

# TECHNICAL MANUAL

## RESCUE BOAT DAVIT

TYPE: PIV 1.0A

MANUFACTURED BY



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.....Leading the World in Davit Technology

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**\* IMPORTANT \***

**STORAGE INFORMATION**

**ON DELIVERY, THE EQUIPMENT MUST BE STORED INSIDE  
A DRY ENVIRONMENT TO PREVENT DAMAGE TO  
ELECTRICAL EQUIPMENT DUE TO CONDENSATION.**





## CHANGE RECORD

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## FOREWORD

This technical manual includes general information, operation, scheduled and corrective maintenance, troubleshooting, drawings and parts lists and installation for the RESCUE BOAT DAVIT, 'A' Frame Pivot Type PIV 1.0A equipment aboard vessel \_\_\_\_\_.

The manual is compiled in accordance with the following Maritime Safety Committee regulations;

- MSC.1/Circ.1205: Guidelines for Developing Operation and Maintenance Manuals for Lifeboat Systems.
- MSC.1/Circ.1206: Measures to Prevent Accidents with Lifeboats.
- MSC.1/Circ.1093: Guidelines for Periodic Servicing and Maintenance of Lifeboats, Launching Appliances and On-Load Release Gear.

The manual is arranged as follows:

Chapter	Title
1.	General Information and Safety Precautions
2.	Operation
3.	Functional Description
4.	Scheduled Maintenance
5.	Troubleshooting
6.	Corrective Maintenance
7.	Drawings and Parts Lists
8.	Installation
9.	Appendix

## DISCLAIMER

**This original technical manual is an English language document. Welin Lambie Ltd accepts no responsibility or liability for the accuracy of any translation, in part or full, into alternative languages by other parties.**



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## SAFETY SUMMARY

### General Safety Notices

The following general safety notices supplement the specific warnings and cautions that appear elsewhere in this manual. They are recommended precautions that must be understood and applied during the operation and maintenance of this davit. Should situations arise that are not covered in the general or specific safety precautions, the commanding officer or other authority will issue orders as deemed necessary to cover the situation. This davit can be dangerous if not operated or maintained correctly.

### Safety Terms

The following terms define the various precautions and notices in this manual.

**WARNING:** Whenever potential personal injury or death situations exist that requires the correct procedures or practices for prevention, the term 'WARNING' is used. Carefully read the message which follows this term, and be alert to the possibility of personal injury or death.

**CAUTION:** Whenever potential damage to equipment exist which require correct procedures for prevention, the term 'CAUTION' is used.

**IMPORTANT:** Whenever information exists that requires special attention to procedures or to ensure proper operation of the davit, or to prevent its possible failure, the term 'IMPORTANT' is used.

**NOTE:** Whenever information exists that requires additional emphasis beyond the standard text, the term 'NOTE' is used.

**NOTE:** All possible safety hazards cannot be foreseen so as to be included in this manual. Therefore, the operator must always be alert to the possible hazards that could endanger personnel or damage the equipment.

**This symbol is used on the davit, whenever potential injury or death exists from electric shock.**



### Operational Safety

The davit operator must receive the proper training before operating the davit. If the operator is trained but does not routinely operate the davit, refresher training is recommended.

Do not operate the davit if you know of any malfunctions, missing parts, and/or incorrectly setup adjustments. These can cause or contribute to an accident to personnel or damage to equipment. Lower the load and stop using the davit immediately if a problem arises during operation.

Before starting operations, walk round the davit and inspect for obvious signs of damage that could prejudice safe operations.

Ensure all personnel who are not required for the operation being carried out are clear of the operating area.

The surrounding area should be inspected for foreign material or objects, which could interfere with davit operations.

If a problem with the davit occurs after commencing an operation, stop immediately and consult with the commanding officer or other authority before proceeding.

Never allow anyone under the boat while it is suspended from the davit.

Never attempt any lifting operation with less than four turns of rope on the drum, as the rope clamp plate is not designed to hold loads.

Do not overload the davit beyond its rated Safe Working Load except during authorised tests.

Always leave the davit in a safe condition. Never leave unattended with control system active.

The davit operator must not open any enclosed compartment identified as carrying high voltage.

Regularly inspect ropes, shackles, hooks, gripe gear etc., before and while operating for signs of damage such as cuts, abrasion, rust, kinks etc. Do not use suspect equipment if it's not worth it. Destroy any damaged equipment so that it cannot be used again.

## **Maintenance Safety**

The maintenance tasks on the davit can be dangerous unless carried out properly. The maintainer must have the necessary skills, information, proper tools and equipment to perform the maintenance task and be fully conversant with the safe working practices of the local and shipboard health and safety regulations.

Never attempt any maintenance while the davit is loaded unless it is part of a specific adjustment or procedure.

Always switch 'OFF' power at the davit isolator, which can be padlocked in the 'off' position, before carrying out work on any electrical equipment. Tag "out of service" or follow standard shipboard procedures to ensure that power will not be reconnected while the maintenance task is being carried out. The electrical supply to the davit should be

isolated and tagged as an added precaution. Power should be restored as soon as possible to prevent build up of condensation. If condensation has occurred the davit must not be used until the heaters have been reconnected and dried out the equipment.

If electrical panels are opened when it is raining they must be covered to prevent ingress of water.

When testing live equipment always use meters etc., which have been checked for safety and follow manufacturer's instructions for their safe use.

Always follow local health and safety or shipboard regulations when maintaining electrical equipment.

Do not bypass any electrical safety interlock circuits.

Ensure all electrical equipment is properly grounded.

Special care should be taken where power operations require the removal of guards. Unguarded rotating parts may present a serious hazard. Only persons familiar with these hazards should carry out these operations. The control station should be manned at all times to prevent unauthorised operation and to be prepared to operate the 'Emergency Stop' button should an accident occur.

### **Authorised Spares and Service Agents**

Only genuine replacement parts sourced from Welin Lambie Ltd should be used to ensure fit, function and reliability of the life saving equipment. Refer to Section 7.0: Drawings and Parts Lists, to identify spare and replacement parts.

**CAUTION:** To comply with current statutory regulations all major repairs and annual inspections must be carried out by Welin Lambie technicians, or persons trained and authorised by Welin Lambie.

Please contact Welin Lambie Ltd for all spares requests and availability of local service engineers.

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## **1.0 GENERAL INFORMATION AND SAFETY PRECAUTIONS**

This chapter provides general information on the 'A' Frame Pivot Davit (Type: PIV 1.0A) and safety precautions that must be adhered to when it is being operated or maintained.

### **1.1 GENERAL INFORMATION**

#### **1.1.1 Davit Description**

The davit is designed to launch/recover a Rescue Boat in accordance with the latest SOLAS 2010 regulations, Chapter III, Regulation 4.

The davit is shown in figure 1.1: General Davit Layout, indicating all the main features.

The main structure consists of a davit ('A' frame, deck stools, arm pivot brackets, main rope and gripes/lashing device), a winch (spur/pinion gear set, manual disc brake, centrifugal brake and rope drum) and a power pack (reservoir, control panel, accumulator and motor/pump arrangement).

Luffing out and lowering of the rescue boat can be controlled both from within the boat and at the ship's deck. The lowering speed of the boat can be controlled by operating the remote brake control rope from within the boat, at the ship's deck or by manually lifting the brake release handle on the winch. In addition, it is possible to suspend the lowering operation of the rescue boat at any height.

Recovery of the rescue boat is performed by operating the winch using the 'Hoist' button located on the control station. When the boat reaches a prescribed position the winch is automatically stopped by the hoist limit switch. The davit/rescue boat can now be luffed inboard by manually operating the 'luff' hand valve on the power pack at the ship's deck. After luffing operation is complete the boat can be manually lowered using the winch brake release handle, before being stowed securely in position.

The davit/rescue boat is luffed outboard and inboard by a cylinder, powered by oil stored in an accumulator. The accumulator is permanently charged by an electrically driven pump within the power pack. The capacity of the accumulator enables emergency launch and recovery even if the ship's power fails. Conversely, if the accumulator fails, the pump is capable of luffing the davit load, though at approximately half the speed.

The rescue boat can also be manually recovered in an emergency from the winch, using the supplied turning handle. With the turning handle fitted the winch is fully safety interlocked to prevent power hoisting (if power is restored) and gravity lower.

To avoid possibly injury or death, read this manual carefully before using the rescue boat davit, winch, and the automatic offload release hook.

### 1.1.2 Davit Specification

Equipment:	'A' Frame Pivot Davit
Equipment Type No:	PIV 1.0A
Davit SWL:	1000 kg (2205 lbs)
Rescue Boat:	Zodiac RIBO 420
Hoist Rope:	Diameter: Ø9 mm. Construction: 24/7 multi-strand, non-rotating. Minimum breaking load: 6983 kg (15,395 lbs)
Main Power Supply:	600vAC: 3ph: 60Hz
Auxiliary Power Supply:	110vAC: 1ph: 60Hz
Winch Electrically Operated:	
Electric Motor Power:	4.8 kW (6.4 Hp) @ 1800 rpm
Power Hoist SWL:	0 to 18 m/min. (minimum)
Winch Manually Operated:	
Hand Hoist:	Turning handle
Gravity Lower:	45 m/min. minimum to 60 m/min. maximum
Davit Luffing Hydraulically Operated:	
Electric Pump Motor Power:	1.5 kW (2 Hp) @ 1800 rpm
Accumulator Oil Capacity	20 litres
Accumulator Nitrogen Pre-Charge	76 bar (1100 psi)
Hydraulic Cylinder	Ø80 mm bore x Ø45 mm rod 425 mm stroke
Operating Conditions:	
Maximum Angle of List:	+/- 20°
Maximum Angle of Trim:	+/- 10°
Maximum Operating Temperature:	35°C (95°F)
Minimum Operating Temperature:	-20°C (-4°F)



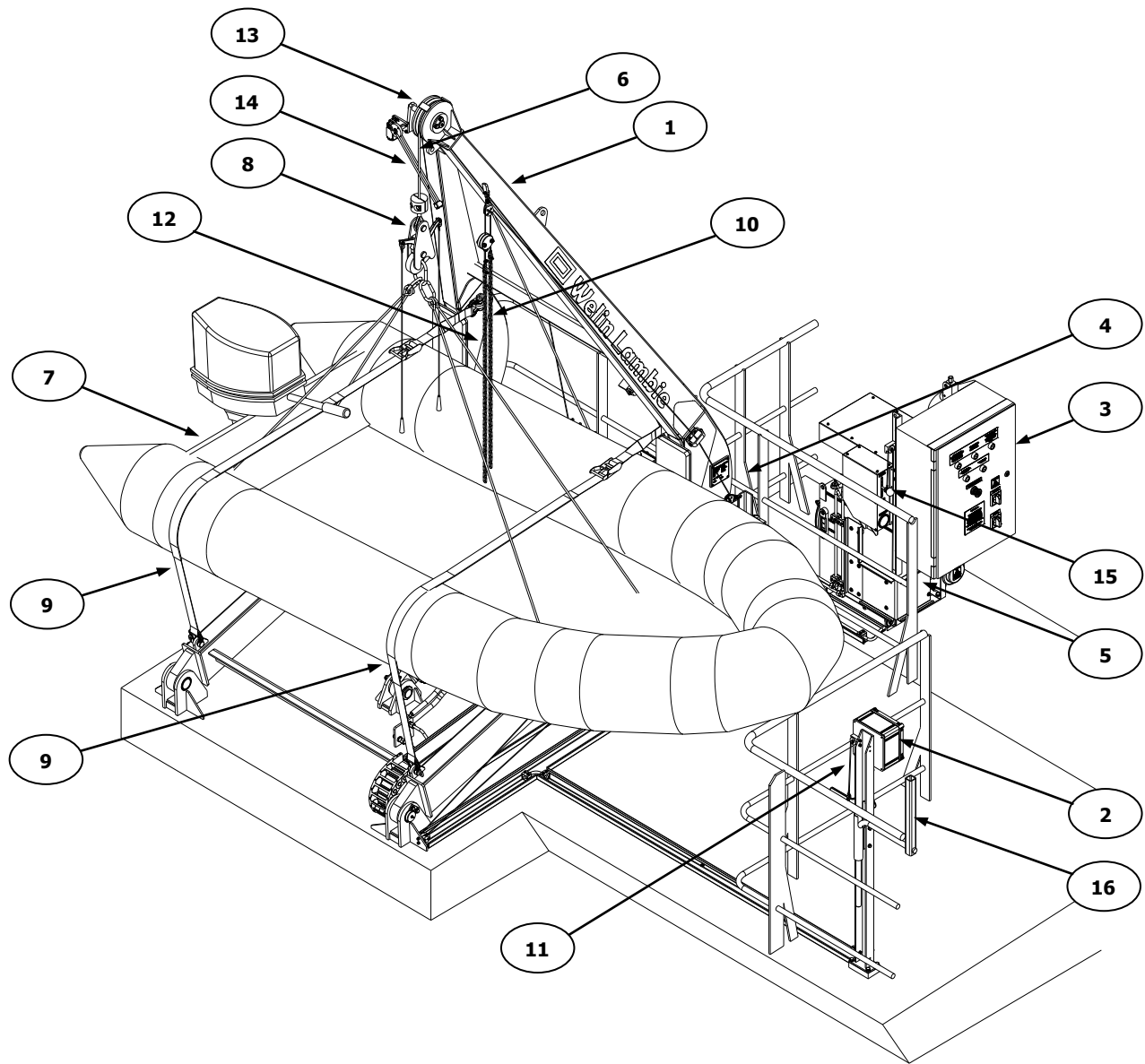


Figure 1.1: General Davit Layout

Key for figure 1.1:

1. Davit 'A' Frame
2. Control Station (supplied by Welin – positioned by shipyard)
3. Control Panel
4. Winch Gearbox
5. Hydraulic Power Pack (c/w accumulator, reservoir, motor, pump etc.)
6. Main Rope
7. Rescue Boat
8. Release Hook
9. Boat Gripes
10. Remote Brake Control Rope – Boat
11. Remote Brake Control Rope – Deck
12. Remote Luff Control Rope – Boat
13. Head Sheave

- 14. Hoist Limit Switch Striker Arm
- 15. Luff Hand Valve
- 16. Turning Handle

## 1.2 SAFETY

Before any operational or maintenance functions are carried out the following section on safety and the safety summary appearing prior to this chapter must be read and understood. If any of the information is not fully understood, clarification must be sought from the manufacturer.

### 1.2.1 Warning and Cautions

Warnings and cautions appear throughout this manual and are of paramount importance to personnel and equipment safety. Should situations arise that are not covered in the general safety precautions or rules, the commanding officer or other authority will issue orders as deemed necessary to cover the situation.

The following terms define the various precautions and notices in this manual:

**WARNING:** Whenever potential personal injury or death situations exist that requires the correct procedures or practices for prevention, the term 'WARNING' is used. Carefully read the message which follows this term, and be alert to the possibility of personal injury or death.

**CAUTION:** Whenever potential damage to equipment exist which require correct procedures for prevention, the term 'CAUTION' is used.

**IMPORTANT:** Whenever information exists that requires special attention to procedures or to ensure proper operation of the davit, or to prevent its possible failure, the term 'IMPORTANT' is used.

**NOTE:** Whenever information exists that requires additional emphasis beyond the standard text, the term 'NOTE' is used.

**NOTE:** All possible safety hazards cannot be foreseen so as to be included in this manual. Therefore, the operator must always be alert to the possible hazards that could endanger personnel or damage the equipment.

**This symbol will be used, whenever potential injury or death exists from electric shock.**



### 1.2.2 General Safety Precautions

Personnel responsible for the davit's operation and maintenance shall become thoroughly familiar with and frequently review these safety precautions and the safety summary, which appears prior to this chapter.

The davit shall be installed and grounded in accordance with applicable regulations and shipboard practices.

All operation and maintenance shall comply with applicable health and safety standards.

Proper installation and maintenance of protective guards, safety devices, and high voltage sources shall be observed.

Appropriate safety clothing and equipment must be worn while carrying out operations and maintenance tasks.

Only genuine spare parts supplied by the davit manufacturer shall be used. The safety of the davit may be compromised if inferior parts of doubtful specification are used.

No toxic materials have knowingly been used in the davit construction or produced in its use. However, lubricating oils and greases are used and should be handled and disposed of in accordance with the manufacturers' recommendations and local regulations.

### 1.2.3 General Rules

The following rules are to be observed whenever operating or carrying out maintenance on the davit:

- Do not make unauthorised alterations to the davit.
- Do not attempt to start, operate, maintain, or troubleshoot, etc., the davit without first reading and understanding the appropriate portion of this manual.
- Do not turn 'OFF' the davit electric power isolators after operations are finished, it is essential that power to the davit is maintained at all times, except during maintenance procedures, to run the anti-condensation heaters. Damage to the electrical system may occur if the power is turned 'off' for more than a few hours. When the power is returned the davit should not be operated until any condensation, which may have collected, has dried out.
- Do not attempt to operate or maintain the davit while alone, it is essential that someone watch for problems or make signals when operating and to be ready to give emergency assistance to the maintainer if necessary.
- Do not remove any of the guards or safety devices, except for maintenance.
- Before starting operations, walk round the davit and inspect for obvious signs of damage that could prejudice safe operations.

- Ensure all personnel who are not required for the operation being carried out are clear of the operating area.
- The surrounding area should be inspected for foreign material or objects, which could interfere with davit operations.
- Do not operate the davit if you know of any malfunctions, missing parts, and/or incorrectly setup adjustments. These can cause or contribute to an accident to personnel or damage to equipment. Lower the load and stop using the davit immediately if a problem arises during operation.
- Do not wear loose clothing while working near rotating parts of the davit.

### 1.3 DAVIT SAFETY FEATURES

The davit incorporates specific safety features including guards, safety switches/buttons and limit switches, together with a winch safety device, which are listed and explained below. See figure 1.2: Specific Davit Safety Features.

Key for figure 1.2:

1. Winch Rope Drum Guard
2. Deck Guards
3. Winch Turning Handle Safety Device
4. Winch Turning Handle Safety Switch
5. Winch Brake Release Handle Mechanism
6. Winch Brake Release Handle Safety Switch
7. Hoist Limit Switch
8. Emergency Stop Button – Control Station
9. Emergency Stop Button – Control Panel
10. Emergency Stop Button – Winch Terminal Box

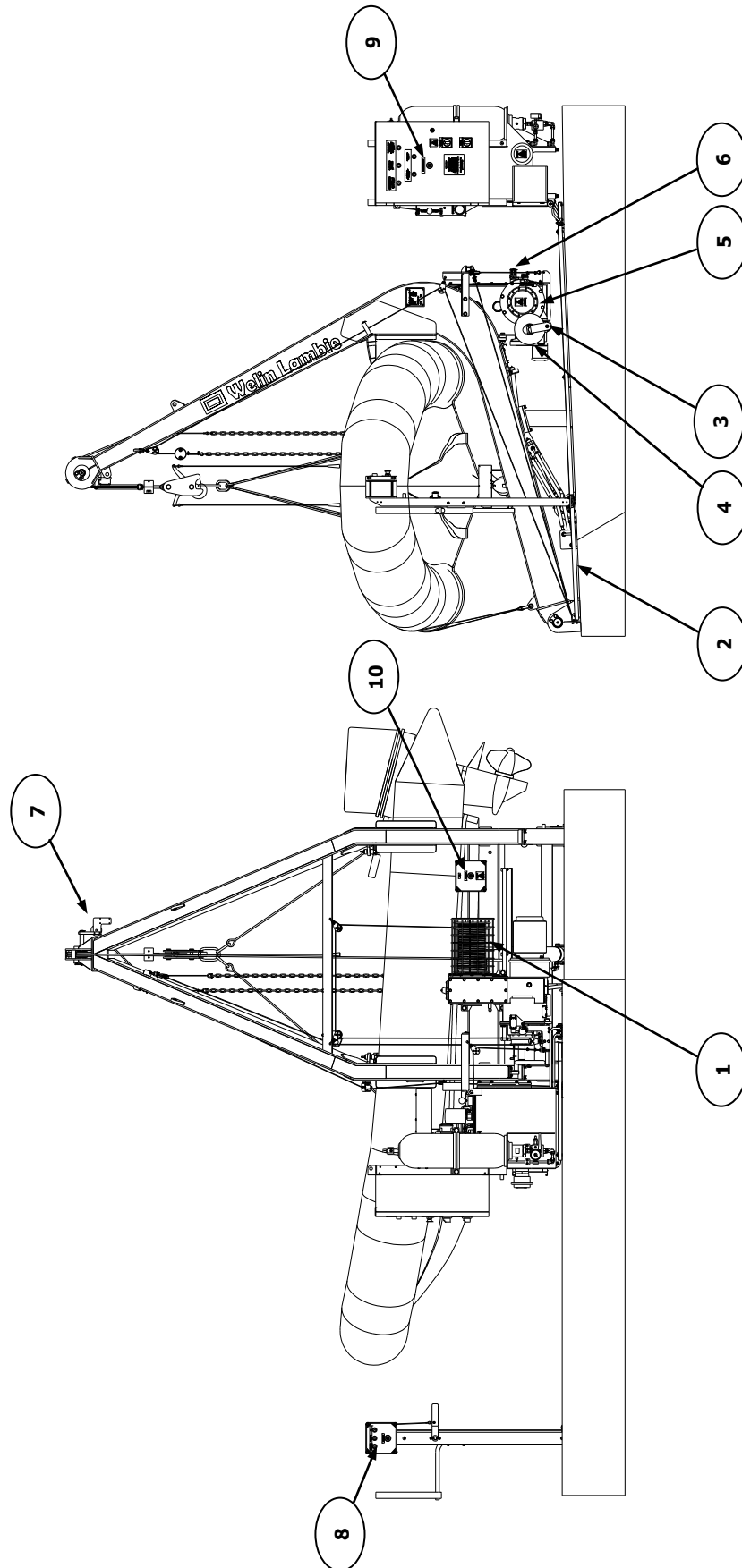


Figure 1.2: Specific Davit Safety Features

### 1.3.1 Guards

Guards are fitted to the davit where there is a possibility that danger exists, to personnel, from moving parts. The position of which is shown in figure 1.2: Specific Davit Safety Features.

- Winch Rope Drum Guard:

This guard should only be removed when reeving/de-reeving ropes and greasing.

- Deck Guards:

All electrical cables, hydraulic pipe work and remote ropes are routed in enclosed stainless steel cable tray, when possible, for added protection. These guards should only be removed for inspection and maintenance.

### 1.3.2 Safety Switches/Buttons

Safety switches are fitted to the davit where danger, to personnel, exists due to power operation. The location of which is shown in figure 1.2: Specific Davit Safety Features.

- Winch Turning Handle Safety Switch:

This switch is fitted to the turning handle safety device on the winch. There is a safety plate, which must be moved to one side to attach the turning handle, in doing so it operates the switch and prevents the mechanism being operated by power until the handle is removed, and the 'Safety System Tripped' reset pressed.

- Winch Brake Release Handle Safety Switch:

This switch is fitted to the brake release handle safety mechanism on the winch. The switch is interconnected mechanically and electrically to provide an integrated safety system, whereby when the turning handle is fitted the brake cannot be released and the motor engaged, or the motor engaged and the brake released. Manually releasing the brake requires that the 'Safety System Tripped' reset button must be pressed to continue any power operations.

- Emergency Stop Button:

If an emergency stop button is pressed, all power operation will stop. The control being used at the time this button was operated must be returned to 'OFF' and the button reset, by pulling out, and the 'Safety System Tripped' reset pressed, before that operation can recommence. Emergency stop buttons are located on the control station, control panel and the winch terminal box.

**NOTE:** These switches/buttons are monitored by a safety relay, which if any are operated or faulty will prevent all power operation until the switch is reset if operated or replaced if faulty.

### 1.3.3 Hoist Limit Switch

The hoist limit switch is fitted to the davit head and is operated by the approach of the hook to prevent the hook coming hard up against the davit frame.

### 1.3.4 Winch Turning Handle Safety Device

This device is fully safety interlocked with the turning handle safety switch (refer to 1.3.2: Safety Switches/Buttons) and the brake mechanism. When adjusted correctly, with the turning handle fitted it prevents the brake release handle being lifted, and operates the safety switch preventing power operation.

### 1.3.5 Winch Brake Release Handle Mechanism

This mechanism interconnects mechanically and electrically, the turning handle shaft and main brake. If either the winch turning handle safety switch or brake release handle safety switch (refer to 1.3.2: Safety Switches/Buttons) are activated, by fitting the turning handle or raising the brake release handle, the appropriate safety switch prevents power operation.

### 1.3.6 Specific Davit Warning Labels

Warning labels are fitted to the davit highlighting various adjustments/maintenance tasks that require regular checking or electrical warnings which should be observed. For details see figure 1.3: Location of Specific Davit Warning Labels.

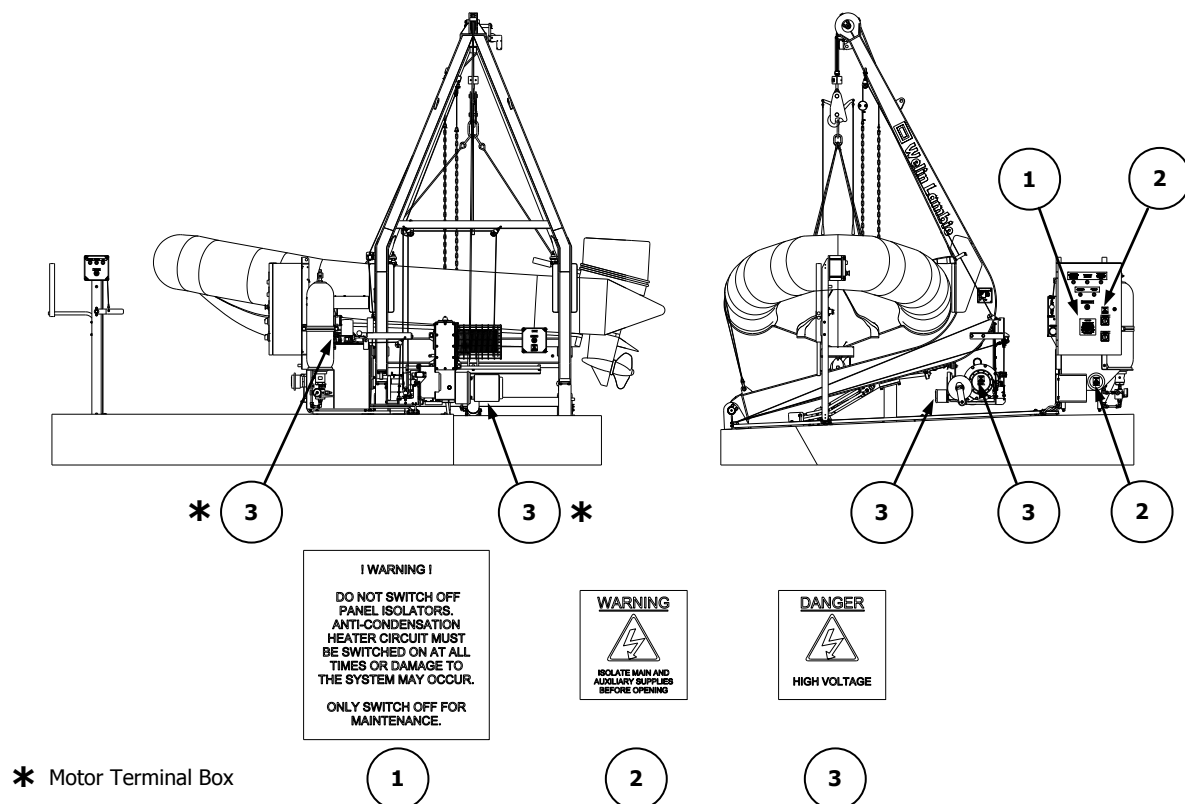


Figure 1.3: Location of Specific Davit Warning Labels





## 2.0 OPERATION

This chapter provides information and instructions how to operate the 'A' Frame Pivot Davit (Type: PIV 1.0A) by power operation, or manually in an emergency.

The operator must be fully trained in all aspects of the Davit operational features before attempting to launch or recover the rescue boat.

**WARNING:** Before operating any controls ensure that any personnel in the area are aware of and will not be endangered by your actions.

### 2.1 DAVIT FUNCTION

The davit is primarily designed to launch/recover a rescue boat by one person on the ship's deck and one person from within the boat.

The boat is luffed inboard to outboard and back by hydraulic power, lowered by gravity and hoisted by power. The boat can also be manually recovered in an emergency from the winch, using the supplied turning handle.

### 2.2 DAVIT OPERATIONAL FEATURES

The main operational features of the davit are shown in figure 2.1: Davit Operational Features.

Key for figure 2.1:

1. Control Station
2. Control Panel
3. Winch Gearbox
4. Remote Brake Control Rope – Boat
5. Remote Brake Control Rope – Deck
6. Remote Luff Control Rope – Boat
7. Luff Hand Valve
8. Brake Release Handle
9. Winch Turning Handle Shaft
10. Winch Turning Handle – Stowed
11. Winch Handwheel
12. Release Hook

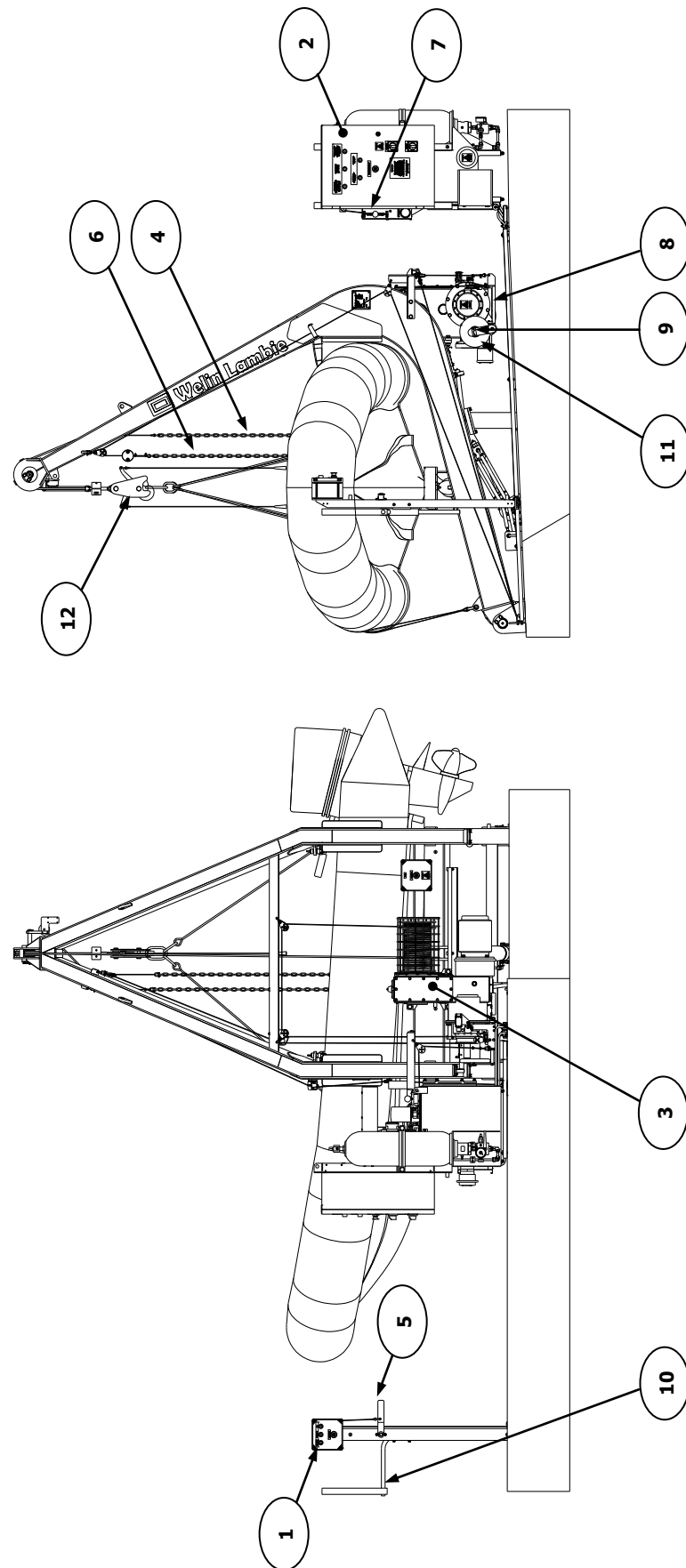


Figure 2.1: Davit Operational Features

## 2.2.1 Boat Connection

The main rope end is terminated with an ordinary thimble, to allow fitting of a suitable hook by the end user. A combined automatic offload release hook (SWL: 3500 kg) is supplied.

**WARNING:** Never enter the rescue boat without ensuring complete closure of release hook. Incomplete resetting of the release hook can cause the boat to drop resulting in death.

## 2.2.2 Control Panel

The control panel is mounted on the hydraulic power pack frame, and contains the mains and auxiliary supply isolator switches, push buttons, various indicators and an emergency stop button, see figure 2.2: Control Panel Layout.

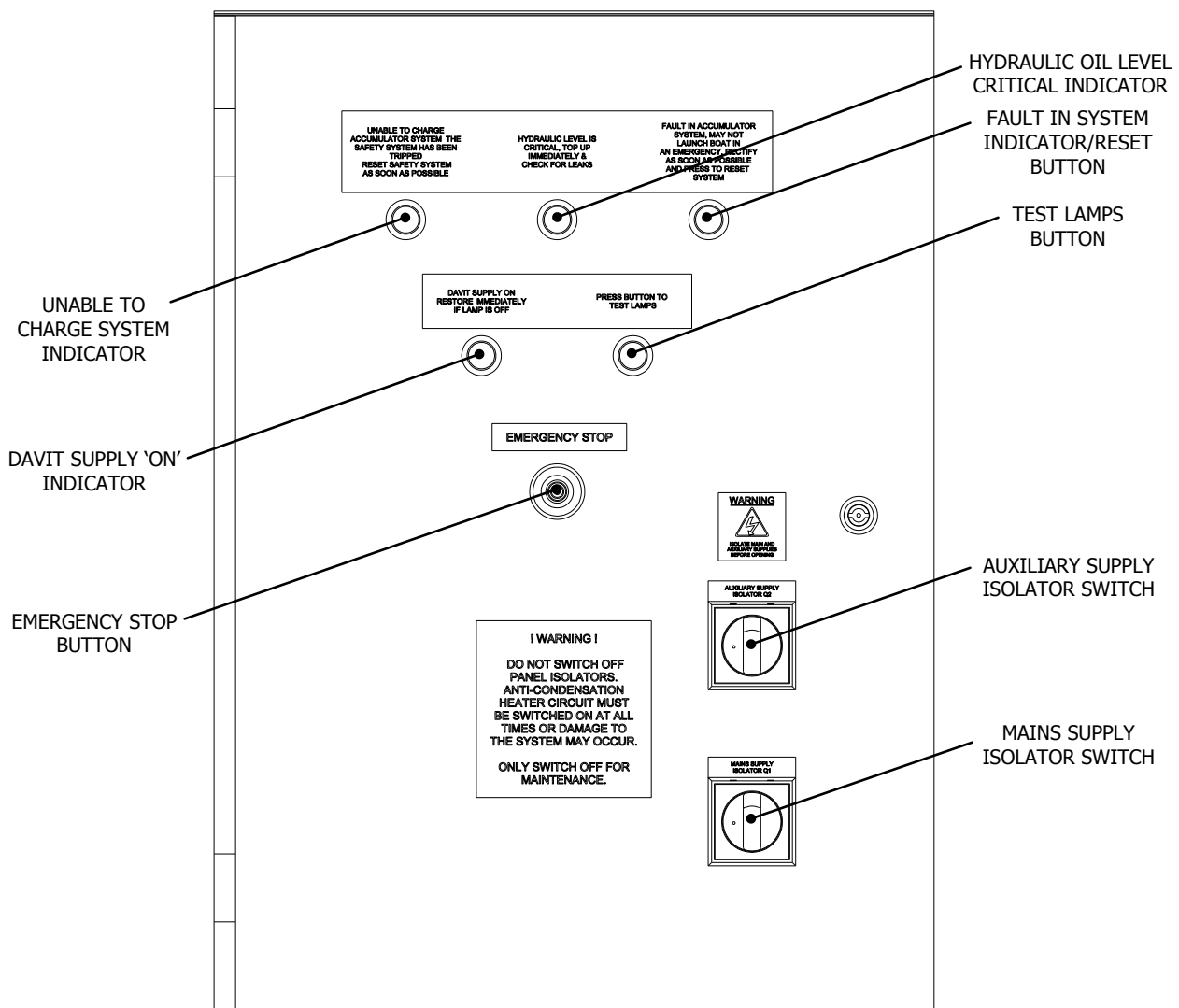


Figure 2.2: Control Panel Layout

The control panel comprises the following:

- **Mains Supply Isolator Switch:**

Power is supplied to the davit by setting the isolator switch to 'ON' position. The mains supply isolator must be 'ON' at all times or damage to the winch motor and hydraulic pump motor circuits may occur. To turn off and access panel, for maintenance only, set to 'OFF' position.

**IMPORTANT:** Both mains and auxiliary supply isolators must be on at all times to enable operation of the davit. With the isolators in the 'ON' position the 'Davit Supply On' indicator, also mounted on the control panel, will be illuminated.

**WARNING:** **Do not switch 'OFF' mains supply isolator. The winch motor and hydraulic pump motor circuits must be on at all times or damage to the system may occur. Switch 'OFF' mains supply isolator for maintenance only.**

- **Auxiliary Supply Isolator Switch:**

Power is supplied to the safety and heater circuits by setting the isolator switch to 'ON' position. The auxiliary supply isolator must be 'ON' at all times or damage to safety and heater circuits may occur. To turn off and access panel, for maintenance only set to 'OFF' position.

**IMPORTANT:** Both mains and auxiliary supply isolators must be on at all times to enable operation of the davit. With the isolators in the 'ON' position the 'Davit Supply On' indicator, also mounted on the control panel, will be illuminated.

**WARNING:** **Do not switch 'OFF' auxiliary supply isolator. The safety and heater circuits must be on at all times or damage to the system may occur. Switch 'OFF' auxiliary supply isolator for maintenance only.**

- **Emergency Stop Button:**

This button when pressed stops any power operation that is currently in motion should a fault/malfunction occur. The button remains depressed preventing further davit actions until the fault/malfunction is rectified. Pulling out the head of the button, and pressing the 'Safety System Tripped' reset button, mounted on the control station, restores power to the davit.

**IMPORTANT:** The emergency stop button must only be used in an emergency situation and should not be used to stop normal power operation.

- **Unable To Charge System Indicator:**

This indicator illuminates if the safety system has been tripped. Press the 'Safety System Tripped' reset button, mounted on the control station, as soon as possible to reactivate the accumulator charging system.

- **Hydraulic Oil Level Critical Indicator:**

This indicator illuminates when the oil level in the hydraulic reservoir is too low. The hydraulic pump will not run until the level has been raised to the 'working level'. The stored oil within the accumulator may not be at sufficient pressure to operate the davit normally.

- **Fault in System Indicator/Reset Button:**

This indicator illuminates when a fault occurs within the accumulator system, which may prevent normal operation of the davit. The fault must be investigated and corrected immediately. Once the fault has been rectified the accumulator charging system is reset by pressing the button.

A gauge is mounted adjacent to the luff hand valve, which registers the pressure of the oil within the accumulator, and should show between 180/200 bar when the davit is operational, but not in use.

**IMPORTANT:** The pressure must be above 180 bar in order to allow normal operation of the davit.

- **Davit Supply 'ON' Indicator:**

This indicator should be illuminated at all times, signifying that the 'Mains' and 'Auxiliary' supply isolators are both set to 'ON', confirming the davit is ready to perform normal operations.

If the indicator extinguishes the mains or auxiliary supply, or both must be restored as soon as possible to prevent damage to any electronic components.

**WARNING:** The 'Davit Supply On' indicator must be illuminated at all times, signifying that the 'Mains' and 'Auxiliary' supply isolators are both set to 'ON'. If the indicator extinguishes the mains or auxiliary supply, or both must be restored as soon as possible to prevent damage to any electronic components. The 'Mains' and 'Auxiliary' supply isolators should be switched 'OFF' for maintenance only.

- **Test Lamps Button:**

This button when pressed illuminates all indicators and buttons, temporarily, on the control panel. Any bulb not illuminating should be replaced immediately.

### 2.2.3 Control Station

The control station (suitably positioned on the ship's deck by shipyard) allows hoisting of the rescue boat or light rope. The station also contains the 'Safety System Tripped' indicator/reset button, station on/off button and an emergency stop button. See figure 2.3: Control Station Layout.

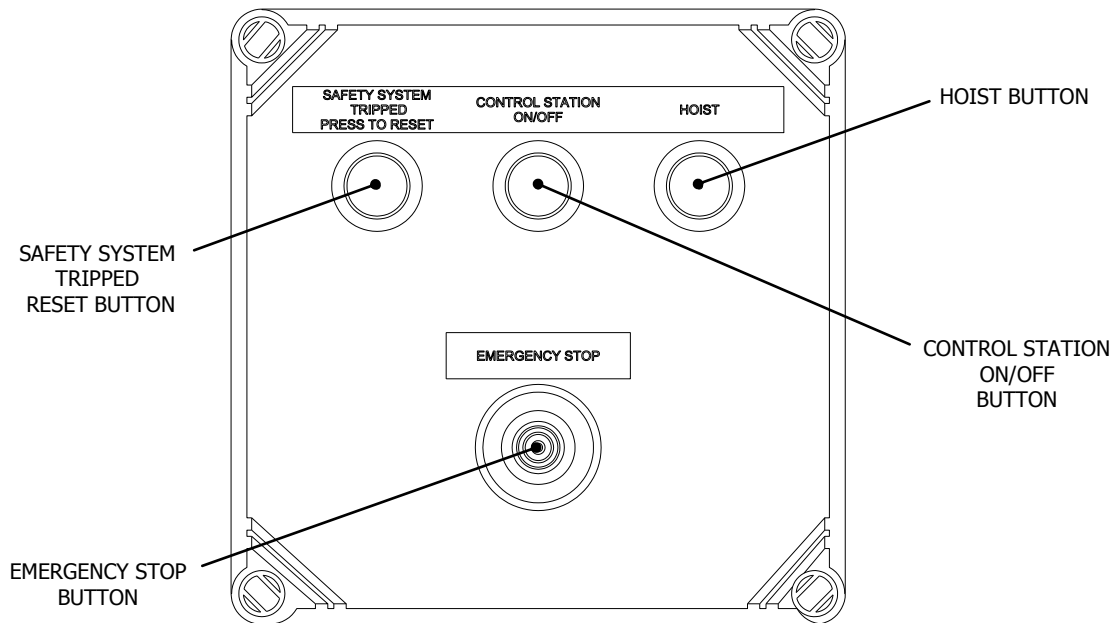


Figure 2.3: Control Station Layout

The control station comprises the following:

- **Control Station 'ON'/'OFF' Button:**

Press to activate the control station - button illuminates and remains depressed. Press again to deactivate the control station – button extinguishes and returns to original position.

- **Hoist Button:**

Press and hold to hoist the rescue boat.  
Release button to stop the hoist motion.

This button when pressed activates the electric motor on the winch; hoisting the boat at a minimum speed of 18 m/minute. Hoisting is only available when the control station 'ON' button is active.

- **Safety System Tripped Indicator/Reset Button:**

This indicator illuminates if a safety critical switch has failed to operate.

This indicator/button is independent to the control station on/off button, and is continually monitoring the safety system while the davit is operating.

There are five switches that are regarded as safety critical, the winch turning handle and winch brake release handle switches together with three emergency stop buttons. If any of these switches are operated or develop a fault, power operation will stop until the relevant switch is reset, the fault corrected or the switch replaced. The indicator/reset button remains illuminated until the button is pressed.

**IMPORTANT:** If the safety system has been tripped illuminating the indicator, always reset the relevant switch/button and press the 'Safety System Tripped' reset button.

## 2.2.4 Power Pack

The hydraulic power pack contains the control panel (refer to 2.2.2: Control Panel) and the Luff Hand Valve, mounted on the frame, local to the control panel, see figure 2.4: Luff Hand Valve Location.

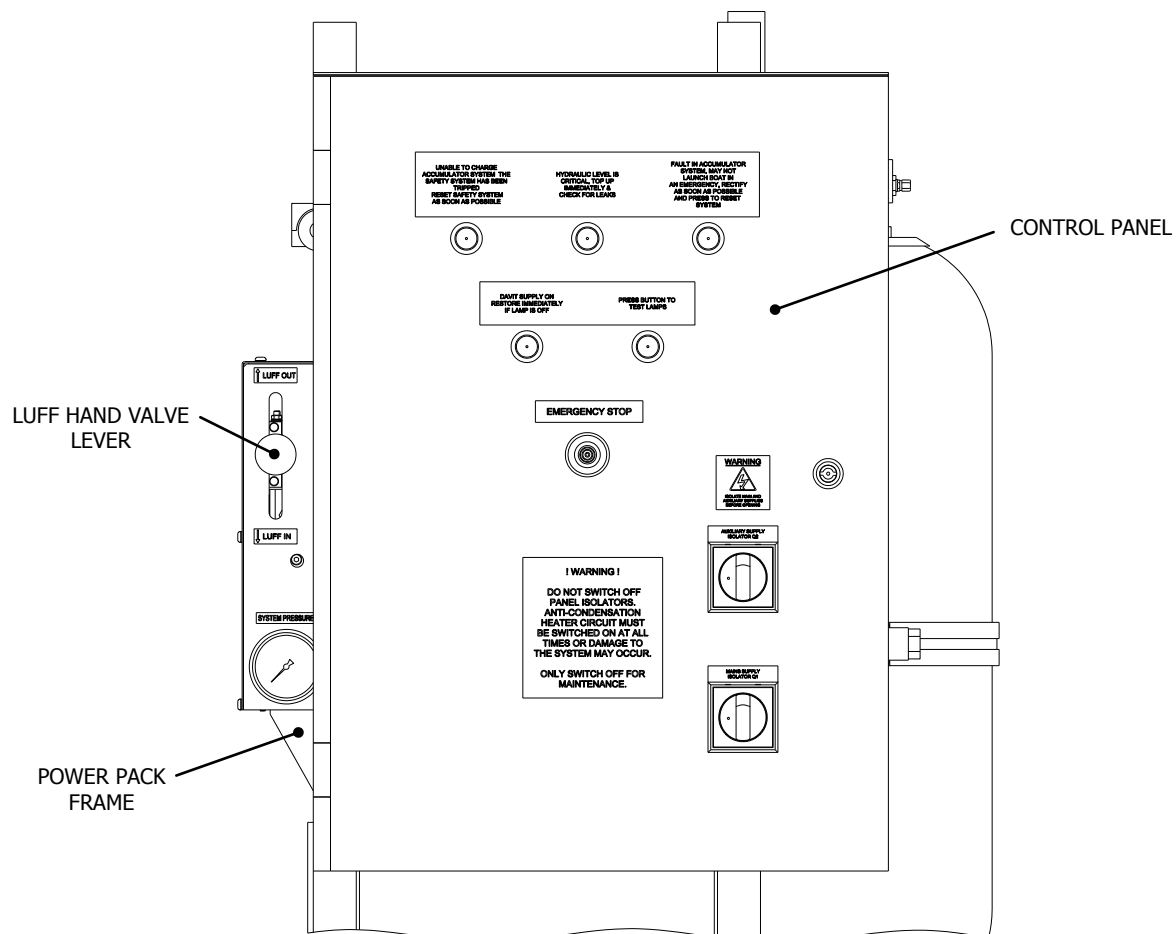


Figure 2.4: Luff Valve Location

The Luff Hand Valve operation comprises the following:

- **Luff Out:**

Operate the valve lever in the 'Luff Out' direction to move the davit outboard. Returning the lever to neutral position slows, or stops the luffing operation.

- **Luff In:**

Operate the valve lever in the 'Luff In' direction to move the davit inboard. Returning the lever to neutral position slows, or stops the luffing operation.

## 2.3 DAVIT OPERATION

The objective of the davit is to launch and recover a rescue boat; a description of the three main davit motions, 'luffing', term applied to moving the boat from inboard to outboard, lowering and hoisting is given below.

### 2.3.1 Luffing

The davit/rescue boat is luffed outboard and inboard by a cylinder, powered by oil stored in an accumulator mounted on the power pack. This is achieved by manual operation of the luff valve, in direction required, which is situated adjacent to the control panel on the power pack.

The Luff Hand Valve can be operated in two ways:

- Directly by hand from the ship's deck.

Manually operate the valve lever in the direction required (Luff Out/Luff In) to move boat either outboard or inboard. Returning the lever to neutral position slows, or stops the luffing operation.

- Using the remote luff control rope from within the boat.

Pulling down on the rope and maintaining a nominal pressure, the luff valve can be operated, and held in the 'Luff Out' direction, to move the boat to the outboard position. Releasing the pressure slows, or stops the luffing operation when the valve is returned to the neutral position.

**CAUTION:** Only pull down the luff control rope gently and slowly during 'Luff Out' operation to prevent swinging of boat.



### 2.3.2. Lowering

When the boat reaches the outboard position, it can be gravity lowered to the sea, using the winch brake gear. Lifting the brake release handle manually will lower the boat, releasing the handle stops the operation.

The speed at which the boat lowers is automatically controlled by a 'centrifugal' type brake, which maintains a constant speed.

The handle can be operated in three ways:

- By using the remote brake control rope, positioned at the control station, which when pulled down will lift the brake release handle. Pulling down and maintaining a nominal pressure on the control rope lowers the boat, releasing the pressure slows, or stops the operation.
- By using the brake control rope from within the boat, which when pulled down will lift the brake release handle. Pulling down and maintaining a nominal pressure on the control rope lowers the boat, releasing the pressure slows, or stops the operation. The remote control rope descends at the same rate as the rescue boat.
- Directly by hand.  
Lifting the brake release handle manually will lower the boat, releasing the lever stops the operation.

**CAUTION:** Only pull down the remote brake control rope to lower the boat after the luff out operation is complete.

### 2.3.3 Hoisting

Hoisting the boat is achieved by pressing the 'hoist' button on the control station, if power 'ON' is active, releasing the button will stop the hoist motion. Hoist operation will stop automatically when the limit switch situated at the davit head is activated.

An 'Emergency Stop' button is mounted on the control station, which if pressed stops any power operation that is currently in motion, and remains depressed preventing any further operation until reset. Pulling out the head of the button, and pressing the 'Safety System Tripped' reset button restores power operation to the davit.

**CAUTION:** Do not power hoist the 'light rope' i.e. without the boat attached. Hoist limit switch will not detect striker arm in sufficient time to cut off power, therefore damage to the davit structure will occur.

### 2.3.4 Emergency Operation

In an emergency situation, i.e. the ship's power fails; the capacity of the accumulator enables the rescue boat to be luffed outboard and inboard, and recovered manually using the winch.

Emergency luff is achieved by manual operation of the Luff Hand Valve located at the power pack on the ship's deck, in the appropriate direction, or luffed outboard from within the boat using the remote control rope.

A turning handle is provided, located adjacent to the winch on the power pack, which can be fitted to the squared end of the winch brake shaft, and can be used to manually recover the boat if rotated in the required direction. Before fitting to the shaft, a safety plate must be displaced operating a safety switch, which prevents power hoisting (if power is restored) when the turning handle is fitted. An additional interlock prevents gravity lower.

**IMPORTANT:** Always remove turning handle immediately after use.

### 2.3.5 Payout 'Light Rope'

The unladen 'light rope' i.e. without the boat attached, can be lowered manually by lifting the brake lever and rotating the winch handwheel in the appropriate direction.

**NOTE:** In the unladen state, weight of the hook alone is insufficient to allow light rope to lower. Therefore an additional weight applied to the hook is required, or lanyard attached to enable pulling down from within the boat.

## 2.4 OPERATIONAL CHECKS

During operation the following checks should be made in order to maintain the davit in good safe working order. If any check identifies a problem it must be reported to the appropriate authority for rectification.

During operation check;

- Control panel functions correctly.
- Indicator(s)/button(s) on control panel.
- Control station functions correctly.
- Indicator(s)/button(s) on control station.
- All protective covers fitted on buttons and indicators are not damaged.
- Ropes and sheaves are running freely.
- Ropes for signs of damage, deformation, broken strands, kinks, drying out or rust etc.
- All safety switches and mechanisms operate correctly.
- Hoist limit switch operates correctly.
- Brake release handle moves freely.
- Hydraulic system for signs of leakage or malfunction.

- Davit for signs of damage.
- Paintwork for signs of damage.
- Turning handle safely stowed.

**WARNING:** The 'Davit Supply On' indicator must be illuminated at all times, signifying that the 'Mains' and 'Auxiliary' supply isolators are both set to 'ON'. If the indicator extinguishes the mains or auxiliary supply, or both must be restored as soon as possible to prevent damage to any electronic components. The 'Mains' and 'Auxiliary' supply isolators should be switched 'OFF' for maintenance only.

## 2.5 OPERATIONAL SUMMARY

All davit operations are summarised and presented on an instruction board, which is supplied for mounting local to the davit. (See figure 2.5: Instruction Board).

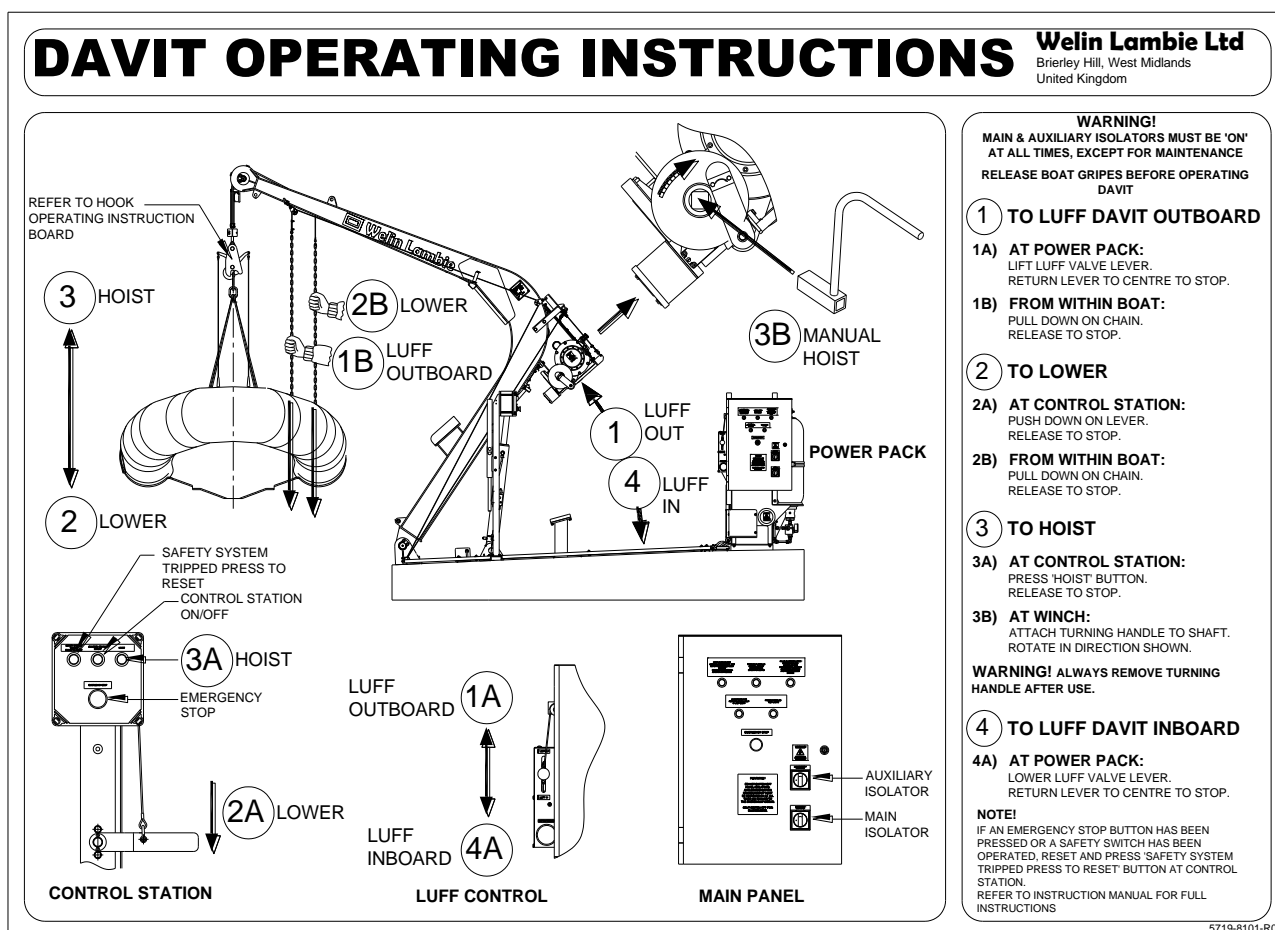


Figure 2.5: Instruction Board



### 3.0 FUNCTIONAL DESCRIPTION

This chapter provides a functional description of the 'A' Frame Pivot Davit (Type: PIV 1.0A), which provides the capability to launch and recover a Zodiac RIBO 420 Rescue Boat in accordance with the latest SOLAS 2010 regulations, chapter III, Regulation 4.

#### 3.1 MECHANICAL

The main davit structure consists of an 'A' frame arm, fabricated from aluminium plate. The arm luffs outboard and inboard by pivoting about two lugs, pinned and bushed to brackets fixed on the ship's deck, when the hydraulic cylinder is operated. The upper clevis of the cylinder connects centrally to a cross member on the 'A' frame, whilst the lower end is attached to a bracket welded on the ship's deck. A clevis, fitted with a spherical bearing, at each end of the cylinder accommodates any minor alignment problems.

Two deck stools fitted with protective pads, supplied overlong in length allow trimming to suit the deck profile, ensure the davit frame is positioned correctly onboard ship.

The winch, Solas approved, mounted on the davit 'A' frame is mainly of aluminium construction, except for major structural components, such as gears, shafts and rope drum which are steel. With the winch being an integral part of the frame simplifies reeving of the main davit rope.

The gearbox contains a spur/pinion gear set running in an oil bath, all the shafts are supported on ball or roller bearings which require minimum attention or maintenance. The rope drum, suitably sized to store the main and remote ropes, is directly coupled to and driven by an electric motor through the gear train. The electric motor is connected to a centrifugal type clutch, which is disengaged during gravity lower. The motor shaft is fitted with the brake system, which consists of two types; a failsafe main brake and a centrifugal actuated type, which automatically controls the speed of the winch when lowering the boat by gravity.

The main brake is fitted inline to a ratchet freewheel that allows secure hoisting, but transmits the load to the brake in the lowering direction. This also permits safe manual hoisting of the load.

A turning handle shaft is provided, spurred off the motor shaft, allowing for manual hoist. This shaft and the main brake manual release handle are interconnected by mechanical links and electrical safety switches, providing an integrated safety system, whereby when the turning handle is fitted the brake cannot be released or the motor operated.

A handwheel is also provided, mechanically connected to the brake shaft, to permit manual paying out of the light rope.

Mounted at the davit head is a sheave which leads the main rope from the winch down to the boat hook. A limit switch, is fitted on one side of the head unit, which when operated

stops power hoist. The switch is activated by a striker arm that loops around the rope and is lifted by a block attached to the rope ferrule.

A system of remote control ropes also pass around the davit structure, using a combination of pulley blocks and shackles, which aid luffing and lowering operations to be performed from within the rescue boat, and at the ship's deck. Where possible the control ropes are routed along enclosed stainless steel cable tray for protection.

### **3.2 ELECTRICAL**

The control panel, located on the power pack, is a weatherproof enclosure of IP66 ingress protection, complete with stainless steel locks and a rain protection strip, and houses all the electrical control gear for the davit. Mounted on the panel door are the mains and auxiliary supply isolator switches, push buttons, various indicators and an emergency stop button.

The control station, suitably positioned on the ship's deck by shipyard, is a weather proof enclosure of IP66/67 ingress protection, and contains the 'Hoist' button, 'Safety System Tripped' indicator/reset button, station on/off button and an emergency stop button.

All electrical cable (Welin supply) from the control panel, located on the power pack, to the davit and control station is routed along enclosed stainless steel cable tray for added protection.

Incoming power supply to control panel:

Mains power supply: 600vAC: 3ph: 60Hz.  
Auxiliary power supply: 110vAC: 1ph: 60Hz.

### **3.3 HYDRAULIC**

Positioned directly behind the davit structure, and mounted on the ship's deck, is the hydraulic power pack. The unit contains an oil reservoir, motor/pump arrangement, bladder type accumulator with safety valve, and the davit control panel and luff hand valve.

The accumulator is kept permanently charged by the electrically driven pump, which allows the davit to be luffed outboard and inboard. The capacity of the accumulator enables emergency launch and recovery of the rescue boat even if the ship's power fails. Conversely if the accumulator fails, the pump is capable of luffing the davit load, though at approximately half the normal operating speed.

All hydraulic pipe work (Welin supply) from the power pack to the deck mounted cylinder hose connection plate is routed in enclosed stainless steel cable tray for added protection. Pressure hoses (Welin supply) are used from the cylinder to connection plate.

## 4.0 SCHEDULED MAINTENANCE

In accordance with SOLAS Ch.III Regulation 20, before the ship leaves port and at all times during the voyage, all life saving appliances shall be in working order and ready for immediate use.

Weekly and monthly inspections, and routine maintenance as specified in the equipment maintenance manual(s), should be conducted under the direct supervision of a senior ship's officer in accordance with the maintenance manual(s).

All other inspections, servicing and repair should be conducted by the manufacturer's representative or other person appropriately trained and certified for the work to be done in accordance with MSC.1/Circ.1277.

