vertical end float adjustment” is completed.

6. Fit the upper and lower pivot bolts complete with the pivot sleeves [12] and stepped adjusting washers [13] fitted, to secure the nozzle to the nozzle housing.
7. Tighten bolts [11] and torque load to 60 Nm (45 ft/lbs).
8. Move the nozzle through its full arc of travel to ensure that the nozzle moves freely.

Nozzle vertical end float adjustment:

Check and ensure that the end float between the nozzle and the nozzle housing is between 0.1 to 0.3 mm.

1. Measure between the outer shoulder of the steering pivot bush sleeve [22] and the inner face of the thrust washer [23]. ***Refer to Drawing*** HJ-241-06-000 Steering Assembly General Arrangement Sht1. ***This should measure between 0.1 and 0.3 mm.***
2. Invert either one or both of the stepped adjusting washers [13] to achieve the measurement above.

Note: The 'end float' can be decreased by inverting one or both of the Stepped Washers [13].

3. Once the "end float" has been adjusted, remove the pivot bolts [11] and apply Loctite 222 to the threads of the pivot bolts [11] and refit.
4. Torque load pivot bolts [11] to 60 Nm (45 ft/lbs).

Steering lip seal adjustment:

Prior to refitting the nozzle / nozzle housing to the tailpipe, the steering lip seals [24] should be adjusted for correct fitment.

Note: If the JT steering lip seals [24] have been removed, they should be refitted at this point. Refer to Section 9.4.4 Nozzle Assembly Overhaul.

1. Place the nozzle / nozzle housing on a workbench with the nozzle facing downwards.
2. Adjust the lip seals [24] to give a ***0.4 to 0.6mm clearance*** to the spherical inner surface of the nozzle housing [9].

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

3. Thoroughly clean the threads of the screws [25] and apply Loctite 222.
4. Secure the JT steering lip seals [24] using screws [25]. Tighten to the recommended torque.

9.5.2 Re-Assemble the Nozzle / Nozzle Housing to the Tailpipe

Refer to Drawing HJ-241-01-010 Basic Jet Assemblies Standard and Dry Run Sht 3.

Note: Ensure that the nozzle assembly is fitted in the correct orientation to suit the application. Refer to Drawings HJ-241-06-000 Steering Assembly General Arrangement Sht1.

Nozzle insert re-fitting:

Note: The nozzle insert has a cutout in one side to correctly locate the nozzle insert into the nozzle housing.

Refit the nozzle insert [21] into the nozzle housing [9], ensuring that the cutout in the nozzle insert locates with the spigot in the rear of the nozzle housing. ***Refer to Drawing*** HJ-241-06-000 Steering Assembly General Arrangement Sht1.

Re-fitting the nozzle housing assembly to the jet unit:- Refer to Drawings HJ-241-06-000 Steering Assembly General Arrangement Sht1.

1. Apply Loctite 243 to studs [9] located on the rear face of the tailpipe.
2. With the crank boss uppermost, refit the nozzle / nozzle housing assembly complete to the tailpipe attachment studs [9] and secure with spring washers [28] and nuts [27]. Torque load to the recommended torque.

9.5.3 Steering Shaft Re-Fitting

Refer to Drawings HJ-241-06-000 Steering Assembly General Arrangement Sht1.

1. Smear the ball of the steering crank [4] with grease and refit into the steering crank bush [14] of the nozzle [15].
2. If the steering shaft has been removed to replace the steering bushes. Lightly grease the steering shaft and refit through the steering shaft bushes from the front to the rear of the jet unit.
3. From outside the vessel, pull the steering shaft [1] rearwards and slide the steering crank onto the end of the steering shaft ensuring that the steering crank is correctly orientated to suit the nozzle trim required. ***(See "nozzle up trim" HJ-241-06-005 and "nozzle straight trim" HJ-241-06-001 shown on Drawing*** HJ-241-06-000 Steering Assembly General Arrangement Sht1.
4. Refit cotter [5] to secure the the steering crank [4] to the steering shaft [1] and secure with special washer [6], spring washer [8] and Nut [7] in the correct order. ***(Fit the cotter from the port side of the jet unit, Refer to Drawing*** HJ-241-06-000 Steering Assembly General Arrangement Sht1***).*** Torque load to the recommended torque.
5. Operate the tiller [16] and ensure that there is freedom of movement.

9.5.4 Steering Cylinder Re-Fitting

Drawing HJ-241-06-000 Steering Assembly General Arrangement Sht1 and Drawing CT-SJK-02-005 Steering Cylinder, Seastar refers.

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 [16] or steering shaft [1]. (If tiller for tie rods fitted).
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.

Note: If this jet unit is fitted with the "Seastar" steering cylinder as a steering option, refer to the "Seastar manual" supplied with the steering cylinder for overhaul information.

9.5.5 Steering Linkages Adjustment

Refer to Section 5.5.4 Assembling the Jet Steering Tillers, Section 5.5.5 Centering the Jet(s) Steering and drawing HJ-241-06-000 Steering Assembly General Arrangement Sht2 for information on steering linkage and tiller adjustment for multiple jets.

9.5.6 Steering cylinder / Control Cable Connect

Refer to Section 5.5.3 Re-Fitting the Steering Components ***and Drawings*** HJ-241-06-000 Steering Assembly General Arrangement Sht1 & 2, CT-HLM-06-002 Helm Wheel Options and CT-SJK-02-005 Steering Cylinder, Seastar ***for further information.***

1. Ensure that the steering tiller [16] has been securely refitted to the steering shaft [1]. ***Refer to Drawing*** HJ-241-06-000 Steering Assembly General Arrangement Sht1 & 2. Refer to sheet 2 for tiller connections for tie rod, steering cylinder or cable steering system.
2. Operate the tiller [16] and ensure that there is freedom of movement.
3. Reconnect the steering control cable / Steering cylinder ***(Whichever Steering Option is fitted)*** to the steering tiller [16] and operate to ensure that there is freedom of movement. ***Refer to Section*** 5.5.3 Re-Fitting the Steering Components ***and Drawings*** CT-HLM-06-002 Helm Wheel Options and CT-SJK-02-005 Steering Cylinder, Seastar ***for further information.***
4. Refit the reverse duct and splash guard [7] as shown in ***Section*** 9.3.2 Reverse Duct: Refit to the Jet Unit.
5. Fully check all steering and reverse functions to ensure correct operation.

9.6 Bearing Housing Assembly Overhaul

Refer to Drawings HJ-241-01-000 Basic Jet Assemblies Standard and Dry Run Sht 1 & 2**.**

Overhaul of the bearing housing with the vessel afloat is not recommended, as the seal face holder would not remain in place once the bearing housing is dismantled.

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.

9.6.1 Bearing Housing Dismantling

Refer to Drawings HJ-241-01-000 Basic Jet Assemblies Standard and Dry Run Sht 1 & 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.

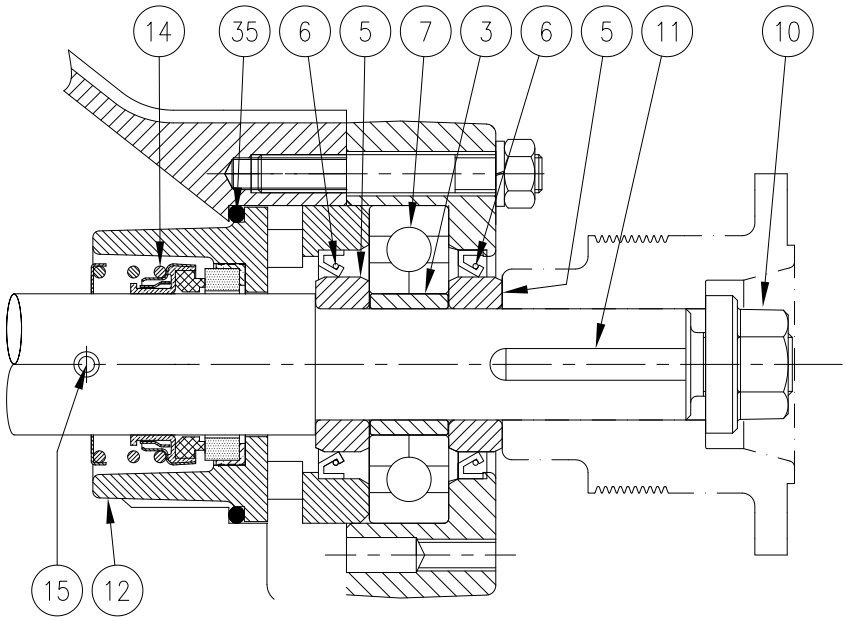


Figure 29: Bearing Housing & Waterseal Components

Dismantling the bearing housing assembly:-

To dismantle the bearing housing, carry out the following operations:

1. Disconnect the drive shaft from the jet unit coupling.
2. Fit the reaction arm tool to the jet unit coupling to prevent the coupling from turning.
3. Unscrew coupling nut [10] and remove.
4. Remove the reaction arm tool from the jet unit coupling.
5. Fit the puller to the end of the coupling and remove the coupling. Gently tap the coupling with a hammer during removal.
6. Remove the coupling key [11].
7. Remove the nuts [17] and spring washers [16] from studs [43] attaching the bearing housing [8] to the Intake [19].

Note: If the mainshaft is to remain in the jet unit, the waterseal retaining pin [15] can remain fitted to the mainshaft.

8. Remove the bearing housing [8] complete from the Intake [19] with bearing [7], outer seal [6] and outer seal sleeve [5].

Note: One half of the bearing inner race will probably stay on the mainshaft. Remove this and keep it with the bearing. Do not swap the bearing inner race halves. Keep the bearing clean.

9. Remove the bearing [7] and the outer seal [6] from the bearing housing [8].
10. Remove the bearing carrier [3] from the mainshaft.

9.6.2 Waterseal Removal

Refer to Drawings HJ-241-01-000 Basic Jet Assemblies Standard and Dry Run Sht 1 ***& 2 and Drawing*** 61483 Rotary Seal**.**

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.

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

Note: The rubber bellows [5] (Shown in Drawing 61483 Rotary Seal) 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. The seal face holder [12] assembly can now be removed by gently tapping the seal face holder forward from the rear of the jet, using a wooden drift.
3. Take care to support the mainshaft as the seal face holder comes free.
4. Remove the seal face holder [12] complete with the inner seal [6] and the inner seal sleeve [5].
5. Remove intake/seal face holder o-ring [35].
6. Remove the waterseal carbon face forwards off the mainshaft. ***Item [3] of Drawing*** 61483 Rotary Seal**.**
7. Break the seal between the waterseal neoprene bellows [4] and the mainshaft. Slide the neoprene bellows [4], holder [5], spring [6] and spring cap [7] forward off the mainshaft. ***Drawing*** 61483 Rotary Seal ***refers.***

Note: Take care during removal of the waterseal assembly as the stationary face is ceramic and is quite brittle

Removing the bearing housing assembly complete with mainshaft and waterseal:

Note: The bearing housing can be dismantled complete with the jet unit coupling, mainshaft and waterseal attached, if the impeller has already been removed.

If the impeller has already been removed, proceed as follows:-

1. Remove the nuts [17] and spring washers [16] on the 3 studs [43] attaching the bearing housing [8] to the intake [19].
2. While supporting the mainshaft, the complete bearing housing, waterseal and mainshaft assembly can now be removed by tapping the seal face holder forward from the rear of the Jet, using a hammer and wooden drift.
3. The complete assembly can now be removed to a workbench to carry out further dismantling.
4. Continue as from sub-heading ***"Waterseal Removal"*** to dismantle the remainder of the bearing housing assembly.

Checking for wear:-

Clean all components and check the following parts for wear or damage. Obtain replacement parts if significant wear or damage is found.

1. **Inner and outer main bearing seals [6].** Check the seals for wear, cuts or deformity. Replace if damaged.
2. **Inner and outer seal sleeves [5].** Check the seals for wear, fretting or damage. Replace if damaged. ***The sleeves may be turned end for end instead of replacing***.
3. **Bearing [7].** Check that the bearing has no signs of wear. Replace if any signs of wear are evident.

Note: Do not swap the bearing inner halves. Keep the bearing clean.

4. **Bearing housing [8].** Ensure that there are no signs of wear, fretting or relative movement in the bearing housing.
5. **Bearing carrier [3].** Ensure that there are no signs of wear, fretting or damage.
6. **Seal face holder [12].** Ensure that there are no signs of wear, fretting, or relative movement.
7. **Waterseal and stationary face assembly (Items [2] & [3] in Drawing 61483).** Check the mating faces of ***Items [2] & [3]*** are not scored, cracked or chipped. The waterseal stationary face [2] should be checked without removing it from the seal face holder [12].
8. It is recommended that all the seal rotary components ([3], [4], [5], [6] & [7] and the stationary face components [1] & [2] in ***Drawing*** 61483 Rotary Seal be replaced even if only one appears worn.
9. **O-ring [35].** Check for cuts, deformation or permanent set. Replace o-ring if any defects or damage are found. Ensure that this o-ring is refitted on reassembly.
10. **Mainshaft [1].** Check for signs of scuffing, pitting or corrosion. Remove any burrs from the waterseal area with emery paper. Thoroughly clean on completion.
11. **ll Parts.** Thoroughly clean and examine all parts prior to re-assembly

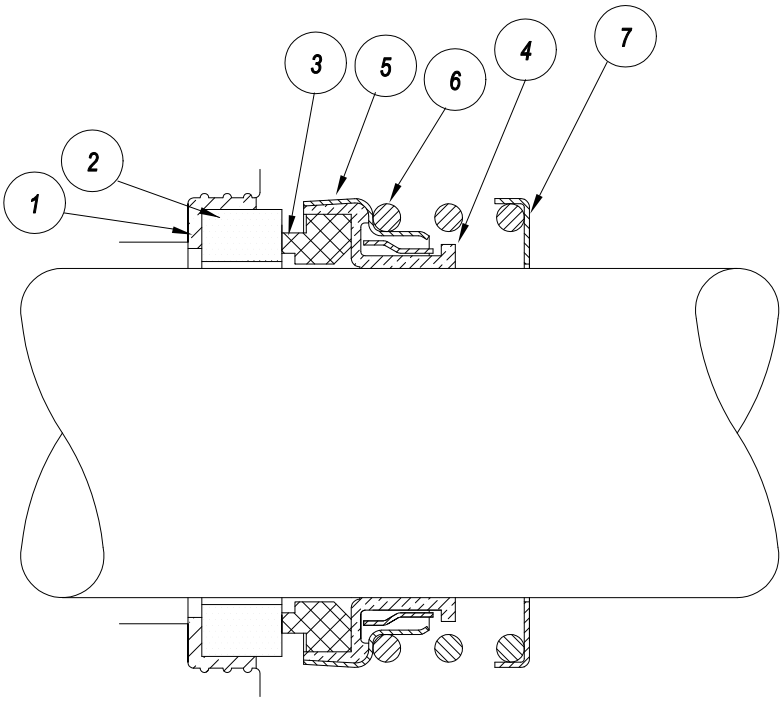


Figure 30: HJ-241 Jet Water Seal

Table 12: HJ-241 Jet Waterseal Components

Item No.	Description
1	Neoprene boot
2	Ceramic stationary face
3	Resin bonded face
4	Neoprene bellows
5	Holder
6	Spring
7	Spring cap

9.6.3 Water Seal Replacement and Re-Fitting

CAUTION

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

1. If the mainshaft has been removed from the jet unit and the water seal retaining pin [15] has been removed, insert a new water seal retaining pin [15] into the hole in the mainshaft, folding the legs closely around the mainshaft to avoid their fouling with the seal face holder [12].
2. Coat the mainshaft / water seal location area with a 20:1 water and household detergent mix.
3. Slide the waterseal spring cap [7] and spring [6] ***(Drawing*** 61483 Rotary Seal ***refers)*** onto the mainshaft up to the waterseal retaining pin hole in the mainshaft.
4. Carefully slide the remaining waterseal rotary components ***(Items [3],[4] & [5] of Drawing*** 61483 Rotary Seal***)*** onto the mainshaft, to their approximate final position. If necessary wrap tape around the mainshaft shoulder to ease the waterseal over, this will prevent damaging the waterseal.

Note: The neoprene bellows [4] (Shown in Drawing 61483 Rotary Seal) will bind to the mainshaft [1] after about 15 minutes, ensure that the assembly of the bearing housing and waterseal is complete within this time.

5. Wipe away all traces of the water and detergent mixture from the mainshaft and waterseal. This prevents corrosion of the mainshaft if the jet unit is put into storage. Do not allow grease or oil near the waterseal face.
6. Lubricate the seal face holder [12] and the stationary face rubber boot with a 20:1 water and household detergent or liquid soap mix.
7. Fit a new rubber boot [1] and ceramic face [2] ***(Refer to*** Figure 30: HJ-241 Jet Water Seal) to the rear of the seal face holder [12] and ensure that it is pushed fully home into the recess in the rear of the seal face holder.
8. Fit the seal face holder over the mainshaft and push into place against the intake face.
9. The bearing housing can now be re-fitted.

9.6.4 Re-Assembly of the Bearing Housing

Refer to Drawing HJ-241-01-000 Basic Jet Assemblies Standard and Dry Run Sht 1.

Note:

1. The main bearing seals [6] are oriented as shown to ensure that the grease pumped in through the grease nipple (Item [18] of Drawing HJ-241-01-000 Basic Jet Assemblies Standard and Dry Run Sht 1.) passes through the bearing and excess grease can escape out past the front main bearing seal [6] of the bearing housing where it can be seen.
2. If the inner seal [6] is fitted incorrectly, grease may not get into the bearing, and will escape into the waterseal cavity. Grease on the waterseal will attract grit and will form a grinding paste which will destroy the waterseal.

10. Fit a new o-ring [35] to the recess in the intake.
11. Lightly smear the outer surface of the inner oil seal [6] with grease and press the inner oil seal [6] into the seal face holder [12]. ***Ensure that the lip of the seal faces towards the coupling flange when the seal face holder is fitted in position. Refer to*** Figure 29: Bearing Housing & Waterseal Components**.**
12. Apply marine grease to the o-ring [37] fitted to the Intake recess and around the seal face holder contact area with the intake.
13. Lightly grease the inner seal sleeve [5] and fit over the mainshaft [1]. Push the seal sleeve through the inner oil seal [6] until the seal sleeve rests against the shoulder on the mainshaft.
14. Lightly smear the outer surface of the outer oil seal [6] with grease. Press the outer oil seal [6] into the recess in the bearing housing [8] until the outer oil seal is firmly against the shoulder in the bearing housing. ***Ensure that the lip of the seal faces the coupling flange when the bearing housing is fitted in position. Refer to*** Figure 29: Bearing Housing & Waterseal Components**.**
15. Pre-pack the main bearing [7] with an approved bearing grease, then press the bearing into the bearing housing [8].
16. Fit the bearing housing [8] complete with bearing [7] over front part of the mainshaft and locate into studs [43] fitted to the forward face of the intake [19].
17. Fit spring washers [16] and nuts [17] to studs [43] and secure the bearing housing to the intake. Torque load to the recommended torque.
18. Smear the bearing carrier [3] with grease and carefully slide the bearing carrier onto the mainshaft and into the bearing housing through the centre of the bearing [7].
19. Using a soft hammer, gently tap the bearing carrier [3] until it is level with the outside face of the bearing [7].
20. Apply grease to the outer face of the outer seal sleeve [5] and slide the outer seal sleeve along the mainshaft towards the bearing housing.
21. Carefully push the outer seal sleeve through the outer oil seal [6] fitted in the bearing housing, until the seal sleeve rests firmly against the bearing [7].
22. Lightly grease the bore and keyway of the coupling glange, the keyway of the mainshaft and the contact face of the coupling Nut [10].
23. Fit the coupling key [11] to the mainshaft and tap into position with a soft hammer.
24. Fit the coupling to the mainshaft, ensuring that the keyway in the coupling aligns with the coupling key [11] fitted to the mainshaft.
25. Ensure that the coupling key [11] has not been dislodged whilst fitting the coupling to the mainshaft.
26. Fit the coupling nut [10] to the mainshaft.
27. Fit the reaction arm tool to the jet unit coupling to prevent the coupling from turning. Torque load coupling nut [10] to ***240 Nm (177 ft/lbs).***
28. Refill the bearing housing with an approved bearing grease. This can be carried out using the grease nipple [18] on the top of the bearing housing. ***(Drawing*** HJ-241-01-000 Basic Jet Assemblies Standard and Dry Run Sht 1 ***refers).***

29. Whilst slowly rotating the mainshaft, lightly grease the bearing via the grease nipple [18] on the top of the of the bearing housing. Continue adding grease until the grease is seen to escape between the outer seal sleeve [5] and the outer seal [6]. Wipe off any excess grease.
30. Turn the mainshaft by hand to ensure that it rotates freely before connecting the coupling to the driveshaft.
31. Put the vessel in the water and run the jet unit to check that the waterseal is not leaking.

9.7 Tailpipe Area - Overhaul

Refer to Drawing HJ-241-01-000 Basic Jet Assemblies Standard and Dry Run Sht 1 & 2

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.

9.7.1 Impeller - Checking for Wear

Before dismantling the tailpipe end of the jet, remove the inspection cover [20] (or intake screen [24] 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 17.***
2. **Water bearing wear check:**
   Refer: Section ***8.6.1 Jet Unit Servicing Details Item 17.***

9.7.2 Tailpipe Area - Dismantling

Refer to Drawings HJ-241-01-000 Basic Jet Assemblies Standard and Dry Run Sht 1 & 2.

Dismantling:

If the tailpipe is being removed complete, proceed as follows, otherwise refer to *Section* 9.4.2 Steering shaft Removal for the removal of the steering components.

1. Ensure that the procedures shown in ***Section*** 9.2.1 Reverse Duct Removal and ***Section*** 9.4.2 Steering shaft Removal of this manual have been carried out to remove the reverse duct and the splash guard [7] and to disconnect the steering shaft and steering control cable / steering cylinder.
2. Ensure that the steering shaft has either been withdrawn from the steering bush located in the tailpipe or completely removed from the jet unit.
3. Unscrew and remove nuts [17] and spring washers [16] from the studs [30] securing the intake to the tailpipe.
4. Hit the tailpipe sideways with the heel of the hand or a rubber mallet to free the joint.
5. Gently ease the tailpipe [41] aft off the studs [30] and slide it carefully off the impeller. The impeller and impeller nut is now exposed.

Impeller removal:

6. Fit the reaction arm to the coupling flange to prevent the mainshaft from turning and unscrew the impeller nut [10].
7. Remove the impeller nut [10] from the rear end of the mainshaft.
8. Remove the water bearing sleeve [4].
9. The impeller can be withdrawn off the mainshaft, ensuring that the key [11] is also removed.

9.7.3 Inspection of the Tailpipe Marine Bearing and Wear Ring

With the tailpipe removed from the jet unit Intake as shown in *Section* 9.7.2 Tailpipe Area - Dismantling, carry out the following actions:-

1. **Marine water bearing sleeve [4].** 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*** 9.7.7 Tailpipe Overhaul.
2. **Tailpipe water drain hole.** Check that the water drain hole in the centrew of the tailpipe cone is not blocked. Clear any blockage found.
3. **Wear ring [37] and insulator [38].** 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*** 9.7.4 Wear Ring and Insulator Removal and Replacement.
4. **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*** 9.7.4 Wear Ring and Insulator Removal and Replacement.
5. **Stator blades.** Check for signs of damage or erosion to the leading edges. Dress off any burrs.
6. **Plug [36] (on tailpipe).** Check the water-offtake screen by removing any stones from the filter holes.

9.7.4 Wear Ring and Insulator Removal and Replacement

Wear ring and insulator replacement:

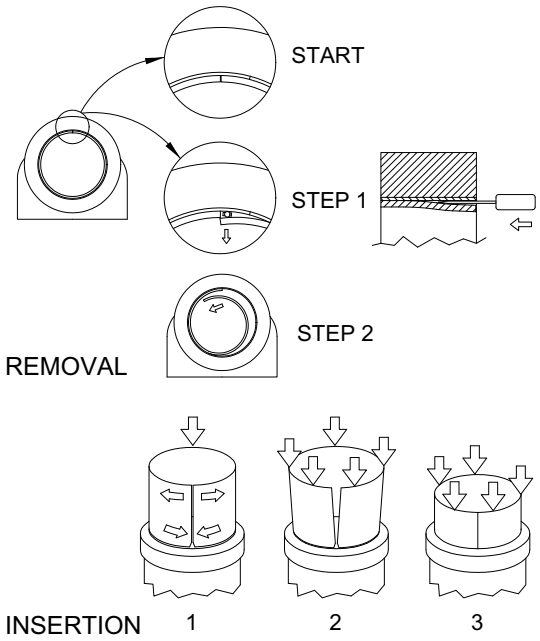


Figure 31: Wear Ring Inspection & Removal Instructions

Step 1:

1. Find the joint in the wear ring [37] and force a long thin screwdriver between the wear ring [37] and the Insulator [38], adjacent to the wear ring joint, until the end of the wear ring is free. ***(See 'Step 1 Removal' in*** Figure 31: Wear Ring Inspection & Removal Instructions).

Step 2:

2. Pull the free end of the wear ring inwards and remove it from the tailpipe. ***(See 'Step 2 Removal' in*** Figure 31: Wear Ring Inspection & Removal Instructions***).***
3. Remove the insulator [38] and thoroughly clean and degrease the tailpipe bore.

Preparing a new wear ring for fitting:

1. Before fitting a new wear ring, it should be trial fitted into the tailpipe bore with ***No insulator Fitted*.**
2. There should be a gap of approximagely 1mm between the mating ends of the wear ring with the wear ring completely fitted into the tailpipe bore.
3. The wear ring may not fit without some "dress" filling 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 tailpipe once the insulator is fitted. This ensures that the wear ring remains in the correct position during operation.

Fitting an new insulator:

1. Paint tailpipe bore with a thin layer of two pot vinyl etch primer suitable for aluminium and allow to dry.
2. Apply a 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 expoxy primer. ***While the primer is still wet,*** fit in a new insulator [38] into the tailpipe, ensuring that 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:

Step 1:

1. Take a new wear ring [37] and with the chamfer end leading, butt the strip at the chamfers by twisting slightly, (this reduces the lead in diameter) ***(See 'Step 2 Insertion' in*** Figure 31: Wear Ring Inspection & Removal Instructions***).***
2. Gradually feed it inside the insulator [38] fitted in the tailpipe until it butts fully. ***(See 'Step 3 Insertion' in*** Figure 31: Wear Ring Inspection & Removal Instructions***).***
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 wear ring)***.
5. Drive the wear ring evenly into the tailpipe 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 tailpipe. ***Refer to*** Figure 33: 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 protrudes ***by 2 mm*** from the forward end of the tailpipe.

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 tailpipe Figure 32: Wear Ring Forward Position and the wear ring protrudes by up to 2 mm from the forward face of the tailpipe. Figure 33: Wear Ring Aft Position. This gap must be maintained to prevent electrical contact between the wear ring and the tailpipe / intake of the jet unit.

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.**

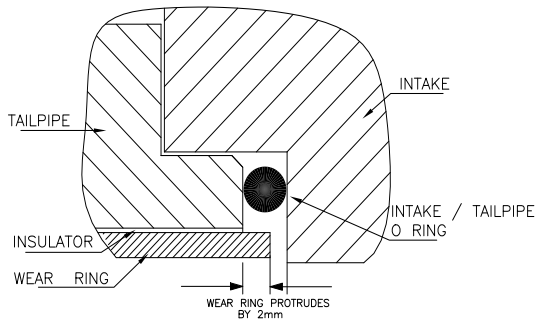


Figure 32: Wear Ring Forward Position

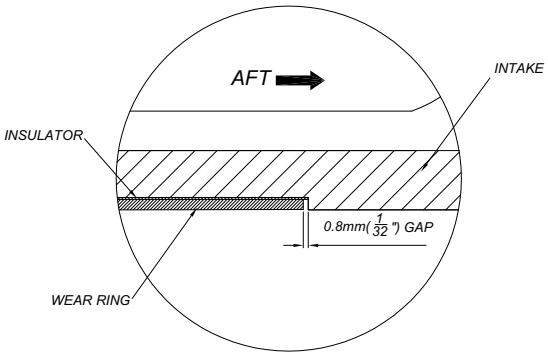


Figure 33: Wear Ring Aft Position

9.7.5 Impeller Area - Overhaul

Minor corrosion damage around the wear ring / impeller position inside the tailpipe, 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.

9.7.6 Impeller Overhaul

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 chemical analysis similar to AISI 316L (Carbon content less than 0.03%) 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.
2. Check the impeller leading and trailing edges for damage. In particular the outer corners of a blade may be bent if the impeller has been dropped or mishandled. Bent or dented blades may be straightened using suitable tools. Bring the blade back to it's original smooth profile checking against 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 HJ-241-03-001 Impellers shows 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 same thickness all along. **Refer to Drawings** 82206 impeller Dressing Instruction Sht1.
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. **Refer to Drawings** 82206 impeller Dressing Instruction Sht1.

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

1. If the impeller OD is excessively worn it may be built up by welding. After welding turn the impeller on a mandrel to the correct OD. 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 outside diameter to avoid deformation of the impeller Blades).

Impeller diameter		
New max diameter	New min diameter	Worn min diameter
239.55	239.40	238.7

3. File and polish the impeller blades.

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 impeller and coupling 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 27 gm-cm (0.38 oz/ins.).*** Balance weights of 316SS may be welded to the inside of the hub and grinding is permitted.

Passivation:

WARNING

Wear appropriate safety glasses, protective gloves and clothing to prevent skin exposure to nitric acid.

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.

9.7.7 Tailpipe Overhaul

Refer to Drawings HJ-241-01-000 Basic Jet Assemblies Standard and Dry Run Sht 1 & 2.

Tailpipe:

1. Check the marine water bearing [2] and bearing sleeve [4] for wear or severe scoring and if necessary replace. ***Refer to Section*** 8.6.1 Jet Unit Servicing Details Item No***16 h). Also refer to Section*** 9.7.1 Impeller - Checking for Wear. Replace automatically if the impeller has just been built up and the wear ring has been replaced.
2. Use an internal extractor to pull the marine water bearing [2] from the tailpipe.
3. Apply grease to the tailpipe bore before inserting a new marine water bearing but ensure that grease is kept away from the rubber bearing surfaces.
4. When pressing in the new marine water bearing, use a wooden block under the nose of the tailpipe 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.

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** 9.4.2 Steering shaft Removal ***and*** **Section** 9.4.4 Nozzle Assembly Overhaul.

External tailpipe anodes [39] - replacement:

Refer to Drawings HJ-241-01-000 Basic Jet Assemblies Standard and Dry Run Sht 1 & 2 ***and Drawing*** HJ-241-13-002 Anode Locations.

1. Check the 2 x external tailpipe anodes [39] attached to the underside of the tailpipe, if these are less than half of their original size, they should be replaced.
   a) To replace the external tailpipe anodes, carry out the following operation:-
   b) Remove the nuts [27], spring washers [28] and screws [40] securing the anodes to the web on the underside of the tailpipe.
   c) Remove the external anodes [39].
   d) Clean up the contact area where the anode will locate to remove any corrosion and paint. Repair the paint finish.
   e) Fit a new external anodes [39] and secure with screws [40], spring washers [28] and nuts [27]. Torque load to the recommended torque.
2. If the anodes are still in good condition, ensure that they have not been painted over.
3. Scrub down the anodes with a wire brush if a coating has built up on the anodes.

Internal tailpipe anodes [50] - replacement:

Drawings HJ-241-01-000 Basic Jet Assemblies Standard and Dry Run Sht 1 & 2 ***and Drawing*** HJ-241-13-002 Anode Locations refer.

1. Check the 4 x internal tailpipe anodes [50] attached to the anode mounting plate [44] 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 4 x internal tailpipe anodes [50], carry out the following operation:-
   a) With the tailpipe removed from the intake [19], remove the nyloc nuts [65] and spring washers [28] from the studs [52] attaching the anode mounting plate [44] to the tailpipe.
   b) Remove the bolts [51], nyloc nuts [65] and spring washers [28] securing each anode to the anode mount plate.
   c) Remove the 4 internal tailpipe anodes [50].
   d) Clean up the contact area where the anodes will locate to remove any corrosion and paint. Repair the paint finish.
   e) Clean the threads of the attachment bolts [51] and apply Loctite 243 to the threads.
   f) Fit new internal tailpipe anodes [50] to the anode mounting plate [44] and secure with bolts [51], nyloc nuts [65] and spring washer [28]. Torque load nyloc nuts to the recommended torque.
   g) Clean the threads of the studs [52] located on the inner face of the tailpipe and apply Loctite 243 to the threads of the studs [52]
   h) Refit the anode mounting plate [44] to the tailpipe and attach to studs [52] with nuts [27] and spring washers [28]. Torque load to the recommended torque.
3. If the anodes have not been replaced and 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.

9.7.8 Tailpipe Area Re-Assembly

Refer to Drawings HJ-241-01-000 Basic Jet Assemblies Standard and Dry Run Sht 1 & 2.

Impeller re-assembly:

1. Smear a light coating of grease over the mainshaft from the rear of the threaded area to the shoulder on the mainshaft. **Do not grease the threads on the mainshaft.**
2. Insert the impeller key [11] into the mainshaft keyway and tap into position with a soft hammer.
3. Slide the impeller onto the mainshaft ensuring that the impeller engages fully with the impeller key [11].
4. Fit the bearing sleeve [4] onto the mainshaft.
5. Apply "Loctite 243" or equivalent to the mainshaft threads.
6. Fit the impeller nut [10]. **Torque load to 240 Nm (177 ft/lbs).**

Tailpipe re-assembly:

7. Dust the water bearing [2] with talcum powder or french chalk.
8. Clean and grease the tailpipe / Intake contact faces.
9. Check the intake / tailpipe o-ring [42] for permanent set. Replace if necessary. To refit the o-ring [42], stretch the o-ring by hand until it is a snug fit in the intake recess and holds itself in place. Grease can be used to help keep the o-ring in place and to ensure that the o-ring is not pinched during assembly.
10. Carefully refit the tailpipe over the impeller and onto the intake and tailpipe studs [30].
11. Apply a light smear of grease to the threads of the studs [30].
12. Refit heavy flat washers [66] and nuts [17] using loctite 222 and tighten evenly to the correct torque.
13. Rotate the mainshaft to ensure that the assembly will rotate.
14. The nozzle and nozzle housing can be re-fitted to the tailpipe. ***Refer to Section*** 9.5.2 Re-Assemble the Nozzle / Nozzle Housing to the Tailpipe.
15. Re-connect the steering shaft and steering control cable / steering cylinder or tie rod (Whichever steering option fitted). ***Refer to Section*** 9.5.3 Steering Shaft Re-Fitting**.**
16. Refit the reverse duct and the splash guard [7]. ***Refer to Section*** 9.3.2 Reverse Duct: Refit to the Jet Unit.

