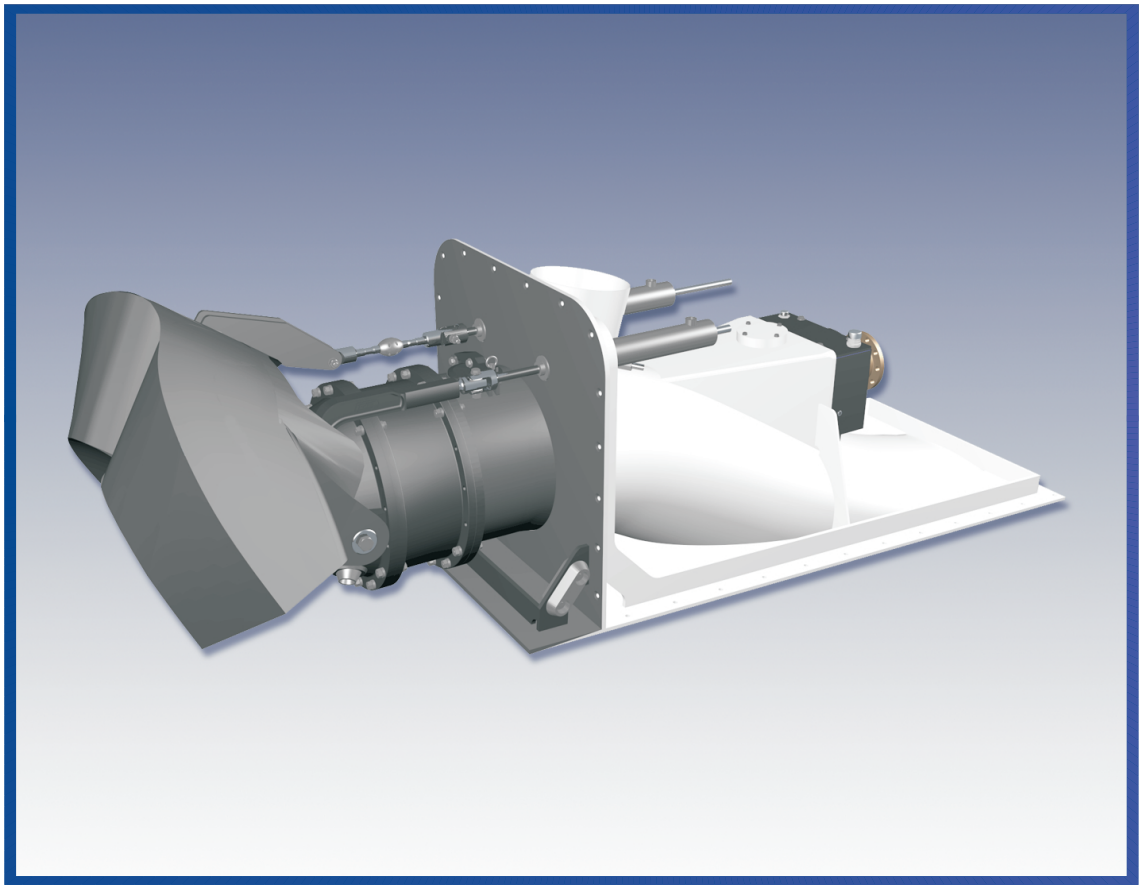
Rolls-Royce

Instruction manual
Kamewa waterjets



Kamewa FF550

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Preface

Thank you for choosing us as the supplier of the water jet unit for your boat.

It is the responsibility of the operator to ensure that the water jet unit is handled and cared for in a safe and correct manner. Therefore you should read the instruction manual thoroughly so that you learn how to operate the controls and other equipment safely before casting off for the first time. In particular pay special attention to the safety information.

To obtain trouble-free operation with low wear the water jet unit must be maintained and stored in accordance with these instructions. To avoid personal injury and damage to the equipment, follow the instruction manual when operating, servicing and maintaining the water jet unit.

Rolls-Royce accepts no responsibility for any damage that occurs as a consequence of work carried out by non-authorized personnel.

Please feel free to contact Rolls-Royce if you have any queries regarding this equipment.

We wish you success with the new water jet unit.

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About the instruction manual

In the instruction manual you will find safety information, a general introduction of the water jet unit, the basic theory for maneuvering a boat with a water jet unit, the main maintenance instructions, technical data and a spare parts catalogue. Finally there is also a glossary containing the most common terms.

You will find enclosed drawings and documents in section “DRAWINGS”.

Always have the instruction manual close to hand. Store it in a safe place and do not forget to hand it over to the new owner if you sell your boat.

1. Safety instructions

1.1 General

Read this chapter very carefully. It concerns your personal safety. This chapter describes how the safety information in the manual is presented. There is also an overview of basic boating safety for boating and care of the water jet unit.

⚠ *Warning!*

If these instructions are not followed, there is a risk of personal injury, serious damage to the product or property or major operating faults.

⚠ *Caution!*

Draws attention to factors that may cause damage to the product or property, or operational faults.

NOTE!

Draws attention to important information that facilitates maintenance or operation.

1.2 Driving the boat

The new boat

⚠ *Caution!*

Carefully read the instruction manual and other information supplied with the boat. Learn how to safely handle and operate the engine, controls and other equipment.

If this is your first boat or you are inexperienced with this type of boat, we recommend that you practice manoeuvring the boat in a quiet and calm area. Make sure you learn the handling characteristics of the boat at different speeds, water and load conditions before casting off on your first "real" trip.

Remember that according to the law, anyone in charge of a boat is required to know and follow all traffic and safety rules and regulations at sea. Check which regulations apply to you and the waters in which you will be sailing by contacting the relevant authorities or marine safety organisation.

It is a good idea to take a mate's course. We recommend that you contact a regional boating or marine safety organisation for information about suitable courses.

Accidents and near misses

⚠ *Caution!*

Statistical evidence clearly demonstrates that insufficient maintenance of boats and engines, and a lack of safety equipment are the major cause of accidents and near misses on the water.

Ensure that your boat, engine and water jet unit are maintained according to the instructions in the relevant instruction manual and that all essential safety equipment is on board and functional.

Safety switch

⚠ *Caution!*

We recommend that you install and use a safety switch, especially if your boat is capable of high speed. The safety switch stops the engine if the pilot falls and/or loses control of the boat.

Daily check

⚠ *Caution!*

Make a habit of carrying out visual inspections prior to operation (before starting the engine) and after operation (after the engine has been stopped). This will help you to quickly identify potential leaks or other abnormalities.

⚠ *Caution!*

Check that the impeller shaft rotates freely.

⚠ *Caution!*

Check the oil level in the bearing housing.

⚠ *Caution!*

Check the oil level in the hydraulic tank.

Before starting for the first time

⚠ *Caution!*

Check that there are no foreign objects in the inlet duct or impeller housing.

Maneuvering

Warning!

The braking effect is extremely powerful if the reversing bucket control is shifted to full reverse when driving ahead at high speed. Avoid heavy and sudden steering and ahead/astern manoeuvres. There is a risk of those on board falling down or overboard.
If full steering lock is applied at high speed the boat will turn sharply. This produces high side forces and may cause personal injury and equipment damage.
Never drive close to bathers or in areas where it is reasonable to expect that there may be people in the water. Take care when manoeuvring in harbours for example. Because of the power of the water expelled by the water jet, injury can be caused even when manoeuvring at low speeds. The suction in the inlet duct presents a risk to people and objects in the water under the boat and close to the inlet opening. There is a danger that these may be adhered to the inlet duct and cause major damage or suffer serious injury. It is the responsibility of the captain/operator to ensure that the area around the inlet opening is clear of people or objects.

While driving

Warning!

Never open the anode hatch or the inspection hatch when the engine is operating.

Warning!

If the water jet unit disengages or the engine stalls while driving, there is no steering or drive force and the boat cannot be manoeuvred.

After driving

Caution!

When the boat is not in use, the reversing bucket of the water jet unit must be in the "full ahead" position. This is to protect the piston rods from corrosion and fouling.

1.3 Maintenance work

Prior to maintenance

⚠ *Caution!*

There are directions for safe and correct maintenance and service procedures in the instruction manual. Read through them carefully before beginning work.

Never attempt an operation if you are not completely confident of how to do it. Contact Rolls-Royce if necessary.

Undertaking any work envisaged by this document may either directly or indirectly create risks to (1) the safety and health of the person undertaking the work or (2) the water jet unit and/or its components whilst the work is being undertaken.

It is the responsibility of the user to ensure that appropriate controls and precautions are identified and applied in relation to the work envisaged by this document in accordance with relevant statutory, legal and industry requirements to protect the health and safety of the persons undertaking the work.

It is also the user's responsibility to ensure that appropriate controls and precautions are identified and applied in relation to work envisaged by this document to protect against risks to the water jet unit and/or its components whilst the work is being undertaken.

Neither this document, nor its use, in any way absolves the user from their responsibility to ensure that the controls and precautions referred to above are implemented.

If, whilst undertaking any work envisaged by this document, you become aware of any Rolls-Royce product design related feature which could create risk to a person undertaking work or to the water jet unit and/or its components please contact After Sales department at Rolls-Royce Oy Ab immediately.

It is the user's responsibility to make all relevant hazard identifications and risk assessments of all the activities associated with the use of this document.

It is the user's responsibility to design and implement safe systems of work and to supply safe equipment (including, without limitation, safety equipment) and training (including, without limitation, health and safety training) to anyone using this document to work on products to which it relates.

A user without the relevant experience of working in accordance with this document or with products, or similar products, to which it relates should seek appropriate advice to enable them to identify the appropriate health and safety controls and precautions and controls and precautions to protect against risks to the water jet unit and/or its components whilst work is being undertaken. Technical assistance can be sought from Rolls-Royce and will be subject to Rolls-Royce's terms and conditions.

While carrying out maintenance work

⚠ *Warning!*

Never work alone when removing or installing heavy components, even when using the safe lifting equipment such as lockable pulleys. In most cases two people are required when working with lifting equipment; one to operate the lifting equipment and the other to ensure that all components have sufficient space to move freely so that they are not damaged during the lift.

⚠ *Warning!*

Make it impossible to start the engine by disconnecting the electrical system. Secure a warning sign on the instrument panel - "Maintenance work in progress!"

⚠ *Warning!*

The intermediate shaft should only be adjusted with the engine stationary.

⚠ *Warning!*

Never open the inner inspection hatch and the anode hatch before checking that the water level is lower than the hatch openings. The boat may sink if water can enter the boat through the opening. Never leave the hatches open when the boat is in the water.

⚠ *Warning!*

The water jet unit hydraulic system operates under extremely high pressure. This pressure may be high even when the engine is not operating. Always take great care when opening nipples. Carelessness can result in injury. In addition, the oil may be hot and cause scalding.

Warning!

The chemicals used (for example sealant and thread sealant) can cause skin irritation. Follow the safety instructions on the product packaging.

Warning!

Use only components manufactured or approved by Rolls-Royce. Remember that components that appear identical to approved components may not fulfil the requirements.

Warning!

Ensure clean conditions and take great care when installing.

After maintenance

Caution!

The oil in the bearing housing must be topped up before the water jet unit is operated.

Caution!

The water jet unit must not be operated dry, since the rubber bearing and the mechanical sealing require water lubrication.

Caution!

The tightness of the bearing tensioner nut should be checked after approximately 30 hours of operation and should be re-tightened if necessary.