The following chapter gives a brief description of the relevant functioning parts and required maintenance as an aid to the maintainer when servicing the equipment. It is assumed that the maintainer is experienced in the area of maintenance being undertaken, practiced in the local and shipboard safety disciplines and that the 'Safety Summary' at the beginning of this manual, and Chapter 1: General Information and Safety Precautions, has been read and understood.

The maintenance intervals stated are meant as a guide only. The user is responsible for adjusting these intervals with consideration to the number of times the equipment is used and the operational environment, in order to maintain the equipment in a good and safe working condition.

During any maintenance procedure:

- If a threaded fastener or nut is damaged on removal, it must be replaced.
- If a circlip is damaged on removal, it must be replaced.
- If an oil seal is damaged or is showing signs of oil leakage, it must be replaced.

Any flanged item removed that was fitted using a compound to seal against oil or water ingress, must have the old compound removed completely from both faces and new compound applied before refitting.

Any areas of paintwork damaged during maintenance procedures must be repaired in accordance with the ships paint procedure

It is essential when removing, refitting, storing and handling brake shoes or drums that they are kept free of oil or grease contamination. Even greasy finger marks must be removed

## 4.1 WINCH

The gearbox contains a spur/pinion gear set running in an oil bath, all the shafts are supported on ball or roller bearings which require minimum attention or maintenance. The rope drum, suitably sized to store the main and remote ropes, is directly coupled to and driven by an electric motor through the gear train. The electric motor is connected to

a centrifugal type clutch, which is disengaged during gravity lower. The motor shaft is fitted with the brake system, which consists of two types; a failsafe main brake and a centrifugal actuated type, which automatically controls the speed of the winch when lowering the boat by gravity.

The main brake is fitted inline to a ratchet freewheel that allows secure hoisting, but transmits the load to the brake in the lowering direction. This also permits safe manual hoisting of the load.

A turning handle shaft is provided, spurred off the motor shaft, allowing for manual hoist. This shaft and the main brake manual release handle are interconnected by mechanical links and electrical safety switches, providing an integrated safety system, whereby when the turning handle is fitted the brake cannot be released or the motor operated.

A handwheel is also provided, mechanically connected to the brake shaft, to permit manual paying out of the light rope.

#### 4.1.1 Gearbox

All internal gears and bearings are lubricated by the oil bath and will require no further attention. Check for oil leaks after every operation.

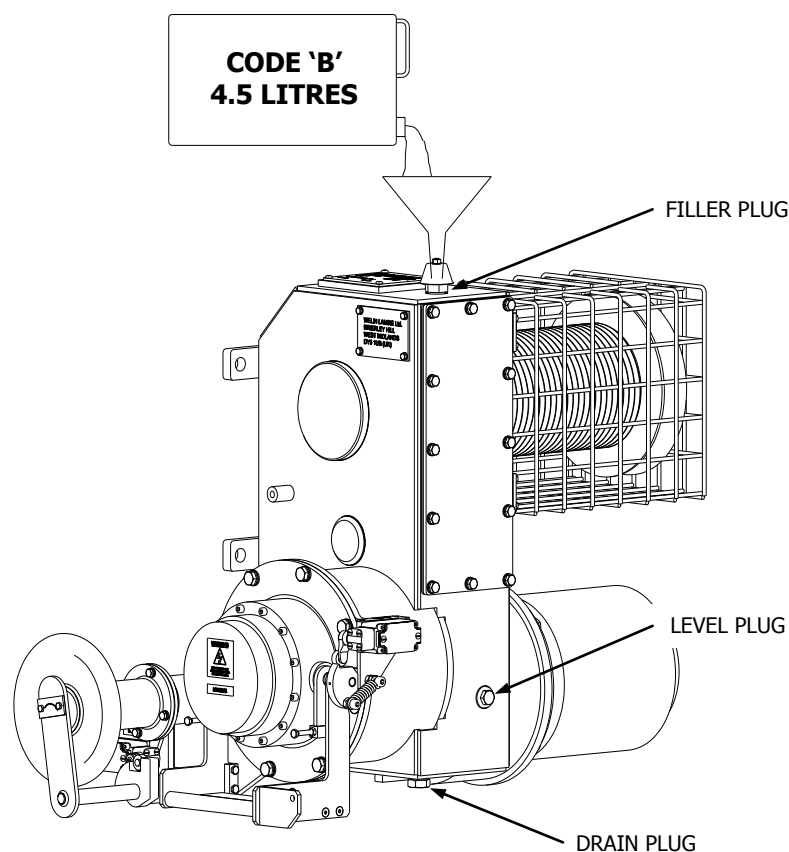


Figure 4.1: Gearbox Lubrication



Every **48 months** the inspection cover plate should be removed and the gears, shafts and bearings checked for signs of wear.

The oil level should be checked every **6 months** and topped up as necessary (Code 'B').

The gearbox oil should be changed after the first **12 months**, then every **60 months**.

Oil drain and filler plugs are provided at the bottom and top of the box, the drain plug is magnetic and should be wiped clean before replacing. A plug is fitted at the oil level height, which should be removed when filling, and oil added (Code 'B') until level with the bottom of the hole. Replace the plug and wipe off any oil runs. See figure 4.1: Gearbox Lubrication.

#### 4.1.2 Safety Device

The safety device prevents the brake from being released for lowering, and also hoisting by power, when the turning handle is fitted to the brake shaft square. The action of moving the safety plate, allowing fitting of the turning handle, rotates the safety boss that activates a safety switch, preventing winch operation by power. Check free operation of safety plate every **3 months**.

The above action also prevents manual lifting of the brake lever – gravity lower.

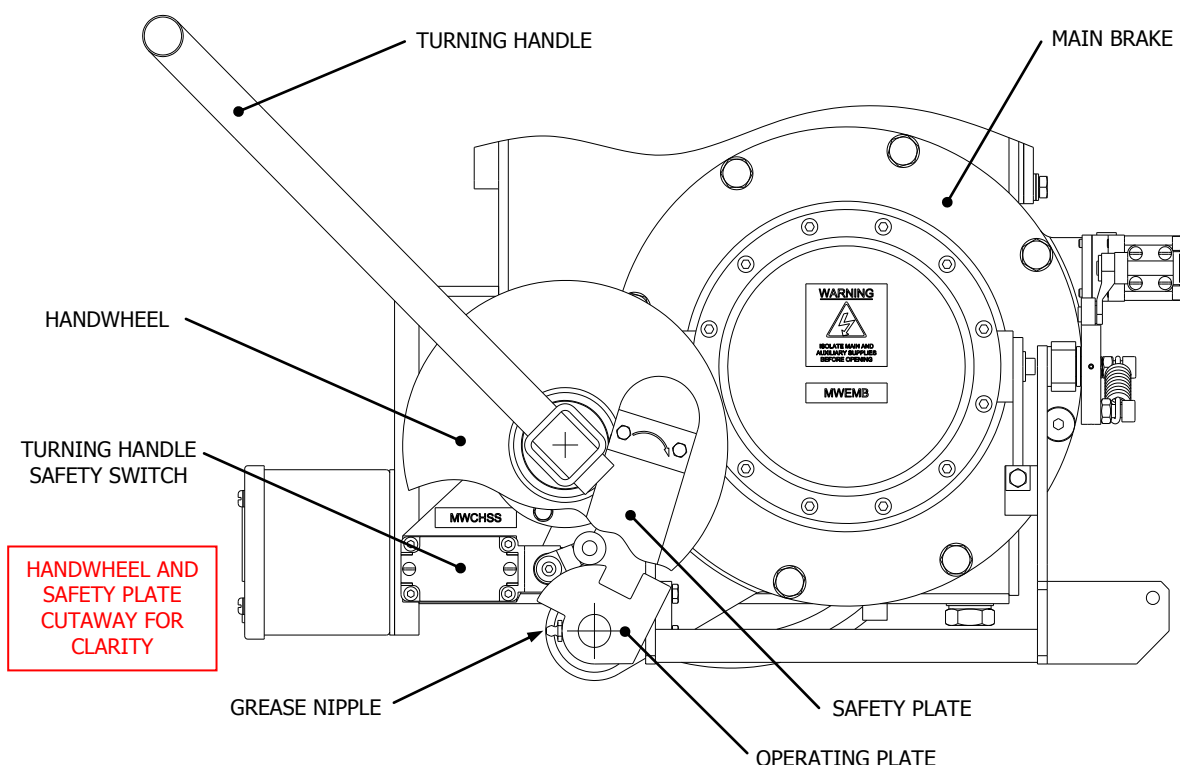


Figure 4.2: Safety Device Setup

The safety plate incorporates a stainless steel pivot pin that rotates in a housing fitted with two bearings, which should be lubricated via a nipple with grease every **3 months** (Code 'A'). See figure 4.2: Safety Device Setup.

**WARNING:**      **Serious injury or death may occur if this safety device is not regularly maintained and adjusted correctly.**

#### 4.1.3 Main Brake

The main brake is a fail-safe spring applied single disc type. The brake is set before leaving the factory and will need adjusting periodically as the brake linings wear. The airgap, corresponding to lining wear, should be checked every **6 months** and adjusted if outside the stated tolerance. See figure 4.3: Main Brake – checking Airgap.

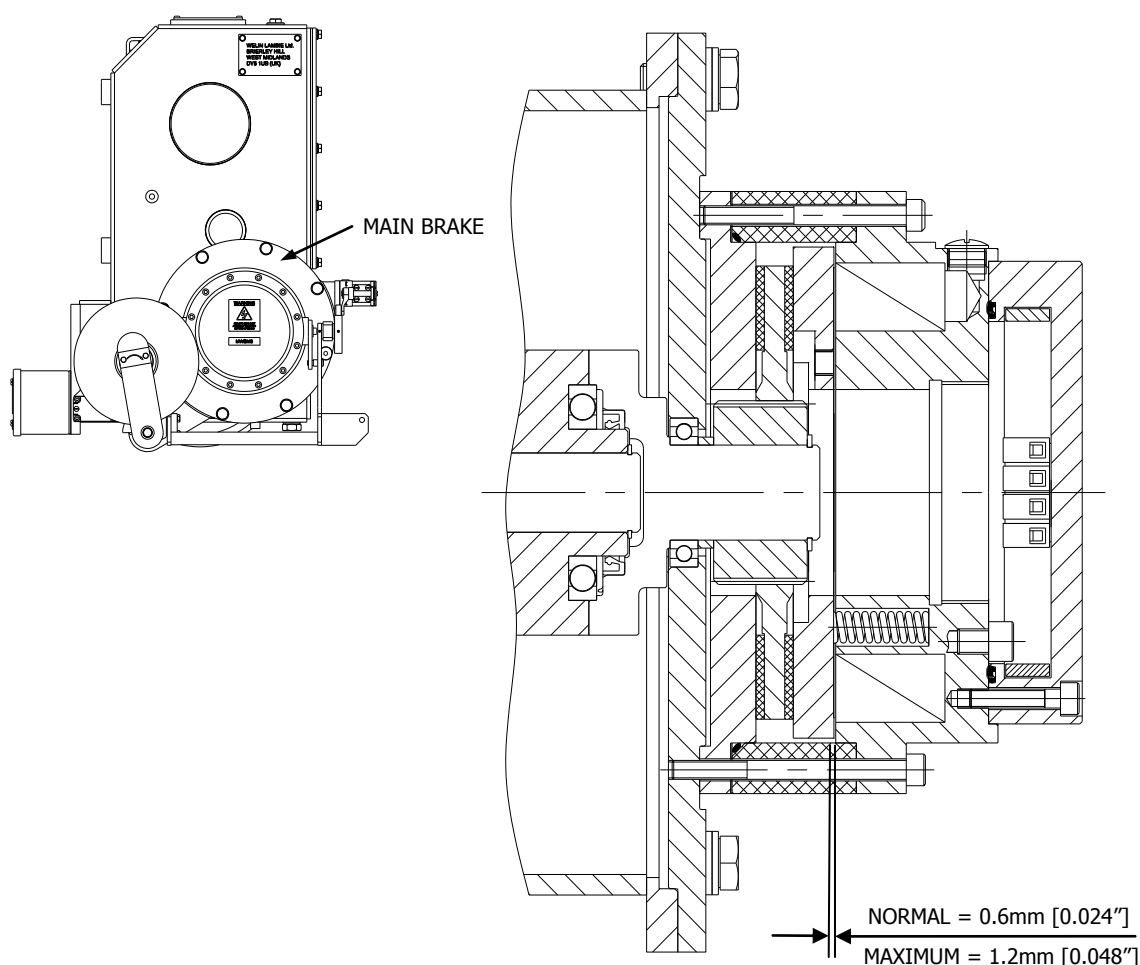


Figure 4.3: Main Brake – Checking Airgap

To check the airgap dimension remove the inspection cover and introduce a thickness gauge between the body and armature disc.

For correct operation of the brake ensure the airgap does not exceed maximum stated. The airgap should also be indicated on the brake rating plate attached to the casing.

**AIRGAP**  
**Normal = 0.6mm (0.024")**  
**Maximum = 1.2mm (0.048")**

If the airgap is within dimensions stated, refit inspection cover.

When the airgap has reached its maximum stated, a readjustment becomes necessary. Refer to Chapter 6: Corrective Maintenance for instructions.

#### 4.1.4 Roller Freewheel

A roller type ratchet freewheel is fitted directly behind the main brake, housed between the brake stub shaft and a fixed cover, both of which contain a standard oil seal. The unit is self contained, bearing supported and equipped with 3 screws for oil filling, drain and level. The lubrication oil should be checked every **6 months** (Code 'E' \*), and changed every **60 months** (Code 'E' \*). The screws should always be cleaned before refitting.

\* see lubrication chart for additional information.

Access to the roller freewheel is achieved by removing the main brake and brake housing cover plate. Refer to figure 4.4: Roller Freewheel Location and figure 4.5: Roller Freewheel lubrication.

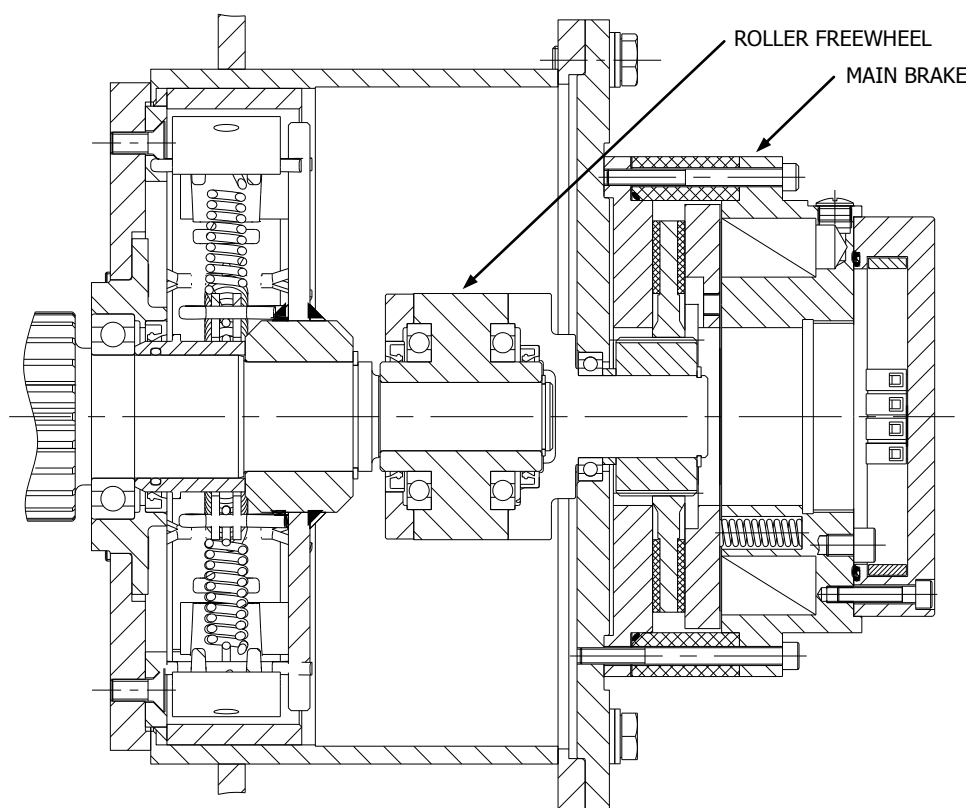


Figure 4.4: Roller Freewheel Location

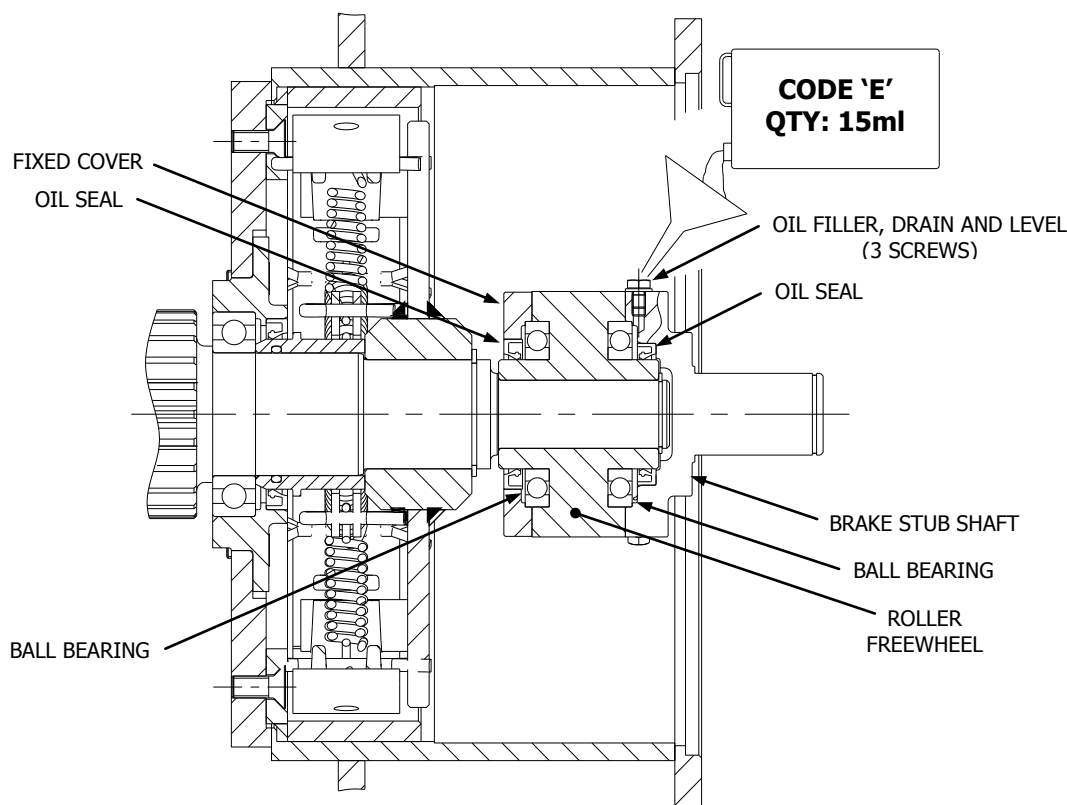


Figure 4.5: Roller Freewheel Lubrication

#### 4.1.5 Centrifugal Brake

The centrifugal brake assembly should be inspected every **6 months** for signs of rust build up, oil leakage and brake lining wear. See figure 4.6: Centrifugal Brake Assembly.

**CAUTION:** Grease must not contaminate housing drum or linings.

Access to the centrifugal brake is achieved by removing the main brake, brake housing cover plate and the roller freewheel, before extracting the complete centrifugal brake shoe assembly from the shaft.

**NOTE:** The roller freewheel lubricant must be drained before removal.

The brake shoe linings (made from non-asbestos material) should be inspected, and if thickness is less than 2mm (1/16") or level with the rivet heads, or lining has become contaminated by oil, shoes require relining or replacing. Refer to figure 4.7: Centrifugal Brake Shoe Mounting.

**CAUTION:** It is essential that the linings be replaced with the same type as the original. If not the speed of lower may vary beyond the limits to which the winch has been tested.

Refer to Chapter 6: Corrective Maintenance for instructions.

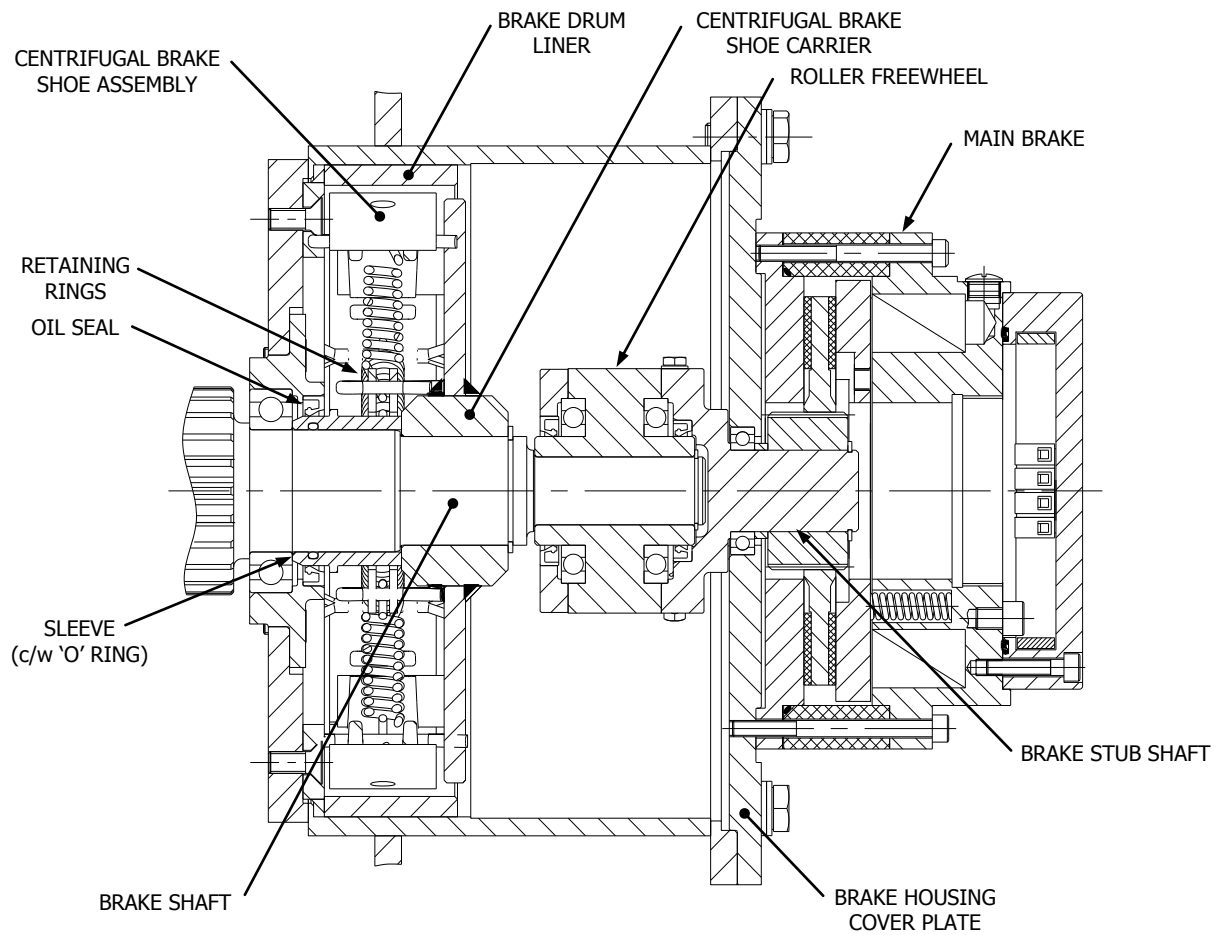


Figure 4.6: Centrifugal Brake Assembly

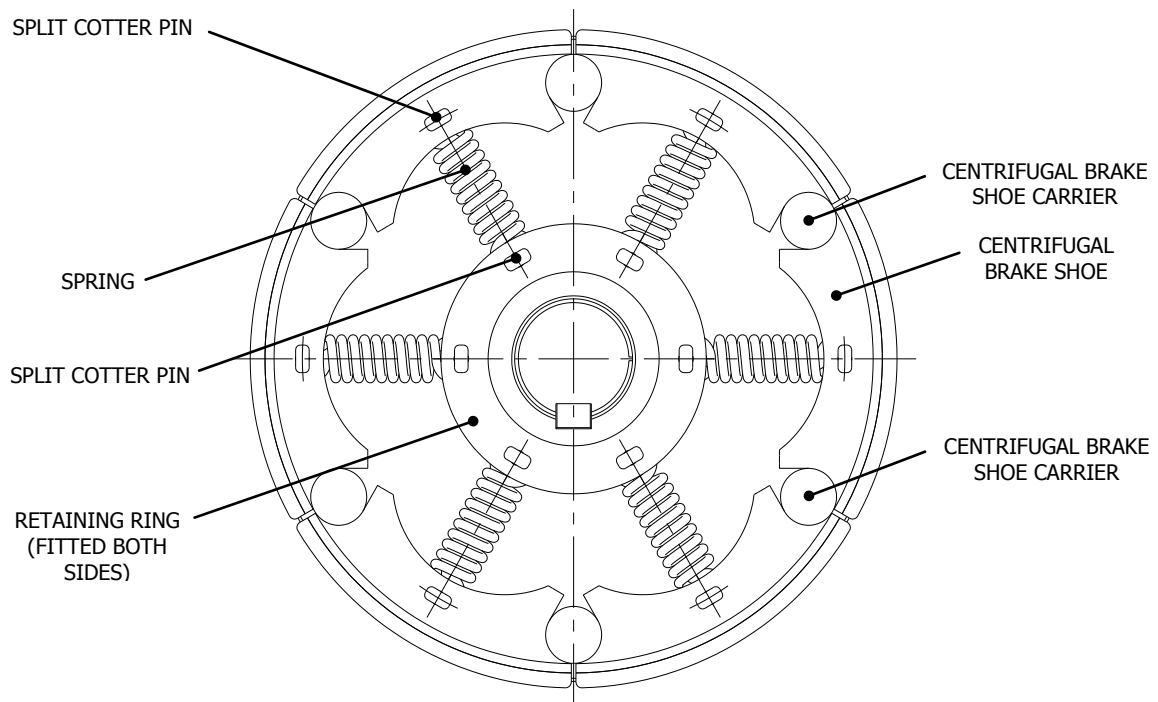


Figure 4.7: Centrifugal Brake Shoe Mounting  
 (Note: Number of shoes may vary depending on winch capacity)

If shoe replacement is not necessary, thoroughly clean all bearing surfaces and faces, ensuring the shoes operate freely on the carrier. Check operation of turning handle safety switch.

**CAUTION:** Free movement is essential to ensure brake operates correctly.

**WARNING:** If any oil or grease has contaminated the housing surface during the above procedure it must be thoroughly cleaned off with an appropriate solvent. Oil or grease on this surface will reduce the efficiency of the centrifugal brakes, which could result in injury or death.

#### 4.1.6 Centrifugal Clutch

The centrifugal clutch shoe assembly should be inspected every **6 months** for signs of rust build up, oil leakage and clutch shoe lining wear. See figure 4.8: Centrifugal Clutch Assembly.

**CAUTION:** Grease must not contaminate housing drum or linings.

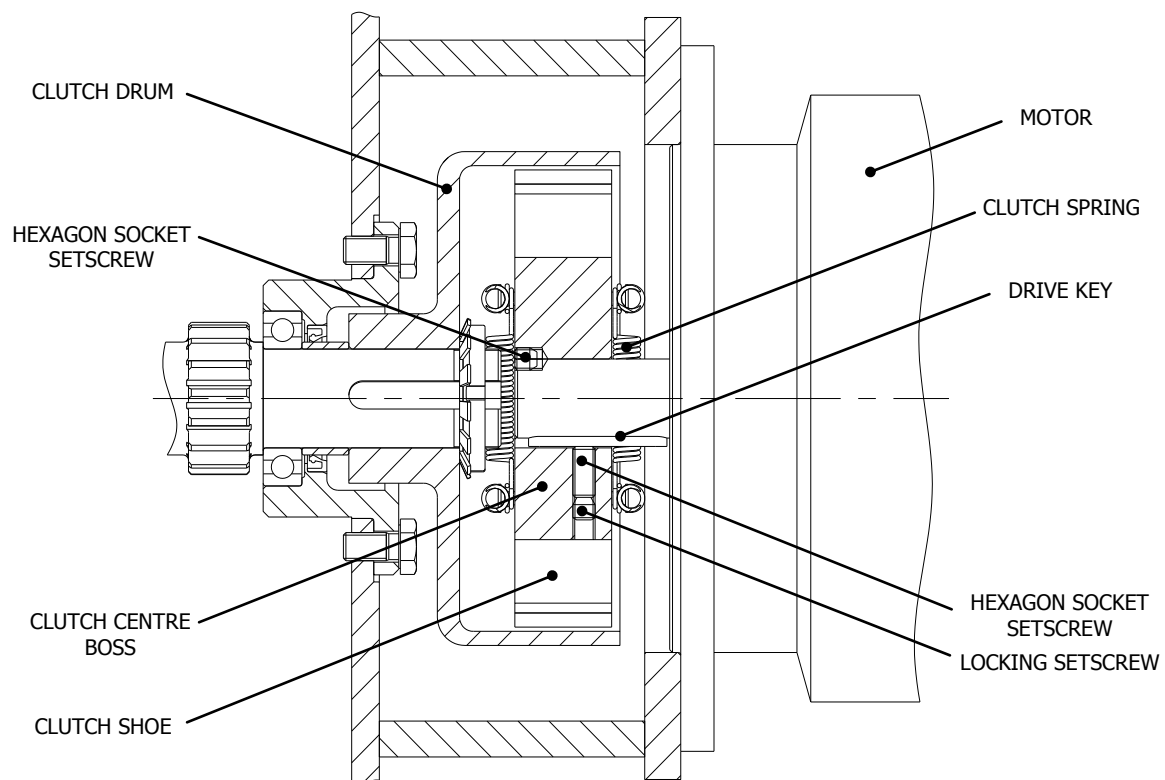


Figure 4.8: Centrifugal Clutch Assembly

Access to the centrifugal clutch is achieved by removing the motor. Always isolate the electrical power supply and disconnect the wires from the terminal box.

**WARNING:** Do not attempt to lift or support the motor manually as injury is likely to occur.

The clutch shoe linings (made from non-asbestos material) should be inspected, and if thickness is less than 2mm (1/16") or level with the rivet heads, or lining has become contaminated by oil, shoes require relining or replacing. See figure 4.9: Centrifugal Clutch Shoe Mounting.

**CAUTION:** It is essential that the linings be replaced with the same type as the original. If not the speed of lower may vary beyond the limits to which the winch has been tested.

Refer to Chapter 6: Corrective Maintenance for centrifugal clutch shoe replacement instructions.

If shoe replacement is not necessary, thoroughly clean all bearing surfaces and faces, ensuring the shoes fit correctly in the clutch centre boss and that the springs are fitted correctly both sides.

**IMPORTANT:** It is vital to the correct running and safety of the equipment that the terminals are correctly tightened and that the terminal box lid is correctly re-fitted to prevent water ingress.

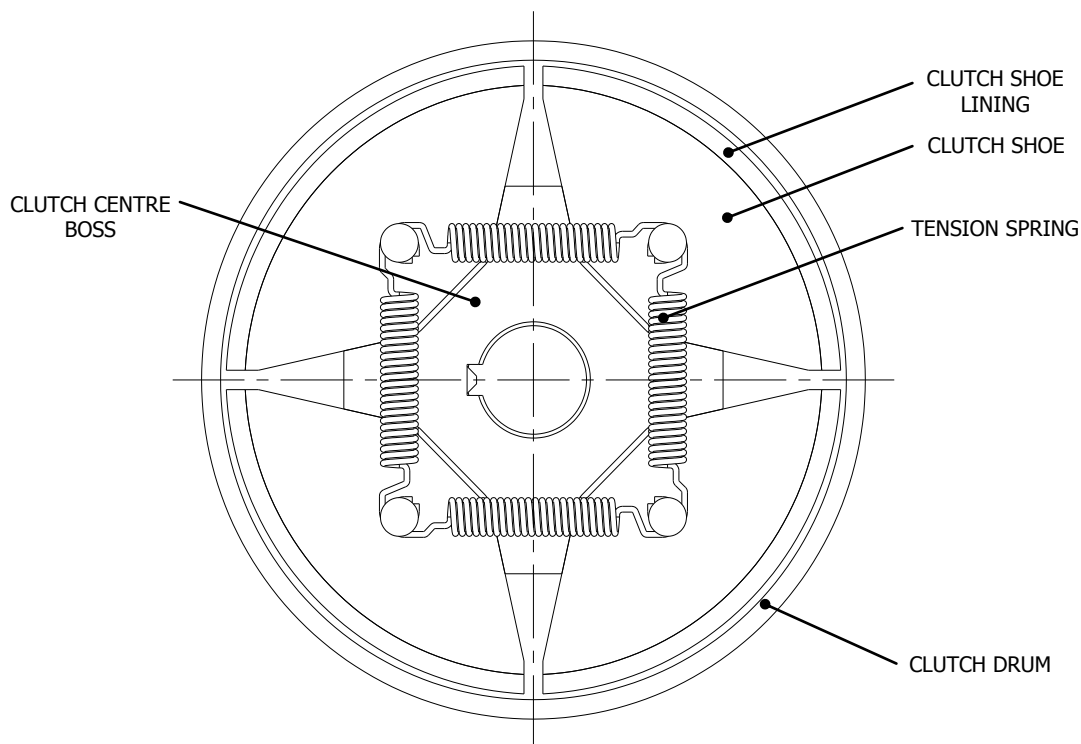


Figure 4.9: Centrifugal Clutch Shoe Mounting

#### 4.1.7 Turning Handle Safety Switch

Every **3 months** the turning handle safety switch roller and arm should be lightly oiled to maintain free rotation. Also check the switch cover is fitted securely, and that the switch operates correctly. See figure 4.2: Safety Device Setup

## 4.2 DAVIT

### 4.2.1 Head Sheave

The head sheave is produced from high strength, low friction plastic and rotates on a stainless steel pin. Provided the sheave is lubricated (Code 'A') every **3 months** via the grease nipple located in the end of the pin no further attention is necessary. Every **12 months** check the sheave for excessive wear. See figure 4.10: Head Sheave Lubrication.

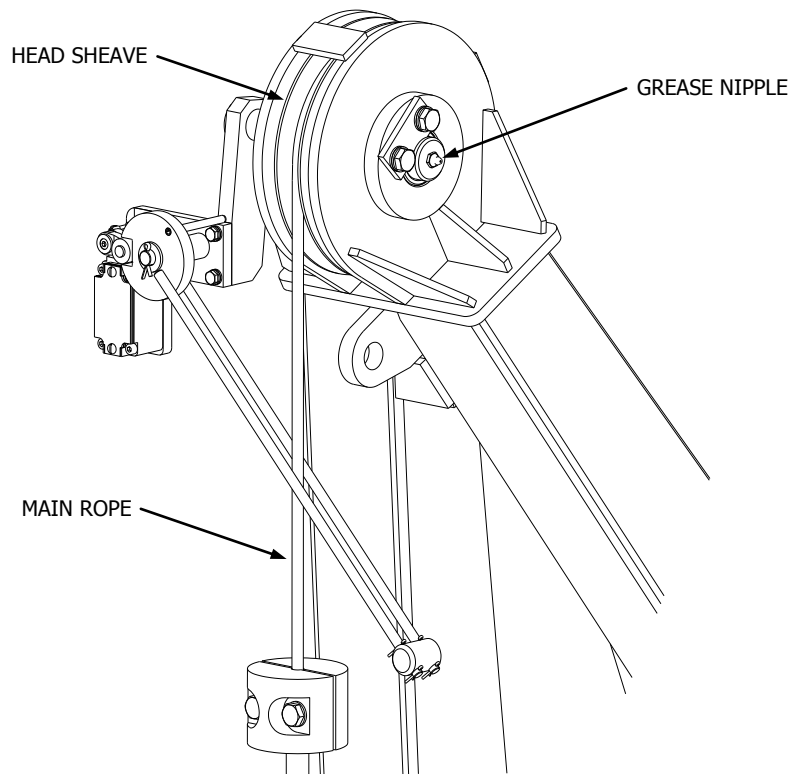


Figure 4.10: Head Sheave

### 4.2.2 Arm Pivots

The davit arm pivots about two lugs which house self lubricating, high performance composite bearings which rotate on stainless steel pins, secured to the deck mounted brackets. The pivot pins should be lubricated (Code 'A') every **3 months** via the grease nipple. See figure 4.11: Arm Pivots.



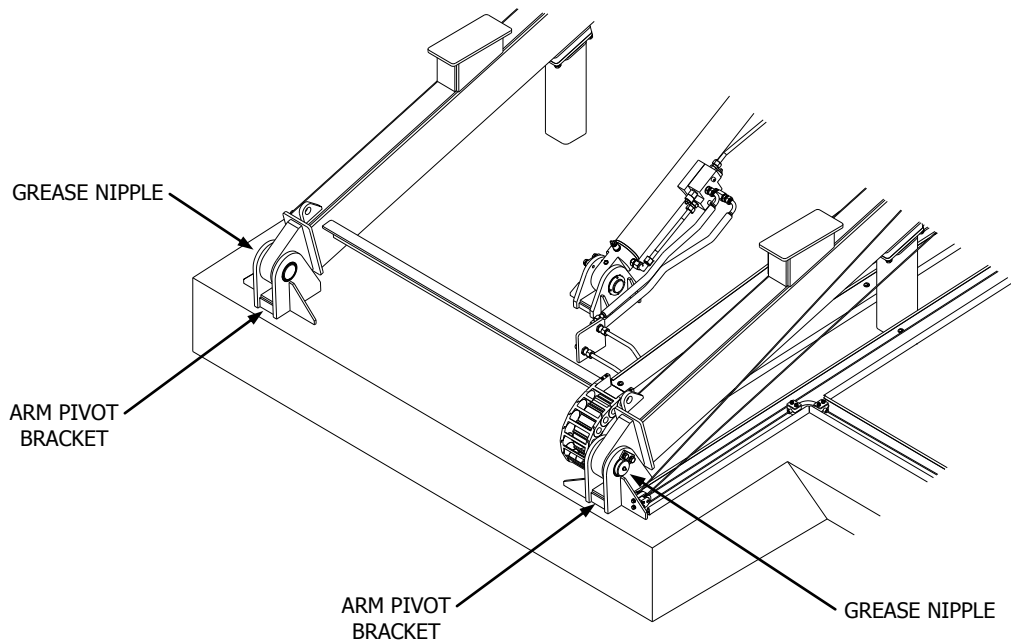


Figure 4.11: Arm Pivots

### 4.2.3 Luff Cylinder Pivots

The luff cylinder pivots on two stainless steel pins that remain static mounted to the davit arm and deck bracket. A clevis, fitted with a spherical bearing, at each end of the cylinder allows lubrication (Code 'A') every **3 months** via a grease nipple. See figure 4.12: Luff Cylinder Pivots.

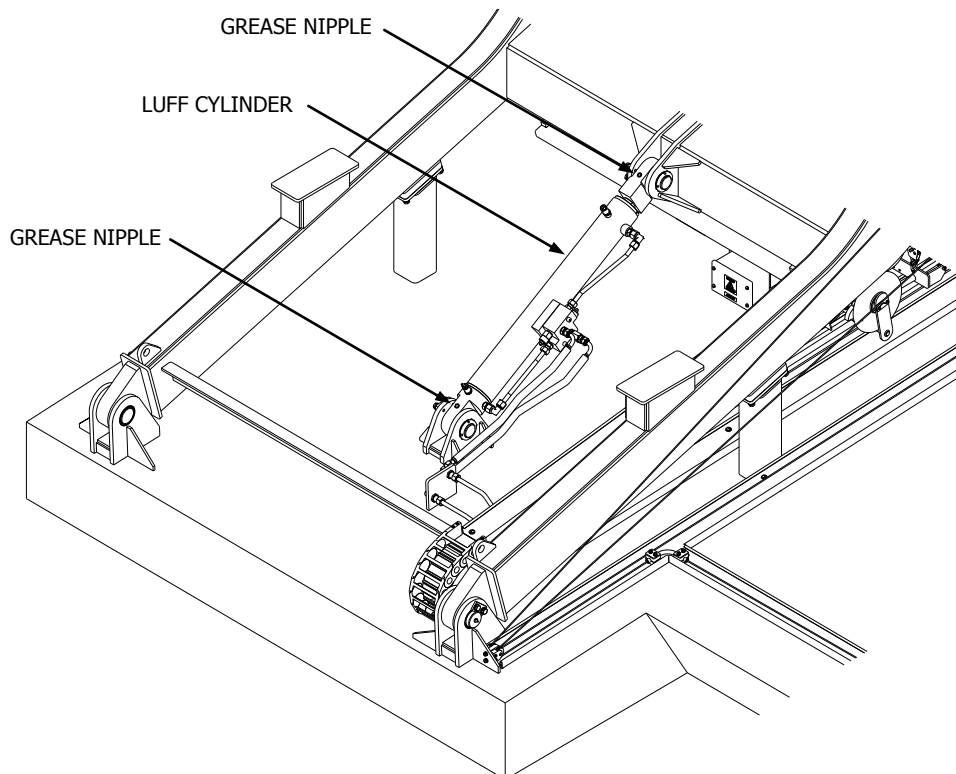


Figure 4.12: Luff Cylinder Pivots

#### 4.2.4 Main Rope

The rope should be visually checked, along the entire length, with each operation for signs of damage, deformation, broken strands, kinks, drying out or rust etc. If damage occurs the rope should be replaced as soon as possible and use of the davit suspended on the decision of the ships safety officer. (Refer to Chapter 6 for details on main rope replacement).

The rope should be hand lubricated (Code 'C') every **3 months**; including both the rope on the drum and round the davit, and pressure lubricated every **12 months**. Always ensure ropes are clean and dry before lubricant is applied. The rope should be replaced every **48 months**. Also check the rope clip plate is secure every **3 months**.

**CAUTION:** Wear appropriate leather gloves while handling the wire rope

**NOTE:** The normal practise of 'end for ending' the main ropes (i.e. changing the ropes around) is discouraged as wire may develop a set.

#### 4.2.5 Remote Brake Control Rope - Boat

The rope should be visually checked, along the entire length, with each operation for signs of damage, deformation, broken strands, kinks, drying out or rust etc. If damage occurs the rope should be replaced as soon as possible and use of the davit suspended on the decision of the ships safety officer. (Refer Chapter 6 for details on remote brake control rope replacement).

The rope should be hand lubricated (Code 'C') every **3 months**; including both the rope on the drum and round the davit, and pressure lubricated every **12 months**. Always ensure ropes are clean and dry before lubricant is applied. Also check the rope clamp is secure every **3 months**.

Check all pulleys are free to rotate, and the rope has not become displaced and trapped between the pulley and side plate. Apply a small amount of light oil to pulley pivot pins every **3 months**.

#### 4.2.6 Remote Brake Control Rope - Deck

The rope should be visually checked, along the entire length, with each operation for signs of damage, deformation, broken strands, kinks, drying out or rust etc. If damage occurs the rope should be replaced as soon as possible and use of the davit suspended on the decision of the ships safety officer. (Refer Chapter 6 for details on remote brake control rope replacement).

The rope should be hand lubricated (Code 'C') every **3 months**; and pressure lubricated every **12 months**. Always ensure ropes are clean and dry before lubricant is applied. Also check the two wire rope grips at the brake connection for tightness every **3 months**.

Check all pulleys are free to rotate, and the rope has not become displaced and trapped between the pulley and side plate. Apply a small amount of light oil to pulley pivot pins every **3 months**.

#### 4.2.7 Remote Luff Control Rope - Boat

The rope should be visually checked, along the entire length, with each operation for signs of damage, deformation, broken strands, kinks, drying out or rust etc. If damage occurs the rope should be replaced as soon as possible and use of the davit suspended on the decision of the ships safety officer. (Refer Chapter 6 for details on remote brake control rope replacement).

The rope should be hand lubricated (Code 'C') every **3 months**; and pressure lubricated every **12 months**. Always ensure ropes are clean and dry before lubricant is applied. Also check the two wire rope grips at the chain connection for tightness every **3 months**.

Check all pulleys are free to rotate, and the rope has not become displaced and trapped between the pulley and side plate. Apply a small amount of light oil to pulley pivot pins every **3 months**.

#### 4.2.8 Release Hook

The release hook should be inspected with each operation for signs of damage, and the release mechanism checked. The hook should be replaced if damaged or faulty. Refer to Chapter 9: Appendix for manufactures manual.

#### 4.2.9 Hoist Limit Switch

Every **3 months** the hoist limit switch roller and arm should be lightly oiled to maintain free rotation. Also check the switch cover is fitted securely, and that the switch operates correctly. The striker arm pivot should be checked for free movement every **3 months**. See figure 4.13: Hoist Limit Switch.

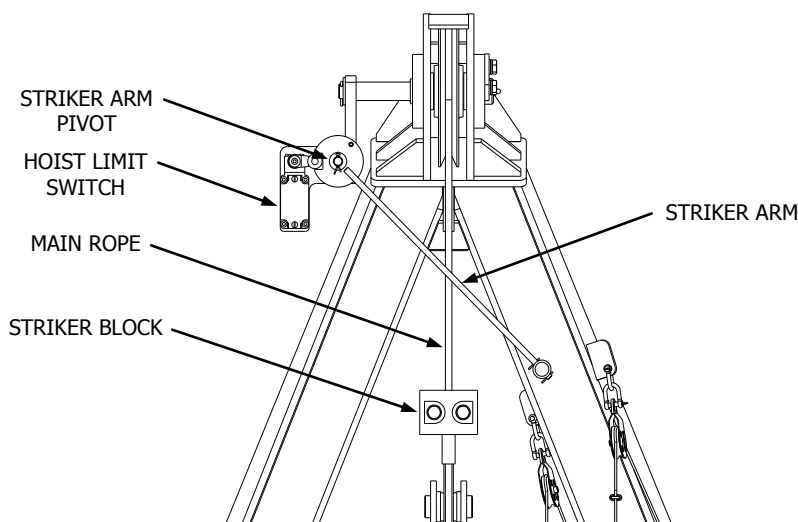


Figure 4.13: Hoist Limit Switch

#### 4.2.10 Boat Gripes

The boat gripes comprise of two sets of ratchet sling assemblies, each made from 2" wide webbing, and incorporating a ratchet tensioner, one end contains a shackle, the other end terminating with a soft eye. The webbing should be visually checked every **3 months** for signs of damage, and replaced if required. Lightly grease (Code 'A') ratchet mechanism every **3 months**.

#### 4.2.11 Paintwork

The paintwork should be visibly inspected with each operation for damage especially where bare metal is exposed. Where damage is noticed it should be repaired as soon as possible to avoid any rust developing.

The damaged areas should have all loose paint removed to a firm edge, feathered by sand paper, all surface irregularities and contaminants shall be removed, any hard glossy surfaces may require abrading to obtain a suitable surface for painting. All repairs shall be made using the same or equivalent materials as per the original specification.

### 4.3 HYDRAULIC

Positioned directly behind the davit structure, and mounted on the ship's deck, is the hydraulic power pack. The unit contains an oil reservoir, motor/pump arrangement, bladder type accumulator with safety valve, and the davit control panel and luff hand valve.

Hydraulic system working pressure: 200 bar (2900 psi)

#### 4.3.1 Power Pack

The hydraulic power pack comprises the oil reservoir, motor, pump, accumulator, filter, valves together with other hydraulic components. See figure 4.14: Power Pack Arrangement and figure 4.15: Power Pack – Lid Components.

The main components are:

- Oil Reservoir: The reservoir is fitted with a level gauge which indicates the maximum and working oil levels within the system. Every **6 months** check the oil (Code 'D') and if below working level, with system fully charged (accumulator, cylinder and all pipe work), top up.
- Motor: This requires no regular maintenance.
- Pump: This is directly coupled to the electric motor and housed within the reservoir. It should require no attention unless a deterioration of performance is noticed.

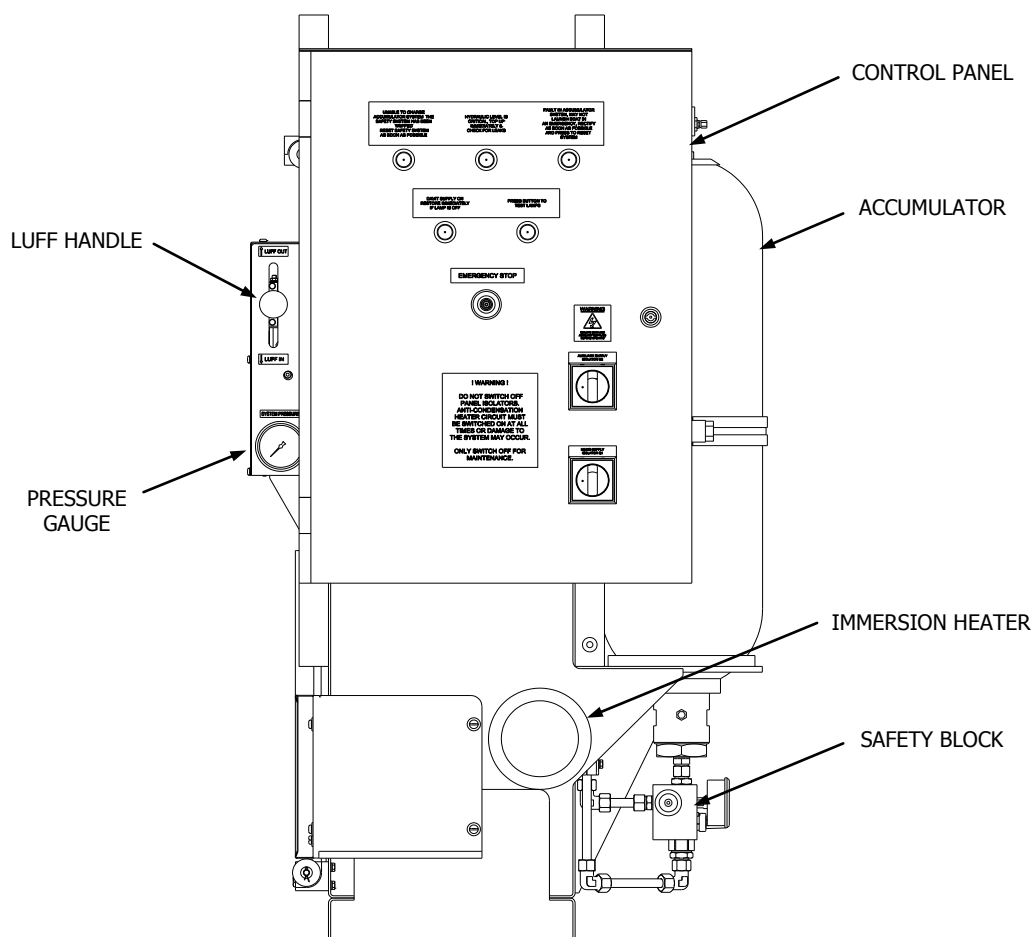


Figure 4.14: Power Pack Arrangement

- **Return Line Filter:** This is fitted with a coloured visual indicator which, when it turns from 'green' to 'red' the filter element should be replaced. The filtration is to 10 microns. The filter element should be replaced at least every **30 months**. (Refer to 4.3.5: Return Line Filter, for details on replacing).
- **Accumulator:** The accumulator is of the 'Bladder' type, which contains pressurised nitrogen gas separated from the oil in a low temperature rubber bladder, which is compressed by pumping in oil to a pre-determined pressure. This can then be released to move the luffing cylinder by operation of the luffing valve.

The accumulator requires no regular maintenance, however every **6 months** check pre-charge to ensure there is no leakage. (Refer to 4.3.3: Checking Accumulator Pre-Charge)

- **Safety Block:** Connected between the accumulator and the operating system it contains a relief valve, to protect against over pressurisation, a shut off valve, to isolate the accumulator from the system, and a dump valve, to drain all the oil from the accumulator back to the reservoir. When using the dump valve it is advised to release the oil slowly to avoid foaming in the reservoir. No regular maintenance is required – replace if faulty.

- **Level Switch:** This is set to indicate a critical low oil level position, which is shown by a warning lamp on the control panel. No regular maintenance is required – replace if faulty.

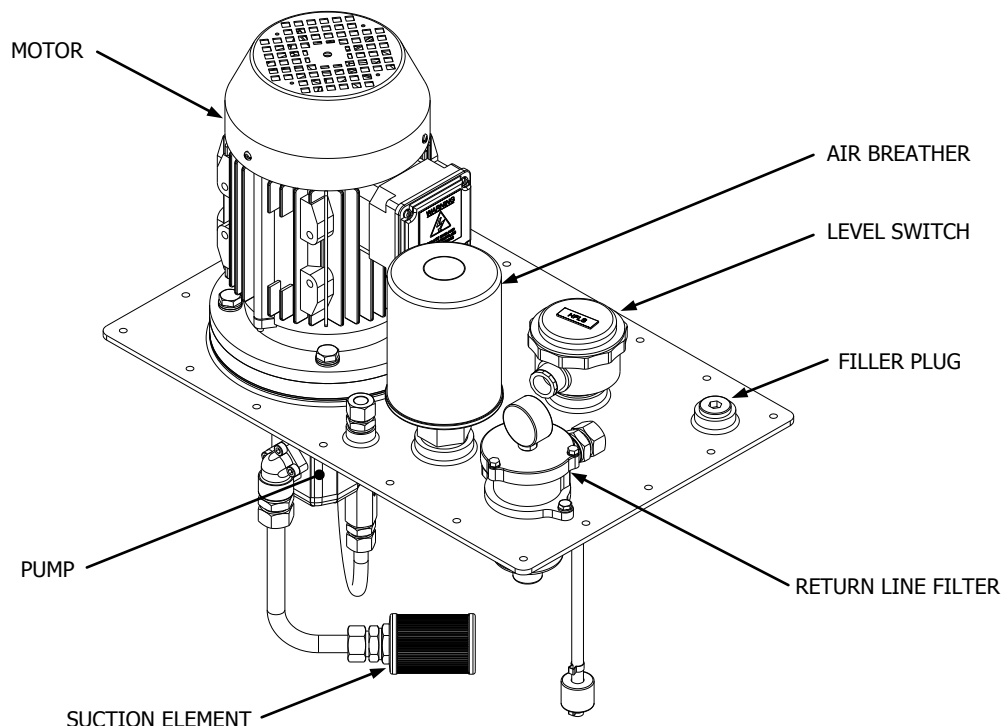


Figure 4.15: Power Pack – Lid Components

- **Immersion Heater:** This maintains the oil temperature at a set level, regulated by an integral thermostat. No regular maintenance is required – replace if faulty.
- **Pressure Gauge:** This records the pressure in the accumulator or the working pressure when operating the davit. The gauge should be visually checked for physical damage; otherwise no regular maintenance is required.
- **Pressure Sensor:** Ensures the pump maintains required pressure within the system.

The pump is set to switch 'ON' at 180 bar (2600 psi) and 'OFF' at 200 bar (2900 psi). The pressure sensor is maintenance free so if it is suspected as being faulty it should be replaced.

- **Suction Element:** Mounted in the reservoir and fitted to pump inlet, the fine wire mesh suction element requires no regular maintenance, however every **60 months**, during oil change, the element should be thoroughly cleaned. (Refer to 4.3.4: Changing Hydraulic Oil)
- **Air Breather:** The spin-on type air breather is fitted with a disposable element which should be replaced every **24 months**.

### 4.3.2 Accumulator Pre-Charge Procedure

Pre-charge setting for the accumulator: 76 bar (1100 psi).

**IMPORTANT:** Accumulator charging contains inherent risks associated with the unexpected release of high pressure gaseous energy. Take into account the following:

- Gas jet effects and the acceleration of loose particulate.
- Asphyxiation due to the release of nitrogen gas in a confined space.
- Accumulator acceleration in the event of unexpected release of gas.
- Note the maximum working pressure of the accumulator and do not over pressurise.
- Ensure that any protective caps (usually plastic) are removed prior to pre-charging.
- Noise may be emitted in the event of sudden release of gas.
- Avoid direct contact with oil mists.
- Select the correct charging equipment in good working condition ensuring that pressure gauges are safety pattern type and all hoses must be designed to be used with gas.

### USE ONLY OXYGEN FREE DRY NITROGEN GAS

**WARNING:** It is recommended that a regulator valve is fitted in the gas line when charging accumulators with a shell rating less than that of the gas supply.

The accumulator pre-charge should be set as follows:

- Set main and auxiliary isolators, located on control panel, to 'OFF' position.

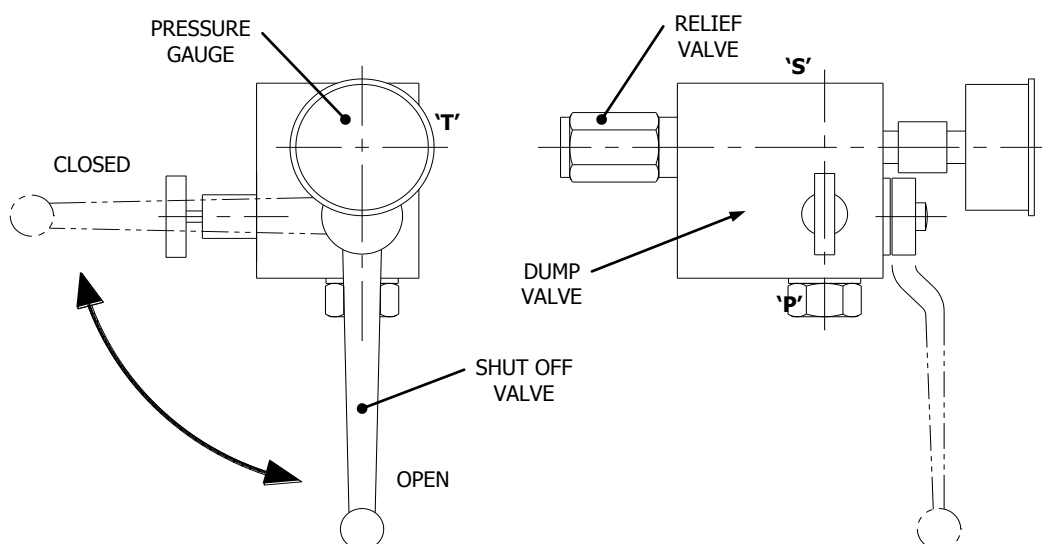


Figure 4.16: Accumulator Safety Block

- Dump all of the oil in the accumulator to the reservoir, by slowly opening the dump valve on the safety block. Refer to figure 4.16: Accumulator Safety Block.

**IMPORTANT:** Check the pressure gauge on the safety block reads zero before continuing with procedure.

- With zero hydraulic pressure in the accumulator, isolate from the rest of the system by rotating the shut off valve to 'OFF' (closed). Refer to figure 4.16: Accumulator Safety Block.
- Remove the sealing cap from the gas charge connection. Refer to figure 4.17: Accumulator Pre-Charge Setup.

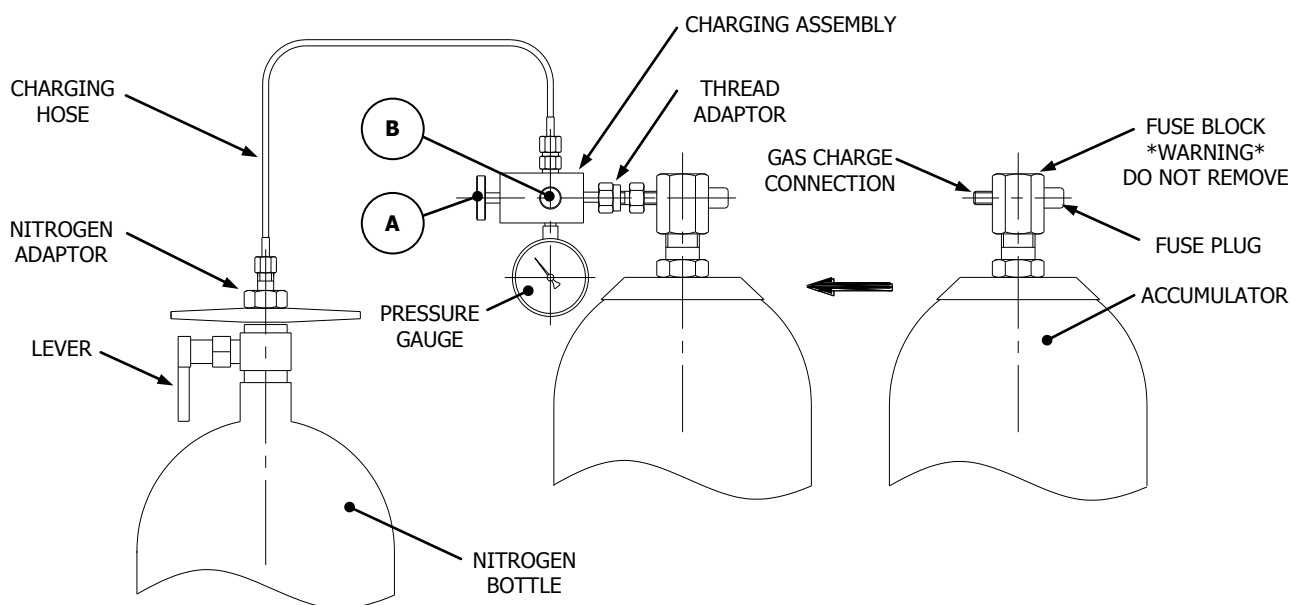


Figure 4.17 Accumulator Pre-Charge Setup

- Fit charging assembly using the thread adaptor, having ensured the hand wheel 'A' is fully retracted (counter-clockwise), bleed screw 'B' is open and pressure gauge fitted.
- Connect charging hose to charging assembly and to the nitrogen supply using the appropriate adaptor. (N<sup>2</sup> cylinder).
- Attach lever to nitrogen bottle valve. Rotate the hand wheel 'A' on the charging assembly (clockwise) to open the gas valve. Do not screw hand wheel down tight. Slowly open the nitrogen supply and allow gas to gently enter the accumulator until a pressure slightly in excess of final pressure is obtained (i.e. 76 bar –1100 psi). Close the nitrogen supply.
- Allow nitrogen pressure to stabilize (approximately 5 minutes).
- Retract hand wheel 'A' (counter-clockwise) to seal gas valve.