9.8 Transom Plate Assembly Overhaul

Refer to Drawings

HJ-241-08-001 Installation Details GRP Hull ,
HJ-241-08-002 Installation Details Aluminium Hull
HJ-241-08-003 Installation Details Steel Hull Sht1.

Note: The transom plate o-ring [8] and transom plate [1] should not be removed unless they are suspected of leaking or unless the transom plate [1] is corroded or damaged.

Should it be necessary to remove the transom plate 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 [8] or transom plate [1], the reverse duct and tailpipe must be removed complete, to allow access to remove the transom plate.

9.8.1 Transom Plate Removal

Note: The transom plate [1] can only be removed with the reverse duct and tailpipe removed from the jet unit.

Should it be necessary to remove the transom plate from the vessel transom, carry out the following actions:-

1. Remove the splash guard and reverse duct from the jet unit as shown in ***Section*** 9.2.1 Reverse Duct Removal**.**
2. Remove the steering assembly and nozzle housing assembly as shown at ***Section*** 9.4.2 Steering shaft Removal ***and Section*** 9.4.3 Nozzle Assembly Removal.
3. Remove the tailpipe as shown in ***Section*** 9.7.2 Tailpipe Area - Dismantling.

GRP hulls:

Refer to Drawings HJ-241-08-001 Installation Details GRP Hull**.**

Aluminium hulls:

Refer to Drawings HJ-241-08-002 Installation Details Aluminium Hull.

To remove the transom plate [1] and replace the transom plate o-ring [8], carry out the following operation:-

1. Slacken and remove the screws [9], nuts [4], flat washers [6], and spring washers [5] securing the transom plate to the transom.
2. Remove the transom plate off the jet unit intake.
3. Remove the transom plate o-ring [8] from to o-ring groove around the jet unit Intake and discard.
4. Clean off any old RTV sealant from the transom plate [1] and the transom and examine the transom plate for damage and corrosion. Replace or repair as required.
5. Ensure that the seal contact surface of the transom plate is free of corrosion and will give a good contact area with the transom o-ring [8].

Steel hulls:

Refer to Drawings HJ-241-08-003 Installation Details Steel Hull Sht1 & 2.

To remove the transom plate [1] and replace the transom plate o-ring [8], carry out the following:

1. Slacken and remove the bolts [9], 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 [19] 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 [8] from around the jet unit and discard.
6. Clean off old RTV sealant from the transom plate [1] and the transom and examine for damage and corrosion. Replace or repair as required.

9.8.2 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.

1. Refit the tailpipe assembly as shown in ***Section*** 9.7.7 Tailpipe Overhaul.
2. Refit the steering assembly and nozzle assembly as shown in ***Section*** 9.5 Steering Assembly Re-Fitting.
3. Refit the reverse duct and splash guard as shown in ***Section*** 9.3.2 Reverse Duct: Refit to the Jet Unit.

9.9 Hatch Extension (Optional Extra)

Refer to Drawing HJ-241-10-004 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 hatch cover may allow water to enter the vessel. The hatch extension raises the height of the inspection hatch by approximately 150mm.

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.

9.9.1 Hatch Extension Fitting.

Refer to Drawing HJ-241-01-000 Basic Jet Assemblies Standard and Dry Run Sht 1 & 2and Drawing HJ-241-10-004 Hatch Extension.

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 hatch.
3. Remove nuts [23] and spring washers [22] from the two studs [58] retaining the inspection cover [20] on the intake.
4. Remove the inspection cover [20] and o-ring [34].
5. Check the o-ring [34] and replace if damaged or distorted.
6. Smear o-ring [34] with grease and refit to the o-ring groove in the inspection cover [20].
7. Ensure that o-ring [2] on the base of the inspection hatch extension [1] is not damaged or distorted. ***Refer to Drawing*** HJ-241-10-004 Hatch Extension.
8. Smear the o-ring [2] with grease and refit the hatch extension [1].
9. Fit the hatch extension over the 2 studs [58] ***(shown on Drawings*** HJ-241-01-000 Basic Jet Assemblies Standard and Dry Run Sht 1 & 2
10. Secure with spring washers [22] and nuts [23] ***(Shown on Drawing*** HJ-241-01-000 Basic Jet Assemblies Standard and Dry Run Sht 1 & 2and torque load to the recommended torque.
11. Fit the inspection cover [20] to studs [3] ***(shown on Drawing*** HJ-241-10-004 Hatch Extension***)*** and secure with spring washers [5] and nuts [4]. Torque load to the recommended torque.
12. Once the vessel is "in use", ensure that the hatch extension is not leaking water.

9.9.2 Hatch Extension Removal.

Refer to Drawings HJ-241-01-000 Basic Jet Assemblies Standard and Dry Run Sht 1 & 2***and*** Drawing HJ-241-10-004 Hatch Extension.

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.

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 [4] and spring washers [5] from studs [3] ***(shown on Drawing*** HJ-241-10-004 Hatch Extension***)*** securing the inspection cover [20] to the hatch extension.
3. Remove the inspection cover [20] and o-ring [34] from the top of the hatch extension. ***Refer to Drawing*** HJ-241-01-000 Basic Jet Assemblies Standard and Dry Run Sht 1 & 2.
4. To remove the hatch extension from the inspection opening, remove nuts [23], and spring washers [22] from the studs [58] securing the hatch extension to the intake opening.
5. Remove the hatch extension [1] and o-ring [2] from the securing studs on the intake opening. ***Refer to Drawing*** HJ-241-10-004 Hatch Extension.
6. Ensure that the o-ring [34] fitted to the inspection cover [20] is not cut or perished. ***Refer to Drawing*** HJ-241-01-000 Basic Jet Assemblies Standard and Dry Run Sht 1 & 2.
7. Smear the o-ring [34] with marine grease and fit to the o-ring groove on the underside of the inspection cover [20].
8. Fit the inspection cover over studs [58] fitted around the inspection opening and secure in position with spring washers [22] and nuts [23].
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.

9.10 Screen Rake Assembly Overhaul (If Fitted)

Refer to Drawing HJ-241-09-002 Screen Rake Assembly.

Before removing the screen rake, ensure that the screen has been removed. ***Refer to Section*** 9.10.4 Screen Removal.

The screen rake need only be dismantled if it is suspected of being defective for the following reasons:-

1. The port [4] and starboard [3] screen rake bearings are worn.
2. The o-rings [14] and [15] are leaking.
3. The screen rake [1] is bent or damaged.

9.10.1 Screen Rake Removal

Refer to Drawing HJ-241-09-002 Screen Rake Assembly.

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 spring [7] from the screen rake actuating arm [2] and spring anchor bracket [8] on the starboard side of the intake, in the vicinity of the coupling flange.
3. Remove nut [11], spring washer [12], washer [10] and the cotter pin [9] securing the screen rake actuating arm [2] to the screen rake [1].
4. Remove the screen rake actuating arm [2].
5. With the screen rake supported beneath the vessel, from inside the vessel, remove the screen rake bearing attachment nuts [11] and spring washers [12] 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 [1] 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 [11] and spring washers [12] from the port screen rake Bearing [4] and withdraw the port screen rake bearing from the intake.
12. Check the o-rings [14] and [15] 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 [13] from the starboard screen rake bearing [3] and ensure that the grease channels are not blocked.
15. Refit the grease nipple [13] to the starboard screen rake bearing.
16. Check the o-ring [14] on the port screen rake bearing and replace if cut, damaged or distorted.
17. Remove the grease nipple [13] from the port screen rake bearing [4] and ensure that the grease channels are not blocked.
18. Refit the grease nipple [13] to the port screen rake bearing.
19. Thoroughly clean all components and examine for wear, damage and distortion.

9.10.2 Screen Rake Re-Fitting

Drawing HJ-241-09-002 Screen Rake Assembly refers.

1. Smear a new o-ring [14] with grease and fit onto the port screen rake bearing. Smear the shaft and the bore of the port screen rake bearing with marine grease.
2. Fit the port screen rake bearing to the studs [9] on the port side of the intake. ***Refer to Drawing*** HJ-241-01-000 Basic Jet Assemblies Standard and Dry Run Sht 1 & 2.
3. Secure the port screen rake bearing with spring washer [12] and nuts [11], ensuring that the grease nipple [13] is positioned at the top of the bearing.
4. Torque load the nuts [11] to the recommended torque.
5. 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.
6. Raise the port side of the screen rake and align the pivot point of the screen rake with the port screen rake bearing [4].
7. Push the screen rake fully to port and into the port screen rake bearing [4].
8. From inside the vessel, smear new o-rings [14] and [15] with marine grease and fit to the starboard screen rake bearing [3]. Smear the shaft and bore of the starboard screen rake bearing with marine grease.
9. Fit the starboard screen rake bearing [3] over the starboard screen rake pivot point, which is protruding through the intake.
10. Align the starboard screen rake bearing [3] with the studs [9] on the intake, ***Refer to Drawing*** HJ-241-01-000 Basic Jet Assemblies Standard and Dry Run Sht 1 & 2.
11. Ensure that the grease nipple [13] is positioned at the top of the starboard screen rake bearing.
12. Secure the starboard screen rake bearing with spring washers [12] and nuts [11]. Torque load to the recommended torque.
13. Fit the screen rake actuating arm [2] to the starboard screen rake pivot point and fit cotter pin [9]. Secure with washer [10], spring washer [12] and nut [11]. Torque load to the recommended torque.
14. Connect one end of the spring [7] to the spring anchor bracket [8] and connect the other end of the spring [7] to the screen rake actuator [2].
15. Grease the port and starboard screen rake bearings at the grease nipples [13] on top of the screen rake bearings until grease is seen oozing from the inboard ends of the screen rake bearings.
16. Remove the support from the screen rake beneath the vessel.
17. 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.

9.10.3 Screen Rake Blanking Plugs

Refer to Drawing HJ-241-09-001 Blanking Plugs (For Screen Rake).

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 9.10.1 Screen Rake Removal.
2. Ensure that o-ring [4] fitted to the screen rake blanking plug [1] is not damaged, cut or distorted.
3. Liberally coat the shaft of the blanking plug with grease and fit onto studs [9]. ***Refer to Drawings*** HJ-241-01-000 Basic Jet Assemblies Standard and Dry Run Sht 1 & 2
4. Secure with spring washer [3] and Nut [2]. Torque load to the recommended torque.
5. Repeat Items 2 to 4 above to fit the second blanking plug.

9.10.4 Screen Removal

Refer to Drawing HJ-241-01-000 Basic Jet Assemblies Standard and Dry Run Sht 1 & 2.

To remove the screen from the intake, carry out the following actions:-

1. 1.Whilst supporting the screen [24], remove the 4 nuts [25], flat washers [29] off the studs [21] securing the front of the screen to the underside of the intake block.
2. Remove the 4 nuts [25], flat washers [29] off the studs [21] securing the rear of the screen to the underside of the intake block.
3. Lower the screen off the studs [21] and remove from the vessel for repair, refurbishment.

9.10.5 Screen Re-Fitting

Refer to Drawing HJ-241-01-000 Basic Jet Assemblies Standard and Dry Run Sht 1 & 2.

Ensure that the screen rake has been re-fitted prior to re-fitting the screen. ***Refer to Section*** 9.10.2 Screen Rake Re-Fitting.

1. Ensure that the studs [21] that support the front and rear of the screen are securely fitted to the intake. If the studs are loose, refit using Loctite 263.
2. Offer the screen up to the studs [21] on the front and rear of the underside of the intake and secure in position with flat washers [29] and nuts [25].
3. Tighten to the recommended torque.

9.11 HSRX Hydraulic Reverse System

9.11.1 Removal of the Pump Assembly from the Jet Unit

Refer to the following Drawings:-
CT-HPU-01001 Hydraulic Power Unit" **f**
CT-HSE-12-001 Hose Kits".

To remove the pump assembly from the jet unit, carry out the following actions:-
Refer to drawing CT-HSE-12-001 Hose Kits.

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 CT-HPU-01001 Hydraulic Power Unit.

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].

9.11.2 Re-Fitting the Pump Assembly to the Jet Unit

Refer to the following Drawings:-
CT-HPU-01001 Hydraulic Power Unit.
CT-HSE-12-001 Hose Kits.

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:- CT-HSE-12-001 Hose Kits.

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 HSRX 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

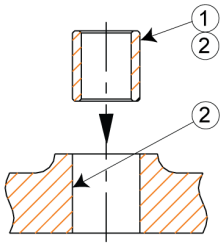
Loctite Grade		Equivalent
222	Purple	**Low Strength Threadlocker:** Loctite 221 (Compatible Primer is 7471) Loctite 225 (Compatible Primer is 7471)
243	Blue	**Medium Strength Threadlocker:** Loctite 242 (Compatible Primer is 7471) Loctite 245 (Compatible Primer is 7471) Loctite 248 (Compatible Primer 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

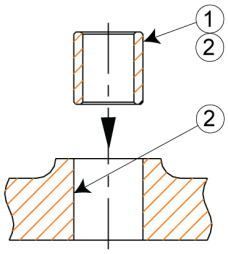


Bushes, sleeves, composite bush assemblies. (extra high strength retaining) primer will be used in all retaining applications.
1 - Apply primer to whole surface of bore and allow to dry before fitting.
2 - Apply Loctite to whole surface of bore and front of bush before fitting.
- There are to be no dry 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

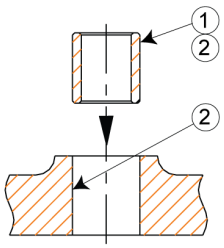


Bushes, sleeves, composite bush assemblies. (extra high strength retaining) primer will be used in all retaining applications.
Do not apply primer to LG2 Bushes
1 - Apply primer to whole surface of bore and allow to dry before fitting.
2 - Apply Loctite to whole surface of bore and front of bush before 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

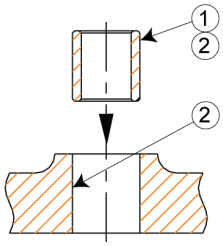


Bushes, sleeves, composite bush assemblies. (high strength adhesive) activator will be used in all retaining applications.
325 loctite will not cure without the activator. Do not apply activator to painted bore.
1 - Apply Activator to outside of bush and allow to dry.
2 - Apply Loctite to whole surface 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

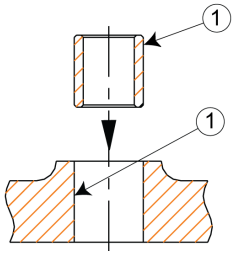


Bushes, sleeves, composite bush assemblies. (Extra high strength retaining)
Primer is used in all retaining applications.
Do not apply primer to painted bore.
1 - Apply primer to outside of outside of bush and allow to dry.
2 - Apply Loctite to whole surface of bore and outside of bush before fitting 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

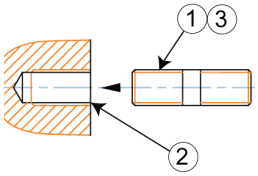


Bushes, sleeves, composite bush assemblies. (Extra high strength retaining)
1 - Apply Loctite to whole surface of bore and outside of bush before fitting bush.
- There are to be no dry areas between bush and bore.

Rotate bush when fitting to distribute the Loctite evenly

Studs M8 and Larger

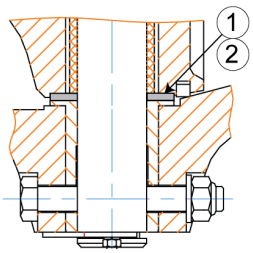
Loctite	Colour	Primer, Activator, Accelerator		Loctite Cure Speed		
263	RED	Type	Drying Time		Partial	Full
		Primer 7649	30-705ec	With Primer	10Min	2Hrs
		(Optional)	n/a	Without Primer	20Min	6Hrs



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



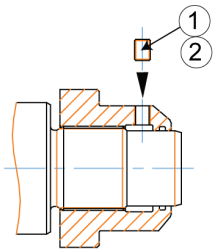
D-glide thrust washer retention (high strength adhesive)
Activator will be used in all retaining applications.
325 Loctite will not cure without the activator.
1 - Apply activator to one side of thrust washer and allow to dry.
2 - Apply Loctite evenly to housing recess.

- 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

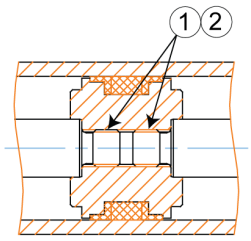
Loctite	Colour	Primer, Activator, Accelerator		Loctite Cure Speed		
243	*BLUE*	Type	Drying Time		Partial	Full
		Primer 7471	30-70Sec	With Primer	10Min	2Hrs
		(Optional)	N/A	Without Primer	20Min	6Hrs
222	*PURPLE*	Primer 7471	30-70Sec	With Primer	10Min	2Hrs
		(Optional)	N/A	Without Primer	20Min	6Hrs



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

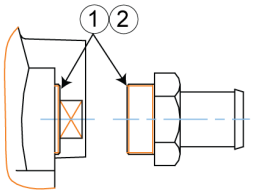
Loctite	Colour	Primer, Activator, Accelerator		Loctite Cure Speed		
263	*RED*	Type	Drying Time		Partial	Full
		Primer 7649	30-70Sec	With Primer	10Min	2Hrs
		(Optional)	n/a	Without Primer	20Min	6Hrs



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

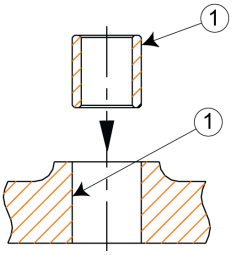
Loctite	Colour	Primer, Activator, Accelerator		Loctite Cure Speed		
567	*White*	Type	Drying Time		Partial	Full
		Accelerator 7649 (Optional)	30-70Sec	With Primer	2Hrs	6Hrs
				Without Primer	12 Hrs	24Hrs



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

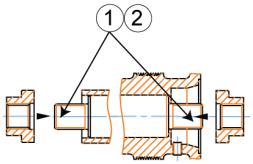


D-glide bush retention (high strength adhesive).
Activator will be used in all retaining applications.
325 Loctite will not cure without the activator.
1 - Apply activator to outside of bush and allow to dry.
2 - Apply adhesive to whole surface of bore.
- There are to be no dry areas between bush and bore.

Press bush into bore within 15 minutes.

Mainshaft Nuts Without Locking Devices

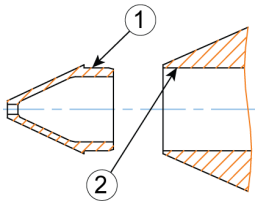
Loctite	Colour	Primer, Activator, Accelerator		Loctite Cure Speed		
243	*BLUE*	Type	Drying Time		Partial	Full
		Primer 7471 (Optional)	30-70Sec N/A	With Primer	10Min	2Hrs
				Without Primer	20Min	6Hrs



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

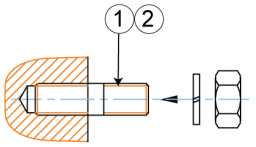
Loctite	Colour	Primer, Activator, Accelerator		Loctite Cure Speed without Primer Activator, Accelerator		
680	*GREEN*	Type	Drying Time		Partial	Full
		n/a	n/a		30 Min	4-6Hrs



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)

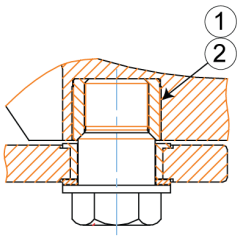
Loctite	Colour	Primer, Activator, Accelerator		Loctite Cure Speed		
243	*BLUE*	Type	Drying Time		Partial	Full
		Primer 7471	30-70Sec	With Primer	10Min	2Hrs
		(Optional)	N/A	Without Primer	20Min	6Hrs
222	*PURPLE*	Primer 7471	30-70Sec	With Primer	10Min	2Hrs
		(Optional)	N/A	Without Primer	20Min	6Hrs



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

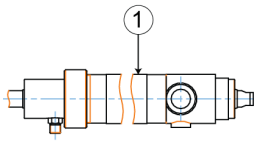


Tailpipe inserts (high strength thread locking).
Primer is used in all retaining applications.
1 - Apply primer to the thread of the insert and allow to dry.
2 - Apply Loctite to the female threads in the tailpipe and the threads of the insert in sufficient quantity to fill all the engaged threads.
- 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

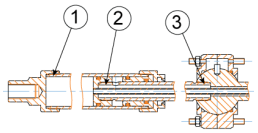
Loctite	Colour	Primer, Activator, Accelerator		Loctite Cure Speed without Primer Activator, Accelerator		
542	*BROWN*	Type	Drying Time		Partial	Full
		N/A	N/A		45Min	24Hrs



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

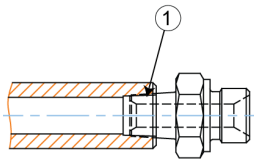
Loctite	Colour	Primer, Activator, Accelerator		Loctite Cure Speed without Primer Activator, Accelerator		
542	*BROWN*	Type	Drying Time		Partial	Full
		N/A	N/A		45Min	24Hrs



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

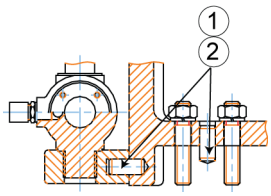
Loctite	Colour	Primer, Activator, Accelerator		Loctite Cure Speed without Primer Activator, Accelerator		
542	*BROWN*	Type	Drying Time		Partial	Full
		N/A	N/A		45Min	24Hrs



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



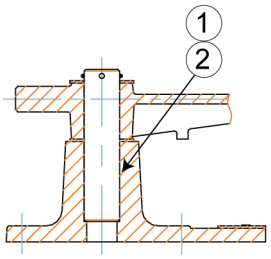
Dowel retention (extra high strength retaining).
Dowels are to be retained at one end only.
1 - Apply primer to one end of dowel and allow to dry.
2 - Apply Loctite to dowel hole in either casting or mounting plate, not both.

- 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 support bearings are aligned with the engine flywheel. • Outer support bearings 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:

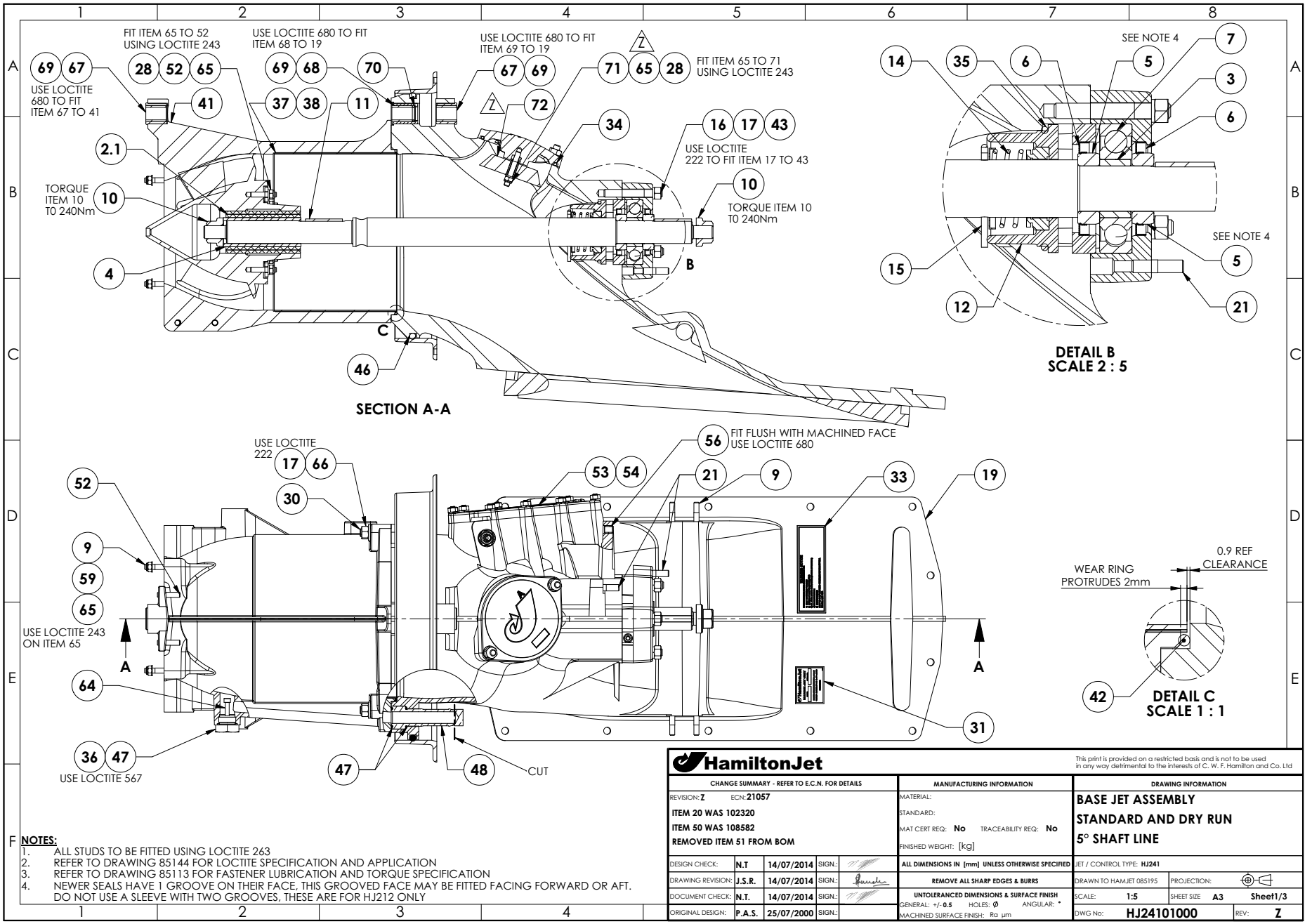
Engine speed:	Vessel speed:	Comments (loading, sea conditions etc):

Comments:

Drawings

- Technical Drawings

HJ-241-01-000 Basic Jet Assemblies Standard and Dry Run Sht 1



NOTES:

1. ALL STUDS TO BE FITTED USING LOCTITE 263
2. REFER TO DRAWING 85144 FOR LOCTITE SPECIFICATION AND APPLICATION
3. REFER TO DRAWING 85113 FOR FASTENER LUBRICATION AND TORQUE SPECIFICATION
4. NEWER SEALS HAVE 1 GROOVE ON THEIR FACE, THIS GROOVED FACE MAY BE FITTED FACING FORWARD OR AFT. DO NOT USE A SLEEVE WITH TWO GROOVES, THESE ARE FOR HJ212 ONLY

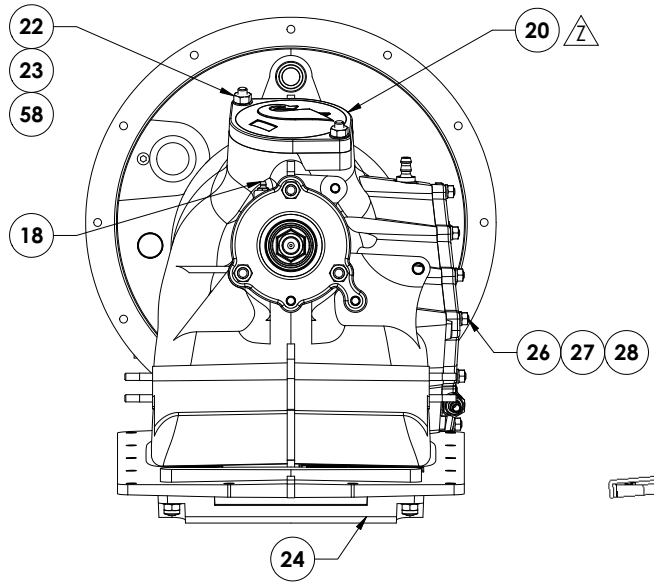
HamiltonJet

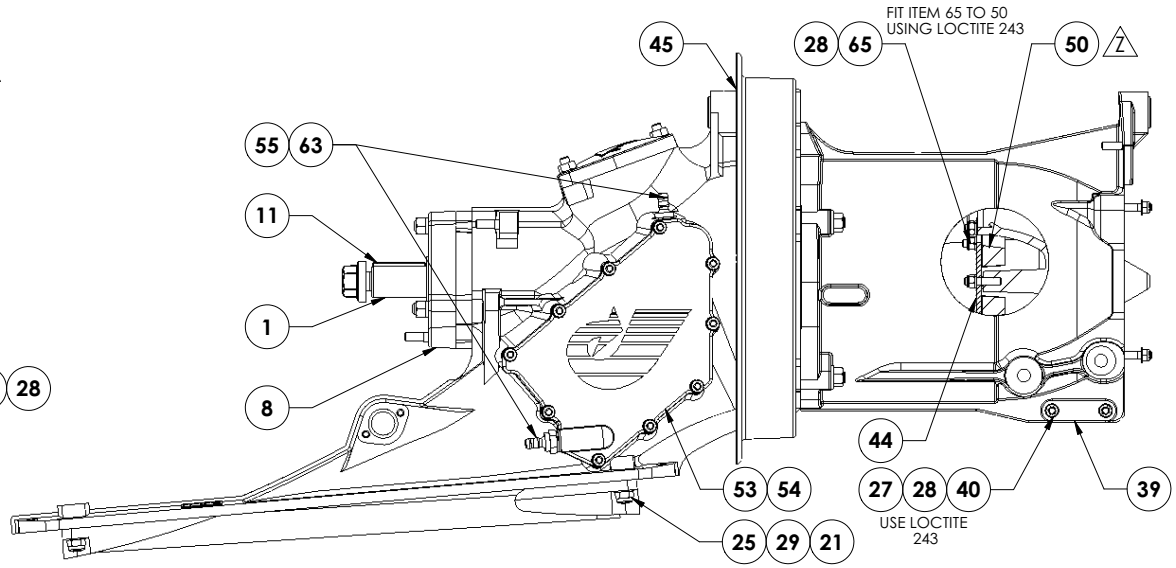
CHANGE SUMMARY - REFER TO E.C.N. FOR DETAILS			
REVISION: Z ECN: 21057			
ITEM 20 WAS 102320			
ITEM 50 WAS 108582			
REMOVED ITEM 51 FROM BOM			
DESIGN CHECK:	N.T	14/07/2014	SIGN.:
DRAWING REVISION:	J.S.R.	14/07/2014	SIGN.:
DOCUMENT CHECK:	N.T.	14/07/2014	SIGN.:
ORIGINAL DESIGN:	P.A.S.	25/07/2000	SIGN.:

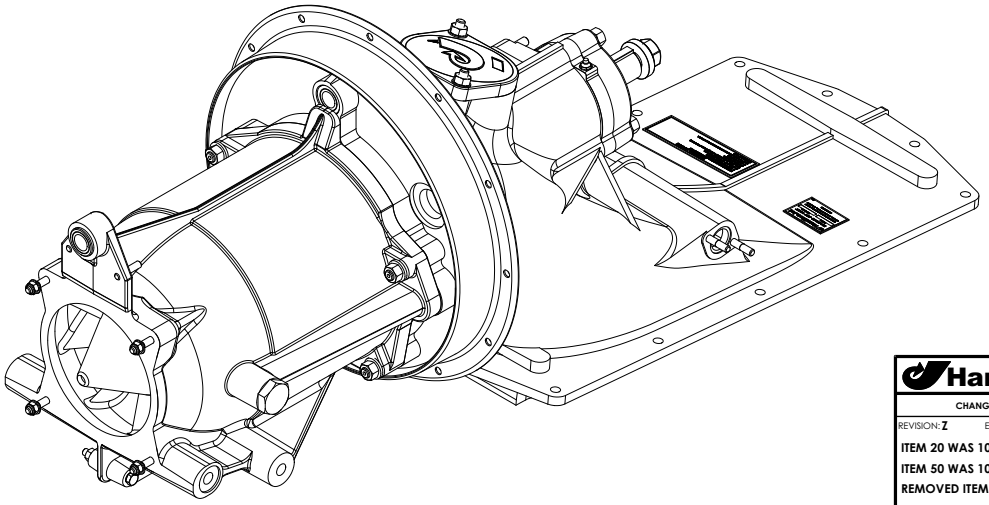
MANUFACTURING INFORMATION
MATERIAL:
STANDARD:
MAT CERT REQ: No TRACEABILITY REQ: No
FINISHED WEIGHT: [kg]
ALL DIMENSIONS IN [mm] UNLESS OTHERWISE SPECIFIED
REMOVE ALL SHARP EDGES & BURRS
UNTOLERANCED DIMENSIONS & SURFACE FINISH
GENERAL: +/- 0.5 HOLES: Ø ANGULAR: °
MACHINED SURFACE FINISH: Ra µm

DRAWING INFORMATION			
BASE JET ASSEMBLY			
STANDARD AND DRY RUN			
5° SHAFT LINE			
JET / CONTROL TYPE: HJ241			
DRAWN TO HAMJET 085195	PROJECTION:		
SCALE: 1:5	SHEET SIZE A3	Sheet1/3	
DWG No: HJ24101000	REV: Z		

HJ-241-01-000 Basic Jet Assemblies Standard and Dry Run Sht 2







NOTES:

1. ALL STUDS TO BE FITTED USING LOCTITE 263
2. REFER TO DRAWING 85144 FOR LOCTITE SPECIFICATION AND APPLICATION
3. REFER TO DRAWING 85113 FOR FASTENER LUBRICATION AND TORQUE SPECIFICATION