2. Introduction to the FF-series

2.1 Water jet unit

Main components of the water jet unit

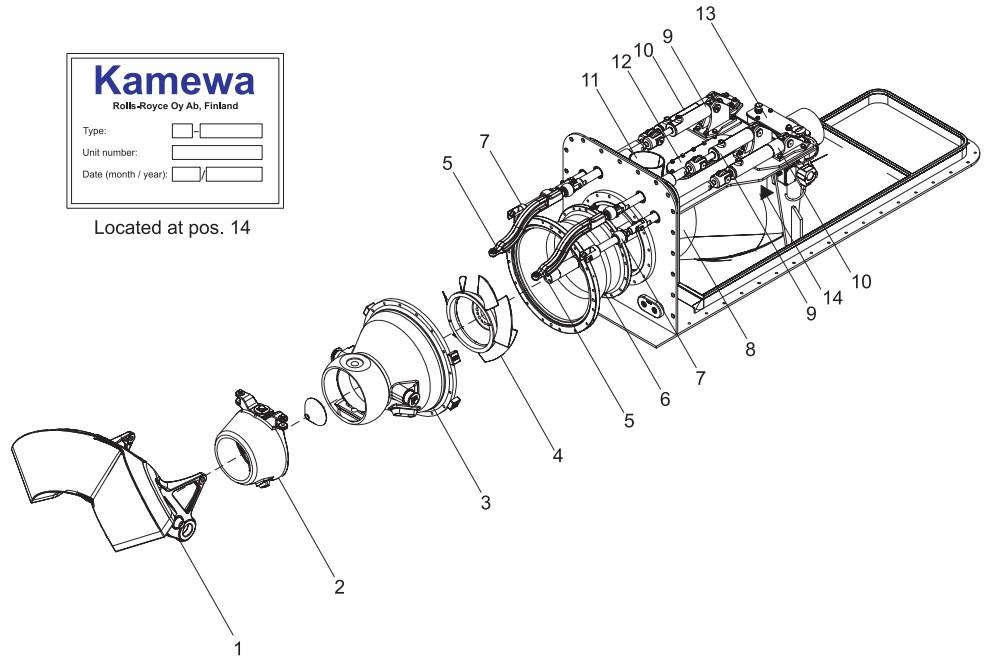


Figure 2-1. Main components of the water jet unit.

1 Reversing bucket
2 Steering nozzle
3 Guide vane chamber
4 Impeller
5 Steering rod
6 Impeller housing
7 Reversing rod
8 Inlet duct
9 Steering cylinder
10 Reversing cylinder
11 Inspection hatch
12 Anode hatch
13 Bearing housing
14 Serial number plate

NOTE!
Refer to the enclosed “assembly drawing” for more information about the water jet unit components.

Description of function

Water enters through the inlet duct. The base plate of the inlet duct is positioned flat against the hull of the boat. Water enters both as a result of the movement of the boat and due to the action of the impeller, which sucks it in. At low speeds, most of the water is sucked in, while at higher speed most of the water is pressed in. The pump is said to be operating at heavy or light load. Inside the inlet duct the speed of the water slows, causing the pressure to increase. There is a further increase in pressure above the impeller until the guide vanes in the guide vane chamber eliminate the rotation of the water flow. This maintains the energy generated by the rotation. The flow of water then accelerates via the guide vane chamber and the trim nozzle (which is located on the end of the guide vane chamber) and out in to the air. It is the difference between the ingoing and outgoing speeds which generates thrust. This can be explained using the impulse law:

$$T = \rho Q(V_{out} - V_{in})$$

where

T thrust (N)
ρwater density (kg/m^3)
Q volumetric flow (m^3/s)
$\mathbf{V_{out}}$ average speed out (m/s)
$\mathbf{V_{in}}$ average speed in (m/s)

Function of the reversing bucket

The ahead/astern movement of the boat is controlled with the reversing bucket. The reversing bucket is infinitely variable between three main positions to obtain the speed and control needed for different manoeuvres.

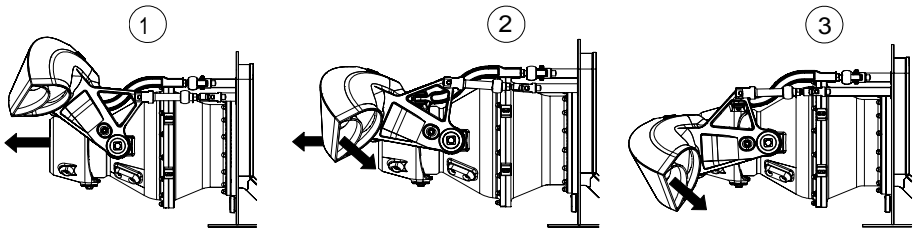


Figure 2-2. Main positions of the reversing bucket.

1. **Full ahead position**
   When driving full ahead the reversing bucket is in its upper position, i.e. completely raised. The jet of water is now unaffected by the reversing bucket and thereby the maximum ahead thrust is obtained.

2. Zero thrust position
   At the zero thrust position the reversing bucket deflects the major part of the jet of water in a forward/downward direction, while the remaining part of the jet of water passes straight backwards. The forces are equal, and the boat is neither moving ahead nor astern. Zero thrust is obtained when the reversing bucket is lowered about 70%.

3. Full astern position
   At full astern position the reversing bucket fully deflects the jet of water in a forward/downward direction, i.e. the boat is reversing.

Function of the steering nozzle

Sideways movement of the boat is controlled by the steering nozzle. There are three main positions with infinite variables in-between:

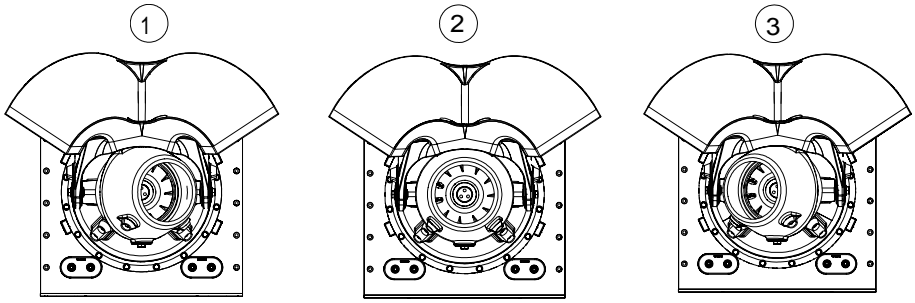


Figure 2-3. Main positions of the steering nozzle.

1. Full steering lock starboard
   Full steering lock starboard means that the steering nozzle is turned 30° to starboard side. Due to the deflection of the jet of water a side force is generated which turns the boat to starboard.

2. Steering nozzle straight
   When the steering nozzle is straight the jet of water is unaffected, which means that the boat will move straight ahead, or astern, depending on the position of the reversing bucket.

3. Full steering lock port
   Full steering lock to port side means that the jet of water is deflected to port and the generated side force turns the boat to port.

Advantages

General water jet unit advantages to a propeller installation:

- As a rule of thumb, the water jet unit gives higher overall efficiency, in comparison with a corresponding propeller installation, at speeds exceeding 25 knots.
- Superior manoeuvrability at all speeds.
- No underwater appendages which results in shallow draught and safe operation.
- No risk of overloading the engine, low noise and vibration levels. This means longer service life and low maintenance costs.
- High thrust at low speeds, giving fast acceleration.

Competitive advantages of the FF-series over other water jet unit manufacture:

- Lightweight and tough. Fabricated in aluminium and with thorough strength calculations.
- Easy installation. Delivered painted and complete with a structurally dimensioned inlet duct for easy installation by means of bolting or welding. The water jet unit can be welded directly to a aluminium boat.
- Easy service and maintenance. Wear parts are easy to replace without any special tools. Low risk of damage.
- Best corrosion resistance. Fabricated of marine aluminium. Impeller housing is lined with polyurethane to minimize wear and corrosion.

2.2 The manoeuvring system

The boat is manoeuvred by the steering wheel, the reversing bucket control and the engine speed control. The steering wheel affects the steering cylinder which in its turn affects the steering nozzle, i.e. the direction of the jet of water. This means that the engine must be running and the gear must be engaged to be able to manoeuvre the boat.

By manoeuvring the reversing bucket you are braking and reversing the boat. When the reversing bucket control is set at ahead position and the reversing bucket is in the upper position, there is nothing blocking the jet of water. When shifting the reversing bucket control to reverse position, the reversing bucket is lowered and deflects the jet of water. When the reversing bucket is completely lowered the jet of water is directed ahead and the boat is reversing.

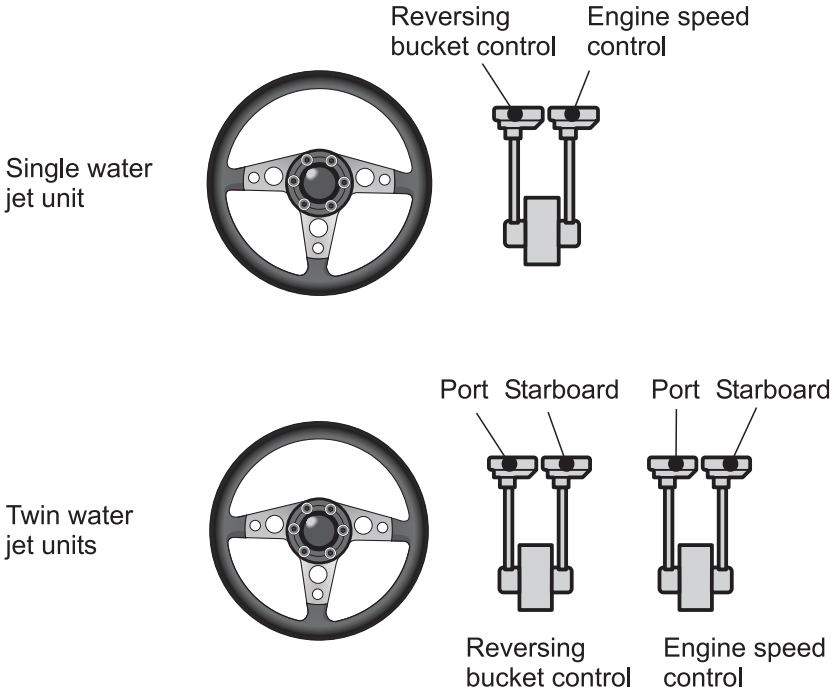


Figure 2-4. Example of control stations.

3. Operating a boat with a water jet unit

Driving a boat with a water jet unit is different from driving a boat with a propeller. Read this chapter carefully before casting off on your first trip.

3.1 Operating

The steering wheel and reversing bucket control are used when manoeuvring at low speeds, in harbour for example. Otherwise the steering wheel and the engine speed control are used. The best way to drive is to manoeuvre the steering wheel with one hand and to control the reversing bucket and engine speed with the other.

⚠ *Caution!*

Do not use full power at low speed, when towing another boat for example. There is a risk that cavitation may damage the water jet unit. Cavitation is experienced as abnormal vibration and noise!

Set a constant engine speed before manoeuvring with the reversing bucket. Better steering response can be obtained when driving ahead at low speed by increasing engine speed slightly and then reducing ahead speed with the reversing bucket. This since the steering response is low at low engine speed and increases when the engine speed increases.

⚠ *Warning!*

If the water jet unit disengages or the engine stalls while driving, there is no steering or drive force and the boat cannot be manoeuvred.

Zero thrust position

The zero thrust position is when the reversing bucket deflects the jet of water both downwards and forwards. Ahead and astern drive power are then the same and the boat is stationary.

To obtain zero thrust position, the reversing bucket control must be set at approximately 70% (0% being “full ahead” position and 100% “full astern”). Because the zero thrust position varies for each boat, and is dependent on wind and load conditions, familiarise yourself with the zero thrust position of your boat.

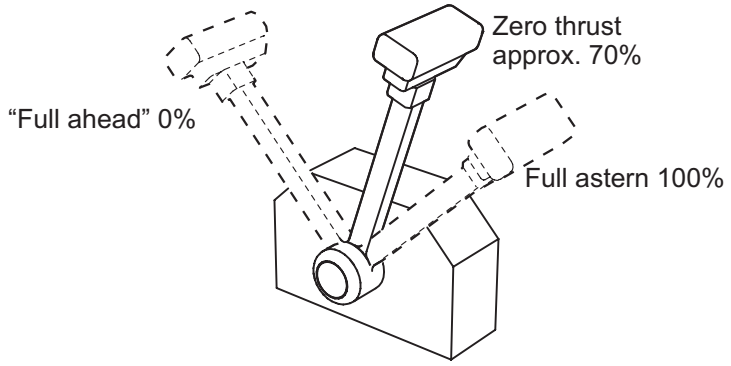


Figure 3-1. The reversing bucket controller.

Steering

A big difference between steering a boat with a water jet unit and a propeller driven boat is that when reversing the steering works in the opposite direction.