Crack bleed screw 'B' to exhaust gas from charging hose and remove hose from charging assembly and replace hose connection sealing cap.

Remove charging assembly and thread adaptor.

Replace the sealing cap on the gas charge connection.

Fully close the dump valve on the safety block.

- Set main and auxiliary isolators, located on control panel, to 'ON' position and press 'Safety System Tripped' reset button on the control station.
- The hydraulic pump will charge the accumulator to 200 bar (2900 psi), and automatically switched off. The oil will return to the 'Working' level.

Hydraulic system should be now ready for use.

### 4.3.3 Checking Accumulator Pre-Charge

Pre-charge setting for the accumulator: 76 bar (1100 psi).

Checking the accumulator pre-charge should be as follows:

- Set main and auxiliary isolators, located on control panel, to 'OFF' position.
- Dump all of the oil in the accumulators to the reservoir, by slowly opening the dump valve on the safety block. Refer to figure 4.16: Accumulator Safety Block.

**IMPORTANT:** Check the pressure gauge on the safety block reads zero before continuing with procedure.

- Before fitting the charging assembly ensure the hand wheel 'A' is fully retracted (counter-clockwise), bleed screw 'B' is closed and pressure gauge c/w copper sealing washer is fitted. **Note: Do not fit charging hose.** Refer to figure 4.17: Accumulator Pre-Charge Setup.
- Remove the sealing cap from the gas charge connection.
- Fit the charging assembly using the thread adaptor.
- Rotate the hand wheel 'A' (clockwise) until a pressure is registered. Do not screw hand wheel down tight.

**NOTE:** The correct pre-charge pressure should be 76 bar (1100psi).

- If the pressure is too high, it can be reduced, by opening the bleed Screw 'B' until the correct pressure is registered on the gauge.
- If the pressure is too low, refer to the pre-charging procedure (4.3.2).
- If the pressure is correct, remove the charging assembly as follows:  
Retract hand wheel 'A' (counter-clockwise).

Open the bleed screw 'B'.  
 Remove charging assembly and thread adaptor.  
 Replace the sealing cap on the gas charge connection.  
 Fully close the dump valve on the safety block.

- Set main and auxiliary isolators, located on control panel, to 'ON' position and press 'Safety System Tripped' reset button on the control station.

#### 4.3.4 Changing Hydraulic Oil

The hydraulic oil (Code 'D') should be changed every **60 months**.

- Set main and auxiliary isolators, located on the control panel, to 'OFF' position.
- Drain oil from accumulators by opening the dump valve (turn counter-clockwise) on the safety block. Refer to figure 4.16: Accumulator Safety Block.
- Place a large container close to the drain plug on the reservoir.
- Remove the drain plug and drain oil from reservoir.
- Once the oil has been drained, remove inspection cover from the reservoir and clean inside thoroughly. Also remove the suction element from the pump inlet and clean. Finally check that all joints are tight.
- Refit inspection cover and apply silicon sealant around the outer flange. The silicon prevents any galvanic reaction between the stainless steel reservoir/fasteners and aluminium cover.
- Clean and refit drain plug.
- Recharge hydraulic system using clean hydraulic oil filtered (10 micron). Refer to section 8.6.
- Close safety block dump valve.
- Set main and auxiliary isolators, located on the control panel, to 'ON' position and press 'Safety System Tripped' reset button on the control station. Accumulator will automatically recharge, and the pump should switch off at 200 bar (2900 psi).
- Operate the davit 'out' and 'in' several times to clear any air from the system until the operation runs smoothly.

#### 4.3.5 Return Line Filter

It is recommended that the return line filter element be changed every **30 months**.

Change filter element as follows:

- Set main and auxiliary isolators, located on control panel, to 'OFF' position. Open accumulator dump valve in the safety block to drain the oil, and check the pressure gauge registers zero.
- Unscrew the sealing flange of the return filter.
- Remove filter element from the location spigot. Examine the surface of the element for dirt residue or larger particles; these can indicate damage to the components.
- Clean bowl and examine any 'O' rings and back-up rings for signs of damage. Replace if necessary.
- To fit new filter element, moisten sealing surfaces on flange as well as the 'O' ring on the element if necessary, with clean hydraulic oil.
- When fitting a new element, check that the designation corresponds to that of the element being replaced.
- Place filter element carefully onto the element location spigot. Re-fit the sealing flange and tighten screws.
- Fully close the dump valve on the safety block.
- Set main and auxiliary isolators, located on the control panel, to 'ON' position and press 'Safety System Tripped' reset button on the control station.

#### 4.3.6 Luffing Cylinder

The luffing cylinder has been designed to keep maintenance down to a minimum. The pipe work and fittings should be inspected regularly for signs of damage or oil leakage. If oil is leaking from the cylinder itself, this would suggest a damaged piston seal. Repairs to the cylinder seals should only be carried out with supervision of the Welin Lambie technical department.

#### 4.3.7 General

Check all fittings and pipe work every **month** for leaks and tighten any joints as necessary. At the same time check pipe work for any damage and replace if required.

Check any flexible hoses for signs of damage/deterioration at least every **3 months**, and replace if necessary. Regular replacement should be in accordance with ship policy.

## 4.4 ELECTRICAL

### 4.4.1 Control Panel

The control panel should be checked for any signs of damage or water ingress every **3 months**. Check isolator switches, pushbuttons, indicators and the emergency stop button are secure and operating correctly each time the davit is operated.

**IMPORTANT:** It is vital for the correct operation and safety of the equipment that the control panel is fully watertight.

### 4.4.2 Control Station

The control station should be checked for any signs of damage or water ingress every **3 months**. Check pushbuttons, indicators and the emergency stop button are secure and operating correctly each time the davit is operated.

**IMPORTANT:** It is vital for the correct operation and safety of the equipment that the control station is fully watertight.

### 4.4.3 Cables

All electrical cables should be visually checked for external damage with each operation. If any cable is damaged it should be replaced immediately. Check all cable clips and ties are secure.

### 4.4.4 General

The following maintenance should be carried out every **12 months**.

**WARNING:** Only competent personnel should carry out the maintenance tasks detailed in the section. All system power should be isolated and locked off, including auxiliary supplies for heaters and lighting.

- Check the tightness of all electrical connections including earth connections.
- Check connections for signs of wire damage/breakage, and reconnect where required.
- Check power contactors for signs of carbon powder residue, this is due to excessive arcing, if found replace contactor(s) affected. Pay particular attention to the brake contactor if fitted as this switches a DC brake coil and is prone to high levels of arcing.
- Check all equipment for signs of corrosion, any affected equipment should be cleaned or replaced as required. If corrosion is present check thermostat or hygrostat settings, where fitted, and operation of anti-condensation heaters. Use conformal coating sprays where required for protecting against corrosion.

**CAUTION:** Do not spray any open electronic equipment or contacts

- Check all equipment is fitted securely to mounting surfaces.
- Check integrity of anti-vibration mountings if fitted, and replace where required.
- Check PLC I/O cards are secure in the rack.
- Check inverter plug in cards (if fitted) are secure in their sockets.
- Check plug-in relays (if fitted) are secure in the sockets, and retaining clips are present.
- Check all cable glands are tight.
- Check all seals on terminal boxes/panels are in good condition and watertight.
- Lubricate all door hinges and locks where required.

## 4.5 MAINTENANCE SUMMARY

The following list gives a summary of all the scheduled maintenance tasks described in this chapter.

Maintenance intervals are stated in months.

Maintenance interval shown thus ♦ indicates visual check after every operation.

Use maintenance check list (section 4.7) to keep a maintenance record.

Section	Task	Task No.	Lubrication Code	Maintenance Interval
4.1	<b>WINCH</b>			
4.1.1	Gearbox:			
	Oil change (initial)	1	B	12
	Oil change (after initial change)	2	B	60
	Check oil level (top up if necessary)	3	B	6
	Check for oil leaks			♦
	Check gears, shafts and bearings for wear	4		48
4.1.2	Safety Device:			
	Check for free operation	5		3
	Lubricate safety plate pivot	6	A	3
4.1.3	Main Brake:			
	Check airgap	7		6
4.1.4	Roller Freewheel:			
	Check oil level (top up if necessary)	8	E	6
	Oil change	9	E	60
4.1.5	Centrifugal Brake:			
	Check centrifugal brake shoe wear	10		6
	Check assembly for signs of rust build up and oil leakage	11		6
4.1.6	Centrifugal Clutch:			
	Check centrifugal clutch shoe wear	12		6
	Check assembly for signs of rust build up and oil leakage	13		6
4.1.7	Turning Handle Safety Switch:			
	Lubricate roller and arm	14		3
	Check lid & seal are fitted correctly	15		3
	Check operation	16		3

Section	Task	Task No.	Lubrication Code	Maintenance Interval
4.2	<b>DAVIT</b>			
4.2.1	Head Sheave:			
	Lubricate sheave	17	A	3
	Check sheave for excessive wear	18		12
4.2.2	Arm Pivots:			
	Lubricate pivots	19	A	3
4.2.3	Luff Cylinder Pivots:			
	Lubricate pivots	20	A	3
4.2.4	Main Rope:			
	Lubricate rope (manually)	21	C	3
	Lubricate rope (pressure)	22	C	12
	Replace rope	23		48
	Check rope clip plate	24		3
	Check rope for damage, deformation, broken strands, rust etc.			♦
4.2.5	Remote Brake Control Rope - Boat:			
	Lubricate rope (manually)	25	C	3
	Lubricate rope (pressure)	26	C	12
	Check rope clamp	27		3
	Check rope for damage, deformation, broken strands, rust etc.			♦
	Lubricate pulley blocks	28		3
	Check pulleys are free to rotate			♦
4.2.6	Remote Brake Control Rope - Deck:			
	Lubricate rope (manually)	29	C	3
	Lubricate rope (pressure)	30	C	12
	Check wire rope grips for tightness	31		3
	Check rope for damage, deformation, broken strands, rust etc.			♦
	Lubricate pulley blocks	32		3
	Check pulleys are free to rotate			♦
4.2.7	Remote Luff Control Rope - Boat:			
	Lubricate rope (manually)	33	C	3
	Lubricate rope (pressure)	34	C	12
	Check wire rope grips for tightness	35		3
	Check rope for damage, deformation, broken strands, rust etc.			♦
	Lubricate pulley blocks	36		3

Section	Task	Task No.	Lubrication Code	Maintenance Interval
	Check pulleys are free to rotate			♦
4.2.8	Release Hook:			
	Check operation of hook			♦
4.2.9	Hoist Limit Switch:			
	Lubricate roller and arm	37		3
	Check operation	38		3
	Check lid & seal are fitted correctly	39		3
	Check free movement of striker arm	40		3
4.2.10	Boat Grips:			
	Lubricate ratchet mechanism	41	A	3
	Inspect webbing for signs of damage	42		3
4.2.11	Paintwork:			
	Inspect for paintwork damage			♦
4.3	<b>HYDRAULIC</b>			
4.3.1	Power Pack:			
	Check reservoir oil level (top if necessary)	43	D	6
	Change air breather element	44		24
4.3.3	Check Accumulator Pre-Charge	45		6
4.3.4	Change Hydraulic Oil	46	D	60
	Suction element – clean and refit	47		60
4.3.5	Return Line Filter:			
	Change element	48		30
4.3.6	Luffing Cylinder:			
	Check fittings and pipe work for damage/leaks (tighten as necessary)			♦
4.3.7	General:			
	Check fittings and pipe work for damage/leaks (tighten as necessary)	49		1
	Check any flexible hoses for damage/deterioration	50		3



Section	Task	Task No.	Lubrication Code	Maintenance Interval
4.4	<b>ELECTRICAL</b>			
4.4.1	Control Panel:			
	Check for damage, water ingress etc.	51		3
	Check isolator switches, pushbuttons, indicators and emergency stop button			♦
4.4.2	Control Station:			
	Check for damage, water ingress etc.	52		3
	Check pushbuttons, indicators and emergency stop button			♦
4.4.3	Cables:			
	Check for external damage			♦
	Check cable clips and ties are secure			♦
4.4.4	General:			
	Check tightness of all electrical connections	53		12
	Check for wire damage/breakage			12
	Check contactors			12
	Check fuses and carriers			12
	Check all equipment for signs corrosion			12
	Check equipment is fitted securely			12
	Lubricate door hinges and locks			12
	Check all cable glands for tightness			12
	Check warning light/push button bulbs			12
	Check push buttons for free operation			12

## 4.6 LUBRICANTS

The following major brand lubricants are suggested:

- Where referred, temperatures are guidance bulk oil temperature only.
- Always charge and top-up with the same lubricant. It is generally not recommended to mix different brands or grades of lubricants due to unknown compatibility effects.
- Using incorrect grades of lubricants may result in poor performance and possible damage to davit equipment.

The oil type and grade must be as specified unless specifically agreed otherwise by Welin Lambie Ltd.

### Lubrication chart (Temperature range +5°C to +60°C approximately)

Supplier	Code 'A'	Code 'B'	Code 'C'	Code 'D'	Code 'E' (see note)
BP	Energrease MP-MG2	Energol GR-XP 220	Energrease MP-MG2	Energol HLP-HM32	Energol CS22
Exxon Mobil	Mobilux EP 2	Mobilgear 630	Mobilarma 798	DTE 32	Velocite 10
Shell	Alvania EP 2	Omala 220	Malleus GL 95	Tellus 32	Morlina 22
Chevron Texaco	Multifak EP 2	Meropa 220	Crater 2X	Rando 32	Texpar 22
Castrol	Spheerol SX2	Alpha SP 220	Spheerol SX2	Hyspin AW 32	Magna 22

### Lubrication chart (Temperature range -20°C to +5°C approximately)

Supplier	Code 'A'	Code 'B'	Code 'C'	Code 'D'	Code 'E' (see note)
BP	Energrease MP-MG2	Energol GR-XP 100	Energrease MP-MG2	Energol SHF-LT15	Energol CS10
Exxon Mobil	Mobilux EP 2	Mobilgear 627	Mobilarma 798	DTE 11M	Velocite 6
Shell	Alvania EP 2	Omala 100	Malleus GL 95	Tellus T15	Morlina 10
Chevron Texaco	Multifak EP 2	Meropa 100	Crater 2X	Rando HDZ 15	Rando HD 10
Castrol	Spheerol SX2	Alpha SP 100	Spheerol SX2	Hyspin AWH 15	Magna 10

**NOTE:** The oil type and grade recommended for this free wheel must not be substituted for any other unless approved by Welin Lambie Ltd. The oil must not contain any extreme pressure (EP) or low friction additives as this could prevent the free wheel/winch brake from holding the load.

## 4.7 MAINTENANCE CHECK LIST

Task No.	Date	Maintenance Task (3 Monthly Intervals)																			
		3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60
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2																					
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Task No.	Date	Maintenance Task (3 Monthly Intervals)																			
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## 5.0 TROUBLESHOOTING

This chapter provides information to aid the operator or maintainer to isolate the causes of any problems that may occur during the operation of the davit.

### 5.1 OPERATIONAL TROUBLESHOOTING

Most, if not all, of the problems that occur, will be noticed by the operator who should initially run through the following checks and then, if the problem persists, report the situation to the appropriate officer.

It is assumed that the operator has been fully trained, has read and fully understood chapter 2 and therefore will operate each davit function correctly and in the right order.

#### 5.1.1 Control Panel

Symptom/Malfunction	Possible Cause	Corrective Action
'Davit Supply On' indicator is not illuminated.	Main or/and auxiliary isolator set to 'OFF' position.	Set main or/and auxiliary isolator to 'ON' position.
	Circuit breakers have tripped.	Check circuit breakers and reset to 'ON' position.
	LED has failed.	Press 'Test Lamp' button and replace LED if required.
'Unable to Charge System' and 'Safety System Tripped', on control station, indicators illuminated.	An emergency stop button has been operated.	Pull out relevant emergency stop button and press 'Safety System Tripped' reset button.
	Turning handle is fitted.	Remove turning handle and press 'Safety System Tripped' reset button. Always remove turning handle after use.
	Winch safety plate has not been reset.	Reset and press 'Safety System Tripped' reset button.
	Wiring fault.	Check wiring is secure and cable insulation for signs of damage and press 'Safety System Tripped' reset button.
	Mechanical fault on turning handle safety switch.	Replace switch and press 'Safety System Tripped' reset button.

Symptom/Malfunction	Possible Cause	Corrective Action
'Fault in System' indicator illuminated.	System failed to charge within 5 minutes.	Check for oil leaks, repair if required. Press 'Fault in System' reset button.
	Incorrect accumulator pre-charge.	Check accumulator pre-charge, reset to correct pressure if required. Press 'Fault in System' reset button.
	Faulty pressure transducer.	Check and replace if required. Press 'Fault in System' reset button.
	Hydraulic oil leak.	Check for oil leaks, repair if required. Press 'Fault in System' reset button.
'Hydraulic Oil Level Critical' indicator illuminated.	Oil level in the hydraulic reservoir is too low.	Check for oil leaks. Top up to correct level and press 'Fault in System' reset button.

### 5.1.2 Control Station

Symptom/Malfunction	Possible Cause	Corrective Action
'Safety System Tripped' and 'Unable to Charge System', on control panel, indicators illuminated.	An emergency stop button has been operated.	Pull out relevant emergency stop button and press 'Safety System Tripped' reset button.
	Turning handle is fitted.	Remove turning handle and press 'Safety System Tripped' reset button. Always remove turning handle after use.
	Winch safety plate has not been reset.	Reset and press 'Safety System Tripped' reset button.
	Wiring fault.	Check wiring is secure and cable insulation for signs of damage and press 'Safety System Tripped' reset button.
	Mechanical fault on turning handle safety switch.	Replace switch and press 'Safety System Tripped' reset button.



Symptom/Malfunction	Possible Cause	Corrective Action
Cannot power hoist when button is pressed.	Control station 'ON/OFF' button not activated.	Press control station 'ON' button.
	Turning handle fitted.	Remove if fitted. Always remove turning handle after use.
	Turning handle safety switch malfunction.	Check switch and setup.
	Winch safety plate has not been reset.	Reset.
	Centrifugal clutch shoes worn.	Fit new clutch shoes. (See Chapter 4).
Remote brake control rope hard to pull.	Rope has wedged in a pulley.	Free and repair/replace pulley block if required.
	Rope trapped around part of davit.	Free rope.

### 5.1.3 Winch

Symptom/Malfunction	Possible Cause	Corrective Action
When lowering, the load runs on or creeps when motion should stop.	Mechanical brake shoe lining worn or damaged.	Fit new brake shoe. (See Chapter 4).
	Mechanical brake/safety device incorrectly adjusted.	Adjust. (See Chapter 4)
Load lowers too quickly/slowly under gravity.	Centrifugal brake shoe linings worn.	Fit new brake shoes. (See Chapter 4).
	Broken or damaged springs.	Fit new springs. (See Chapter 4).
Cannot lower by gravity.	Turning handle is fitted.	Remove if fitted. Always remove turning handle after use.
	Safety device set up incorrectly.	Check and reset. (See Chapter 4).

Symptom/Malfunction	Possible Cause	Corrective Action
Excessive noise/vibration when operating winch.	Insufficient lubricant in gearbox.	Top up lubricant. (See Chapter 4).
	Loose mounting bolts/screws.	Retighten.
	Loose or broken components.	Retighten or replace.
	Bearing failure.	Investigate failure thoroughly and replace.

#### 5.1.4 Davit

Symptom/Malfunction	Possible Cause	Corrective Action
Increase in operating noise level. (Grinding or rumbling sound).	Loose mounting bolts/screws.	Retighten.
	Loose or broken components.	Retighten or replace.
	Dry pivot/sheave bushes.	Inspect and lubricate.
Remote luff control rope hard to pull.	Rope has wedged in a pulley.	Free and repair/replace pulley block if required.
	Rope trapped around part of davit.	Free rope.
Remote brake control rope hard to pull.	Rope has wedged in a pulley.	Free and repair/replace pulley block if required.
	Rope trapped around part of davit.	Free rope.

#### 5.1.5 Hydraulic Power Pack

Symptom/Malfunction	Possible Cause	Corrective Action
Davit fails to luff.	Low oil level.	Top up oil level.
	Insufficient pressure.	Check accumulator pre-charge pressure. Check pump motor is working.

### 5.1.6 Electrical

Generally an electrical fault will be highlighted by a problem outlined in the previous sections.

If an electrical fault is suspected, first check the following:

- All electrical connections for circuit integrity, including earth connections.
- External cables for signs of damage/breakage.
- Panel mounted equipment is securely fastened.
- Any sign of water ingress in control panel, control station, terminal boxes etc.

**WARNING:**      **Make sure main and auxiliary power supplies are fully isolated before carrying out any investigation of electrical panels, terminal boxes, switches and cable.**



## 6.0 CORRECTIVE MAINTENANCE

In accordance with SOLAS Ch.III Regulation 20, before the ship leaves port and at all times during the voyage, all life saving appliances shall be in working order and ready for immediate use.

Weekly and monthly inspections, and routine maintenance as specified in the equipment maintenance manual(s), should be conducted under the direct supervision of a senior ship's officer in accordance with the maintenance manual(s).

All other inspections, servicing and repair should be conducted by the manufacturer's representative or other person appropriately trained and certified for the work to be done in accordance with MSC.1/Circ.1277.

The philosophy of this chapter is that the maintainer assigned to the maintenance task is skilled and experienced in that discipline, and that the figures and drawings provided are sufficient so that it can be clearly seen how to disassemble and reassemble all parts of the davit. Information is only given where specific and general procedures must be followed.

The ships authority and the maintainer are responsible for using the proper tools and equipment to perform the maintenance task required.

The maintainer must also have read, and fully understood the 'Safety Summary' at the beginning of this manual, and information contained in Chapter 1, as well as being fully conversant with the Safe Working Practices of the local authorities, and the shipboard Health & Safety Regulations.

### 6.1 WEIGHTS OF SIGNIFICANT DAVIT PARTS

ITEM	Approx weight (kg)
Davit Assembly c/w Davit 'A' Frame, Winch Gearbox Assembly, Release Hook, Remote Brake Control Rope, Hoist Limit Switch and Winch Terminal Box	417
Luffing Cylinder	46
Hydraulic Power Pack c/w Control Panel	198
Control Station c/w Stand	11.7
Winch Gearbox Assembly	160

## **6.2 MECHANICAL**

### **6.2.1 General**

Reference should be made to Chapter 4: Scheduled Maintenance for any adjustments etc that may affect the reassembly of parts of the equipment.

During maintenance procedures, if a circlip is damaged on removal, it must be replaced.

During maintenance procedures, if an oil seal is damaged or is showing an oil leakage, it must be replaced.

Any flanged item removed that was fitted using a compound to seal against oil or water ingress, must have the old compound removed completely from both faces and new compound applied before refitting.

Any areas of paintwork damaged during maintenance procedures must be repaired in accordance with the ships paint procedure

It is essential when removing, refitting, storing and handling brake shoes or drums that they are kept free of oil or grease contamination. Even greasy finger marks must be removed.

**WARNING:**        **Any oil or grease on the brake linings or drum surfaces will reduce the efficiency of the brake and could result in injury or death.**

### **6.2.2 Main Brake**

The main brake is a fail-safe spring loaded single disc type fitted to the gearbox, if complete replacement is necessary no dismantling of the unit is required. The hub is fitted to the shaft by a key and axially located using a circlip. See figure 6.1: Main Brake Assembly and 6.2: Main Brake - Checking Airgap.

**WARNING:**        **Ensure 'mains supply' and 'auxiliary supply' isolator is set to 'off' before commencing any maintenance.**

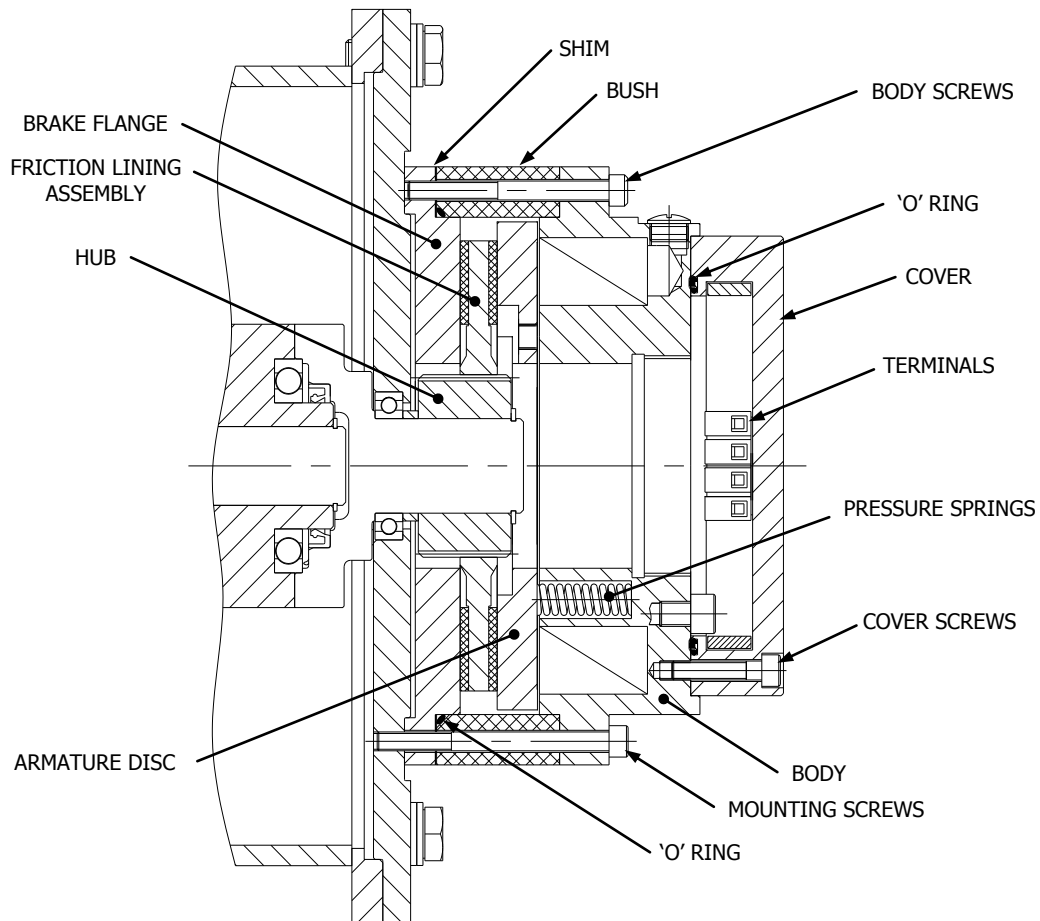


Figure 6.1: Main Brake Assembly

### 6.2.2.1 Checking Airgap

To check the airgap dimension remove the inspection cover and introduce a thickness gauge between the body and armature disc.

For correct operation of the brake ensure the airgap does not exceed maximum stated. The airgap should also be indicated on the brake rating plate attached to the casing.

#### **AIRGAP**

**Normal = 0.6mm (0.024")**

**Maximum = 1.2mm (0.048")**

If the airgap is within dimensions stated, refit inspection cover.

When the airgap has reached its maximum stated, a readjustment becomes necessary.

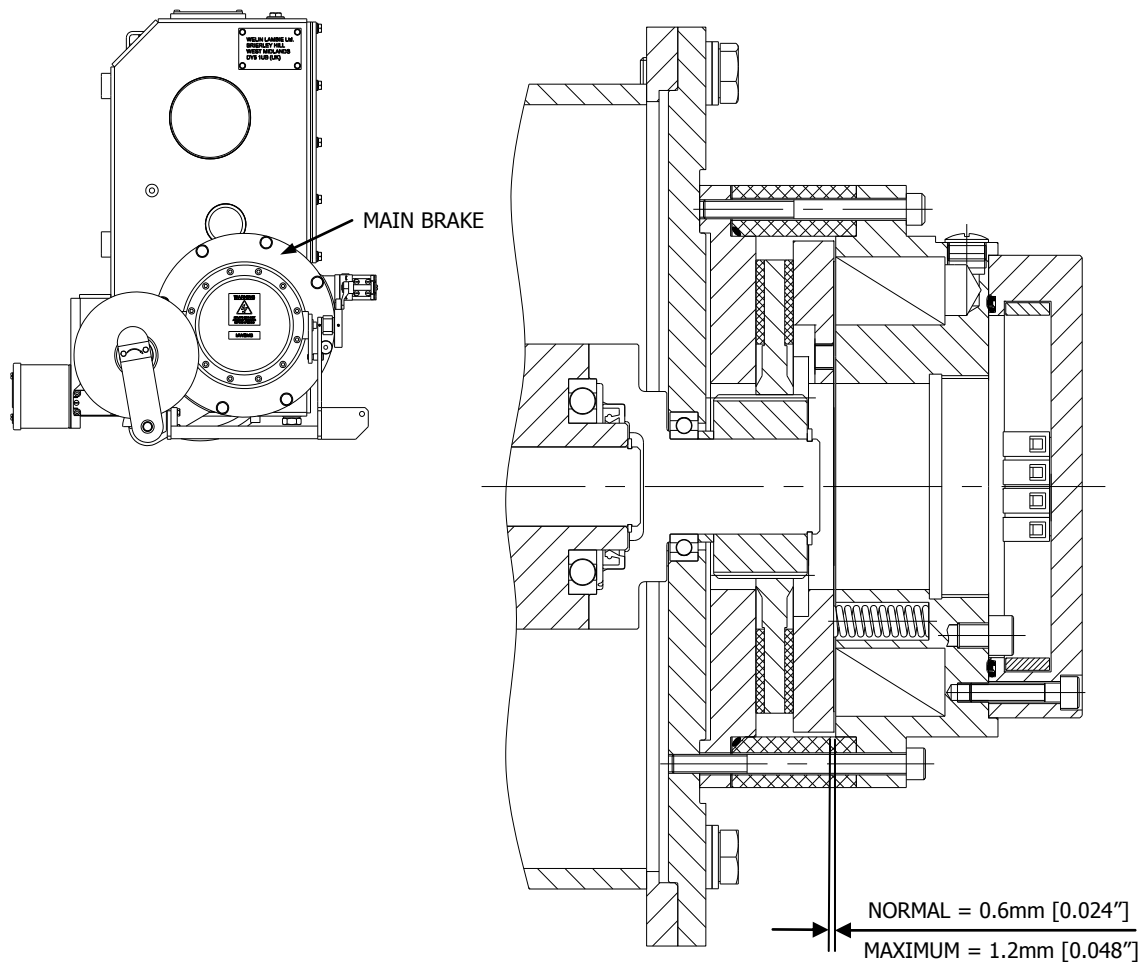


Figure 6.2: Main Brake – Checking Airgap

### 6.2.2.2 Readjustment of Airgap

When the airgap has reached its maximum stated, a readjustment becomes necessary.

- Extract the fasteners (x4) and remove brake cover to expose the terminal rails.
- Disconnect all wires from the terminals, and note positions – make safe in the event mains power is unexpectedly turned on.
- Remove the brake mounting screws (x6) and body screws (x6), and extract the body assembly and bush from the brake flange – taking care not to lose the pressure springs or damage the armature disc.

**NOTE:** The armature disc may be retained in position using two M6 socket head cap screws. However, ensure these are removed after reassembly.

- Carefully extract the 'O' ring from the brake flange and check for damage. Replace if necessary.
- Remove the stainless steel shim – 0.5mm (0.02") thick.



**NOTE:** If the shim has previously been removed, new friction linings and shim must be fitted.

- Carefully replace the 'O' ring on the brake flange.
- Refit the bush and body assembly to the brake flange and secure in position using the body screws (x6) and the brake mounting screws (x6). Tightening torque for mounting screws: 7 Nm (5 lbft).
- Reconnect all wiring to terminals.
- Refit brake cover.

**NOTE:** Seal face between brake assembly and gearbox with EMI Hylomar gasket sealant.

**WARNING:** When assembling the brake or replacing the friction lining assembly, care should be exercised to ensure the linings do not come in contact with grease, oil, water etc. If contaminated remove using a suitable cleaning agent.

**DO NOT USE PETROL OR PARAFFIN**

### 6.2.2.3 Checking/Replacement of Friction Lining Assemblies

Replacement of the friction lining assemblies becomes necessary when the shim has been removed and the maximum airgap can no longer be achieved.

- Extract the fasteners (x4) and remove brake cover to expose the terminal rails.
- Disconnect all wires from the terminals, and note positions – make safe in the event mains power is unexpectedly turned on.
- Undo two terminal rails to expose two tapped holes. Insert M6 x 55 long socket head cap screws (x2) to retain the brake body and bush in position.
- Extract the brake mounting screws (x6) – not the body screws (x6), these are the shorter than the brake mounting screws.
- Withdraw the complete brake assembly from the gearbox. Brake hub fitted to the shaft by a key and axially located by a circlip, should remain in place.
- Carefully remove the body screws (x6) from the brake to release the friction lining assembly. When all screws are removed the brake assembly will split apart.

**NOTE:** The friction linings are non asbestos – use only genuine spare parts.

- Turn the assembly upside down – being careful not to damage any of the terminals – and place on clean flat surface.
- Remove the brake flange to reveal a stainless steel shim – 0.5mm (0.02”) – and an 'O' ring, carefully remove both.
- The armature disc now remains inside the bush – this is being held by the two retaining screws inserted originally. This disc should not require removing, however if the retaining screws are removed the pressurised brake springs will be released. It is recommended that this task, if necessary, be carried out in a workshop – not on the davit/ship.

- Replace the friction lining assembly and reassemble the brake in the reverse of the above. Tightening torque for mounting screws: 7 Nm (5 lbft).

**NOTE:** Seal face between brake assembly and gearbox with EMI Hylomar gasket sealant.

**WARNING:** When assembling the brake or replacing the friction lining assembly, care should be exercised to ensure the linings do not come in contact with grease, oil, water etc. If contaminated remove using a suitable cleaning agent.

**DO NOT USE PETROL OR PARAFFIN**

**CAUTION:** The armature disc retaining screws must remain in place until the brake is reassembled. If removal is necessary, care must be taken because they are pressurised by the brake springs.

#### 6.2.2.4 Brake Replacement

The main brake is a fail-safe spring loaded single disc type fitted to the gearbox, if complete replacement is necessary no dismantling of the unit is required. The hub is fitted to the shaft by a key and axially located using a circlip.

- Extract the fasteners (x4) and remove brake cover to expose the terminal rails.
- Disconnect all wires from the terminals, and note positions – make safe in the event mains power is unexpectedly turned on.
- Extract mounting screws (x6) and withdraw the brake assembly.
- Offer the replacement brake onto the shaft ensuring friction lining assembly is centralised on the hub.
- Refit mounting screws (x6) – tightening torque: 7 Nm (5 lb ft).
- Reconnect all wiring to terminals.
- Refit brake cover.

**NOTE:** Seal face between brake assembly and gearbox with EMI Hylomar gasket sealant.

#### 6.2.3 Centrifugal Brake Shoe Replacement

The centrifugal type brake is fitted to the gearbox, operating in conjunction with the turning handle and brake shaft. See figure 6.3: Centrifugal Brake Assembly.

The brake shoe linings should be replaced if thickness is less than 2mm (1/16”) or level with the rivet heads, or lining has become contaminated by oil, shoes require relining or replacing.

Access to the centrifugal brake is achieved by removing the main brake, brake housing cover plate and the roller freewheel, before extracting the complete centrifugal brake shoe assembly from the shaft.

**NOTE:** The roller freewheel lubricant must be drained before removal.

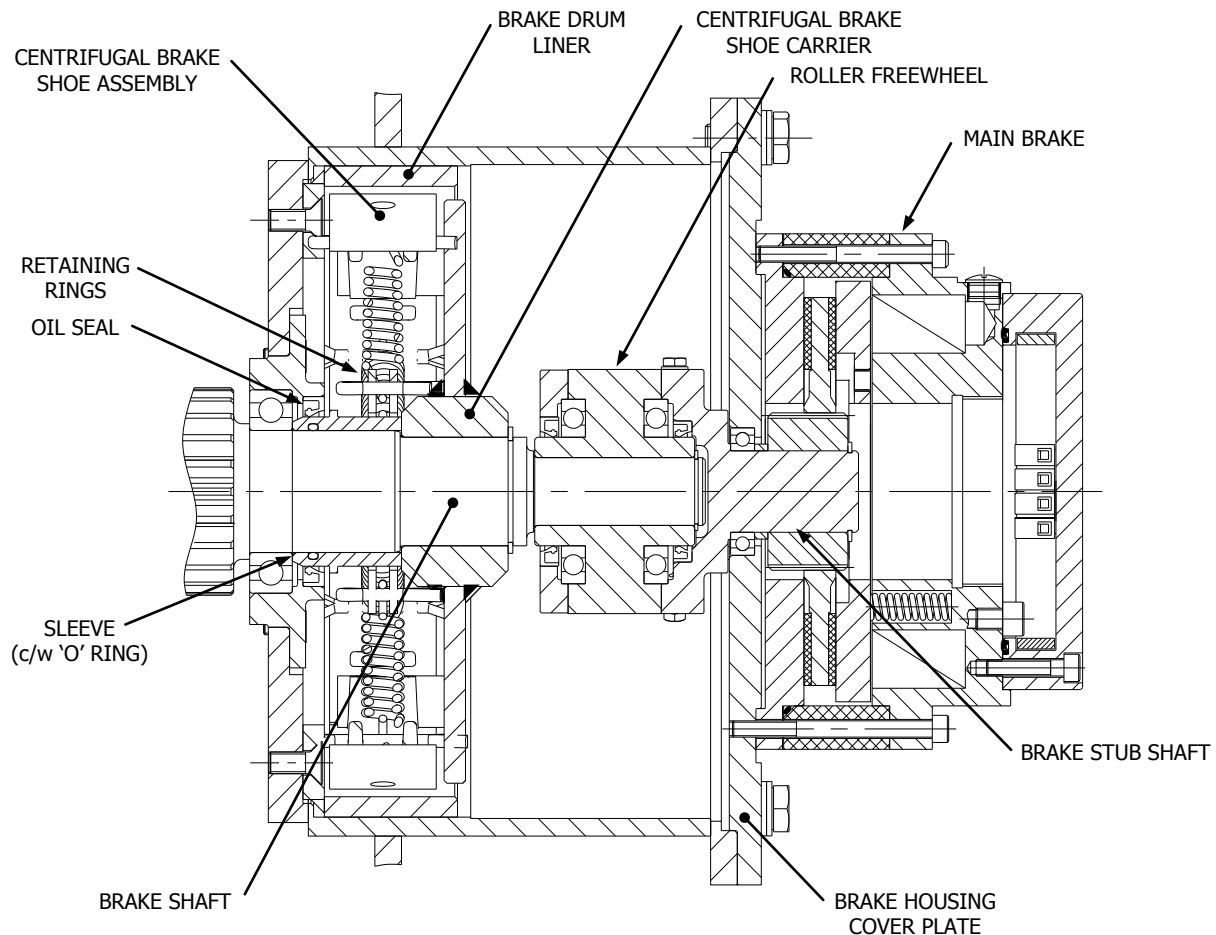


Figure 6.3: Centrifugal Brake Assembly

- Check the centrifugal brake shoe linings for wear; if thickness is less than 2mm or level with the rivet heads, or linings have become contaminated by oil, shoes require replacing.
- Remove split cotter pins and springs that retain the shoes to the carrier. See figure 6.4: Centrifugal Brake Shoe Mounting.

**IMPORTANT:** Grease/oil must not contaminate the brake drum liner.

- Remove the sleeve from the brake shaft.
- Check the shaft bearing seal and the sleeve 'O' ring for signs of damage. If there are any signs of damage/leakage replace. Remove any oil leakage using a suitable solvent.
- Remove any dust and scale that may have accumulated in the housing - the brake linings are made from non-asbestos material.
- Thoroughly clean all bearing surfaces and faces.
- Refit the bearing seal together with the sleeve and 'O' ring.
- Fit new shoes and replace split cotter pins and springs.

**IMPORTANT:** If less than 6 shoes are fitted, refit new shoes in same position as originals.

**CAUTION:** It is essential that the linings be replaced with the same type as the original. If not the speed of lower may vary beyond the limits to which the winch has been tested.

- Check shoes operate freely on the carrier.

**CAUTION:** Free movement is essential to ensure the brake operates correctly.

- Lightly grease the brake shaft; ensuring any excess is removed, before refitting the complete centrifugal brake shoe assembly and the retaining circlip.

**CAUTION:** Grease must not contaminate brake housing or drum liner.

- Refit the roller freewheel to the brake shaft.
- Refit the brake stub shaft and refill roller freewheel with oil to the correct level.
- Remove any previously applied sealing compound from both the cover plate face and the brake housing face and apply new waterproof jointing compound. Equally tension all cover plate hexagon head screws and remove any excess grease.
- Refit the main brake hub to the stub shaft.
- Refit the main brake assembly.
- Refit the main brake handle release mechanism, and check correct operation.

**WARNING:** If any oil or grease has contaminated the brake drum surface during the above procedure, it must be thoroughly cleaned off with an appropriate solvent. Oil or grease on the brake lining surface will reduce the efficiency of the brake, which could result in injury or death.

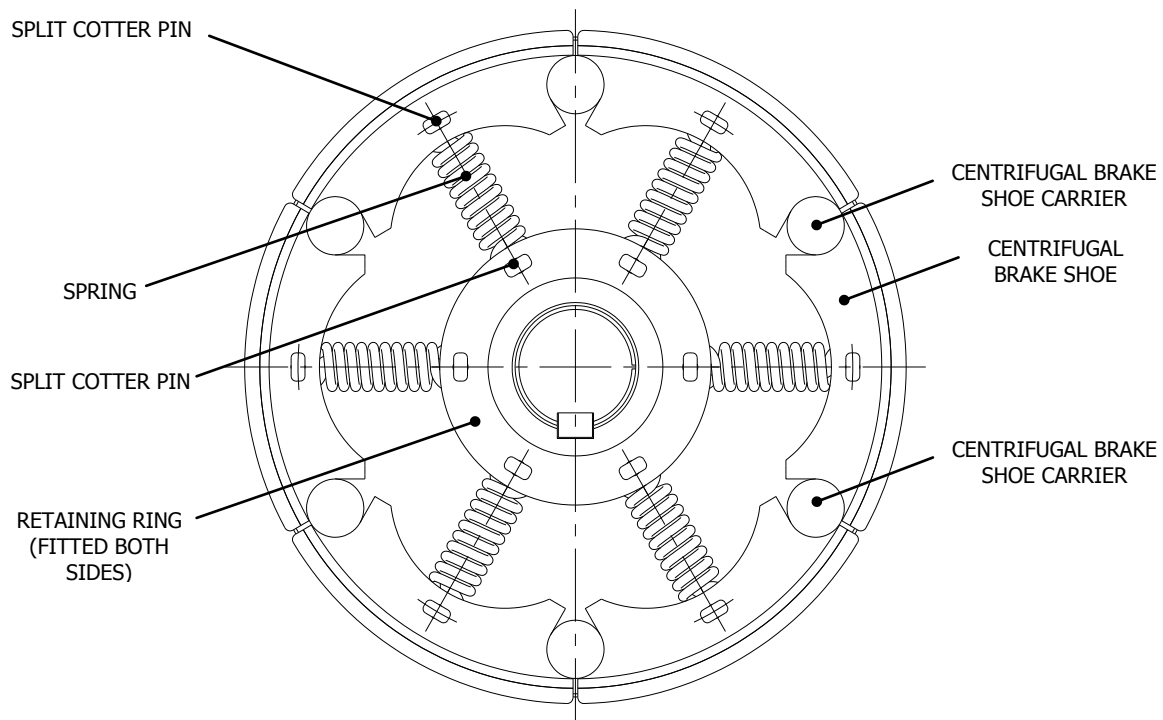


Figure 6.4: Centrifugal Brake Shoe Mounting  
(Note: Number of shoes may vary depending on winch capacity)

#### 6.2.4 Clutch Shoe Replacement

The clutch assembly, which comprises four individual shoes, is mounted directly to the motor shaft, housed within the winch gearbox. See figure 6.5: Centrifugal Clutch Assembly.

Replacement of the clutch shoes is as follows:

- Isolate the electrical supply to the motor.
- Remove the motor terminal box lid and make a note of the electrical connections.
- Detach individual cores from the respective terminals, unscrew the cable glands and completely remove the cables.
- Replace the terminal box lid and support the weight of the motor using a crane or similar.

**WARNING:** Do not attempt to lift or support the motor manually as injury is likely to occur.

- Remove the hexagon head setscrews (x4) holding the motor and carefully withdraw until the clutch shoes are exposed.
- Inspect the clutch drum for any signs of excessive wear. Remove any dust and scale, that may have accumulated (clutch linings are made from non-asbestos) in the drum and housing.

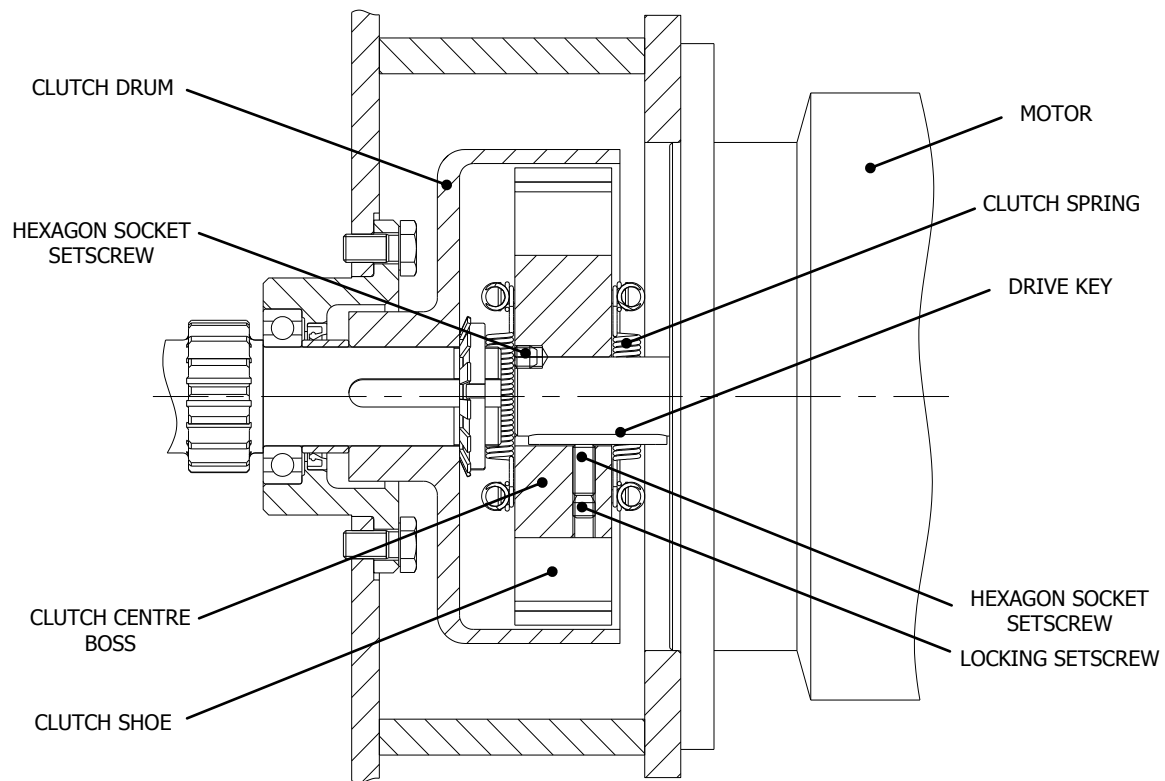


Figure 6.5: Centrifugal Clutch Assembly

- Check the tightness of the hexagon socket setscrew and locking screw in the clutch centre boss onto the key. Check the tightness of the hexagon socket setscrew on the end of the motor shaft/clutch centre boss and also inspect the drive key for signs of excessive wear.
- Check the clutch shoe linings for wear, if thickness is less than 2mm or level with the rivet heads, or the linings have become contaminated with oil or grease they need replacing. See figure 6.6: Centrifugal Clutch Shoe Mounting.

**IMPORTANT:** Ensure all terminals are fully tightened.

- Refit the cable glands, first coating the threads and sealing surfaces with waterproof sealant.
- Check the terminal box lid gasket for signs of damage and apply a coating of waterproof sealing compound. Replace the lid and fully tighten screws.

**IMPORTANT:** It is vital for the correct running and safety of the equipment that the terminals are correctly tightened and that the terminal box lid is correctly fitted to prevent water ingress.

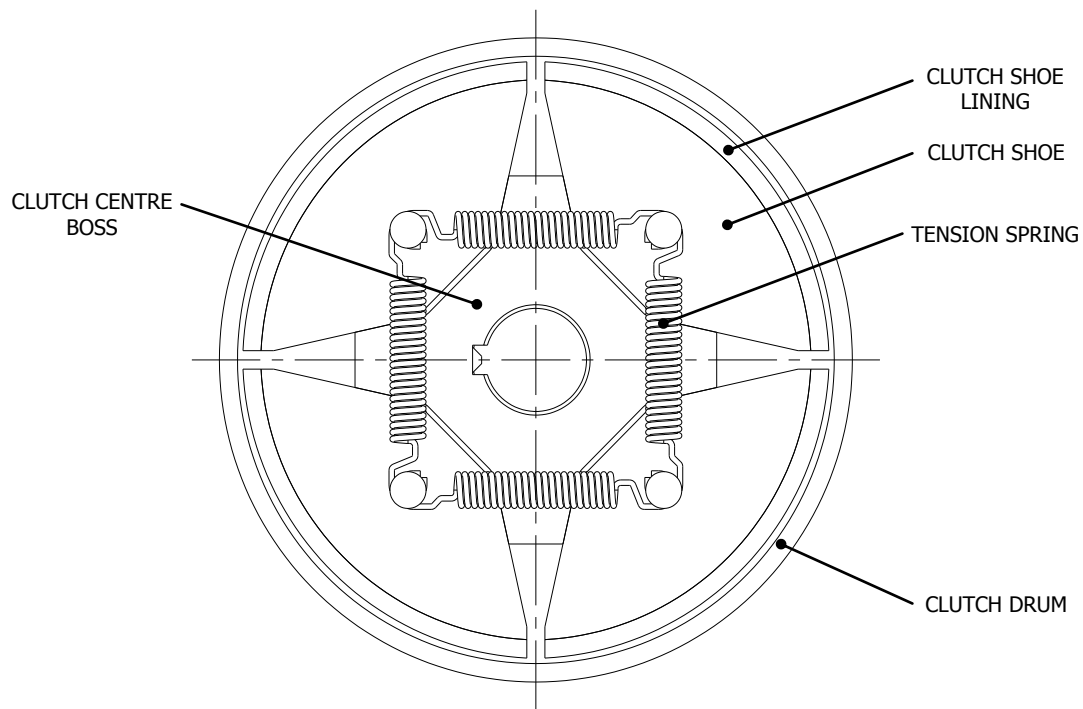


Figure 6.6: Centrifugal Clutch Shoe Mounting

### 6.2.5 Roller Freewheel

A roller type ratchet freewheel is fitted directly behind the main brake, housed between the brake stub shaft and a fixed cover, both of which contain a standard oil seal. The unit is self contained, bearing supported and equipped with 3 screws for oil filling, drain and level.

Access to the roller freewheel is achieved by removing the main brake and brake housing cover plate. The unit is keyed to the brake shaft and axially located using a circlip; however removal requires draining the lubricant and removing the brake stub shaft. See figures 6.7: Roller Freewheel Assembly.

Roller freewheel removal:

- Extract fasteners (x4) and remove brake cover to expose the terminal rails.
- Disconnect all wires from the terminals – make safe in the event mains power is unexpectedly turned on.
- Extract mounting screws (x6) and withdraw the brake assembly.
- Remove brake hub from the brake stub shaft.
- Remove brake housing cover plate and oil seal.
- Drain the lubricant from the freewheel and remove the brake stub shaft.
- Remove freewheel and fixed cover from the brake shaft, noting the freewheeling direction, the replacement must be fitted in the same attitude.

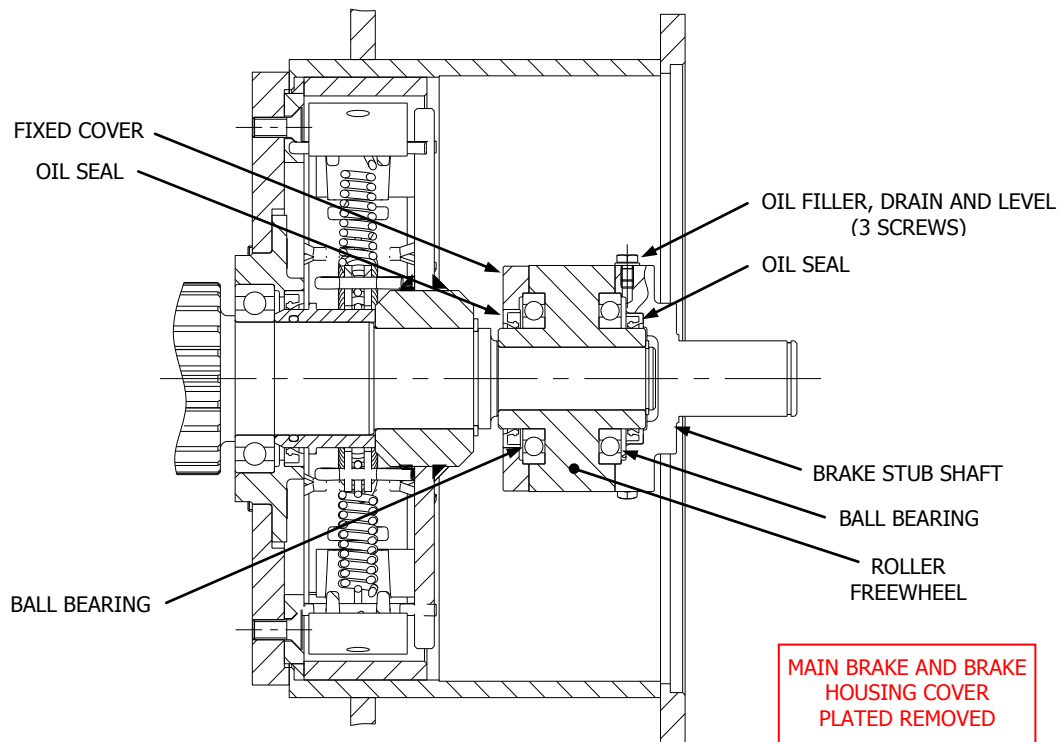


Figure 6.7: Roller Freewheel Assembly

#### Roller freewheel fitting:

- Refit freewheel and fixed cover to the brake shaft, ensuring freewheel direction is correct.
- Refit the brake stub shaft and refill the freewheel with lubricant. Refer to Chapter 4.6: Lubricants.
- Refit the brake housing cover plate.
- Refit the brake hub to the brake stub shaft.
- Offer the brake onto the shaft ensuring friction lining and assembly is centralised.
- Tighten fixing screws (x6) to 7 Nm (5 lbsft).
- Reconnect all wiring to terminals.

#### Roller freewheel information:

Tighten the setscrews to 25 Nm (19 lbsft).

Care must be taken that the ball bearings are not loaded radially or axially during installation.

After installation, ensure the unit freewheels in the required direction.

Prior to use check that the lubricant is to the correct level.

**NOTE:** For units despatched 'dry' the corrosion inhibitor should be removed using flushing oil.



**WARNING:** The roller freewheel must be installed in a clean dry environment. If any foreign matter should enter the assembly it may cause failure, resulting in equipment damage, personal injury or death.

### 6.2.6 Main Rope Replacement

Before commencing make sure the deck around the davit is clean (cover deck if required to protect from oil/grease). Refer to figure 6.8: Reeving Main Rope.

Remove old rope as follows:

- Remove the release hook and striker block and keep nearby for refitting to the new rope.
- Remove the rope drum guard from the winch.
- Wind off the rope using the winch handwheel.

**NOTE:** The remote rope will be wound off at the same time as the main rope. Apply tension while winding off.

**WARNING:** Always wear gloves when handling wire rope.

- Undo main rope clamp and remove the rope.
- Dispose of old rope safely.

The new rope should be uncoiled in an area which has been cleaned of all dirt and debris prior to installing. It is also advisable to lubricate (Code 'C') the rope either before or during the reeving process. Refer to Chapter 4.6: Lubricants.

Fit the new main rope as follows:

- Take plain end of the new rope and pass through striker arm, then reeve around the head sheave, passing beneath the rope guard plates, then down to the winch rope drum.
- At the rope drum pass the rope end through the slot in the wide drum section and fit between rope clamp and drum.
- Tighten both nuts securely to clamp the rope.
- When working there should always be at least 3 dead turns of rope on the drum at all times which prevents any significant load being transferred back to the anchorage.
- Tension both main and remote control ropes and wind on both ropes until main rope thimble end is lifted from the deck. Ensure tension is maintained in both ropes while winding and coil evenly without gaps. Do not allow either rope to twist or kink while winding on.
- Refit the striker block and release hook and re-check the nuts securing the rope clamp are tight.
- Refit the rope drum guard.

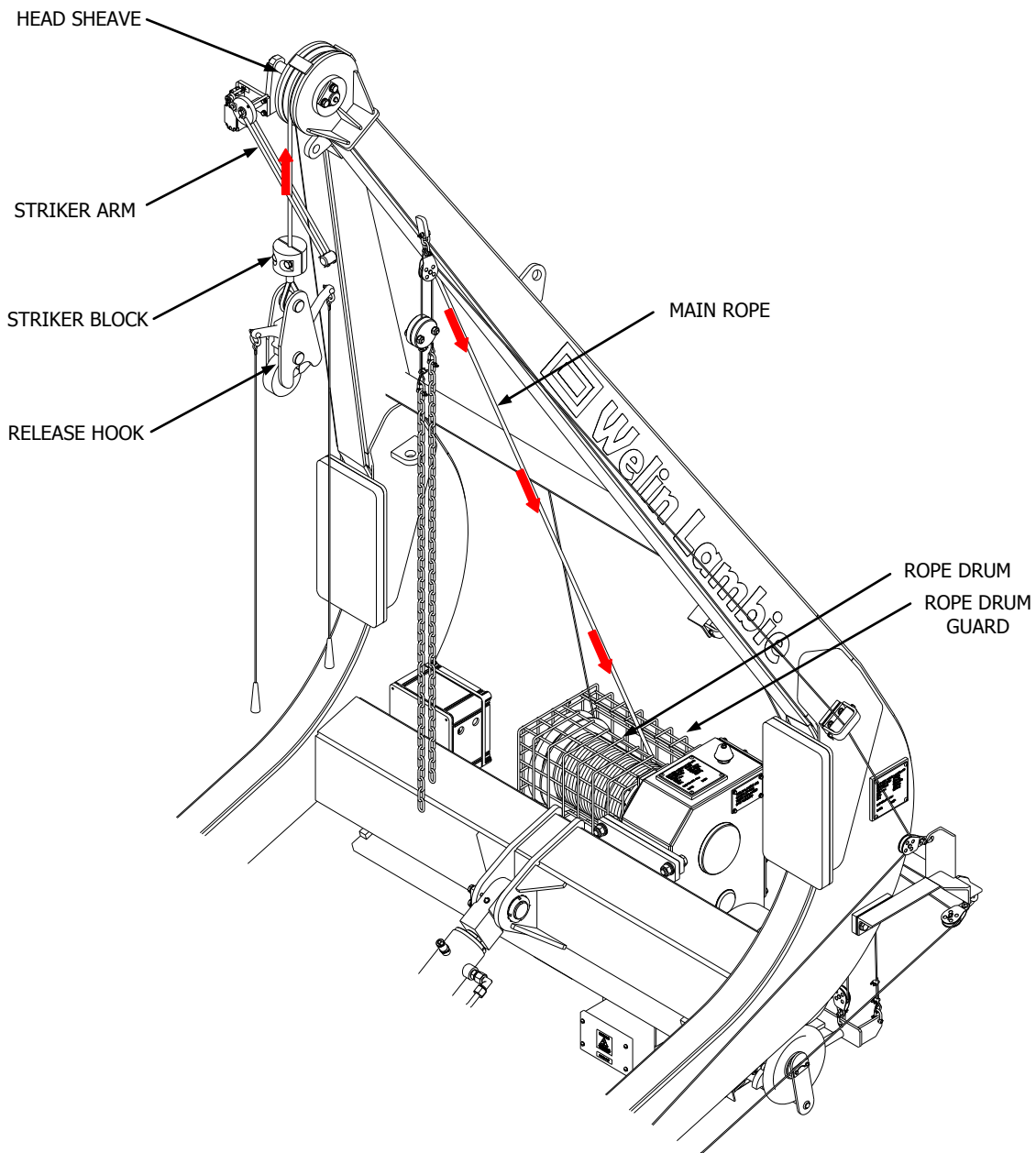


Figure 6.8: Reeving Main Rope

### 6.2.7 Remote Brake Control Rope (Boat) Replacement

Before commencing make sure the deck around the davit is clean (cover deck if required to protect from oil/grease). Refer to figure 6.9: Reeving Remote Brake Control Rope - Boat.

Remove old rope as follows:

- Remove the chain and shackle and keep nearby for refitting to the new rope.
- Remove the rope drum guard from the winch.
- Wind off the rope using the winch handwheel.

**NOTE:** The main rope will be wound off at the same time as the remote rope. Apply tension while winding off.

**WARNING:** **Always wear gloves when handling wire rope.**

- Undo the rope clamp and remove the rope. Note its path through the shackles around the davit.
- Dispose of old rope safely.