HamiltonJet

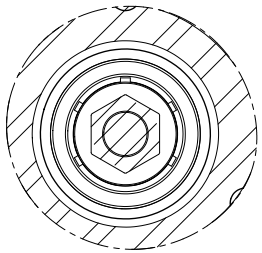
CHANGE SUMMARY - REFER TO E.C.N. FOR DETAILS			
REVISION: **Z** ECN: **21057**			
ITEM 20 WAS 102320			
ITEM 50 WAS 108582			
REMOVED ITEM 51 FROM BOM			
DESIGN CHECK:	**N.T**	**14/07/2014**	SIGN.:
DRAWING REVISION:	**J.S.R.**	**14/07/2014**	SIGN.:
DOCUMENT CHECK:	**N.T.**	**14/07/2014**	SIGN.:
ORIGINAL DESIGN:	**P.A.S.**	**25/07/2000**	SIGN.:

MANUFACTURING INFORMATION
MATERIAL:
STANDARD:
MAT CERT REQ: **No** TRACEABILITY REQ: **No**
FINISHED WEIGHT: [kg]
ALL DIMENSIONS IN [mm] UNLESS OTHERWISE SPECIFIED
REMOVE ALL SHARP EDGES & BURRS
UNTOLERANCED DIMENSIONS & SURFACE FINISH
GENERAL: +/- **0.5** HOLES: Ø ANGULAR: °
MACHINED SURFACE FINISH: Ra µm

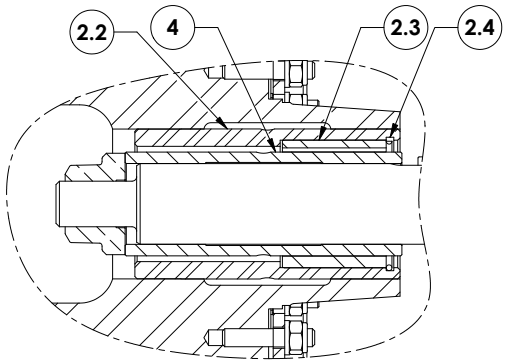
DRAWING INFORMATION			
BASE JET ASSEMBLY			
STANDARD AND DRY RUN			
5° SHAFT LINE			
JET / CONTROL TYPE: **HJ241**			
DRAWN TO HAMJET 085195	PROJECTION:		
SCALE: **1:5**	SHEET SIZE **A3**	**Sheet2/3**	
DWG No: **HJ24101000**	REV: **Z**		

HJ-241-01-000 Basic Jet Assemblies Standard and Dry Run Sht 3

A	B	C	D	E	F	G	Item	Kit	Part Number	Product Description	Drawing
								A	HJ24101001	BASE JET (STANDARD) FOR 5° SHAFT LINE	HJ24101000
								B	HJ24101004	BASE JET (DRY RUN SHAFT) FOR 5° SHAFT LINE	HJ24101000
								C	108603	INTAKE KIT 5° - HJ241	HJ24101000
								D	111664	TAILPIPE KIT - HJ241	HJ24101000
								E	111665	TAIPIPE KIT (DRY RUN) - HJ241	HJ24101000
								F	108605	BEARING HOUSING KIT - HJ241	HJ24101000
								G	108213	DRY RUN BEARING ASSEMBLY	HJ21201000
A1	B1						1		108548	MAINSHAFT HJ241	108548
A1			D1				2.1		106011	MARINE WATER BEARING 65x45x115	106264
	B1			E1		G1	2.2		108213-1	BEARING SHELL	108213-1
	B1			E1		G1	2.3		108213-2	BEARING INNER	108213-1
	B1			E1		G1	2.4		104201	(GENERAL) ROUND CIRCLIP	104201
A1	B1				F1		3		106005	BEARING CARRIER	106005
A1	B1						4		110379	WATER BEARING SLEEVE	110379
A2	B2						5		106004	SEAL SLEEVE	106004
A2	B2				F2		6		061458	(OIL SEALS) NAK (#SCW10-55*72*8)	N/A
A1	B1				F1		7		201439	(SKF) BEARINGS ALL TYPES (SKF# QJ309)	N/A
A1	B1				F1		8		108568	BEARING HOUSING	108568
A8	B8	C4	D4	E4			9		030667	(STUDS) METRIC (316-STST) M8x46 (16/16)	30647
A2	B2						10		203395	AB2 IMPELLER-COUPLING NUT	203395
A2	B2						11		110343	IMPELLER / COUPLING KEY	110343
A1	B1						12		111717	SEAL FACE HOLDER MK2 HJ241 & 213	111717
A1	B1						14		061483	(JET) ROTARY SEALS (PAC SEAL) (#21-175-06)	61483
A1	B1						15		201074	(SPLIT PINS) ST ST 316 0.19"x2.50"	N/A
A3	B3	C3					16		201396	(WASHERS) (SPRING) M12 SS316	N/A
A7	B7	C7					17		201311	(NUTS) (HEX) M12 SS316	N/A
A1	B1				F1		18		200917	(GREASE) NIPPLES 1/8" BSP STAINLESS STEEL	N/A
A1	B1	C1					19		111461	INTAKE MK2	111461
Z A1	B1						20		212140	INSPECTION COVER FOR HJ212 TO HJ241	212140
A4	B4	C5			F2		21		201280	(STUDS) METRIC (316-STST) M10x40 (15/20)	30637
A2	B2						22		201395	(WASHERS) (SPRING) METRIC ST ST 316 M10	N/A
A2	B2						23		201310	(NUTS) (METRIC ST ST 316) M10	N/A
A1	B1						24		108487	HJ241 SCREEN ASSEMBLY (ALUMINIUM BARS)	108487
A4	B4	C4					25		201331	(NUTS) (METRIC NYLOC ST ST 316) M10	N/A
A10	B10	C10					26		109518	(STUDS) METRIC (316-STST) M8x41 (16/16)	30647
A12	B12	C6	D2	E2			27		201309	(NUTS) (METRIC ST ST 316) M8	N/A
Z A21	B21	C6	D10	E10			28		201394	(WASHERS) (SPRING) M8 SS316	N/A
A4	B4						29		201384	(WASHERS) (FLAT) METRIC ST ST 316 M10x21x1.2	N/A
A4	B4	C4					30		111617	(STUDS) METRIC (SAF 2205) M12x78 (30/20)	30710
A1	B1	C1					31		063097	(LABELS) (MODEL & SERIAL NUMBER PLATE)	63097
A1	B1	C1					33		063610	(LABELS) (WARNING PLATE)	63610
A1	B1	C1					34		200985	(O RINGS) IMPERIAL 0.19x4.50x4.88 (#349N70)	N/A
A1	B1	C1					35		061488	(O RINGS) IMPERIAL 5.34x85.1x95.8 (#340N70)	N/A
A1	B1		D1	E1			36		110019	BUNG for WATER OFFTAKE	110019
A1	B1		D1	E1			37		108512	WEAR RING	105987
A1	B1		D1	E1			38		108511	INSULATOR (WEAR RING)	105988
A2	B2		D2	E2			39		103359	ANODE MK3 (ZINC)	103359
A2	B2		D2	E2			40		201225	(SCREWS) (M/C SCREWS) METRIC ST ST 316 HEX HD M8x70	N/A
A1	B1		D1	E1			41		112669	TAILPIPE MK3	112669
A1	B1	C1	D1	E1			42		061489	(O RINGS) METRIC 3.53x247x255 273N70	N/A
A3	B3	C3					43		103927	(STUDS) METRIC (316 STST) M12x90 (28/28)	30639
A1	B1		D1	E1			44		108583	ANODE MOUNTING PLATE	108583
							45	REF	108514	TRANSOM PLATE	108514
							46	REF	108552	(JET) O RINGS SPECIAL TRANSOM PLATE	111183
A3	B3	C2	D2	E2			47		064726	(O RINGS) METRIC 2.62x25.07x30.30 (#120N70)	N/A
A1	B1	C1					48		212065	HOSETAIL/BUNG 1" for WATER OFFTAKE	212065
A1	B1						49		108602	(JET) WOOD TRANSPORT CRATE HJ241	108602
Z A4	B4		D4	E4			50		212260	ANODE (ZINC)	212260
A6	B6		D6	E6			52		201279	(STUDS) METRIC (316-STST) M8x40 (12/22)	30647
A1	B1	C1					53		108571	COOLER COVER PLATE	108571
A1	B1	C1					54		108675	ORING 210x3.53 N70 CUT LENGTH 671	113050
A2	B2	C2					55		065234	HOSE TAIL 3/8" BSPP MALE PUSH LOC (#3D982-6-6C)	115000
A1	B1	C1					56		110806	SLEEVE FOR SAGINAW PUMP MOUNT	110806
A1	B1						57		111425	HJ241 LABELS KIT	111420
A2	B2	C2					58		030671	(STUDS) METRIC (316-STST) M10x51 (20/20)	30637
Z A4	B4		D4	E4			59		201383	(WASHERS) (FLAT) M8x16x1.2 SS316	N/A
							62.1	REF	111552	PAINT APPLICATION 241 AND 241A JETS (STANDARD) GLOSS FINISH	111178
							62.2	REF	210606	PAINT APPLICATION 241 AND 241A JETS (OPTIONAL) ANTIFOUL FINISH	111178
A2	B2	C2					63		201767	BONDED SEAL 3/8" BSP (#400-823-4490-74)	N/A
A1	B1		D1	E1			64		201259	SCREW CAP SOCKET M6x40 SS316	N/A
A13	B13		D12	E12			65		201330	(NUTS) (METRIC NYLOC ST ST 316) M8	N/A
A4	B4						66		104908	(WASHER) SPECIAL M12	103451
		C1	D1	E1			67		111462	SLEEVE FOR STEERING SHAFT BUSH	111462
		C1					68		111463	SLEEVE FOR STEERING SHAFT BUSH & SEAL (INTAKE)	111463
		C2	D1	E1			69		111464	BUSH FOR STEERING SHAFT	111464
		C1					70		200964	(O RINGS) IMPERIAL 0.13x3/4"x1.0" (#210N70)	N/A
Z A1	B1	C1					71		109411	(STUDS) METRIC (316-STST) M8x56 (16/16)	30647
Z A1	B1	C1					72		102185	ANODE (ZINC)	102185



NOTE: POSITION OF GROOVE
(NO GROOVE AT BOTTOM)



DRY RUN BEARING ASSEMBLY

HamiltonJet

CHANGE SUMMARY - REFER TO E.C.N. FOR DETAILS

REVISION: **Z** ECN: **21057**

ITEM 20 WAS 102320

ITEM 50 WAS 108582

REMOVED ITEM 51 FROM BOM

DESIGN CHECK:	N.T	20/05/2014	SIGN.:
DRAWING REVISION:	J.S.R.	20/05/2014	SIGN.:
DOCUMENT CHECK:	N.T.	20/05/2014	SIGN.:
ORIGINAL DESIGN:	P.A.S.	25/07/2000	SIGN.:

MANUFACTURING INFORMATION

MATERIAL:

STANDARD:

MAT CERT REQ: **No** TRACEABILITY REQ: **No**

FINISHED WEIGHT: [kg]

ALL DIMENSIONS IN [mm] UNLESS OTHERWISE SPECIFIED

REMOVE ALL SHARP EDGES & BURRS

UNTOLERANCED DIMENSIONS & SURFACE FINISH

GENERAL: +/- **0.5** HOLES: Ø ANGULAR: °

MACHINED SURFACE FINISH: Ra µm

DRAWING INFORMATION

BASE JET ASSEMBLY
STANDARD AND DRY RUN
5° SHAFT LINE

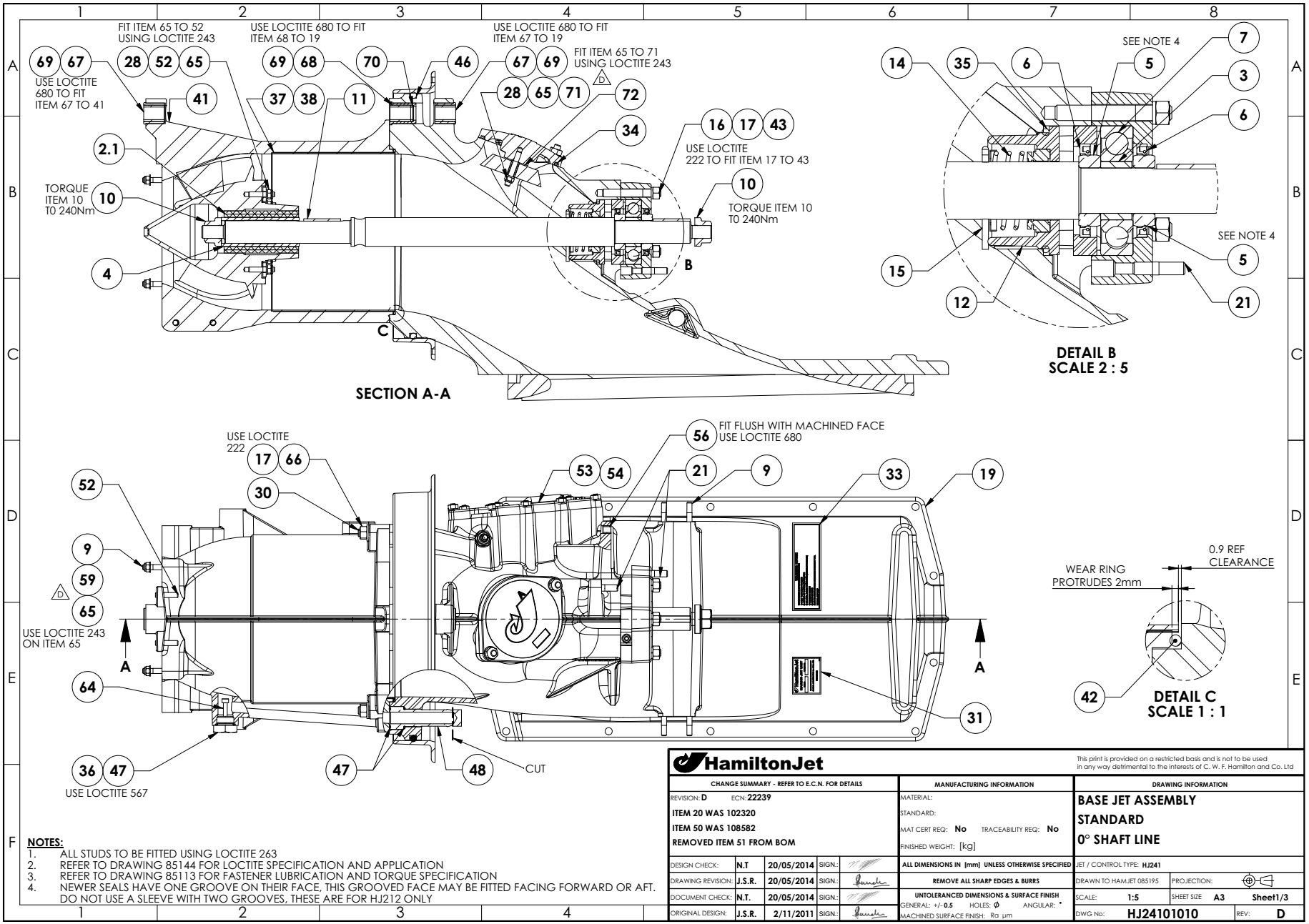
JET / CONTROL TYPE: **HJ241**

DRAWN TO HAMJET 085195 PROJECTION:

SCALE: **1:5** SHEET SIZE **A3** **Sheet3/3**

DWG No: **HJ24101000** REV: **Z**

HJ-241-01-010 Basic Jet Assemblies Standard and Dry Run Sht 1



NOTES:

1. ALL STUDS TO BE FITTED USING LOCTITE 263
2. REFER TO DRAWING 85144 FOR LOCTITE SPECIFICATION AND APPLICATION
3. REFER TO DRAWING 85113 FOR FASTENER LUBRICATION AND TORQUE SPECIFICATION
4. NEWER SEALS HAVE ONE GROOVE ON THEIR FACE, THIS GROOVED FACE MAY BE FITTED FACING FORWARD OR AFT. DO NOT USE A SLEEVE WITH TWO GROOVES, THESE ARE FOR HJ212 ONLY

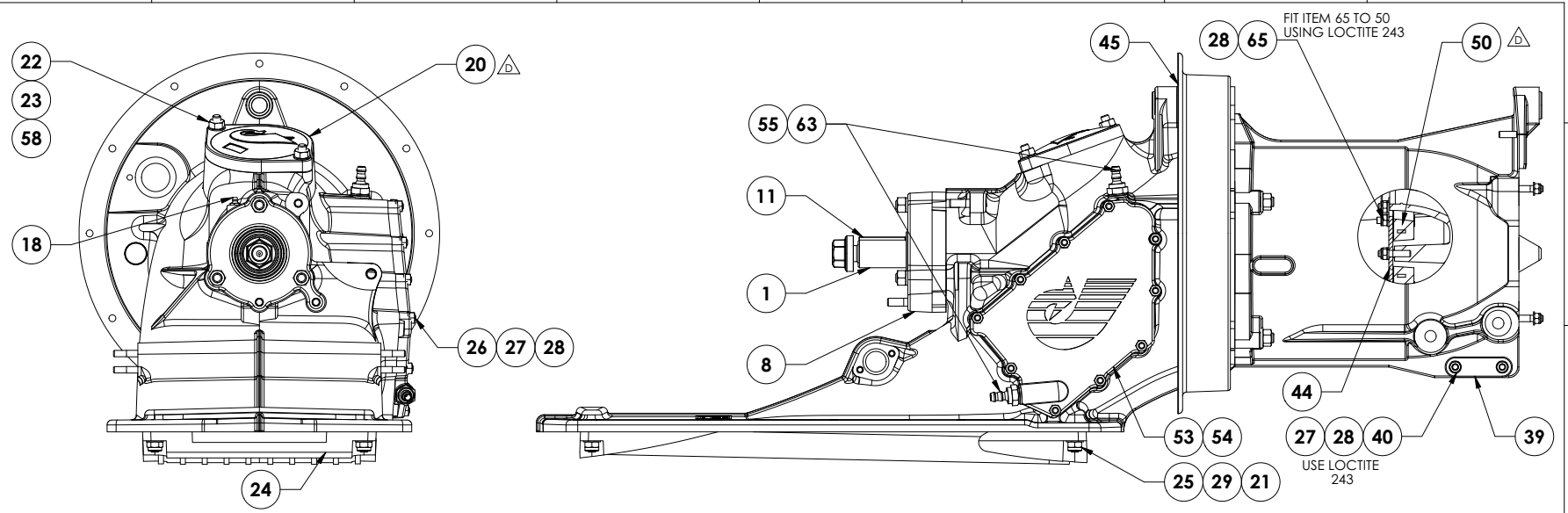
HamiltonJet

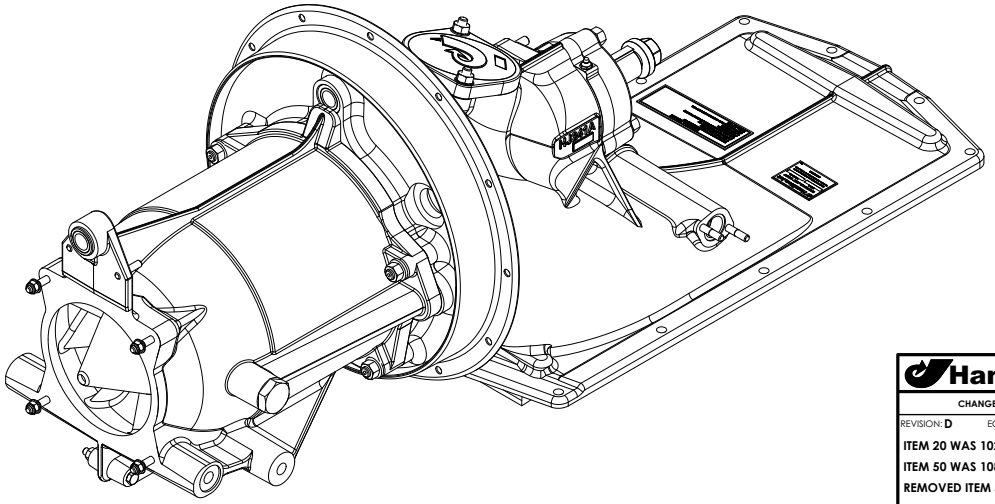
CHANGE SUMMARY - REFER TO E.C.N. FOR DETAILS				
REVISION: D	ECN: 22239			
ITEM 20 WAS 102320				
ITEM 50 WAS 108582				
REMOVED ITEM 51 FROM BOM				
DESIGN CHECK:	N.T	20/05/2014	SIGN.:	
DRAWING REVISION:	J.S.R.	20/05/2014	SIGN.:	
DOCUMENT CHECK:	N.T.	20/05/2014	SIGN.:	
ORIGINAL DESIGN:	J.S.R.	2/11/2011	SIGN.:	

MANUFACTURING INFORMATION
MATERIAL:
STANDARD:
MAT CERT REQ: No TRACEABILITY REQ: No
FINISHED WEIGHT: [kg]
ALL DIMENSIONS IN [mm] UNLESS OTHERWISE SPECIFIED
REMOVE ALL SHARP EDGES & BURRS
UNTOLERANCED DIMENSIONS & SURFACE FINISH
GENERAL: +/- 0.5 HOLES: Ø ANGULAR: °
MACHINED SURFACE FINISH: Ra µm

DRAWING INFORMATION		
BASE JET ASSEMBLY		
STANDARD		
0° SHAFT LINE		
JET / CONTROL TYPE: HJ241		
DRAWN TO HAMJET 085195	PROJECTION:	
SCALE: 1:5	SHEET SIZE A3	Sheet1/3
DWG No: HJ24101010	REV:	D

HJ-241-01-010 Basic Jet Assemblies Standard and Dry Run Sht 2





NOTES:

1. ALL STUDS TO BE FITTED USING LOCTITE 263
2. REFER TO DRAWING 85144 FOR LOCTITE SPECIFICATION AND APPLICATION
3. REFER TO DRAWING 85113 FOR FASTENER LUBRICATION AND TORQUE SPECIFICATION

HamiltonJet

CHANGE SUMMARY - REFER TO E.C.N. FOR DETAILS				
REVISION: **D** ECN: **22239**				
ITEM 20 WAS 102320				
ITEM 50 WAS 108582				
REMOVED ITEM 51 FROM BOM				
DESIGN CHECK:	**N.T**	**20/05/2014**	SIGN.:	
DRAWING REVISION:	**J.S.R.**	**20/05/2014**	SIGN.:	
DOCUMENT CHECK:	**N.T.**	**20/05/2014**	SIGN.:	
ORIGINAL DESIGN:	**J.S.R.**	**2/11/2011**	SIGN.:	

MANUFACTURING INFORMATION
MATERIAL:
STANDARD:
MAT CERT REQ: **No** TRACEABILITY REQ: **No**
FINISHED WEIGHT: [kg]
ALL DIMENSIONS IN [mm] UNLESS OTHERWISE SPECIFIED
REMOVE ALL SHARP EDGES & BURRS
UNTOLERANCED DIMENSIONS & SURFACE FINISH
GENERAL: +/- **0.5** HOLES: Ø ANGULAR: °
MACHINED SURFACE FINISH: Ra µm

DRAWING INFORMATION		
BASE JET ASSEMBLY		
STANDARD		
0° SHAFT LINE		
JET / CONTROL TYPE: **HJ241**		
DRAWN TO HAMJET 085195	PROJECTION:	
SCALE: **1:5**	SHEET SIZE **A3**	**Sheet2/3**
DWG No: **HJ24101010**	REV:	**D**

HJ-241-01-010 Basic Jet Assemblies Standard and Dry Run Sht 3

A	B	C	D	Item	Kit	Part Number	Product Description	Drawing
					A	HJ24101010	BASE JET (STANDARD) FOR 0° SHAFT LINE	HJ24101010
					B	210593	INTAKE KIT 0° - HJ241A	HJ24101010
					C	111664	TAILPIPE KIT - HJ241	HJ24101000
					D	108605	BEARING HOUSING KIT - HJ241	HJ24101000
A1				1		108548	MAINSHAFT HJ241	108548
A1		C1		2		106011	MARINE WATER BEARING 65x45x115	106264
A1			D1	3		106005	BEARING CARRIER	106005
A1				4		110379	WATER BEARING SLEEVE	110379
A2				5		106004	SEAL SLEEVE	106004
A2			D2	6		061458	(OIL SEALS) NAK (#SCW10-55*72*8)	N/A
A1			D1	7		201439	(SKF) BEARINGS ALL TYPES (SKF# QJ309)	N/A
A1			D1	8		108568	BEARING HOUSING	108568
A8	B4	C4		9		030667	(STUDS) METRIC (316-STST) M8x46 (16/16)	30647
A2				10		203395	AB2 IMPELLER-COUPLING NUT	203395
A2				11		110343	IMPELLER / COUPLING KEY	110343
A1				12		111717	SEAL FACE HOLDER MK2 HJ241 & 213	111717
A1				14		061483	(JET) ROTARY SEALS (PAC SEAL) (#21-175-06)	61483
A1				15		201074	(SPLIT PINS) ST ST 316 0.19"x2.50"	N/A
A3	B3			16		201396	(WASHERS) (SPRING) M12 SS316	N/A
A7	B7			17		201311	(NUTS) (HEX) M12 SS316	N/A
A1			D1	18		200917	(GREASE) NIPPLES 1/8" BSP STAINLESS STEEL	N/A
A1	B1			19		210592	INTAKE HJ241A	210592
A1				20		212140	INSPECTION COVER FOR HJ212 TO HJ241	212140
A4	B5		D2	21		201280	(STUDS) METRIC (316-STST) M10x40 (15/20)	30637
A2	B1			22		201395	(WASHERS) (SPRING) METRIC ST ST 316 M10	N/A
A2				23		201310	(NUTS) (METRIC ST ST 316) M10	N/A
A1				24		108487	HJ241 SCREEN ASSEMBLY (ALUMINIUM BARS)	108487
A4	B4			25		201331	(NUTS) (METRIC NYLOC ST ST 316) M10	N/A
A10	B10			26		109518	(STUDS) METRIC (316-STST) M8x41 (16/16)	30647
A12	B6	C2		27		201309	(NUTS) (METRIC ST ST 316) M8	N/A
A21	B6	C10		28		201394	(WASHERS) (SPRING) M8 SS316	N/A
A4				29		201384	(WASHERS) (FLAT) METRIC ST ST 316 M10x21x1.2	N/A
A4	B4			30		111617	(STUDS) METRIC (SAF 2205) M12x78 (30/20)	30710
A1	B1			31		063097	(LABELS) (MODEL & SERIAL NUMBER PLATE)	63097
A1	B1			33		063610	(LABELS) (WARNING PLATE)	63610
A1	B1			34		200985	(O RINGS) IMPERIAL 0.19x4.50x4.88 (#349N70)	N/A
A1	B1			35		061488	(O RINGS) IMPERIAL 5.34x85.1x95.8 (#340N70)	N/A
A1		C1		36		110019	BUNG for WATER OFFTAKE	110019
A1		C1		37		108512	WEAR RING	105987
A1		C1		38		108511	INSULATOR (WEAR RING)	105988
A2		C2		39		103359	ANODE MK3 (ZINC)	103359
A2		C2		40		201225	(SCREWS) (M/C SCREWS) METRIC ST ST 316 HEX HD M8x70	N/A
A1		C1		41		112669	TAILPIPE MK3	112669
A1	B1	C1		42		061489	(O RINGS) METRIC 3.53x247x255 273N70	N/A
A3	B3			43		103927	(STUDS) METRIC (316 STST) M12x90 (28/28)	30639
A1		C1		44		108583	ANODE MOUNTING PLATE	108583
				45	REF	108514	TRANSOM PLATE	108514
				46	REF	108552	(JET) O RINGS SPECIAL TRANSOM PLATE	111183
A3	B2	C2		47		064726	(O RINGS) METRIC 2.62x25.07x30.30 (#120N70)	N/A
A1	B1			48		212065	HOSETAIL/BUNG 1" for WATER OFFTAKE	212065
A1				49		108602	(JET) WOOD TRANSPORT CRATE HJ241	108602
A4		C4		50		212260	ANODE (ZINC)	212260
A6		C6		52		201279	(STUDS) METRIC (316-STST) M8x40 (12/22)	30647
A1	B1			53		108571	COOLER COVER PLATE	108571
A1	B1			54		108675	ORING 210x3.53 N70 CUT LENGTH 671	113050
A2	B2			55		065234	HOSE TAIL 3/8" BSPP MALE PUSH LOC (#3D982-6-6C)	115000
A1	B1			56		110806	SLEEVE FOR SAGINAW PUMP MOUNT	110806
A1				57		111425	HJ241 LABELS KIT	111420
A2	B2			58		030671	(STUDS) METRIC (316-STST) M10x51 (20/20)	30637
A4	B4	C4		59		201383	(WASHERS) (FLAT) M8x16x1.2 SS316	N/A
				62.1	REF	111552	PAINT APPLICATION 241 AND 241A JETS (STANDARD) GLOSS FINISH	111178
				62.2	REF	210606	PAINT APPLICATION 241 AND 241A JETS (OPTIONAL) ANTIFOUL FINISH	111178
A2	B2			63		201767	BONDED SEAL 3/8" BSP (#400-823-4490-74)	N/A
A1		C1		64		201259	SCREW CAP SOCKET M6x40 SS316	N/A
A13	B4	C12		65		201330	(NUTS) (METRIC NYLOC ST ST 316) M8	N/A
A4				66		104908	(WASHER) SPECIAL M12	103451
	B1	C1		67		111462	SLEEVE FOR STEERING SHAFT BUSH	111462
	B1			68		111463	SLEEVE FOR STEERING SHAFT BUSH & SEAL (INTAKE)	111463
	B2	C1		69		111464	BUSH FOR STEERING SHAFT	111464
	B1			70		200964	(O RINGS) IMPERIAL 0.13x3/4"x1.0" (#210N70)	N/A
A1	B1			71		109411	(STUDS) METRIC (316-STST) M8x56 (16/16)	30647
A1	B1			72		102185	ANODE (ZINC)	102185

HamiltonJet

CHANGE SUMMARY - REFER TO E.C.N. FOR DETAILS

REVISION: D ECN: 22239
ITEM 20 WAS 102320
ITEM 50 WAS 108582
REMOVED ITEM 51 FROM BOM

DESIGN CHECK:	N.T	20/05/2014	SIGN.:
DRAWING REVISION:	J.S.R.	20/05/2014	SIGN.:
DOCUMENT CHECK:	N.T.	20/05/2014	SIGN.:
ORIGINAL DESIGN:	J.S.R.	2/11/2011	SIGN.:

MANUFACTURING INFORMATION

MATERIAL:
STANDARD:
MAT CERT REQ: No TRACEABILITY REQ: No
FINISHED WEIGHT: [kg]

ALL DIMENSIONS IN [mm] UNLESS OTHERWISE SPECIFIED
REMOVE ALL SHARP EDGES & BURRS
UNTOLERANCED DIMENSIONS & SURFACE FINISH
GENERAL: +/- 0.5 HOLES: Ø ANGULAR: °
MACHINED SURFACE FINISH: Ra µm

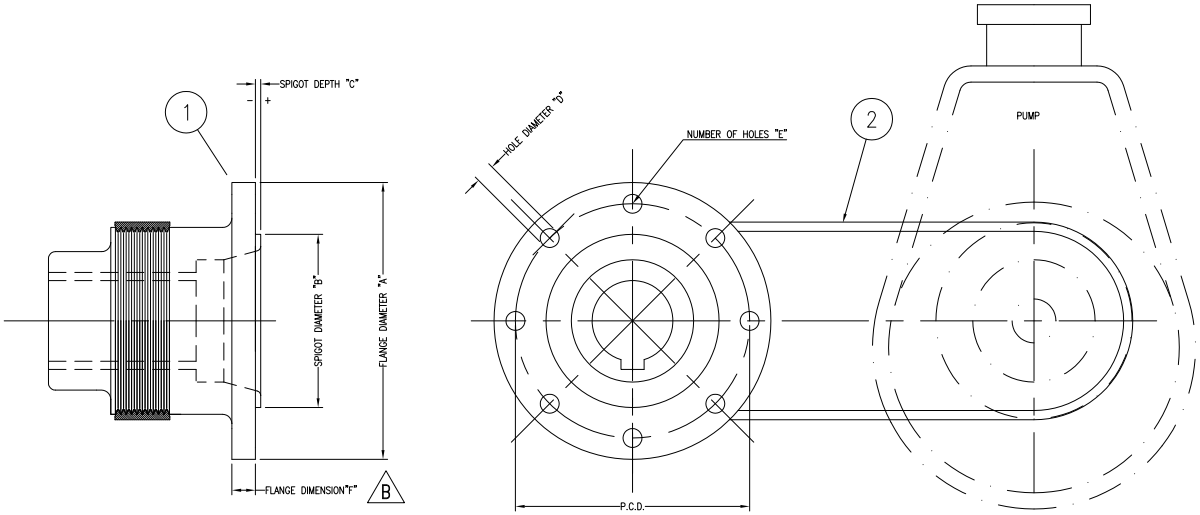
DRAWING INFORMATION

BASE JET ASSEMBLY
STANDARD
0° SHAFT LINE

JET / CONTROL TYPE: HJ241
DRAWN TO HAMJET 085195 PROJECTION:
SCALE: 1:5 SHEET SIZE A3 Sheet3/3
DWG No: HJ24101010 REV: D

HJ-241-02-001 Couplings and Belts

PROJECTION



A	B	C	D	E	Item	Kit	PartNumber	MovexAlias	Qty	ProductDescription	DrawingNbr
						A	108632			COUPLING & V-BELT KIT (ELBE 0.112)	HJ21302001
						B	108633			COUPLING & V-BELT KIT (GWB 287.2 & 387.2)	HJ21302001
						C	108634			COUPLING & V-BELT KIT (HARDY SPICER 1400)	HJ21302001
						D	108635			COUPLING & V-BELT KIT (AQUA DRIVE 14200)	HJ21302001
						E	110399			COUPLING & V-BELT KIT (HARDY SPICER 1510 & 1550)	HJ24102001
				E	1		110398		1	COUPLING (HARDY SPICER 1510 & 1550) 1510 & 1550 HARDY SPICER	110398
			D		1		108594		1	COUPLING (SCATRA AQUA DRIVE 14200)	108594
		C			1		108593		1	COUPLING (HARDY SPICER 1400)	108593
	B				1		108592		1	COUPLING (GWB 287.2 & 387.2)	108592
A					1		108591		1	COUPLING (ELBE 0.112)	108591
A	B	C	D	E	2		64430	064430	1	(VEE BELTS) Gates (PJ559 10 RIB) Micro Vee	N/A

B

COUPLING	DIA.A	DIA.B	DIA.C	DIA.D	PCD	HOLES(E)	DIM.F
108591	120	75	2.3/2.1	8.2	101.5	8	10
108592	120	75	2.3/2.15	10.2	101.5	8	10
108593	116	69.9R	(-2.0/1.8)	11.5	95.3	4*	10
108594	135	90.0R	(-6.0)	M12x1.75-H6	108	6	30
110398	146	95.2R	(-2.5)	11.5	120.6	4	13

HJ241 02 001 B

REF	NO.	BY	DATE	AMENDMENTS
CL413	B	SC	24.04.06	DIM.F ADDED
CL3817	A	P.S.	12/1/98	SPARES ASSEMBLY E ADDED.
CL3732	0	P.S.	19/12/95	ISSUE FOR PRODUCTION
JET	241			

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

MATERIAL N.A.