On a boat with a water jet unit the steering response is progressive, that is when the steering wheel is turned a little bit when driving ahead, the steering response is less than on a propeller boat. At approximately half steering lock the steering response is the same and at full steering lock the steering response is more powerful than on a propeller boat.

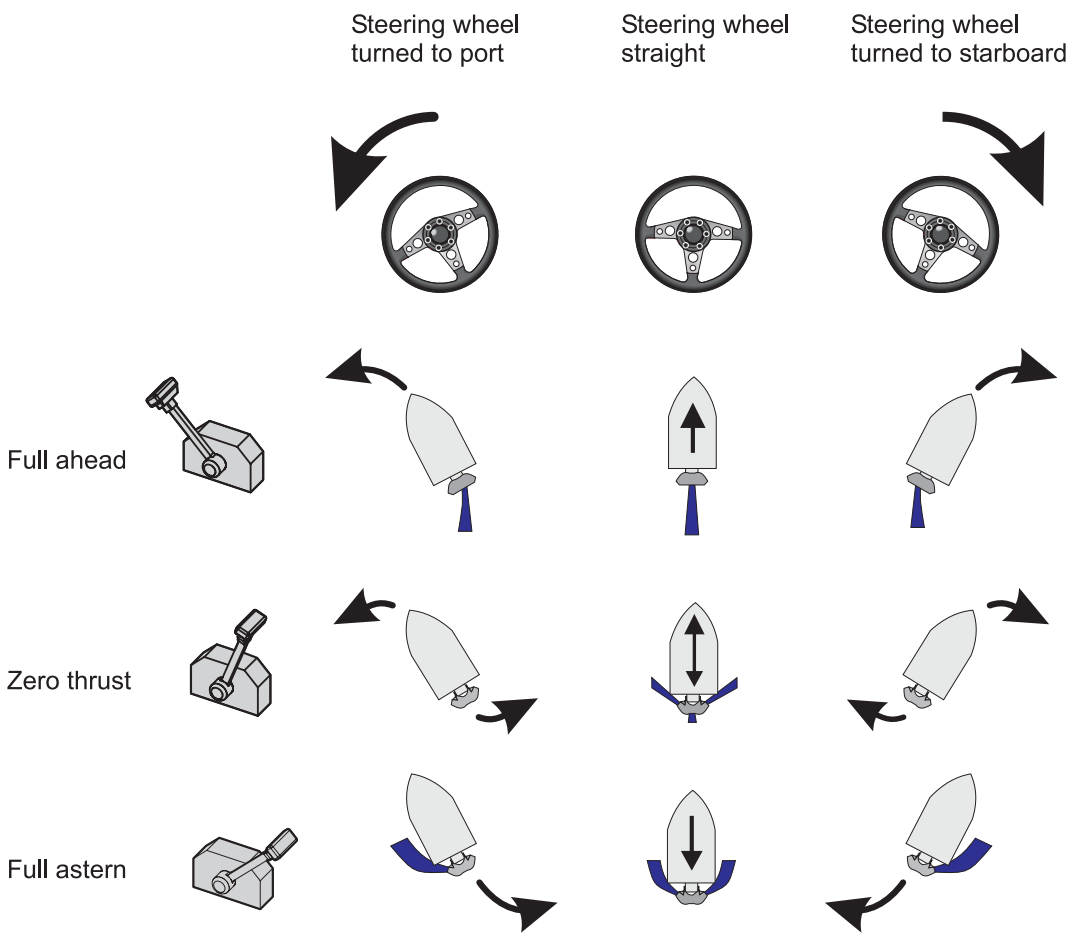


Figure 3-2. Schematic steering diagram.

Warning!

The braking effect is extremely powerful if the reversing bucket control is shifted to full reverse when driving ahead at high speed. There is a risk of equipment damage and personal injury. If full steering lock is applied at high speed the boat will turn sharply. This produces high side forces and may cause personal injury and equipment damage. The driver must warn the passengers about the risks with an emergency manoeuvre.

Operating to and from a jetty with a water jet unit

1. Using a relatively low engine speed, swing the stern of the boat out first, and then reverse out. When driving ahead and leaving a jetty, make sure that the stern does not collide with the jetty to avoid damages on both boat and jetty.
2. Dock at a jetty by first mooring the bow. The stern can then be swung in with the water jet unit.

Operating sideways with twin water jet units

1. Shift the inner reversing bucket control to astern position (to the side you want to move).
2. Use the outer reversing bucket control to balance the boat in position (ahead/astern position).
3. Maintain the desired course using the steering wheel. The boat will move sideways. Sideways speed depends on engine speed, wind and load conditions.

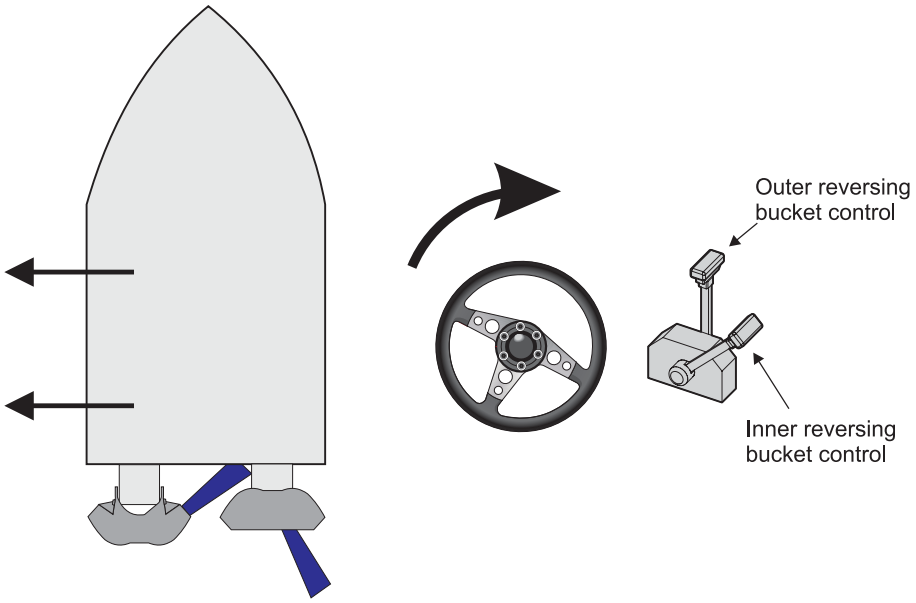


Figure 3-3. Operating a boat sideways.

Rotating the boat

Boats with one water jet unit:

1. Maintain a constant engine speed.
2. Shift the reversing bucket control to zero thrust position so that the boat is kept stationary.
3. Turn the steering wheel in the direction that the boat should turn.
4. The boat will now rotate on the spot. By shifting the reversing bucket control to the limit positions the boat can be made to move ahead or astern.

Boats with two water jet units:

1. Maintain a constant engine speed.
2. Move the inner reversing bucket control to full astern and the outer reversing bucket control to ahead position.
3. The boat will now rotate on the spot. By shifting one reversing bucket control to the limit positions the boat can be made to move ahead or astern. To strengthen the rotation turn the steering wheel the same direction as the boat is rotating.

Braking

Braking is very different from braking with a propeller boat. The biggest difference is the reversing bucket which is constructed to be manoeuvred from “full ahead” to “full astern” in approximately 2 seconds. This without damaging the water jet unit nor the engine. In case of an emergency braking the braking distance will be much shorter.

1. Select a suitable engine speed.
2. Shift the reversing bucket control to astern position.
3. Carefully increase the engine speed if necessary until the desired braking force is obtained.
4. Reduce the engine speed as soon as the boat has slowed down.
5. Do not apply full steering lock before the boat has slowed down.

Emergency braking

1. Maintain a constant engine speed throughout the entire emergency braking.
2. Obtain the desired braking force using the reversing bucket.
3. Reduce the engine speed as soon as the boat has slowed down.

⚠ *Warning!*

Never disengage the water jet unit or reduce throttle when emergency braking. If this is done there will be no braking force. The forces involved in emergency braking can cause personal injury and material damage.

3.2 Operating in shallow water

Avoid driving at high engine speed in shallow waters. Sand and stones can be sucked through the water jet unit. This may cause wear to the impeller and guide vane chamber.

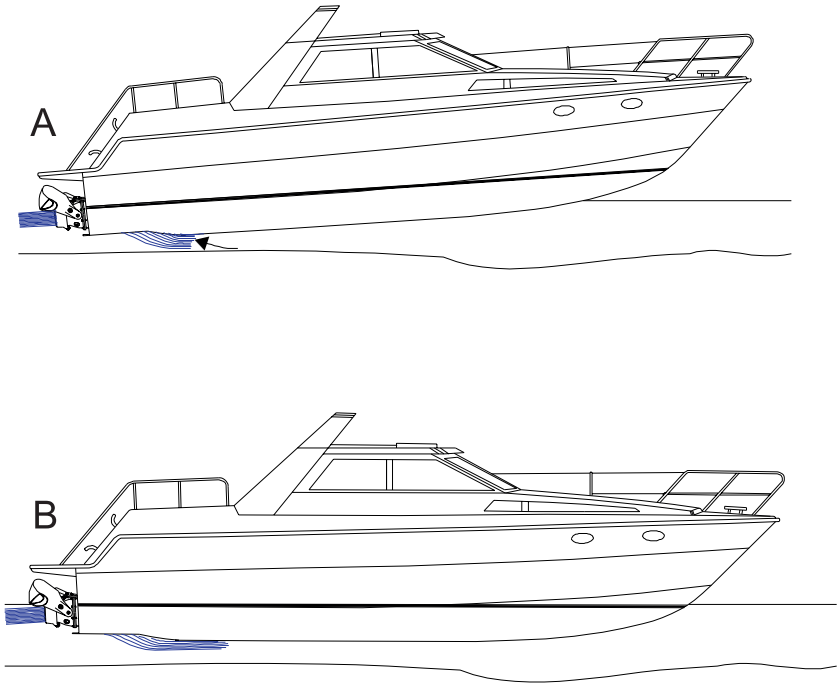


Figure 3-4. Operating in shallow water.

A Do not accelerate heavily in shallow waters. Stones and sand etc. may be sucked into the water jet unit and cause wear to the impeller and guide vane chamber.

B Drive at idling speed until deeper water is reached. If a foreign object is sucked into the inlet duct, temporarily disengage the water jet unit to remove the object(s).

3.3 Checklist if you run aground

Warning!

Remove the start key and shut off the power using the main switch to make it impossible to start the engine.

Checklist:

1. Inlet duct:
   - Check that there are no water leaks.
   - Check the condition of the inlet grid.
   - Check that there are no cracks in the inlet duct.
   - Check that there is no buckling in the inlet duct or on the bottom of the hull in front of the duct.
   - Remove any scrap, stones, seaweed etc. that has been sucked in.
2. Shaft, impeller, impeller housing and guide vane chamber
   - Check that the impeller rotates freely by turning the shaft by hand.
   - Remove any scrap that has stuck in the impeller and guide vane chamber.
   - Check that the guide vanes in the guide vane chamber have not been deformed.
3. Steering nozzle and reversing bucket
   - Check that the cylinders and rods are not bent.

When starting the engine and engaging the gear:

1. Check that there are no abnormal vibrations in the shaft and hull.
2. Move the steering nozzle from side to side between the limit positions. Check for abnormal noises from the steering gear.
3. Move the reversing bucket up and down. Check for abnormal noises.

3.4 Driving through flotsam and seaweed

Scrap, twigs, seaweed etc. will not usually block or damage the water jet unit. However, avoid driving over such objects because they affect the performance of the water jet unit.

It is usually possible to notice when the water jet unit is blocked because:

- engine speed increases,
- the speed of the boat decreases,
- abnormal sound and vibrations can be heard from the water jet unit.

⚠ *Caution!*
If fishing nets or lines are sucked into the water jet unit, the water jet unit must be disengaged or the engine stopped as quickly as possible to avoid damage to the impeller and impeller housing!

Removing an obstruction of the water jet unit

If a blockage of the water jet unit occurs, reduce the engine speed to idling speed or disengage it. The blockage may clear when the boat goes forward and water flows through the water jet unit.