The new rope should be uncoiled in an area which has been cleaned of all dirt and debris prior to installing. It is also advisable to lubricate (Code 'C') the rope either before or during the reeving process. Refer to Chapter 4.6: Lubricants.

Fit the new remote brake control rope as follows:

- Take plain end of the new rope and reeve around the pulley blocks, beginning at the arm apex. Continue down the arm, passing between the guide brackets and rollers, to the pulley block at the brake lever. Return back through the guide bracket and roller directly above the lever to the pulley block on the arm cross member, continue horizontally to the next pulley block then finally down to the winch drum.
- At the rope drum pass the rope end through the hole in the narrow drum section and attach the clamp by tightening screw securely to rope. Pull tight and wind on a full layer rope.
- Tension both main and remote control ropes and wind on both ropes until main rope is lifted from the deck. Ensure tension is maintained in both ropes while winding and coil evenly without gaps. Do not allow either rope to twist or kink while winding on.
- Attach the shackle and chain to the thimble end of the new rope.
- Refit the rope drum guard.

**NOTE:** When the ropes are fully wound on and with the limit switch striker touching the hoist limit switch striker arm there must be approximately 350mm (14") between the remote rope thimble and the first pulley block.

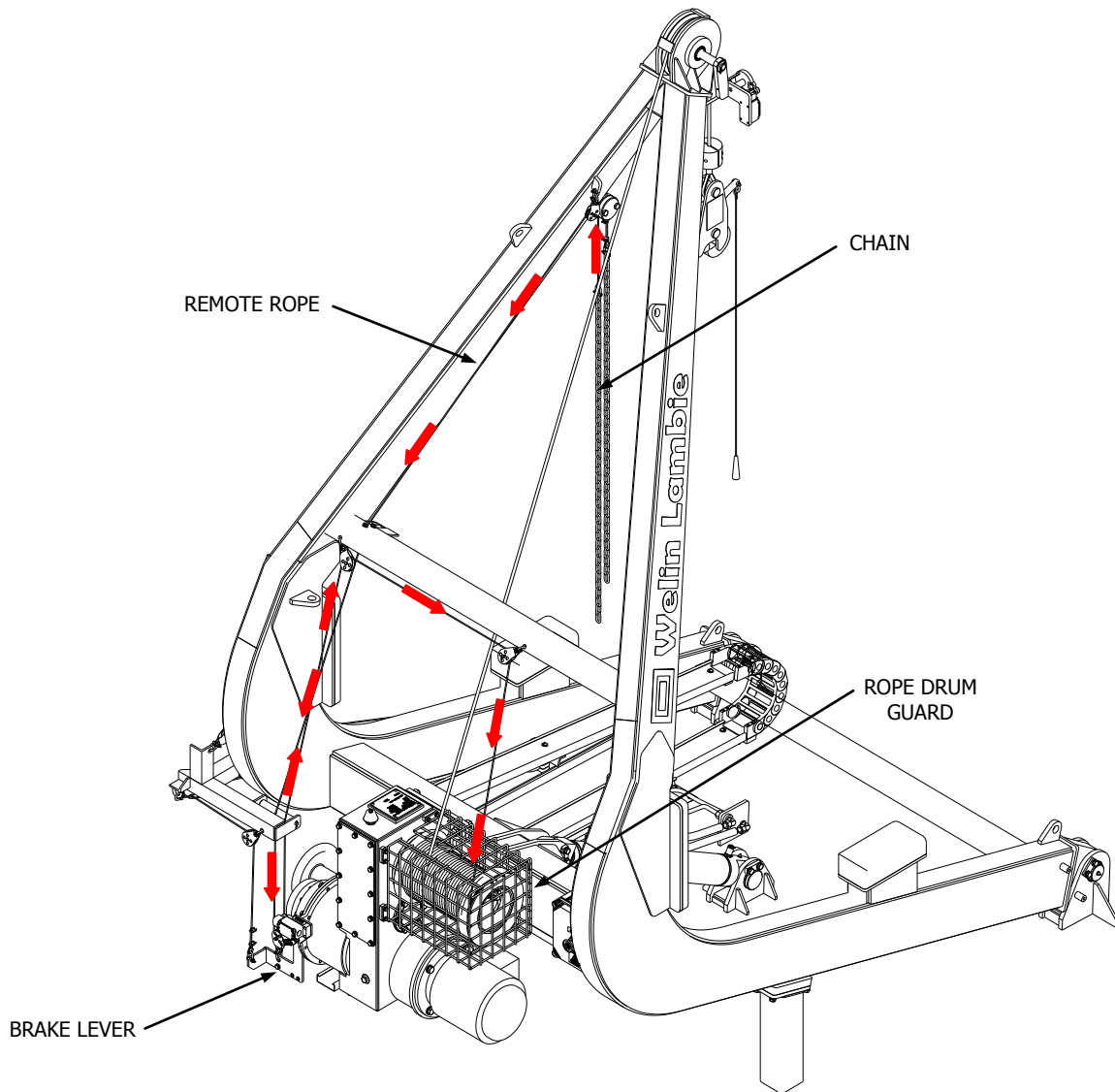


Figure 6.9: Reeving Remote Brake Control Rope – Boat

### 6.2.8 Remote Brake Control Rope (Deck) Replacement

Before commencing make sure the deck around the davit is clean (cover deck if required to protect from oil/grease). Refer to figure 6.10: Reeving Remote Brake Control Rope - Deck.

**WARNING:** Always wear gloves when handling wire rope.

Remove old rope as follows:

- Remove the wire grips and thimble from the brake release lever shackle, and keep nearby for refitting to the new rope.
- Remove the rope, noting its path through the shackles and guides around the davit.
- At the control station remove the shackle from the lever, and keep nearby for refitting to the new rope.
- Dispose of old rope safely.

- The new rope should be uncoiled in an area which has been cleaned of all dirt and debris prior to installing. It is also advisable to lubricate (Code 'C') the rope either before or during the reeving process. Refer to Chapter 4.6: Lubricants.

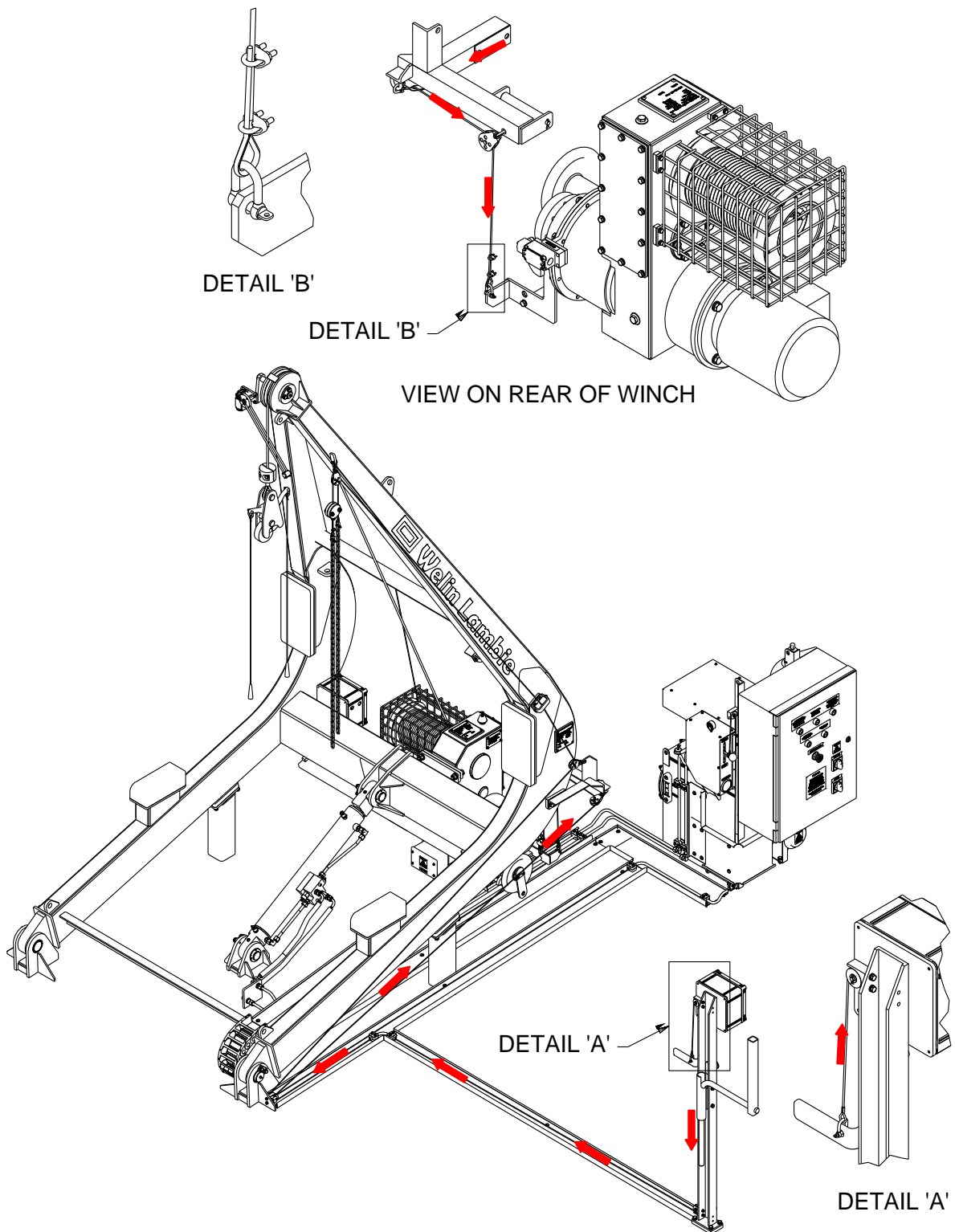


Figure 6.10: Reeving Remote Brake Control Rope – Deck

Fit the new remote brake control rope as follows:

- At control station attach thimble end of the new rope to the lever using shackle.
- Pass the plain end of the new rope around pulley block directly above the lever, then down to a pulley at the control station base. Continue along cable tray to the forward arm pivot bracket, feeding through guide tube located at the cable tray junction, before passing around the outer pulley. From here rope should follow the davit arm to the lower shackle on arm bracket, then along to shackle at rear of bracket. Finally pass plain end of rope round thimble and attach wire grips, then connect to the brake release handle using shackle.

### 6.2.9 Remote Luff Control Rope Replacement

Before commencing make sure the deck around the davit is clean (cover deck if required to protect from oil/grease). Refer to figure 6.11: Reeving Remote Luff Control Rope.

**WARNING:** Always wear gloves when handling wire rope.

Remove old rope as follows:

- Remove the chain and shackle, counter weights, wire grips and thimble, and keep nearby for refitting to the new rope.
- Remove the rope, noting its path through the shackles and guides around the davit.
- At the hydraulic power pack unscrew the plastic ball knob from luff valve handle, remove the spacer, and keep nearby for refitting to the new rope.
- Dispose of old rope safely.

The new rope should be uncoiled in an area which has been cleaned of all dirt and debris prior to installing. It is also advisable to lubricate (Code 'C') the rope either before or during the reeving process. Refer to Chapter 4.6: Lubricants.

Fit the new remote luff control rope as follows:

- At hydraulic power pack attach thimble end of the new rope to luff valve handle, refit spacer and plastic ball knob, to secure rope in position.
- Pass the plain end of the rope around pulley block mounted directly above the luff valve handle, and then down to a pulley at base of the power pack, ensuring rope passes behind the cable tray. Feed the rope through guide tube located on deck mounted cable tray, and continue to the forward arm pivot bracket, before passing around the pulley nearest davit arm. From here the rope should follow davit arm up to the head, passing around the upper shackle at the arm bracket, the roller guide located directly above and then the shackle at davit head. Finally pass plain end of rope round thimble and attach wire grips together with counter weights, then connect chain using shackle.

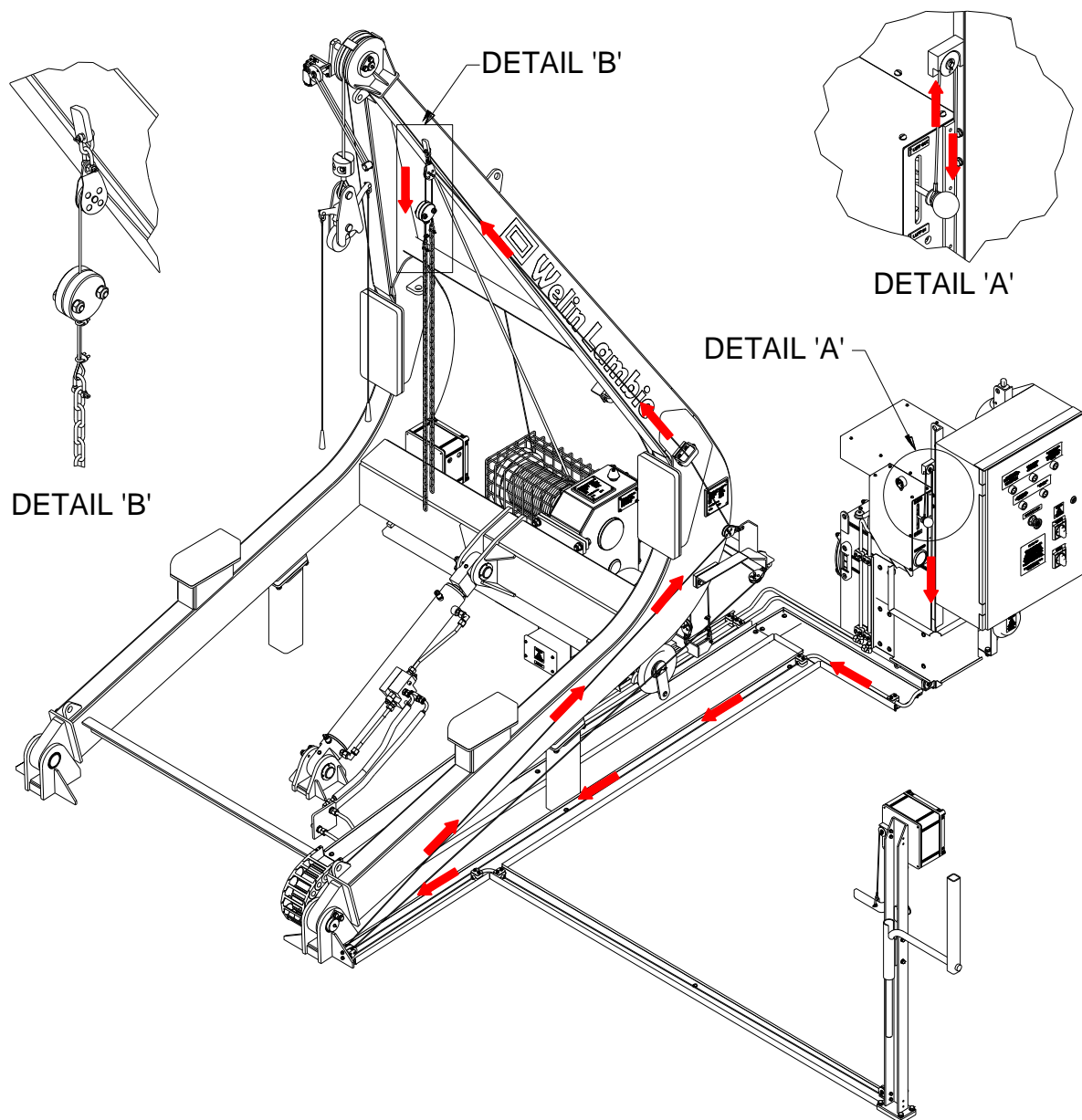


Figure 6.11: Reeving Remote Luff Control Rope – Boat

## 6.3 HYDRAULIC

### 6.3.1 General

Corrective maintenance work must only be carried out by trained personnel using the correct equipment.

It is the responsibility of the maintainer to comply with the water regulations of the country concerned.



Please ensure safe and environmentally friendly disposal of hydraulic oils. The relevant regulations in the country concerned with regard to ground water pollution, used oil and waste must be complied with.

Statutory accident prevention regulations, safety regulations and safety data for fluids must be observed.

The electrical supply must be completely isolated before any corrective maintenance work is carried out on the hydraulic system.

Before disconnecting any pipe work first make certain the pressure has been released.

Always use the correct fittings and pipe work for the working pressure of the system and ensure that such fittings and pipe work are clean and assembled correctly.

Check any replacement parts to be fitted are to the correct specification.

When working on, or in the vicinity of the hydraulic system, naked flames, spark generation and smoking are forbidden.

Cleanliness is essential at all times.

Drain trays, suction equipment and absorbent material should be to hand to prevent oil spillage.

**WARNING:**        **Always wear appropriate protective clothing when working with hydraulic fluid.**

### **6.3.2        Accumulator Pre-Charge Procedure**

Pre-charge setting for the accumulator: 76 bar (1100 psi).

**IMPORTANT:**        Accumulator charging contains inherent risks associated with the unexpected release of high pressure gaseous energy. Take into account the following:

- Gas jet effects and the acceleration of loose particulate.
- Asphyxiation due to the release of nitrogen gas in a confined space.
- Accumulator acceleration in the event of unexpected release of gas.
- Note the maximum working pressure of the accumulator and do not over pressurise.
- Ensure that any protective caps (usually plastic) are removed prior to pre-charging.
- Noise may be emitted in the event of sudden release of gas.
- Avoid direct contact with oil mists.
- Select the correct charging equipment in good working condition ensuring that pressure gauges are safety pattern type and all hoses must be designed to be used with gas.

**USE ONLY OXYGEN FREE DRY NITROGEN GAS**



**WARNING:** It is recommended that a regulator valve is fitted in the gas line when charging accumulators with a shell rating less than that of the gas supply.

The accumulator pre-charge should be set as follows:

- Set main and auxiliary isolators, located on control panel, to 'OFF' position.
- Dump all of the oil in the accumulator to the reservoir, by slowly opening the dump valve on the safety block. Refer to figure 6.12: Accumulator Safety Block.

**IMPORTANT:** Check the pressure gauge on the safety block reads zero before continuing with procedure.

- With zero hydraulic pressure in the accumulator, isolate from the rest of the system by rotating the shut off valve to 'OFF' (closed). Refer to figure 6.12: Accumulator Safety Block.

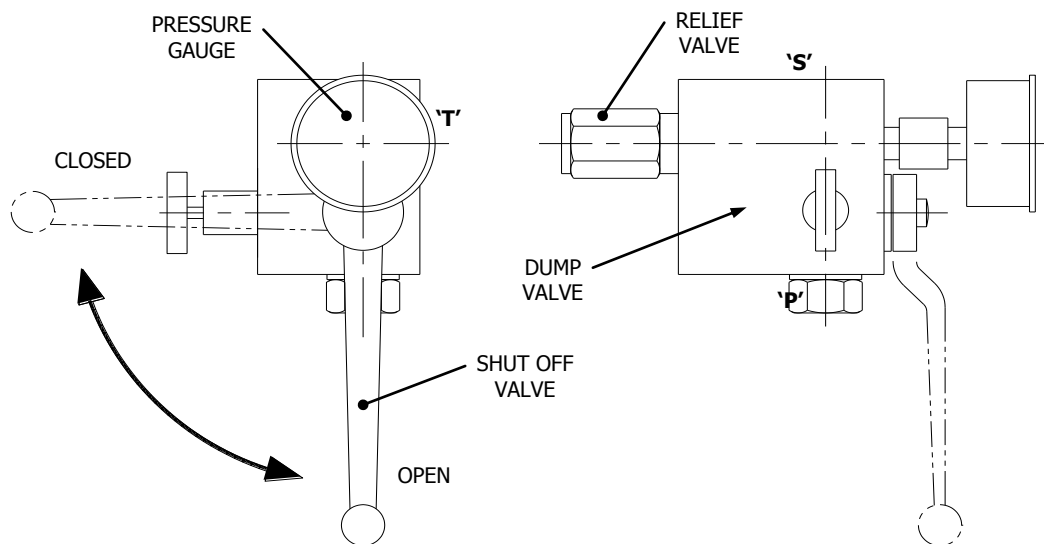


Figure 6.12: Accumulator Safety Block

- Remove the sealing cap from the gas charge connection. Refer to figure 6.13: Accumulator Pre-Charge Setup.
- Fit charging assembly using the thread adaptor, having ensured the hand wheel 'A' is fully retracted (counter-clockwise), bleed screw 'B' is open and pressure gauge fitted.
- Connect charging hose to charging assembly and to the nitrogen supply using the appropriate adaptor. (N<sup>2</sup> cylinder).
- Attach lever to nitrogen bottle valve. Rotate the hand wheel 'A' on the charging assembly (clockwise) to open the gas valve. Do not screw hand wheel down tight. Slowly open the nitrogen supply and allow gas to gently enter the accumulator until a pressure slightly in excess of final pressure is obtained (i.e. 76 bar –1100 psi). Close the nitrogen supply.

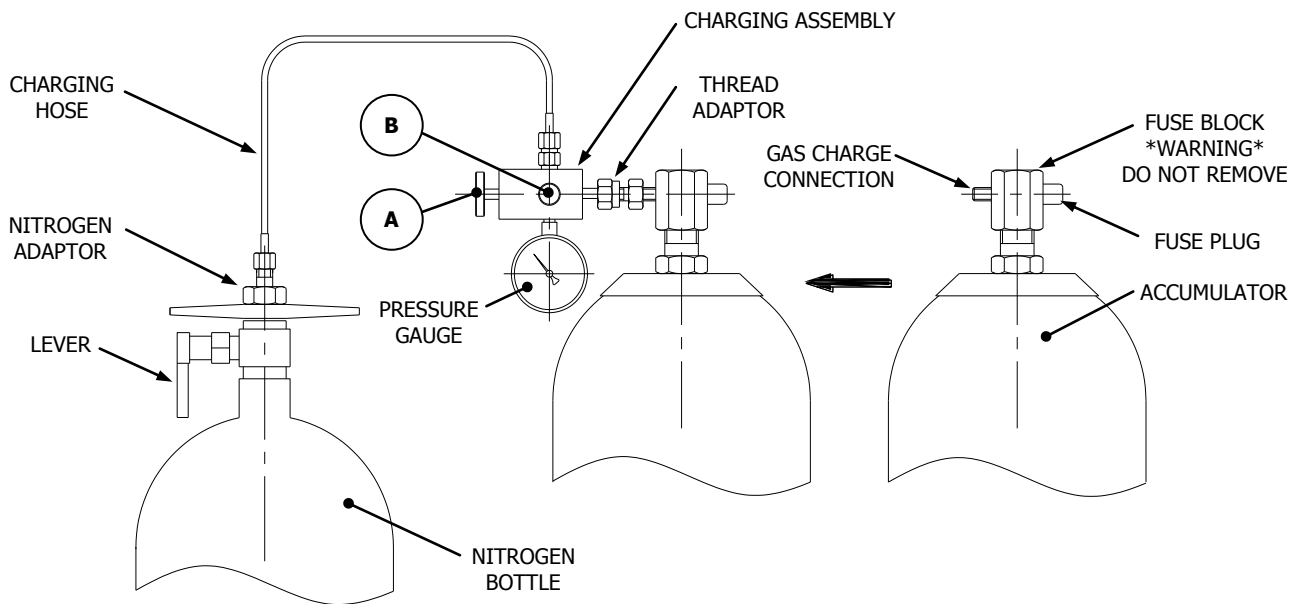


Figure 6.13 Accumulator Pre-Charge Setup

- Allow nitrogen pressure to stabilize (approximately 5 minutes).
- Retract hand wheel 'A' (counter-clockwise) to seal gas valve. Crack bleed screw 'B' to exhaust gas from charging hose and remove hose from charging assembly and replace hose connection sealing cap. Remove charging assembly and thread adaptor. Replace the sealing cap on the gas charge connection. Fully close the dump valve on the safety block.
- Set main and auxiliary isolators, located on control panel, to 'ON' position and press 'Safety System Tripped' reset button on the control station.
- The hydraulic pump will charge the accumulator to 200 bar (2900 psi), and automatically switched off. The oil will return to the 'Working' level. Hydraulic system should be now ready for use.

### 6.3.3 Checking Accumulator Pre-Charge

Pre-charge setting for the accumulator: 76 bar (1100 psi).

Checking the accumulator pre-charge should be as follows:

- Set main and auxiliary isolators, located on control panel, to 'OFF' position.
- Dump all of the oil in the accumulators to the reservoir, by slowly opening the dump valve on the safety block. Refer to figure 6.12: Accumulator Safety Block.

**IMPORTANT:** Check the pressure gauge on the safety block reads zero before continuing with procedure.

- Before fitting the charging assembly ensure the hand wheel 'A' is fully retracted (counter-clockwise), bleed screw 'B' is closed and pressure gauge c/w copper sealing washer is fitted. **Note: Do not fit charging hose.** Refer to figure 6.13: Accumulator Pre-Charge Setup.

- Remove the sealing cap from the gas charge connection.
- Fit the charging assembly using the thread adaptor.
- Rotate the hand wheel 'A' (clockwise) until a pressure is registered. Do not screw hand wheel down tight.

**NOTE:** The correct pre-charge pressure should be 76 bar (1100psi).

- If the pressure is too high, it can be reduced, by opening the bleed Screw 'B' until the correct pressure is registered on the gauge.
- If the pressure is too low, refer to the pre-charging procedure (6.3.2).
- If the pressure is correct, remove the charging assembly as follows:  
Retract hand wheel 'A' (counter-clockwise).  
Open the bleed screw 'B'.  
Remove charging assembly and thread adaptor.  
Replace the sealing cap on the gas charge connection.  
Fully close the dump valve on the safety block.
- Set main and auxiliary isolators, located on control panel, to 'ON' position and press 'Safety System Tripped' reset button on the control station.

## 6.4 ELECTRICAL

### 6.4.1 General

The following checks should be carried out before removing/replacing any electrical items which may be considered faulty.

- Check supply to relevant circuit breaker/fuse.
- Check voltage is present to appropriate circuit.
- Check the tightness of all electrical connections including earth connections.

Reference should be made to Chapter 4: Scheduled Maintenance, for any adjustments etc; which may affect any parts of the equipment during reassembly.

**WARNING:** Always ensure davit isolators are 'off' before commencing any corrective maintenance.

### 6.4.2 Control Panel Thermostat

The thermostat is used to control the anti-condensation heater. It has an adjustable range from 0 to 60°C (32 to 140°F). The thermostat should be set to 20°C. Refer to figure 6.14: Control Panel Interior.

The thermostat is maintenance free. Therefore, if it is suspected as being faulty it must be replaced.

To replace the thermostat:

- Switch main and auxiliary isolators to 'OFF' position at the control panel.
- Remove the two wires going into the bottom of the thermostat (106 & 113) and unclip from the DIN rail. Clip new thermostat to the DIN rail, reconnect the two wires and set to 20°C.
- Switch main and auxiliary isolators to 'ON' position and press 'Safety System Reset' button.

### 6.4.3 Control Panel Anti-Condensation Heater

The control panel contains an anti-condensation heater, controlled by a thermostat. Power to the heater (via the thermostat) should be on at all times to prevent the build up of any moisture. If the heater is suspected as being faulty, first check by turning the heater to its highest setting. If the heater does not operate it should be replaced. Refer to figure 6.14: Control Panel Interior.

To replace the anti-condensation heater:

- Switch main and auxiliary isolators to 'OFF' position at the control panel.
- First remove the safety cage, and then disconnect the two wires (107 & 113). Unscrew the heater and remove.
- Refit new heater in position and reconnect wires.
- Refit safety cage.
- Switch main and auxiliary isolators to 'ON' position and press 'Safety System Reset' button.
- Check heater operation by setting the thermostat to its highest setting. If the heater operates okay, reset the thermostat to the correct setting. Refer to section 6.4.2: Control Panel Thermostat.

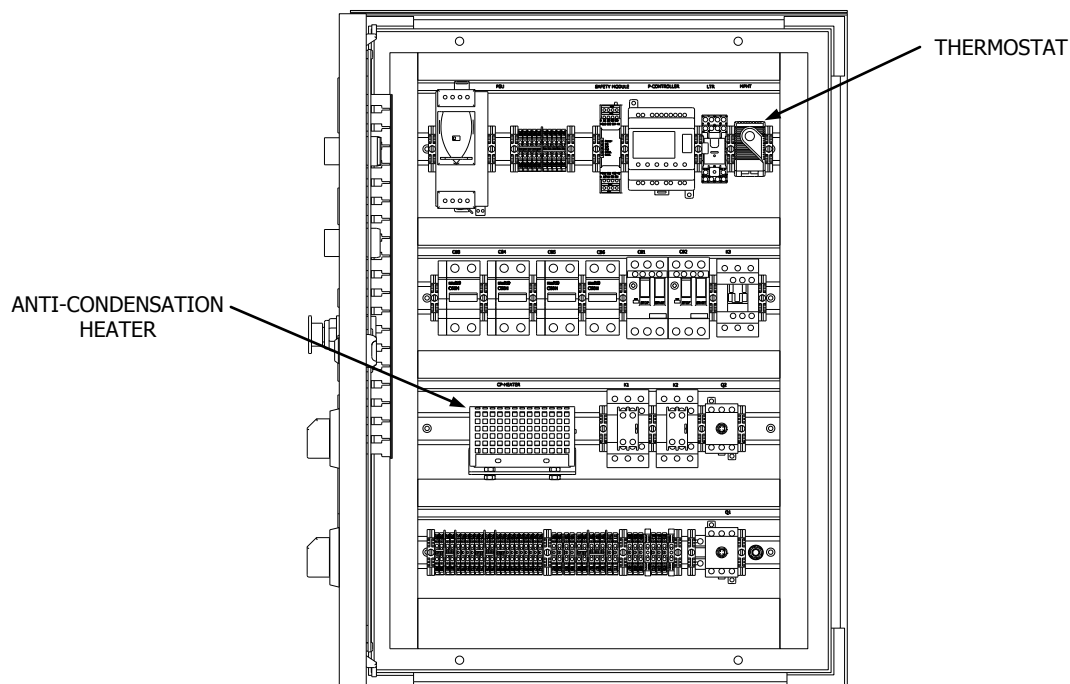


Figure 6.14: Control Panel Interior

#### 6.4.4 Oil Heater and Thermostat

The hydraulic reservoir oil heater is fitted to keep the hydraulic oil at a set temperature thus maintaining the oil at a constant viscosity. The heater is rated 1.0 kW at 110V, and is controlled by an integral thermostat set to 18°C (64°F).

If the heater is faulty or broken it should be replaced.

Replacement is as follows:

- Switch main and auxiliary isolators, located on the control panel, to 'OFF' position.
- Remove the end cover.
- Disconnect the cable from the terminals (make a note of which cable goes to which terminal).
- Unscrew the heater and remove.
- Fit new gasket and screw in the new heater. Re-connect the cables to the relevant terminals and make sure the thermostat is set to 18°C (64°F).
- Replace the end cover.
- Switch main and auxiliary isolators, located on the control panel, to 'ON' position and press 'Safety System Tripped' reset button.

#### 6.4.5 Safety/Hoist Limit Switch Replacement

Before removing the old switch check the relative position of the roller lever to the switch body.

**WARNING:** The lever is fitted on a spline with 36 possible positions and must be refitted in exactly the same position or damage to equipment, injury or death may occur.

- Remove the cover of the old limit switch and disconnect the electrical cables. Make a record of which numbered core goes to which terminal.
- Disconnect any earth cable and unscrew the cable gland.
- Carefully withdraw the cable from the switch.
- Undo the four cap head screws and remove the switch.
- Before fitting the new switch check mounting holes for any signs of paint damage or rust. Repair as necessary.

Fitting the new switch is generally a reversal of the above, but new waterproof sealant should be applied to the cable gland before fitting.

**CAUTION:** Make sure the limit switch lid screws are fully tightened to prevent water ingress.

After fitting check the switch functions correctly.



## 7.0 DRAWINGS AND PARTS LISTS

The drawings and parts lists in this section are included as reference aids to the other chapters in this manual and identify part by number/description.

### 7.1 DRAWING LIST

Drawing No.	Title
5683-4301	General Arrangement
5683-4302	Deck Interface
5683-4304	Hydraulic and Electrical Interface
5601-1901	Davit Assembly
5601-1902	Davit Installation Assembly
5504-6801	Winch Gearbox Assembly
2520-3401	Centrifugal Brake Shoe Assembly
2520-3001	Clutch Shoe Assembly
2781-5301	Control Panel Assembly
5802-0701	Control Station Stand Assembly
2781-5101	Control Station Assembly
5673-5601	Winch Terminal Box Assembly
2762-1301	Electrical Assembly
2771-2404	Wiring Diagram
5723-3401	Hydraulic Power Pack Assembly
5725-3301	Hydraulic Diagram

### 7.2 ORDERING INFORMATION

When ordering spare parts it is important to state the following information, to ensure that the correct items will be supplied;

- Part number and quantity required.
- Assembly drawing number where part is called up.
- Welin supplier reference number. Located on any load plate – davit or winch.  
(Or 'Welin reference' from the cover of this technical manual)
- Where possible the name of the vessel.

### 7.3 AUTHORISED SPARES AND SERVICE AGENTS

Only genuine replacement parts sourced from Welin Lambie Ltd should be used to ensure fit, function and reliability of the life saving equipment.

**CAUTION:** To comply with current statutory regulations all major repairs and annual inspections must be carried out by Welin Lambie technicians, or persons trained and authorised by Welin Lambie.

Please contact Welin Lambie Ltd for all spares requests and availability of local service engineers.

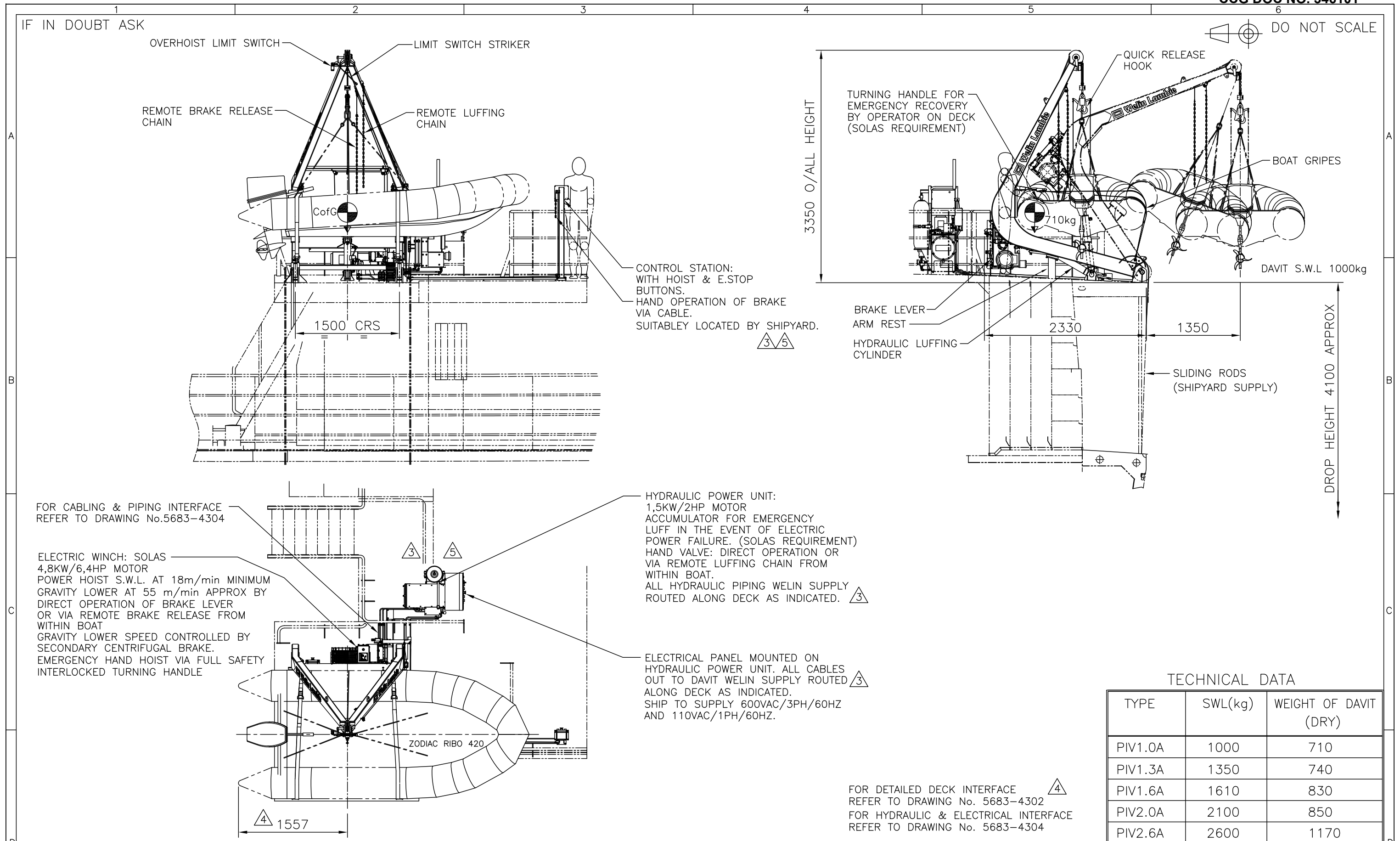
Welin Lambie Ltd.  
 Britannia House  
 Old Bush Street  
 Brierley Hill  
 West Midlands  
 DY5 1UB  
 ENGLAND  
 Office: +44 (0)1384 78294  
 Fax: +44 (0)1384 265100  
 Email: [admin@welin-lambie.co.uk](mailto:admin@welin-lambie.co.uk)  
 Web site: <http://www.welin-lambie.co.uk>

Welin Lambie NA Inc.  
 18 Ridgecrest Drive  
 Bridgewater  
 Nova Scotia  
 BV4 3V8  
 Canada  
 Office: (902) 543 4337  
 Fax: (902) 543 9787  
 Email: [welinlambie@eastlink.ca](mailto:welinlambie@eastlink.ca)

For technical and service support in North America:

Tim McCarty  
 Welin Lambie NA  
 York  
 PA  
 Office: (717) 467 4242  
 Fax: (717) 718 5065  
 Mobile: (717) 887 9081  
 Email: [welin-lambie@comcast.net](mailto:welin-lambie@comcast.net)





TECHNICAL DATA

TYPE	SWL(kg)	WEIGHT OF DAVIT (DRY)
PIV1.0A	1000	710
PIV1.3A	1350	740
PIV1.6A	1610	830
PIV2.0A	2100	850
PIV2.6A	2600	1170

6								
5	CON STATION NOTE MOD'D. POWER PACK POSITIONED AS INTERFACE	PDF	141210	TL				
4	DRAWING UPDATED, REF TO DRG 5683-4304 ADDED	PDF	141010	TL				
3	POWER PACK RELOCATED. ADDITIONAL NOTES.	TL	020610	PDF				
2	DAVIT INTERFACE REMOVED	PDF	020610	DW				
1	DROP HEIGHT (4100 APPROX) DIM ADDED	PDF	180510	DW				
Rev	Description	Drn	Date	Chd	PDF	1:50	050210	DW



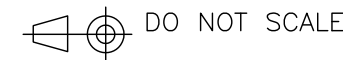
WELIN LAMBIE LTD. BRIERLEY HILL,  
WEST MIDLANDS, UNITED KINGDOM.  
Telephone (01384) 78294 Email : ADMIN@WELIN-LAMBIE.CO.UK  
Telefax (01384) 265100 Web Site : WWW.WELIN-LAMBIE.CO.UK.

Title

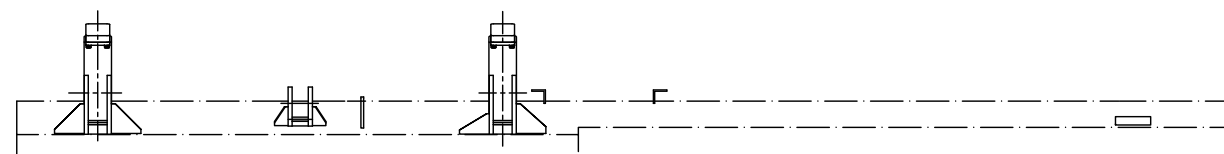
'A' FRAME PIVOT DAVIT  
TYPE PIV1.0A FOR SOLAS  
RESCUE BOATS

This drawing is the sole property of WELIN LAMBIE LTD.  
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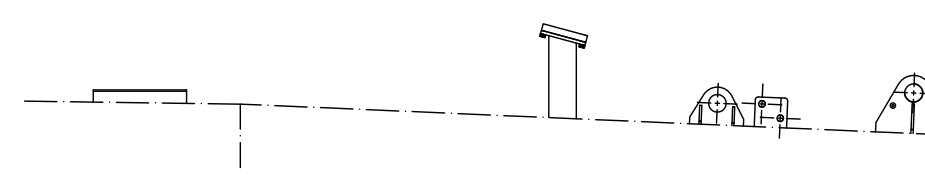
Drg No	Rev
5683-4301	5



IF IN DOUBT ASK



VIEW LOOKING INBOARD



SIDE ELEVATION

4 HOLES  $\phi 11$  FOR  
M10 BOLTS.  
SUPPLIED BY WELIN

HYDRAULIC POWER UNIT  
INTERFACE

ARM RESTS  
WELIN SUPPLY.  
WELDED TO DECK BY  
OTHERS. SUPPLIED OVER  
LONG TO ALLOW TRIMMING

CYLINDER PIVOT LUG  
WELIN SUPPLY.  
WELDED TO DECK BY  
OTHERS

AFT ARM PIVOT LUG  
WELIN SUPPLY.  
WELDED TO DECK BY OTHERS

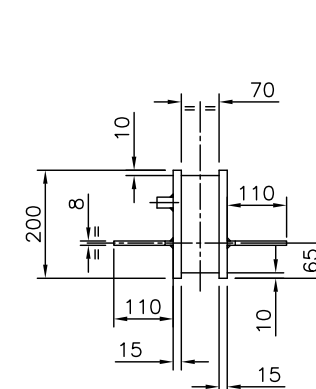
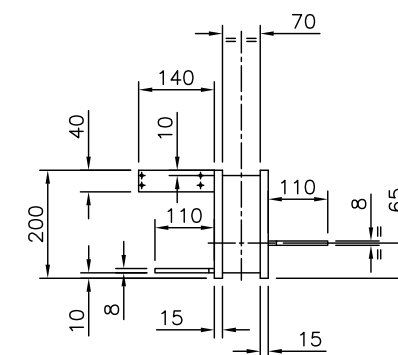
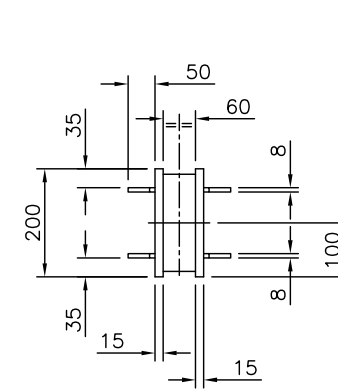
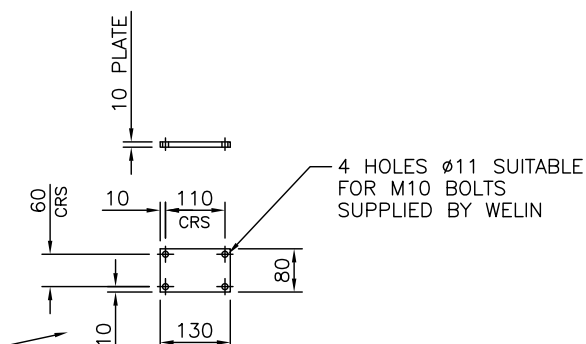
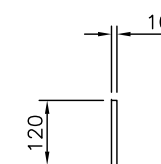
ALL MATERIAL SUPPLIED FOR WELDING  
TO DECK, PRODUCED FROM MARINE GRADE  
ALUMINIUM. ALL WELDS 8mm CONTINUOUS  
FILLET MINIMUM

D

Rev	Description	Dwn	Date	Chd	Scale	Drawn	Date	Chd	ALL DIMENSIONS
6									
5									
4	CYL HOSE PLATE RE-POSITIONED (140 WAS 175, 225 WAS 165)	PF	310111	TL					
3	RE-DRAWN ON A2 SHEET, PIVOT LUGS MODIFIED, DECK PLAN DETAIL ADDED.	PF	091210	TL					
2	LUG DETAILS ADDED, CYLINDER HOSE PLATE ADDED, POWER UNIT INTERFACE MODIFIED	PF	141010	TL					
1	HYD POWER UNIT, CONTOL STAT'N BOLTING PLANS & LOAD TABLE ADDED	PF	010610	DW					
Rev	Description	Dwn	Date	Chd	1:20	PDF	180510	DW	IN

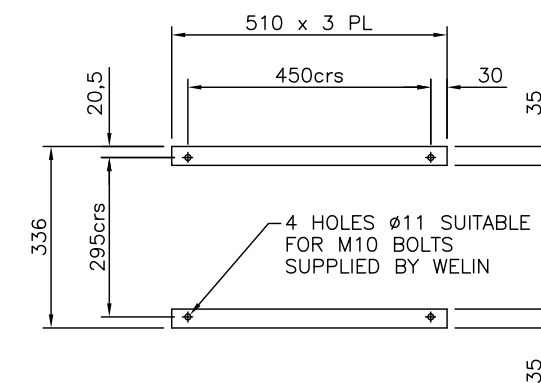
PLAN

FWD →

AFT ARM PIVOT LUG  
(SCALE 1:10)FWD ARM PIVOT LUG  
(SCALE 1:10)CYLINDER PIVOT LUG  
(SCALE 1:10)CONTROL STATION STAND  
BOLTING PATTERN  
(SCALE 1:10)CYLINDER HOSE PLATE  
(SCALE 1:10)

ESTIMATED MAXIMUM DAVIT LOADS AT  
DECK INTERFACE (1000kg SWL)

	SWL EVEN KEEL	SWL 20° OUTLIST & 10° FWD/AFT TRIM
P <sub>fwd</sub>	16kN COMPRESSION	31kN COMPRESSION
P <sub>aft</sub>	16kN COMPRESSION	31kN COMPRESSION
R <sub>cyl</sub>	13kN TENSION	33kN TENSION

HYDRAULIC POWER UNIT  
BOLTING PATTERN  
(SCALE 1:10)

WELIN LAMBIE LTD. BRIERLEY HILL, WEST MIDLANDS, UNITED KINGDOM.  
Telephone (01384) 78294 Email : ADMIN@WELIN-LAMBIE.CO.UK  
Telefax (01384) 265100 Web Site WWW.WELIN-LAMBIE.CO.UK.

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Title

'A' FRAME PIVOT DAVIT  
TYPE PIV1.0A  
DECK INTERFACE

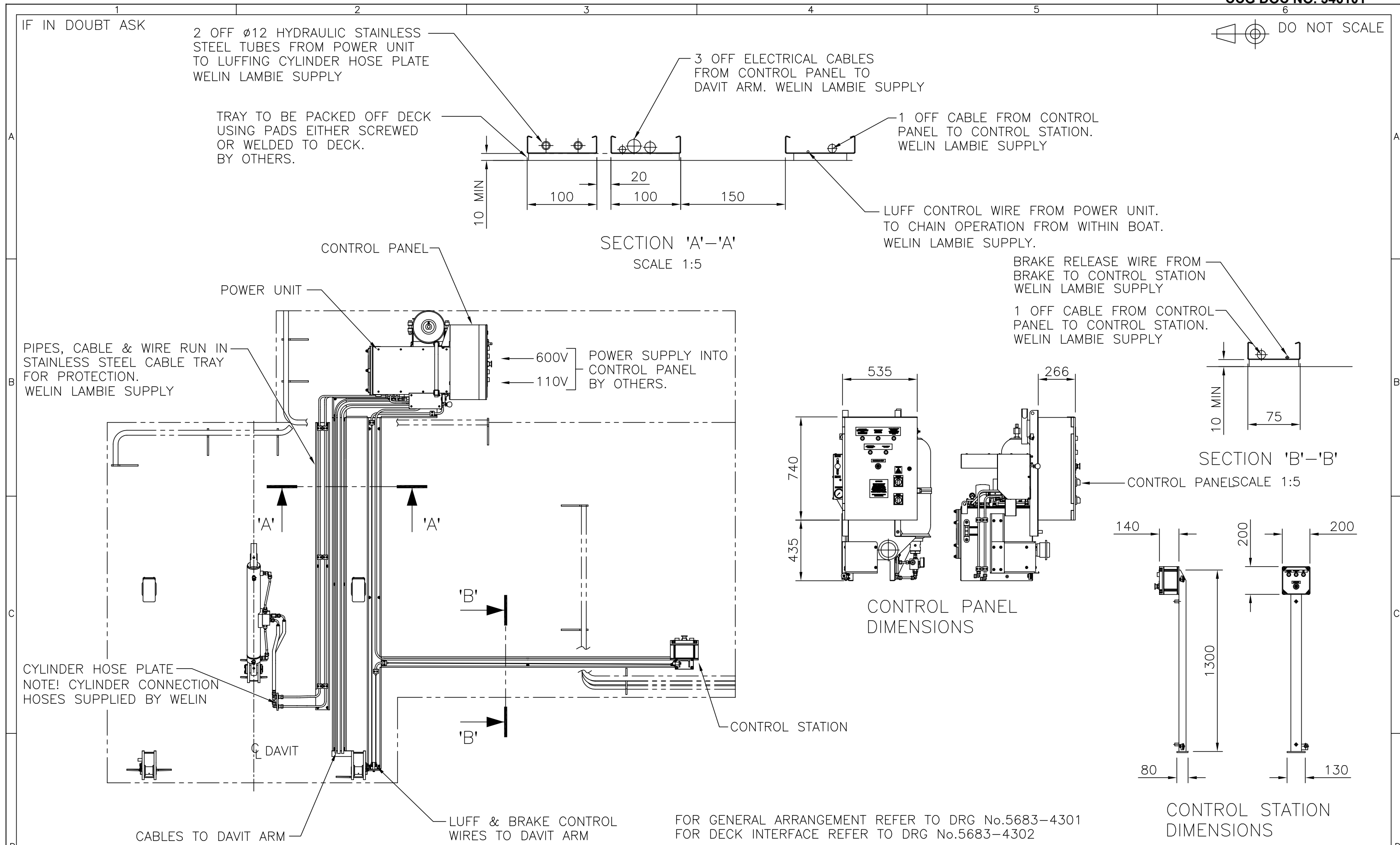
Drg No

5683-4302


Rev

4

QAP052A-01



6								
5								
4								
3								
2								
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Rev	Description	Drn	Date	Chd	PDF	1:25	131010	TL



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Title

'A' FRAME PIVOT DAVIT  
HYDRAULIC & ELECTRICAL INTERFACE

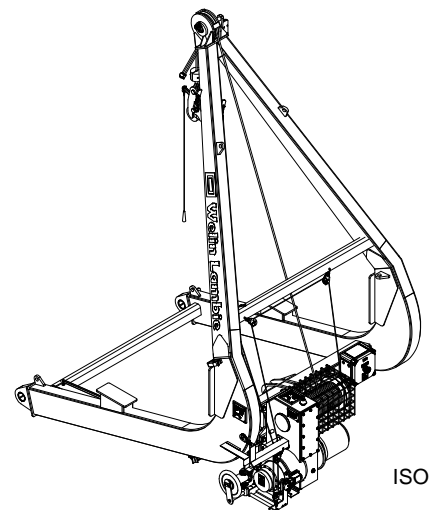
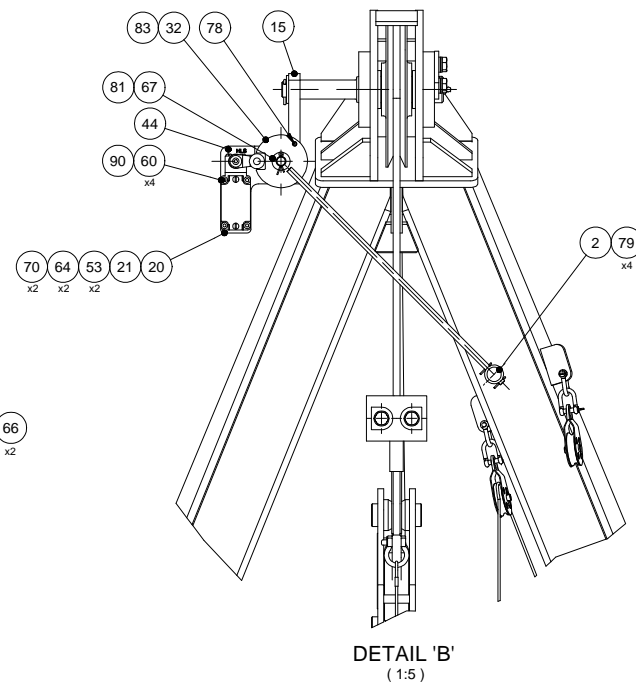
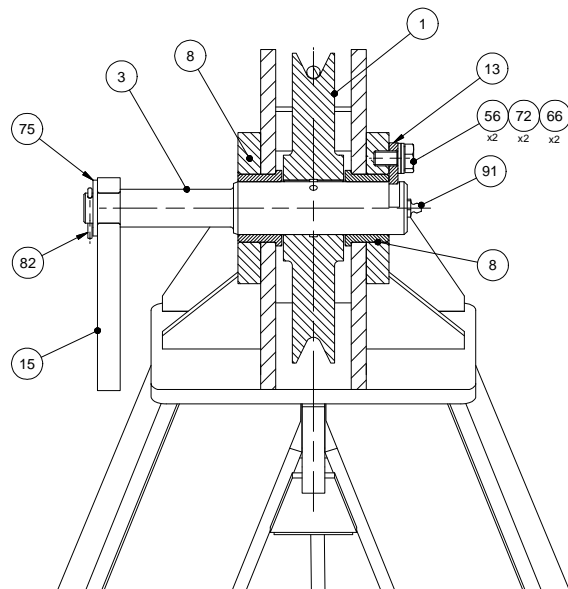
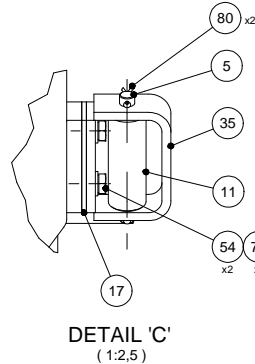
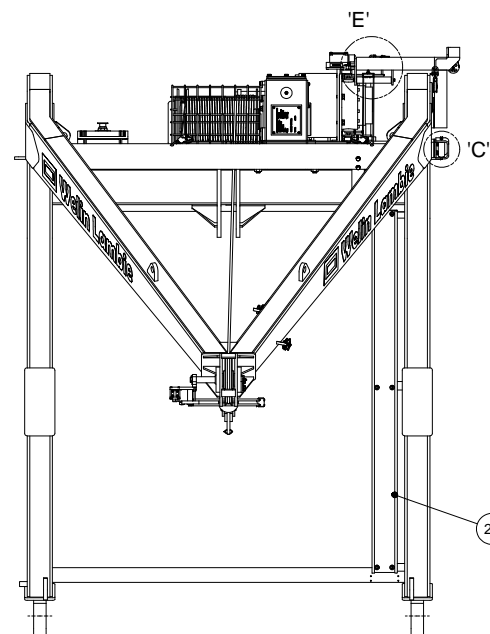
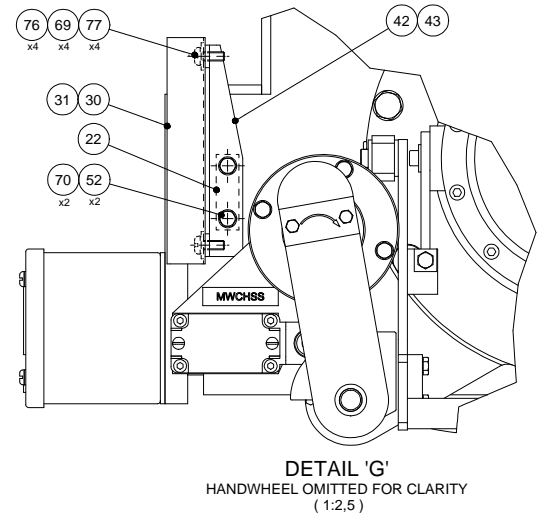
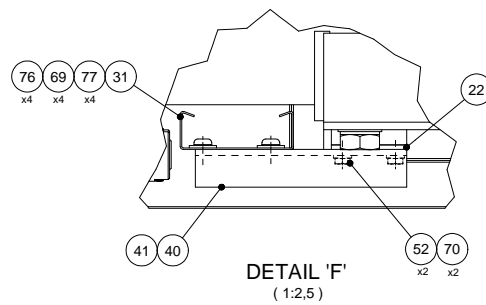
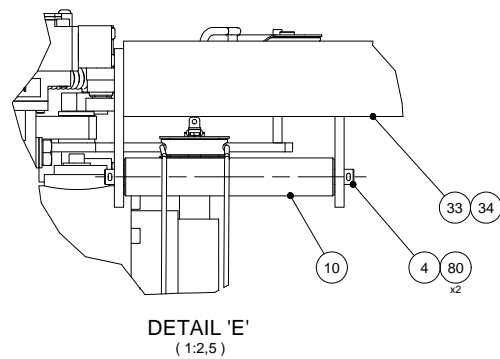
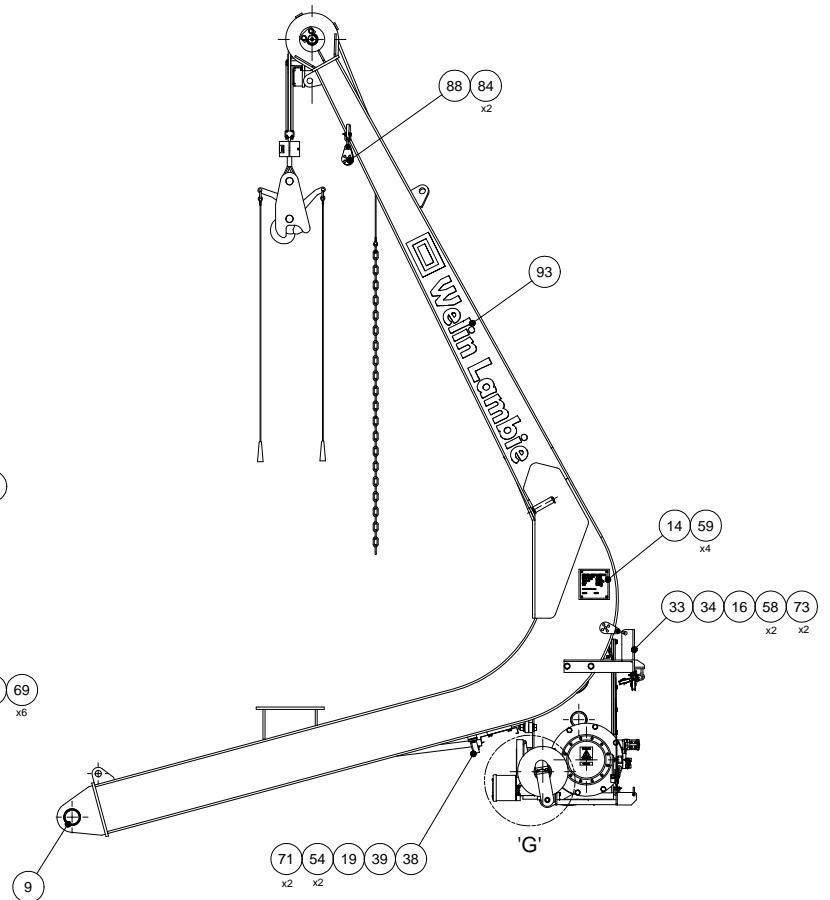
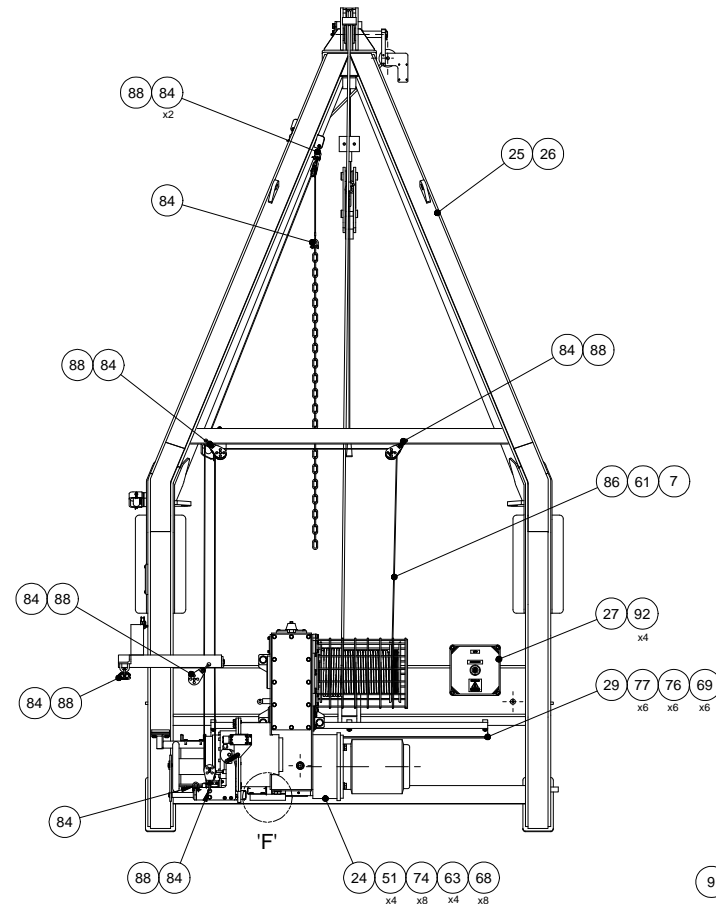
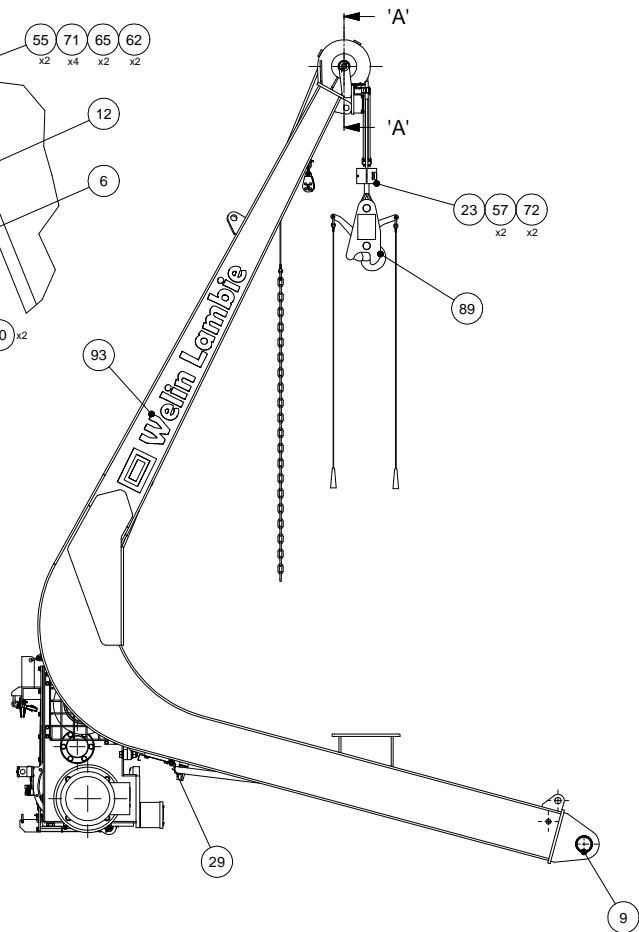
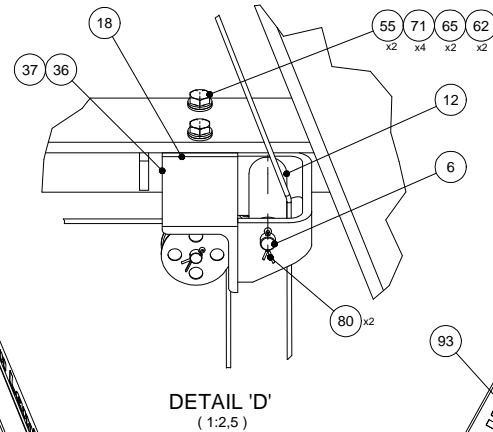
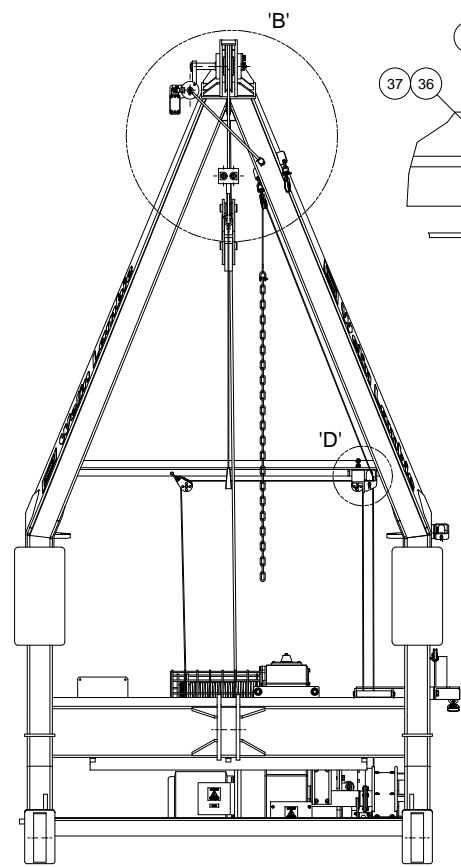
Drg No