√ = N9 EXCEPT AS STATED

UNLIMITED DIMENSIONS TO BE ± -

MAT'L CERT

DESIGNED P.A.S. DATE 26/10/95

DRAWN P.A.S. 26/10/95

CHECKED

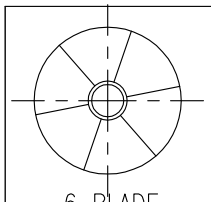
APPROVED

NAME
COUPLINGS & BELTS
HJ241

SCALE N.T.S.

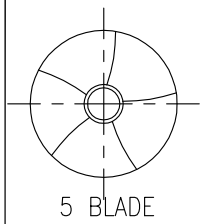
No: A3–HJ241 02 001 B

HJ-241-03-001 Impellers



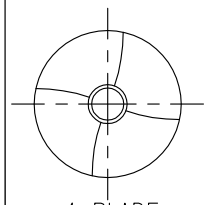
6 BLADE

PART No	QTY	DESCRIPTION	DWG No
109984	1	IMPELLER TYPE 6.4	108545
109983	1	IMPELLER TYPE 6.8	108545
109982	1	IMPELLER TYPE 7.1	108545
108545	1	IMPELLER TYPE 7.5	108545



5 BLADE

PART No	QTY	DESCRIPTION	DWG No
109987	1	IMPELLER TYPE 5.0	108546
109986	1	IMPELLER TYPE 5.5	108546
109985	1	IMPELLER TYPE 5.8	108546
108546	1	IMPELLER TYPE 6.1	108546



4 BLADE

PART No	QTY	DESCRIPTION	DWG No
109990	1	IMPELLER TYPE 3.7	108547
109989	1	IMPELLER TYPE 4.1	108547
109988	1	IMPELLER TYPE 4.4	108547
108547	1	IMPELLER TYPE 4.7	108547

△D NOTE:
REFER TO DRAWING 82206 FOR BLADE DRESSING INSTRUCTIONS AND BALANCING INFORMATION.

REF	NO.	BY	DATE	AMENDMENTS
CL287	D	P.M.W	28.07.03	BLADE SHARPENING DETAIL DELETED, REF TO 82206 ADDED.
CL167	C	P.S.	18.12.00	DETAIL ADDED FOR BALANCE WEIGHT
CL3791	B	P.S.	11/6/97	109989 WAS TYPE 4.0
CL3788	A	P.S.	20.05.97	TRIMMED IMPELLERS ADDED TO LIST.
CL3731	0	L.C.	19.05.97	ISSUED FOR PRODUCTION

JET 241

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

PROJECTION

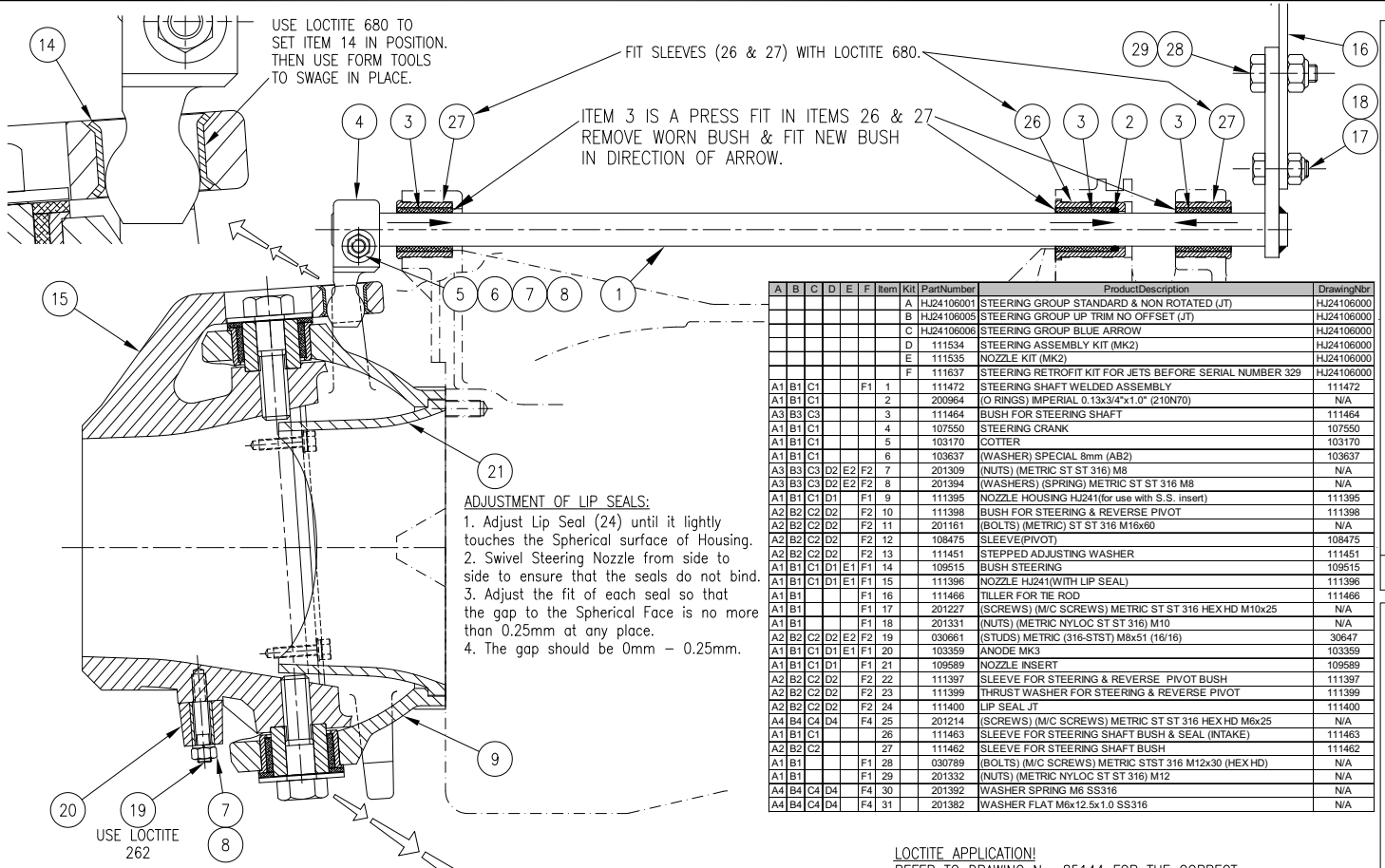
DESIGNED K.V.A	DATE 20.10.95	
DRAWN L COOPER	26.10.95	
CHECKED K.V.A.	12.11.95	
APPROVED K.V.E	11.12.95	

NAME
HJ241
IMPELLERS

SCALE -

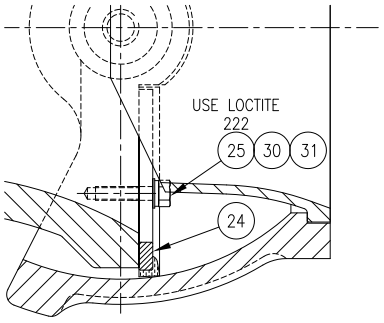
No: ASSY-HJ241 03 001 D

HJ-241-06-000 Steering Assembly General Arrangement Sht1

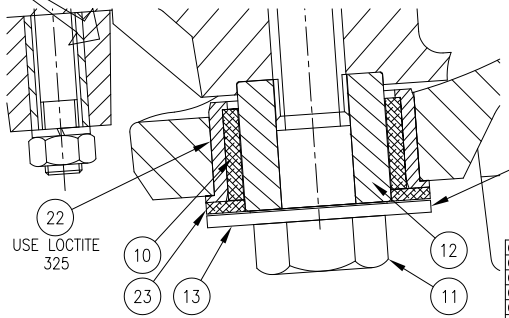


A	B	C	D	E	F	Item	Kit	PartNumber	ProductDescription	DrawingNbr
							A	HJ24106001	STEERING GROUP STANDARD & NON ROTATED (JT)	HJ24106000
							B	HJ24106005	STEERING GROUP UP TRIM NO OFFSET (JT)	HJ24106000
							C	HJ24106006	STEERING GROUP BLUE ARROW	HJ24106000
							D	111534	STEERING ASSEMBLY KIT (MK2)	HJ24106000
							E	111535	NOZZLE KIT (MK2)	HJ24106000
							F	111637	STEERING RETROFIT KIT FOR JETS BEFORE SERIAL NUMBER 329	HJ24106000
A1	B1	C1			F1	1		111472	STEERING SHAFT WELDED ASSEMBLY	111472
A1	B1	C1				2		200964	(O RINGS) IMPERIAL 0.13x3/4"x1.0" (210N70)	N/A
A3	B3	C3				3		111464	BUSH FOR STEERING SHAFT	111464
A1	B1	C1				4		107550	STEERING CRANK	107550
A1	B1	C1				5		103170	COTTER	103170
A1	B1	C1				6		103637	(WASHER) SPECIAL 8mm (AB2)	103637
A3	B3	C3	D2	E2	F2	7		201309	(NUTS) (METRIC ST ST 316) M8	N/A
A3	B3	C3	D2	E2	F2	8		201394	(WASHERS) (SPRING) METRIC ST ST 316 M8	N/A
A1	B1	C1	D1		F1	9		111395	NOZZLE HOUSING HJ241(for use with S.S. insert)	111395
A2	B2	C2	D2		F2	10		111398	BUSH FOR STEERING & REVERSE PIVOT	111398
A2	B2	C2	D2		F2	11		201161	(BOLTS) (METRIC) ST ST 316 M16x60	N/A
A2	B2	C2	D2		F2	12		108475	SLEEVE(PIVOT)	108475
A2	B2	C2	D2		F2	13		111451	STEPPED ADJUSTING WASHER	111451
A1	B1	C1	D1	E1	F1	14		109515	BUSH STEERING	109515
A1	B1	C1	D1	E1	F1	15		111396	NOZZLE HJ241(WITH LIP SEAL)	111396
A1	B1				F1	16		111466	TILLER FOR TIE ROD	111466
A1	B1				F1	17		201227	(SCREWS) (M/C SCREWS) METRIC ST ST 316 HEX HD M10x25	N/A
A1	B1				F1	18		201331	(NUTS) (METRIC NYLOC ST ST 316) M10	N/A
A2	B2	C2	D2	E2	F2	19		030661	(STUDS) METRIC (316-STST) M8x51 (16/16)	30647
A1	B1	C1	D1	E1	F1	20		103359	ANODE MK3	103359
A1	B1	C1	D1		F1	21		109589	NOZZLE INSERT	109589
A2	B2	C2	D2		F2	22		111397	SLEEVE FOR STEERING & REVERSE PIVOT BUSH	111397
A2	B2	C2	D2		F2	23		111399	THRUST WASHER FOR STEERING & REVERSE PIVOT	111399
A2	B2	C2	D2		F2	24		111400	LIP SEAL JT	111400
A4	B4	C4	D4		F4	25		201214	(SCREWS) (M/C SCREWS) METRIC ST ST 316 HEX HD M6x25	N/A
A1	B1	C1				26		111463	SLEEVE FOR STEERING SHAFT BUSH & SEAL (INTAKE)	111463
A2	B2	C2				27		111462	SLEEVE FOR STEERING SHAFT BUSH	111462
A1	B1				F1	28		030789	(BOLTS) (M/C SCREWS) METRIC STST 316 M12x30 (HEX HD)	N/A
A1	B1				F1	29		201332	(NUTS) (METRIC NYLOC ST ST 316) M12	N/A
A4	B4	C4	D4		F4	30		201392	WASHER SPRING M6 SS316	N/A
A4	B4	C4	D4		F4	31		201382	WASHER FLAT M6x12.5x1.0 SS316	N/A

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.



SECTIONAL PLAN



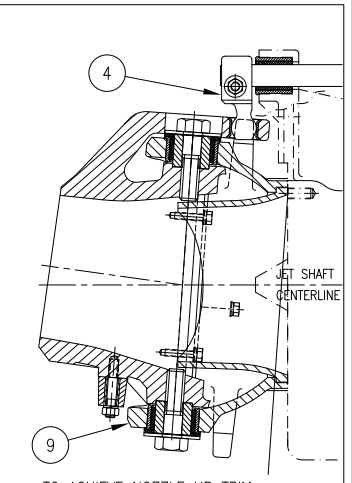
PUSH FIT BUSH (10) UNTILL FLUSH WITH END OF SLEEVE (22).

FIT BOLT ITEM 11 WITH LOCTITE 243. M
TORQUE TO 60Nm (45ftlbs).

LOCTITE APPLICATION!
REFER TO DRAWING No: 85144 FOR THE CORRECT APPLICATION INSTRUCTIONS FOR LOCTITE 222, 262, 325 & 680.

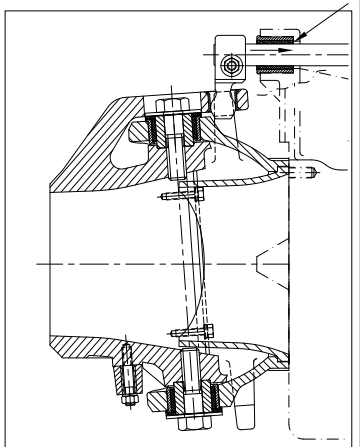
PAINTING NOTES!
1. STANDARD GLOSS FINISH: REFER TO DRAWING No: 85133 FOR PAINTING OF PARTS.
2. REFER TO DRAWING No: 111178 FOR PAINT SPECIFICATION AND APPLICATION.

FIT STEPPED WASHER (13) WITH STEP FACING INWARDS
CHECK THAT THE END FLOAT IS BETWEEN 0.1 & 0.3mm.
THE END FLOAT CAN BE DECREASED BY INVERTING ONE OR BOTH OF THE STEPPED WASHERS.



TO ACHIEVE NOZZLE UP TRIM ITEMS 4 AND 9 ARE ASSEMBLED TURNED THROUGH 180° AS SHOWN.

NOZZLE 'UP' – HJ241 06 005



NOZZLE 'STRAIGHT' – HJ241 06 001

CL602	N	B.B.	21.12.09	KIT HJ24106006 ADDED TO DRAWING.
CL503	M	R.K.	14.01.08	LOCTITE 243 WAS 222.
CL414	L	SC	01.05.06	ADJUSTMENT NOTE FOR LIP SEAL ADDED
CL238	K	P.M.W.	24.06.02	BALLOON FOR ITEM 1 WAS NOT SHOWN
CL229	J	P.M.W.	22.04.02	LOCTITE DETAILS UPDATED
CL229	J	P.M.W.	22.04.02	FOR CHANGES REF CL3767,3773,147,153,158,161,163,221
REF	NO.	BY	DATE	AMENDMENTS

JET 241

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

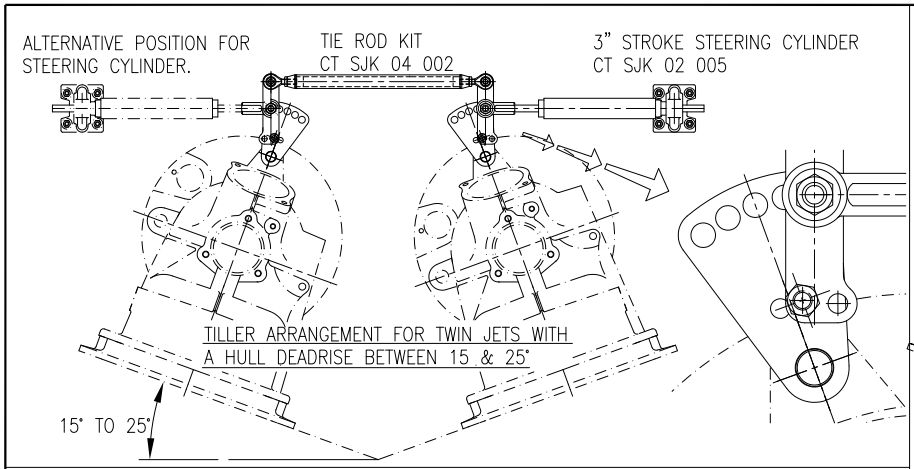
PROJECTION

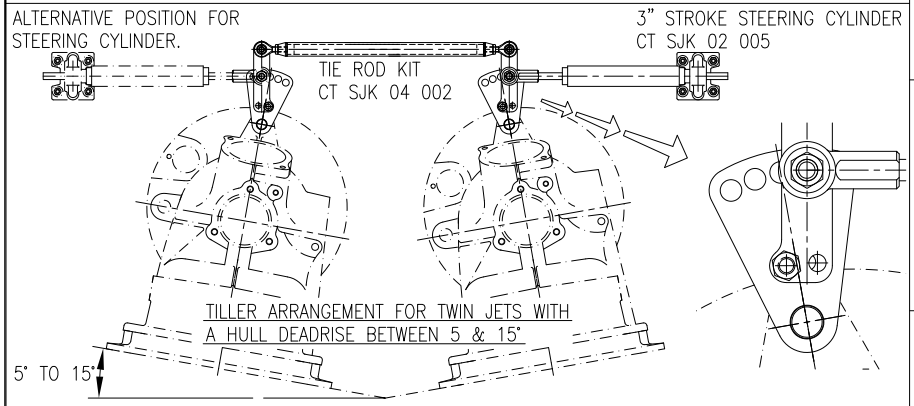
NAME: JT STEERING ASSEMBLY GENERAL ARRANGEMENT 241 sheet 1 of 2

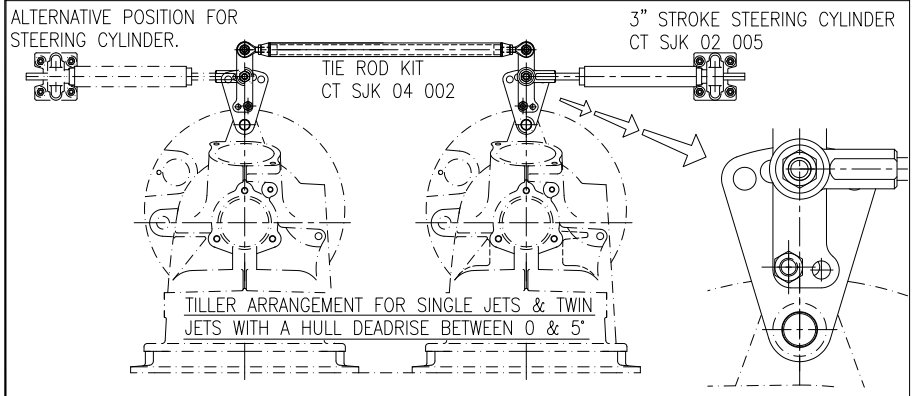
DESIGNED K.V.A.	DATE 10.95
DRAWN L. COOPER	13.11.95
CHECKED K.V.A.	14/11/95
APPROVED K.V.E.	12/12/95

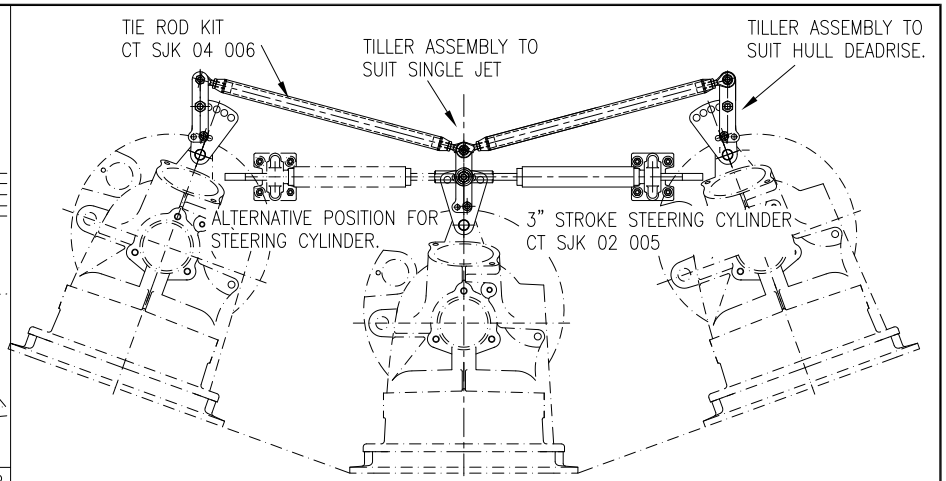
SCALE 1:2.5 | No. ASSY–HJ241 06 000 | N

HJ-241-06-000 Steering Assembly General Arrangement Sht2





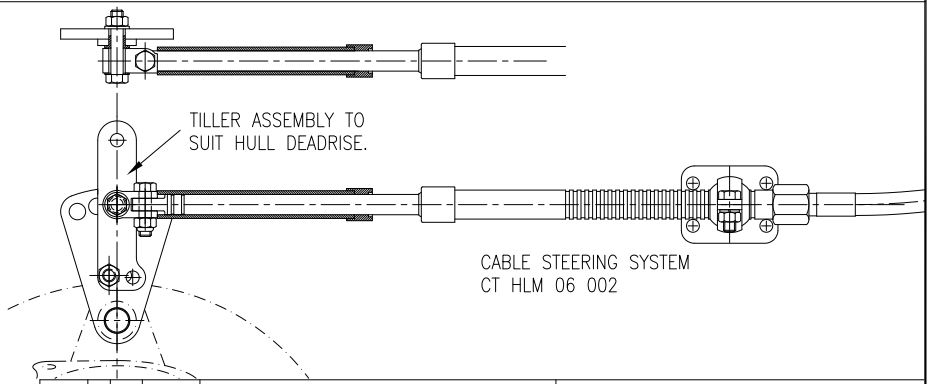




TYPICAL TILLER ARRANGEMENT FOR TRIPLE JETS (HULL DEADRISE BETWEEN 15 & 25° SHOWN)

NOTE

THE STEERING ARRANGEMENT HAS BEEN DESIGNED TO USE A 3" STROKE CYLINDER. IF A LONGER STROKE CYLINDER IS USED IT MUST HAVE ITS STROKE LIMITED TO 3"(76mm) BY FITTING A SLEEVE OVER THE CYLINDER SHAFT OR A PLUG IN THE CYLINDER BORE.
IF A CABLE STEERING SYSTEM, SUCH AS MORSE DO290, IS USED THEN ITS STROKE MUST LIMITED TO 3"(76mm) BY FITTING A SLEEVE OVER THE CABLE END AS SHOWN.



C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

PROJECTION

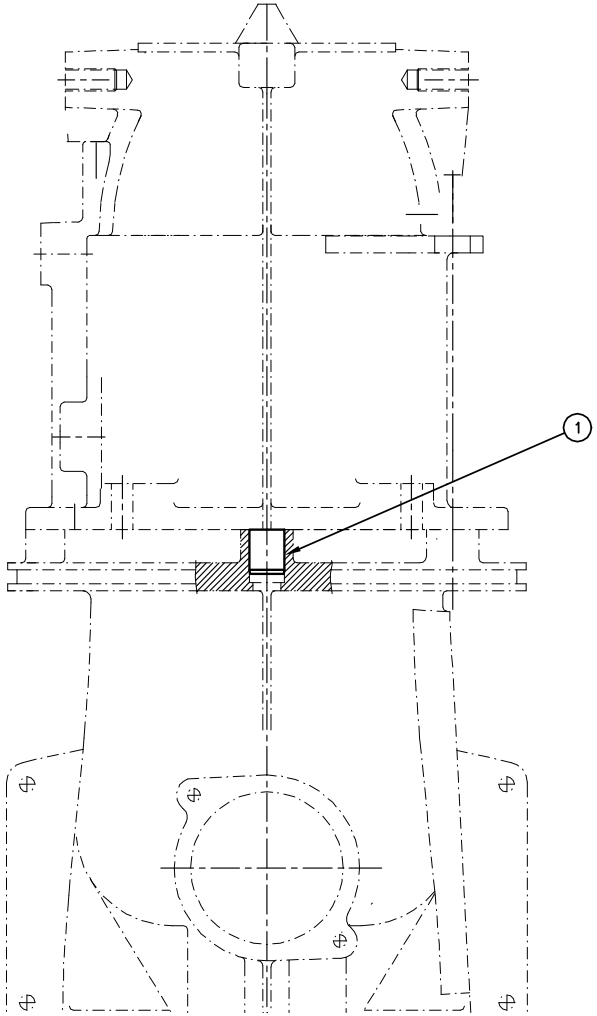
NAME: STEERING ASSEMBLY TILLER ROTATION FOR MULTIPLE INSTALLATIONS HJ241 (sheet 2 of 2)

DESIGNED P.A.S. DATE 04.08.00
DRAWN P.A.S. 16.08.00
CHECKED
APPROVED

SCALE -
No: ASSY-HJ241 06 000 N

REF | NO. | BY | DATE | AMENDMENTS
REFER SHEET 1 FOR CHANGES
JET 241

HJ-241-06-004 Blanking Plugs (No Steering)



SPARES ASSY			ITEM	PART No	QTY	DESCRIPTION	DWG No
		4	1	108543	1	BLANKING PLUG	108543

CL3731	0	I.B.W.	12.12.95	ISSUED FOR PRODUCTION	
REF	NO.	BY	DATE	AMENDMENTS	
JET 241					

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C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

PROJECTION

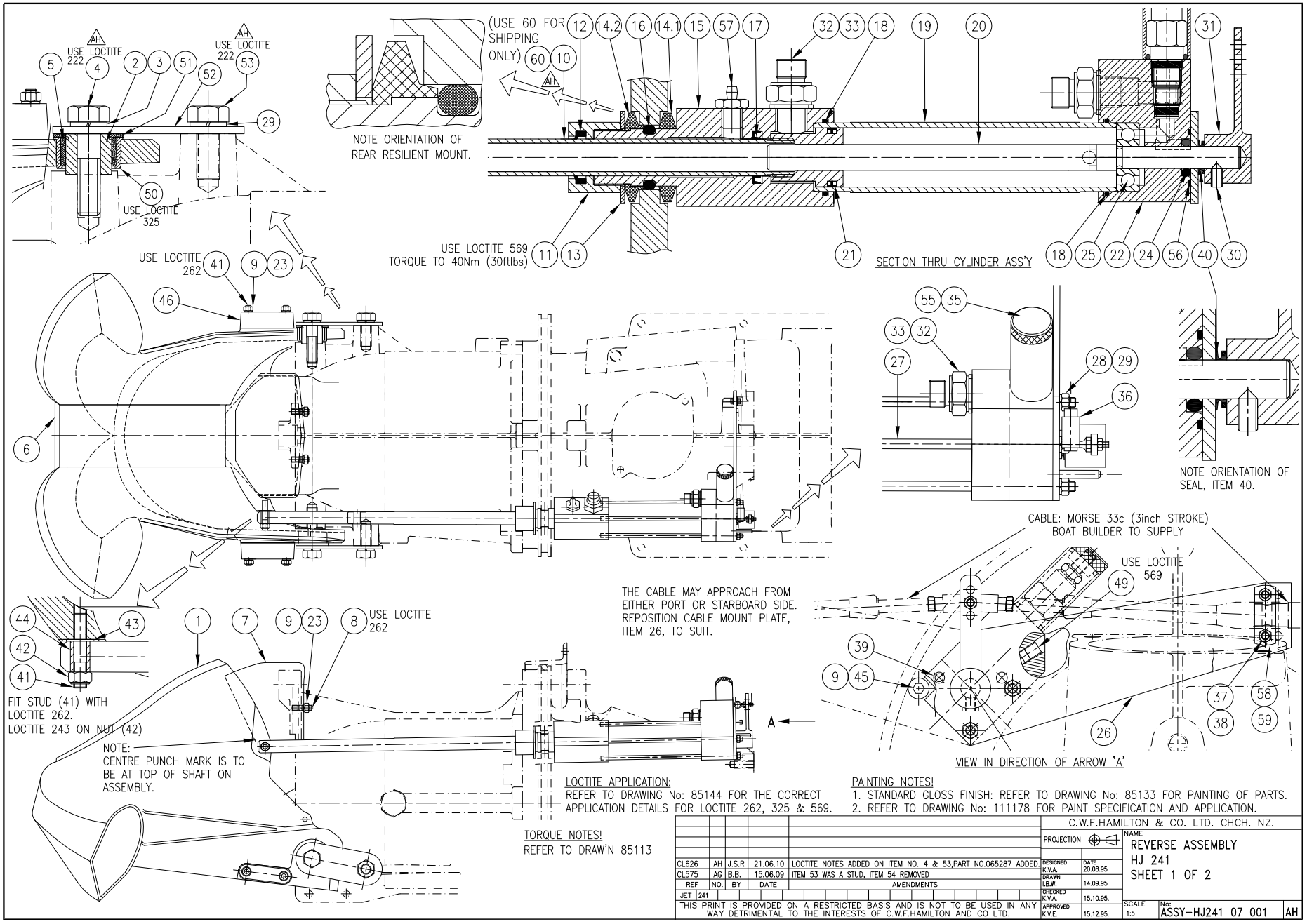
DESIGNED K.V.A.	DATE 20.06.95.
DRAWN I.B.W.	21.09.95.
CHECKED K.V.A.	
APPROVED K.V.E.	

NAME
BLANKING PLUGS
(NO STEERING)
HJ241

SCALE -

No: ASSY-HJ241 06 004 0

HJ-241-07-001 Reverse Assembly Sht1



LOCTITE APPLICATION:
REFER TO DRAWING No: 85144 FOR THE CORRECT APPLICATION DETAILS FOR LOCTITE 262, 325 & 569.

PAINTING NOTES!
1. STANDARD GLOSS FINISH: REFER TO DRAWING No: 85133 FOR PAINTING OF PARTS.
2. REFER TO DRAWING No: 111178 FOR PAINT SPECIFICATION AND APPLICATION.

TORQUE NOTES!
REFER TO DRAW'N 85113

CL626	AH	J.S.R	21.06.10	LOCTITE NOTES ADDED ON ITEM NO. 4 & 53,PART NO.065287 ADDED	
CL575	AG	B.B.	15.06.09	ITEM 53 WAS A STUD, ITEM 54 REMOVED	
REF	NO.	BY	DATE	AMENDMENTS	

JET 241

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C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

PROJECTION

DESIGNED K.V.A.	DATE 20.08.95
DRAWN I.B.W.	14.09.95
CHECKED K.V.A.	15.10.95.
APPROVED K.V.E.	15.12.95.