If the blockage was not removed:

1. If a marine gear is installed, backflush the water jet unit by reversing impeller rotation. Use low engine speed.
2. **If multiple water jet units are installed:**
   Set the unblocked water jet unit to reversing position. The blocked water jet unit, which must be in the ahead position and disengaged, will be flushed by the flow of water through it.

   If this is not successful either, the next step is to open the inspection hatch and the anode hatch. The following points must be observed before the hatches are opened:

If the measures above were not successful:

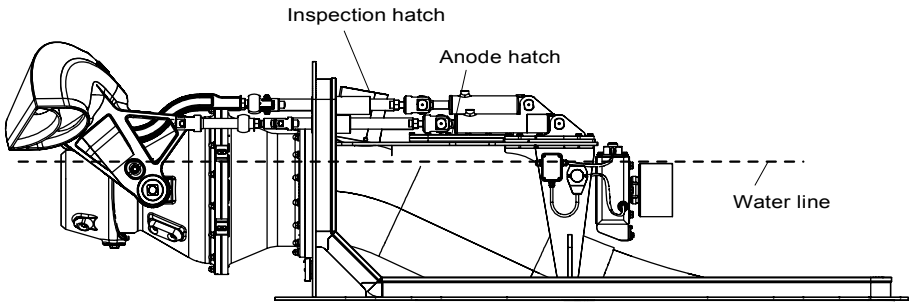
1. Switch off the engine(s).

⚠ **Warning!**
Remove the start key and shut off the power using the main switch to make it impossible to start the engine!

2. Check that the water level is not above the inner inspection hatch. If the water level is too high, weight can be added to the bow so that the stern rises sufficiently for the inner inspection hatch to be opened.

⚠ Warning!

Never open the inner inspection hatch or anode hatch before checking that the water level is lower than the hatch opening. The boat may sink if water can enter the boat through the opening. Never leave an open hatch unattended.



3. Open the inspection hatch.
4. Remove the blockage from the inlet duct through the inspection hatch.

If measures described in this chapter were not helpful contact Rolls-Royce.

3.5 Driving in heavy seas

When driving in heavy seas note that engine speed may vary as the impeller sucks in air. When the impeller sucks in air, drive and manoeuvring force are reduced. Engine speed should be reduced until engine speed and drive force are stable.

4. Starting and stopping

4.1 Before starting

Water jet unit

Check the following before the water jet unit is started:

1. Check that there is no oil or water leakage.
2. Check the oil level in the bearing housing, see page 33 section “Oil level”.
3. Check the oil level in the hydraulic oil tank of the control system.

⚠ *Caution!*

If there is a risk of foreign objects in the inlet duct, remove the objects before starting the engine or engaging the gear. When starting pay special attention to abnormal vibrations. If there is abnormal vibrations, the reason for this must be investigated and remedied else the impeller and impeller housing may be damaged.

4.2 Starting the engine and the water jet unit

The start procedure depends on whether the water jet unit is directly engaged to the engine or if it is engaged via a gearbox. Note that it is not possible to move the position of the reversing bucket and the steering nozzle if the engine is not running.

The water jet unit is directly engaged to the engine

1. Check that the engine speed control is in idling position.
2. Be prepared to adjust the reversing bucket to zero thrust position, the steering nozzle in centre position as soon as the engine has started.
3. Start the engine.
4. Set the steering wheel in centre position and the reversing bucket control to zero thrust position.

The water jet unit is engaged to the engine via a gearbox

1. Check that the engine speed control is in idling position and that the gear is in neutral position.
2. Start the engine.
3. Set the steering wheel in the centre position and the reversing bucket control to zero thrust position.
4. Engage the gear. Only ahead position is used, counter-clockwise rotation viewed from the stern, during normal operation.

4.3 After starting

1. Check that the steering nozzle turns both starboard and port and that the reversing bucket manoeuvres correctly.

4.4 Stopping the engine and water jet unit

The water jet unit is directly engaged to the engine

1. Before the engine is stopped, set the reversing bucket in “full ahead” position so that the piston rods are inside the cylinders as illustrated below.

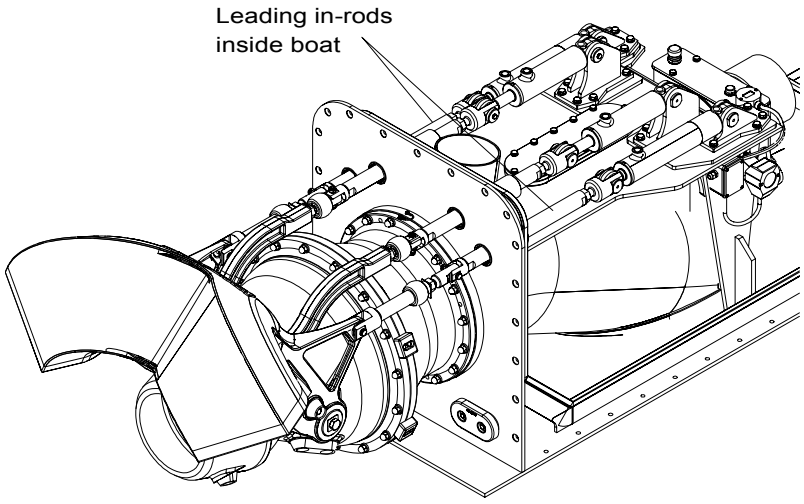


Figure 4-1. The reversing bucket in “full ahead” position.

This must be done so that the piston rods on the reversing cylinders are inside the cylinders. This protects the piston rods from fouling and corrosion.

⚠ *Caution!*

If the cylinders are above the water line it is recommended that the reversing bucket is kept in reversing position because the anodes provide better anti-corrosion protection when the reversing bucket is in the water.

2. Stop the engine.

NOTE!

Be aware that the boat will move as soon as the engine RPM is increased the next time the engine is started. This due to the positions of the reversing bucket and steering nozzle. Be prepared to adjust the position of the reversing bucket and steering nozzle as soon as the engine is started again.

3. Check that there is no oil or water leakage.

The water jet unit is engaged to the engine via a gearbox

1. Set the steering wheel to the centre position and the reversing bucket control to zero thrust position.

2. Disengage the gear.

3. Set the reversing bucket in “full ahead” position so that the piston rod is inside the cylinder as illustrated in Figure 4-1.

   This must be done so that the piston rods on the reversing cylinders are inside the cylinders. This protects the piston rods from fouling and corrosion.

⚠ *Caution!*

If the cylinders are above the water line it is recommended that the reversing bucket is kept in reversing position because the anodes provide better anti-corrosion protection when the reversing bucket is in the water.

4. Stop the engine.

5. Check that there is no oil or water leakage.

5. Maintenance instructions

The Kamewa FF-series are constructed for maximum service life and operational safety. Regular maintenance according to the table below maintains these qualities and will avoid unnecessary operational difficulties.

Warning!

Read through the safety instructions before beginning the maintenance work, see page 8 section "Maintenance work".

Caution!

Never attempt an operation if you are not completely confident of how to do it. Contact Rolls-Royce if necessary.

5.1 Maintenance schedule

Maintenance schedule	See
After the first 30 hours	page 32
Daily before the first start-up	page 33
Weekly	page 34
Each month	page 35
After 500 hours of operation	page 36
Yearly service (with the boat docked)	page 37
Painting	page 39

NOTE!

The warranty only applies when the instructions in chapter "Maintenance schedule" are followed and documented in a proper way.

After the first 30 hours

Visual checkpoints:

1. Check the bearing housing (1) temperature - after approximately half an hour of operation. Stop the engine and check the temperature of the bearing housing. Normal temperature is approximately 20-40°C higher than the temperature of the water.

Warning!

The engine must be stopped when measuring the temperature. If not, there is a risk of personal injury. Secure a warning sign on the instrument panel "Maintenance work in progress!" to avoid the engine being started.

2. Check that the bearing tensioner nut (2) is tightened.
3. Check that the hydraulic cylinders with accessories (3) are tightened.
4. Check the installation of the steering and reversing rods (4).
5. Check the installation of the steering nozzle (5).
6. Check the installation of the reversing bucket (6).

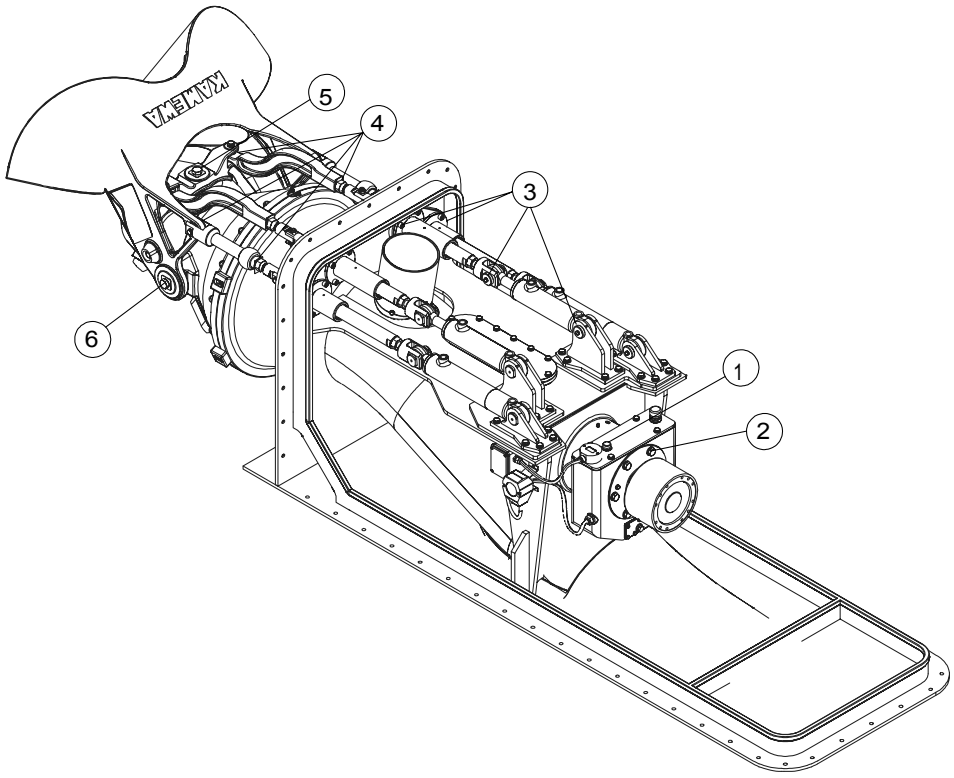


Figure 5-1. Checkpoints after the first 30 hours of operation.

Daily before the first start-up

Visual check

1. Check the water jet unit visually both inside and outside the boat. Check that there is no oil or water leakage.

Oil level

1. Check the oil level in the bearing housing. The oil level is checked with the dipstick and must be between the max. and min. markings. If a top up is required, oil is filled through the hole where the dipstick is positioned.

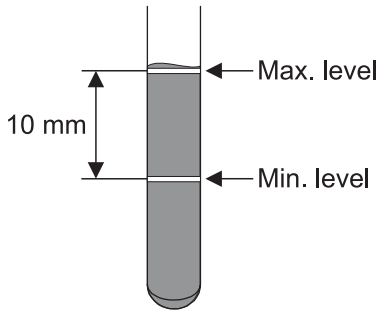


Figure 5-2. Checking the oil level.

2. Also check the condition of the oil. The oil must not be mixed with water (greyish) or burned (dark).
3. Check the oil level in the hydraulic oil tank of the control system.

Weekly

1. Check for possible water leak (a few water drops are allowed) or oil leak from the bearing housing inspection hole. If there is water leakage the mechanical sealing in the bearing housing must be replaced. If there is oil leakage the seals in the bearing housing must be replaced. Refer to the enclosed document 55030312 for instructions how to replace the seals.