5683-4304

Rev

1

QAP053A-01



ISOMETRIC VIEW  
(1:25)

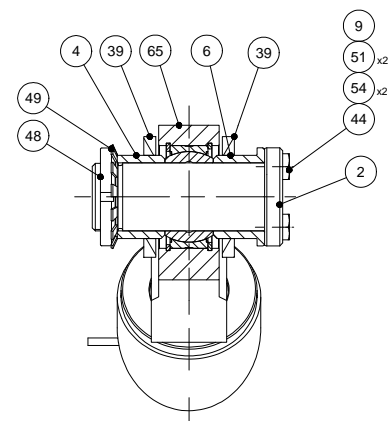
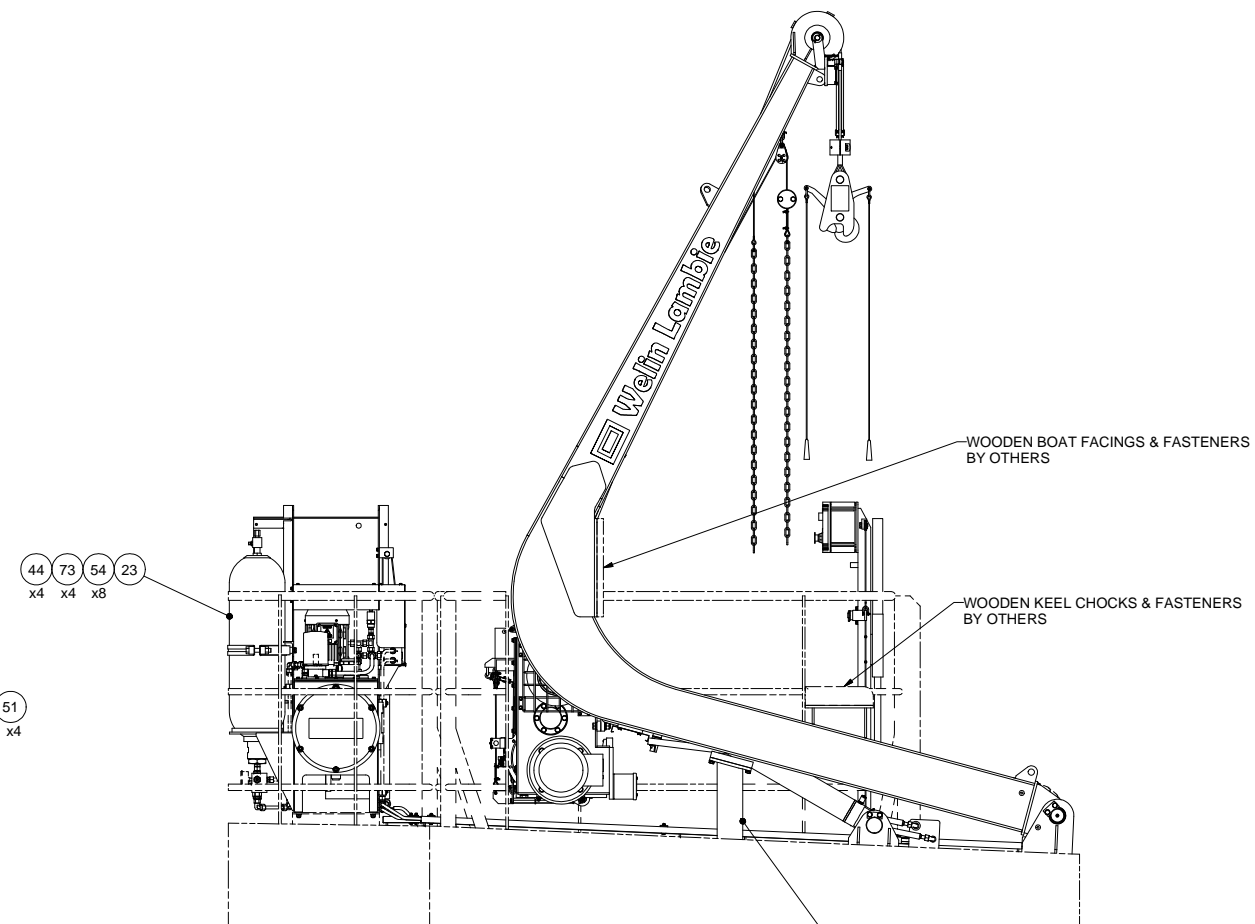
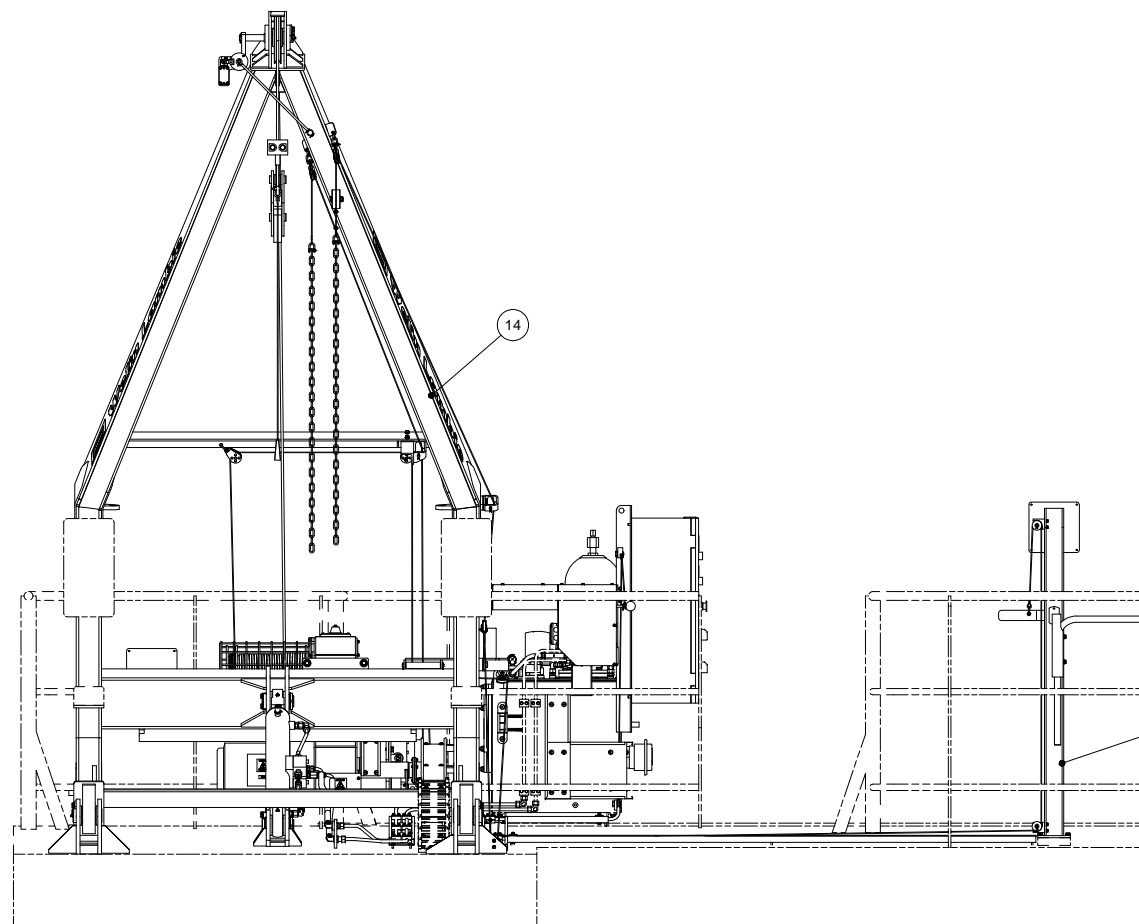
SECTION 'A'-A'  
(1:2.5)

General Notes				WELIN LAMBIE LTD Brierley Hill, West Midlands, United Kingdom. Tel: 44 (0) 1384 76294 Fax: 44 (0) 1384 265100 - Email: admin@welin-lambie.co.uk				This drawing is the sole property of WELIN LAMBIE LTD. Copy and transmission to third parties are prohibited except with written permission.	
ALL DIMENSIONS IN mm				GENERAL DIMENSIONAL TOLERANCES: UNLESS OTHERWISE STATED.				Drawing Title	
REMOVE ALL SHARP CORNERS				OPERY RANGE				Drawing Number	
Drawn				MACHINING				As Dim	
Scale				FABRICATION				Opp As Dim	
Date				Checked				Rev	
1:15				TL				5601-1901	
111110								3	
								Sheet 1 of 1	

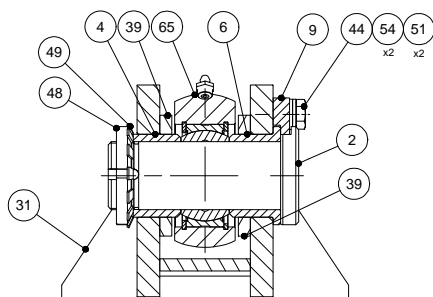
3	BALLOON (ITEM 83) ADDED TO DETAIL 'B'	PF	15/02/11	DW
2	'HLS' LABEL (ITEM 44) ADDED (SEE DETAIL 'B')	PF	14/01/11	DW
1	HOOK ADDED TO DRG. ITEM 93 (DECAL) ADDED	PF	16/12/10	DW
Rev	Description	Dm	Date	Chd

PARTS LIST				Sheet
Title		Drg No. 5601-1901		1 of 2
Item No.	Part No.	Description	No. Off / Set	
1	5012-2811	SHEAVE	1	
2	5040-1711	STRIKER ARM BOSS	1	
3	5124-7411	SHEAVE PIN	1	
4	5150-0411	ROLLER PIN	1	
5	5150-0511	ROLLER PIN	1	
6	5150-0611	ROLLER PIN	1	
7	5190-0911	REMOTE CONTROL ROPE CLAMP	1	
8	5201-9611	BUSH	2	
9	5326-0311	BUSH	2	
10	5391-7211	ROLLER	1	
11	5391-7311	ROLLER	1	
12	5391-7411	ROLLER	1	
13	5400-9111	KEEP PLATE	1	
14	5422-1811	LOAD PLATE	1	
15	5442-4011	PIVOT ARM	1	
16	5442-6011	INSULATING GASKET	1	
17	5442-6111	INSULATING GASKET	1	
18	5442-6211	INSULATING GASKET	1	
19	5442-6311	INSULATING GASKET	1	
20	5442-6421	LIMIT SWITCH MOUNTING PLATE	1	
21	5442-6521	LIMIT SWITCH MOUNTING PLATE		
22	5442-6811	INSULATING GASKET	3	
23	5490-4011	STRIKER BLOCK	1	
24	5504-6801	WINCH ASSEMBLY	1	
25	5601-1931	DAVIT 'A' FRAME	1	
26	5601-2031	DAVIT 'A' FRAME		
27	5673-5601	WINCH TERMINAL BOX ASSEMBLY	1	
28	5699-3111-1	CABLE TRAY	1	
29	5699-3311-1	CABLE TRAY	1	
30	5699-3711-1	CABLE TRAY	1	
31	5699-3711-2	CABLE TRAY	1	
32	5801-7731	LIMIT SWITCH STRIKER ARM	1	
33	5801-8921	REMOTE CONTROL BRACKET	1	
34	5801-9021	REMOTE CONTROL BRACKET		
35	5801-9121	ROPE GUIDE BRACKET	1	
36	5801-9221	ROPE GUIDE BRACKET	1	
37	5801-9321	ROPE GUIDE BRACKET		
38	5801-9421	TRAY BRACKET	1	
39	5801-9521	TRAY BRACKET		
40	5802-0011	TRAY BRACKET	2	
41	5802-0111	TRAY BRACKET		
42	5802-0511	TRAY BRACKET	1	
43	5802-0611	TRAY BRACKET		
44	5435-3811/R	LABEL - HLS	1	
45				
46				
47				
48				
49				
50				

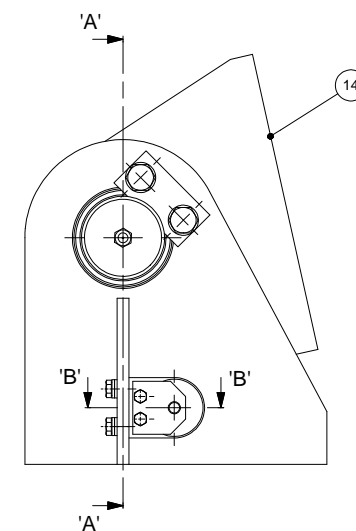
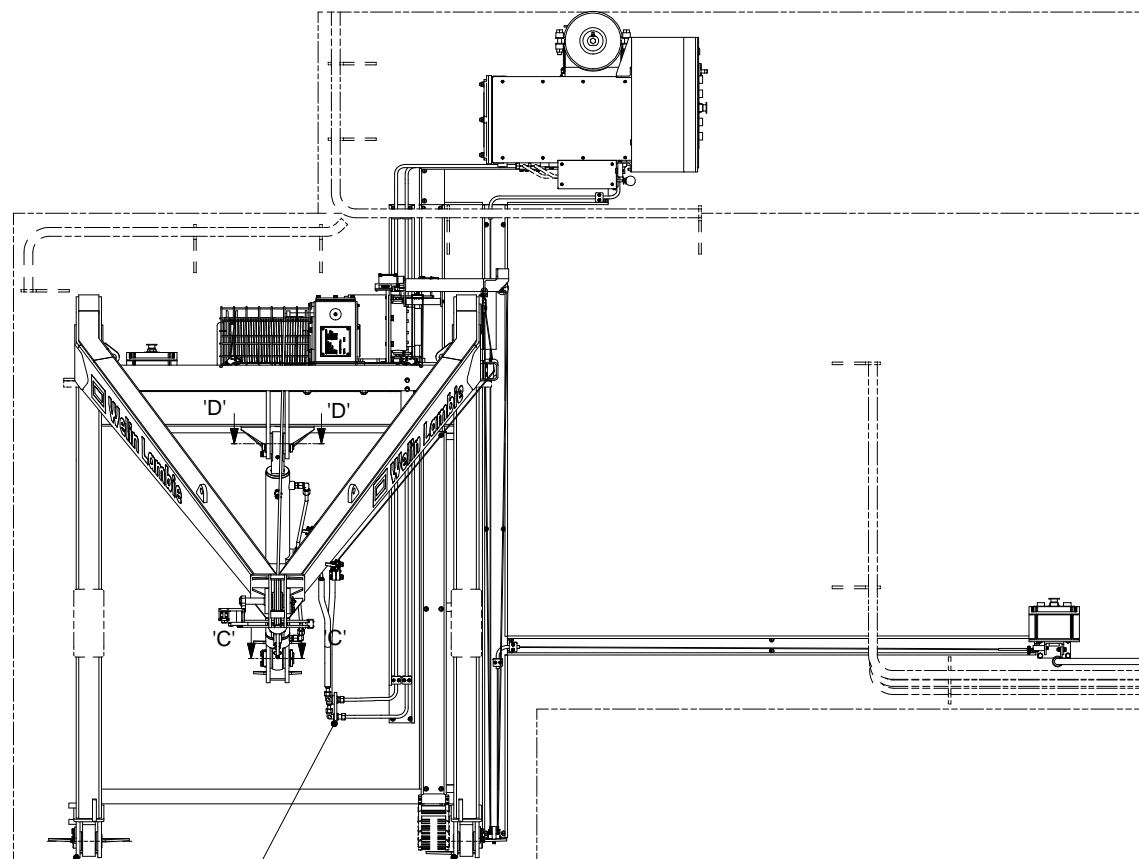
PARTS LIST				Sheet
Title	DAVIT ASSEMBLY		Drg No. 5601-1901	2 of 2
Item No.	Part No.	Description	No. Off / Set	
51	603-16060	HEX HD BOLT	4	
52	609-06016	HEX HD SETSCREW	6	
53	609-06030	HEX HD SETSCREW	2	
54	609-08016	HEX HD SETSCREW	4	
55	609-08030	HEX HD SETSCREW	2	
56	609-10020	HEX HD SETSCREW	2	
57	609-10045	HEX HD SETSCREW	2	
58	609-12025	HEX HD SETSCREW	2	
59	616-02072	HEX SKT BUTTON HD CAPSCREW	4	
60	617-04005	HEX SKT HD CAPSCREW	4	
61	617-42010	HEX SKT SETSCREW (CUP POINT)	1	
62	629-00008	HEX NUT	2	
63	629-00016	HEX NUT	4	
64	647-00306	PLAIN WASHER	2	
65	647-00308	PLAIN WASHER	2	
66	647-00310	PLAIN WASHER	2	
67	647-00312	PLAIN WASHER	1	
68	647-00316	PLAIN WASHER	8	
69	647-00706	SHAKEPROOF WASHER	20	
70	647-00806	PLAIN WASHER	8	
71	647-00808	PLAIN WASHER	8	
72	647-00810	PLAIN WASHER	4	
73	647-00812	PLAIN WASHER	2	
74	647-00816	PLAIN WASHER	8	
75	647-00820	PLAIN WASHER	1	
76	647-00906	PLAIN WASHER (LARGE DIA)	20	
77	649-06016	SLOTTED PAN HD SCREW	20	
78	675-06065	TENSION PIN	1	
79	679-36014	SPLIT COTTER PIN	4	
80	679-37018	SPLIT COTTER PIN	6	
81	679-38020	SPLIT COTTER PIN	1	
82	679-38028	SPLIT COTTER PIN	1	
83	7500-0712	SELF-LUBRICATING BEARING	1	
84	800-00922	SHACKLE	12	
85	800-02070	MAIN ROPE	1	
86	800-03021	REMOTE CONTROL ROPE	1	
87	800-04000	CHAIN - LONG LINK	1	
88	800-09901	PULLEY BLOCK	8	
89	800-09988	QUICK RELEASE HOOK	1	
90	859-01070	ROLLER LIMIT SWITCH	1	
91	889-01002	GREASE NIPPLE	1	
92	617-03506	HEX SKT HD CAPSCREW	4	
93	830-00156	WELIN LAMBIE DECAL (LARGE)	2	
94				
95				
96				
97				
98				
99				
100				



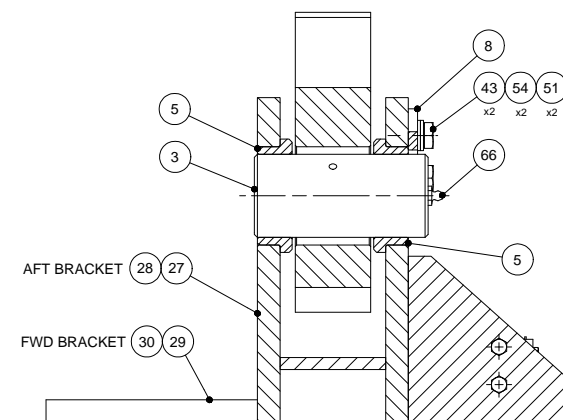
SECTION 'D'-D'  
CYLINDER TO 'A' FRAME ASSEMBLY  
(1:2.5)



SECTION 'C'-C'  
CYLINDER TO DECK BRACKET ASSEMBLY  
(1:2.5)



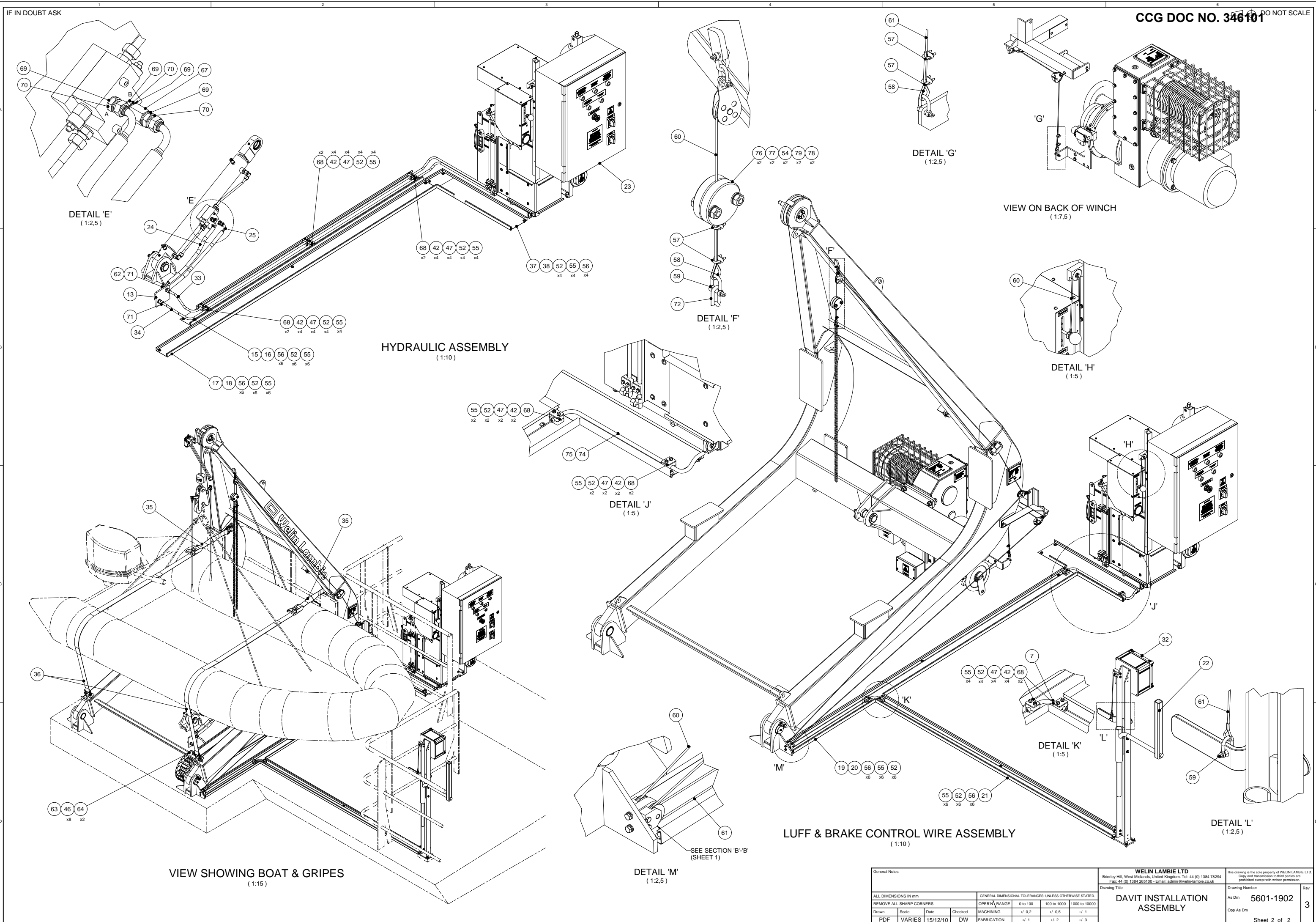
ARM PIVOT ASSEMBLY  
TYPICAL 2 PLACES  
(1:2.5)



SECTION 'B'-B'  
FWD BRACKET ONLY  
(1:2.5)

3	TURNING HANDLE MOVED FROM POWER PACK TO CONTROL STATION. ITEM 62 ADDED (SHEET 2) ITEM 39 ADDED (CYL PIVOTS)	PDF	14/02/11	DW
2	COUNTER WEIGHT & CONTROL STATION BRAKE LEVER ADDED	PDF	08/02/11	DW
1	EXTRA VIEWS AND DETAILS ADDED	PDF	16/12/10	DW
Rev	Description	Dwn	Date	Chd

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ALL DIMENSIONS IN mm					Drawing Title		Drawing Number	
REMOVE ALL SHARP CORNERS					DAVIT INSTALLATION ASSEMBLY		5601-1902	
Drawn					Scale		Opp As Dm	
Date					15/10/12		Sheet 1 of 2	
Checked					DW		3	
MACHINING					GENERAL DIMENSIONAL TOLERANCES: UNLESS OTHERWISE STATED.			
FABRICATION					OPERATION RANGE			
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					100 to 1000			
					1000 to 10000			
					MACHINING			
					±0.2			
					±0.5			
					±1			
					FABRICATION			
					±1			
					±2			
					±3			

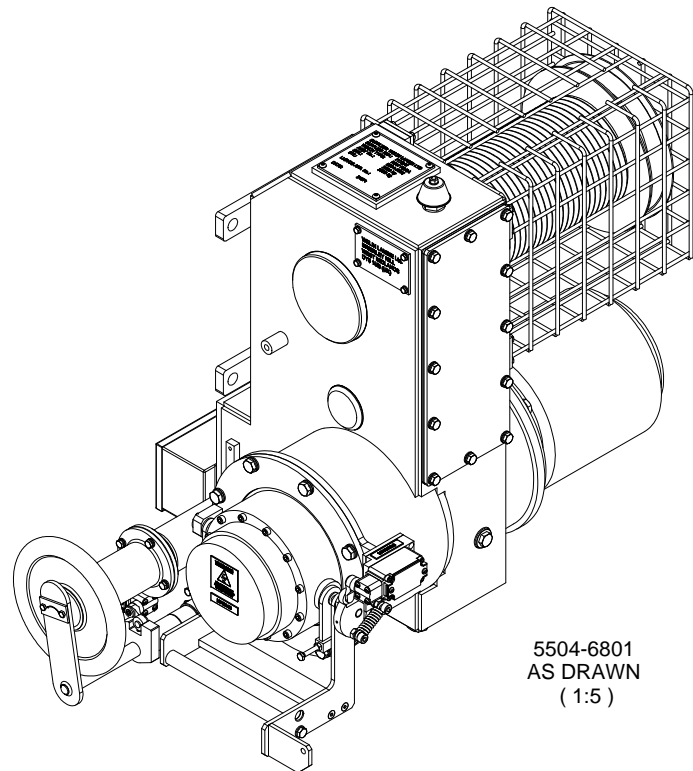
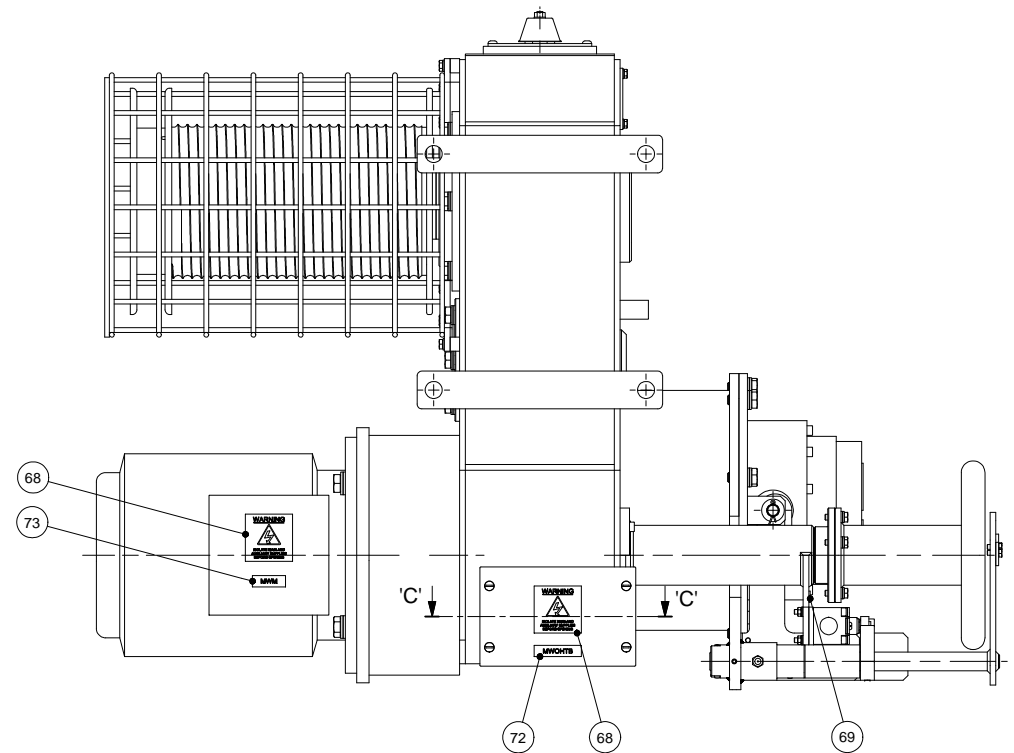
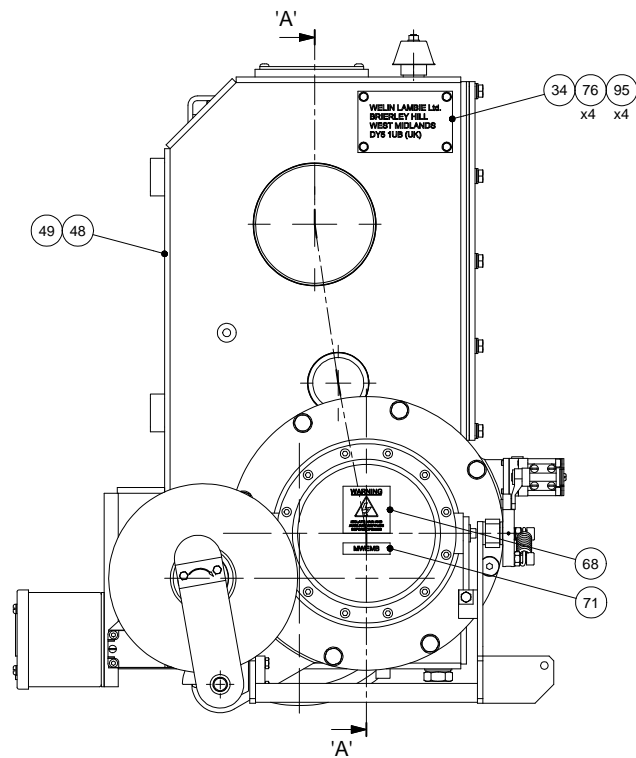
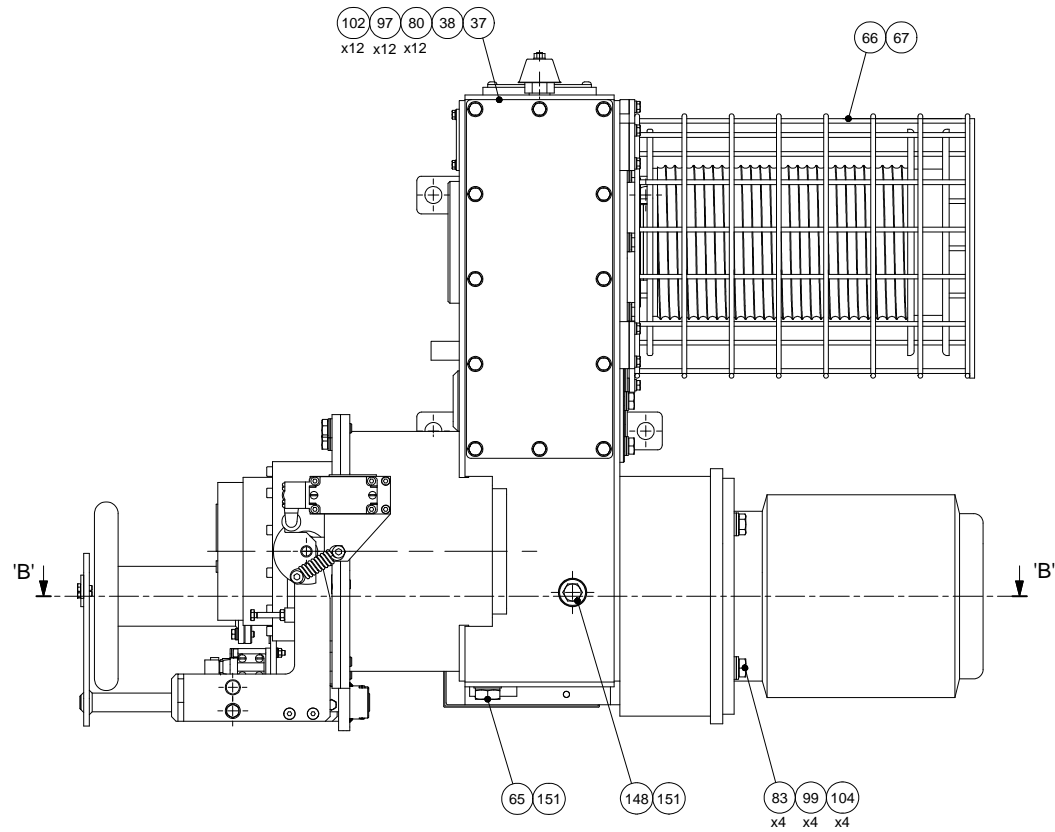


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ALL DIMENSIONS IN mm				Drawing Title		Drawing Number	
REMOVE ALL SHARP CORNERS				GENERAL DIMENSIONAL TOLERANCES: UNLESS OTHERWISE STATED.		As Dim	
Drawn				OPERA RANGE		5601-1902	
Scale				0 to 100 100 to 1000 1000 to 10000		Opp As Dim	
Date				MACHINING		Rev	
Checked				±0.2 ±0.5 ±1		3	
DW				FABRICATION		Sheet 2 of 2	
PDF				±1 ±2 ±3			

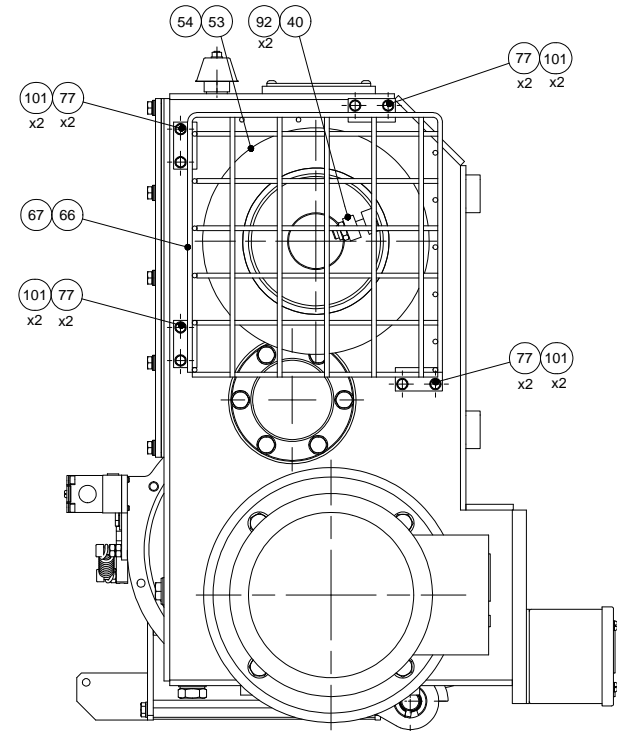
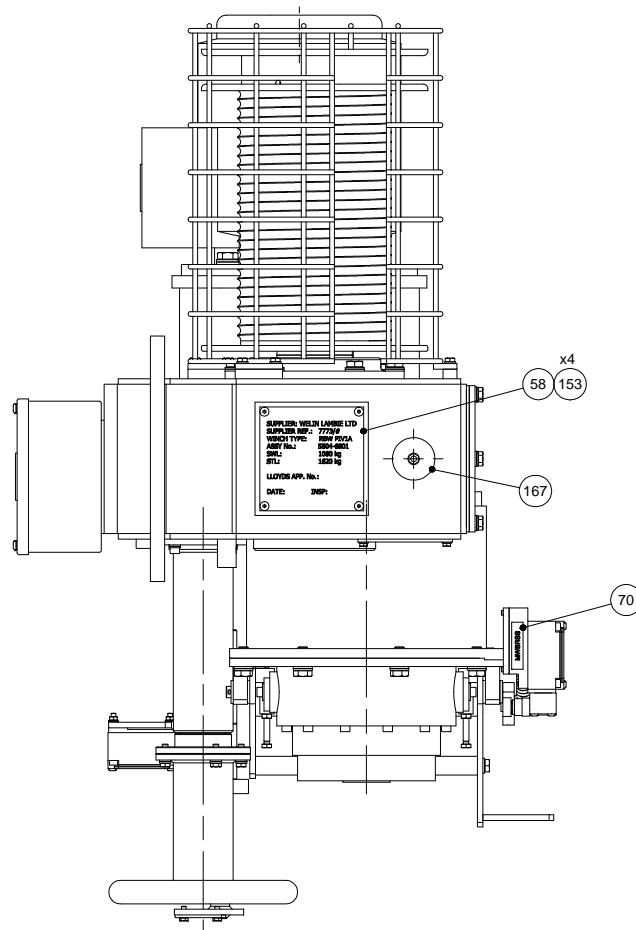


PARTS LIST				Sheet
Title		Drg No. 5601-1902		1 of 2
Item No.	Part No.	Description	No. Off / Set	
1	5010-3311	PULLEY	2	
2	5144-9411	CYLINDER PIN	2	
3	5144-9611	ARM PIVOT PIN	2	
4	5222-2211	COLLAR	2	
5	5236-0111	ARM PIVOT BUSH	4	
6	5236-0211	CYLINDER PIN BUSH	2	
7	5331-3311	ROPE GUIDE TUBE	1	
8	5400-9111	KEEP PLATE	2	
9	5442-4311	KEEP PLATE	2	
10	5442-4411	ARM REST PAD	2	
11	5442-6621	PULLEY MOUNTING PLATE	1	
12	5442-6711	COVER PLATE	2	
13	5442-6911	CYLINDER HOSE PLATE	1	
14	5601-1901	DAVIT ASSEMBLY	1	
15	5699-3111-2	CABLE TRAY	1	
16	5699-3111-3	CABLE TRAY		
17	5699-3111-4	CABLE TRAY	1	
18	5699-3111-5	CABLE TRAY		
19	5699-3111-6	CABLE TRAY	1	
20	5699-3111-7	CABLE TRAY		
21	5699-3711-5	CABLE TRAY	1	
22	5711-0421	TURNING HANDLE	1	
23	5723-3401	HYDRAULIC POWER PACK ASSY	1	
24	5726-6901	PRESSURE HOSE ASSEMBLY	1	
25	5726-7001	PRESSURE HOSE ASSEMBLY	1	
26	5801-8231	DECK STOOL	2	
27	5801-9631	ARM PIVOT BRACKET	1	
28	5801-9731	ARM PIVOT BRACKET		
29	5801-9831	ARM PIVOT BRACKET	1	
30	5801-9931	ARM PIVOT BRACKET		
31	5802-0431	CYLINDER DECK BRACKET	1	
32	5802-0701	CONTROL STATION STAND ASSY	1	
33	5331-3411	CYLINDER CONNECTION TUBE	1	
34	5331-3511	CYLINDER CONNECTION TUBE	1	
35	5799-2611	GRIPE WEBBING TENSIONER	2	
36	5799-2711	GRIPE WEBBING SLING	2	
37	5699-3311-2	CABLE TRAY	1	
38	5699-3311-3	CABLE TRAY		
39	5245-0911	WASHER	4	
40	609-05020	HEX HD SETSCREW	4	
41	609-06020	HEX HD SETSCREW	2	
42	609-06040	HEX HD SETSCREW	20	
43	609-10020	HEX HD SETSCREW	4	
44	609-10025	HEX HD SETSCREW	12	
45	609-10030	HEX HD SETSCREW	8	
46	617-04505	HEX SKT HD CAPSCREW	8	
47	629-00006	HEX NUT	20	
48	639-00045	NOTCH NUT	2	
49	640-00045	LOCK WASHER	2	
50	647-00306	PLAIN WASHER	2	

PARTS LIST				Sheet
Title	DAVIT INSTALLATION ASSEMBLY		Drg No. 5601-1902	2 of 2
Item No.	Part No.	Description	No. Off / Set	
51	647-00310	PLAIN WASHER	20	
52	647-00706	SHAKEPROOF WASHER	48	
53	647-00806	PLAIN WASHER	2	
54	647-00810	PLAIN WASHER	30	
55	647-00906	PLAIN WASHER (LARGE DIA)	48	
56	649-06016	SLOTTED PAN HD SCREW	28	
57	800-00503	WIRE ROPE GRIP	4	
58	800-00603	ORDINARY THIMBLE	2	
59	800-00922	SHACKLE	2	
60	800-03022	LUFF CONTROL ROPE	1	
61	800-03023	BRAKE CONTROL ROPE	1	
62	5241-1811	SPACER	1	
63	859-03773	CABLE CHAIN	1	
64	859-03774	CABLE CHAIN END BRACKET	2	
65	885-01006	HYDRAULIC CYLINDER	1	
66	889-01002	GREASE NIPPLE	2	
67	890-55403	FEMALE ADAPTOR	1	
68	891-02012	PIPE CLAMP c/w ST. ST. COVER PLT	10	
69	894-01702	BONDED WASHER	4	
70	894-12328	MALE -MALE ADAPTOR	3	
71	894-12564	BULKHEAD ELBOW (EO)	2	
72	800-04000	CHAIN - LONG LINK	1	
73	629-00110	NYLOC NUT	4	
74	5331-3611	ROPE GUIDE TUBE	1	
75	5331-3711	ROPE GUIDE TUBE		
76	5041-4011	COUNTER WEIGHT	2	
77	609-10045	HEX HD SETSCREW	2	
78	629-00010	HEX NUT	2	
79	647-00710	SHAKEPROOF WASHER	2	
80	830-00166	ICE PROTECTION COVER	1	
81	830-00167	ICE PROTECTION COVER	1	
82	830-00168	ICE PROTECTION COVER	1	
83	5719-8101	INSTRUCTION BOARD	1	
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5504-6801  
AS DRAWN  
(1:5)

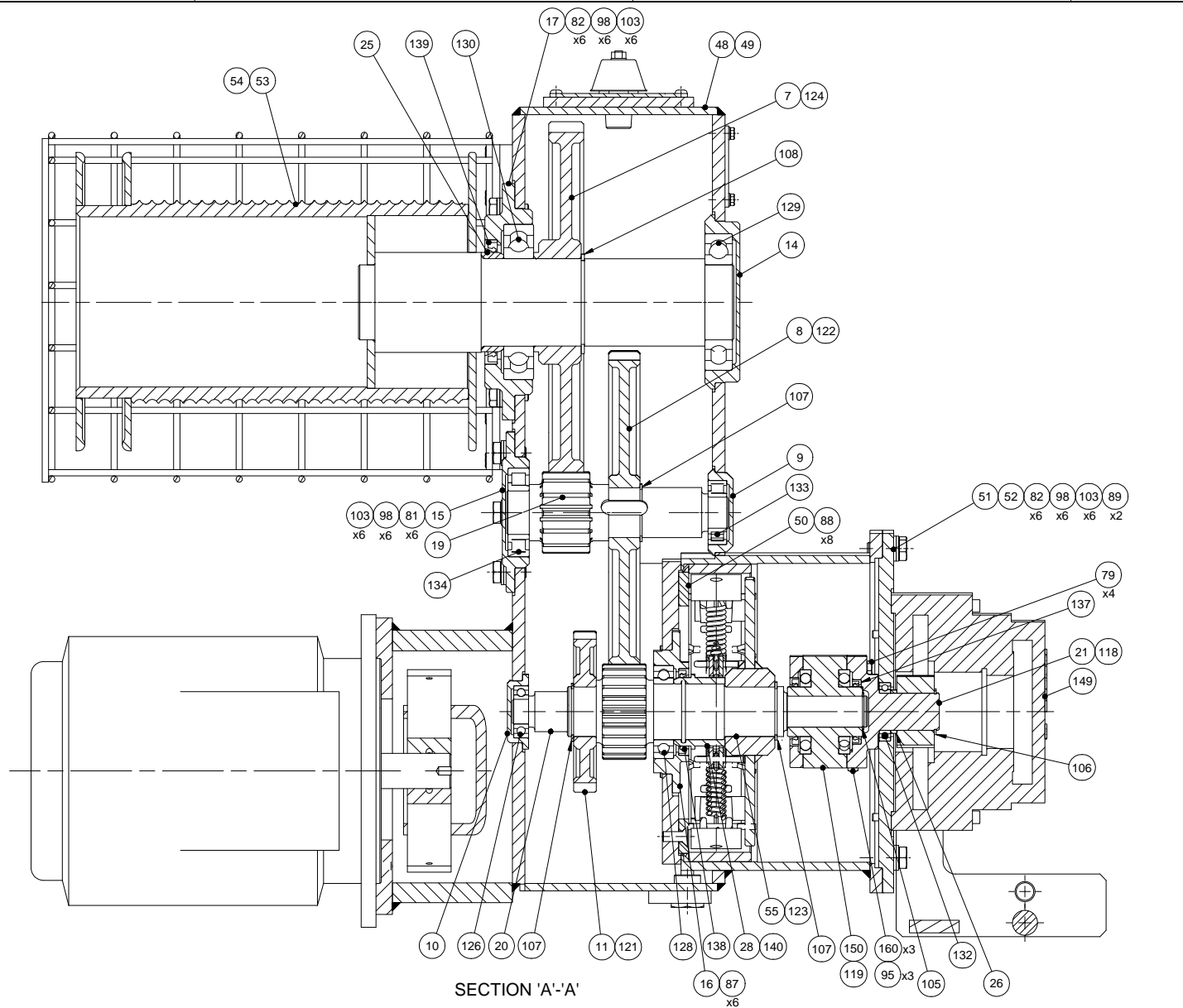


VIEW ON 'A'

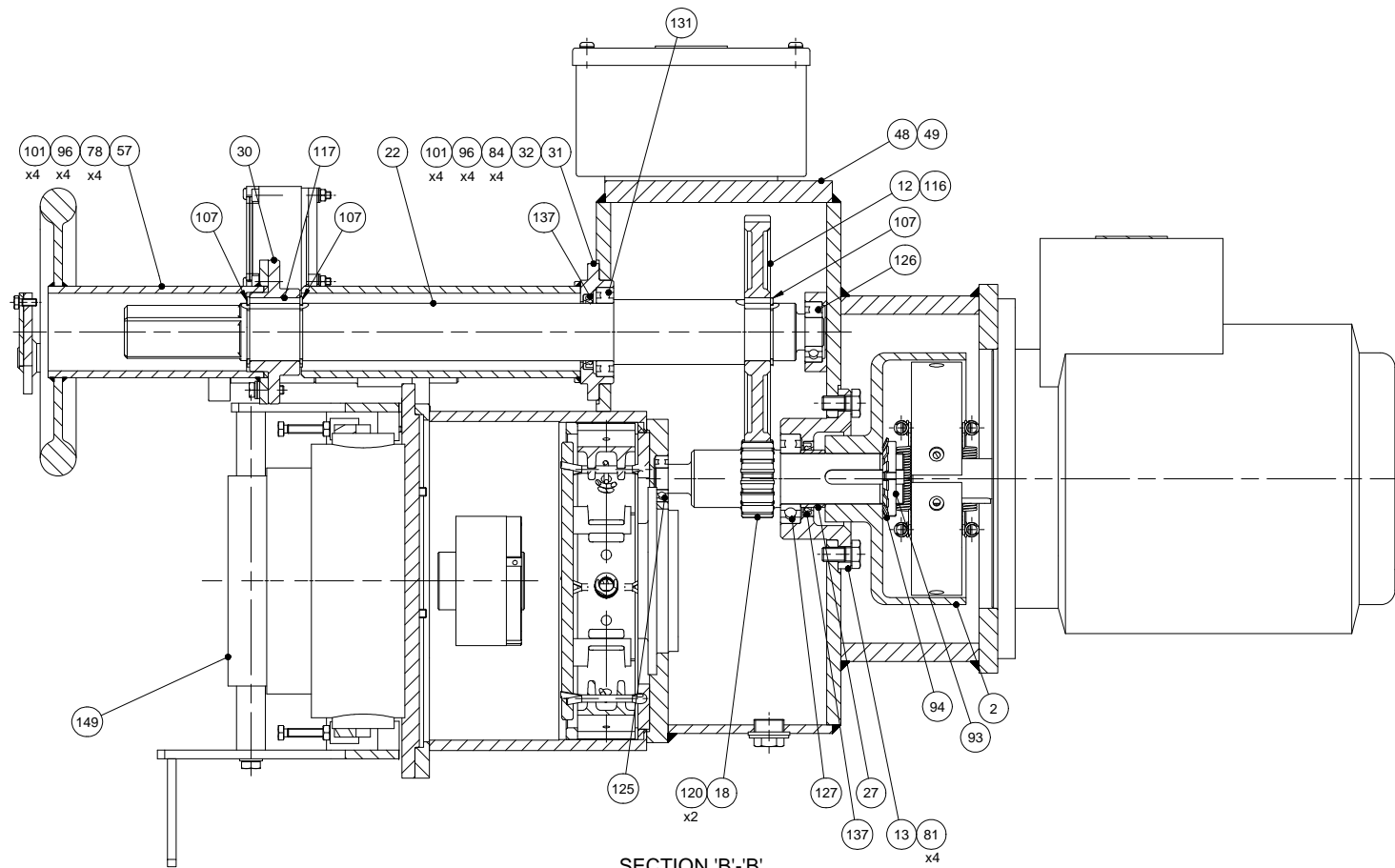
NOTE: REFER TO SHEET 2 FOR SECTION 'A'-A', 'B'-B' AND SECTION 'C'-C'.  
REFER TO SHEET 2 FOR CENTRIFUGAL BRAKE SETUP AND CLUTCH SHOE SETUP.  
REFER TO SHEET 3 FOR MANUAL DISC BRAKE AND SAFETY DEVICE SETUP.