NAME
REVERSE ASSEMBLY
HJ 241
SHEET 1 OF 2

SCALE 1:5 | No: ASSY-HJ241 07 001 | AH

HJ-241-07-001 Reverse Assembly Sht2

A	B	C	D	E	F	G	Item	Kit	PartNumber	ProductDescription	DrawingNbr
								A	HJ24107001	REVERSE GROUP (HYDRAULIC) CONTROL	HJ24107001
A1								B	112080	REVERSE CYLINDER H.S.R.X. MK2 HJ241	HJ24107001
								C	112078	SEALS KIT H.S.R.X. MK2	HJ24107001
								D	112049	HSRX BACKHEAD KIT	HJ21307001
								E	112240	HSRX FRONT HEAD KIT	HJ24107001
								F	112242	REVERSE DUCT KIT	HJ24107001
								G	080934	CABLE CLAMP KITSET	80934
		C2						REF	108559	RESILIENT MOUNT 50 x 30 (Rubber)	107135
A1					F1		1		111524	REVERSE DUCT HJ241	111524
A2							2		111685	REVERSE PIVOT	111685
A4							3		201397	(WASHERS) (SPRING) METRIC ST ST 316 M16	N/A
A2							4		201162	(BOLTS) (METRIC) ST ST 316 M16x65	N/A
A2					F2		5		111398	BUSH FOR STEERING & REVERSE PIVOT	111398
A1					F1		6		107562	(LABELS) REVERSE LABEL	107562
A1							7		111460	SPLASH GUARD MK2	111460
A2							8		201278	(STUDS) METRIC (316-STST) M8x35 (12/22)	30647
A7					F4		9		201394	(WASHERS) (SPRING) METRIC ST ST 316 M8	N/A
	B1						10		108580	SHAFT ASSEMBLY	108580
	B1			E1			11		108550	REVERSE CYL RETAINING NUT	108550
	B1	C1		E1			12		201511	(SEAL) WIPER SEAL 20x28x4.8 TYPE 839N HALLITE #4630900	N/A
	B1			E1			13		108564	(WASHER) SPECIAL WASHER 30mm OD x 3.0 thk 316 STST	108564
	B1	C1		E1			14.1		112234	FRONT - RESILIENT MOUNT (Rubber)	112234
	B1	C1		E1			14.2		112233	REAR - RESILIENT MOUNT (Rubber)	112233
	B1			E1			15		112076	FRONT HEAD H.S.R.X. REVERSE CYLINDER	112076
	B1	C1		E1			16		061487	(O RINGS) METRIC 5.3x25x35.6 DASH NO. 318N70	N/A
	B1	C1		E1			17		201512	(OIL SEALS) 20x28x5 TYPE 605 HALLITE #4611100	N/A
	B2	C2	D1	E1			18		201002	(O RINGS) IMPERIAL 0.10x1.44x1.63 (127N70)	N/A
	B1						19		108572	CYLINDER	106555
	B1						20		108569	SPOOL H.S.R.X.	108569
	B1	C1					21		201497	(SEAL) PISTON SEAL-GT 8065-173-HR	N/A
	B1		D1				22		112235	BACKHEAD H.S.R.X. Mk3 (HDM8724)	112235
A6					F4		23		201309	(NUTS) (METRIC ST ST 316) M8	N/A
	B1	C1	D1				24		065222	12x4.5 Viton O ring	N/A
	B1		D1				25		201466	(SKF) BEARING 6301	N/A
	B1						26		108553	CABLE MOUNTING PLATE H.S.R.X.	108553
	B4						27		108565	(STUDS) METRIC (316-STST) M6x224 (15/15)	30635
	B4						28		201308	NUT HEX M6 SS316	N/A
	B4						29		201392	WASHER SPRING M6 SS316	N/A
	B1						30		201244	(SCREWS) (SET SCREWS) METRIC ST ST 316 Socket M6x10	N/A
	B1						31		106561	HANDLE H.S.R.X	106561
	B2		D1	E1			32		205065	NIPPLE 3/8" BSPP MALE x 3/8" BSPP MALE # Z101006	115000
	B2	C2	D1	E1			33		201767	BONDED SEAL 3/8" BSP (400-823-4490-74)	115000
	B1		D1				35		202986	PRESSURE RELIEF VALVE (RDBA-LDN) PRESSURE SET TO 34 BAR (500 psi)	N/A
	B1						36		201553	BALL JOINT MORSE 30C CABLE 10-32 UNF S.S.	201553
	B2					G2	37		201183	SCREW RND 0.19UNCx1 SS316	N/A
	B2					G2	38		201326	NUT NYLOC 019UNC SS316	N/A
	B1		D1				39		108927	PIN 3/16" dia x 40	108250
	B1	C1	D1				40		065187	V-RING (VA-12)	N/A
A5					F5		41		030661	(STUDS) METRIC (316-STST) M8x51 (16/16)	30647
A1					F1		42		201330	NUT NYLOC M8 SS316	N/A
A1					F1		43		201383	WASHER FLAT M8x16x1.2 SS316	N/A
A1					F1		44		111808	PLAIN BUSH - REVERSE CYLINDER (REPLACES PT No.64452)	111808
A1							45		201261	(SCREWS) (CAPSCREWS) METRIC ST ST 316 Socket Hd M8x20	N/A
A2					F2		46		103359	ANODE MK3	103359
							49	REF	065186	DRYSEAL PRESSURE PLUG 1/16" NPT	N/A
A2					F2		50		111397	SLEEVE FOR STEERING & REVERSE PIVOT BUSH	111397
A2					F2		51		111399	THRUST WASHER FOR STEERING & REVERSE PIVOT	111399
A2							52		111526	REVERSE PIVOT LINK	111526
A2							53		201233	(BOLTS) (M/C SCREWS) METRIC STST 316 M16 X 40 HEX HD	N/A
	B1		D1				55		065185	COVER KIT (HCO 2240)	N/A
	B1	C1	D1				56		065183	(O RINGS) METRIC 25x2 N70	N/A
	B1			E1			57		200917	(GREASE) NIPPLES 1/8"BSP STAINLESS STEEL	N/A
	B2					G2	58		202544	MORSE CABLE CLAMP 30 S.S.	202544
	B2					G2	59		202543	SHIM - MORSE CABLE CLAMP	202543
AH	B0.20						60		065287	25mm Spiral Tie. Fits 20mm hydraulic shafts. (SPL 25/B).	N/A

ITEM 35: VALVE PURCHASED AT STD. PRE-SET PRESSURE OF 500 p.s.i.

CYLINDER SPECIFICATION
CYLINDER STROKE = 148mm

REF	NO.	BY	DATE	AMENDMENTS
				REFER TO SHEET 1 FOR CHANGES

JET 241

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

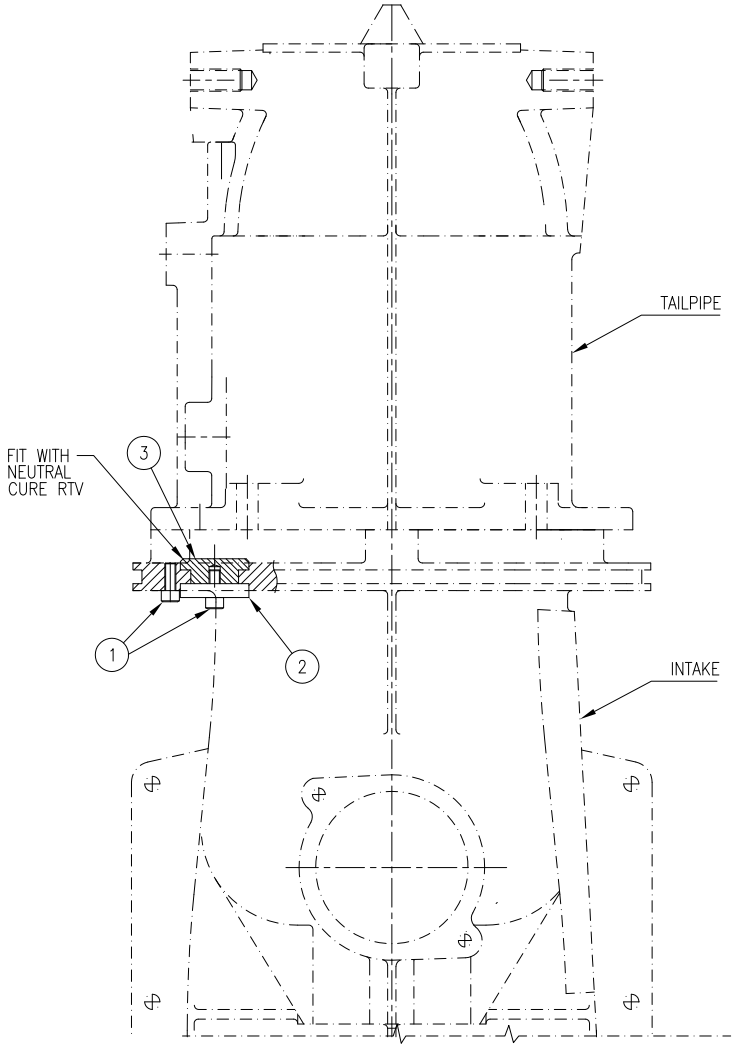
PROJECTION

DESIGNED P.A.S. DATE 27.07.00
DRAWN P.A.S 27.07.00
CHECKED
APPROVED

NAME
REVERSE ASSEMBLY
HJ241
SHEET 2 OF 2

SCALE -
No: ASSY-HJ241 07 001 AH

HJ-241-07-002 Blanking Plus (No Reverse)



Item	Kit	PartNumber	Qty	ProductDescription	DrawingNbr
1		JBJYXAH	2	(SCREWS) (CAPSCREWS) METRIC ST ST 316 Socket Hd M8x20	N/A
2		108614	1	(WASHER) SPECIAL	108613
3		108613	1	BLANKING PLUG	108613

NO.	BY	DATE	AMENDMENTS
CL 177	A	P.S.	19/03/01 PLUG FOR MANUAL REVERSE DELETED. ITEM 1 WAS DRG No 108624
CL3731	0	I.B.W.	12/12/95 ISSUED FOR PRODUCTION

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

PROJECTION

		DATE
DESIGNED	K.V.A.	20.8.95
DRAWN	I.B.W.	21.9.95
CHECKED	K.V.A.	11/12/95
APPROVED	K.V.E.	11/12/95

NAME
BLANKING PLUGS
NO REVERSE

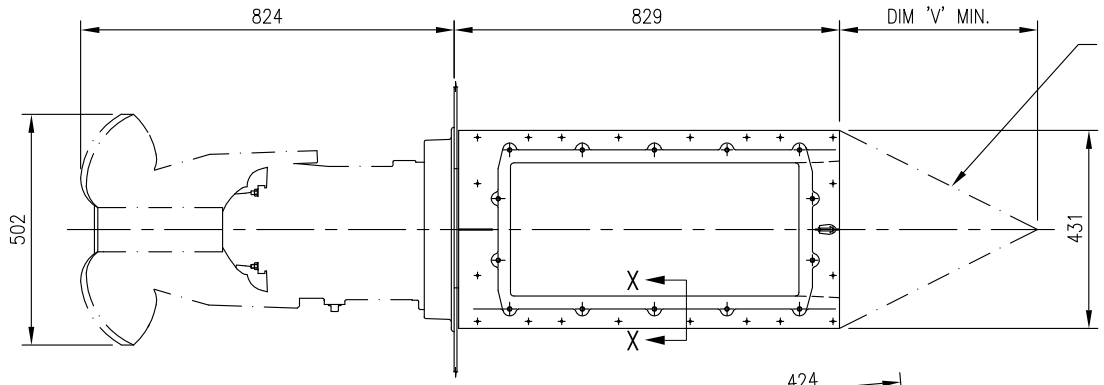
HJ241

SCALE -

No: ASSY–HJ241 07 002 A

JET 241

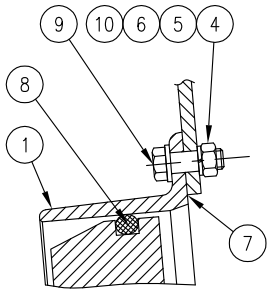
HJ-241-08-001 Installation Details GRP Hull



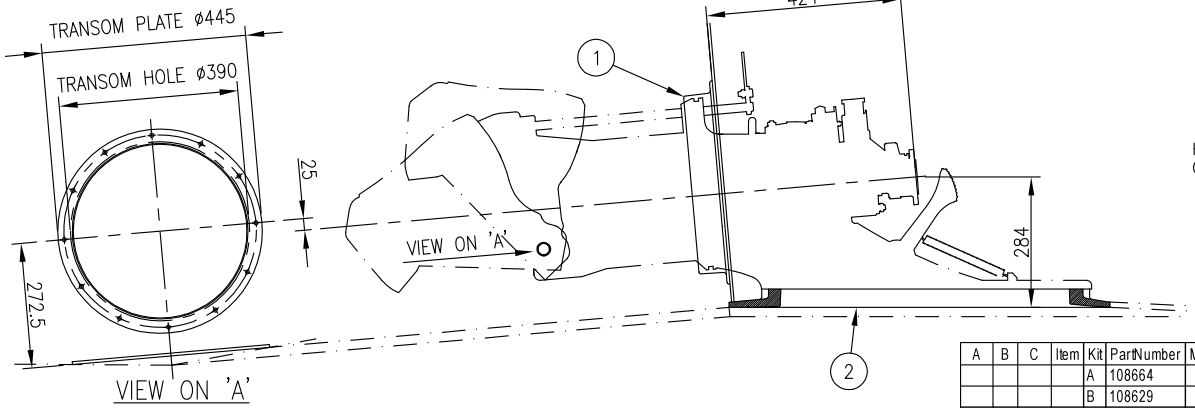
FOR JETS MOUNTED ON HULL CENTER ONLY:

Arrange this triangular shaped fairing which blends from vee bottom hull to front of jet intake in a smoothly curved contour. Dimension 'V' according to deadrise

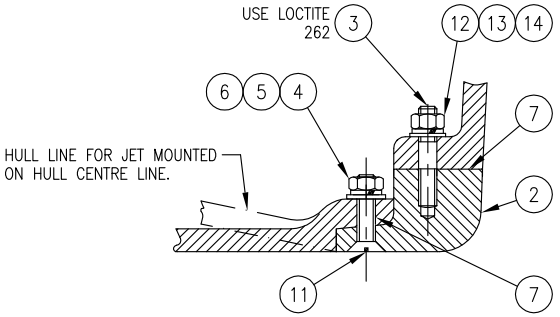
DEADRISE	DIM. V.
10°	431
20°	900
30°	1450



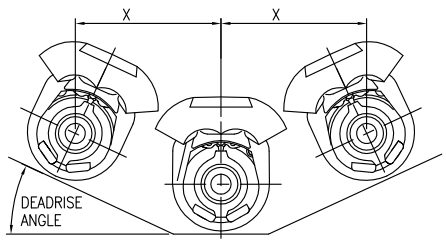
TRANSOM SEAL DETAIL



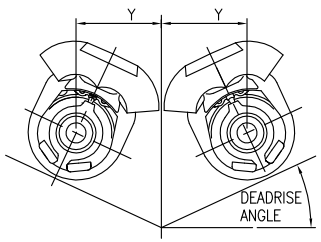
VIEW ON 'A'



SECTION X–X



TRIPLE JET INSTALLATION



TWIN JET INSTALLATION

TRIPLE JETS DIM. X (MIN)		TWIN JETS DIM. Y (MIN)
520	0°	260
535	5°	275
545	10°	285
555	15°	295
555	20°	305
555	25°	310

LOCTITE APPLICATION:
REFER TO DRAWING No: 85144 FOR THE CORRECT APPLICATION INSTRUCTIONS FOR LOCTITE 262.

PAINTING NOTES!
1. STANDARD GLOSS FINISH: REFER TO DRAWING 85133 FOR PAINTING OF PARTS.
2. REFER TO DRAWING 85145 FOR FINISH OF INTAKE BLOCK.
3. REFER TO DRAWING 111178 FOR PAINT SPECIFICATION AND APPLICATION.

A	B	C	Item	Kit	PartNumber	MovexAlias	Qty	ProductDescription	DrawingNbr
				A	108664			INTAKE BLOCK KIT (GRP HULL)	HJ24108001
				B	108629			INSTALLATION HARDWARE KIT	HJ24108001
				C	108630			TRANSOM PLATE KIT (ALUM & GRP HULL)	HJ24108001
		C	1		108514		1	TRANSOM PLATE	108514
A			2		108486		1	INTAKE BLOCK - GRP / ALM	HJ24108002
	B		3		30671	030671	14	(STUDS) METRIC (316-STST) M10x51 (20/20)	30637
A22		C12	4		JDQHXAC	201309	34	(NUTS) (METRIC ST ST 316) M8	N/A
A22		C12	5		JEQKXAC	201394	34	(WASHERS) (SPRING) METRIC ST ST 316 M8	N/A
A22		C12	6		JEOZXAF	201383	34	(WASHERS) (FLAT) METRIC ST ST 316 M8x16x1.2	N/A
A1	B1		7		JMNGAAR	201414	2	NEUT-CURE RTV SILICONE 310G	N/A
		C	8		108552		1	(JET) O RINGS SPECIAL TRANSOM PLATE	111183
		C	9		HZQHXAZ	201219	12	(SCREWS) (M/C SCREWS) METRIC ST ST 316 HEX HD M8x25	N/A
	B		10		MRINAAI	201715	1	LOCTITE 262 10ML BOTTLE	N/A
A			11		HZPPXDI	201200	22	(BOLTS) (M/C SCREWS) METRIC STST 316 M8x30 (CSK HD)	N/A
	B		12		JDQHXAE	201310	14	(NUTS) (METRIC ST ST 316) M10	N/A
	B		13		JEQKXAE	201395	14	(WASHERS) (SPRING) METRIC ST ST 316 M10	N/A
	B		14		JEOZXAI	201384	14	(WASHERS) (FLAT) METRIC ST ST 316 M10x21x1.2	N/A
A1	B1	C1	15		63595	063595	3	(JET) PACKAGING BOLT BOX	N/A

REF	NO.	BY	DATE	AMENDMENTS
CL316	E	F.K.	15.03.04	ITEM 7, RTV SILICONE, ADDED TO KIT A
CL229	D	P.M.W.	22.04.02	LOCTITE DETAILS UPDATED
CL158	C	P.M.W.	05.10.00	PAINT SPEC DRGS ADDED
CL144	B	P.S.	28.06.00	KIT A NOW INCLUDES ITEM 11.
CL132	A	P.S.	05.04.00	TRANSOM HOLE HEIGHT WAS 264.
CL3731	0	L.C.	12.12.95	ISSUED FOR PRODUCTION

JET 241

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

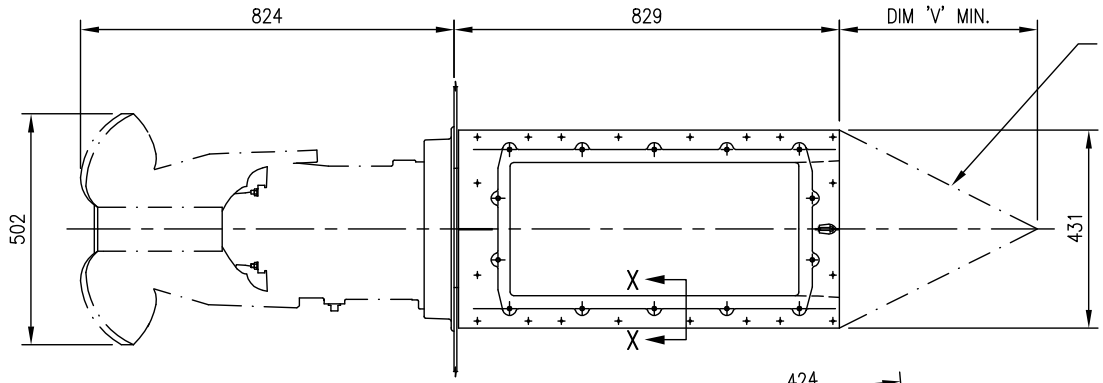
PROJECTION

NAME
INSTALLATION DETAILS
G.R.P. HULL
HJ 241 JET

DESIGNED K.V.A. — DATE 10.95
DRAWN L COOPER — 25.10.95
CHECKED K.V.A.
APPROVED K.V.E.

SCALE 1:10 | No: ASSY-HJ241 08 001 | E

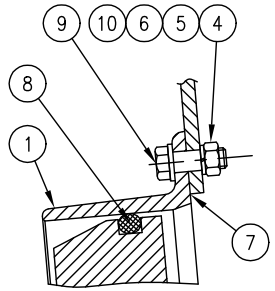
HJ-241-08-002 Installation Details Aluminium Hull



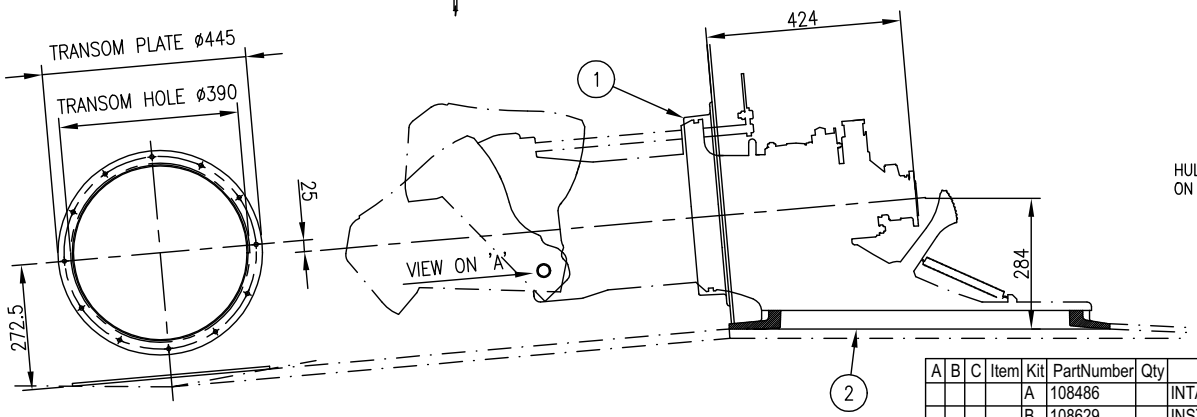
FOR JETS MOUNTED ON HULL CENTER ONLY:

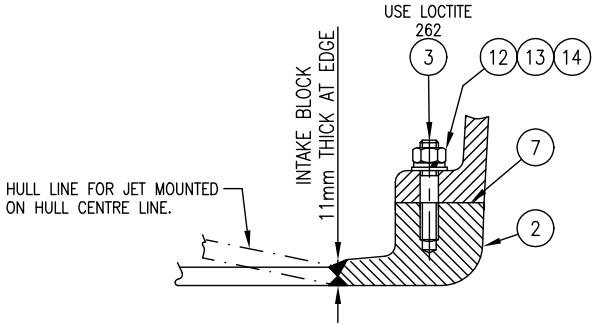
Arrange this triangular shaped fairing which blends from vee bottom hull to front of jet intake in a smoothly curved contour. Dimension 'V' according to deadrise

DEADRISE	DIM. V.
10°	431
20°	900
30°	1450



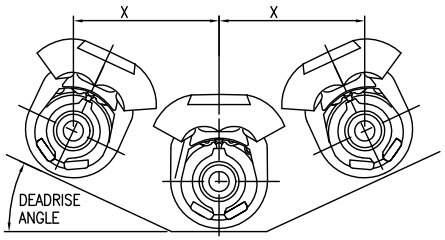
TRANSOM SEAL DETAIL



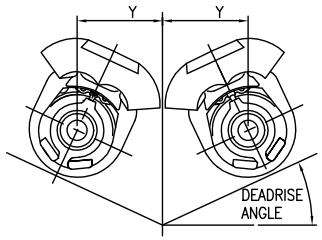


SECTION X–X

VIEW ON 'A'



TRIPLE JET INSTALLATION



TWIN JET INSTALLATION

TRIPLE JETS DIM. X (MIN)		TWIN JETS DIM. Y (MIN)
520	0°	260
535	5°	275
545	10°	285
555	15°	295
555	20°	305
555	25°	310

LOCTITE APPLICATION:
REFER TO DRAWING No: 85144 FOR THR CORRECT APPLICATION INSTRUCTIONS FOR LOCTITE 262.

PAINTING NOTES!
1. STANDARD GLOSS FINISH: REFER TO DRAWING 85133 FOR PAINTING OF PARTS.
2. REFER TO DRAWING 85145 FOR FINISH OF INTAKE BLOCK.
3. REFER TO DRAWING 111178 FOR PAINT SPECIFICATION AND APPLICATION.

A	B	C	Item	Kit	PartNumber	Qty	ProductDescription	DrawingNbr
				A	108486		INTAKE BLOCK - GRP / ALM	108486
				B	108629		INSTALLATION HARDWARE KIT	HJ24108001
				C	108630		TRANSOM PLATE KIT (ALUM & GRP HULL)	HJ24108001
		C	1		108514	1	TRANSOM PLATE	108514
A			2		108486	1	INTAKE BLOCK - GRP / ALM	108486
	B		3		30671	14	(STUDS) METRIC (316-STST) M10x51	30637
		C	4		JDQHXAC	12	(NUTS) (METRIC ST ST 316) M8	N/A
		C	5		JEQKXAC	12	(WASHERS) (SPRING) METRIC ST ST 316 M8	N/A
		C	6		JEOZXAF	12	(WASHERS) (FLAT) METRIC ST ST 316 M8x16x1.2	N/A
	B		7		JMNGAAR	1	NEUT-CURE RTV SILICONE 310G	N/A
		C	8		108552	1	(JET) O RINGS SPECIAL TRANSOM PLATE	111183
		C	9		HZQHXAZ	12	(SCREWS) (M/C SCREWS) METRIC ST ST 316 HEX HD M8x25	N/A
	B		10		MRINAAI	1	LOCTITE 262 10ML BOTTLE	N/A
	B		12		JDQHXAE	14	(NUTS) (METRIC ST ST 316) M10	N/A
	B		13		JEQKXAE	14	(WASHERS) (SPRING) METRIC ST ST 316 M10	N/A
	B		14		JEOZXAI	14	(WASHERS) (FLAT) METRIC ST ST 316 M10x21x1.2	N/A
	B		15		63595	1	(JET) PACKAGING BOLT BOX	N/A

REF	NO.	BY	DATE	AMENDMENTS
CL229	D	P.M.W	22.04.02	LOCTITE DETAILS UPDATED
CL 172	C	KVE	8.2.01	ITEM NBRS ALTERED, NO DWG CHANGE
CL 158	B	P.M.W	5.10.00	PAINT SPEC DRGS ADDED
CL132	A	P.S.	5.4.00	TRANSOM HOLE HEIGHT WAS 264.
CL3731	0	L.C.	12/12/95	ISSUED FOR PRODUCTION

JET 241

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

PROJECTION

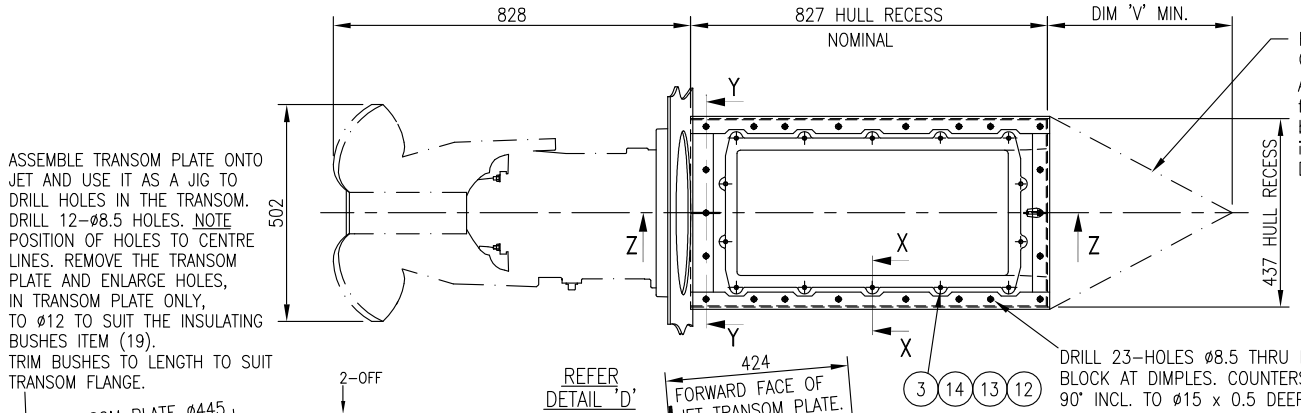
NAME: ALUMINIUM HULL HJ 241 JET

DESIGNED K.V.A.	DATE 10.95
DRAWN L COOPER	25.10.95
CHECKED K.V.A.	
APPROVED K.V.E.	

SCALE 1:10 | No: ASSY–HJ241 08 002 | D

HJ-241-08-003 Installation Details Steel Hull Sht1

DO NOT SCALE THIS DRAWING | REMOVE ALL SHARP EDGES | ALL DIMENSIONS IN mm UNLESS OTHERWISE STATED | PROJECTION



ASSEMBLE TRANSOM PLATE ONTO JET AND USE IT AS A JIG TO DRILL HOLES IN THE TRANSOM. DRILL 12–ø8.5 HOLES. NOTE POSITION OF HOLES TO CENTRE LINES. REMOVE THE TRANSOM PLATE AND ENLARGE HOLES, IN TRANSOM PLATE ONLY, TO ø12 TO SUIT THE INSULATING BUSHES ITEM (19).
TRIM BUSHES TO LENGTH TO SUIT TRANSOM FLANGE.

FOR JETS MOUNTED ON HULL CENTER ONLY:
Arrange this triangular shaped fairing which blends from vee bottom hull to front of jet intake in a smoothly curved contour. Dimension 'V' according to deadrise

DEADRISE	DIM. V.
10°	431
20°	900
30°	1450

DRILL 23–HOLES ø8.5 THRU INTAKE BLOCK AT DIMPLES. COUNTERSINK AT 90° INCL. TO ø15 x 0.5 DEEP.

SET THE INTAKE BLOCK INTO THE HULL RECESS WITH 3mm MINIMUM GAP AT EDGES. USING BLOCK AS A JIG, DRILL THRU THE INTAKE BLOCK TO LOCATE THE HOLES IN THE HULL RECESS. REMOVE THE INTAKE BLOCK AND ENLARGE THE HOLES IN THE HULL RECESS TO ø12mm & SPOT FACE INBOARD SIDE TO ø20 TO SUIT THE INSULATING BUSHES ITEM (19). TRIM THE INSULATING BUSHES TO LENGTH AFTER FITTING THEM TO THE HULL RECESS.

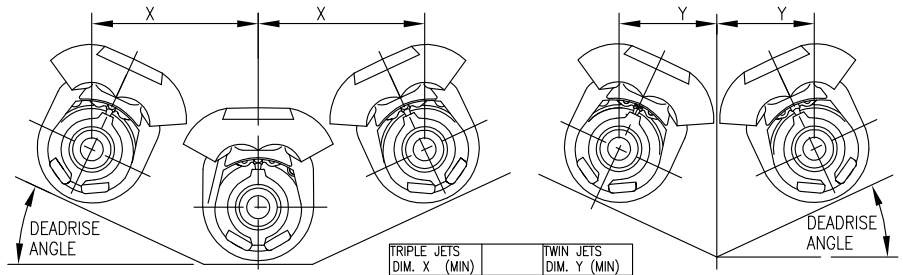
VIEW ON 'A'

NOTE: TRANSOM POSITION MAY VARY, TRIM AFT END OF TO SUIT IF REQUIRED.

SECTION Z–Z THRU BLOCK.

NOTE: FOR SECTIONS AND DETAILS REFER TO SHEET 2 of 2.

A	B	C	Item	Kit	PartNumber	MovexAlias	Qty	ProductDescription	DrawingNbr
				A	202402			INTAKE BLOCK - STEEL	HJ24108003
				B	108629			INSTALLATION HARDWARE KIT	HJ24108001
				C	202403			TRANSOM PLATE KIT (STEEL)	HJ24108003
		C	1		108514		1	TRANSOM PLATE	108514
A			2		108486		1	INTAKE BLOCK - GRP / ALM	HJ24108002
	B		3		30671	030671	14	(STUDS) METRIC (316-STST) M10x51 (20/20)	30637
A23		C12	4		JDQHXAC	201309	35	(NUTS) (METRIC ST ST 316) M8	N/A
A23		C12	5		JEQKXAC	201394	35	(WASHERS) (SPRING) METRIC ST ST 316 M8	N/A
A23		C12	6		JEOZXAF	201383	35	(WASHERS) (FLAT) METRIC ST ST 316 M8x16x1.2	N/A
A1	B1		7		JMNGAAR	201414	2	NEUT-CURE RTV SILICONE 310G	N/A
		C	8		108552		1	(JET) O RINGS SPECIAL TRANSOM PLATE	111183
		C	9		HYQHXBZ	201131	12	(BOLTS) (METRIC) ST ST 316 M8x35	N/A
	B		10		MRINAAI	201715	1	LOCTITE 262 10ML BOTTLE	N/A
	B		12		JDQHXAE	201310	14	(NUTS) (METRIC ST ST 316) M10	N/A
	B		13		JEQKXAE	201395	14	(WASHERS) (SPRING) METRIC ST ST 316 M10	N/A
	B		14		JEOZXAI	201384	14	(WASHERS) (FLAT) METRIC ST ST 316 M10x21x1.2	N/A
A1	B1	C1	15		63595	063595	3	(JET) PACKAGING BOLT BOX	N/A
		C	16		202404		1	GASKET - TRANSOM PLATE (STEEL HULL)	202404
A			17		202405		1	GASKET - INTAKE BLOCK (STEEL HULL)	202405
A			18		HZPPXDR	201201	23	(BOLTS) (M/C SCREWS) METRIC STST 316 M8x40 (CSK HD)	N/A
A23		C12	19		KHACXAF	201528	35	(BUSHES) NYLON FLANGED GS NYLATRON S48M	N/A



TRIPLE JET INSTALLATION

TRIPLE JETS DIM. X (MIN)		TWIN JETS DIM. Y (MIN)
520	0°	260
535	5°	275
545	10°	285
555	15°	295
555	20°	305
555	25°	310

TWIN JET INSTALLATION

C. W. F. Hamilton & Co. Ltd Christchurch, New Zealand

AMENDMENT
ITEM 7, RTV SILICON, ADDED TO KIT A

MATERIAL | Certified | Weight (kg) | √ = N9 EXCEPT AS STATED
Cast | UNLIMITED DIMENSIONS TO BE ±0.5 | Scale none
M/C | DESCRIPTION

INSTALLATION DETAILS
for STEEL HULL
for HJ241 JET.
Sheet 1 of 2.