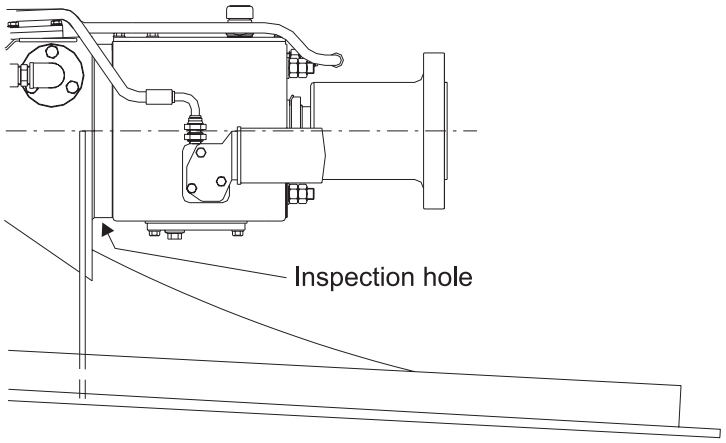


Figure 5-3. The inspection hole of the bearing housing.

Each month

1. Check the condition of the outer anodes (1). Replace the anodes if more than half has been worn away.
2. Check the anode under the anode hatch (2). Replace if more than half has been worn away.

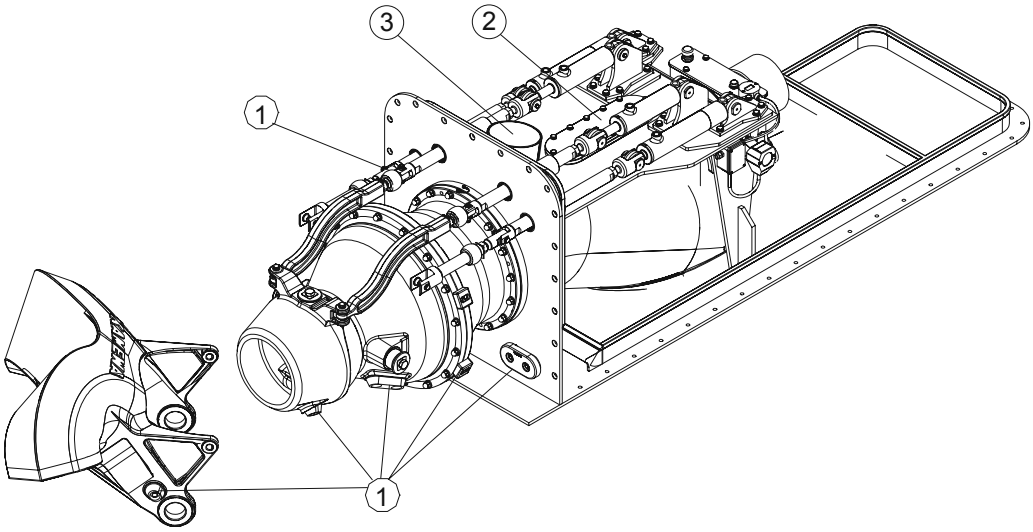


Figure 5-4. Checkpoints to be inspected monthly.

Warning!

Always check that the water level is lower than the opening for the anode hatch (2). The boat may sink if water can enter the boat through the opening. Never leave the anode hatch open when the boat is in the water.

3. Check if the inspection hole in the bearing housing is open. Clean the inspection hole with a stiff wire if necessary.

NOTE!

The consumption of the anodes may vary from case to case. The quality and condition of the water and also incorrect grounding of the boat's electrical system will affect the system.

If the anodes are being used up quickly, the inner anode in the guide vane chamber must also be checked:

1. Dock the boat.
2. Remove the guide vane chamber according to the instructions in the enclosed document 55030312.
3. Remove the anode from the guide vane chamber and check the condition. Replace the anode if more than half the anode has been worn away.

After 500 hours of operation

Replace the oil in the bearing housing:

1. Remove the plugs (1) and drain the oil into a container.
2. Screw the plugs into place when all the oil has drained out.
3. Fill the oil through the dipstick (2) hole.
4. Check the oil level with the dipstick (2). The oil level must be between the max. and min. markings on the dipstick.

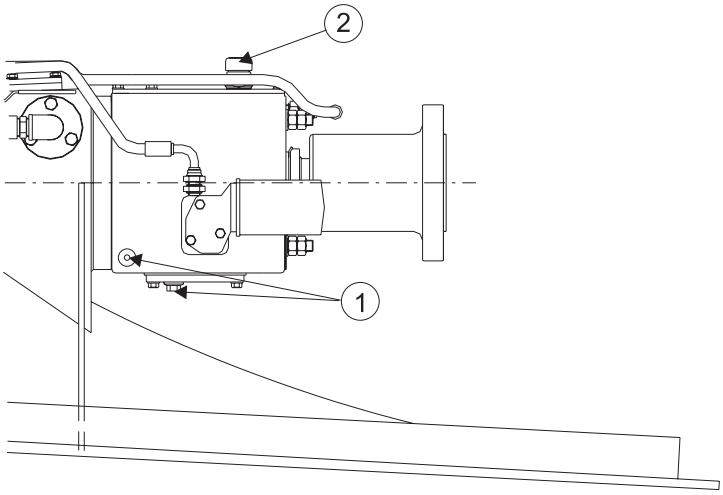


Figure 5-5. The oil dipstick and plugs of the bearing housing.

NOTE!
For the recommended oil grade and the correct volume see page 55 section “Recommended lubricants and sealants”.

Yearly service (with the boat docked)

⚠ *Caution!*

The water jet unit must not be run dry because the rubber bearing in the guide vane chamber and the mechanical sealing require water lubrication!

1. Check all bearing bushings for wear. Replace the bearing bushings if the play is greater than 1 mm.
2. Check the condition of the piston rods (1) on both the steering and reversing cylinders. Note a thin film of oil on the piston rod is normal.
3. Remove the reversing components, steering components and the guide vane chamber, follow the instructions in the enclosed document 55030312. Check the following:
   - Measure the clearance (2) between the impeller and the impeller housing.
   - Check the condition of the rubber bearing. If the play between the rubber bearing and the shaft sleeve (3) is not between 0.1-1.0 mm the rubber bearing must be replaced.
   - Check the guide vanes in the guide vane chamber. If they are damaged and/or corroded contact Rolls-Royce for further instructions.
4. Check the condition of the inner anodes, in the guide vane chamber and under the anode hatch (4). Replace the anodes if more than half have been worn away or after a maximum of two seasons.
5. Check the o-ring (5) under the inspection hatch. The o-ring must be replaced if it does not provide a perfect seal.

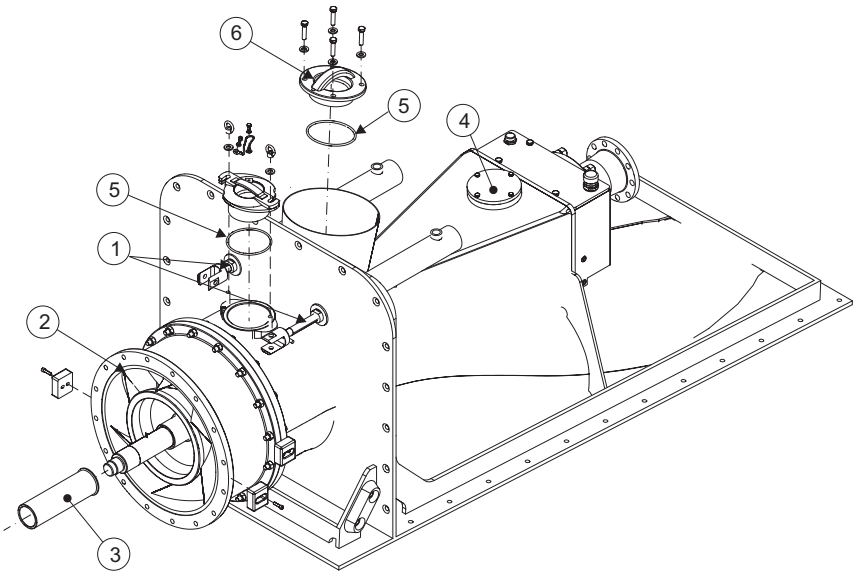


Figure 5-6. Checkpoints to be inspected annually.

6. Remove the impeller and the impeller housing as described in the enclosed document 55030312 and check the following:

   - Check the impeller. If the tips of the impeller blades are lightly damaged they can be filed off as illustrated below. If the impeller blade is deformed the impeller should be replaced.

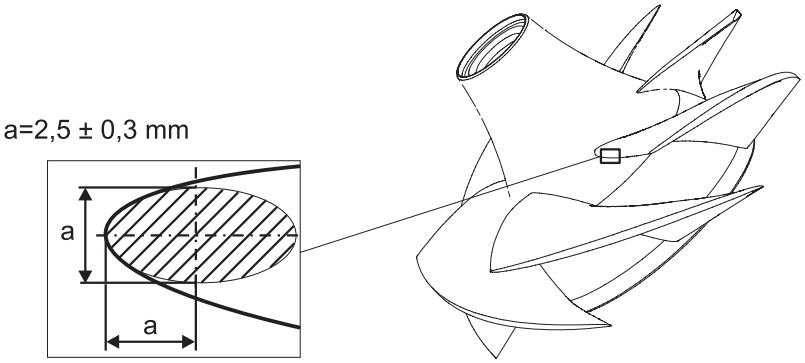


Figure 5-7. Cross-section of the impeller blade.

   - Check the impeller housing running surface. Replace the impeller housing if there are 2 mm deep scratches or 10 mm long scratches in the direction of the shaft.

7. Replace the oil filter:

   - Remove the oil filter. Drain the oil into a suitable container.
   - Apply a thin film of oil on gasket of the new filter.
   - Screw on the new filter. Tighten only ¼ turn. Check for oil leakage when the water jet unit is put into operation again.

8. Check the oil cooling circuit for leakage.

9. Visually check the mounting of all components. Tighten as necessary.

10. Check the condition of the paint on all the water jet unit components. Clean and touch-up the paintwork as necessary.

Painting

Anti-fouling paint

The waterjet is not anti-fouling painted at factory expect for the inside of the inlet pipe and the inlet grid. All painted surfaces on the outside of the waterjet must be painted with anti-fouling before the boat is launched.

Apply the anti-fouling paint as follows:

- Clean the surfaces from grease and oil with a suitable washing detergent.
- Remove salt and other dirt with high pressured fresh water.
- Apply a thin layer off HEMPADUR 45182 or equal epoxy tie coating and let it dry.
- Apply the anti-fouling paint within three (3) days after the epoxy tie coating has been applied.

The water jet unit can be anti-fouling painted with the same type of anti-fouling paint as the boat, provided that the paint does not contain copper. If local legalization does not allow the use of anti-fouling paint, contact Rolls-Royce for advice on alternative methods.

Drying times according to the paint manufacturer's instructions.

Touching up paintwork damage

Any scratched water jet unit component must be repaired. Observe the following before painting a component:

NOTE!
If a corrosive damage to the inlet duct is deeper than 3 mm, contact Rolls-Royce.

1. Wash the area to be painted with fresh water.

   ⚠ Caution!
   Be careful when using pressure washers. High water pressure can damage components on the water jet unit.

2. Leave the area to dry.
3. Lightly blast the surface and level out any unevenness.
4. Paint the area as described below.

Painting

Spray painting:

1. Spray 3 layers with “Intershield 803”.
2. Spray 1 layer with HEMPADUR 45182 or equal epoxy tie coating.
3. Spray 1 layer with anti-fouling paint.

Drying times according to the paint manufacturer’s instructions.

Painting with brushes:

1. Apply 5 layers of “Intershield 803”.
2. Apply 1 layer of HEMPADUR 45182 or equal epoxy tie coating.
3. Apply 2 layers of anti-fouling paint.

Drying times according to the paint manufacturer’s instructions.

Do not apply “anti-fouling paint” on cylinder rods and anodes.

Correction of damages in the painting

Should an area or a component of the water jet unit be scratched during installation, the damaged painting must be remedied. Observe the following before painting a component:

1. Blast the area to be painted.
2. Wash the blasted area with fresh water.

   ⚠ *Caution!*

   Be careful when using pressure washers. High water pressure can damage components on the water jet unit.

3. Leave the area to dry for about 12 hours.
4. Lightly blast the surface and level out any unevenness.
5. Paint the area as described earlier.