Rev	Description	Dwn	Date	Chd
4	TENSION SPRING & BREATHER ADDED	PDF	070211	DW
3	LABELS ADDED (ITEM 68 TO 73)	DW	140111	PDF
2	SEAL ADDED TO BRAKE STUB SHAFT (ITEM 21)	DW	120111	PDF
1	MANUAL DISC BRAKE SETUP UPDATED	DW	161110	PDF

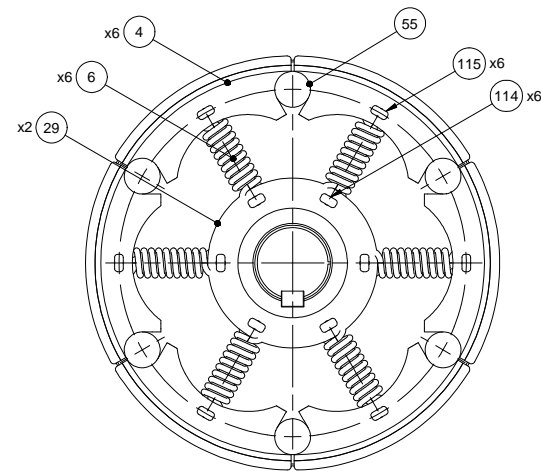
General Notes					Drawing Title		Drawing Number		Rev	
ALL DIMENSIONS IN mm					WINCH GEARBOX ASSEMBLY		5504-6801		4	
REMOVE ALL SHARP CORNERS					GENERAL DIMENSIONAL TOLERANCES: UNLESS OTHERWISE STATED.		As Dim		Opp As Dim	
Drawn					MACHINING		As Dim		Opp As Dim	
DW					FABRICATION		As Dim		Opp As Dim	



SECTION 'A'-A'

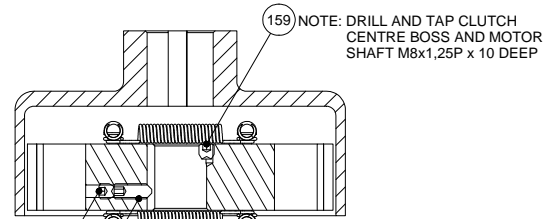
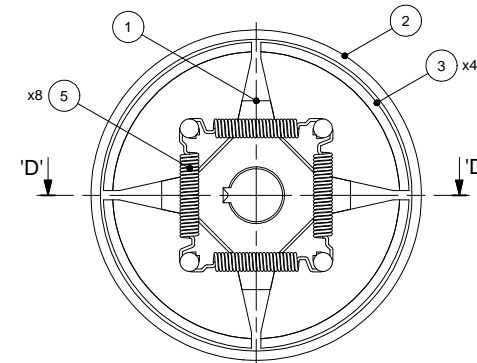


SECTION 'B'-B'



CENTRIFUGAL BRAKE SHOE SETUP  
(1:2)

NOTE: NUMBER OF SPRINGS MAY VARY DEPENDING ON WINCH CAPACITY

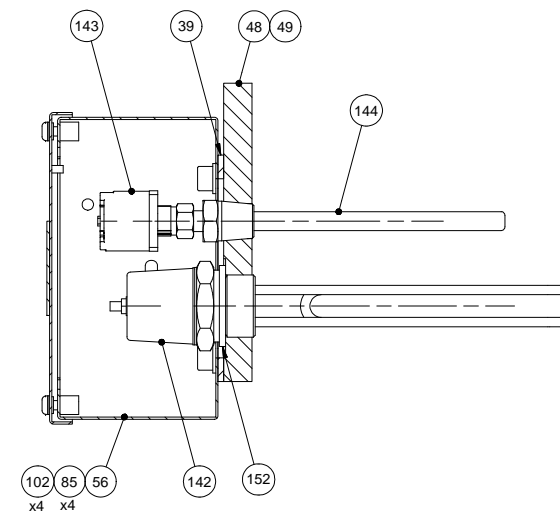


NOTE: DRILL AND TAP CLUTCH CENTRE BOSS AND MOTOR SHAFT M8x1.25P x 10 DEEP

NOTE: DIMPLE MOTOR KEY

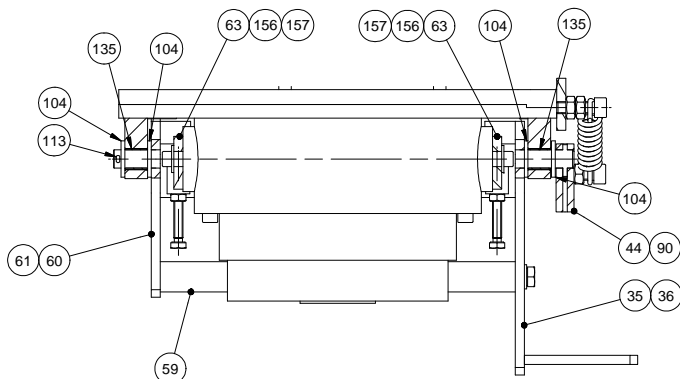
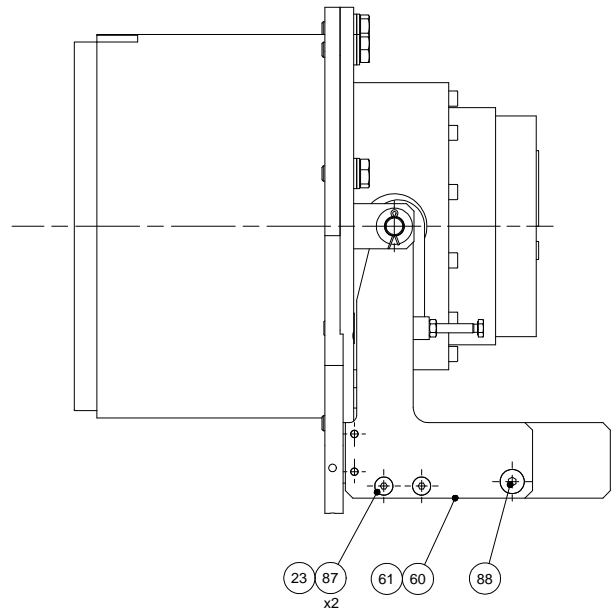
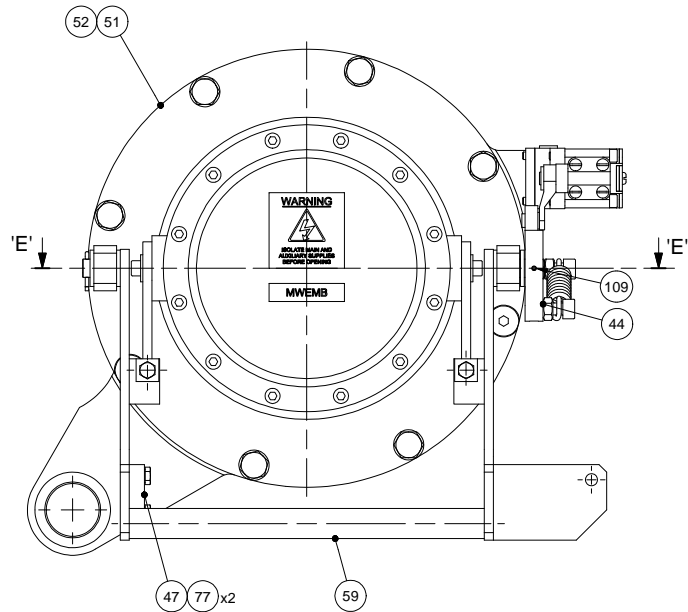
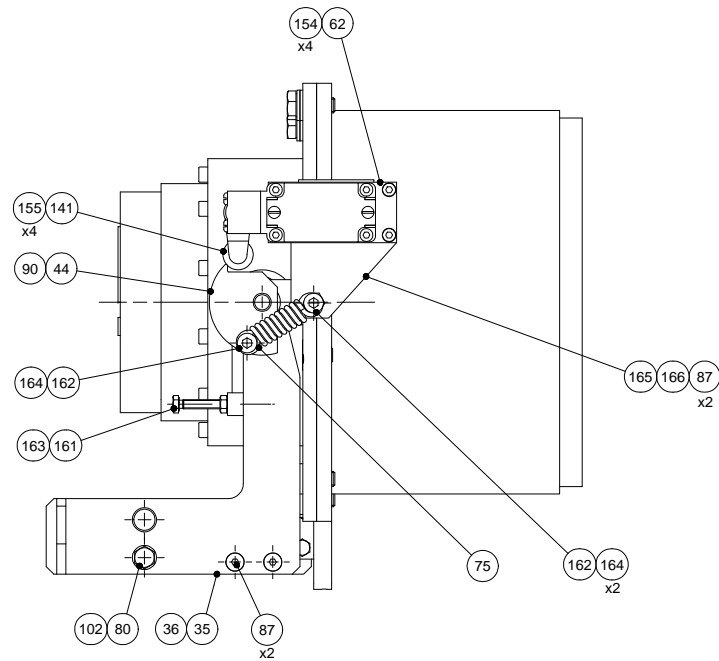
SECTION 'D'-D'  
CLUTCH SHOE SETUP  
(1:2)

NOTE: SPRING SETUP TYPICAL BOTH SIDES

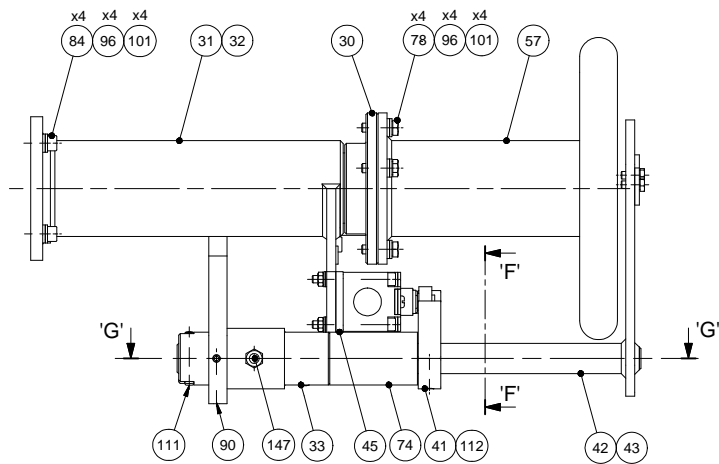
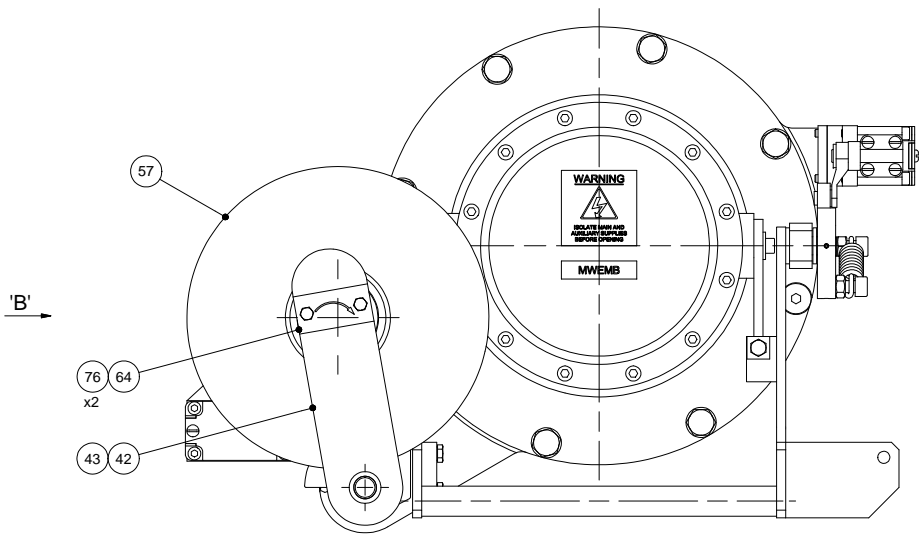
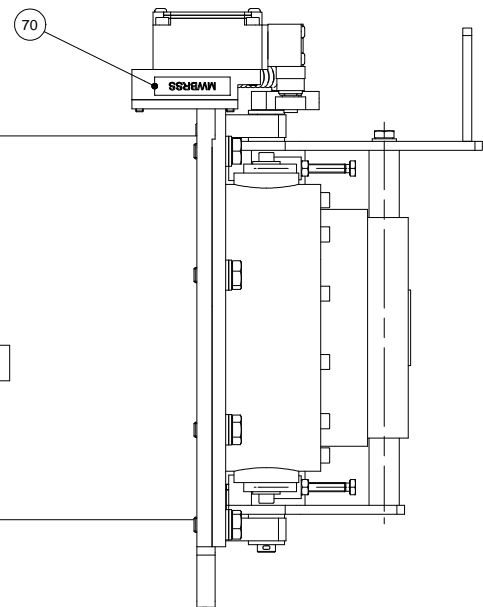


SECTION 'C'-C'  
(1:2)  
IMMERSION HEATER MOUNTING

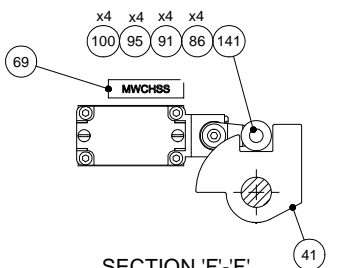
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ALL DIMENSIONS IN mm				GENERAL DIMENSIONAL TOLERANCES: UNLESS OTHERWISE STATED.				Drawing Title	
REMOVE ALL SHARP CORNERS				OPERATIONAL RANGE				Drawing Number	
Drawn				MACHINING				As Dim	
Scale				FABRICATION				Opp As Dim	
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PDF				1000 to 10000				Sheet 2 of 3	
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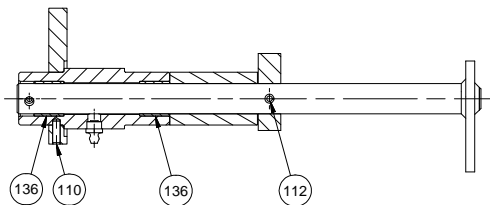
SECTION 'E'-E'  
DETAIL OF MANUAL DISC BRAKE SETUP  
(NOTE: HANDWHEEL AND SAFETY PLATE OMITTED FOR CLARITY)



VIEW ON 'B'



SECTION 'F'-F'  
SAFETY DEVICE SETUP  
(NOTE: SEE ALSO SECTION 'B'-B' FOR SHAFT COVER ASSEMBLING DETAILS)



SECTION 'G'-G'

General Notes				WELIN LAMBIE LTD Brierley Hill, West Midlands, United Kingdom. Tel: 44 (0) 1384 76294 Fax: 44 (0) 1384 265100 - Email: admin@welin-lambie.co.uk				This drawing is the sole property of WELIN LAMBIE LTD. Copy and transmission to third parties are prohibited except with written permission.	
ALL DIMENSIONS IN mm				GENERAL DIMENSIONAL TOLERANCES: UNLESS OTHERWISE STATED.				Drawing Title	
REMOVE ALL SHARP CORNERS				OPERATION RANGE				Drawing Number	
Drawn				MACHINING				As Dim	
Scale				FABRICATION				Opp As Dim	
DW				1:2.5				5504-6801	
Date				011110				Rev	
Checked				PDF				4	
								Sheet 3 of 3	

PARTS LIST				Sheet
Title		Drg No. 5504-6801		1 of 4
Item No.	Part No.	Description	No. Off / Set	
1	2041-0571	CLUTCH CENTRE BOSS	1	
2	2511-0073	CLUTCH DRUM	1	
3	2520-3001	CLUTCH SHOE ASSEMBLY	4	
4	2520-3401	CENTRIFUGAL BRAKE SHOE ASSY	6	
5	2702-0011	TENSION SPRING	8	
6	2702-0411	TENSION SPRING	6	
7	5002-9211	SPUR GEAR	1	
8	5002-9311	SPUR GEAR	1	
9	5031-4711	BEARING HOUSING	1	
10	5031-4811	BEARING HOUSING	1	
11	5051-2611	SPUR GEAR	1	
12	5052-1911	SPUR GEAR	1	
13	5061-1411	BEARING HOUSING	1	
14	5062-2211	BEARING HOUSING	1	
15	5062-2311	BEARING HOUSING	1	
16	5062-2411	BEARING HOUSING	1	
17	5064-1411	BEARING HOUSING	1	
18	5101-5211	MOTOR PINION SHAFT	1	
19	5101-5311	PINION SHAFT	1	
20	5102-9811	BRAKE SHAFT	1	
21	5111-4111	BRAKE STUB SHAFT	1	
22	5114-5311	TURNING HANDLE SHAFT	1	
23	5435-3911	PLATE	1	
24				
25	5213-5711	SLEEVE	1	
26	5241-1511	SPACER	1	
27	5241-1611	SPACER	1	
28	5243-2611	SLEEVE	1	
29	5291-3611	RETAINING RING	2	
30	5292-5611	HANDWHEEL BOSS	1	
31	5331-3131	SHAFT COVER	1	
32	5331-3231	SHAFT COVER		
33	5391-7111	PIVOT BOSS	1	
34	5400-6511	NAMEPLATE	1	
35	5412-4731	BRAKE LEVER-WITH REMOTE LUG	1	
36	5412-4831	BRAKE LEVER-WITH REMOTE LUG		
37	5427-2311	INSPECTION COVER	1	
38	5427-2411	INSPECTION COVER GASKET	1	
39	5442-5911	HEATER TERMINAL BOX GASKET	1	
40	5442-3011	ROPE CLIP PLATE	1	
41	5442-3311	LIMIT SWITCH OPERATING PLATE	1	
42	5442-3431	SAFETY PLATE	1	
43	5442-3531	SAFETY PLATE		
44	5442-5111	SWITCH OPERATING PLATE	1	
45	5442-5211	SWITCH PACKER	1	
46				
47	5442-5411	STOP PAD	1	
48	5504-6831	WINCH GEARBOX	1	
49	5504-6931	WINCH GEARBOX		
50	5512-6131	BRAKE DRUM LINER	1	

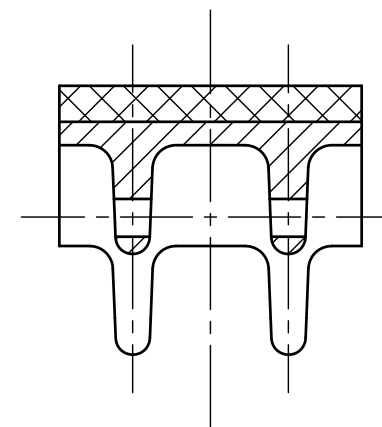
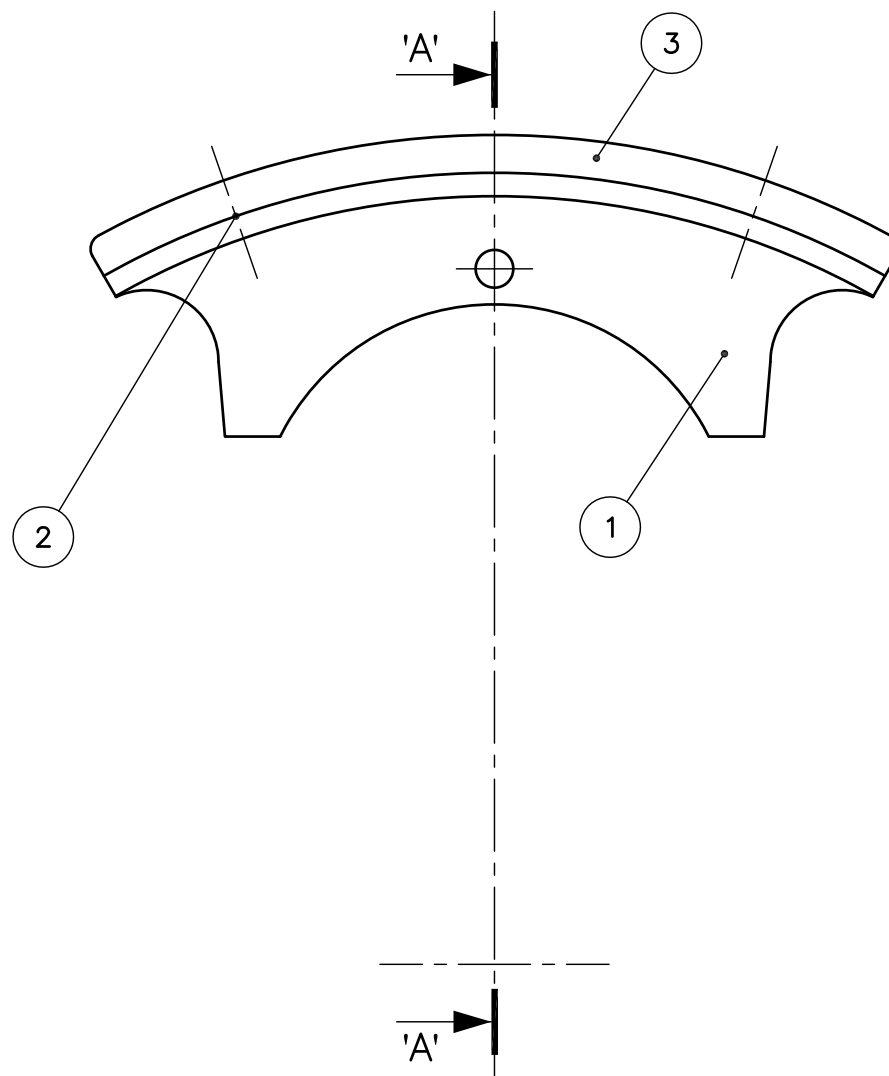
PARTS LIST				Sheet
Title		Drg No. 5504-6801		2 of 4
Item No.	Part No.	Description	No. Off / Set	
51	5523-9231	BRAKE HOUSING COVER PLATE	1	
52	5523-9331	BRAKE HOUSING COVER PLATE		
53	5543-2031	ROPE DRUM	1	
54	5543-2131	ROPE DRUM		
55	5592-5531	CENT'L BRAKE SHOE CARRIER	1	
56	5673-6011	HEATER TERMINAL BOX	1	
57	5711-0321	HANDWHEEL	1	
58	5422-1911	LOAD PLATE	1	
59	5112-4611	HANDLE	1	
60	5412-4931	BRAKE LEVER	1	
61	5412-5031	BRAKE LEVER		
62	5442-7011	LIMIT SWITCH PACKER	1	
63	5442-7131	LOST MOTION LEVER	2	
64	5400-9411	LABEL (ARROW)	1	
65	5080-0201	MAGNETIC PLUG ASSEMBLY	1	
66	5697-5321	ROPE DRUM GUARD	1	
67	5697-5421	ROPE DRUM GUARD		
68	5435-3811/F	LABEL - WARNING (ISOLATE MAIN...)	3	
69	5435-3811/K	LABEL - MWCHSS	1	
70	5435-3811/M	LABEL - MWBRSS	1	
71	5435-3811/N	LABEL - MWEMB	1	
72	5435-3811/P	LABEL - MWOHTB	1	
73	5435-3811/V	LABEL - MWM	1	
74	5322-3311	SPACER	1	
75	5702-0111	TENSION SPRING	1	
76	609-05012	HEX HD SETSCREW	6	
77	609-06016	HEX HD SETSCREW	10	
78	609-06020	HEX HD SETSCREW	4	
79	611-06025	HEX HD SETSCREW	4	
80	609-08020	HEX HD SETSCREW	13	
81	609-10020	HEX HD SETSCREW	10	
82	609-10025	HEX HD SETSCREW	12	
83	609-12030	HEX HD SETSCREW	4	
84	617-02006	HEX SKT HD CAPSCREW	4	
85	617-02008	HEX SKT HD CAPSCREW	4	
86	617-05005	HEX SKT HD CAPSCREW	4	
87	617-21606	HEX SKT CSK HD SCREW	12	
88	617-22008	HEX SKT CSK HD SCREW	9	
89	617-22010	HEX SKT CSK HD SCREW	2	
90	617-41205	HEX SKT SETSCREW (CUP POINT)	2	
91	629-00005	HEX NUT	4	
92	629-00110	NYLOC NUT	2	
93	639-00035	NOTCH NUT	1	
94	640-00035	LOCK WASHER	1	
95	647-00305	PLAIN WASHER	11	
96	647-00306	PLAIN WASHER	8	
97	647-00308	PLAIN WASHER	12	
98	647-00310	PLAIN WASHER	18	
99	647-00312	PLAIN WASHER	4	
100	647-00805	PLAIN WASHER	4	

PARTS LIST				Sheet
Title	WINCH GEARBOX ASSEMBLY		Drg No. 5504-6801	3 of 4
Item No.	Part No.	Description	No. Off / Set	
101	647-00806	PLAIN WASHER	16	
102	647-00808	PLAIN WASHER	17	
103	647-00810	PLAIN WASHER	18	
104	647-00812	PLAIN WASHER	8	
105	651-10025	EXTERNAL CIRCLIP	1	
106	651-10030	EXTERNAL CIRCLIP	1	
107	651-10040	EXTERNAL CIRCLIP	6	
108	651-10070	EXTERNAL CIRCLIP	1	
109	675-03022	TENSION PIN	1	
110	675-05016	TENSION PIN	1	
111	675-06035	TENSION PIN	1	
112	675-06045	TENSION PIN	1	
113	679-37018	SPLIT COTTER PIN	1	
114	679-40025	SPLIT COTTER PIN	6	
115	679-40045	SPLIT COTTER PIN	6	
116	685-12018	KEY (SQ. BOTH ENDS)	1	
117	685-12035	KEY (SQ. BOTH ENDS)	1	
118	686-08030	KEY (SQ. ONE END, RAD.ON OTHER)	1	
119	686-08061	KEY (SQ. ONE END, RAD.ON OTHER)	1	
120	686-10040	KEY (SQ. ONE END, RAD.ON OTHER)	2	
121	686-12018	KEY (SQ. ONE END, RAD.ON OTHER)	1	
122	686-12027	KEY (SQ. ONE END, RAD.ON OTHER)	1	
123	686-12040	KEY (SQ. ONE END, RAD.ON OTHER)	1	
124	686-20038	KEY (SQ. ONE END, RAD.ON OTHER)	1	
125	7003-0015	DEEP GROOVE BALL BEARING	1	
126	7003-0020	DEEP GROOVE BALL BEARING	2	
127	7003-0035	DEEP GROOVE BALL BEARING	1	
128	7003-0045	DEEP GROOVE BALL BEARING	1	
129	7004-0060	DEEP GROOVE BALL BEARING	1	
130	7004-0070	DEEP GROOVE BALL BEARING	1	
131	7037-0040	DEEP GROOVE BALL BEARING	1	
132	7044-0030	DEEP GROOVE BALL BEARING	1	
133	7105-0025	CYLINDRICAL ROLLER BEARING	1	
134	7105-0035	CYLINDRICAL ROLLER BEARING	1	
135	7500-0715	SELF-LUBRICATING BEARING	2	
136	7500-1220	SELF-LUBRICATING BEARING	2	
137	7967-0401	OIL SEAL	3	
138	7967-0551	OIL SEAL	1	
139	7967-0801	OIL SEAL	1	
140	7980-044530	'O' RING	1	
141	859-01070	ROLLER LEVER LIMIT SWITCH	2	
142	859-01333	MINIATURE IMMERSION HEATER	1	
143	859-01334	ROD THERMOSTAT	1	
144	859-01335	STAINLESS STEEL POCKET	1	
145				
146	860-01075	ELECTRIC MOTOR	1	
147	889-01002	GREASE NIPPLE - STRAIGHT	1	
148	889-02004	FLANGED PLUG	1	
149	891-05543	MANUAL DISC BRAKE	1	
150	891-05544	ROLLER FREEWHEEL	1	




PARTS LIST				Sheet
Title		Drg No. 5504-6801		4 of 4
Item No.	Part No.	Description	No. Off / Set	
151	894-01703	BONDED WASHER	2	
152	894-01706	BONDED WASHER	1	
153	616-02072	HEX SKT BUTTON HD CAPSCREW	4	
154	617-01605	HEX SKT HD CAPSCREW	4	
155	617-04005	HEX SKT HD CAPSCREW	4	
156	617-01606	HEX SKT HD CAPSCREW	2	
157	647-00906	PLAIN WASHER (LARGE DIA)	2	
158	617-52008	HEX SKT SETSCREW (CONE POINT)	1	
159	617-40808	HEX SKT SETSCREW (CUP POINT)	2	
160	609-05008	HEX HD SETSCREW	3	
161	609-06060	HEX HD SETSCREW	2	
162	617-02508	HEX SKT HD CAPSCREW	2	
163	629-00006	HEX NUT	2	
164	629-00008	HEX NUT	3	
165	5442-7311	SWITCH MOUNTING PLATE	1	
166	5442-7411	SWITCH MOUNTING PLATE		
167	894-00858	AIR BREATHER	1	
168				
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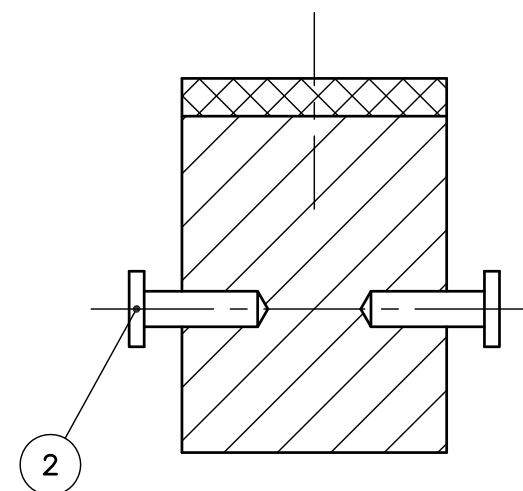


SECTION 'A'-'A'

D	3					 <div>WELIN LAMBIE LTD. BRIERLEY HILL, WEST MIDLANDS, UNITED KINGDOM. Telephone (01384) 78294 Email : ADMIN@WELIN-LAMBIE.CO.UK Telefax (01384) 265100 Web Site : WWW.WELIN-LAMBIE.CO.UK</div>	This drawing is the sole property of WELIN LAMBIE LTD Copy and transmission to third parties are prohibited except with written permission					
	2	LINING MATERIAL WAS TRIMAT 'GBC'			SS		050308	DW				
	1	DRAWING UPDATED			DW		130301	PDF				
	Rev	Description			Drn		Date	Chd				
	Scale		Drawn		Date		Chd					
QAPO54	1:1		DW		190297		AKP		ALL DIMENSIONS IN	CENTRIFUGAL BRAKE SHOE ASSEMBLY (MOD'D 6oz)	Drg No  2520-3401	Rev  2

**PARTS LIST****Sheet****Title    CENTRIFUGAL BRAKE SHOE ASSEMBLY    Drg No. 2520-3401****1 of 1**

Item No.	Part No.	Description	No. Off / Set	
1	2520-3471	CENTRIFUGAL BRAKE SHOE	6	
2	664-05010	RIVET	12	
3	832-01000	LINING	6	
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SECTION 'A'-'A'

3

LINING MATERIAL WAS TRIMAT 'GBC'

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DRAWING UPDATED

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RIVETS REPOSITIONED

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Description

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ALL DIMENSIONS IN

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WELIN LAMBIE LTD. BRIERLEY HILL,  
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Title

CLUTCH SHOE ASSEMBLY

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Drg No

2520-3001

Rev

3

PARTS LIST				Sheet
Title		Drg No. 2520-3001		1 of 1
Item No.	Part No.	Description	No. Off / Set	
1	2520-3071	CLUTCH SHOE	4	
2	669-01000	RIVET	8	
3	669-01520	RIVET	8	
4	832-01002	LINING	4	
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LID VIEW ( 1:3 )

### TYPICAL TRUNKING LAYOUT ( 1:3 )

LID REAR VIEW ( 1:4 )

BASE PLATE LAYOUT ( 1:2 )

TERMINAL RAIL 1 LAYOUT ( 1:1 )

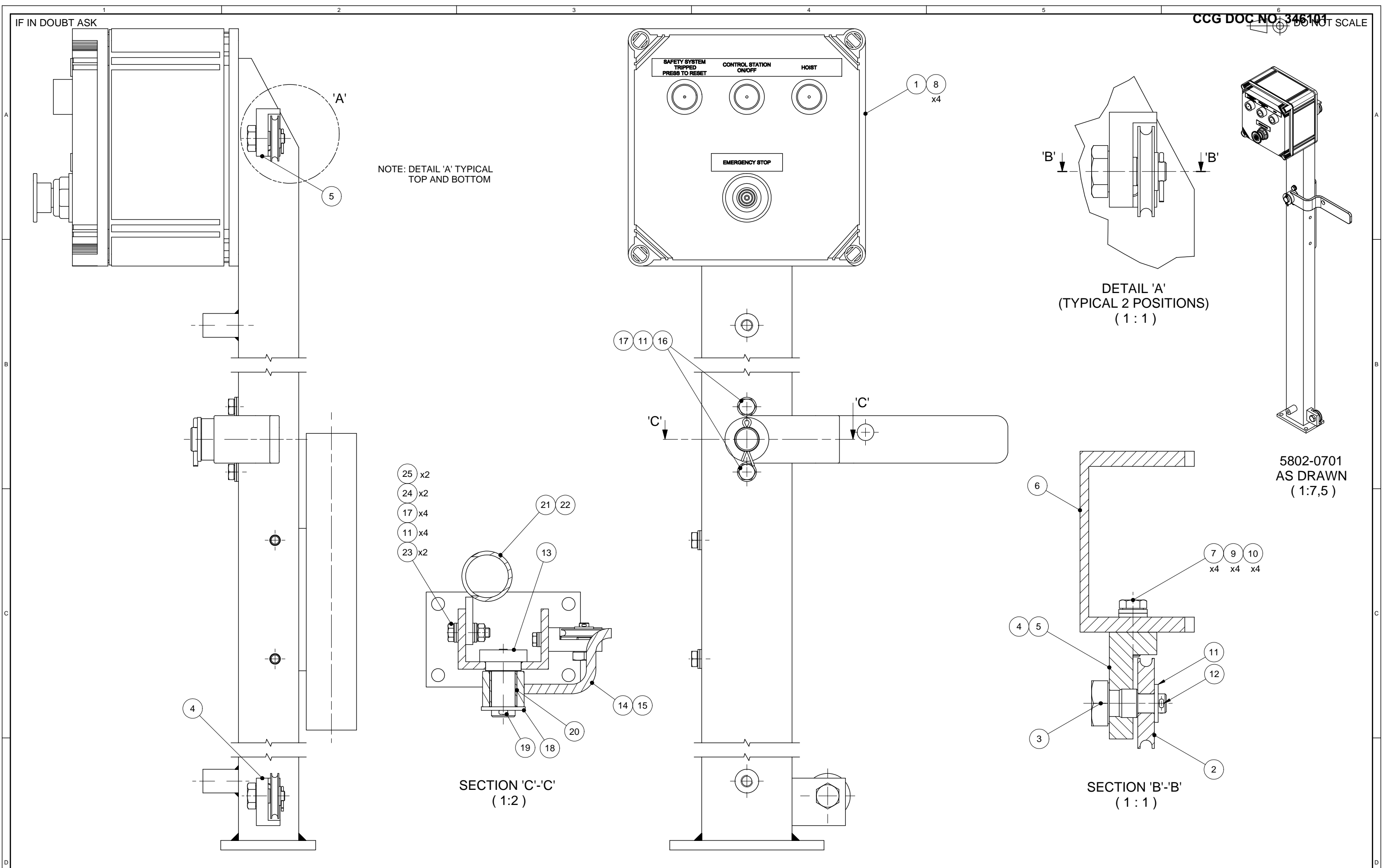
TERMINAL RAIL 2 LAYOUT ( 1:1 )

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ALL DIMENSIONS IN mm				GENERAL DIMENSIONAL TOLERANCES: UNLESS OTHERWISE STATED:				Drawing Title				Drawing Number		Rev	
REMOVE ALL SHARP CORNERS				OPEN / RANGE    0 to 100    100 to 1000    1000 to 10000				CONTROL PANEL ASSEMBLY				As Dm    2781-5301		0	
Drawn	Scale	Date	Checked	MACHINING    +/- 0.2    +/- 0.5    +/- 1 FABRICATION    +/- 1    +/- 2    +/- 3								Opp As Dm    N/A			
JM	1:2	05/10/10	SM					Sheet 1 of 1							

PARTS LIST				Sheet
Title		Drg No. 2781-5301		1 of 2
Item No.	Part No.	Description	No. Off / Set	
1	2781-5311	CONTROL PANEL DRILLINGS	1	
2	2781-5411	CONTROL PANEL DRILLING		
3	859-02881	STEEL MOUNTING PLATE	1	
4	5435-3811/B	LABEL	1	
5	5435-3811/C	LABEL	1	
6	5435-3811/D	LABEL - SWITCH OFF..	1	
7	5435-3811/E	LABEL - EMERGENCY STOP	1	
8	5435-3811/F	LABEL - WARNING (ISOLATE MAIN...)	1	
9	5435-3811/H	LABEL	1	
10	5435-3811/J	LABEL	1	
11	5801-8311	HEATER MOUNTING BRACKET	1	
12	649-03010	SLOTTED PAN HD SCREW	16	
13	649-04008	SLOTTED PAN HD SCREW	2	
14	609-06010	HEX HD SETSCREW	2	
15	609-06016	HEX HD SETSCREW	4	
16	609-08040	HEX HD SETSCREW	1	
17	647-00806	PLAIN WASHER	6	
18	647-00808	PLAIN WASHER	3	
19	647-00706	SHAKEPROOF WASHER	6	
20	647-00708	SHAKEPROOF WASHER	2	
21	629-00006	HEX NUT	8	
22	629-00008	HEX NUT	3	
23	659-00101	POP RIVET	49	
24				
25				
26	859-04582	TOP HAT DIN RAIL	2.225	
27	859-05527	OPEN SLOT TRUNKING	0.4	
28	859-02638	OPEN SLOT TRUNKING	2.86	
29	859-02639	OPEN SLOT TRUNKING	0.39	
30	859-02683	UNILABEL TRACK	1.56	
31	859-02684	IDENTIFICATION STRIP FRONT	1.56	
32	859-03060	ACH CAGE HEATER	1	
33	859-02671	THERMOSTAT	1	
34	859-02652	ISOLATOR	2	
35	859-02655	ISOLATOR SHAFT	2	
36	859_02654	ISOLATOR HANDLE	2	
37	859-03086	CONTACT BLOCK	1	
38	859-04574	CIRCUIT BREAKER	1	
39	859-04572	CIRCUIT BREAKER	1	
40	859-05529	AUXILLARY CONTACT BLOCK	2	
41	859-03707	CIRCUIT BREAKER	1	
42	859-03708	CIRCUIT BREAKER	1	
43	859-03710	CIRCUIT BREAKER	2	
44	859-02665	AUXILLIARY CONTACT BLOCK	3	
45	859-04581	POWER SUPPLY UNIT	1	
46	859-05526	SAFETY RELAY	1	
47	859-02910	ZELIO PROGRAMMABLE RELAY	1	
48	859-03151	CONTACTOR	3	
49	859-02564	AUX ADD ON BLOCK	2	
50	859-04702	RELAY BASE	1	

PARTS LIST				Sheet
Title		Drg No. 2781-5301		2 of 2
Item No.	Part No.	Description	No. Off / Set	
51	859-02680	RELAY	1	
52	859-04713	LED MODULE - RED	1	
53	859-04728	RELAY RETAINING CLIP	1	
54	859-01960	EMERGENCY STOP	1	
55	859-01961	CONTACT BLOCK	1	
56	859-02552	PILOT LIGHT HEAD	2	
57	859-02553	COMPLETE BODY	3	
58	859-02573	PUSH BUTTON - SPRING RETURN	1	
59	859-02551	ILLUMINATED P/B BODY	1	
60	859-02523	PUSH BUTTON HEAD	1	
61	859-02500	COMPLETE BODY	1	
62	859-02504	SINGLE CLEAR BOOT	5	
63	859-01948	LED BULB	3	
64	859-05606	PILOT LIGHT HEAD	1	
65	859-01949	LED BULB	1	
66	859-02400	MODULAR TERMINAL	32	
67	859-02401	MODULAR TERMINAL	17	
68	859-02420	EARTH TERMINAL	2	
69	859-02410	PARTITION	7	
70	859-02406	END PLATE	7	
71	859-02405	END CLAMP	26	
72	859-02437	JUMPER BAR C/W SCREWS	5	
73	859-02438	JUMPER BAR C/W SCREWS	2	
74	859-02455	JUMPER BAR C/W SCREWS	1	
75	859-02456	JUMPER BAR C/W SCREWS	1	
76	859-02449	8 DIGIT MARKER TAG	98	
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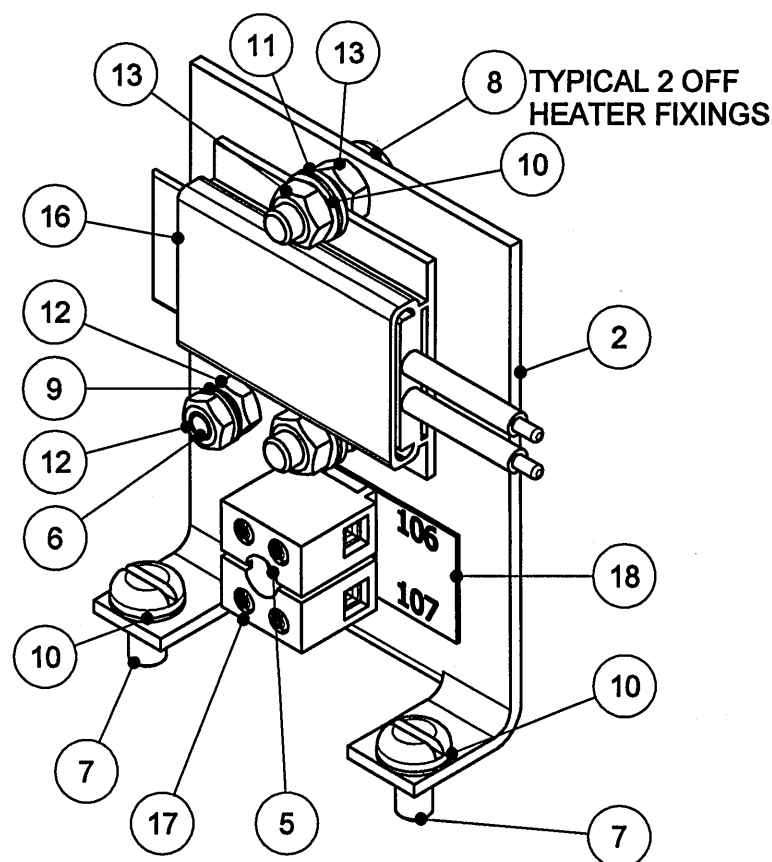
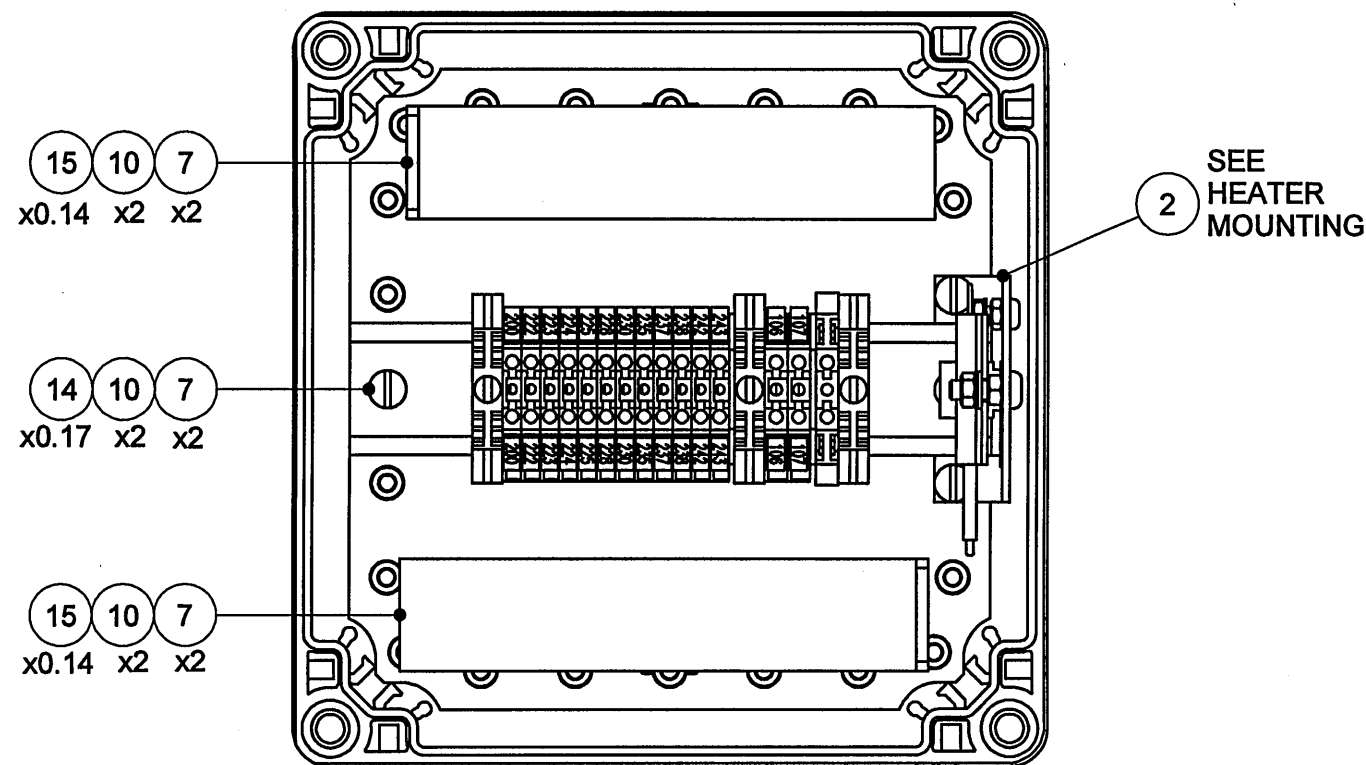
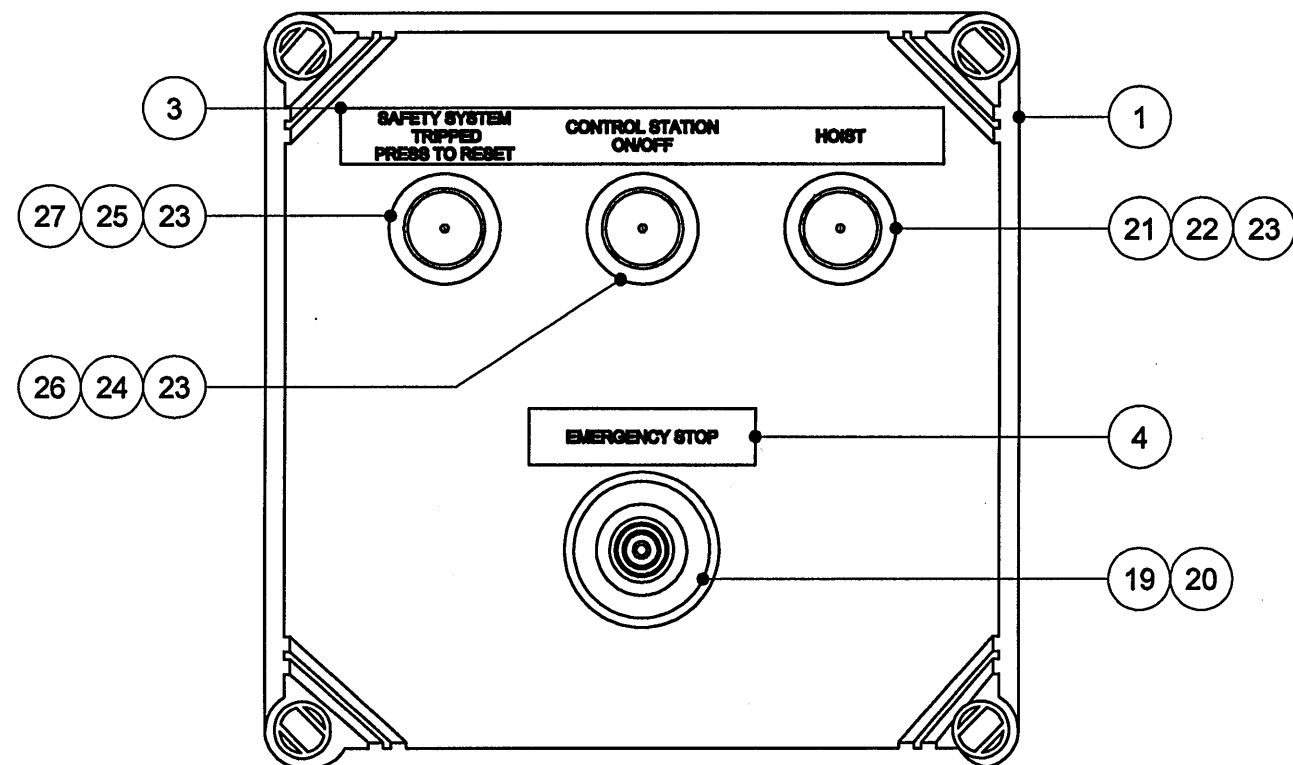
2	TURNING HANDLE HOLDER ADDED	PDF	09/02/11	DW
1	BRAKE LEVER ADDED	PDF	28/01/11	DW
Rev	Description	Dm	Date	Chd

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ALL DIMENSIONS IN mm				GENERAL DIMENSIONAL TOLERANCES: UNLESS OTHERWISE STATED.				Drawing Number	
REMOVE ALL SHARP CORNERS				OPER'N RANGE	0 to 100	100 to 1000	1000 to 10000	As Dm	5802-0701
Drawn	Scale	Date	Checked	MACHINING	+/- 0.2	+/- 0.5	+/- 1	Opp As Dm	2
DW	1:2	221110	PDF	FABRICATION	+/- 1	+/- 2	+/- 3	Sheet 1 of 1	

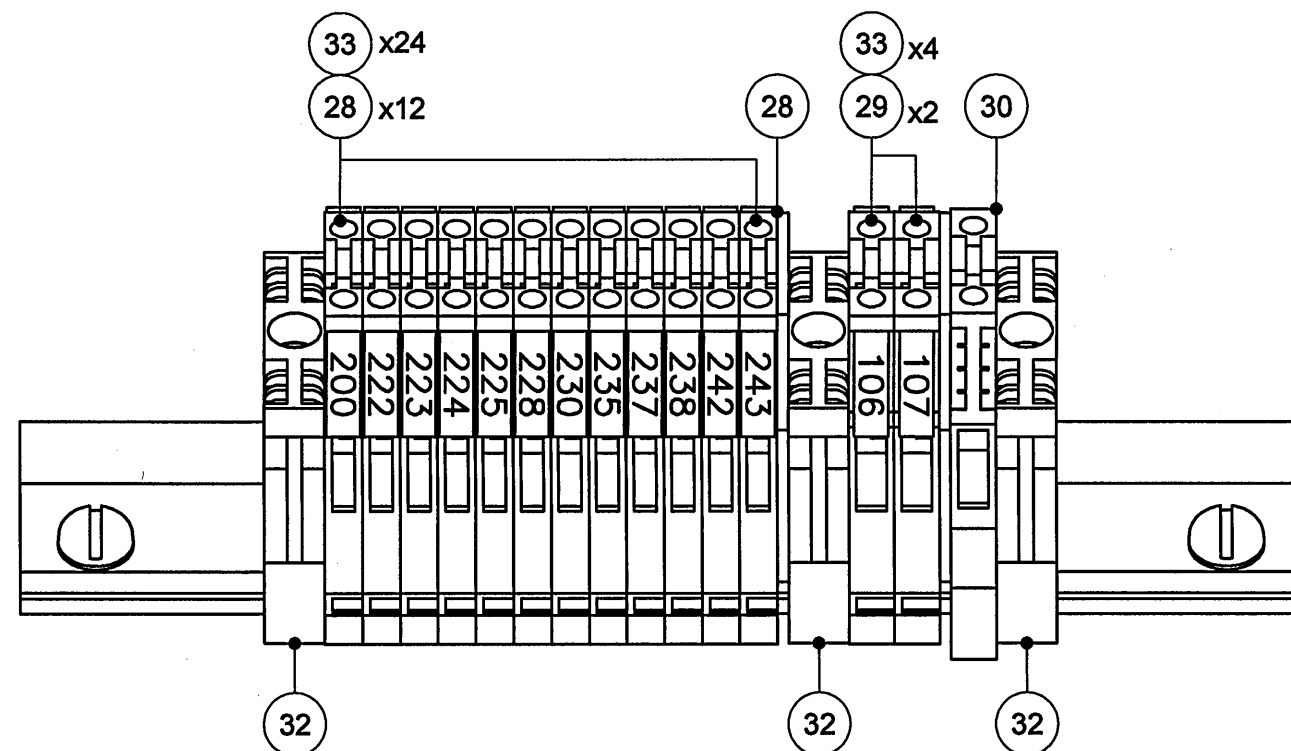
PARTS LIST				Sheet
Title CONTROL STATION STAND ASSEMBLY Drg No. 5802-0701				1 of 1
Item No.	Part No.	Description	No. Off / Set	
1	2781-5101	CONTROL STATION ASSEMBLY	1	
2	5010-3311	PULLEY	2	
3	5140-2211	PIVOT PIN	2	
4	5442-4911	PULLEY MOUNTING PLATE	1	
5	5442-5011	PULLEY MOUNTING PLATE	1	
6	5802-0721	CONTROL STATION STAND	1	
7	609-06020	HEX HD SETSCREW	4	
8	617-03506	HEX SKT HD CAPSCREW	4	
9	647-00306	PLAIN WASHER	4	
10	647-00806	PLAIN WASHER	4	
11	647-00808	PLAIN WASHER	8	
12	679-36014	SPLIT COTTER PIN	2	
13	5150-0711	PIVOT PIN	1	
14	5412-5131	BRAKE LEVER	1	
15	5412-5231	BRAKE LEVER		
16	609-08020	HEX HD SETSCREW	2	
17	647-00308	PLAIN WASHER	6	
18	647-00820	PLAIN WASHER	1	
19	679-39028	SPLIT COTTER PIN	1	
20	7500-1230	SELF-LUBRICATING BEARING	1	
21	5802-0921	TURNING HANDLE HOLDER	1	
22	5802-1021	TURNING HANDLE HOLDER		
23	609-08030	HEX HD SETSCREW	2	
24	647-00708	SHAKEPROOF WASHER	2	
25	629-00008	HEX NUT	2	
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IF IN DOUBT ASK

DO NOT SCALE



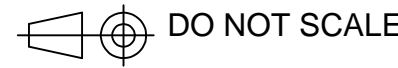
HEATER MOUNTING (1:1)



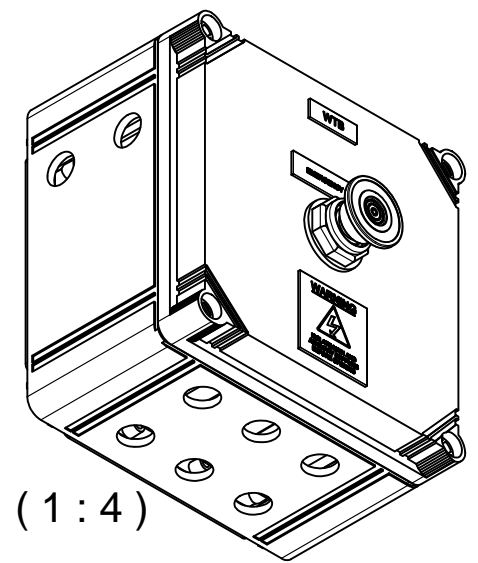
TERMINAL RAIL VIEW (1:1)

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ALL DIMENSIONS IN mm				GENERAL DIMENSIONAL TOLERANCES: UNLESS OTHERWISE STATED.				Drawing Title	
REMOVE ALL SHARP CORNERS				OPER'N RANGE	0 to 100	100 to 1000	1000 to 10000	CONTROL STATION ASSEMBLY	
Drawn	Scale	Date	Checked	MACHINING	+/- 0.2	+/- 0.5	+/- 1	Drawing Number	
JM	1:2	20/09/10	SM	FABRICATION	+/- 1	+/- 2	+/- 3	As Dm 2781-5101	
								Opp As Dm N/A	
								Sheet 1 of 1	
								Rev 0	

PARTS LIST				Sheet
Title		Drg No. 2781-5101		1 of 1
Item No.	Part No.	Description	No. Off / Set	
1	2781-5111	CONTROL STATION DRILLING	1	
2	5801-8411	HEATER BRACKET	1	
3	5435-3811/A	LABEL	1	
4	5435-3811/G	LABEL - EMERGENCY STOP	1	
5	649-03014	SLOTTED PAN HD SCREW	1	
6	649-04010	SLOTTED PAN HD SCREW	1	
7	649-05010	SLOTTED PAN HD SCREW	8	
8	649-05016	SLOTTED PAN HD SCREW	2	
9	647-00704	SHAKEPROOF WASHER	1	
10	647-00705	SHAKEPROOF WASHER	10	
11	647-00805	PLAIN WASHER	2	
12	629-00004	HEX NUT	2	
13	629-00005	HEX NUT	4	
14	859-04582	TOP HAT DIN RAIL	0.17	
15	859-03347	OPEN SLOT TRUNKING	0.28	
16	859-04274	PTC HEATER	1	
17	859-02313	MULTIPOLE TERMINAL BLOCKS	1	
18	859-02333	MARKING STRIP	1	
19	859-01960	EMERGENCY STOP	1	
20	859-01961	CONTACT BLOCK	1	
21	859-02523	PUSH BUTTON HEAD	1	
22	859-02558	COMPLETE BODY	1	
23	859-02504	SINGLE CLEAR BOOT	3	
24	859-05630	PUSH BUTTON -PUSH-PUSH	1	
25	859-02525	PUSH BUTTON - SPRING RETURN	1	
26	859-05611	PUSHBUTTON BODY	1	
27	859-05612	PUSHBUTTON BODY	1	
28	859-02400	MODULAR TERMINAL	12	
29	859-02401	MODULAR TERMINAL	2	
30	859-02420	EARTH TERMINAL	1	
31	859-02406	END PLATE	2	
32	859-02405	END CLAMP	3	
33	859-02449	8 DIGIT MARKER TAG	28	
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IF IN DOUBT ASK

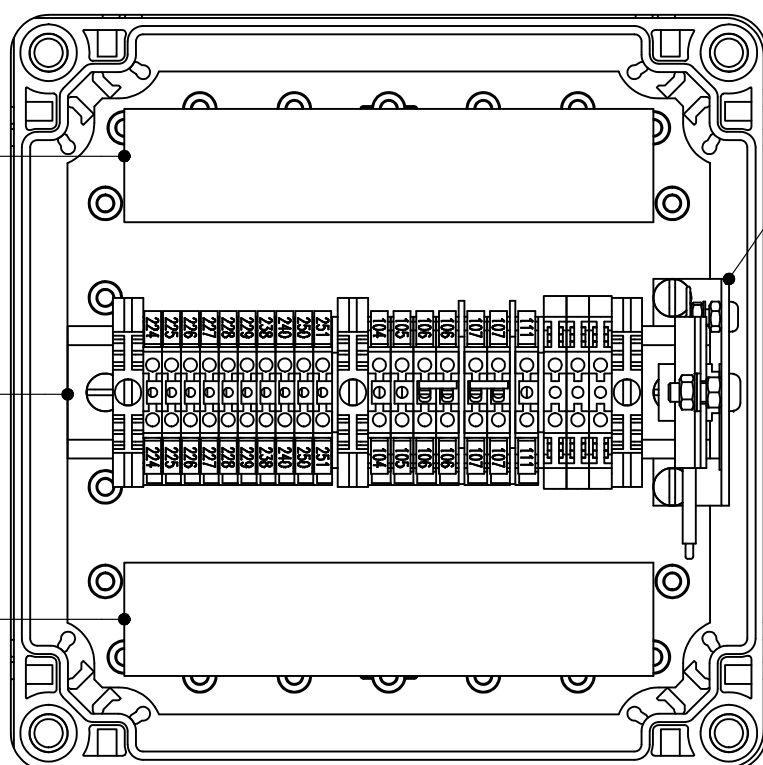


(1 : 4)

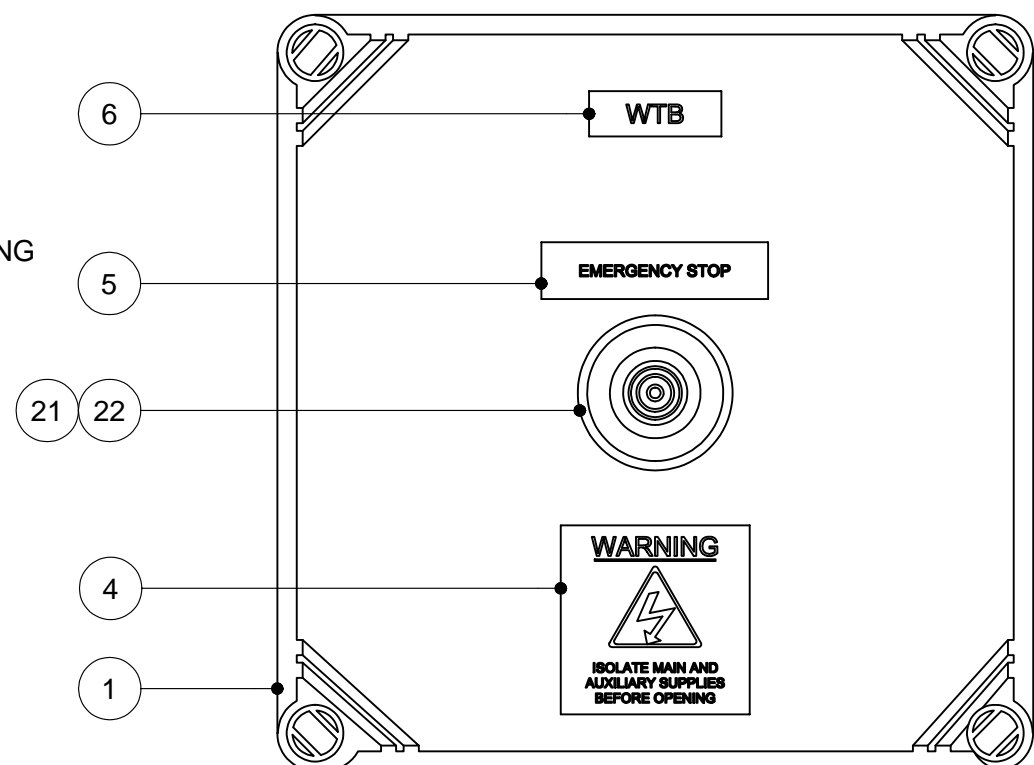
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x2 x2 x0.14

9 12 16  
x2 x2 x0.17

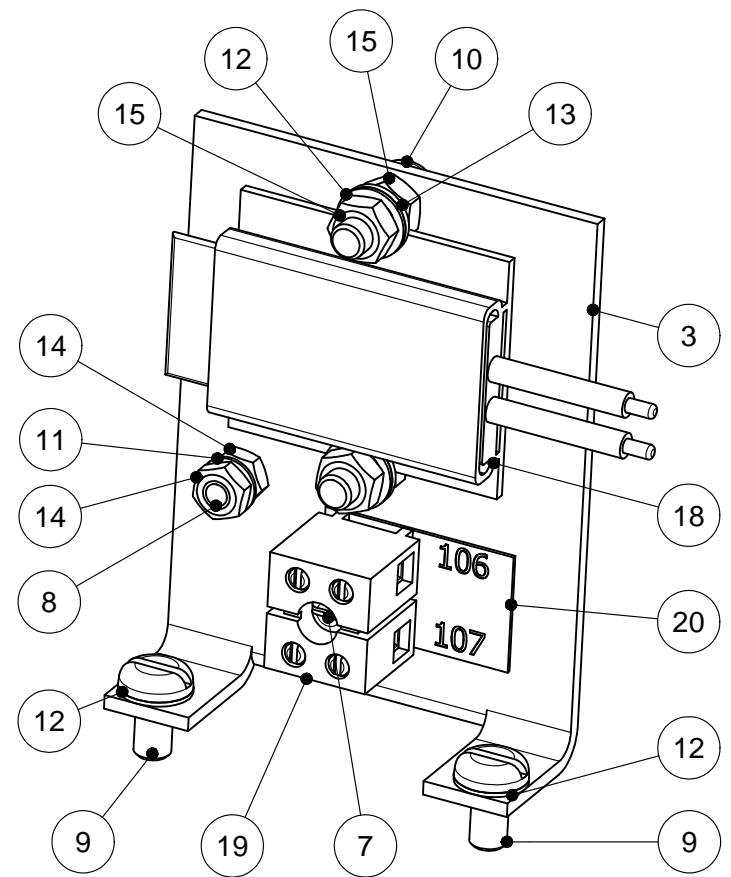
9 12 17  
x2 x2 x0.14



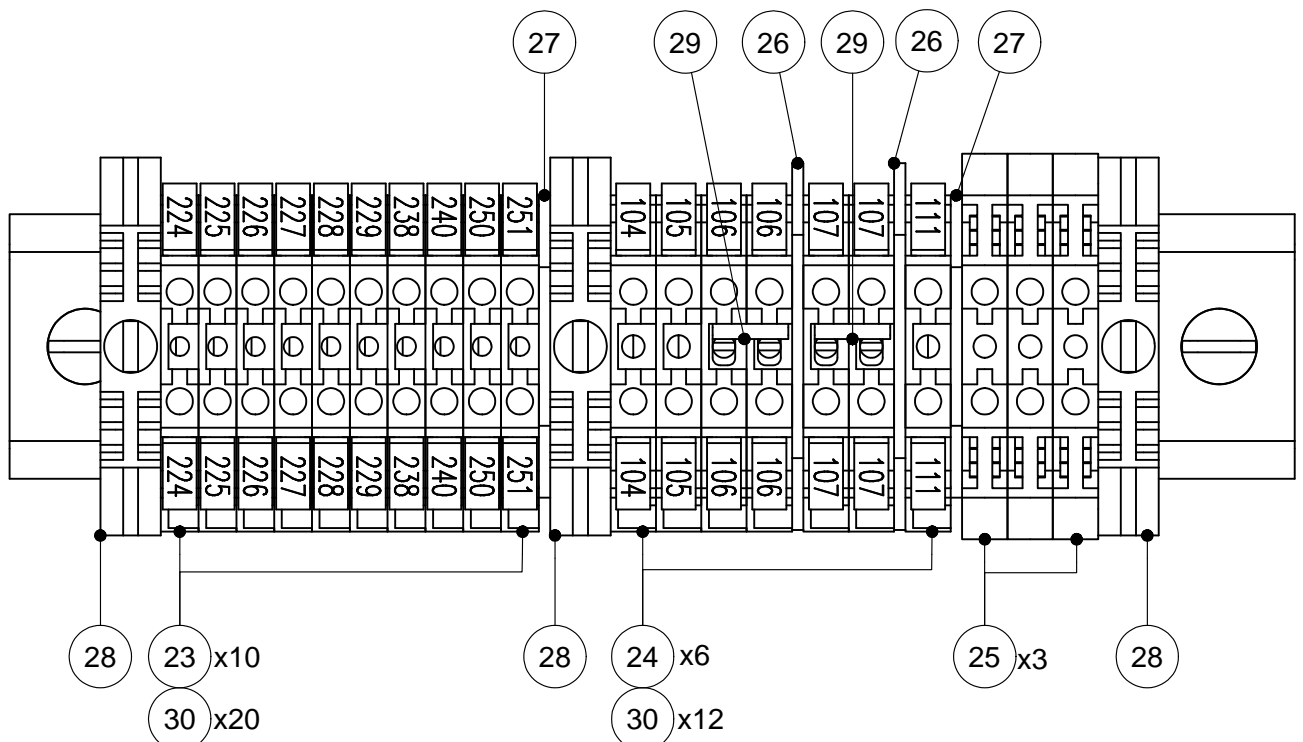
3  
SEE  
HEATER  
MOUNTING



HEATER FIXINGS  
TYPICAL 2 PLACES



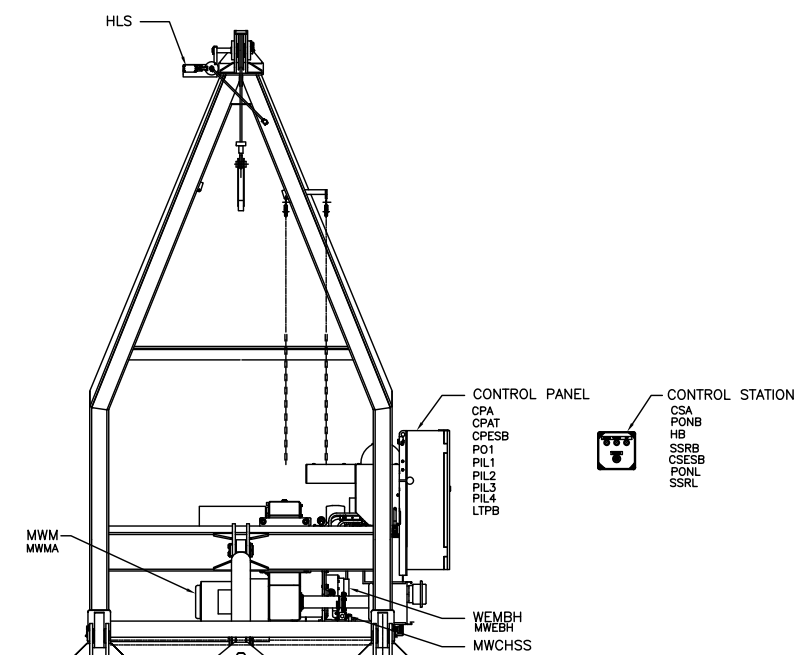
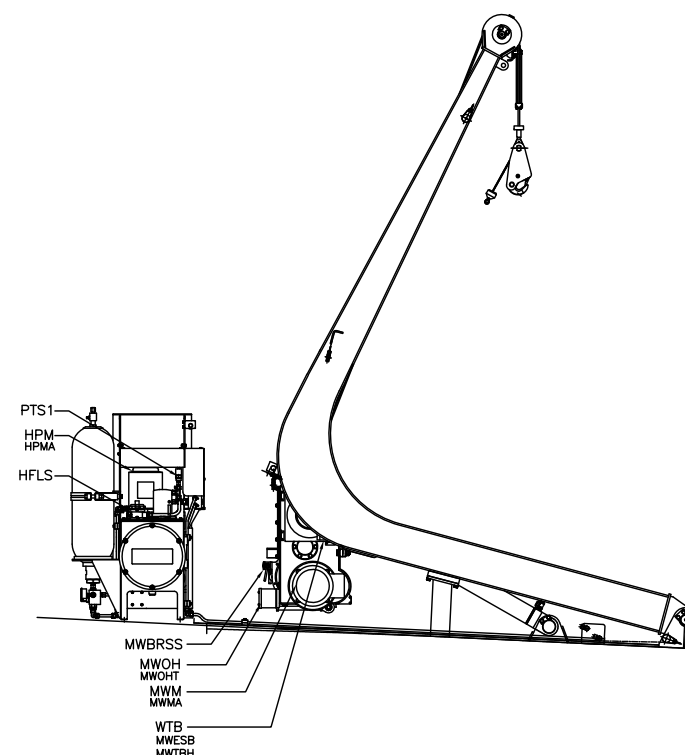
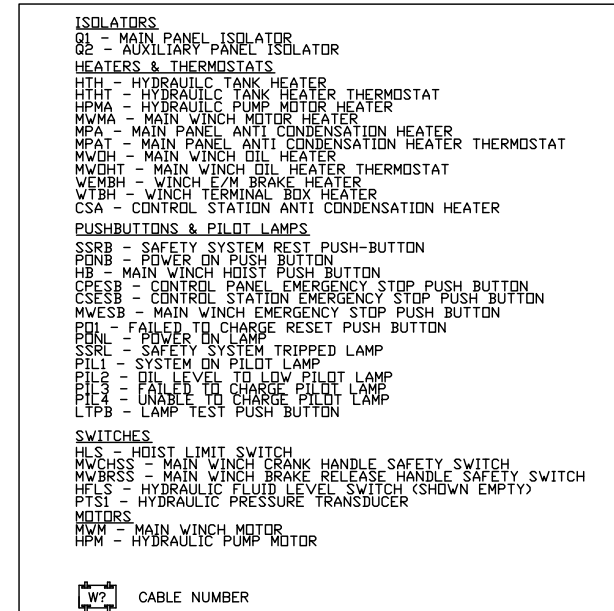
HEATER MOUNTING (1 : 1)