	Name	Date
Standard		
Approvals		
Designed	R.J.L	17-10-03
Reviewed		

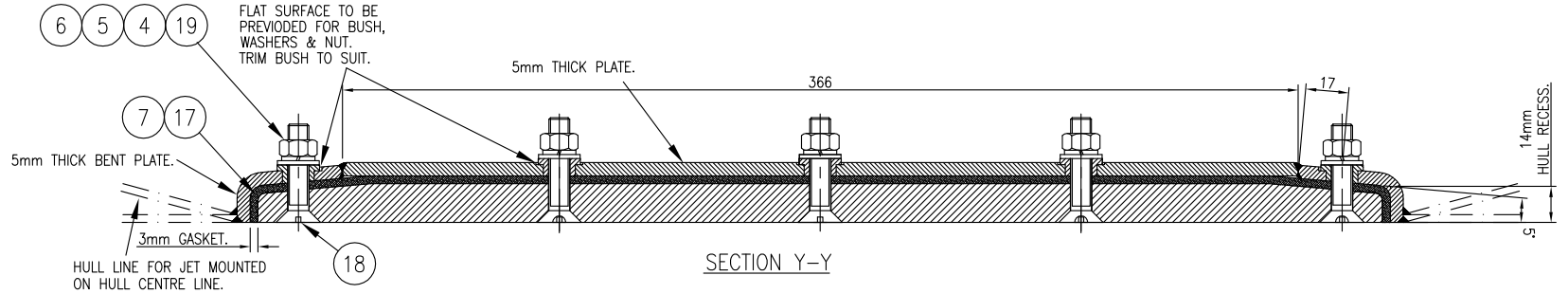
ECN CL316 | BY F.K. | DATE 15.03.04
JET 241

DWG No HJ241 08 003 B

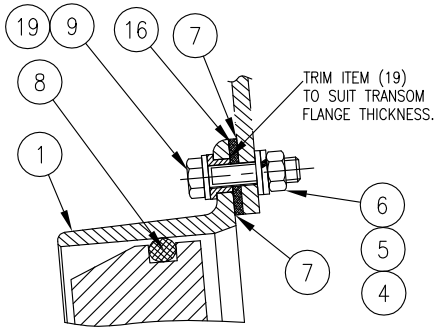
DWG No HJ241 08 003 B

HJ-241-08-003 Installation Details Steel Hull Sht2

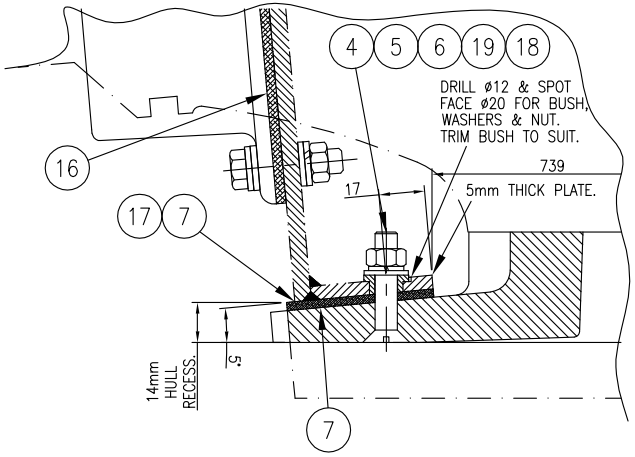
DO NOT SCALE THIS DRAWING | REMOVE ALL SHARP EDGES | ALL DIMENSIONS IN mm UNLESS OTHERWISE STATED | PROJECTION



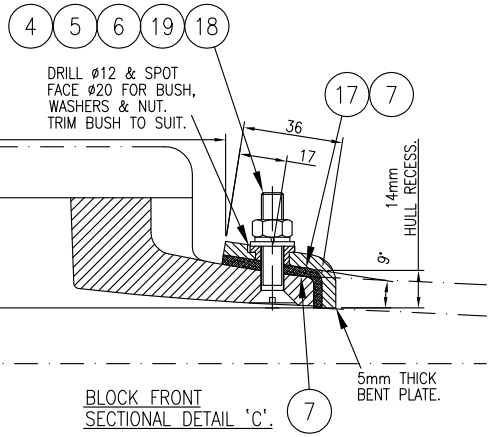
SECTION Y–Y



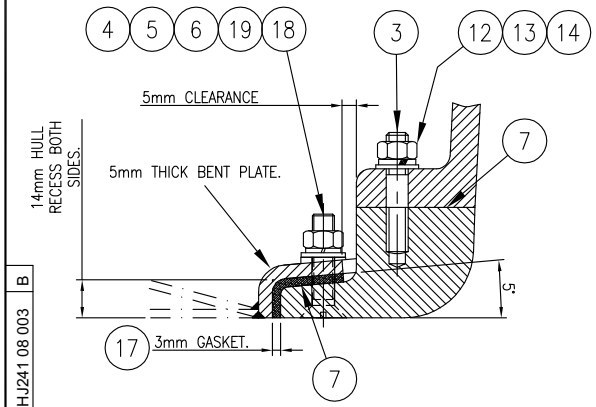
TRANSOM SEAL
SECTIONAL DETAIL 'D'.



BLOCK AFT.
SECTIONAL DETAIL 'B'.



BLOCK FRONT
SECTIONAL DETAIL 'C'.



SECTION X–X

LOCTITE APPLICATION:
REFER TO DRAWING No: 85144 FOR THR CORRECT APPLICATION INSTRUCTIONS FOR LOCTITE 262.
USE LOCTITE 262 ON ALL STUDS.

PAINTING NOTES!
1. STANDARD GLOSS FINISH: REFER TO DRAWING 85133 FOR PAINTING OF PARTS.
2. REFER TO DRAWING 85145 FOR FINISH OF INTAKE BLOCK.
3. REFER TO DRAWING 111178 FOR PAINT SPECIFICATION AND

DWG No HJ241 08 003 B

C. W. F. Hamilton & Co. Ltd Christchurch, New Zealand

AMENDMENT: REFER TO Sheet 1 of 2 FOR AMENDMENTSS.

ECN	CL	BY	R.J.L	DATE	
JET	241				

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 Ltd

MATERIAL | Certified | Weight (kg) | √ = N9 EXCEPT AS STATED
Cast | UNLIMITED DIMENSIONS TO BE ±0.5 | Scale none
M/C | DESCRIPTION

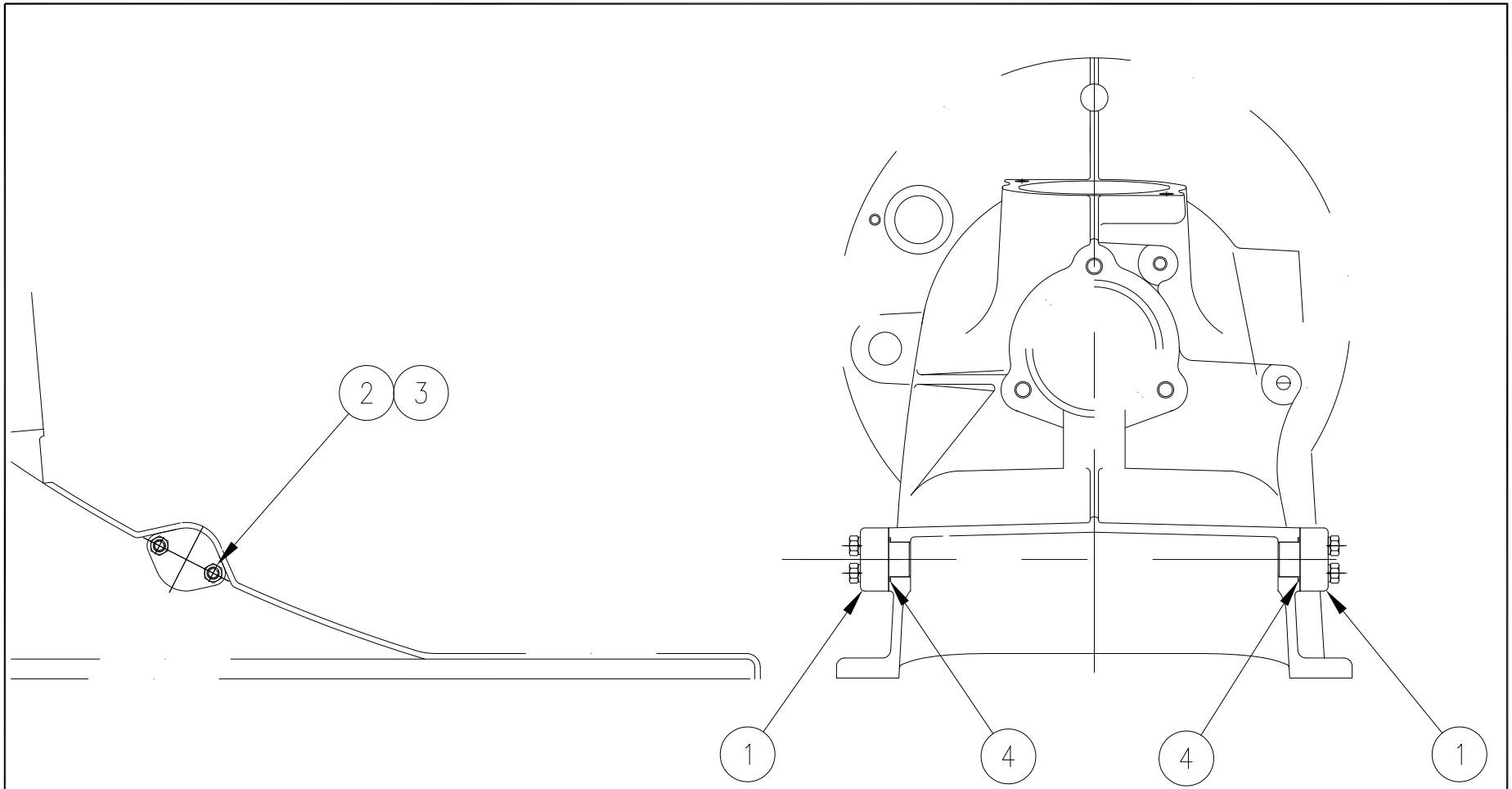
Standard | Approvals | Name | Date

INSTALLATION DETAILS for STEEL HULL for HJ241 JET. Sheet 2 of 2.

	Name	Date
Designed	R.J.L	17-10-03
Reviewed		

DWG No HJ241 08 003 B

HJ-241-09-001 Blanking Plugs (For Screen Rake)



SPARES ASSY	ITEM	PART No	QTY	DESCRIPTION	DWG No
4	1	110068	2	SCREEN RAKE BLANKING PLUG	110068
4	2	JDQHXAC	4	NUT M8 316 S.S.	
4	3	JEQKXAC	4	SPRING WASHER M8 316 S.S.	
4	4	HMHRAEJ	2	'O' RING 0.07" X 1.0" X 1.13" (022N70)	

REF	NO.	BY	DATE	AMENDMENTS
CL3795	B	P.S.	17/7/97	ITEM 1 WAS 105999
CL3791	A	P.S.	27/6/97	REDESIGNED
CL3731	0	P.S.	27/6/97	ISSUED FOR PRODUCTION.

JET 241

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

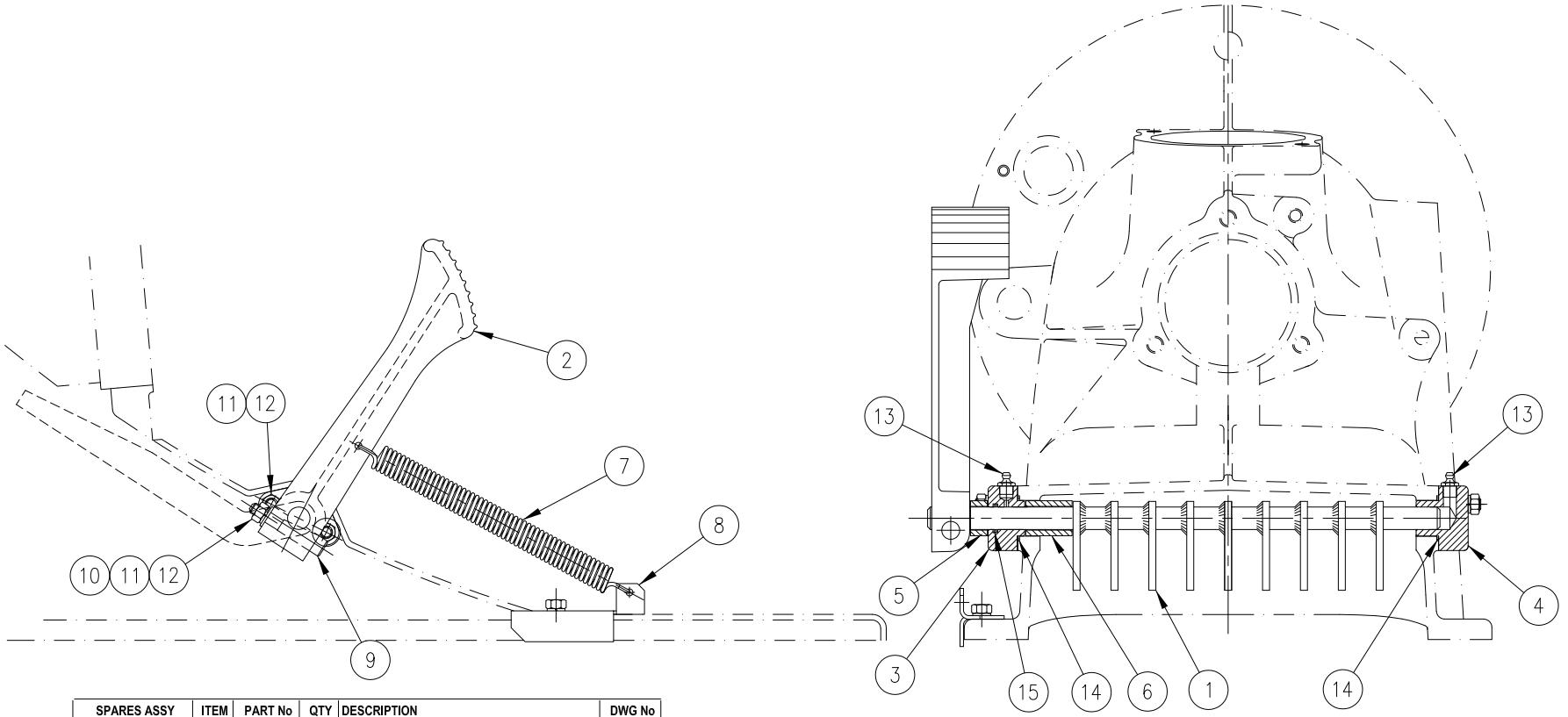
PROJECTION

DESIGNED P.A.S. DATE 27/6/97
DRAWN P.A.S. 27/6/97
CHECKED
APPROVED

NAME
BLANKING PLUGS
for SCREEN RAKE
HJ241

SCALE -
No: ASSY-HJ24109001
B

HJ-241-09-002 Screen Rake Assembly



SPARES ASSY	ITEM	PART No	QTY	DESCRIPTION	DWG No
4	1	110033	1	SCREEN RAKE	110033
4	2	110034	1	SCREEN RAKE ACTUATING ARM	110034
4	3	110035	1	STARBOARD BEARING	110035
4	4	110036	1	PORT BEARING	110036
4	5	110065	1	SPACER (EXTERNAL)	110065
4	6	110067	1	SPACER (INTERNAL)	110067
4	7	102364	1	SPRING	102364
4	8	105359	1	SPRING ANCHOR BRACKET	105359
4	9	105931	1	COTTER PIN	105931
4	10	103637	1	WASHER	103637
4	11	JDQHXAC	5	NUT M8 316 S.S.	
4	12	JEQKXAC	5	M8 SPRING WASHER 316 S.S.	
4	13	HEIDAAA	2	GREASE NIPPLE 1/8" BSP STRAIGHT	
4	14	HMHRAEJ	2	`O' RING 0.07" X 1.0" X 1.13" (022N70)	
4	15	HMHRAAJ	1	`O' RING 0.1" X 0.63" X 0.81" (114N70)	

CL3795	A	P.S.	27.06.97	REDESIGNED
CL3731	0	P.S.	20.10.95	ISSUED FOR PRODUCTION.
REF	NO.	BY	DATE	AMENDMENTS

JET 214

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

PROJECTION

DESIGNED P.A.S.	DATE 20.10.95
DRAWN P.A.S.	20.10.95
CHECKED K.V.E.	12.12.95
APPROVED K.V.A.	12.12.95

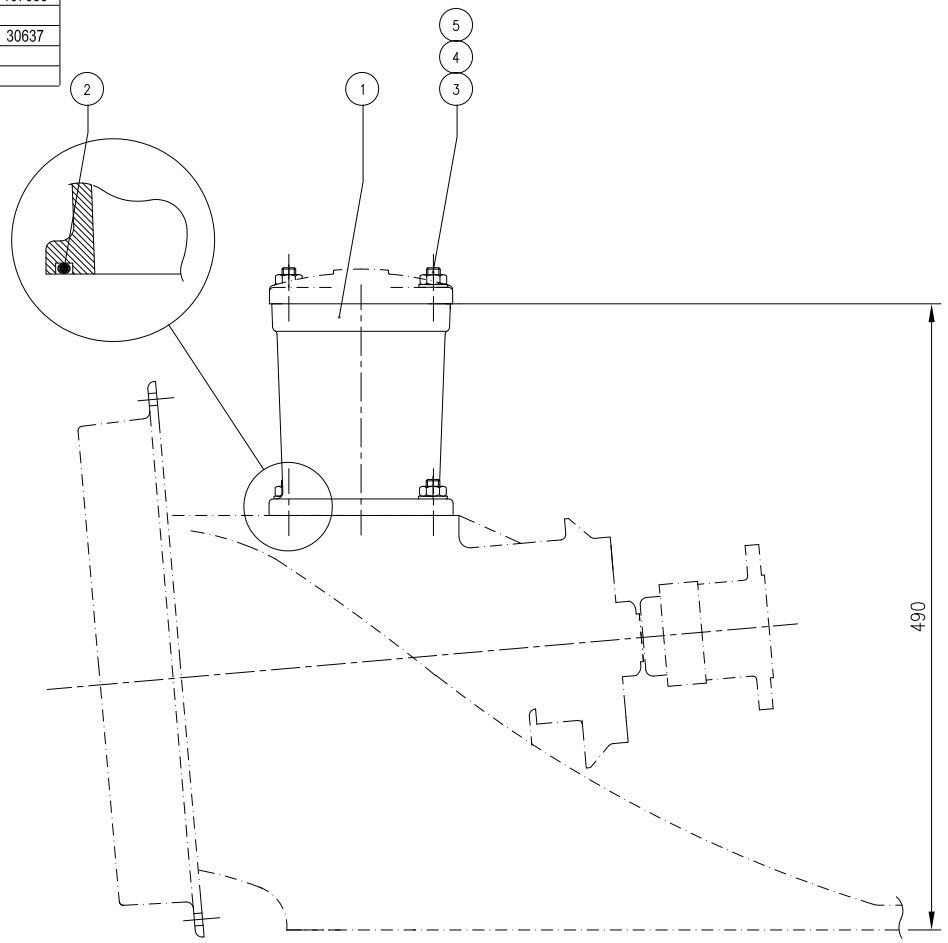
NAME
SCREEN RAKE ASSEMBLY
HJ241

SCALE -

No: ASSY-HJ24109002 A

HJ-241-10-004 Hatch Extension

SPARES ASSY	ITEM	PART No	QTY	DESCRIPTION	DWG No
4	1	107633	1	HATCH EXTENSION	107633
4	2	HMHRADF	1	O RING 3/16"x4-1/2"x4-7/8" (349N70)	
4	3	JCQHXAN	2	M10x40 STUD 316 STST	30637
4	4	JDQHXAE	2	M10 NUT 316 STST	
4	5	JEQKXAE	2	M10 SPRING WASHER	



CL3731	0	L.C.	12.12.95	ISSUED FOR PRODUCTION
REF	NO.	BY	DATE	AMENDMENTS
JET 241				

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

PROJECTION

DESIGNED K.V.A. DATE 10.95

DRAWN L COOPER 02.11.95

CHECKED K.V.A.

APPROVED K.V.E

NAME
HATCH EXTENSION
HJ 241 JET

SCALE –

No: ASSY–HJ241 10 004 0

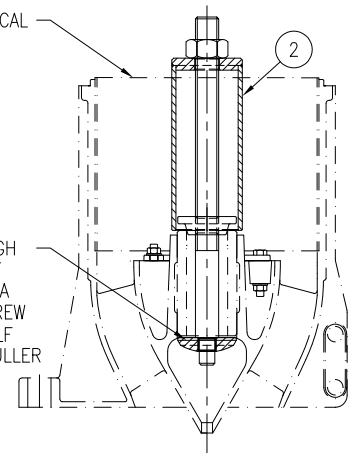
HJ-241-11-000 Tool Kit

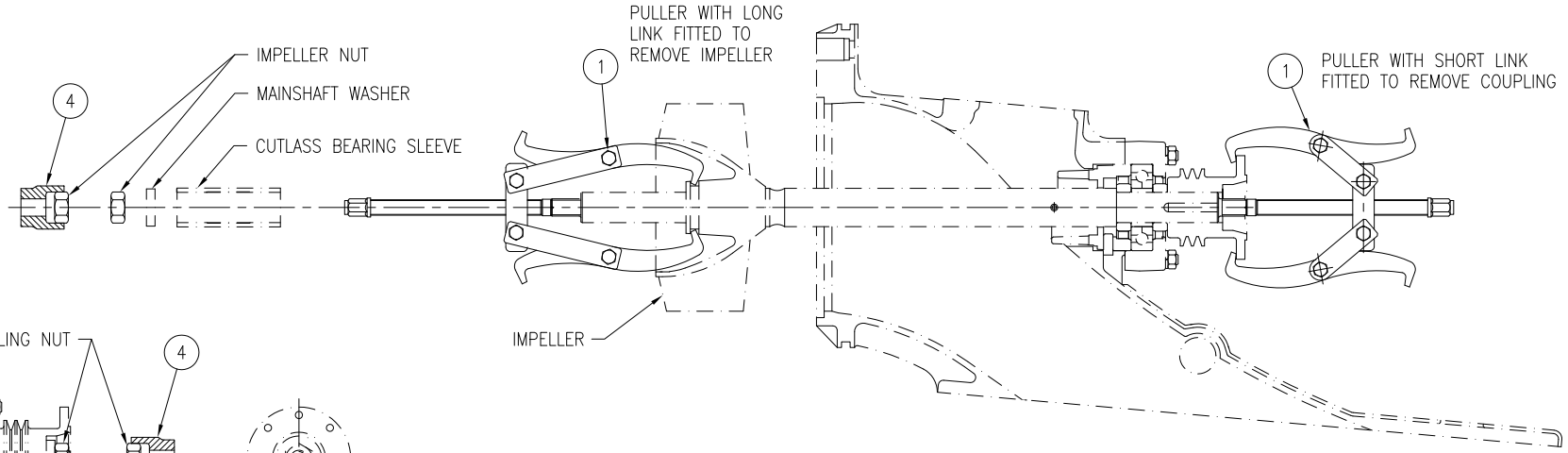
SPARES ASSY				ITEM	PART No	QTY	DESCRIPTION	DWG No
A			4	1	106212	1	PULLER - COUPLING & IMPELLER	106212
A			4	2	106215	1	PULLER - BEARING	106215
A			4	3	105797	1	REACTION ARM COUPLING	105797
A			4	4	SPCMBDA	1	SOCKET 30mm AF x 3/4 SQ DRIVE"	
A			4	5	HYIXXBF	2	BOLT M8 x 55 LONG ZINC PLATED	
A			4	6	JDPVYAC	2	NUT M8 ZINC PLATED	
A			4	7	HYIXXCC	2	BOLTS M10 x 55 LONG ZINC PLATED	
A			4	8	JDPVYAE	2	NUT M10 ZINC PLATED	
A				9	63594	1	CARTON	

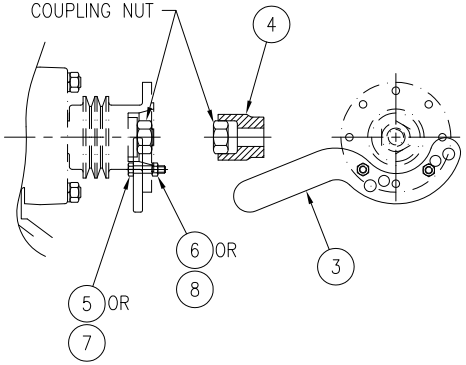
ITEM	PART No		DESCRIPTION	DWG No
A	106013		MAINTINANCE TOOLS KIT	THIS

1 PLACE TAILPIPE IN VERTICAL POSITION AS SHOWN

2 DROP HALF NUT THROUGH BEARING THEN ALIGN AT BOTTOM OF HOLE WITH A LONG SCREWDRIVER. SCREW PULLER SHAFT INTO HALF NUT THEN ASSEMBLE PULLER AS SHOWN. TIGHTEN TOP NUT TO REMOVE BEARING







CL3731	0	L.C	12.12.95	AMENDMENTS			
REF	NO.	BY	DATE				
JET 241							

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 K.V.A. 10.95

DRAWN L COOPER 30.10.95

CHECKED

APPROVED

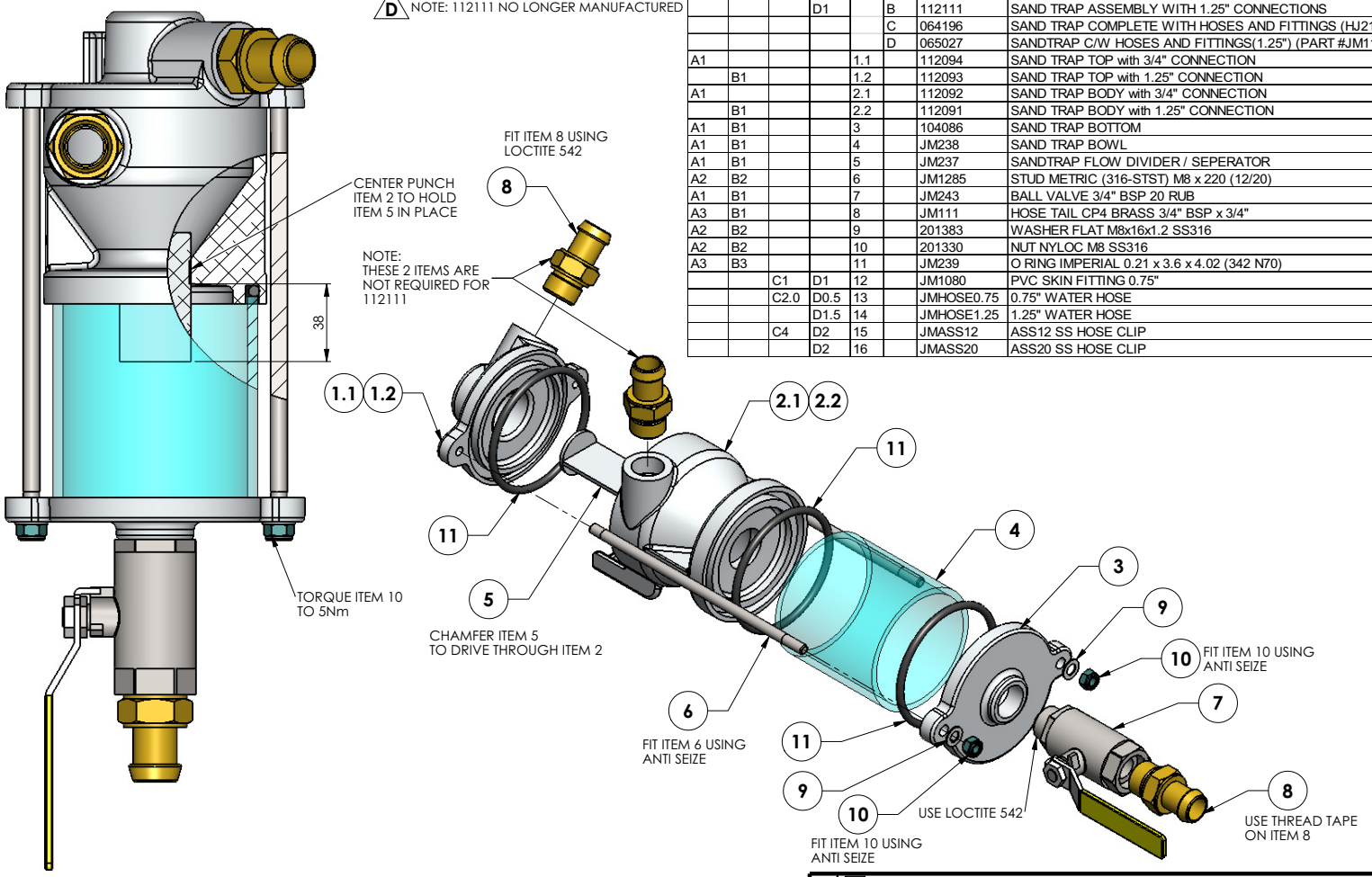
NAME TOOL KITS HJ241 JET

SCALE -

No. ASSY-HJ241 11 000 0

112110 Sandtrap Assembly Sht1

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

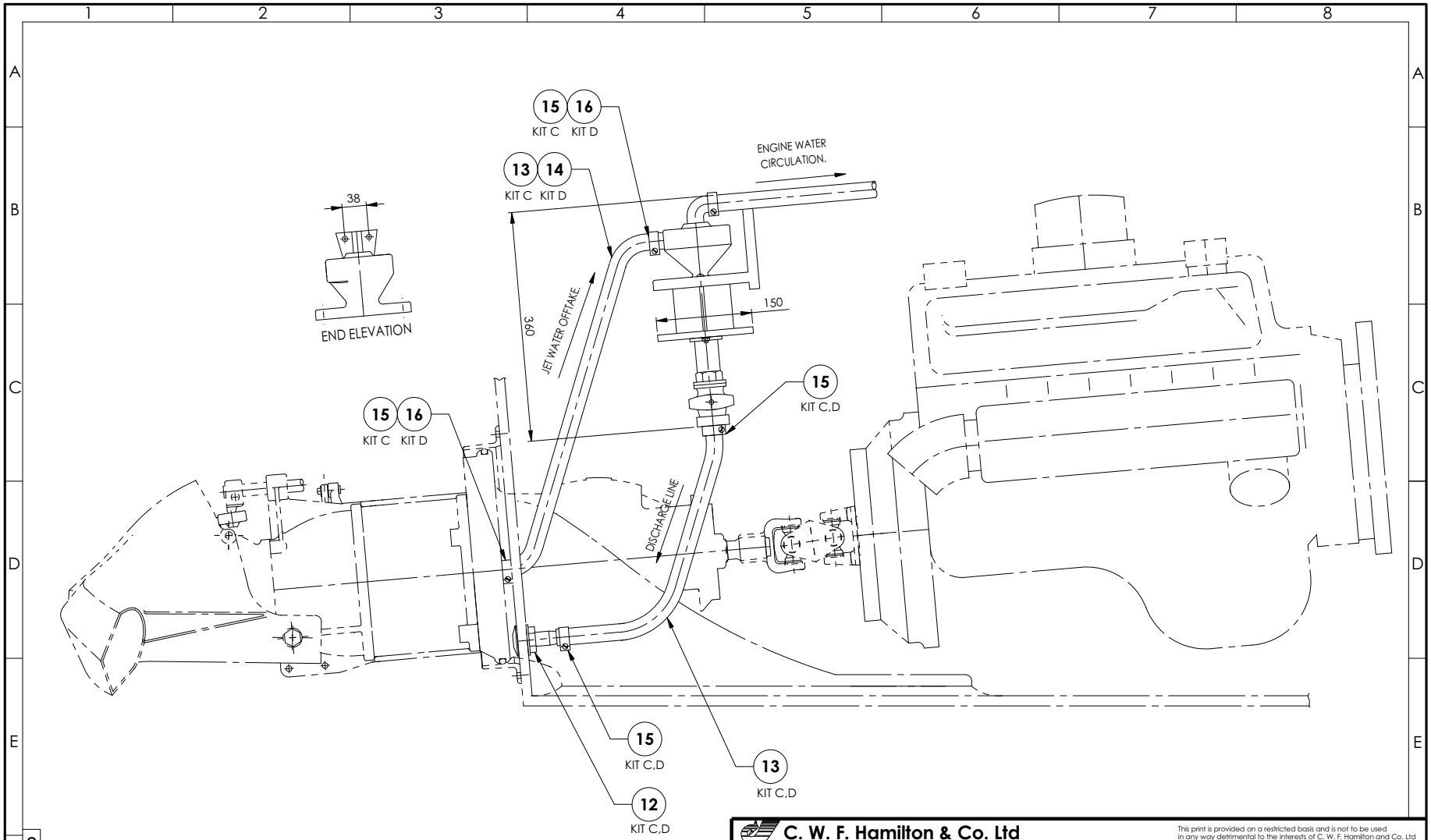
DRAWING INFORMATION

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 Sandtrap 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		

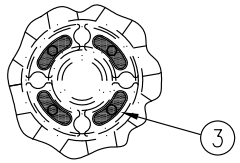
MANUFACTURING INFORMATION	
MATERIAL: N/A	
STANDARD:	
MAT. CERT REQ.: No	TRACEABILITY REQ.: No
WEIGHT: CAST [kg]:	MACHINED [kg]:
ALL DIMENSIONS IN [mm] UNLESS OTHERWISE SPECIFIED	
UNTOLERANCED DIMENSIONS & SURFACE FINISH	
GENERAL: +/- 0.5 HOLES Ø: +/- 0.2 ANGULAR: +/- 0.5°	
MACHINED SURFACE FINISH: Ra 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	

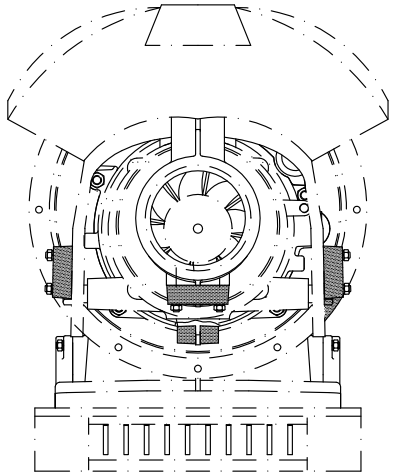
HJ-241-13-002 Anode Locations

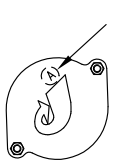
NOTES:

1. QUANTITIES OF FASTENERS SUPPLIED WITH ANODE KIT:
   FOR INTERNAL ANODES NYLOC FASTENERS ARE USED. A FULL SET OF NYLOC NUTS IS SUPPLIED AND SHOULD BE USED EACH TIME THE INTERNAL ANODES ARE CHANGED.
   FOR EXTERNAL ANODES STANDARD NUTS ARE USED. NO STANDARD NUTS ARE SUPPLIED FOR EXTERNAL ANODES ON THE BASIS THAT IF ANY ARE LOST THEN A REMOVED NYLOC MAY BE FITTED IN ITS PLACE. APPROXIMATELY 25% OF SPRING WASHERS ARE SUPPLIED TO REPLACE ANY THAT ARE LOST OR DAMAGED.
2. REFER TO PRODUCT BULLETIN PRB_10_2014 FOR MORE INFORMATION ON THE INTRODUCTION OF THE INTAKE HATCH ANODE