5.2 Laying up

With the boat in the water

If the boat is not going to be in use for a longer period the following actions should be taken to avoid fouling and corrosion:

Once a week

Start the engines and take the following actions.

- Clutch in the water jet and run it for a few minutes to wash out sea growth.
- Lower and raise the reversing bucket a few times.
- Turn the steering wheel to the limit positions a number of times.

⚠ *Caution!*
When the engine is stopped follow the stopping instructions on page 29 to avoid corrosion.

Preventing fouling

1. The water jet unit must be painted with “anti-fouling” paint of prescribed quality.
2. If possible, moor the boat in deep water.
3. Keep the water jet unit out of sunlight as much as possible. A tarpaulin can be used to cover the water jet unit to protect it from sunlight. In shallow waters a similar protection should be placed over the opening for the inlet duct.
4. If there is a risk of frost the engine compartment should be warmed sufficiently to prevent water from freezing in the inlet duct and guide vane chamber.

Before starting the water jet unit after a longer period of inactivity, check that no foreign objects are obstructing the moving components or blocking the inlet duct.

⚠ *Caution!*
In regions where it is a risk of frost, the boat should be lifted onto dry land. Seasonal storage of the water jet unit is recommended to avoid that the inlet duct does not crack as a result of freezing.

Boat docked



NOTE!

To avoid fouling and corrosion the mechanical seal should be flushed with fresh water every time the boat is docked.

Seasonal storage

Carry out the following after the boat has been taken on to dry land:

1. Clean the water jet unit with fresh water.

⚠ ***Caution!***

Do not use pressure washers. High water pressure can damage components on the water jet unit.

2. Touch up any damage to the paintwork, as described on page 39 section “Touching up paintwork damage”.
3. Replace the oil in the bearing housing, as described on page 36 section “After 500 hours of operation”.
4. Grease all zinc coated components, for example hydraulic connections, zinc coated screws etc.
5. Wipe up all the water in the guide vane chamber.

⚠ ***Caution!***

If the water in the guide vane chamber is not dried off there is a risk of the guide vane chamber cracking due to freezing.

5.3 Fault-tracing

A number of symptoms and possible causes of operational problems are described in the table below. In the event of faults or errors that you cannot remedy yourself you should always contact Rolls-Royce.

⚠ *Warning!*
Read through the safety instructions before beginning the maintenance work, see page 8 .

Symptom	Possible cause
Steering does not function correctly	1,2,3
The boat does not reverse	1,4,5,6
Poor performance	6,7,8,9,10,11,12,13
Abnormal noise from the impeller housing	9,12,14,15
Abnormal vibrations	9,10,12,16,17
Abnormal noise from the bearing house	11,18,19
Bearing housing leaking oil or water	19,20
The axial bearing is hot	11,18,21
The shaft nut/bearing tensioner nut has loosened	11,16,17,22

1. Hydraulic fault
2. The installation of the steering components
3. The function of the steering wheel
4. Obstruction in the reversing bucket
5. The installation of the reversing bucket components
6. The reversing rod setting
7. Engine fault
8. Control setting
9. Foreign objects in the impeller housing or in the guide vane chamber
10. Foreign objects in the inlet duct
11. Bearing fault
12. Partially defective impeller
13. The clearance between the impeller and the impeller housing is too great
14. Defective impeller housing
15. Sand in the water jet unit after operating in shallow waters
16. Shaft damaged due to running aground
17. Intermediate shaft not balanced
18. Oil level too low in bearing housing
19. Defective mechanical sealing
20. Defective seals in bearing housing
21. Water in the oil
22. Defective locking washer/locking screws or shaft nut/bearing tensioner nut not sufficiently tightened

5.4 Manoeuvring in the event of a hydraulic fault

If a hydraulic fault should occur at sea and cannot be repaired emergency steps must be taken. Follow the instructions below and drive to the nearest harbour for service.

Warning!

Be prepared by familiarising yourself with the emergency procedures. Failure to follow these procedures in emergency situations may result in personal injury and equipment damage. Always manoeuvre at low speed.

Symptom	Single installation	Twin installation
No hydraulic pressure, no hydraulic oil or burst hydraulic hoses	page 44	page 48
No steering cylinder function	page 45	page 49
No reversing cylinder function	page 46	page 49
Damaged reversing bucket control cable	page 47	page 50

Single installation

Warning!

The engine must be stopped before any repair work is carried out. Remove the start key and shut off the power using the main switch to make it impossible to start the engine. Secure a warning sign on the instrument panel - "Maintenance work in progress!"

No hydraulic pressure, no hydraulic oil or burst hydraulic hoses

Remedy:

1. Disconnect the hydraulic pump. If the pump is allowed to rotate without being supplied with oil it may run hot and cause a fire in the engine room.

   On installations where the hydraulic pump is located on the engine and is not belt driven, the cover was removed when the hydraulic pump was installed. This cover must be kept on board. The boat operator must know where the cover was taken from and where it is stored.

NOTE!
Follow the instructions how to disconnect the hydraulic pump given by the engine manufacturer.

2. Disconnect the steering cylinders. The steering nozzle will now be pointed astern by the force of the jet of water.
3. Disconnect the reversing rods.
4. Tie up the reversing bucket so that it is in “full ahead” position as illustrated below.

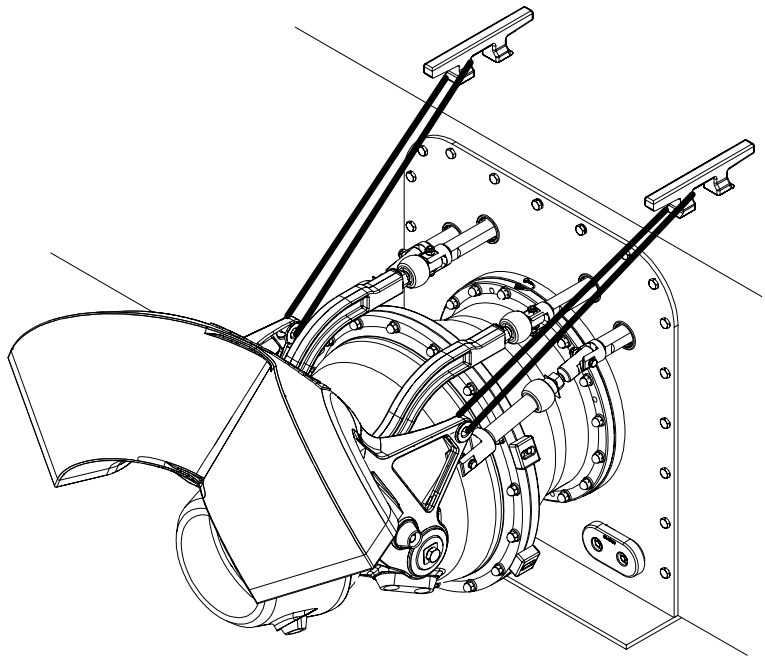


Figure 5-8. The reversing bucket tied up.

5. Start the engine.
6. Use the throttle to increase/reduce speed. It is possible to steer using a paddle or an oar at the side of the boat. If, for example, you wish to turn to starboard, use the oar on the starboard side.

NOTE!
It is also possible to steer the boat with trim tabs, if installed.

No steering cylinder function

Remedy:

1. Disconnect the steering cylinders. The steering nozzle will now be pointed astern by the force of the water jet.
2. Set the reversing bucket control in “full ahead” position.

3. Start the engine.
4. Use the throttle to increase/reduce speed. It is possible to steer using a paddle or an oar at the side of the boat. If, for example, you wish to turn to starboard, use the oar on the starboard side.

No reversing cylinder function

Remedy:

1. Disconnect the reversing rods.
2. Tie up the reversing bucket so that it is in “full ahead” position.
3. Start the engine.
4. Use the throttle to increase/reduce speed.



Warning!

The only way to brake the boat is to disengage the gear/reduce speed. This means that the braking ability is poor.

5. Steer with the steering wheel as usual.

Damaged reversing bucket control cable

Remedy:

1. Disconnect the control cable at the reversing cylinder and move it by hand to “full ahead”position.

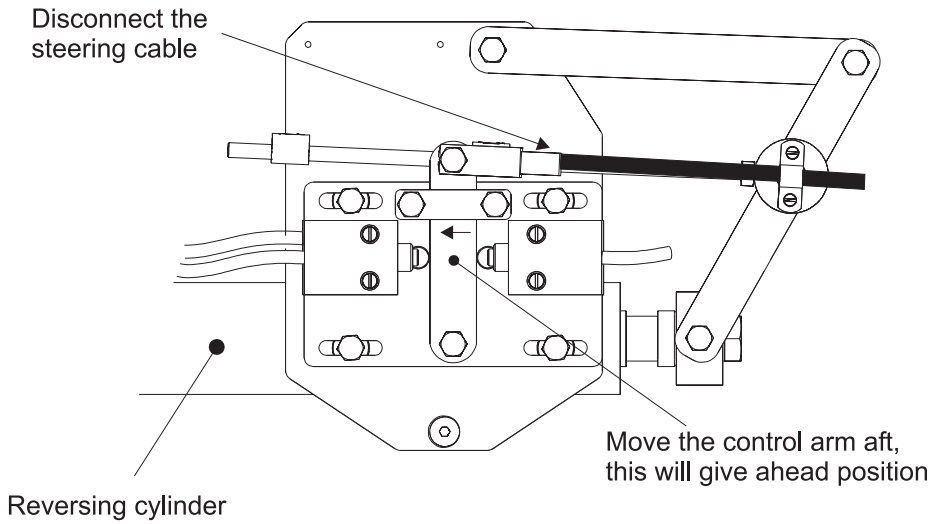


Figure 5-9. The reversing bucket control mechanism.

Warning!
Observe that during this manoeuvre the piston rods enters the boat and this can cause serious injury if a limb is caught between a piston rod and the gear/engine.

2. Start the engine.
3. Use the throttle to increase/reduce speed.

Warning!
The only way to brake the boat is to disengage the gear/reduce speed. Therefore braking ability is poor.

4. Steer with the steering wheel as usual.

Twin installation

Warning!

The engines must be stopped before any repair work is carried out. Remove the start key and shut off the power using the main switch to make it impossible to start the engines. Secure a warning sign on the instrument panel - "Maintenance work in progress!"

No hydraulic pressure, no hydraulic oil or burst hydraulic hoses.

Remedy:

If the fault is in one water jet unit the engine should be stopped and the boat driven carefully to harbour using the other water jet unit.

1. Reduce speed to approximately 10-15 knots depending on boat type and load.

   If the problem is with both water jet units the following must be carried out:

2. Disconnect the hydraulic pumps. If the pumps are allowed to rotate without being supplied with oil it may run hot and cause a fire in the engine room.

   On installations where the hydraulic pump is located on the engine and is not belt driven, the cover was removed when the hydraulic pump was installed. This cover must be kept on board. The boat operator must know where the cover was taken from and where it is stored.

NOTE!

Follow the instructions how to disconnect the hydraulic pumps given by the engine manufacturer.

3. Disconnect the steering cylinders. The steering nozzles will now be pointed astern by the force of the jet of water.
4. Disconnect the reversing rods.
5. Tie up the reversing buckets so that they are in "full ahead" position as illustrated in Figure 5-8.
6. Start the engines.
7. Use the throttles to increase/reduce speed. Steer by increasing the throttle on one engine and reducing the throttle on the other. For example if you wish to turn to starboard, reduce throttle on the starboard engine and increase throttle on the port engine.

NOTE!
It is also possible to steer with trim tabs, if installed.

No steering cylinder function

Remedy:

1. Disconnect the steering cylinders. The steering nozzle will now be pointed astern by the force of the jet of water.
2. It is possible to steer using a paddle or an oar at the side of the boat. If, for example, you wish to turn to starboard, use the oar on the starboard side.

Warning!
Steering with only one water jet unit reduces steering capability.

No reversing cylinder function

Remedy:

1. Disconnect the reversing rods.
2. Tie up the reversing bucket so that it is in “full ahead” position as illustrated in Figure 5-8.
3. Start the engines.
4. Use this water jet unit as a booster. Brake with the other water jet unit.
5. The steering function is as normal.