TERMINAL RAIL LAYOUT (1 : 1)

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					Drawing Title				Drawing Number				Rev								
ALL DIMENSIONS IN mm					GENERAL DIMENSIONAL TOLERANCES: UNLESS OTHERWISE STATED.					WINCH TERMINAL BOX ASSEMBLY				As Dm		5673-5601		0			
REMOVE ALL SHARP CORNERS					OPER'N	RANGE	0 to 100		100 to 1000					1000 to 10000		Opp As Dm			N/A		
Drawn		Scale		Date	Checked	MACHINING		+/- 0,2						+/- 0,5		+/- 1			Sheet 1 of 1		
JM		1:2		24/09/10	SM	FABRICATION		+/- 1						+/- 2		+/- 3					

PARTS LIST				Sheet
Title		Drg No. 5673-5601		1 of 1
Item No.	Part No.	Description	No. Off / Set	
1	5673-5611	WTB DRILLINGS	1	
2	5673-5711	WTB DRILLINGS		
3	5801-8411	HEATER BRACKET	1	
4	5435-3811/F	LABEL - WARNING (ISOLATE MAIN...)	1	
5	5435-3811/G	LABEL - EMERGENCY STOP	1	
6	5435-3811/S	LABEL -WTB	1	
7	649-03014	SLOTTED PAN HD SCREW	1	
8	649-04010	SLOTTED PAN HD SCREW	1	
9	649-05010	SLOTTED PAN HD SCREW	8	
10	649-05016	SLOTTED PAN HD SCREW	2	
11	647-00704	SHAKEPROOF WASHER	1	
12	647-00705	SHAKEPROOF WASHER	10	
13	647-00805	PLAIN WASHER	2	
14	629-00004	HEX NUT	2	
15	629-00005	HEX NUT	4	
16	859-04582	TOP HAT DIN RAIL	0.17	
17	859-02638	OPEN SLOT TRUNKING	0.28	
18	859-04274	PTC HEATER	1	
19	859-02313	MULTIPOLE TERMINAL BLOCKS	1	
20	859-02333	MARKING STRIP	1	
21	859-01960	EMERGENCY STOP	1	
22	859-01961	CONTACT BLOCK	1	
23	859-02400	MODULAR TERMINAL	10	
24	859-02401	MODULAR TERMINAL	7	
25	859-02420	EARTH TERMINAL	3	
26	859-02410	PARTITION	2	
27	859-02406	END PLATE	2	
28	859-02405	END CLAMP	3	
29	859-02455	JUMPER BAR C/W SCREWS	2	
30	859-02449	8 DIGIT MARKER TAG	34	
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Scale	1:20	 <b>WELIN LAMBIE LTD, BRIERLEY HILL, WEST MIDLANDS, UNITED KINGDOM.</b> Telephone (01364) 78294 Email : <a href="mailto:ADMIN@WELIN-LAMBIE.CO.UK">ADMIN@WELIN-LAMBIE.CO.UK</a> Telexref (01364) 305100 Web Site <a href="http://WWW.WELIN-LAMBIE.CO.UK">WWW.WELIN-LAMBIE.CO.UK</a>	This drawing is the sole property of WELIN LAMBIE LTD. Copy and transmission to third parties are prohibited except with written permission.		
Drawn	JM		Title	Drg No	Rev
Date	161010		ELECTRICAL ASSEMBLY	2762-1301	1
Chd	SM				

PARTS LIST				Sheet
Title	ELECTRICAL ASSEMBLY		Drg No. 2762-1301	1 of 1
Item No.	Part No.	Description	No. Off / Set	
1	859-03198	CABLE & PLUG	1	
2	859-04600	P CLIP	1	
3	617-90108	SLOTTED PAN HD SCREW	10	
4	859-01801	ADAPTOR	1	
5	859-02004	CX20 BRASS GLAND KIT - 2 PK	3	
6	859-02003	CX20S BRASS GLAND KIT - 2 PK	3	
7	859-02024	A1/A2-20SS BRASS GLAND KIT - 2 PK	6.5	
8	859-02028	A1/A2-20S BRASS GLAND KIT - 2 PK	2	
9	859-02115	TELECLEAT	10	
10	859-02200	CABLE	6.5	
11	859-02202	CABLE	15	
12	859-02204	CABLE	6	
13	859-02216	CABLE	12	
14	859-02253	CABLE	6	
15	859-02220	CABLE-COLL' SCREENED	10	
16	859-02221	CABLE-COLL' SCREENED	10	
17	859-02242	CABLE - ARMOURED	10	
18	609-06016	HEX HD SETSCREW	7	
19	647-00706	SHAKEPROOF WASHER	7	
20	647-00806	PLAIN WASHER	14	
21	629-00006	HEX NUT	7	
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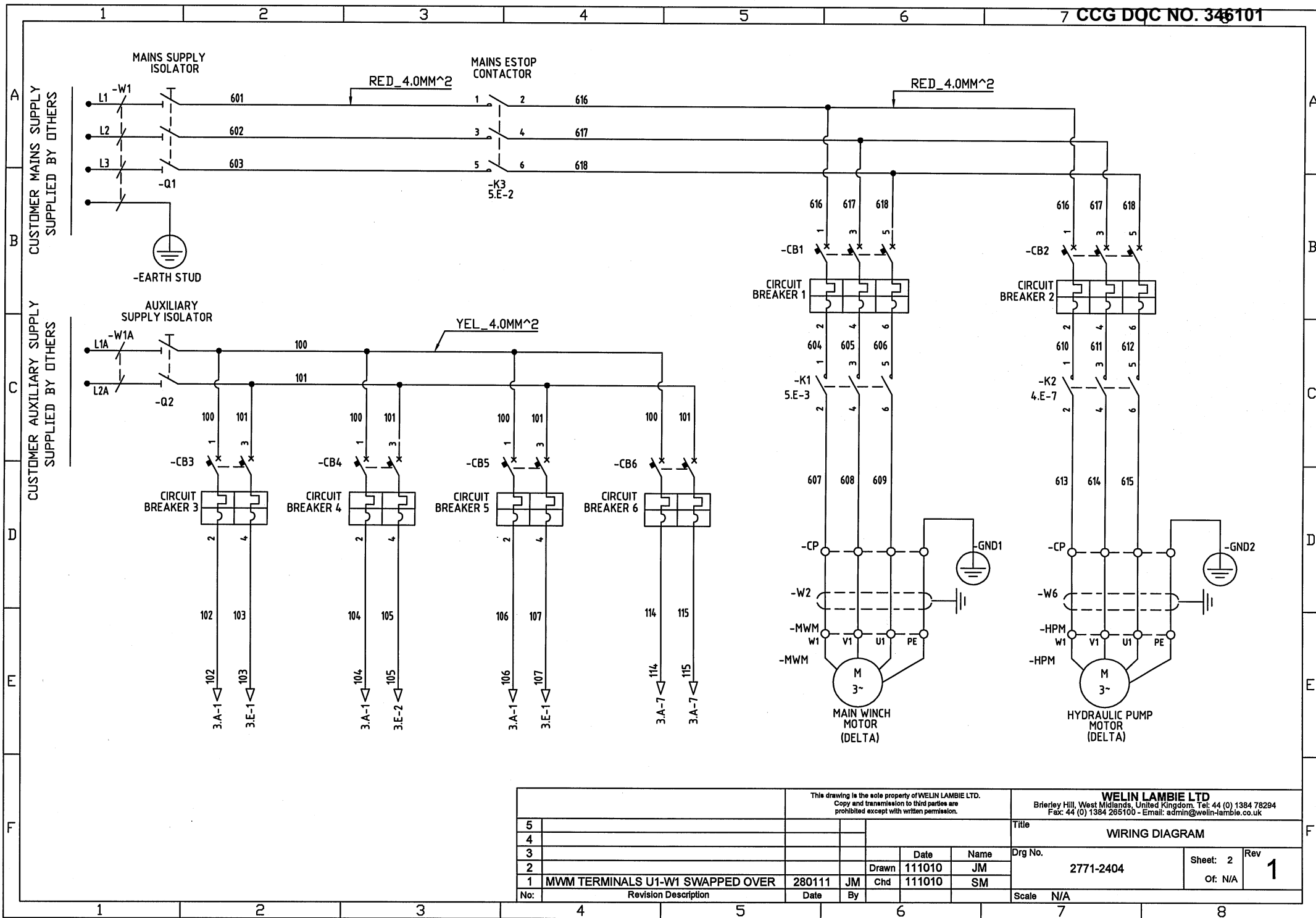
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BB |B |

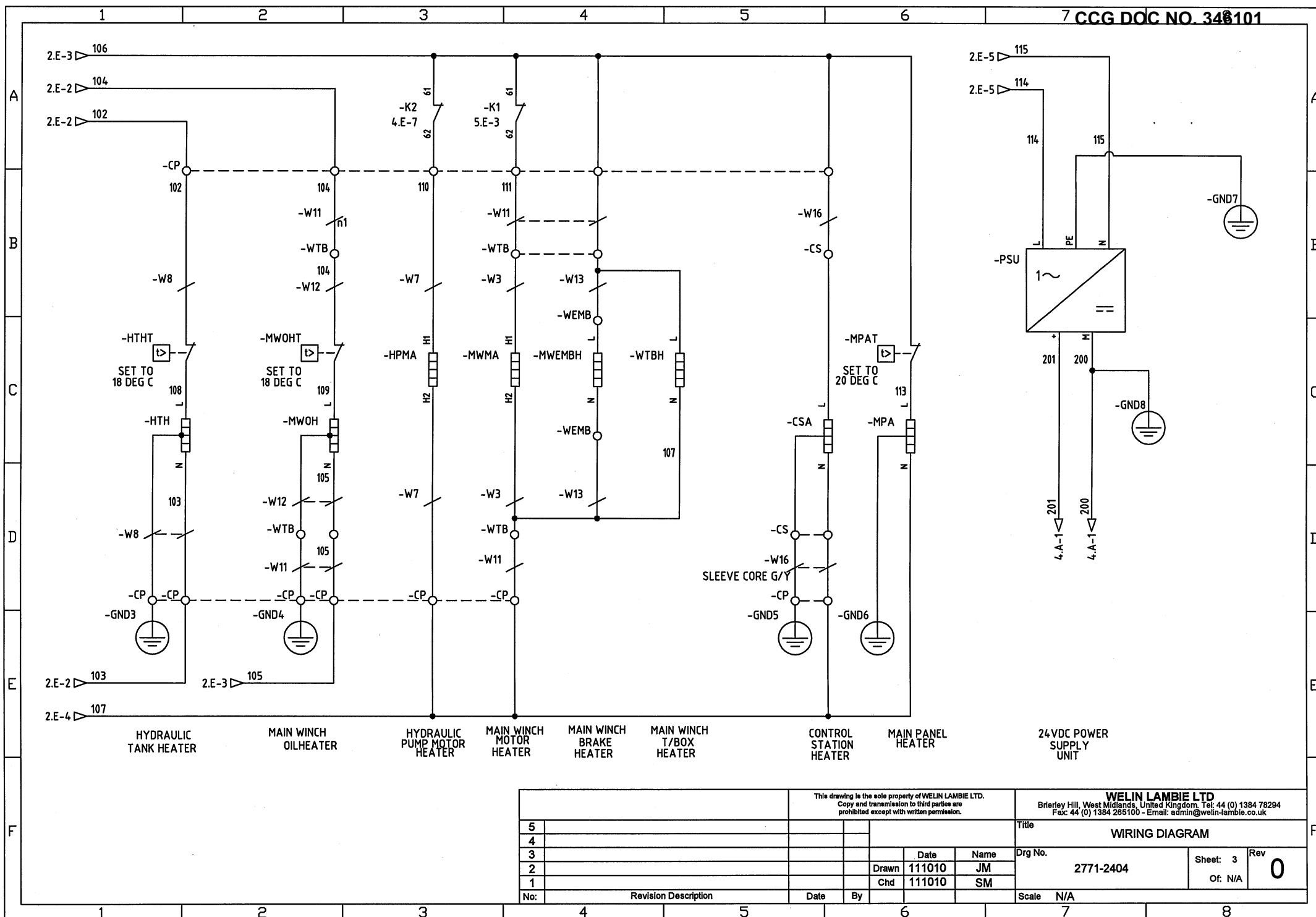
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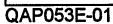
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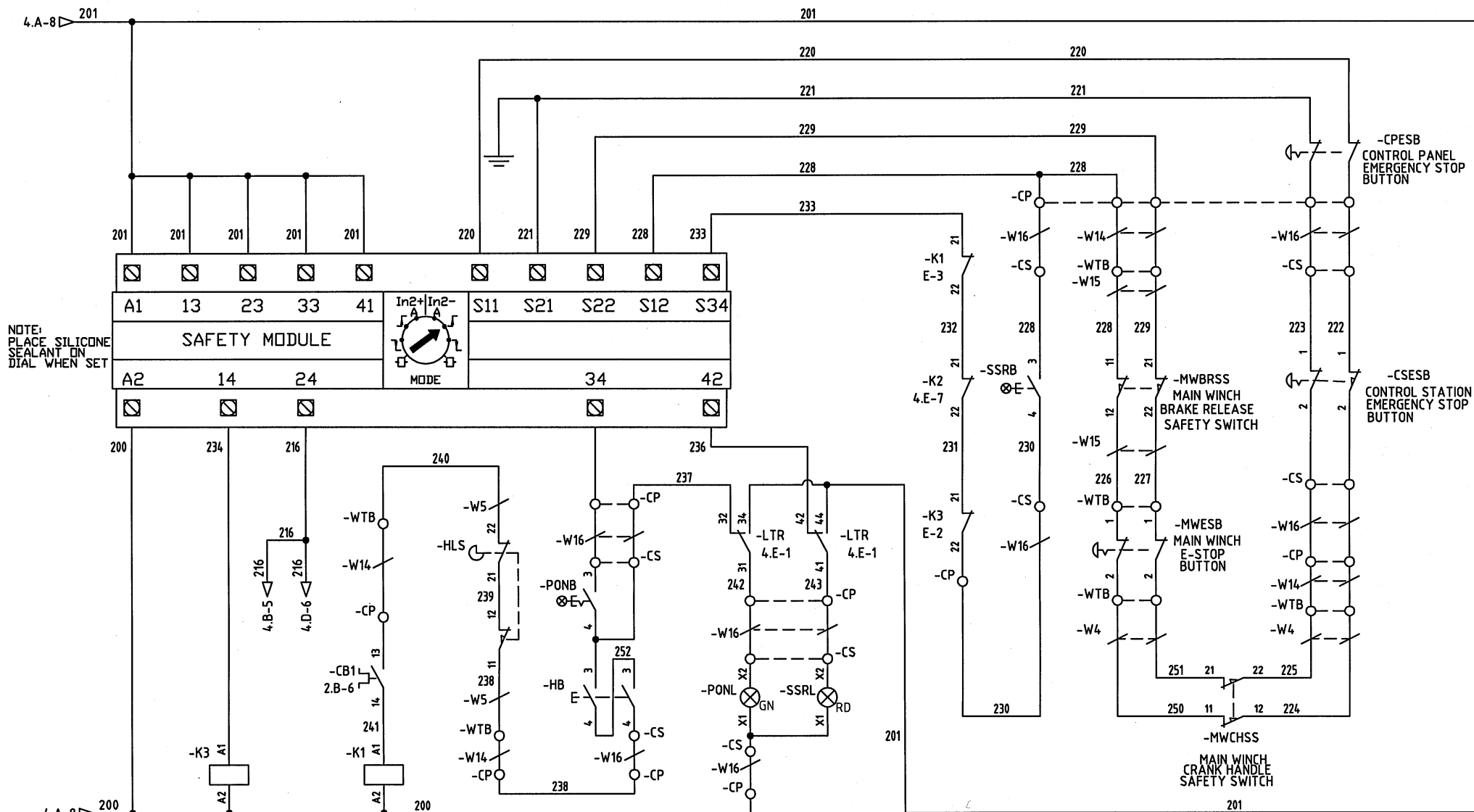


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5				Title <b>WIRING DIAGRAM</b>			
4				Drg No. <b>2771-2404</b>			
3				Drawn	111010	JM	Sheet: 2
2				Chd	111010	SM	Of: N/A
1	MWM TERMINALS U1-W1 SWAPPED OVER		280111	JM			Rev <b>1</b>
No:	Revision Description		Date	By		Scale	N/A



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5				Title <b>WIRING DIAGRAM</b>			
4				Drg No. <b>2771-2404</b>			
3				Drawn	111010	JM	Sheet: 3
2				Chd	111010	SM	Of: N/A
1				Scale N/A			
No:	Revision Description		Date	By	Rev <b>0</b>		





NOTE:  
PLACE SILICONE  
SEALANT ON  
DIAL WHEN SET

MAINS ESTOP  
CONTACTOR  
1 - 2A-3  
3 - 4A-3  
5 - 6B-3  
21 - 22D-6

MAIN WINCH  
MOTOR  
CONTACTOR  
1 - 2C-6  
3 - 4C-6  
5 - 6C-6  
21 - 22B-6  
61 - 62A-4

POWER ON  
LAMP

SAFETY SYSTEM  
TRIPPED LAMP

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5								Title WIRNG DIAGRAM			
4								Drg No. 2771-2404			
3					Date	Name		Sheet: 5		Rev	
2				Drawn	111010	JM		Of: N/A		1	
1	K1 K2 K3 N/C WAS 11-12 . ADDED HB CONTACT			280111	JM	Chd	111010	SM			
No:	Revision Description			Date	By			Scale	N/A		

## COMPONENT IDENTIFICATION, WIRE AND CABLE NUMBERS AND CROSS REFERENCES

## SHEET ISOLATORS

2-A1 Q1 - MAIN PANEL ISOLATOR  
2-C1 Q2 - AUXILIARY PANEL ISOLATOR

## CIRCUIT BREAKERS &amp; OVERLOADS

2-B5 CB1 - MAIN WINCH MOTOR SUPPLY CIRCUIT BREAKER  
2-B6 CB2 - HYDRAULIC PUMP MOTOR SUPPLY CIRCUIT BREAKER  
2-D3 CB3 - HYDRAULIC OIL HEATER SUPPLY CIRCUIT BREAKER  
2-D4 CB4 - MAIN WINCH OIL HEATER SUPPLY CIRCUIT BREAKER  
CB5 - DAVIT HEATERS SUPPLY CIRCUIT BREAKER  
CB6 - PSU SUPPLY CIRCUIT BREAKER

## CONTACTORS

5-E4 K1 - MAIN WINCH MOTOR CONTACTOR  
4-E7 K2 - HYDRAULIC MOTOR CONTACTOR  
5-E1 K3 - MAINS EMERGENCY STOP CONTACTOR

## RELAYS

4-E1 LTR - LAMP TEST RELAY

## HEATERS &amp; THERMOSTATS

3-C1 HTH - HYDRAULIC TANK HEATER  
3-C1 HTHT - HYDRAULIC TANK HEATER THERMOSTAT  
3-C3 HPMA - HYDRAULIC PUMP MOTOR HEATER  
3-C4 MWMA - MAIN WINCH MOTOR HEATER  
3-C6 MPA - MAIN PANEL ANTI CONDENSATION HEATER  
3-C6 MPAT - MAIN PANEL ANTI CONDENSATION HEATER THERMOSTAT  
3-C1 WOH - WINCH OIL HEATER  
3-C1 WOHT - WINCH OIL HEATER THERMOSTAT  
3-C4 WEMBH - WINCH E/M BRAKE HEATER  
3-C5 WTBH - WINCH TERMINAL BOX HEATER  
3-C5 CSA - CONTROL STATION ANTI CONDENSATION HEATER

## PUSHBUTTONS &amp; PILOT LAMPS

5-C6 SSRB - SAFETY SYSTEM RESET PUSH-BUTTON  
5-D4 PONB - POWER ON PUSH BUTTON  
5-E4 HB - MAIN WINCH HOIST PUSH BUTTON  
5-A7 CPESB - CONTROL PANEL EMERGENCY STOP PUSH BUTTON  
5-C7 CSES - CONTROL STATION EMERGENCY STOP PUSH BUTTON  
5-D7 MWESB - MAIN WINCH EMERGENCY STOP PUSH BUTTON  
5-B4 PDI - FAILED TO CHARGE RESET PUSH BUTTON  
5-E5 PONI - POWER ON LAMP  
5-E5 SSRL - SAFETY SYSTEM TRIPPED LAMP  
4-E2 PIL1 - SYSTEM ON PILOT LAMP  
4-E4 PIL2 - OIL LEVEL TO LOW PILOT LAMP  
4-E5 PIL3 - FAILED TO CHARGE PILOT LAMP  
4-E6 PIL4 - UNABLE TO CHARGE PILOT LAMP  
5-D4 LTPB - LAMP TEST PUSH BUTTON

## SWITCHES

5-D3 HLS - HOIST LIMIT SWITCH  
5-E7 CHSS - MAIN WINCH CRANK HANDLE SAFETY SWITCH  
5-C7 BRSS - MAIN WINCH BRAKE RELEASE HANDLE SAFETY SWITCH  
4-B4 HFLS - HYDRAULIC FLUID LEVEL SWITCH (SHOWN EMPTY)  
4-B6 PTS1 - HYDRAULIC PRESSURE TRANSDUCER

## MOTORS

2-E5 MWM - MAIN WINCH MOTOR  
2-E6 HPM - HYDRAULIC PUMP MOTOR

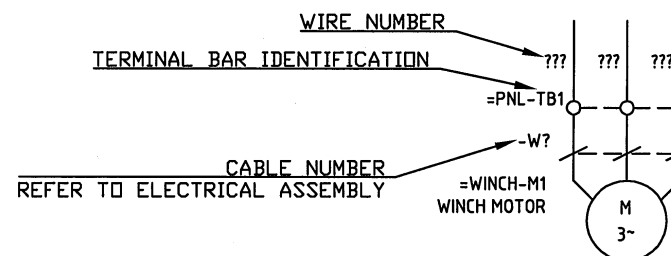
## CONTROLLERS &amp; POWER SUPPLIES

3-B7 PSU - 24VDC POWER SUPPLY UNIT  
4-C6 ZELIO - PROGRAMMABLE CONTROLLER  
5-B2 SAFETY MODULE - EMERGENCY STOP SAFETY MODULE

COMPONENT TERMINAL CONNECTION  
COMPONENT IDENTIFICATION

## COMPONENT DESCRIPTION

CROSS REFERENCE  
IN THIS EXAMPLE:  
6=SHEET NUMBER  
4-D=DRAWING CO-ORDINATES



## SIGNAL SOURCE AND DESTINATION REFERENCES

SOURCE REFERENCE

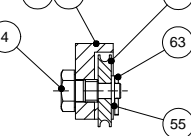
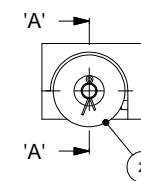
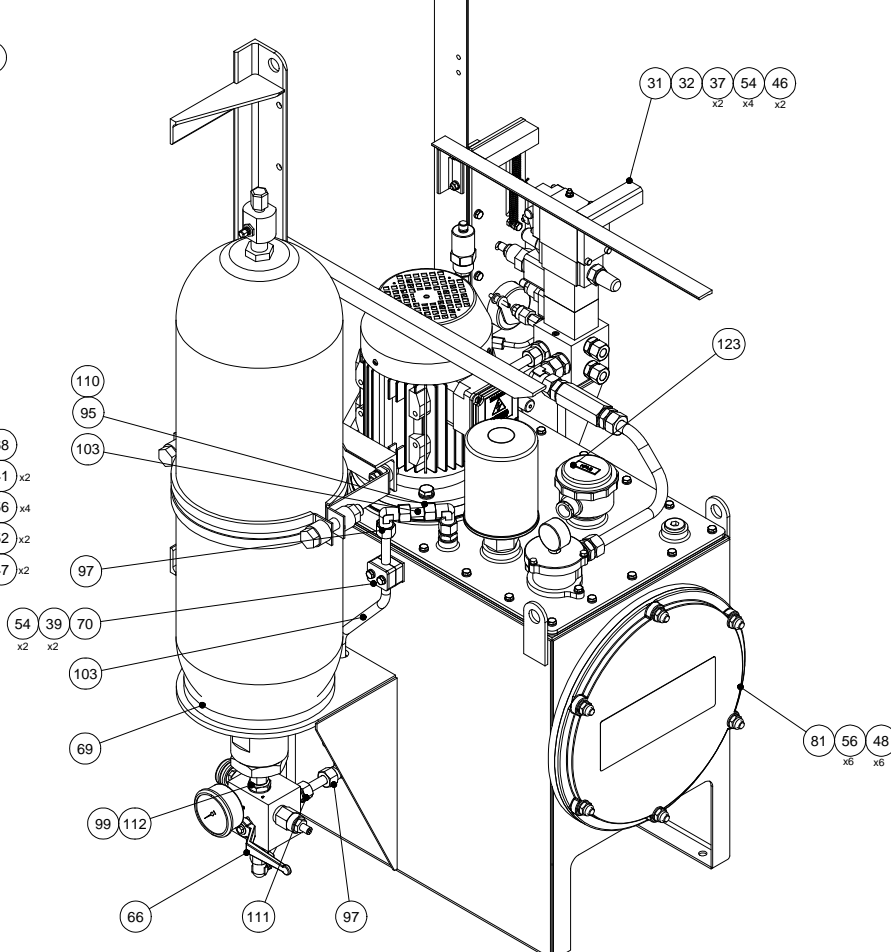
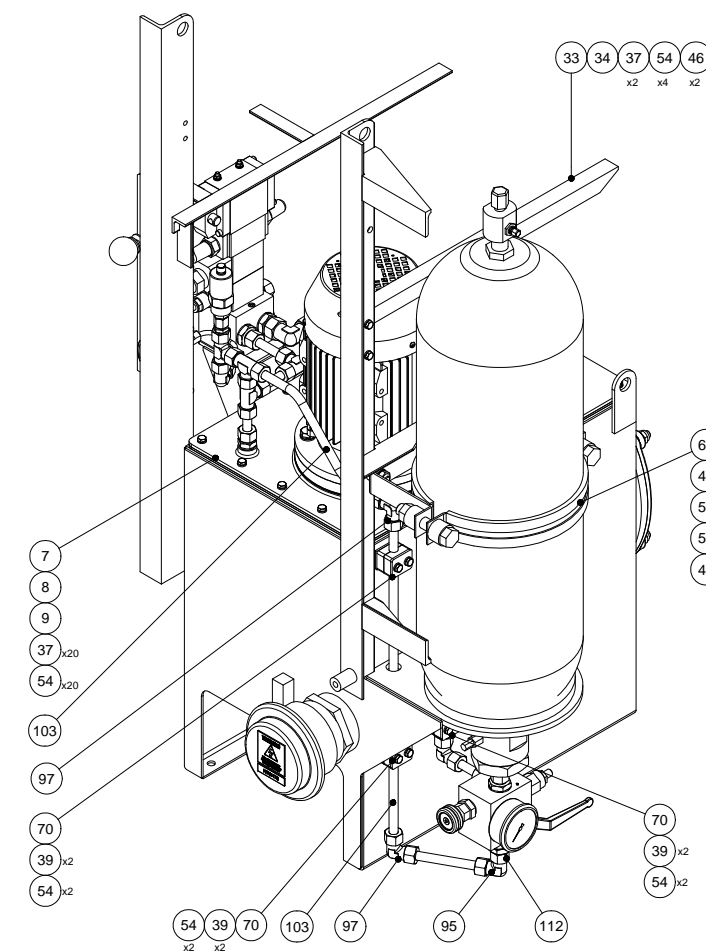
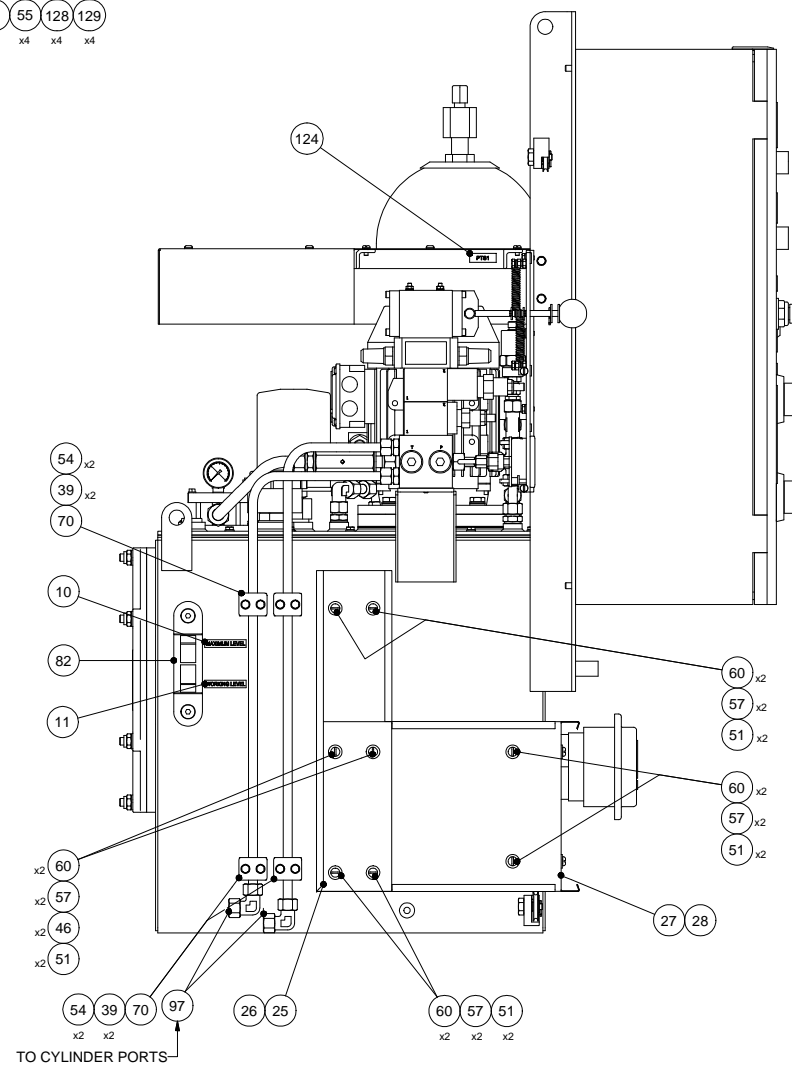
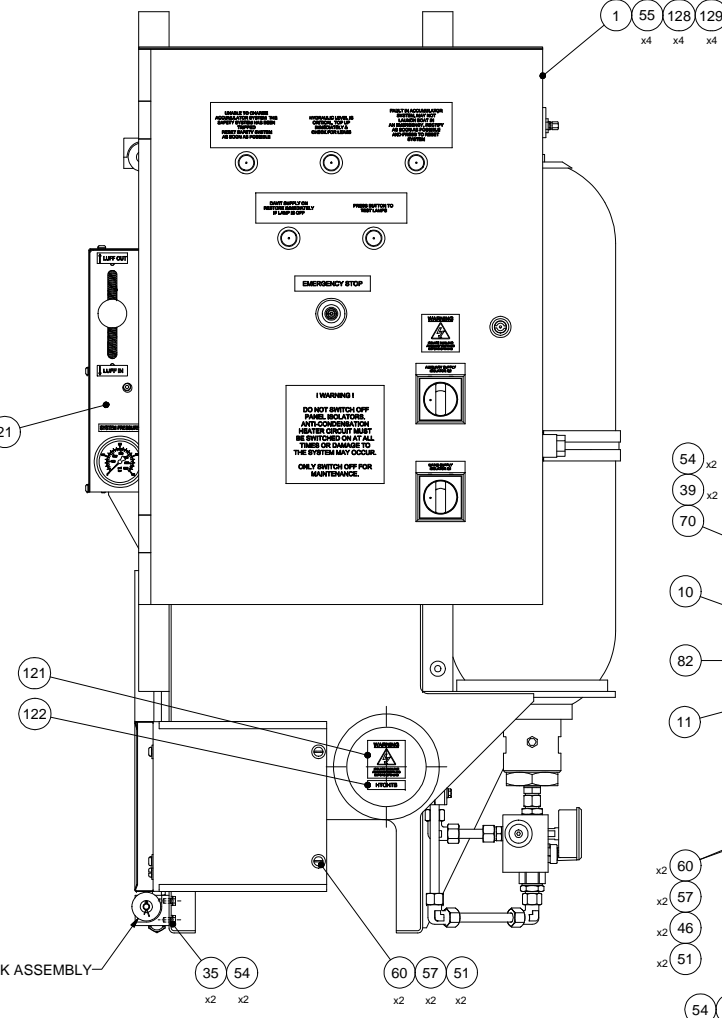
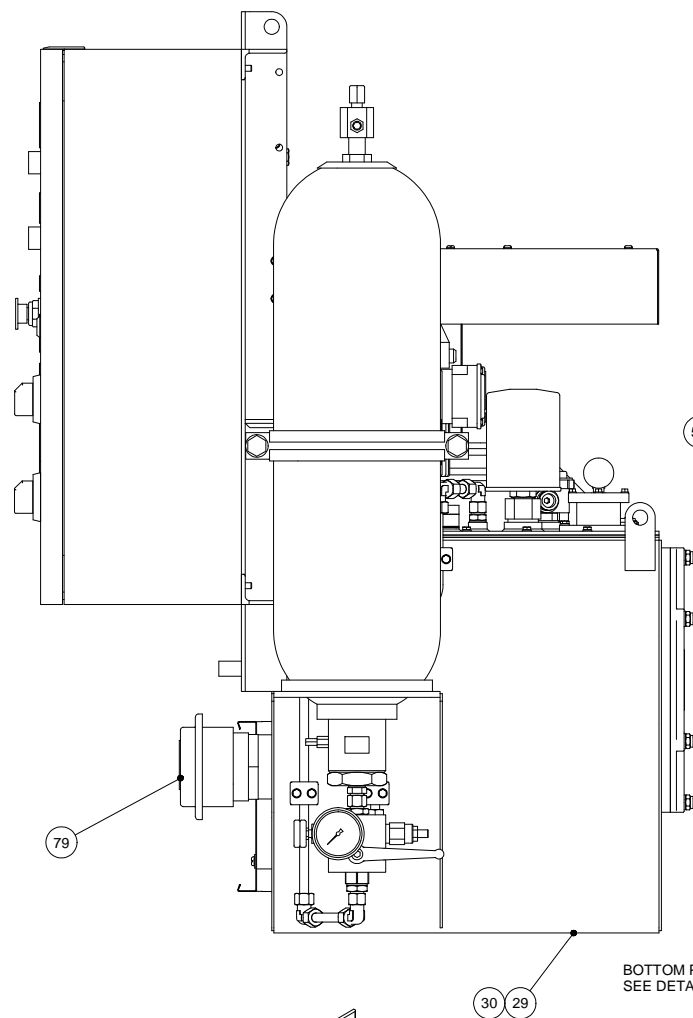
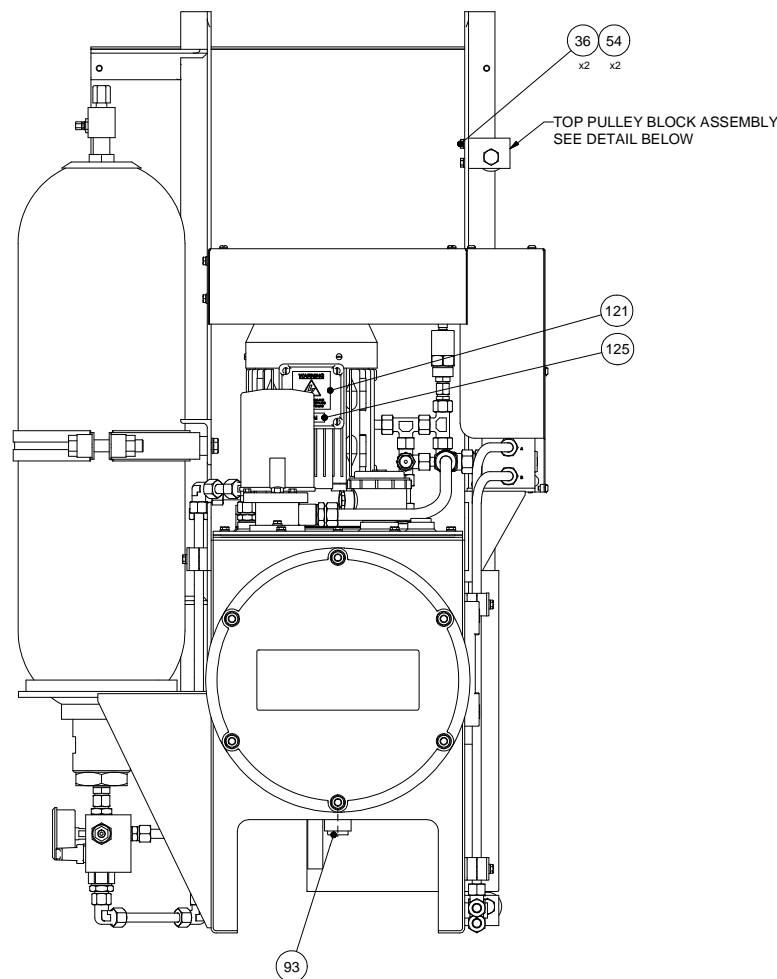
DESTINATION REFERENCE

CROSS REFERENCE  
IN THIS EXAMPLE:  
4=SHEET NUMBER  
A-1=DRAWING CO-ORDINATES

## TYPICAL CABLE SIZES UNLESS STATED

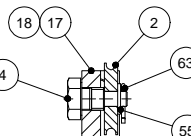
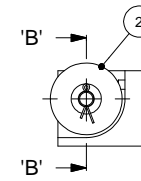
2.5mm RED - CABLES WITH WIRE MARKERS 600-699 (400VAC CIRCUIT & ABOVE)  
1.0mm VIOLET - CABLES WITH WIRE MARKERS 200-399 (24VDC CIRCUIT)  
1.5mm YELLOW - CABLES WITH WIRE MARKERS 0-100 (110VAC CIRCUIT)

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5								Title WIRING DIAGRAM			
4								Drg No. 2771-2404			
3					Date	Name			Sheet: 6	Rev	
2				Drawn	111010	JM			Of: N/A	0	
1				Chd	111010	SM					
No:	Revision Description			Date	By		Scale		N/A		



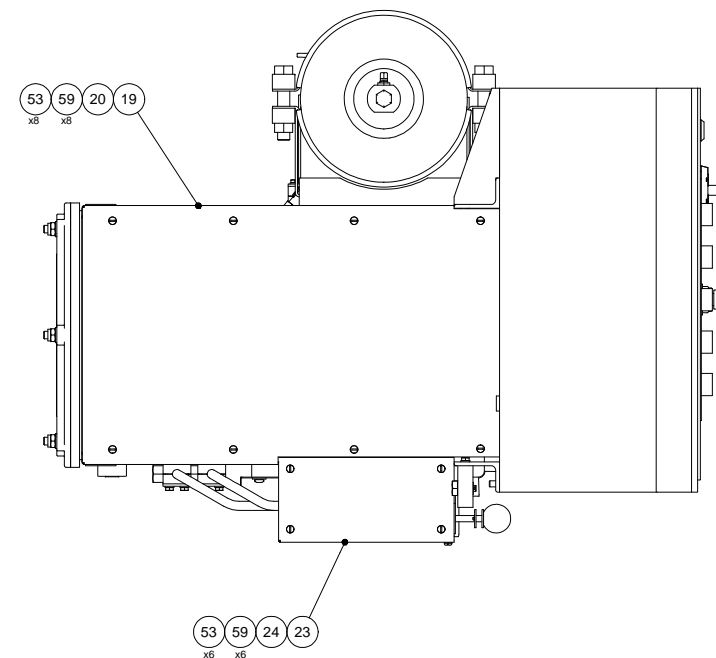
SECTION 'A'-A'

TOP PULLEY BLOCK ASSEMBLY (1:2)



SECTION 'B'-B'

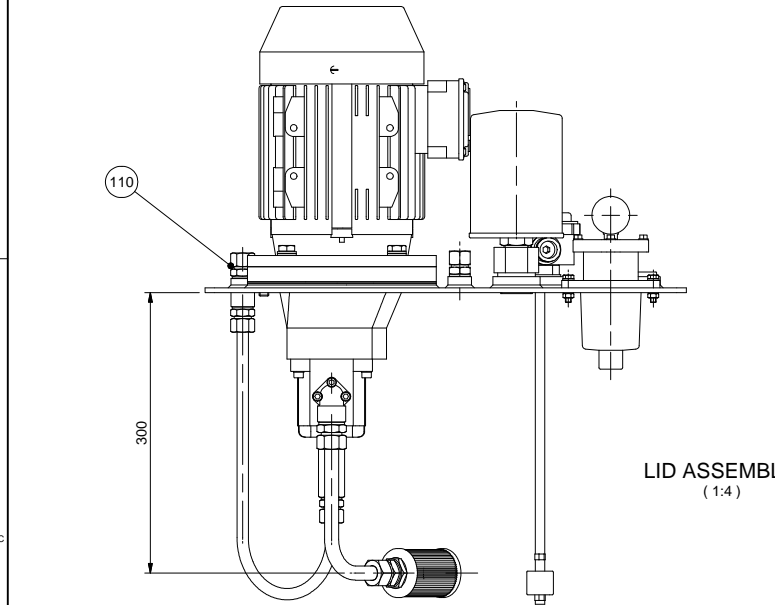
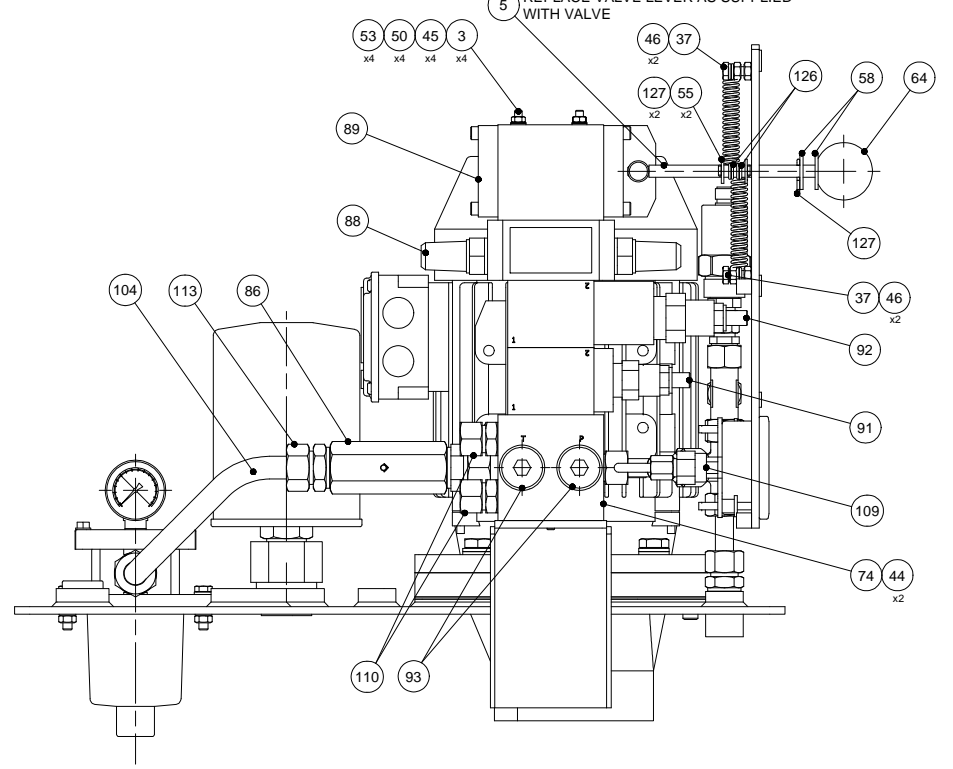
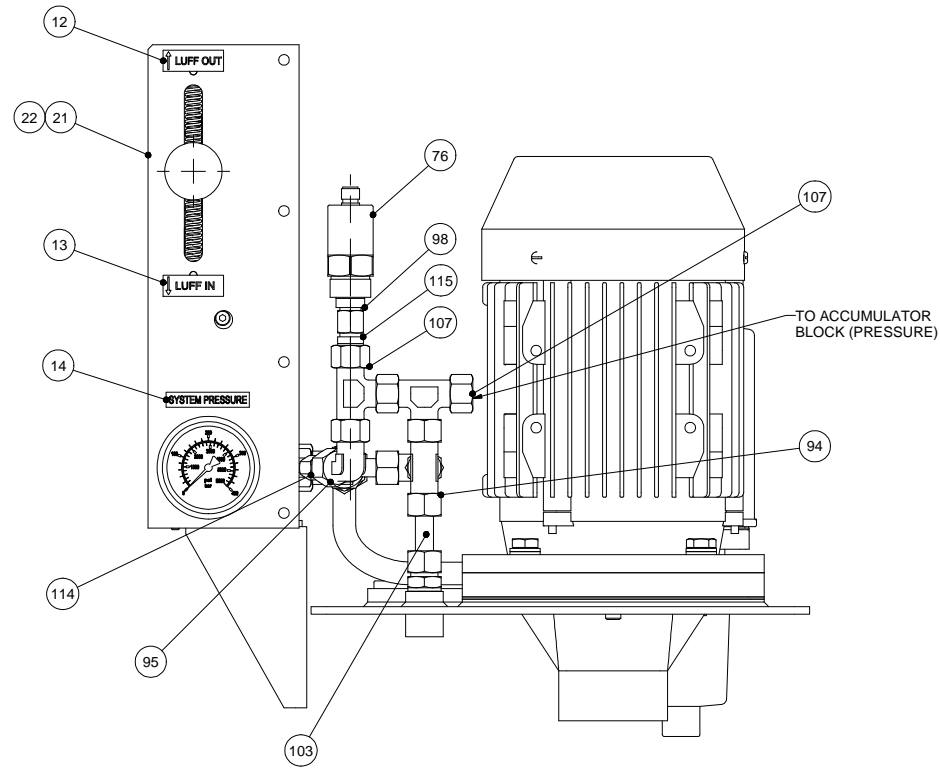
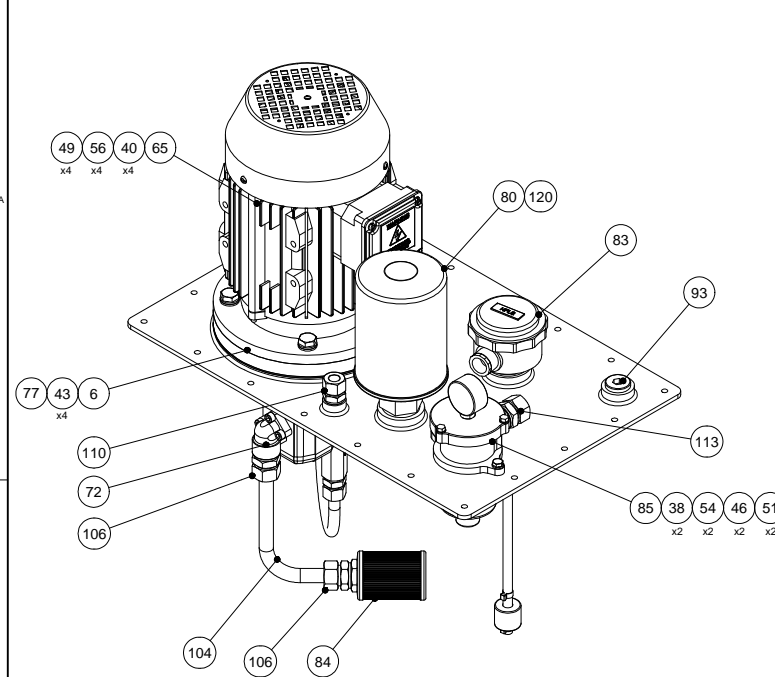
BOTTOM PULLEY BLOCK ASSEMBLY (1:2)



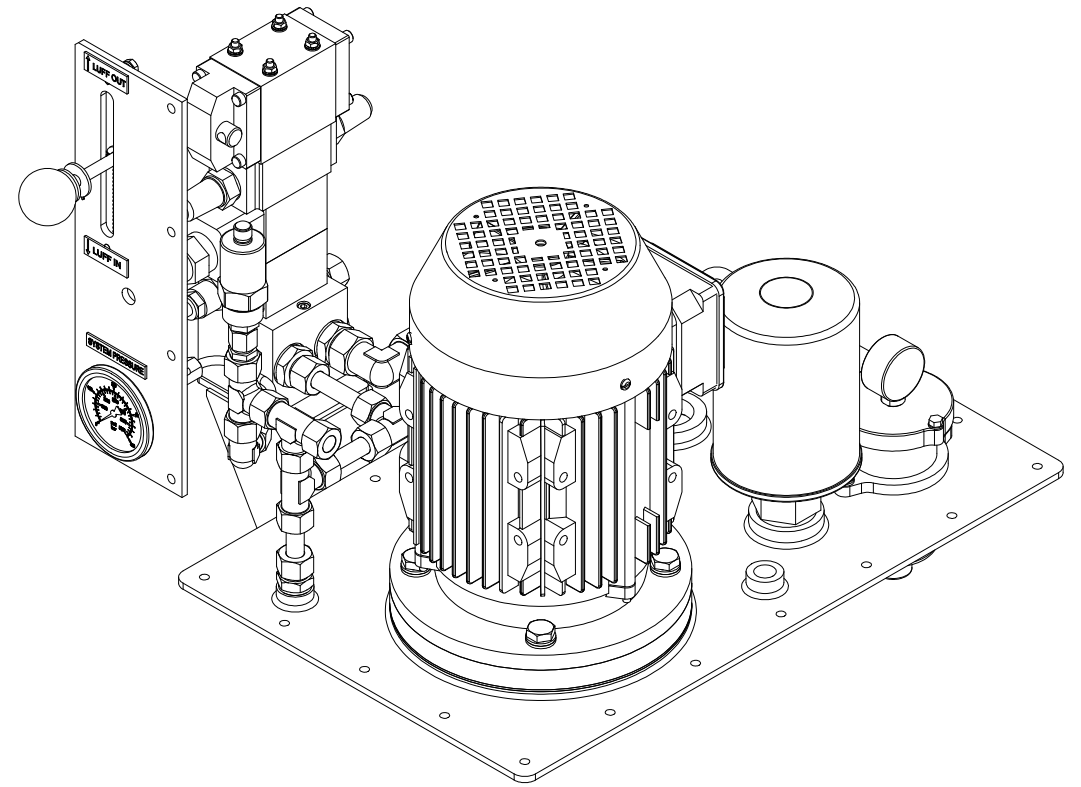
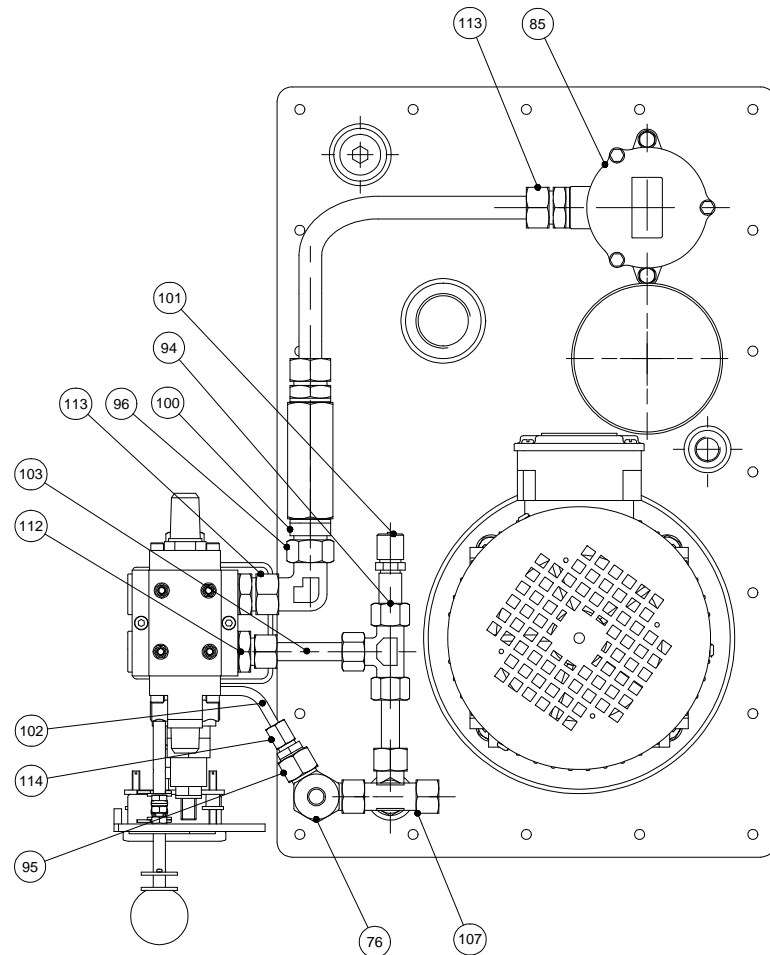
ALSO REFER TO HYDRAULIC CIRCUIT DIAGRAM DRG No.5725-3301

3	TURNING HANDLE HOLDER REMOVED	PF	090211	DW
2	SPRINGS ADDED TO VALVE LEVER	PF	040211	DW
1	LABELS ADDED	PF	140111	DW
Rev	Description	Dm	Date	Chd

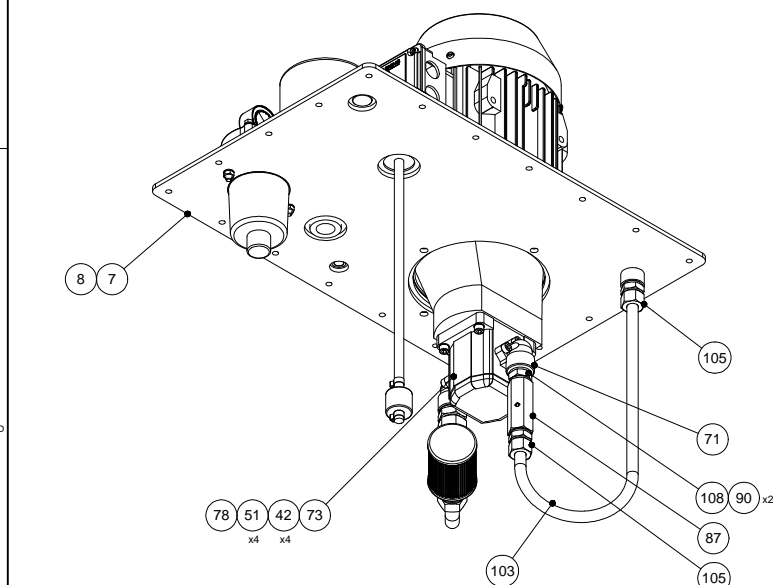
General Notes				WELIN LAMBIE LTD Brierley Hill, West Midlands, United Kingdom. Tel: 44 (0) 1384 76294 Fax: 44 (0) 1384 265100 - Email: admin@welin-lambie.co.uk				This drawing is the sole property of WELIN LAMBIE LTD. Copy and transmission to third parties are prohibited except with written permission.	
ALL DIMENSIONS IN mm				Drawing Title				Drawing Number	
REMOVE ALL SHARP CORNERS				HYDRAULIC POWER PACK ASSEMBLY				As Dim 5723-3401	
Drawn Scale Date Checked				MACHINING				Opp As Dim	
PDF 1:5 181110 TL				FABRICATION				Sheet 1 of 2	
								3	



LID ASSEMBLY  
(1:4)



VALVE & PIPEWORK ASSEMBLY  
(1:2,5)



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ALL DIMENSIONS IN mm				GENERAL DIMENSIONAL TOLERANCES: UNLESS OTHERWISE STATED.				Drawing Title	
REMOVE ALL SHARP CORNERS				OPERY RANGE				Drawing Number	
Drawn				MACHINING				As Dim	
Scale				FABRICATION				Opp As Dim	
PDF				VARIES				Sheet 2 of 2	
Date				Checked				Rev	
181110				TL				3	



PARTS LIST				Sheet
Title HYDRAULIC POWER PACK ASSEMBLY Drg No. 5723-3401				1 of 3
Item No.	Part No.	Description	No. Off / Set	
1	2781-5301	CONTROL PANEL ASSEMBLY	1	
2	5010-3311	PULLEY	2	
3	5124-7311	VALVE STUD	4	
4	5140-2211	PIVOT PIN	2	
5	5146-4811	VALVE LEVER	1	
6	5293-2911	BELL HOUSING GASKET	1	
7	5406-6131	RESERVOIR LID	1	
8	5406-6231	RESERVOIR LID		
9	5406-6311	RESERVOIR LID GASKET	1	
10	5442-2811-A	LABEL (MAX LEVEL)	1	
11	5442-2811-C	LABEL (WORKING LEVEL)	1	
12	5442-2811-F	LABEL (LUFF OUT)	1	
13	5442-2811-G	LABEL (LUFF IN)	1	
14	5442-2811-H	LABEL (SYSTEM PRESS)	1	
15	5442-4711	PULLEY MOUNTING PLATE	1	
16	5442-4811	PULLEY MOUNTING PLATE		
17	5442-4911	PULLEY MOUNTING PLATE	1	
18	5442-5011	PULLEY MOUNTING PLATE		
19	5442-5521	COVER	1	
20	5442-5621	COVER		
21	5442-5731	GAUGE PLATE	1	
22	5442-5831	GAUGE PLATE		
23	5697-5121	VALVE COVER	1	
24	5697-5221	VALVE COVER		
25	5699-2711-1	CABLE TRAY	1	
26	5699-2811-1	CABLE TRAY		
27	5699-2911-1	CABLE TRAY	1	
28	5699-3011-1	CABLE TRAY		
29	5723-3431	HYDRAULIC RESERVOIR	1	
30	5723-3531	HYDRAULIC RESERVOIR		
31	5801-8521	COVER BRACKET	1	
32	5801-8621	COVER BRACKET		
33	5801-8721	COVER BRACKET	1	
34	5801-8821	COVER BRACKET		
35	609-06012	HEX HD SETSCREW	6	
36	609-06016	HEX HD SETSCREW	2	
37	609-06020	HEX HD SETSCREW	26	
38	609-06025	HEX HD SETSCREW	2	
39	609-06030	HEX HD SETSCREW	16	
40	609-10025	HEX HD SETSCREW	4	
41	609-10035	HEX HD SETSCREW	2	
42	617-02006	HEX SKT HD CAPSCREW	4	
43	617-02010	HEX SKT HD CAPSCREW	4	
44	617-07005	HEX SKT HD CAPSCREW	2	
45	629-00005	HEX NUT	4	
46	629-00006	HEX NUT	12	
47	629-00010	HEX NUT	2	
48	629-00110	NYLOC NUT	6	
49	647-00310	PLAIN WASHER	4	
50	647-00705	SHAKEPROOF WASHER	4	

PARTS LIST				Sheet
Title HYDRAULIC POWER PACK ASSEMBLY Drg No. 5723-3401				2 of 3
Item No.	Part No.	Description	No. Off / Set	
51	647-00706	SHAKEPROOF WASHER	16	
52	647-00710	SHAKEPROOF WASHER	2	
53	647-00805	PLAIN WASHER	18	
54	647-00806	PLAIN WASHER	54	
55	647-00808	PLAIN WASHER	8	
56	647-00810	PLAIN WASHER	14	
57	647-00906	PLAIN WASHER (LARGE DIA)	10	
58	647-00908	PLAIN WASHER (LARGE DIA)	2	
59	649-05010	SLOTTED PAN HD SCREW	14	
60	649-06010	SLOTTED PAN HD SCREW	10	
61				
62				
63	679-36014	SPLIT COTTER PIN	2	
64	830-00165	PLASTIC BALL KNOB	1	
65	860-01076	ELECTRIC MOTOR	1	
66	885-02017	SAFETY BLOCK	1	
67	885-02074	BLADDER ACCUMULATOR	1	
68	891-00456	ACCUMULATOR CLAMP KIT	1	
69	891-00460	CUSHION RING	1	
70	891-02012	PIPECLAMP c/w ST.ST. COVER PL	8	
71	894-00222	PRESSURE ELBOW	1	
72	894-00223	SUCTION ELBOW	1	
73	894-00224	GEAR PUMP	1	
74	894-00405	MANIFOLD	1	
75	894-00514	PRESSURE GAUGE	1	
76	894-00521	PRESSURE SENSOR	1	
77	894-00713	BELL HOUSING	1	
78	894-00714	COUPLING	1	
79	894-00836	IMMERSION HEATER	1	
80	894-00849	AIR BREATHER	1	
81	894-00852	TANK CLEANING COVER	1	
82	894-00853	LEVEL GAUGE	1	
83	894-00854	FLOAT LEVEL SWITCH	1	
84	894-00938	SUCTION ELEMENT	1	
85	894-00939	RETURN FILTER	1	
86	894-01002	IN-LINE THROTTLE CHECK VALVE	1	
87	894-01003	IN-LINE THROTTLE CHECK VALVE	1	
88	894-01020	THROTTLE CHECK MODULE	1	
89	894-01201	DIRECTIONAL CONTROL VALVE	1	
90	894-01702	BONDED WASHER	2	
91	894-02002	RELIEF VALVE	1	
92	894-02003	PRESSURE COMP'D F.C.V	1	
93	894-10312	PLUG c/w CAPTIVE SEAL	4	
94	894-10742	EQUAL TEE (EO): LIGHT	2	
95	894-11064	SWIVEL NUT ELBOW (EO):LIGHT	3	
96	894-11065	SWIVEL NUT ELBOW (EO):LIGHT	1	
97	894-11123	EQUAL ELBOW (EO):LIGHT	6	
98	894-11232	STUD ADAPTOR (EO): L	1	
99	894-11234	STUD ADAPTOR (EO): L	1	
100	894-11235	STUD ADAPTOR (EO): L	1	

PARTS LIST				Sheet
Title HYDRAULIC POWER PACK ASSEMBLY Drg No. 5723-3401				3 of 3
Item No.	Part No.	Description	No. Off / Set	
101	894-11912	ST/ST TEST POINT	1	
102	894-12027	TUBE	0.2	
103	894-12034	TUBE	3.5	
104	894-12038	TUBE	0.5	
105	894-12113	MALE STUD COUPING (EO): LIGHT	2	
106	894-12117	MALE STUD COUPING (EO): LIGHT	2	
107	894-12264	SWIVEL NUT BRANCH TEE (EO) - L	2	
108	894-12305	MALE-MALE ADAPTOR	1	
109	894-12413	GAUGE ADAPTOR (DIN)	1	
110	894-12613	MALE STUD COUPING (EO): LIGHT	4	
111	894-12614	MALE STUD COUPING (EO): LIGHT	1	
112	894-12615	MALE STUD COUPING (EO): LIGHT	3	
113	894-12617	MALE STUD COUPING (EO): LIGHT	3	
114	894-13004	TUBE END REDUCER (EO-2) L	1	
115	894-13005	TUBE END REDUCER (EO-2) L	1	
116				
117				
118				
119				
120	894-11363	MALE - FEMALE ADAPTOR	1	
121	5435-3811/F	LABEL - WARNING (ISOLATE MAIN...)	2	
122	5435-3811/Q	LABEL - HTOHTB	1	
123	5435-3811/T	LABEL - HFLS	1	
124	5435-3811/U	LABEL - PTS1	1	
125	5435-3811/W	LABEL - HPM	1	
126	5702-0011	TENSION SPRING	2	
127	679-36016	SPLIT COTTER PIN	3	
128	617-02008	HEX SKT HD CAPSCREW	4	
129	645-00108	SPRING WASHER (SQUARE ENDS)	4	
130				
131				
132				
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LTD. BRIERLEY HILL, OS, UNITED KINGDOM. Email : <a href="mailto:ADMIN@WELIN-LAMBIE.CO.UK">ADMIN@WELIN-LAMBIE.CO.UK</a> Web Site : <a href="http://WWW.WELIN-LAMBIE.CO.UK">WWW.WELIN-LAMBIE.CO.UK</a> .	This drawing is the sole property of WELIN LAMBIE LTD. Copy and transmission to third parties are prohibited except with written permission.	
AM	Drg No  5725-3301	Rev  0

## 8.0 INSTALLATION

The davit is fully assembled mechanically, cabled electrically and fully load and function tested before leaving the factory. The davit is despatched with the main structure fully assembled, together with the hydraulic power pack, control station, luff cylinder and fittings, deck mounting brackets and various ancillary equipment, including boat gripes. All items are recorded on the delivery check list.