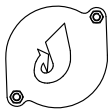


SECTION THROUGH TAILPIPE SHOWING ANODES

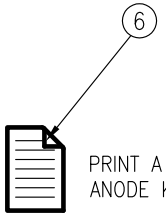




INSPECTION HATCH 212140
SUITS KIT A – WITH INTAKE HATCH ANODE



INSPECTION HATCH 102320
SUITS KIT B – WITHOUT INTAKE HATCH ANODE



PRINT A COPY OF THIS DRAWING AND SUPPLY IT WITH THE ANODE KIT

A	B	Item	Kit	Part Number	Product Description	Drawing
			A	212175	JET ANODE SPARES KIT FOR HJ213 AND HJ241 (WITH HATCH ANODE)	HJ24113002
			B	212361	JET ANODE SPARES KIT FOR HJ213 AND HJ241 (WITHOUT HATCH ANODE)	HJ24130002
A5	B5	1		103359	ANODE MK3 (ZINC)	103359
A1		2		102185	ANODE (ZINC)	102185
A4	B4	3		212260	ANODE (ZINC)	212260
A5	B4	4		201330	(NUTS) (METRIC NYLOC ST ST 316) M8	N/A
A4	B4	5		201394	(WASHERS) (SPRING) M8 SS316	N/A
		6	REF	N/A (PRINT)	PAPER COPY OF THIS DRAWING	N/A

HamiltonJet

CHANGE SUMMARY - REFER TO E.C.N. FOR DETAILS

REVISION: B ECN: 21954

NEW ITEM 2 ADDED TO BOM

DWG PICTORIALLY UPDATED TO SHOW NEW ITEM 3

ITEM 3 - 108582 REPLACED WITH 212260

DESIGN CHECK:	N.T	14.07.14	SIGN.
DRAWING REVISION:	J.S.R	14.07.14	SIGN.
DOCUMENT CHECK:	N.T	14.07.14	SIGN.
ORIGINAL DESIGN:	R.J.L	09.06.00	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

ANODE LOCATION FOR HJ241

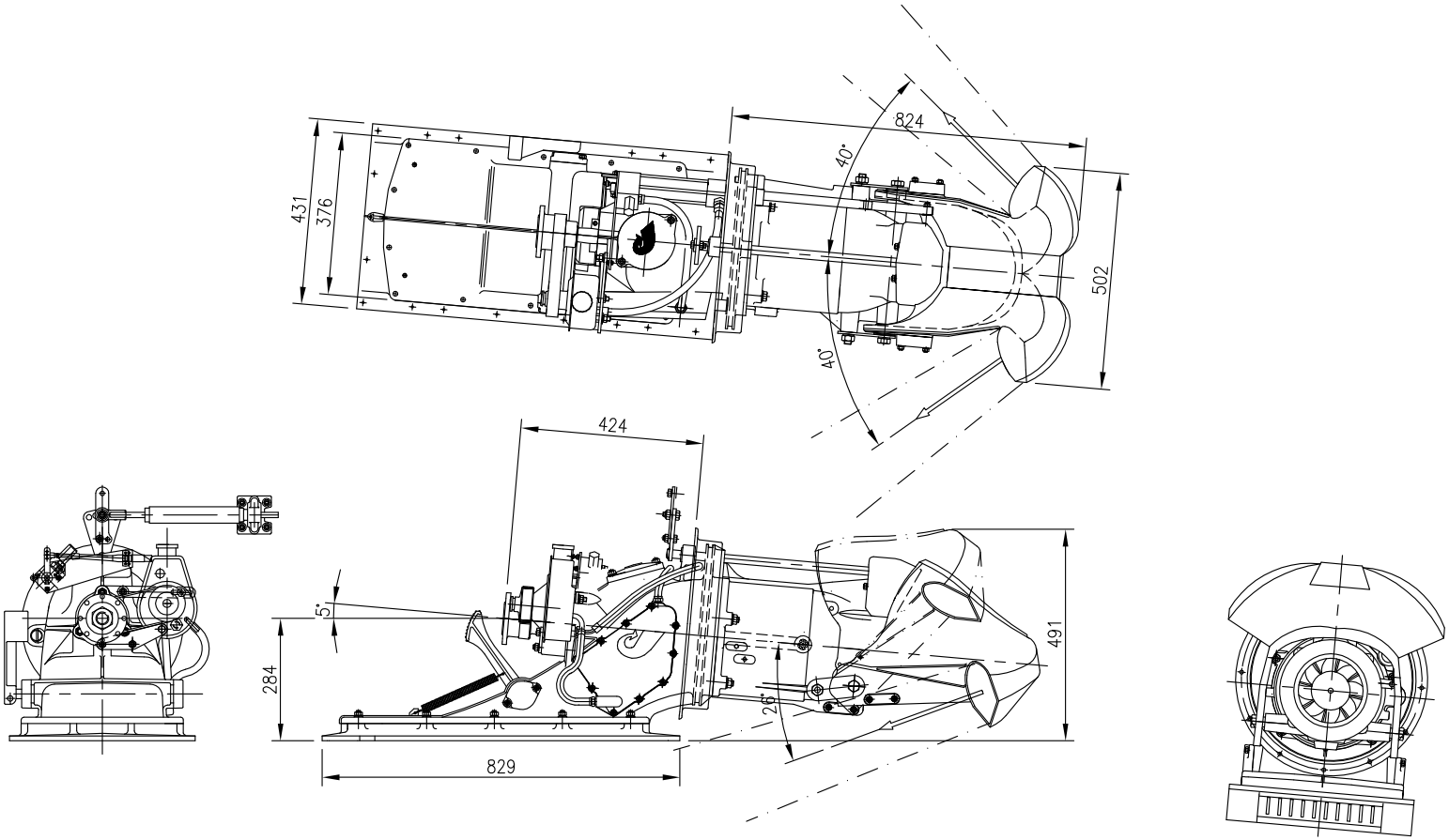
JET / CONTROL TYPE HJ241

DRAWN TO HAMJET 085195 PROJECTION:

SCALE: SHEET SIZE: A3 Sht 1 of 1

DWG No: HJ241 13 002 REV: B

HJ-241-30-001 General Arrangement



CL194	D	P.S.	16/07/01	NEW TILLER,REVERSE PIVOT & STEERING SHAFT BUSHES SHOWN	
CL149	C	P.M.W	28.07.00	VIEW ON COUPLING END ADDED. DIMENSIONS ADDED	
CL3819	B	P.S.	29.01.98	STEERING SHAFT LENGTH INCREASED BY 25mm	
CL3783	A	P.S.	16.04.97	PUMP RAISED	
CL3731	0	P.S.	12.12.95	ISSUED FOR PRODUCTION.	
REF	NO.	BY	DATE	AMENDMENTS	

JET 241

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

PROJECTION

DESIGNED	P.A.S.	DATE 01.12.95
DRAWN	P.A.S.	01.12.95
CHECKED	K.V.E.	12.12.95
APPROVED	K.V.A.	12.12.95

NAME
GENERAL ASSEMBLY
HJ241 JET

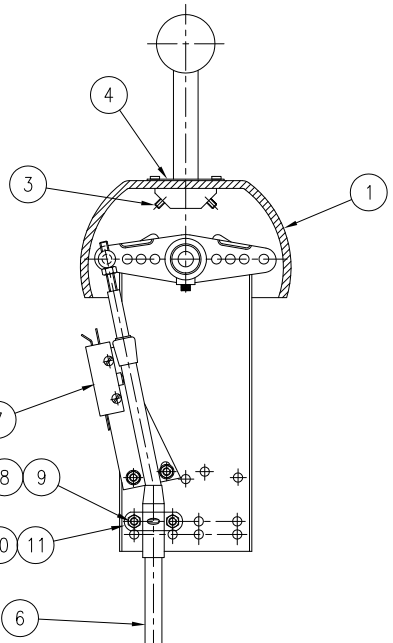
SCALE 1:10

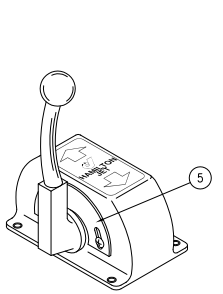
No: ASSY-HJ24130001 D

CT-CLV-01-003 Reverse Controller

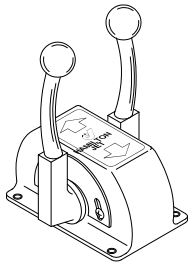
NEUTRAL DETENT AND ENGINE START INTERLOCK.

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.

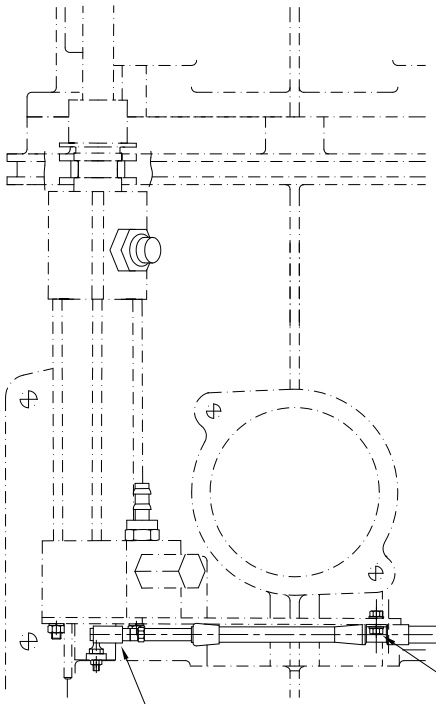




MODEL S



MODEL TWIN S



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.

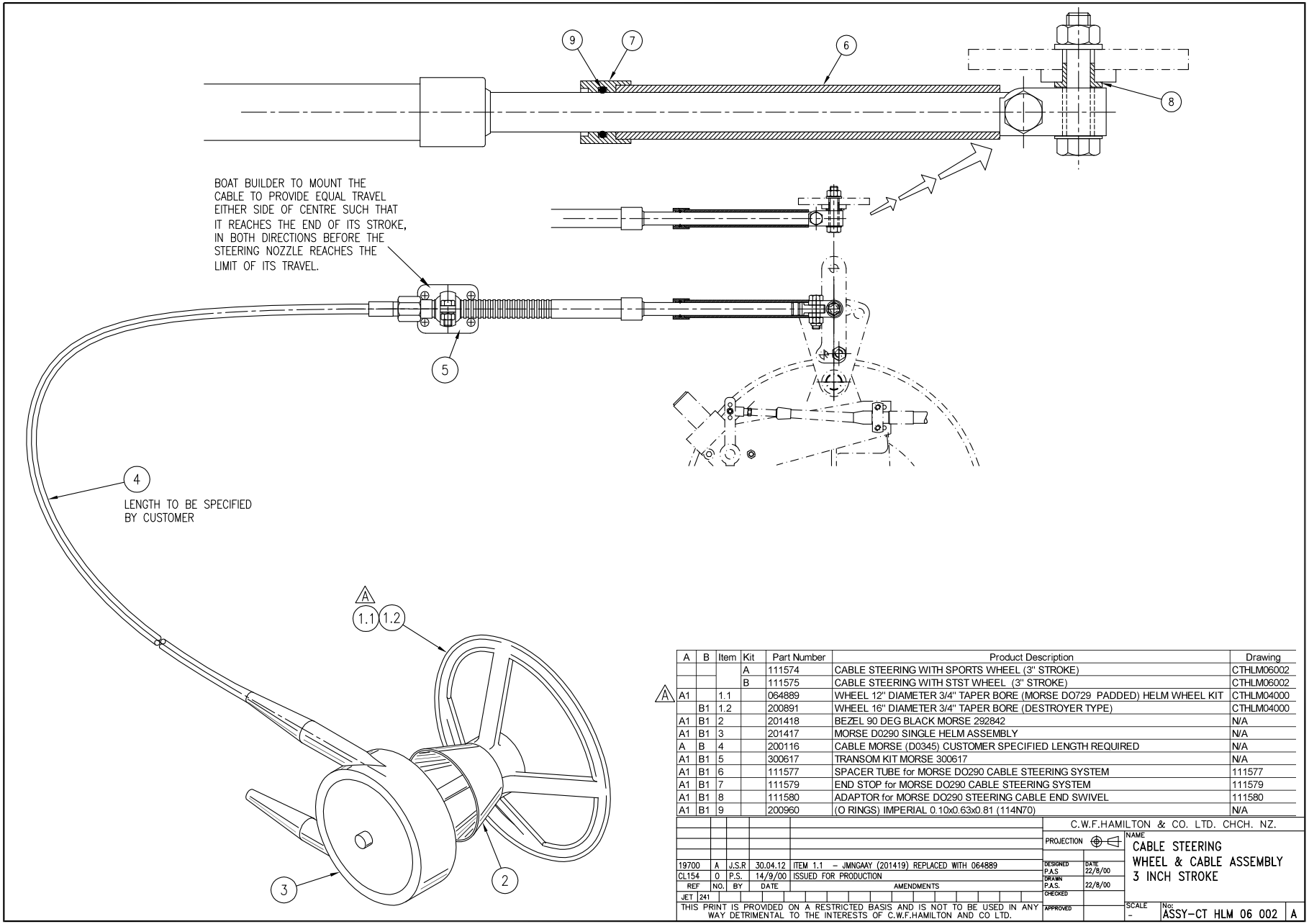
PROJECTION

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

CT-HLM-06-002 Helm Wheel Options



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 DO290 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

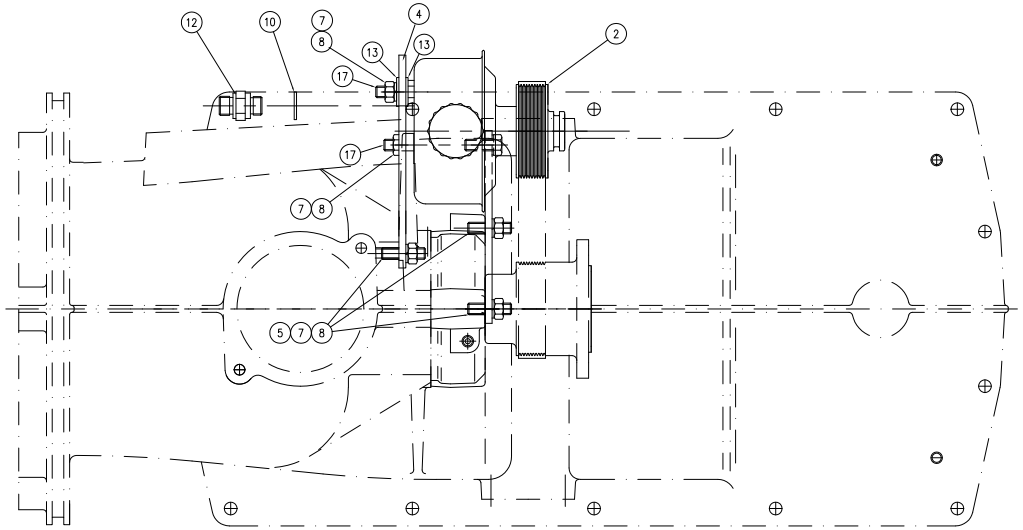
DESIGNED	P.A.S.	DATE 22/8/00
DRAWN	P.A.S.	22/8/00
CHECKED		
APPROVED		

NAME
CABLE STEERING
WHEEL & CABLE ASSEMBLY
3 INCH STROKE

SCALE –

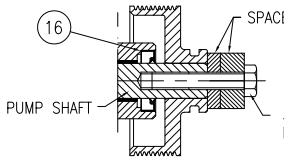
No: ASSY–CT HLM 06 002 A

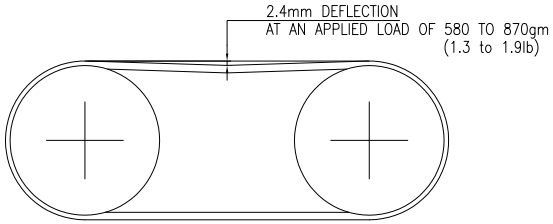
CT-HPU-01001 Hydraulic Power Unit



FITTING PULLEY TO PUMP SHAFT

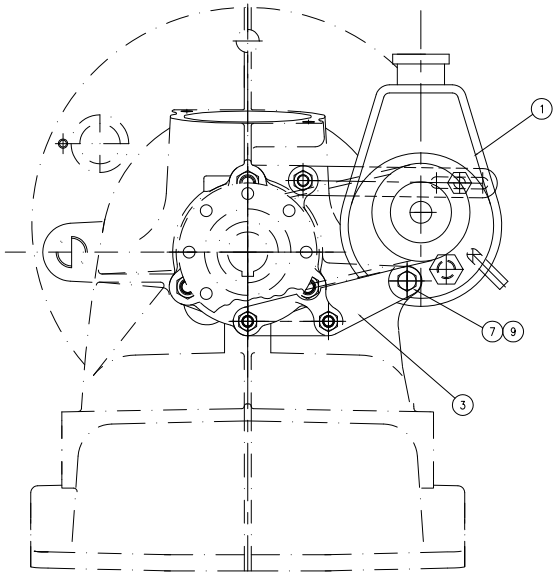
THE PULLEY IS AN INTERFERENCE FIT AND IS DRAWN ONTO THE PUMP SHAFT, IN 2 STAGES, WITH A HIGH TENSILE BOLT AND SUITABLE SPACERS UNTIL IT IS FLUSH WITH THE END OF THE SHAFT. SEE DETAIL BELOW.
REMOVE BOLT AND SPACERS AFTER INSTALLATION.





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	MovexAlias	ProductDescription	DrawingNbr
			A	CTHPU01001		JET HYDRAULIC POWER UNIT (SAGINAW) HSRX SYSTEM	CTHPU01001
			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		108618		SUPPORT BRACKET	108618
A1		4		108617		ADJUSTING LINK	108617
A3		5		JCQHXAN	201280	(STUDS) METRIC (316-STST) M10x40 (15/20)	30637
A6		7		JEQKXAE	201395	(WASHERS) (SPRING) METRIC ST ST 316 M10	N/A
A6		8		JDQHXAE	201310	(NUTS) (METRIC ST ST 316) M10	N/A
A1		9		HZQHXBN	201226	(SCREWS) (M/C SCREWS) METRIC ST ST 316 HEX HD M10x20	N/A
A1		10		64996	064996	BONDED SEAL M16 (400-870-4490-74)	N/A
A1		12		68001	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		DEXRON-III	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	K	P.M.W	28.05.07	SAGINAW PUMP CHANGED TO KIT 206264
CL322	J	I.G.G	03.05.04	ADDED ITEM 16 AS SPARE PARTS
CL159	H	P.M.W.	9.10.00	PAINT SPEC WAS 85020, PART No 111614 ADDED TO LIST
CL129	G	J.W.	28.02.00	ITEM 14 WAS Pt. No. AWS220IL
CL118	F	P.S.	23/11/99	ISEE THIS CL FOR PREV. AMENDMENTS. ITEM 6 WAS JEOZXAI.

JET 213 241

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

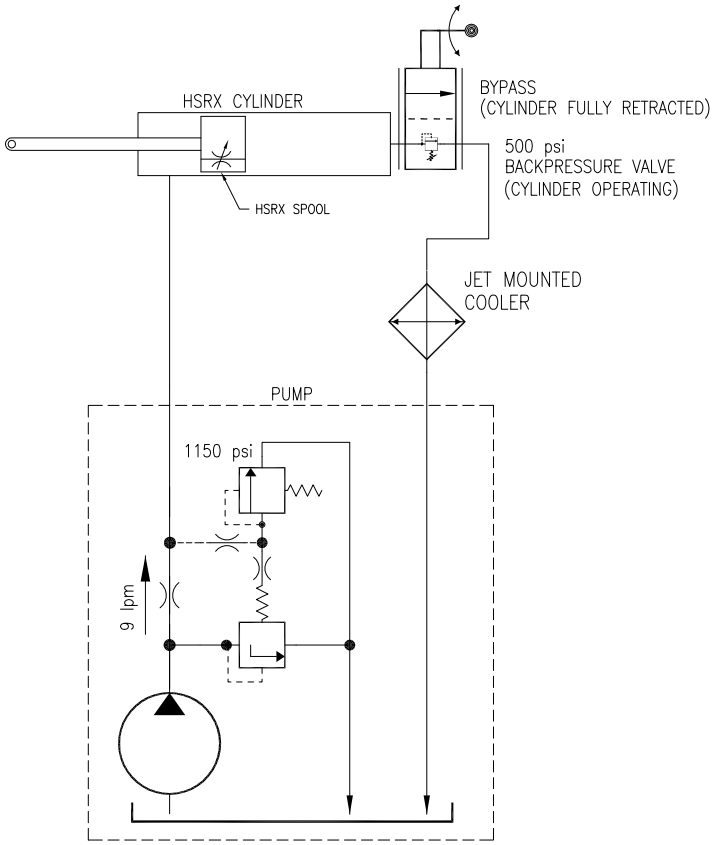
PROJECTION

DESIGNED P.A.S. DATE 25/10/95
DRAWN P.A.S. 25/10/95
CHECKED
APPROVED K.V.E 13/12/95

NAME
J.H.P.U.
H.S.R.X.
(SAGINAW PUMP)

SCALE -
No. ASSY-CTHPU01001 K

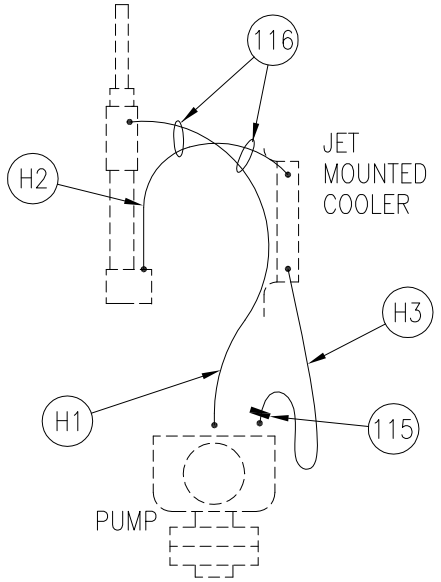
CT-HSE-12-001 Hose Kits



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

CT-HSE-12-001 Hose Kits

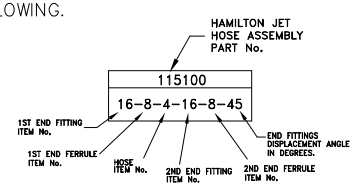
HAMILTON JET (HAM SPEC) HOSE KIT INSTRUCTIONS.

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.

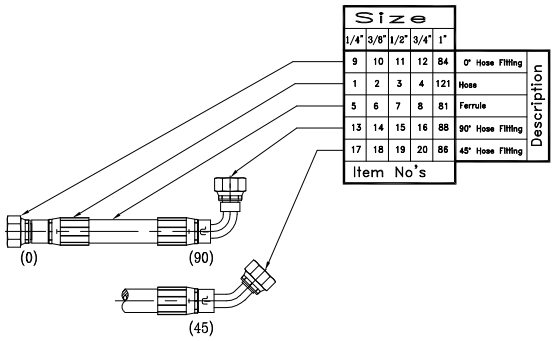
IN THE PARTS LIST ON THIS DRAWING, THE ITEMS REQUIRED TO BUILD EACH HOSE ASSEMBLY ARE LISTED IN EACH HOSE'S DESCRIPTION.

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.



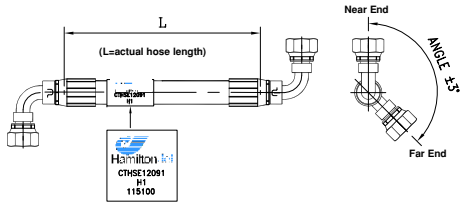
FOR GENERIC DESCRIPTIONS OF COMMON FITTINGS USE THE DIAGRAM BELOW. FOR COMPLETE DESCRIPTIONS OF ALL ITEM NUMBERS REFER TO DRAWING 115000 Sheets 1 & 2.



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.

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	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



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.

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

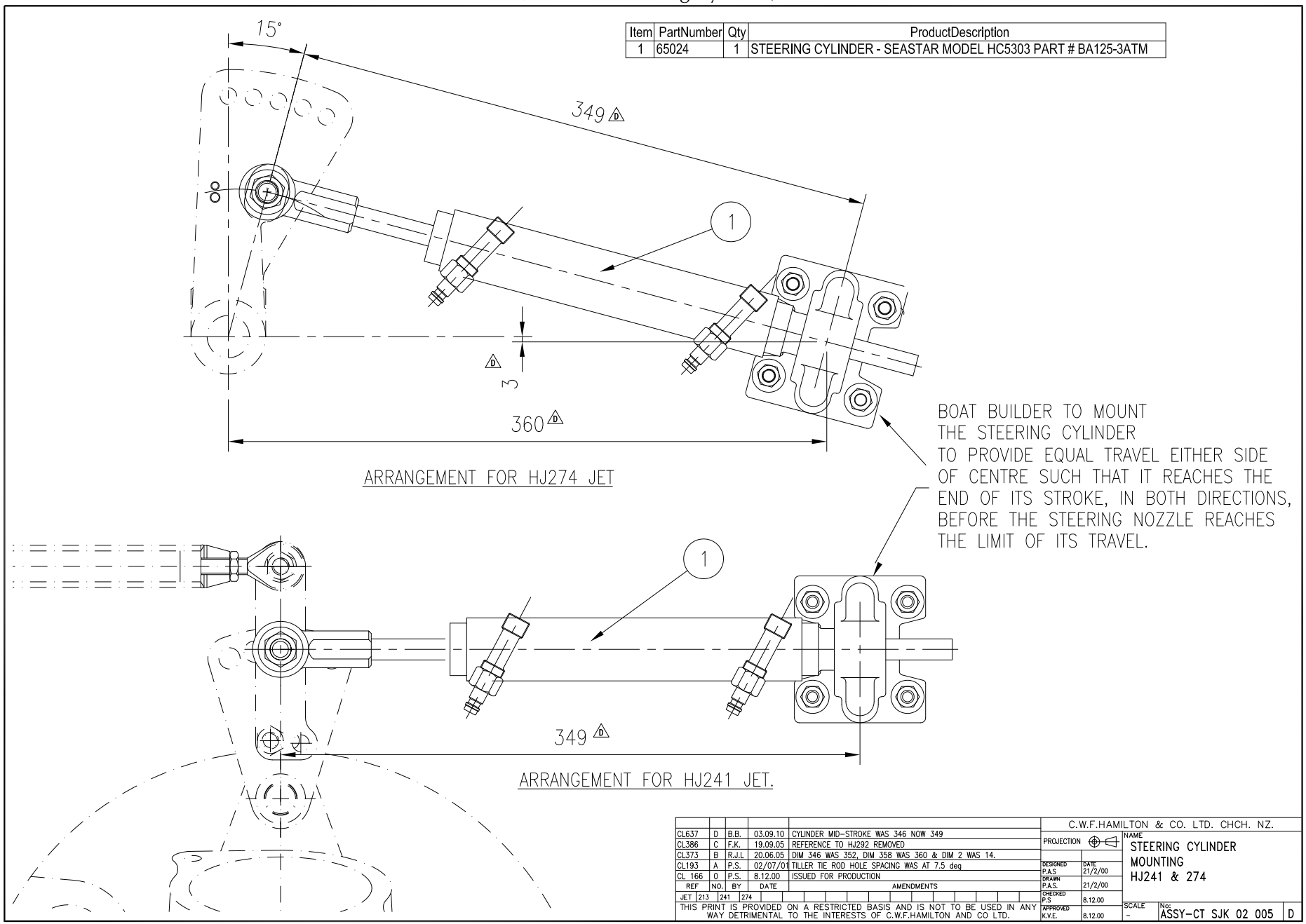
DESIGNED J.W. 08.10.02
DRAWN CMB 18.04.06
CHECKED
APPROVED

NAME
HOSE KITS
STAINLESS STEEL FITTINGS
HJ 213, 241 & 274
Sheet 2 of 2

SCALE -
No: ASSY-CT HSE 12 001
D

CT-SJK-02-005 Steering Cylinder, Seastar

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

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 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 -

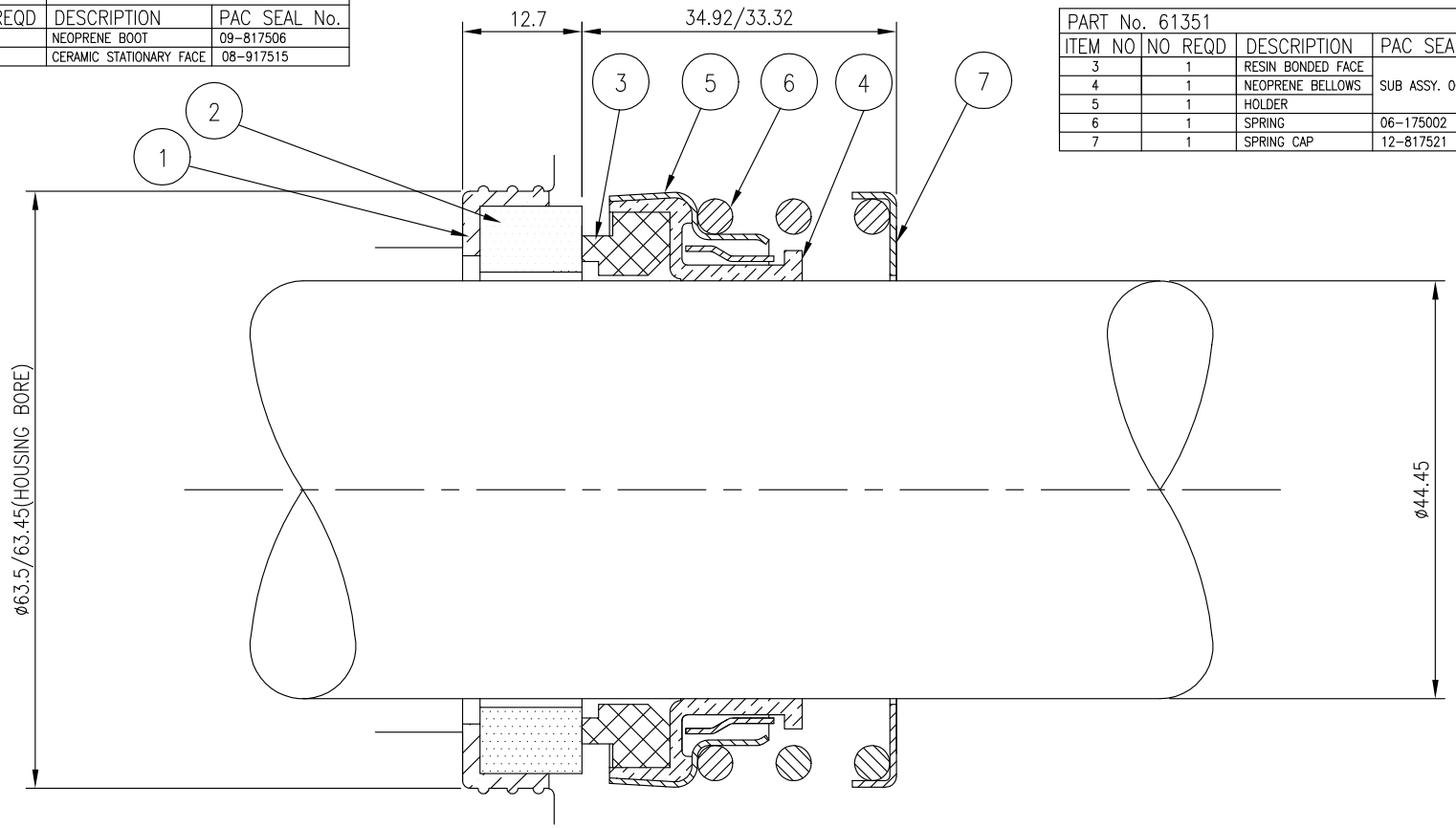
No: ASSY-CT SJK 02 005 D

61483 Rotary Seal

PROJECTION

PART No. 61484		PAC SEAL SUB ASSY. 08–1514	
ITEM NO	NO REQD	DESCRIPTION	PAC SEAL No.
1	1	NEOPRENE BOOT	09–817506
2	1	CERAMIC STATIONARY FACE	08–917515

PART No. 61351			
ITEM NO	NO REQD	DESCRIPTION	PAC SEAL No.
3	1	RESIN BONDED FACE	
4	1	NEOPRENE BELLOWS	SUB ASSY. 00–175001
5	1	HOLDER	
6	1	SPRING	06–175002
7	1	SPRING CAP	12–817521



REF	NO.	BY	DATE	AMENDMENTS
CL3727	0	P.S.	13/11/95	ISSUED FOR PRODUCTION
JET	211			

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

MATERIAL: PAC SEAL 21–175–06
MAT'L CERT:
DESIGNED: K.V.A. DATE: 10.07.95
DRAWN: P.A.S. 10/7/95
CHECKED:
APPROVED:

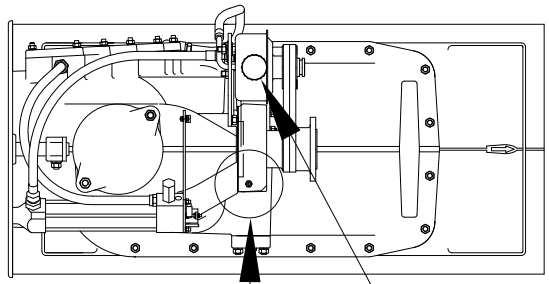
√ = N9 EXCEPT AS STATED
UNLIMITED DIMENSIONS TO BE ± 0.5

NAME: SHAFT WATER SEAL ASSEMBLY (1 3/4 INCH) HJ211

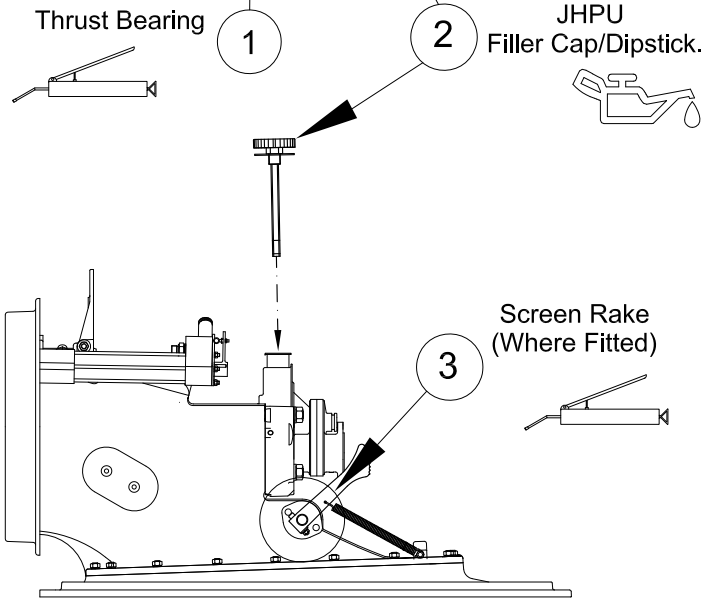
SCALE 2:1 | No: A3– 61483 | 0

61483 | 0

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

CL463	A	SK	23.04.07	ISSUED FOR INFORMATION
REF	NO.	BY	DATE	AMENDMENTS

JET 274 241 213

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

PROJECTION

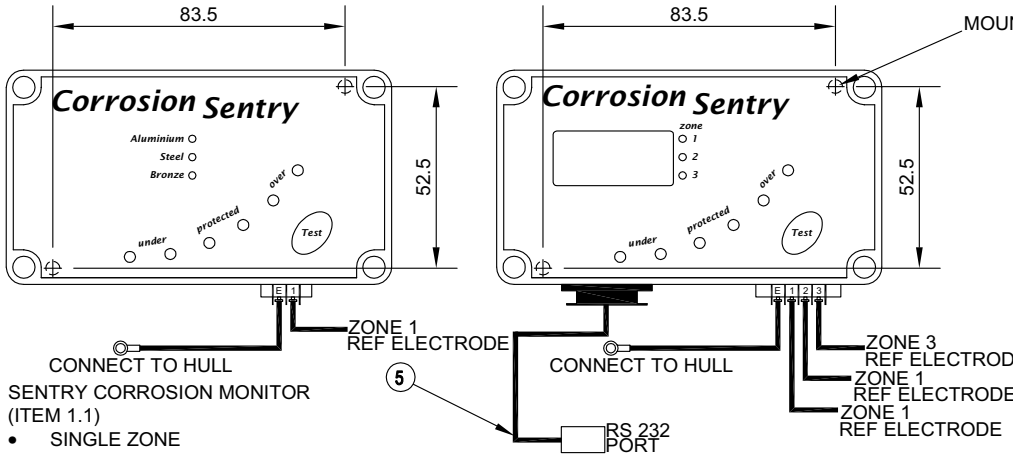
DESIGNED SK	DATE 23.10.06
DRAWN SK	23.10.06
CHECKED N.T.	13.04.07
APPROVED	

NAME

REGULAR LUBRICATION CHART for HJ274, 241 & 213 JETS.