Warning!
Braking with one water jet unit reduces braking capability.

Damaged reversing bucket control cable

Remedy:

1. Disconnect the control cable at the reversing cylinder and move it by hand to “full ahead”position as illustrated in Figure 5-9.

Warning!

Observe that during this manoeuvre the piston rods enters the boat and this can cause serious injury if a limb is caught between a piston rod and the gear/engine.

2. Start the engine.
3. Use the throttle to increase/reduce speed.

Warning!

Braking with one water jet unit reduces braking capability.

4. Steer with the steering wheel as usual.

6. Troubleshooting

A number of symptoms and possible causes of operational problems are described in the table below. In the event of faults or errors that you cannot remedy yourself you should always contact Rolls-Royce.

Warning!

Read through the safety instructions before beginning the maintenance work, see page 8 section "Maintenance work".

6.1 Operating troubles

Steering does not function correctly

Possible cause	Corrective action
1. Installation of the steering components	The steering components may be incorrectly installed.
2. Hydraulic fault	For more information see page 44 "Manoeuvring in the event of a hydraulic fault".

The boat does not reverse

Possible cause	Corrective action
1. Hydraulic fault	For more information see page 44 "Manoeuvring in the event of a hydraulic fault".
2. Obstruction in the reversing bucket	Remove the obstruction, see page 24 "Removing an obstruction of the water jet unit".
3. Installation of the reversing components	The reversing components are incorrectly installed.
4. The reversing bucket is not lowered enough	Check the reversing bucket indicator and the settings of the levers in control system.

Poor performance

Possible cause	Corrective action
1. The reversing bucket is not raised enough	Check the reversing bucket indicator and the settings of the levers in control system.
2. Engine fault	Read the engine instruction manual.
3. Obstruction in the impeller housing, guide vane chamber or in the inlet duct	Remove the obstruction, see page 24 “Removing an obstruction of the water jet unit”.
4. Bearing fault	Check the oil level, see page 33 “Oil level in the bearing housing”.
5. Partially defective impeller	If the impeller blades are lightly damaged they can be filed off. Otherwise the impeller has to be replaced.
6. The clearance between the impeller and the impeller housing is too great	The impeller or running surface of the impeller housing is worn out.

Abnormal noise from the impeller housing

Possible cause	Corrective action
1. Obstruction in the impeller housing, guide vane chamber or in the inlet duct	Remove the obstruction, see page 24 “Removing an obstruction of the water jet unit”.
2. Partially defective impeller	If the impeller blades are lightly damaged they can be filed off. Otherwise the impeller has to be replaced.
3. Defective impeller housing	Repair or replace the impeller housing.

Abnormal vibrations

Possible cause	Corrective action
1. Obstruction in the impeller housing, guide vane chamber or in the inlet duct	Remove the obstruction, see page 24 “Removing an obstruction of the water jet unit”.
2. Partially defective impeller	If the impeller blades are lightly damaged they can be filed off. Otherwise the impeller has to be replaced.
3. Shaft damaged	Replace the shaft, check if the bearing housing components are damaged.

Abnormal noise from the bearing housing

Possible cause	Corrective action
1. Oil level is too low	Check the oil level, see page 33 “Oil level in the bearing housing”.
2. Defective mechanical sealing	Check if there is water leakage from the bearing housing inspection holes, see page 34 “Weekly”.
3 Temperature too high	Check the temperature of the bearing housing. Normal temperature is approximately 20–40°C higher than the temperature of the water. If the temperature is too high, contact Rolls-Royce.

7. Technical information

7.1 Technical data

Water jet unit	FF550
Weight (water jet only)	960 kg
Water volume in inlet duct	325 l
Power range	300–1500 kW
Oil quantity in bearing housing	7 l

7.2 Recommended lubricants and sealants

Type	Rolls-Royce recommend
Oil in bearing housing	Transmission oil (ISO VG 68 with EP-additives)
Hydraulic oil for the control system	Standard mineral oil ISO VG46
Sealant when installing the water jet unit to the hull	Sikaflex® 252 Bostik® 2639 3M® 5200
Gasket adhesive	Loctite® 5203
Water resistance grease	SKF LGWA 2/0.4
Installation paste	CRC® aluminium paste
Thread sealant, securing Thread sealant, securing Thread sealant, locking	Loctite® 243 Loctite® 222 Loctite® 270
Glue	Loctite® 648

7.3 Special tools

Special tools		
Pos	Type	Qty
1	Special puller for the shaft flange / impeller	1
2	Special wrench for the bearing tensioner nut	1
3	Special wrench for the impeller nut	1
4	Special tool for installing the seals of the bearing housing	1
5	Special tool for installing the slide bearings in the bearing housing	1

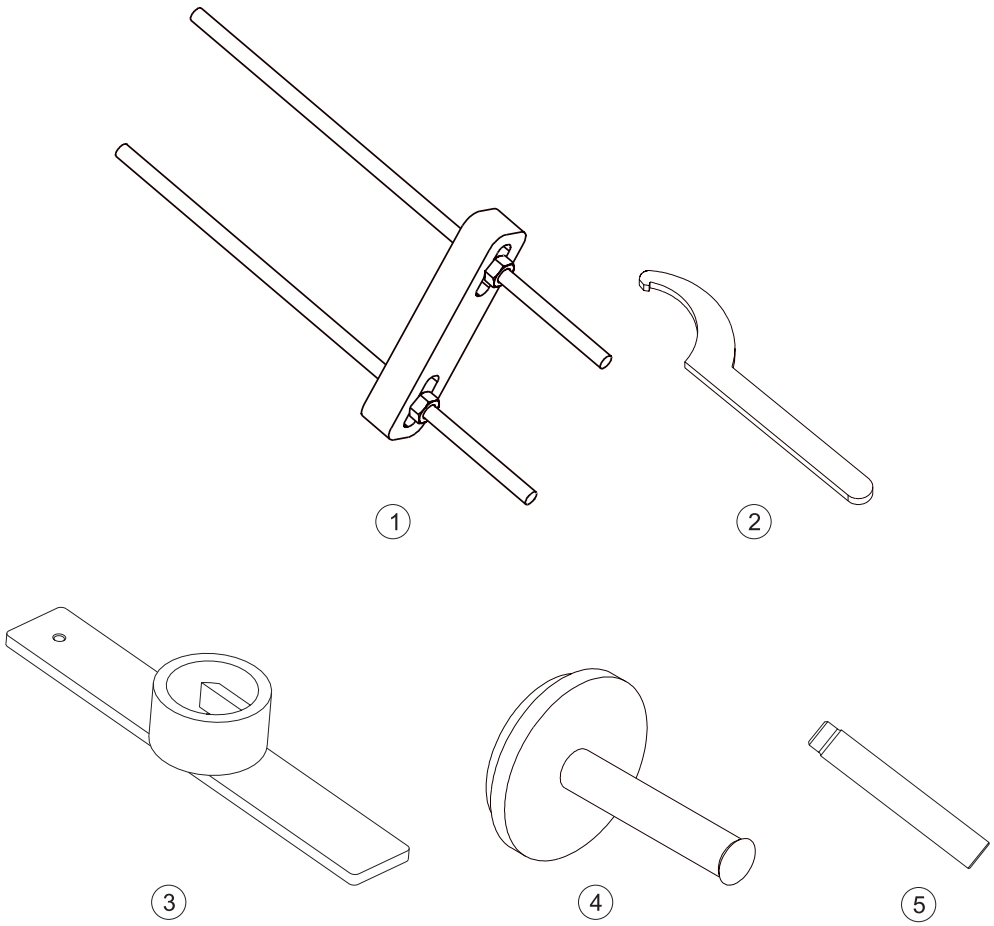


Figure 7-1. Special tools to be used when removing and installing components.

NOTE!
Special tools 1-3 are delivered with the water jet unit.

7.4 Tightening torques

Component	FF550
Stopper ring	15 Nm
Mechanical sealing	10 Nm
Seal holder	30 Nm
Bearing tensioner nut	20 Nm
Bearing tensioner nut, locking screws	30 Nm
Bearing housing cover to bearing housing	25 Nm
Bearing housing, assembly nuts	160 Nm
Bearing housing, assembly lock nuts	200 Nm
Bearing housing, upper cover	25 Nm
Bearing housing, lower cover	25 Nm
Bearing housing, oil pump	25 Nm
Bearing housing, stopper cover	25 Nm
Bearing housing, stopper	50 Nm
Anodes on the inlet duct	20 Nm
Inner inspection hatch	70 Nm
Inner inspection hatch, tube extension	25 Nm
Anode below the anode hatch	30 Nm
Anode hatch	25 Nm
Reversing cylinders	70 Nm
Steering cylinders	70 Nm
Impeller housing	70 Nm
Impeller nut	1000 Nm
Anode in the guide vane chamber	20 Nm
Anodes on the guide vane chamber	20 Nm
Guide vane chamber	70 Nm
Anodes on the guide vane chamber / impeller housing	10 Nm
Steering nozzle	180 Nm
Steering rod	120 Nm
Lock nut for steering rod coupling	300 Nm
Anodes on the reversing bucket	20 Nm
Reversing bucket	300 Nm
Reversing rod	120 Nm
Lock nut for reversing rod	300 Nm
Shaft flange	1000 Nm

Anode below the inspection hatch	30 Nm
Anodes in the inlet pipe	30 Nm

7.5 Conversion factors

Metric to U.S. factors	Multiply by
mm to inches	0.03937
kg to lb	2.205
N to lbf	0.2248
Nm to lbf ft	0.738
l to U.S. gallon	0.2642
m^3 to cu ft	35.315
m/s to ft/min	196.85

°C to °F: $^{\circ}C = \frac{5}{9} \times (^{\circ}F - 32)$

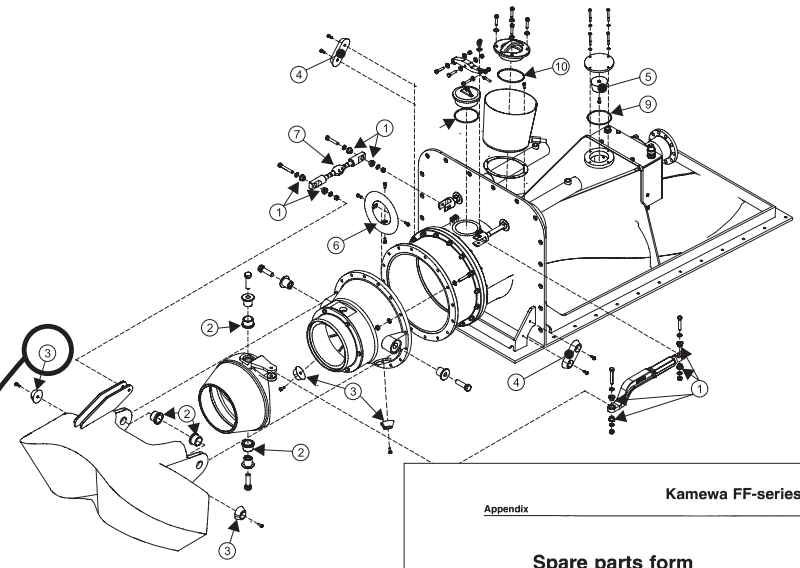
U.S. to metric factors	Multiply by
inches to mm	25.40
lb to kg	0.454
lbf to N	4.448
lbf ft to Nm	1.356
U.S. gallon to l	3.785
cu ft to m^3	0.0283
ft/min to m/s	0.00508

°F to °C: $^{\circ}F = \frac{9}{5} \times (^{\circ}C + 32)$

8. Spare parts

8.1 Ordering spare parts

In this chapter and from the enclosed “assembly drawing” you will find the information you need to order spare parts. Complete the spare parts form with the information needed, you will find a copy of the form in section “DRAWINGS”.



Pos	Qty	Spare part	Part number
1	8	Bearing bushing	101 084 12
2	4	Bearing bushing	101 051 42
3	4	Anode	101 077 01
4	2	Anode	101 080 10
5	1	Anode	101 082 10
6	1	Anode	375 174 11
7	1	Anode	102 081 20
8	1	O-ring	102 026 29
9	1	O-ring	102 026 39
10	1	O-ring	102 026 26

Information about the spare part is found in the table

Fill in the spare parts form

Kamewa FF-series

Appendix — Spare parts form

Spare parts form

Send this form to us when ordering spare parts. Contact information is written on the backside of this form.