SCALE NTS | No: ASSY-205754 | A

HM00013001 anode Condition Monitor



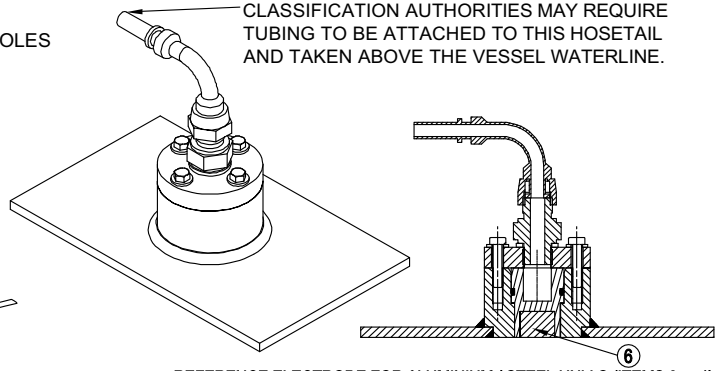
SENTRY CORROSION MONITOR
(ITEM 1.1)

- SINGLE ZONE

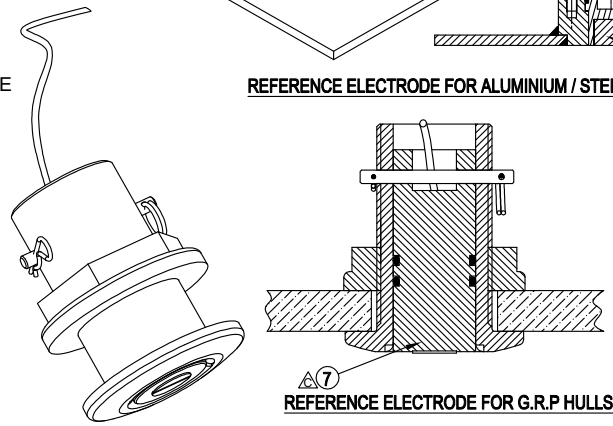
NOTE: PORT NOT ISOLATED FROM HULL. PERMANENT CONNECTIONS TO THIS PORT SHOULD USE AN RS232 ISOLATOR

SENTRY CORROSION LOGGER
(ITEM 1.2)

- UP TO 3 ZONES
- DATA IS LOGGED AND CAN BE TRANSFERRED TO A COMPUTER

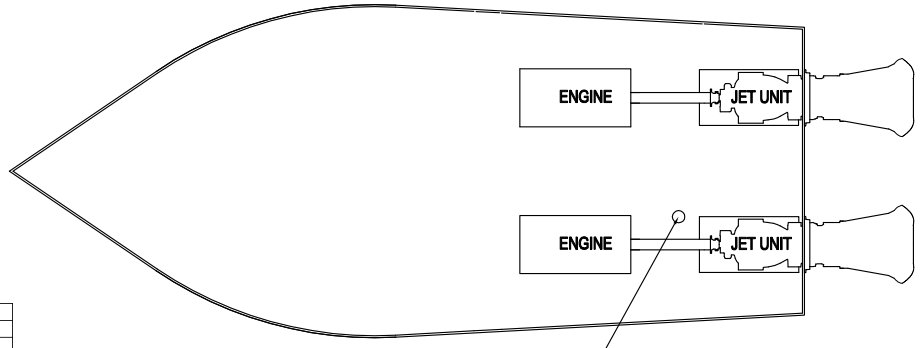


REFERENCE ELECTRODE FOR ALUMINIUM / STEEL HULLS (ITEMS 3 or 4)



REFERENCE ELECTRODE FOR G.R.P HULLS (ITEM 2)

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.



TYPICAL LOCATION OF REFERENCE ELECTRODE-
REFERENCE ELECTRODE LOCATION

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

JET

C.W.F.HAMILTON & CO. LTD. CHCH. NZ.

PROJECTION

NAME: ANODE CONDITION MONITOR

DESIGNED | DATE

DRAWN N.T. 12.05.10

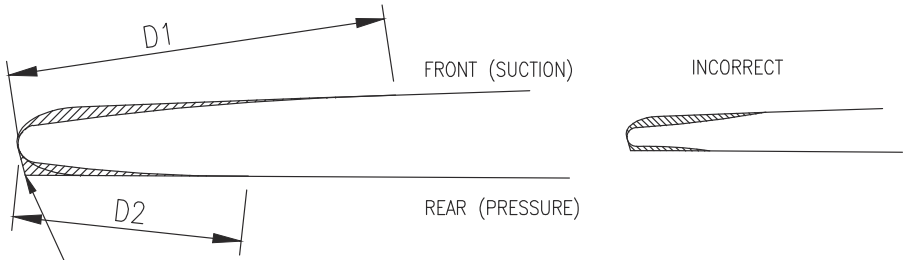
CHECKED

APPROVED

SCALE -

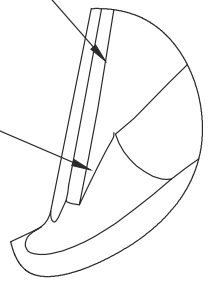
No: ASSY-HM000 13 001 C

FACTORY IMPELLER LEADING EDGE DRESSING



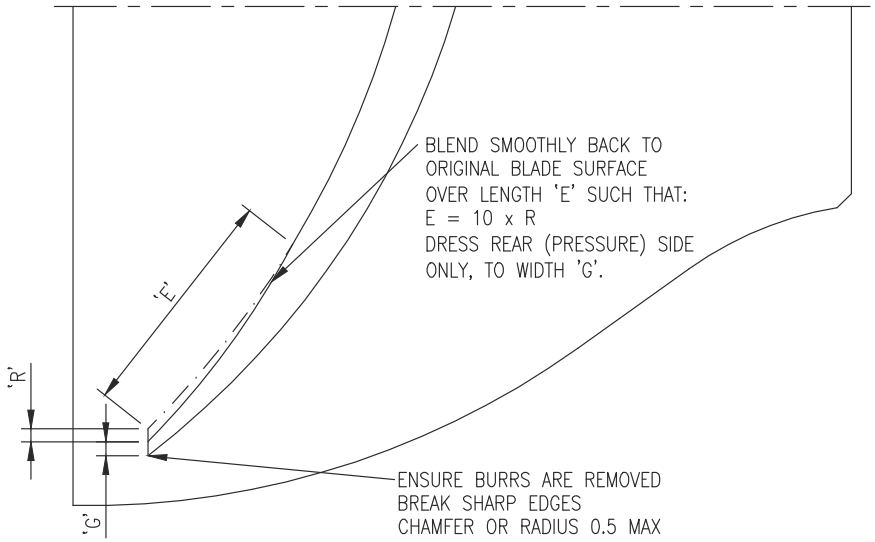
DRESS THE SQUARE EDGE OF THE IMPELLER BLADE LEADING EDGE BACK, AND SHARPEN BLADE AS SHOWN, TO RADIUS GIVEN BELOW IN TABLE 1.

AT THE BLADE–HUB INTERFACE, BLEND THE LE RADIUS INTO THE BLADE–HUB RADIUS.



IMPELLER TRAILING EDGE DRESSING

NOTE: ONLY REQUIRED FOR TRIMMED IMPELLERS



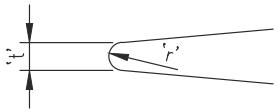
T.E. WIDTH 'G' mm	JET MODELS
2	212 213
2.5	241
3	274 292 322 362 364
4	391 403
4	FIRST TRIM IMPELLERS IF 'G' LESS THAN 5

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

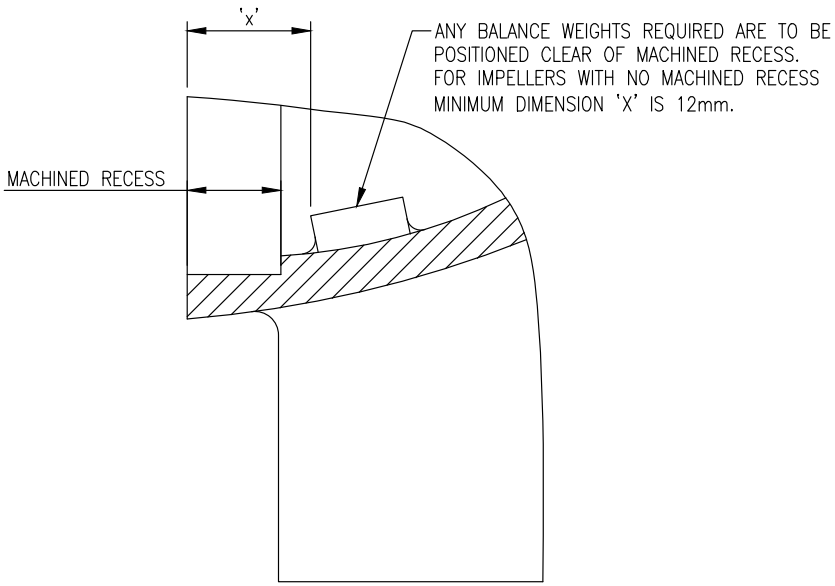
DWG No: 082206 REV: L

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.

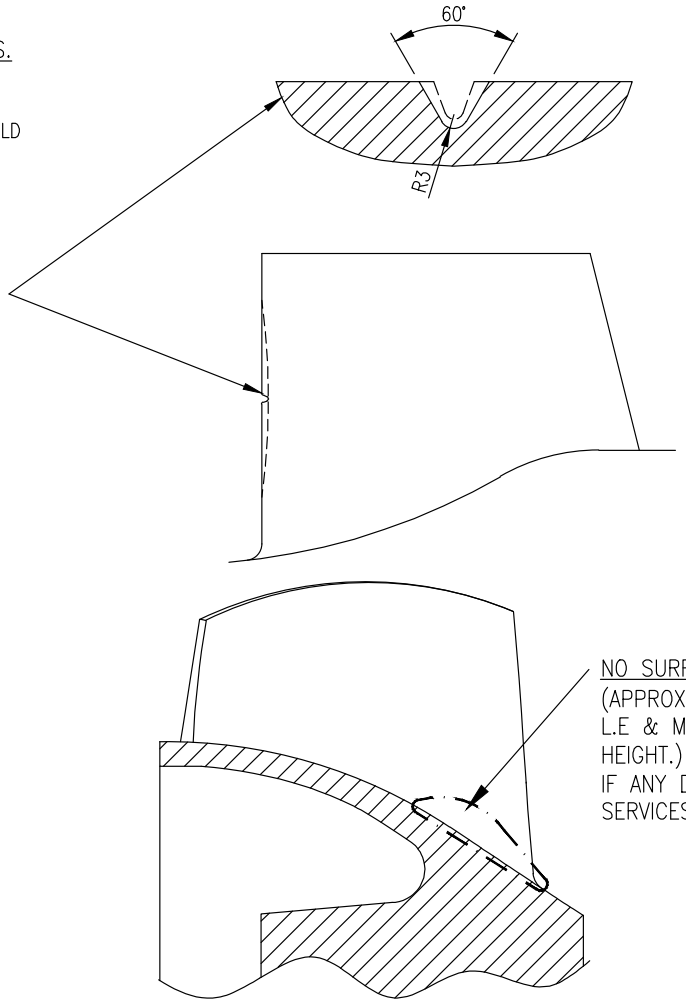
(D) THE SURFACE ROUGHNESS IS TO BE Ra 3.2um (N8) OR BETTER AFTER FETTLING.

(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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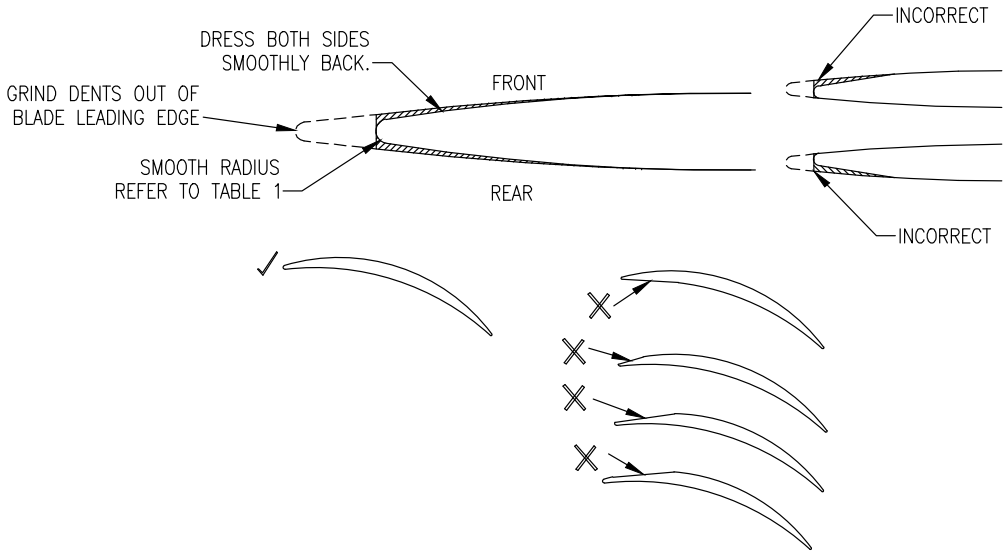
CHANGE SUMMARY - REFER TO E.C.N. FOR DETAILS	MANUFACTURING INFORMATION	DRAWING INFORMATION
REVISION: ECN: REFER TO SHEET 1 FOR AMENDMENTS	MATERIAL: STANDARD: MAT CERT REQ: TRACEABILITY REQ: FINISHED WEIGHT:	HJ IMPELLER BLADE DRESSING INSTRUCTIONS AND BALANCING INFORMATION
DESIGN CHECK: SIGN.	ALL DIMENSIONS 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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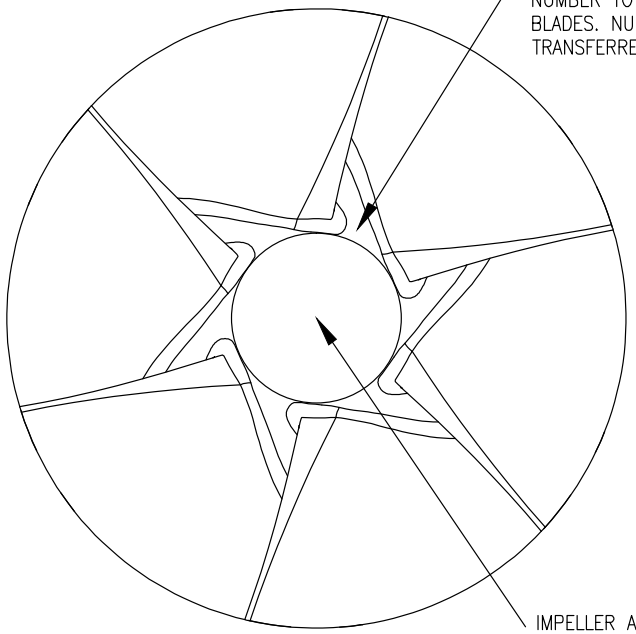
CHANGE SUMMARY - REFER TO E.C.N. FOR DETAILS	MANUFACTURING INFORMATION	DRAWING INFORMATION
REVISION: ECN: **REFER TO SHEET 1 FOR AMENDMENTS**	MATERIAL: STANDARD: MAT CERT REQ: TRACEABILITY REQ: FINISHED WEIGHT:	**HJ IMPELLER BLADE DRESSING INSTRUCTIONS AND BALANCING INFORMATION**
DESIGN CHECK: SIGN.	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

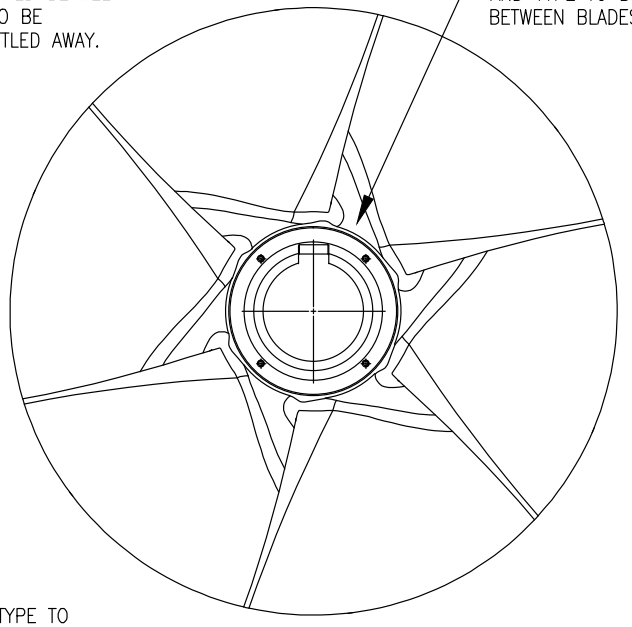
IDENTIFICATION PROCESS ⚠L



IMPELLER SERIAL (CAST IDENTIFICATION) NUMBER TO BE LOCATED BETWEEN BLADES. NUMBERS TO BE TRANSFERRED IF FETTLED AWAY.

IMPELLER AS CAST TYPE TO BE LOCATED ON NOSE AFTER RISER HAS BEEN CUT OFF.

AFTER CASTING



IMPELLER PART NUMBER AND TYPE TO BE LOCATED BETWEEN BLADES.

AFTER MACHINING

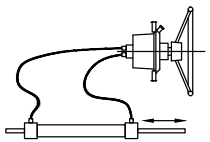
HamiltonJet

CHANGE SUMMARY - REFER TO E.C.N. FOR DETAILS	MANUFACTURING INFORMATION	DRAWING INFORMATION
REVISION: ECN:	MATERIAL:	HJ IMPELLER BLADE DRESSING INSTRUCTIONS AND BALANCING INFORMATION
REFER TO SHEET 1 FOR AMENDMENTS	STANDARD:	
	MAT CERT REQ: TRACEABILITY REQ:	
	FINISHED WEIGHT:	
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	SCALE: SHEET SIZE: A3 Sht 5 of 5
ORIGINAL DESIGN: SIGN.	GENERAL: ±0.5 HOLES: Ø0.2 ANGULAR: ± 0.5°	DWG No: 082206 REV: L
	MACHINED SURFACE FINISH: Ra 6.3 µm	

85018 Recommendations for Lubricants and Oils Sht1

HYDRAULIC FLUIDS	JET	VOLUME (L)

JASTRAM MANUAL HYDRAULIC STEERING



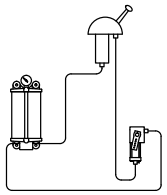
FLUID
ISO VG32 HYDRAULIC OIL

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



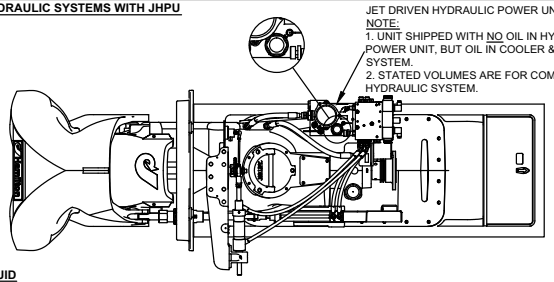
FLUID
50/50 MIXTURE BY VOLUME OF DISTILLED WATER AND ETHYLENE-GLYCOL (ANTI-FREEZE).
ETHYLENE-GLYCOL SHOULD BE AS PURE AS POSSIBLE (NO ADDITIVES).

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.

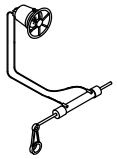
EXAMPLES

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



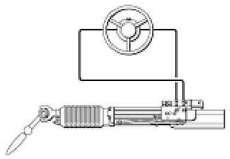
FLUID
FLUIDS MEETING MIL H5606C SPECIFICATIONS

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
FLUIDS MEETING MIL H5606C SPECIFICATIONS

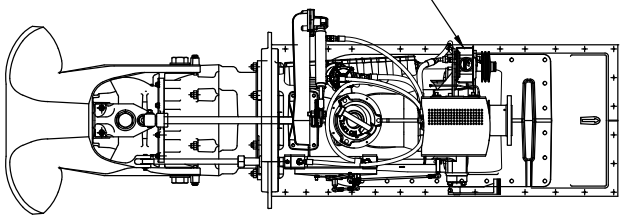
EXAMPLES

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)
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

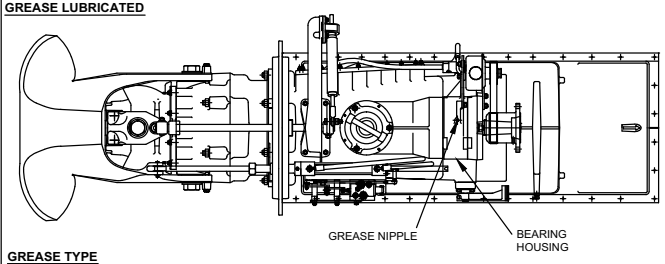
MANUFACTURING INFORMATION	
MATERIAL:	
STANDARD:	
MAT CERT REQ:	TRACEABILITY REQ:
FINISHED WEIGHT:	
ALL DIMENSIONS IN [mm] UNLESS OTHERWISE SPECIFIED	
REMOVE ALL SHARP EDGES AND BURRS	
UNTOLERANCED DIMENSIONS & SURFACE FINISH	
GENERAL: HOLES: ANGULAR:	
MACHINED SURFACE FINISH:	

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	JET	VOLUME (L)

GREASE LUBRICATED



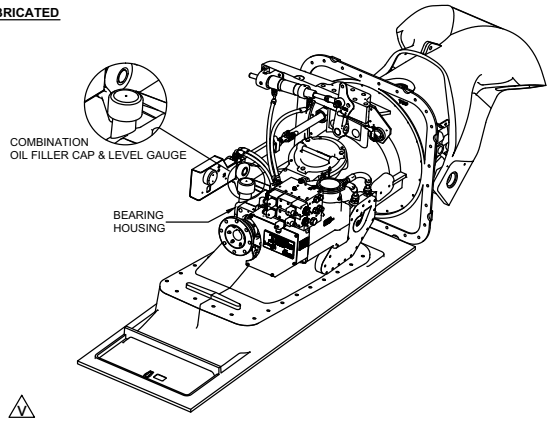
JET	VOLUME (L)
HJ212	REFER TO JET MANUAL
HJ213	
HJ241	
HJ274	
HJ292	
HJ322	

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

OIL LUBRICATED



	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

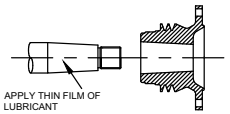
FLUID
MINERAL OR SYNTHETIC BASED HYDRAULIC OIL TO ISO 11158 OR DIN 51524-2/ DIN 51524-3. STRAIGHT MINERAL OILS WITH EP ADDITIVES ARE RECOMMENDED FOR ROLLING BEARING LUBRICATION. RECOMMENDED MINIMUM OIL VISCOSITY INDEX IS 95. THE OPERATING VISCOSITY FOR HAMILTON JET SYSTEMS IS WITHIN THE VISCOSITY RANGE 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).

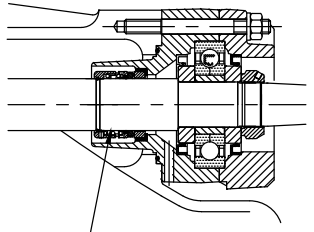
JOINT LUBRICATION

TAPERS (IMPELLERS & COUPLINGS)



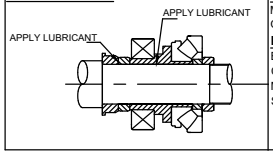
GREASE
MULTIPURPOSE LITHIUM BASE.
OR CALCIUM SULPHATE BASED.
EXAMPLES
BP: ENERGREASE MP-MG2
CASTROL: MOLUB-ALLOY 6040/150
MOBIL: MOBILUX EP 2
SHELL: GADUS S2 V100

FITTING OF ROTARY SEAL



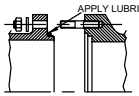
USE ONLY P-80® TEMPORARY RUBBER ASSEMBLY LUBRICANT (P/N 902021). OR
DETERGENT: WATER (20:1)
DO NOT LUBRICATE SEAL FACES
DO NOT USE GREASE OR OIL

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

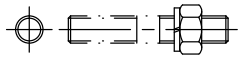
O-RINGS (NITRILE RUBBER ONLY)



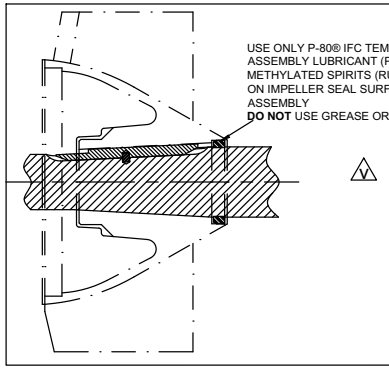
NOTE: DO NOT GREASE BARRIER CORD O-RINGS

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

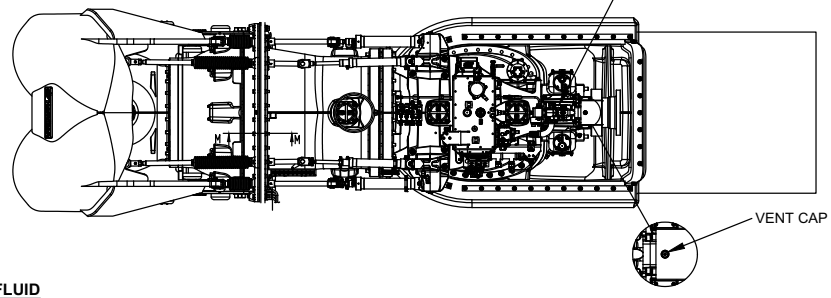
GREASE
MULTIPURPOSE LITHIUM BASE.
OR CALCIUM SULPHATE BASED.
EXAMPLES
BP: ENERGREASE MP-MG2
CASTROL: MOLUB-ALLOY 6040/150
MOBIL: MOBILUX EP 2
SHELL: GADUS S2 V100

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	REFER TO JET MANUAL FOR INSTRUCTIONS ON ACHIEVING CORRECT OIL LEVEL
HT1000	

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:	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.

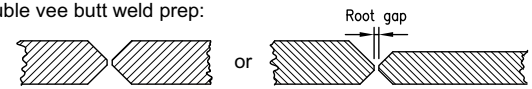
8. Weld Position

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.

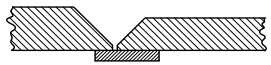
9. Weld Prep

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			A4-70
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	Ø A4-70 2 x Ø MIN IN AL.
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	STEEL, STAINLESS STEEL, BRONZE, or WATERSEALS
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	ALUMINIUM
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	KMT NUT KMTA NUT
M10	35	26	

T

85113

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

MAT'L CERT

DESIGNED R.J.L. DATE

DRAWN R.J.L. 16.08.99

CHECKED

APPROVED

√ = N9 EXCEPT AS STATED

UNLIMITED DIMENSIONS TO BE ± N/A

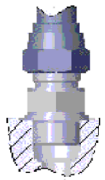
NAME THREADED FASTENER TIGHTENING TORQUES Sheet 1 of 2.

SCALE N/A No: A3-85113 T

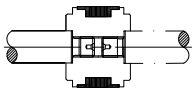
85113 Threaded Fastener Tightening Torques Sht2

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

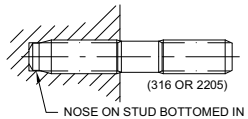
DO NOT USE ANTISEIZES CONTAINING COPPER,NICKEL,GRAPHITE OR METAL FLAKE

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

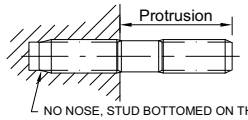
SIZE	N.m	lbs.ft
M12	18	13
M16	30	22
M20	48	35
M24	180	130
M30	370	270

ROLL FORMED STUDS WITH NOSE



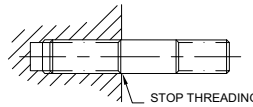
Thread stud into casting until thread bottoms. Confirm protrusion is equal to stud length minus thread length as per stud description

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

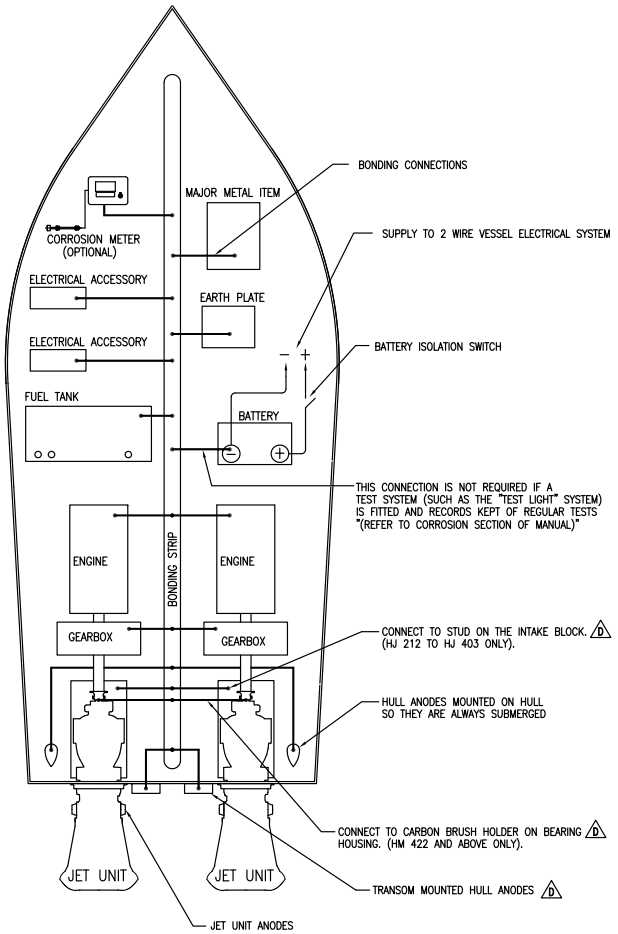
T 85113

85114 Earth Bonding system

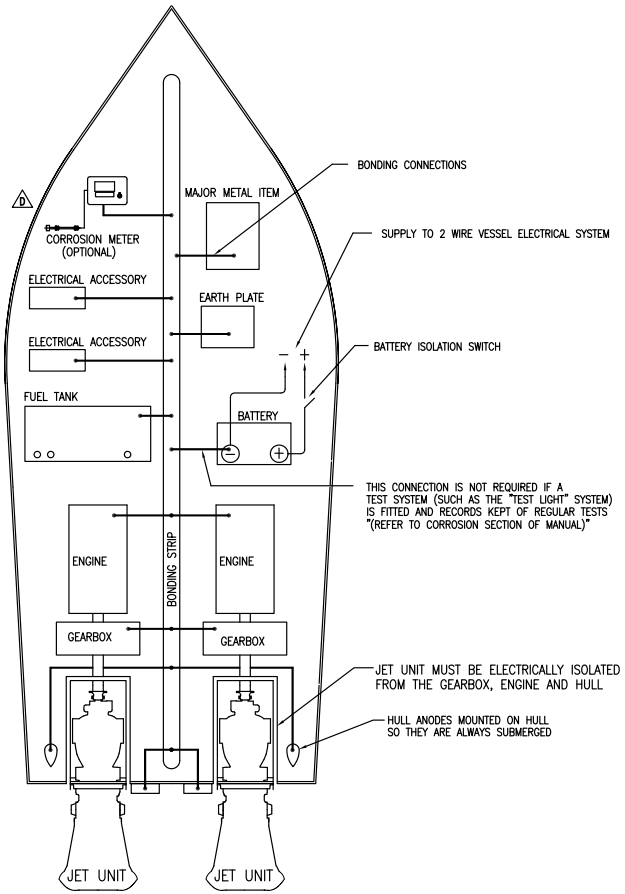
DO NOT SCALE THIS DRAWING.

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 ±

MAT'L 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.

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