Customer: _____ Telephone: _____
Contact person: _____ Telefax: _____
Reference No: _____ E-mail: _____

VAT No: _____

Address: _____ Date needed: _____
_____ Way of delivery: _____
_____
_____

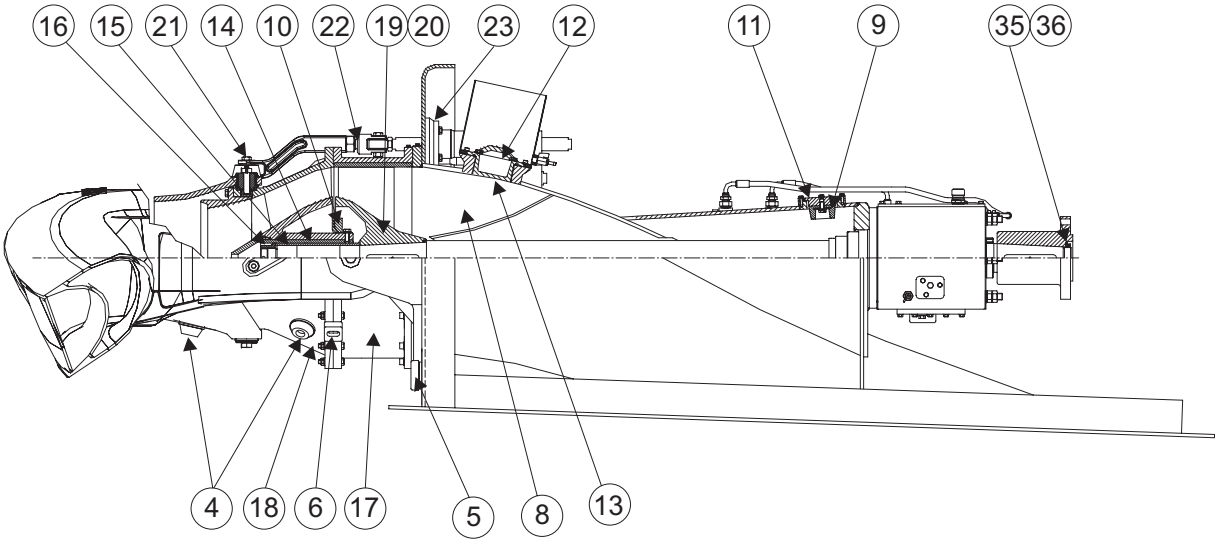
Water jet unit: _____
Serial No: _____
_____

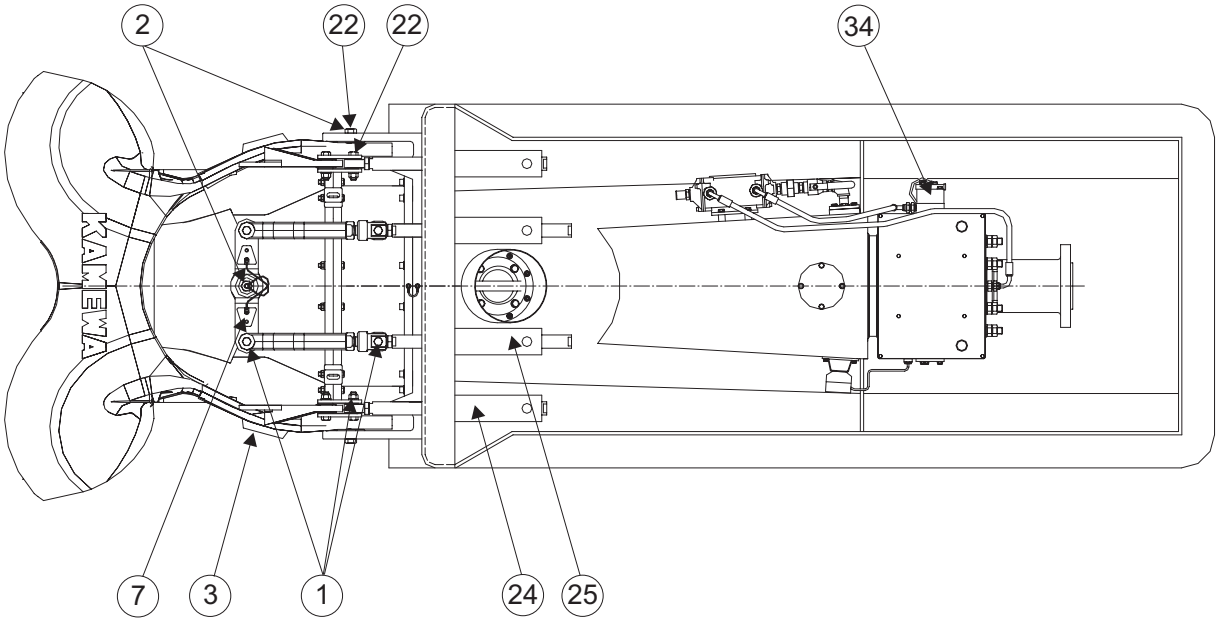
Spare part list

Part number	Spare part	Quantity

10132301
2000-10-03 1 Rolls-Royce Oy Ab

8.2 Spare part series 1, 1-2 seasons or a maximum of 1500 h of operation



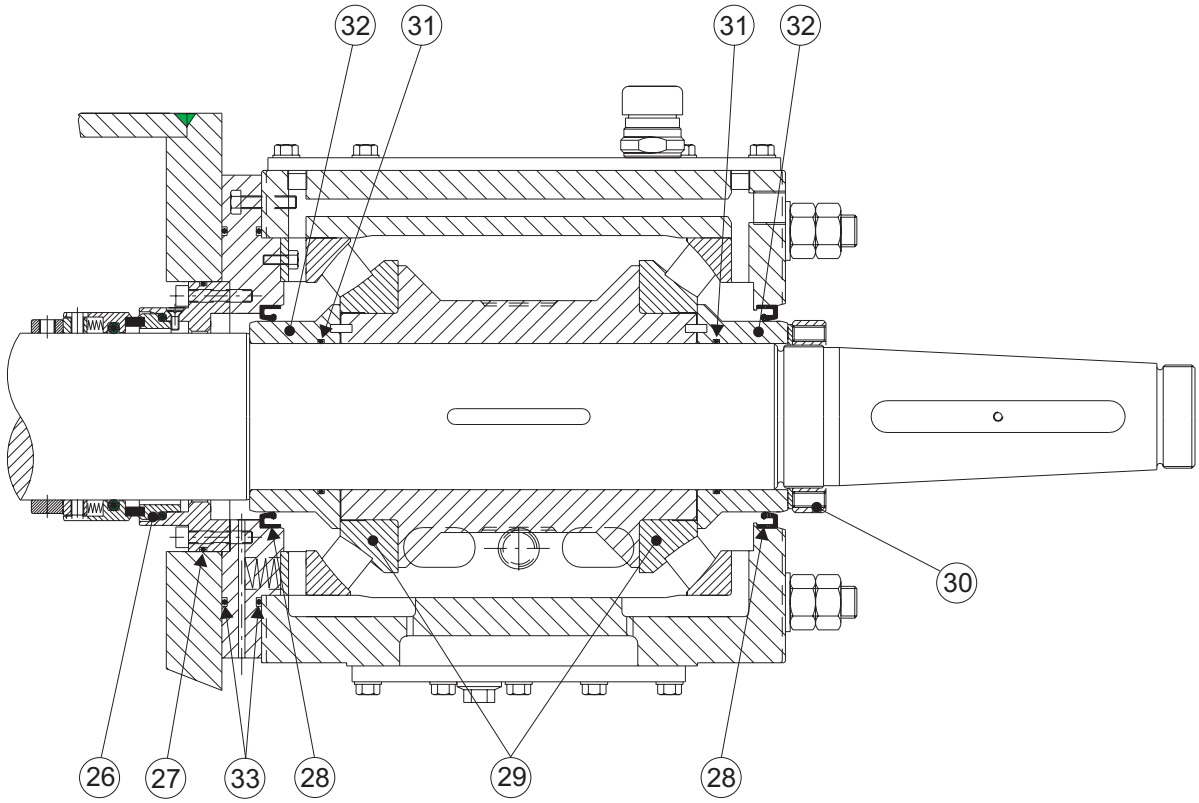


NOTE!

Position numbers 13–24 and 33–35 belong to chapter 8.3 "Other spare parts".

Pos	Qty	Spare part	Part number
1	16	Bearing bushing	101 069 30
2	8	Bearing bushing	101 051 50
3	2	Anode	101 080 10
4	3	Anode	101 077 01
5	2	Anode	101 082 30
6	4	Anode	101 082 20
7	2	Anode	872175
8	2	Anode	101 082 30
9	1	Anode	101 082 10
10	1	Anode	550 174 01
11	1	O-ring	102 026 39
12	1	O-ring	102 026 26
13	1	Anode	101 082 28

8.3 Other spare parts



Pos	Qty	Spare part	Part number
14	1	Rubber bearing	550 014 01
15	1	Shaft bush	550 013 01
16	1	Impeller lock nut	550 016 02
17	1	Impeller housing	550 003 02
18	1	Guide vane chamber	550 186 01
19	1	Impeller	550 007 __
20	1	O-ring	102 026 10
21	2	Distance sleeve	101 078 50
22	8	Distance sleeve	101 078 10
23	4	Seal	101 189 04
24	2	Reversing cylinder	101 210 81
25	2	Steering cylinder	101 210 81
26	1	Mechanical sealing	2411850
27	1	O-ring	102 026 30
28	2	Seal	102 025 12
29	2	Axial bearing	102 034 13
30	1	Bearing tensioner nut	550 029 01
31	2	O-ring	102 026 09
32	2	Support sleeve	550 021 01
33	2	O-ring	102 026 28
34	1	Oil filter	102 136 01
35	1	Flange nut	102 029 13
36	1	Locking washer	102 030 13

NOTE!
Refer to chapter 8.2 "Spare part series 1, 1-2 seasons or a maximum of 1500 h of operation" for location of numbers 13–24 and 33–35.

Glossary

Anode	A metal that protects the water jet unit from corrosion by sacrificing itself.
Anti-fouling paint	Paint that prevents fouling.
Booster	Water jet unit without steering and reversing bucket. Often used as the centre water jet unit on boats with three water jet units.
Cavitation	Cavitation is a phenomenon that may occur in any fluid subjected to velocity increase or a body moving rapidly through the fluid. According to Bernoulli's equation an increase in velocity causes a drop in static pressure. If the pressure drops to the vapour pressure of the fluid, pockets of vapour will be formed. The vapour pressure varies with the temperature of the fluid. These pockets may suddenly collapse, either because they are carried along by the liquid until they arrive at a point of higher pressure, or because the pressure increases again at the point in question. The forces then exerted by the liquid rushing into the cavities may cause very high local pressures which can lead to serious erosion of boundary surfaces. In extreme cases light may be emitted when the cavity collapses.
Displacement boat	Type of boat on which the hull never planes on the water but ploughs through the water. In contrast a planing craft functions as a displacement craft up to a certain speed when the hull rises out of the water and reaches planing position.
Docked	Dock, equipment (fixed or floating) which allows the boat to stand dry on the bottom when the water has been pumped out of the dock. Docks are usually used for larger craft. Smaller craft are usually lifted onto land.
Laid up water jet unit	Boat docked.
Marine gear	Transmission for boats, also designated reverse gear. Usually has only two gear positions, forward and reverse, plus neutral po-

	sition. Generally produces a reduction in engine speed (RPM).
Single installation	Boat with one water jet unit installed.
Thrust	The pressure force generated by the jet of water that forces the boat forward.
Twin installation	Boat with two water jet units installed.
Zero thrust position	All ahead and astern thrusts are equal. See “Function of the reversing bucket chapter“ and section “Zero thrust position”.

ROLLS-ROYCE Oy Ab

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