The purpose of this chapter is to give sufficient information to enable the davit to be reassembled and installed ready for operation.

Please be familiar with the following drawings before proceeding with the davit installation:

- 5683-4301 General Arrangement
- 5683-4302 Deck Interface
- 5683-4304 Hydraulic and Electrical Interface
- 5601-1902 Davit Installation Assembly
- 2762-1301 Electrical Assembly
- 2781-5101 Control Station Assembly
- 2781-5301 Control Panel Assembly
- 2771-2404 Wiring Diagram

Installation should be carried out by qualified Welin Lambie engineers or personnel working under their supervision.

Commissioning must be carried out by Welin Lambie engineers.

## 8.1 STORAGE

**\* IMPORTANT \***

**ON DELIVERY, THE EQUIPMENT MUST BE STORED INSIDE  
A DRY ENVIRONMENT TO PREVENT DAMAGE TO  
ELECTRICAL EQUIPMENT DUE TO CONDENSATION.**

**NOTE:** If the equipment cannot be stored in a dry environment consult Welin Lambie.

**8.2 DELIVERY CHECK LIST**

Item	Description	Welin Lambie Part No.	Approx Weight (kg)	Qty	<input checked="" type="checkbox"/>
01	Pulley	5010-3311		2	
02	Cylinder Pin	5144-9411	1.8 (each)	2	
03	Arm Pivot Pin	5144-9611	2.1 (each)	2	
04	Collar	5222-2211		2	
05	Arm Pivot Bush	5236-0111		4	
06	Cylinder Pin Bush	5236-0211		2	
07	Rope Guide Tube	5331-3311		1	
08	Keep Plate	5400-9111		2	
09	Keep Plate	5442-4311		2	
10	Arm Rest Pad	5442-4411	0.5 (each)	2	
11	Pulley Mounting Plate	5442-6621		1	
12	Cover Plate	5442-6711		2	
13	Cylinder Hose Plate	5442-6911	0.5	1	
14	Davit Assembly	5601-1901	417.0	1	
15	Cable Tray	5699-3111-2	4.5	1	
16	No Item				
17	Cable Tray	5699-3111-4	4.5	1	
18	No Item				
19	Cable Tray	5699-3111-6	4.5	1	
20	No Item				
21	Cable Tray	5699-3711-5	3.5	1	
22	Turning Handle	5711-0421	5.0	1	
23	Hydraulic Power Pack	5723-3401	198.0	1	
24	Pressure Hose Assembly	5726-6901	0.6	1	
25	Pressure Hose Assembly	5726-7001	0.8	1	
26	Deck Stool	5801-8231	2.7 (each)	2	
27	Arm Pivot Bracket - Aft	5801-9631	3.3	1	
28	No Item				
29	Arm Pivot Bracket - Fwd	5801-9831	3.5	1	
30	No Item				
31	Cylinder Deck Bracket	5802-0431	1.9	1	
32	Control Station	5802-0701	11.7	1	
33	Cylinder Connection Tube	5331-3411	1.1	1	

Item	Description	Welin Lambie Part No.	Approx Weight (kg)	Qty	<input checked="" type="checkbox"/>
34	Cylinder Connection Tube	5331-3511	1.1	1	
35	Gripe Webbing Tensioner	5766-2611	1.9 (each)	2	
36	Gripe Webbing Sling	5766-2711	1.1 (each)	2	
37	Cable Tray	5699-3311-2	1.1	1	
38	No Item				
39	Washer	5245-0911		4	
	Ancillary Equipment Box containing:			1	
40	Hex Hd Setscrew M5 x 20 LG	609-05020		4	
41	Hex Hd Setscrew M6 x 20 LG	609-06020		2	
42	Hex Hd Setscrew M6 x 40 LG	609-06040		20	
43	Hex Hd Setscrew M10 x 20 LG	609-10020		4	
44	Hex Hd Setscrew M10 x 25 LG	609-10025		12	
45	Hex Hd Setscrew M10 x 30 LG	609-10030		8	
46	Hex Skt Hd Capscrew M5 x 45 LG	617-04505		8	
47	Hex Nut M6	629-00006		20	
48	Notch Nut M45 x 1.5P	639-00045		2	
49	Lock Washer	640-00045		2	
50	Plain Washer M6 - Nylon	647-00306		2	
51	Plain Washer M10 - Nylon	647-00310		20	
52	Shakeproof Washer M6	647-00706		48	
53	Plain Washer M6 – Stainless Steel	647-00806		2	
54	Plain Washer M10 – Stainless Steel	647-00810		30	
55	Plain Washer (Large Dia.) M6	647-00906		48	
56	Slotted Pan Hd Screw M6 x 16 LG	649-06016		28	
57	Wire Rope Grip	800-00503		4	
58	Ordinary Thimble	800-00603		2	
59	Shackle	800-00922		2	
60	Luff Control Rope	800-03022	0.5	1	
61	Brake Control Rope	800-03023	0.7	1	
62	Spacer	5421-1811		1	
63	No Item				
64	No Item				
65	Hydraulic Cylinder	885-01006	46.0	1	
66	Grease Nipple	889-01002		2	
67	Female Adaptor	890-55403		1	
68	Pipe Clamp (c/w Cover Plate)	891-02012		10	

Item	Description	Welin Lambie Part No.	Approx Weight (kg)	Qty	<input checked="" type="checkbox"/>
69	Bonded Washer	894-01702		4	
70	Adaptor (M/M)	894-12328		3	
71	Bulkhead Elbow	894-12564		2	
72	Chain (Long Link)	800-04000	0.7	1	
73	Nyloc Nut M10	629-00110		4	
74	Rope Guide Tube	5331-3611		1	
75	No Item				
76	Counter Weight	5041-4011		2	
77	Hex Hd Setscrew M10 x 45 LG	609-10045		2	
78	Hex Nut M10	629-00010		2	
79	Shakeproof Washer M10	647-00710		2	
80	Ice Protection Cover – Power Pack	830-00166		1	
81	Ice Protection Cover – Control Station	830-00167		1	
82	Ice protection Cover – Winch Motor	830-00168		1	
83	Instruction Board	5719-8101		1	
84	Release Hook – Operation Instructions and Assembly Tools			1	
	Technical Manual (Paper Copy)			2	
	Technical Manual (CD Version)			1	
	Denso Tape (Roll)	830-01004		1	

**NOTE:** Delivery check list includes approximate weight of single items above 0.5kg.

### Customer supply

- Suitably prepared deck space to position and weld the arm pivot and cylinder pivot brackets, together with the cylinder hose plate and deck stools (all Welin supply).
- Suitably positioned foundations for mounting the hydraulic power pack (Welin supply) and control station (Welin supply).
- Suitably prepared pads on the ship's deck to enable mounting of cable tray (Welin supply) which carry electrical cable, guide tube and control ropes.
- Suitable mains power supply – 600vAC: 3ph: 60Hz, and auxiliary power supply – 110vAC: 1ph: 60Hz to the control panel mounted on the hydraulic power pack.
- Suitable facing on the arm and keel plates to prevent damage to the boat when stowed.
- All lubricants – oil/grease type and grade must be as specified on 'Lubrication Chart' unless specifically agreed otherwise by Welin.
- Suitable dry nitrogen gas (oxygen free) supply for initial charging of the accumulator.



## Interface details

The ship's deck and any foundations should be of sufficient strength to withstand the loads stated on drawing No. 5683-4302: Deck Interface.

The customer should provide support structures, as shown on drawing No. 5683-4304: Hydraulic and Electrical Interface, together with mounting the control station in a suitable position on the ship's deck.

## General Instructions

This chapter is produced in the recommended order of installation for the main davit items. The secondary items can be installed either in the order shown or to suit the availability of labour.

The reference numbers given each item on images and in text corresponds to the delivery check list.

Hoisting equipment should be available for lifting and positioning the davit, and be of sufficient capacity to safely lift components weighing up to 500 kg (1102 lbs).

A number of davit components are delivered packed in boxes or banded to pallets. Care should be exercised when removing banding or protective coverings.

All items supplied for welding to the ship's deck are produced from marine grade aluminium. All welds should be a minimum of 8mm continuous fillet, unless specified otherwise. After welding, remove all scale and weld spatter, and paint using correct specification.

All fasteners (bolts, setscrews, nuts etc;) supplied for assembly of the equipment are grade A4 stainless steel and unless specified can be tightened using a spanner in the normal manner. Any bolts/setscrews requiring a specific tension will be stated separately in the relevant section for that assembly. The torque figures stated assume that the threads are clean and dry, friction coefficient: 0.2, and will induce a theoretical load equal to 75% of the proof load.

## 8.3 DAVIT INSTALLATION

### 8.3.1 Arm Pivot Brackets to Deck

Refer to Deck Interface Drawing No: 5683-4302 and figure 8.1: Arm Pivot Brackets to Deck.

Position the arm pivot bracket – Aft [27] and the arm pivot bracket – Fwd [29] as shown on interface drawing and fully weld to ship's deck.

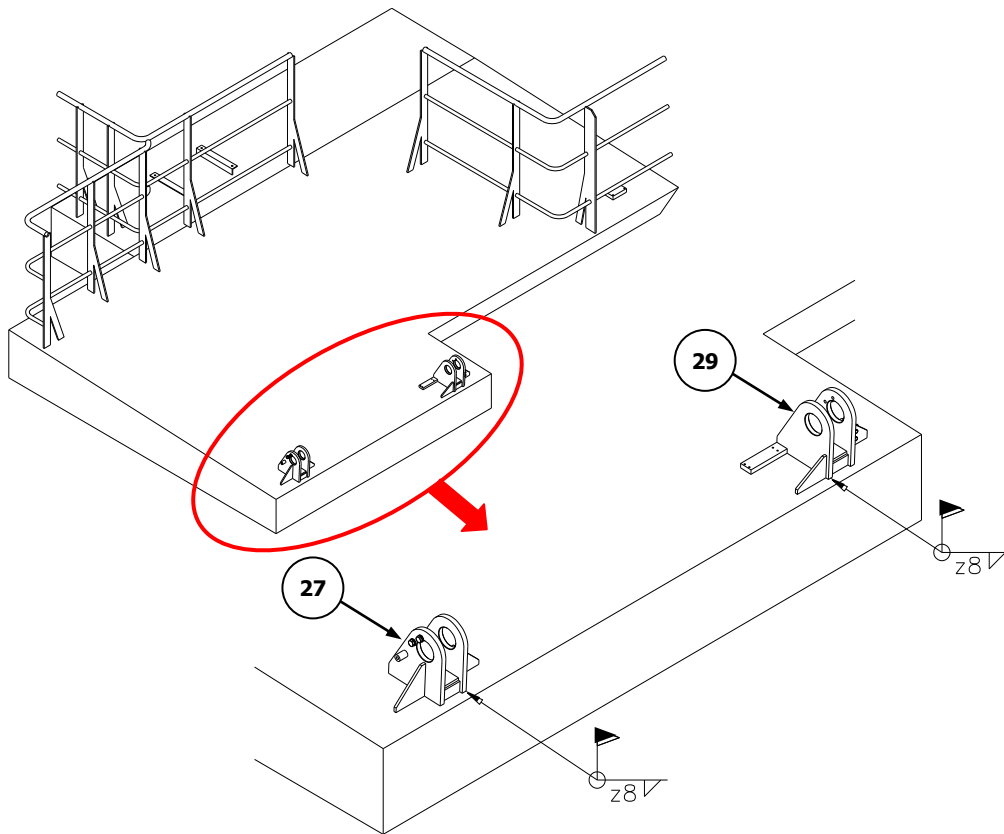


Figure 8.1: Arm Pivot Brackets to Deck

### 8.3.2 Cylinder Bracket and Hose Plate to Deck

Refer to Deck Interface Drawing No: 5683-4302 and figure 8.2: Cylinder Bracket and Hose Plate to Deck.

Position the cylinder deck bracket [31] and the hose plate [13] as shown on interface drawing and fully weld to ship's deck.

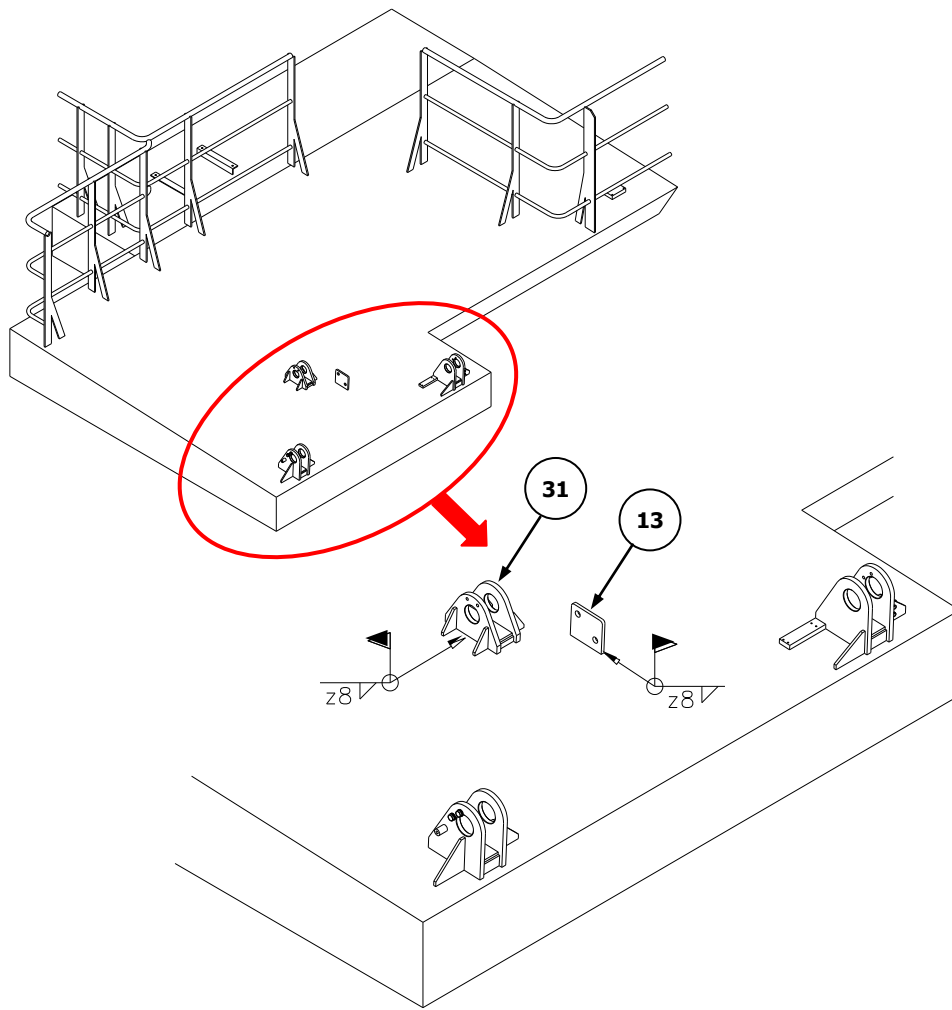


Figure 8.2: Cylinder Bracket and Hose Plate to Deck

### 8.3.3 Davit to Arm Pivot Brackets

Before commencing to fit the davit to arm pivot brackets obtain suitably sized packers to support the assembly while the cylinder is being installed, and before mounting the deck stools.

Fit the arm pivot bushes [5] into the deck mounted aft [27] and fwd [29] arm pivot brackets, with flange of bushes between the bracket plates. Carefully manoeuvre davit arms between the pivot brackets and fit arm pivot pins [3], see note below. Secure pivot pins in position using the keep plate [8] and relevant fasteners. Finally, fit a grease nipple [66] to each pivot pin. See figure 8.3: Davit to Aft Arm Pivot Bracket and figure 8.4: Davit to Fwd Arm Pivot Bracket.

**NOTE:** Check bushes are fitted into davit arm [14] pivot lugs before installing davit frame to deck mounted arm pivot brackets.

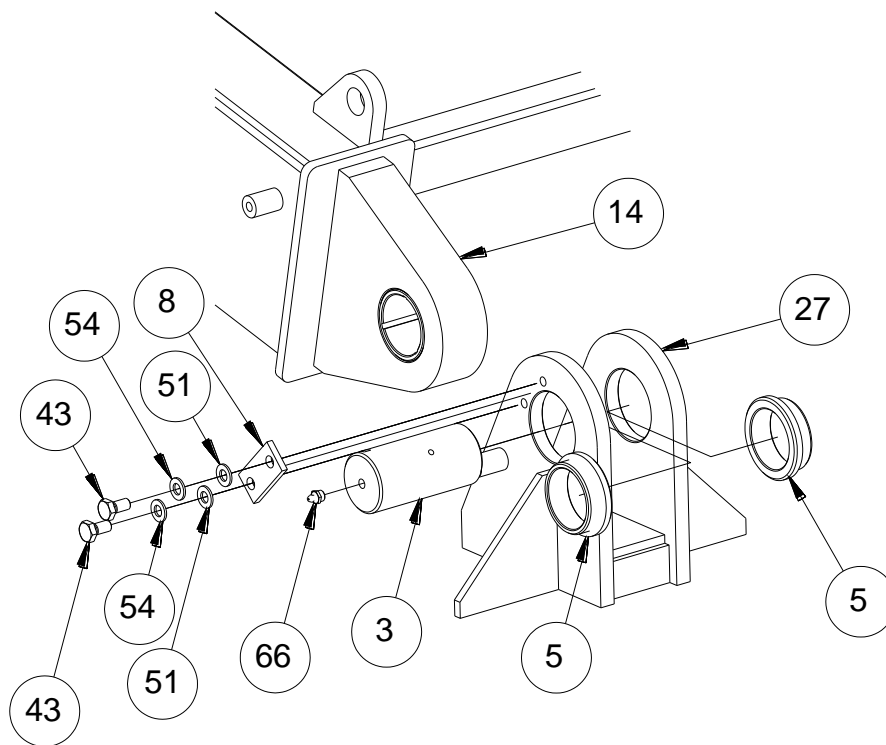


Figure 8.3: Davit to Aft Arm Pivot Bracket

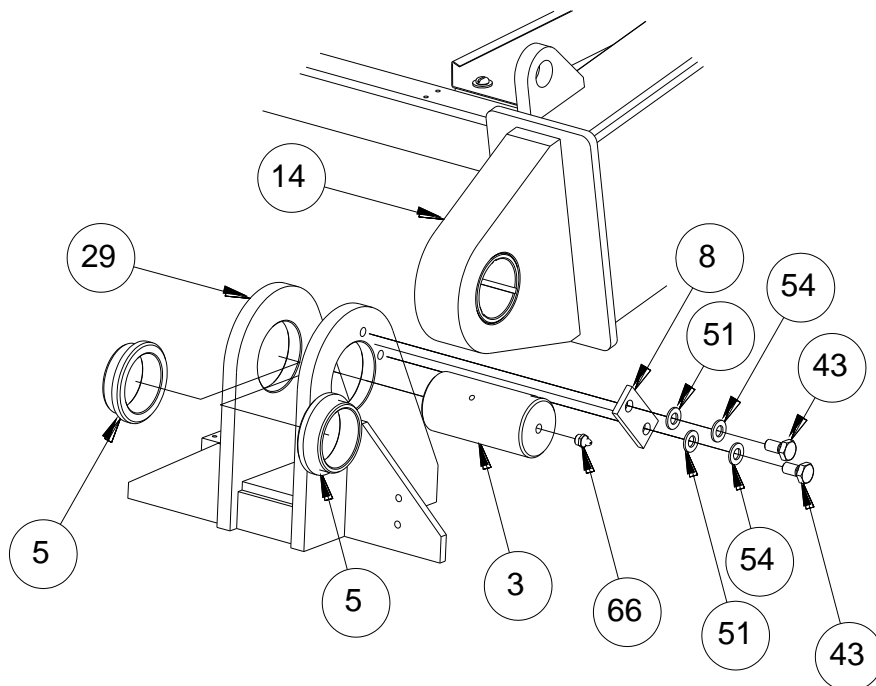


Figure 8.4: Davit to Fwd Arm Pivot Bracket

### 8.3.4 Cylinder to Davit Arm

Fit the cylinder pin bush [6] and collar [4] to davit arm frame, as shown in figure: 8.5 Cylinder to Davit Arm. Carefully manoeuvre cylinder [65] between the mounting plates (see note below) and insert cylinder pin [2], while incorporating a washer [39] either side of the clevis. Secure cylinder pin [2] in position using the keep plate [9] and relevant fasteners. Finally fit lock washer [49] and notch nut [48] to opposite end of cylinder pin.

**NOTE:** Ensure cylinder is mounted with the hose connection points facing forward.

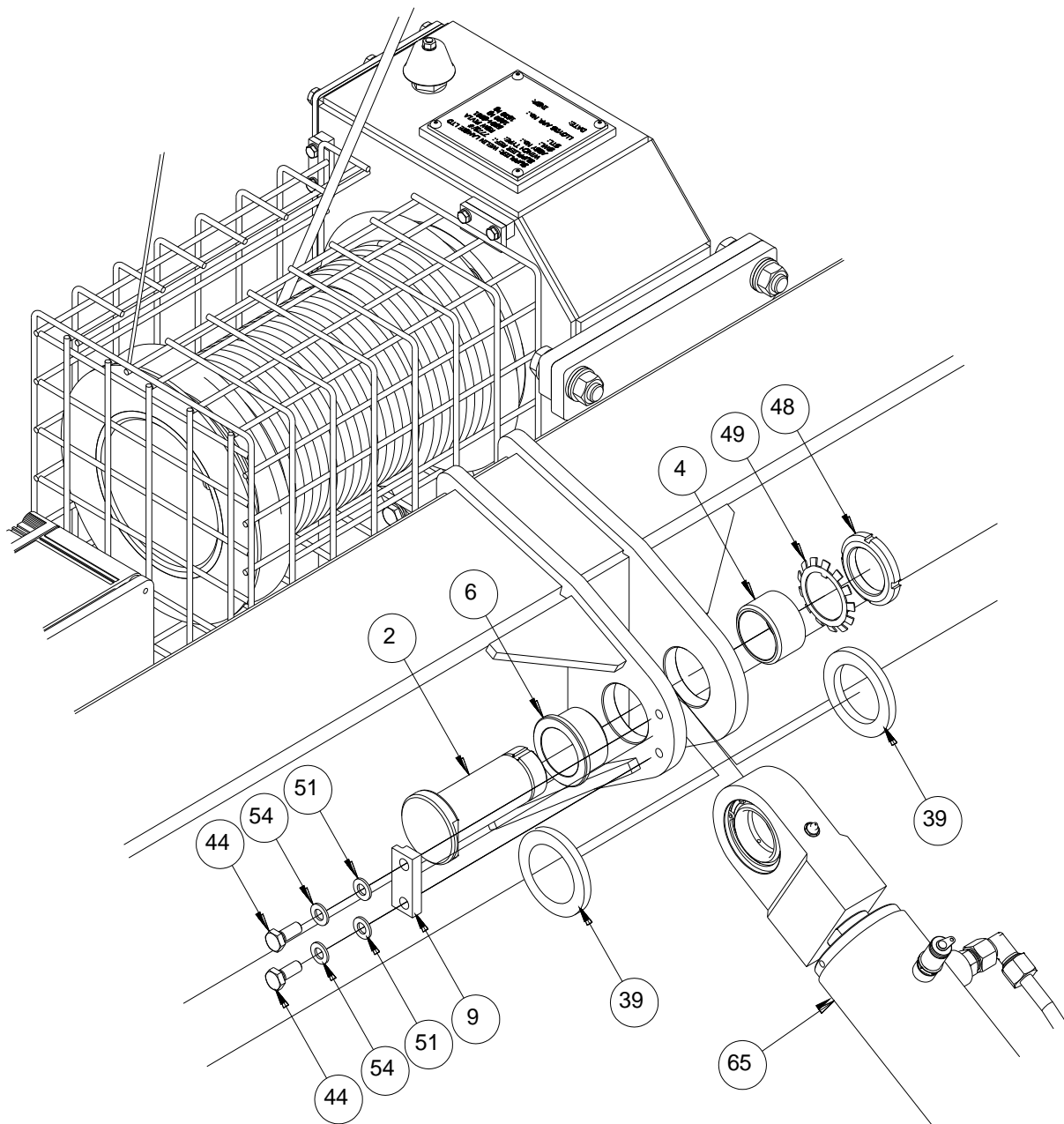


Figure 8.5: Cylinder to Davit Arm

### 8.3.5 Cylinder to Deck Bracket

Fit the cylinder pin bush [6] and collar [4] to deck bracket [31] as shown in figure: 8.6 Cylinder to Deck Bracket. Carefully manoeuvre cylinder [65] between the mounting plates (see note below) and insert cylinder pin [2], while incorporating a washer [39] either side of the clevis. Secure cylinder pin [2] in position using the keep plate [9] and relevant fasteners. Finally fit lock washer [49] and notch nut [48] to opposite end of cylinder pin.

**NOTE:** Ensure cylinder is mounted with the hose connection points facing forward.

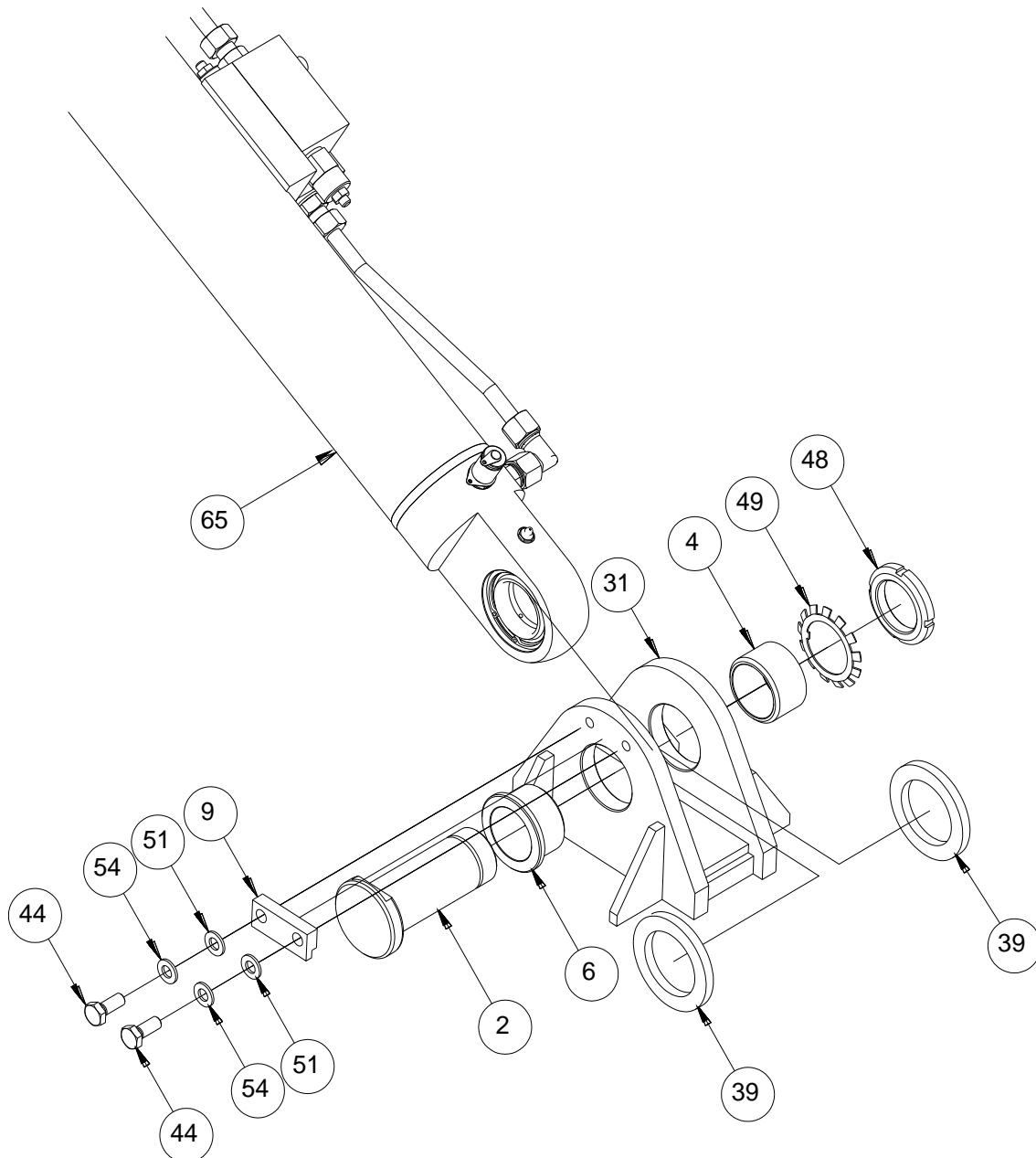


Figure 8.6: Cylinder to Deck Bracket

### 8.3.6 Deck Stools to Deck

Refer to Deck Interface Drawing No: 5683-4302 and figure 8.7: Deck Stools to Deck.

With the davit and cylinder mounted, the deck stools [26], supplied overlong to allow trimming to suit deck profile, can now be positioned as shown on interface drawing and fully welded to ship's deck.

**NOTE:** In normal operation a nominal gap between the underside of the arm and top of both pads should be maintained with the luffing cylinder 'bottomed out'.

Davit arm rest pads [10] are supplied for fitting to the stool faces, preventing damage to the arm frame if maintenance is required, e.g. removal of cylinder.

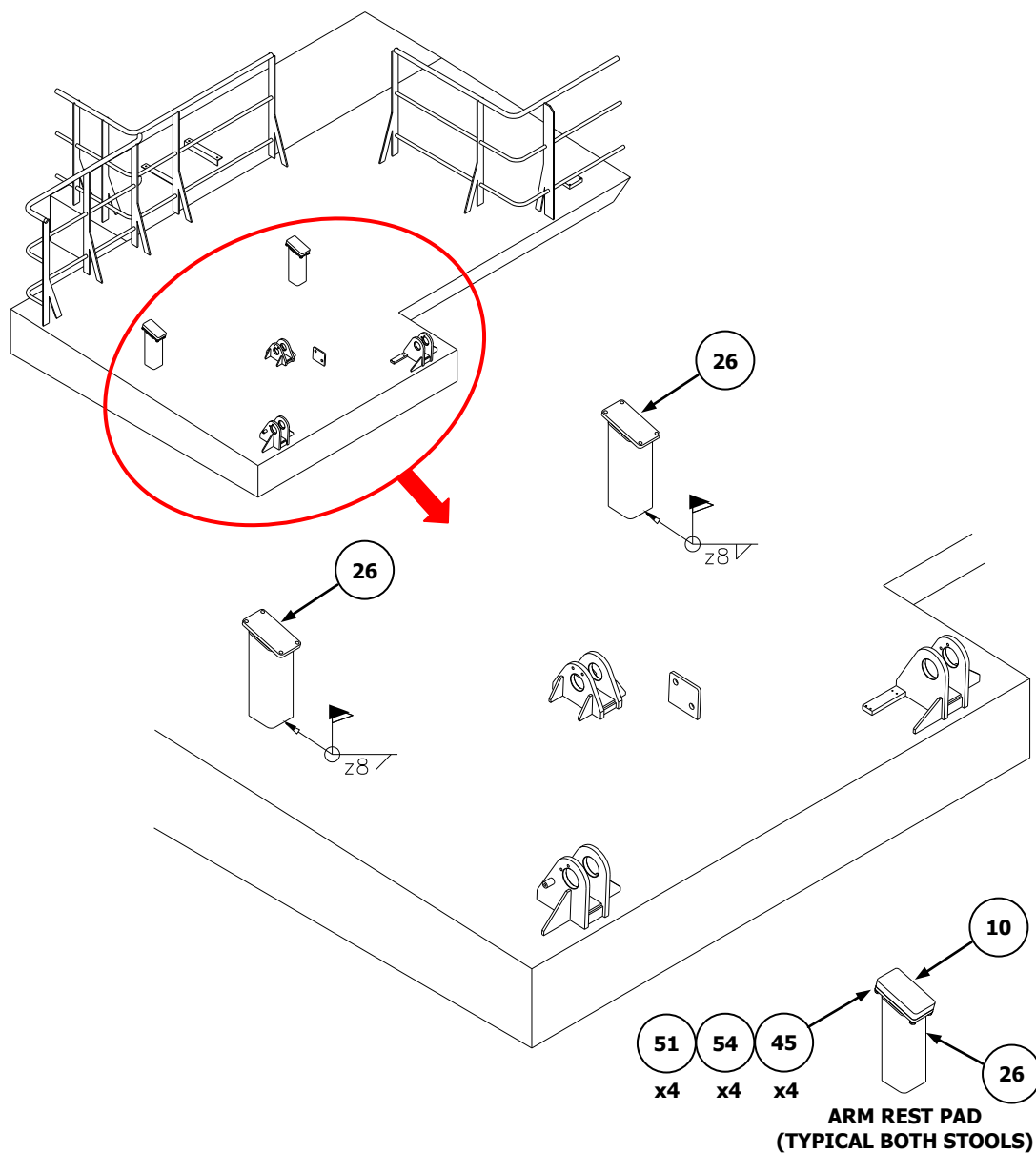


Figure 8.7: Deck Stools to Deck

### 8.3.7 Pulley Block to Fwd Deck Bracket

Assemble pulley block; fit a pulley [1] to both sides of mounting plate [11], and secure in position using cover plates [12] and setscrews [40]. Finally fit complete pulley block assembly to fwd deck bracket [29] using relevant fasteners, as shown in figure: 8.8 Pulley Block to Fwd Deck Bracket.

**NOTE:** Pulley block may be despatched already assembled.

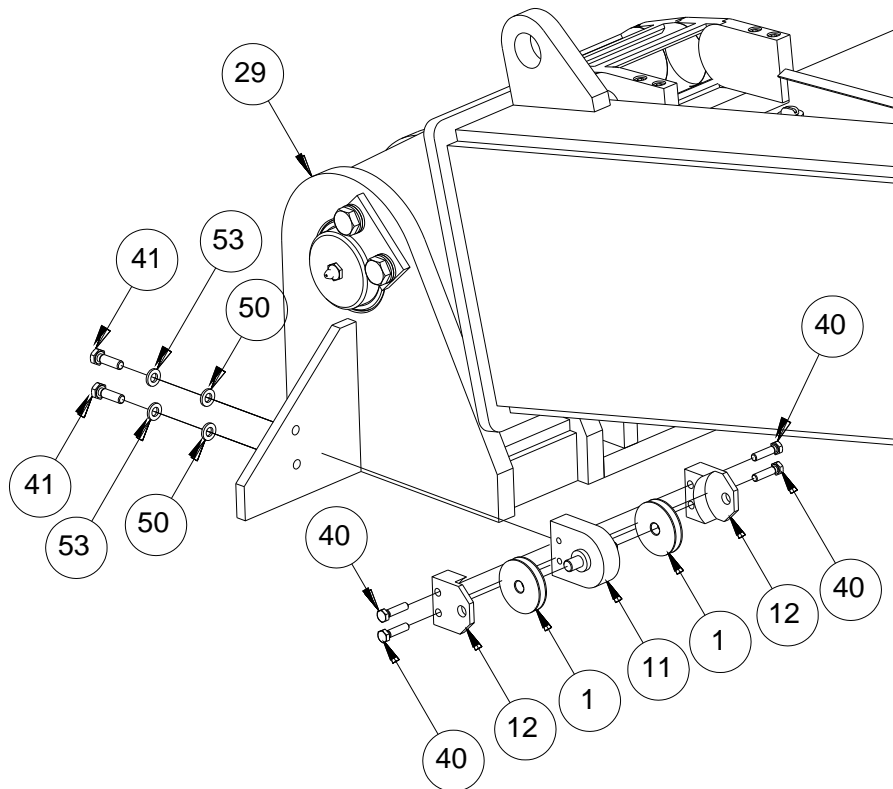


Figure 8.8: Pulley Block to Fwd Deck Bracket

### 8.3.8 Mounting Hydraulic Power Pack

Position hydraulic power pack [23] onto the prepared deck structure, and secure using relevant fasteners, as shown in figure 8.9: Mounting Hydraulic Power Pack.

See also Drawing No. 5601-1902 Davit Installation Assembly for correct orientation of the power pack.



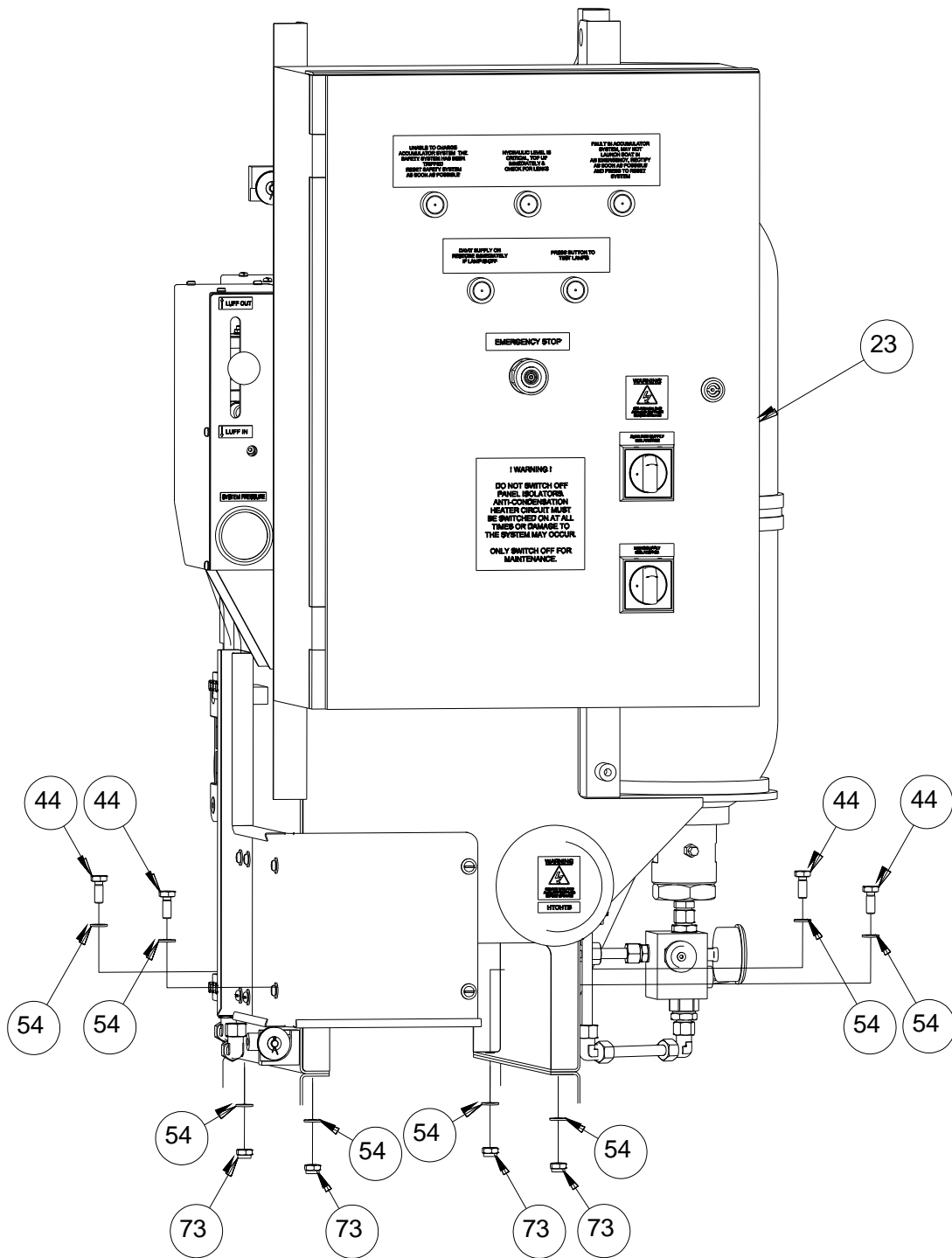


Figure 8.9: Mounting Hydraulic Power Pack

### 8.3.9 Mounting Control Station

Position control station [32] onto the prepared deck structure, and secure using relevant fasteners, as shown in figure 8.10: Mounting Control Station. The turning handle [22] can now be stowed into its holder.

See also Drawing No. 5601-1902 Davit Installation Assembly for correct orientation of the control station.

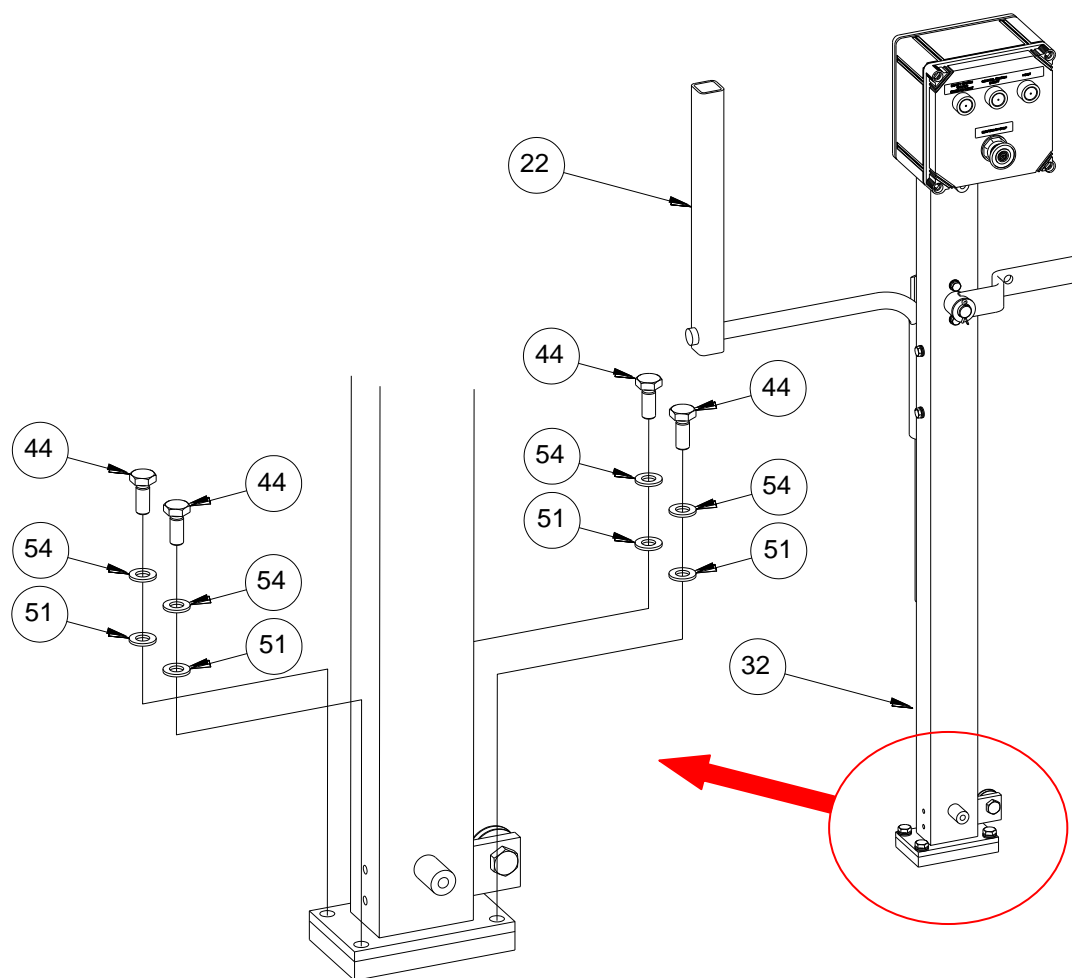


Figure 8.10: Mounting Control Station

### 8.3.10 Mounting Cable Tray to Deck

The cable tray should be cut to the required length and packed off the deck using pads, either screwed or welded in position, by others. Secure cable tray [15/17/19/21/37] onto the prepared deck pads using relevant fasteners, as shown in figure 8.11: Mounting Cable Tray to Deck.

Also fit rope guide tubes [7 and 74] in position using pipe clamps [68] secured by the relevant fasteners. Six pipe clamps [68] should also be fitted to cable tray [15] for mounting hydraulic tube.

The cable chain end bracket should now be fixed to the fwd deck bracket [29] using hexagon socket head setscrews [46].

See also Drawing No. 5683-4304 Hydraulic and Electrical Interface.

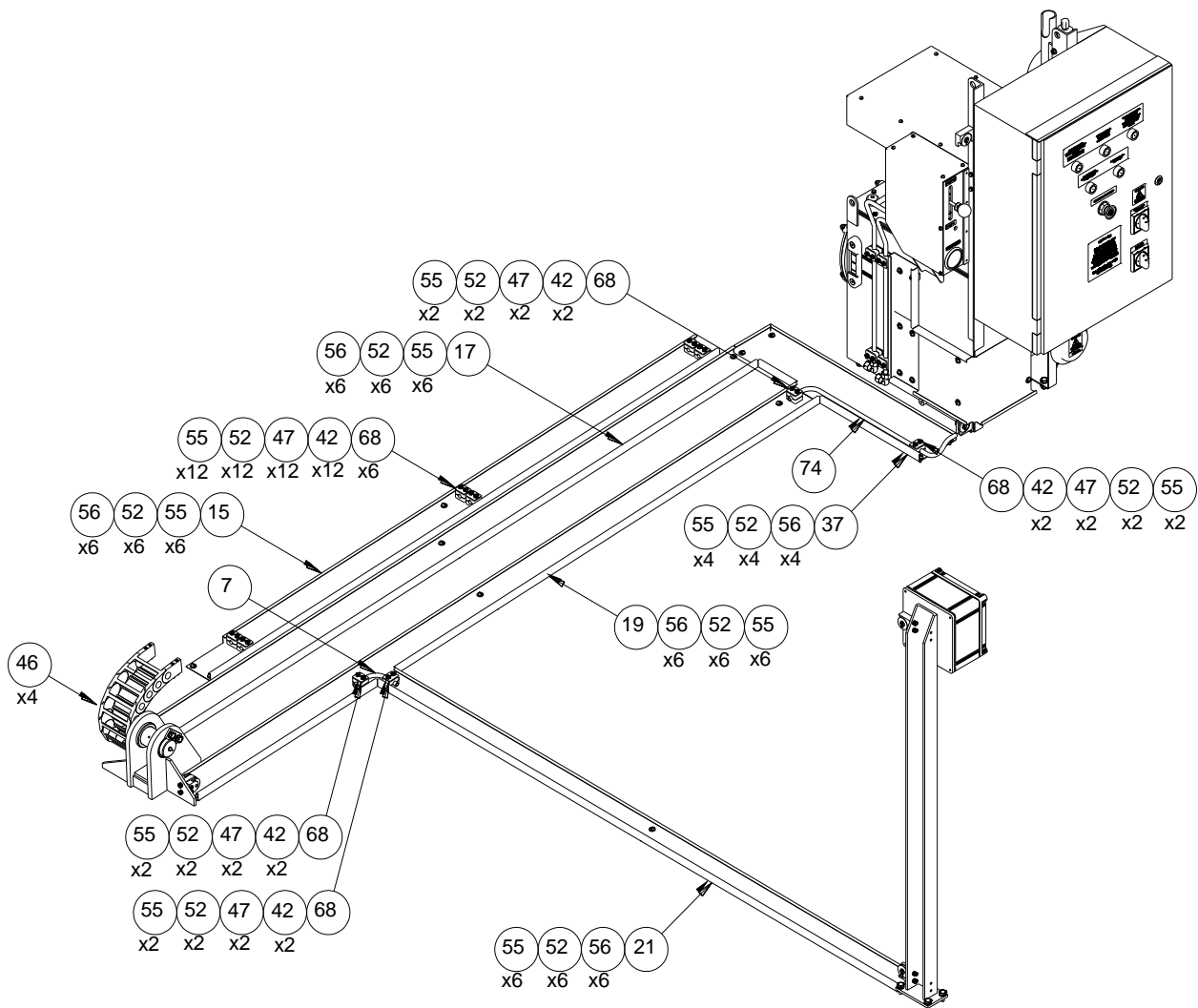


Figure 8.11: Mounting Cable Tray to Deck

### 8.3.11 Connecting Hydraulics

Connect adaptors [67 and 70] and bonded washers [69] to cylinder block as shown in figure 8.12: Hydraulic Layout and Connections. Bulkhead elbows [71] should be fitted to the deck mounted hose plate [13], a spacer [62] is required on the far side of the upper elbow, and then connect both pressure hose assemblies [24 and 25] in position. The cylinder connection tubes [33 and 34], which run from the hose plate to power pack, should be carefully bent and cut to suit, before being secured to the protective tray using previously fitted clamps.

See also Drawing No. 5683-4304 Hydraulic and Electrical Interface.

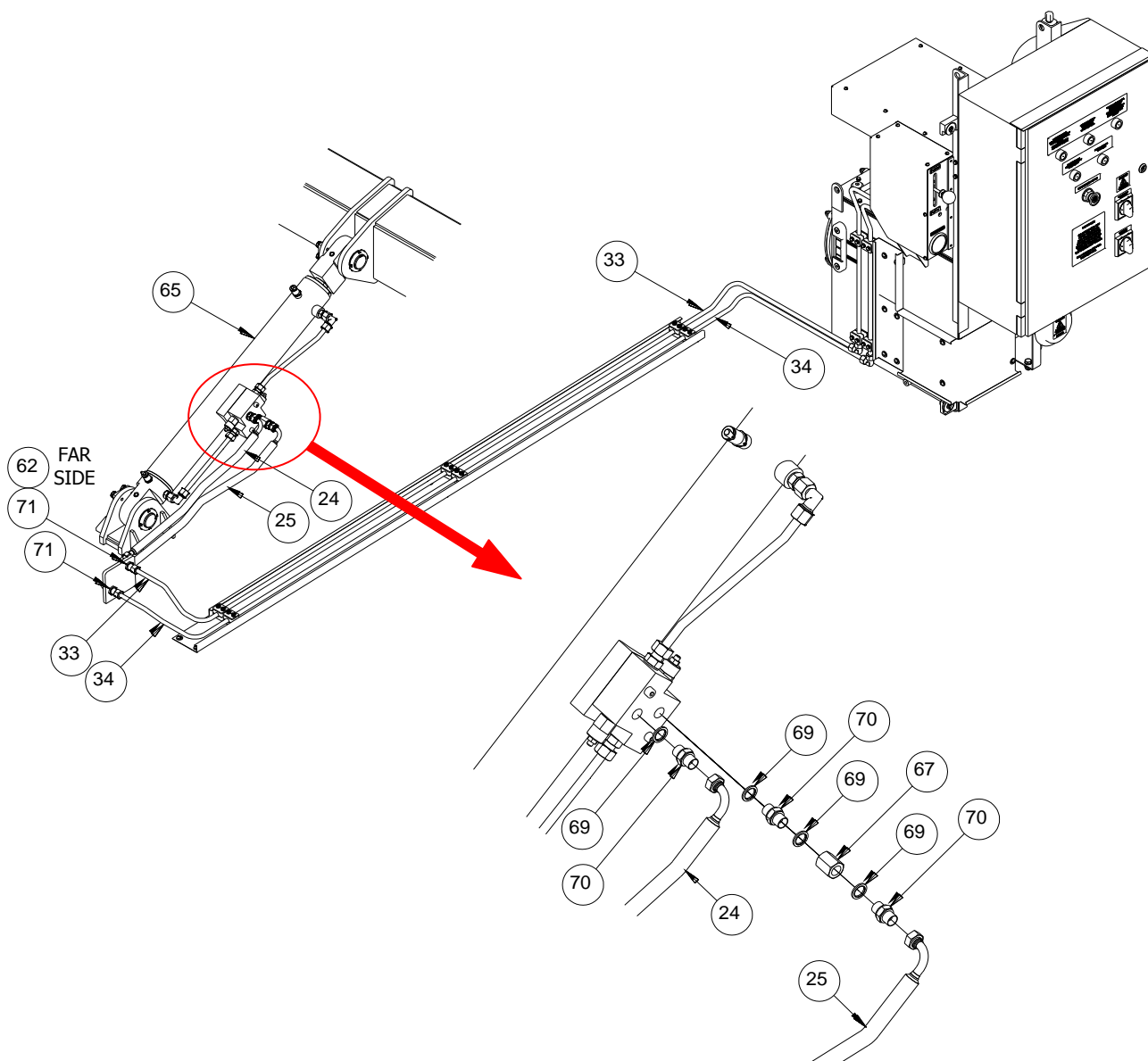


Figure 8.12: Hydraulic Layout and Connections

### 8.3.12 Reeving Remote Luff Control Rope - Boat

At hydraulic power pack: Unscrew the plastic ball knob from luff valve handle, and remove one of the spacers. Fit thimble end of luff control rope [60] to valve handle, and refit spacer and plastic ball knob, to secure rope in position. The plain end of the rope should now be passed around a pulley mounted directly above the luff valve handle, and then down to a pulley at base of power pack, ensuring rope passes behind the cable tray. Feed the rope through guide tube [74] located on deck mounted cable tray, and continue to the fwd arm pivot bracket, before passing around the pulley nearest davit arm. From here the rope should follow davit arm up to the head, passing around the upper shackle at the arm bracket, and roller guide located directly above and then the shackle at davit head. Finally pass plain end of rope round thimble [58] and attach wire grips [57] and counter weights [76] using relevant fasteners, then connect chain [72] using shackle [59]. See figure 8.13: Reeving Remote Luff Control Rope – Boat.

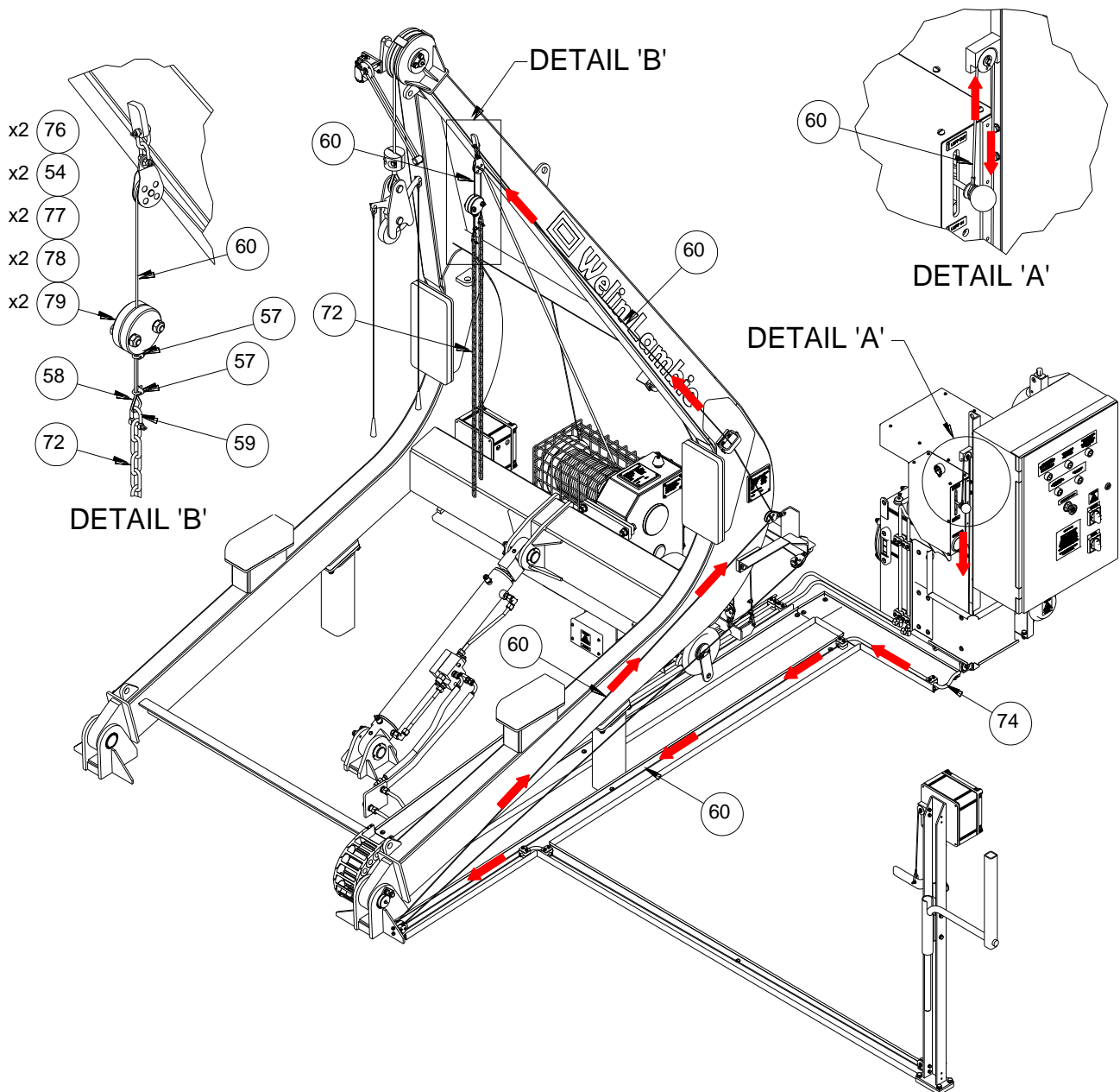


Figure 8.13: Reeving Remote Luff Control Rope - Boat

### 8.3.13 Reeving Remote Brake Control Rope - Deck

At control station: Attach thimble end of the brake control rope [61] to lever using shackle [59]. Pass the plain end of rope around pulley at top of control station stand, down to a pulley at the base. Continue along cable tray to the fwd arm pivot bracket, feeding through guide tube [7] located at cable tray junction, before passing around the outer pulley. From here rope should follow the davit arm to lower shackle on arm bracket, then along to shackle at rear of bracket. Secure thimble [58] to plain end of rope using wire grips [57], and then attach to shackle on brake release lever. See figure 8.14: Reeving Remote Brake Control Rope – Deck.

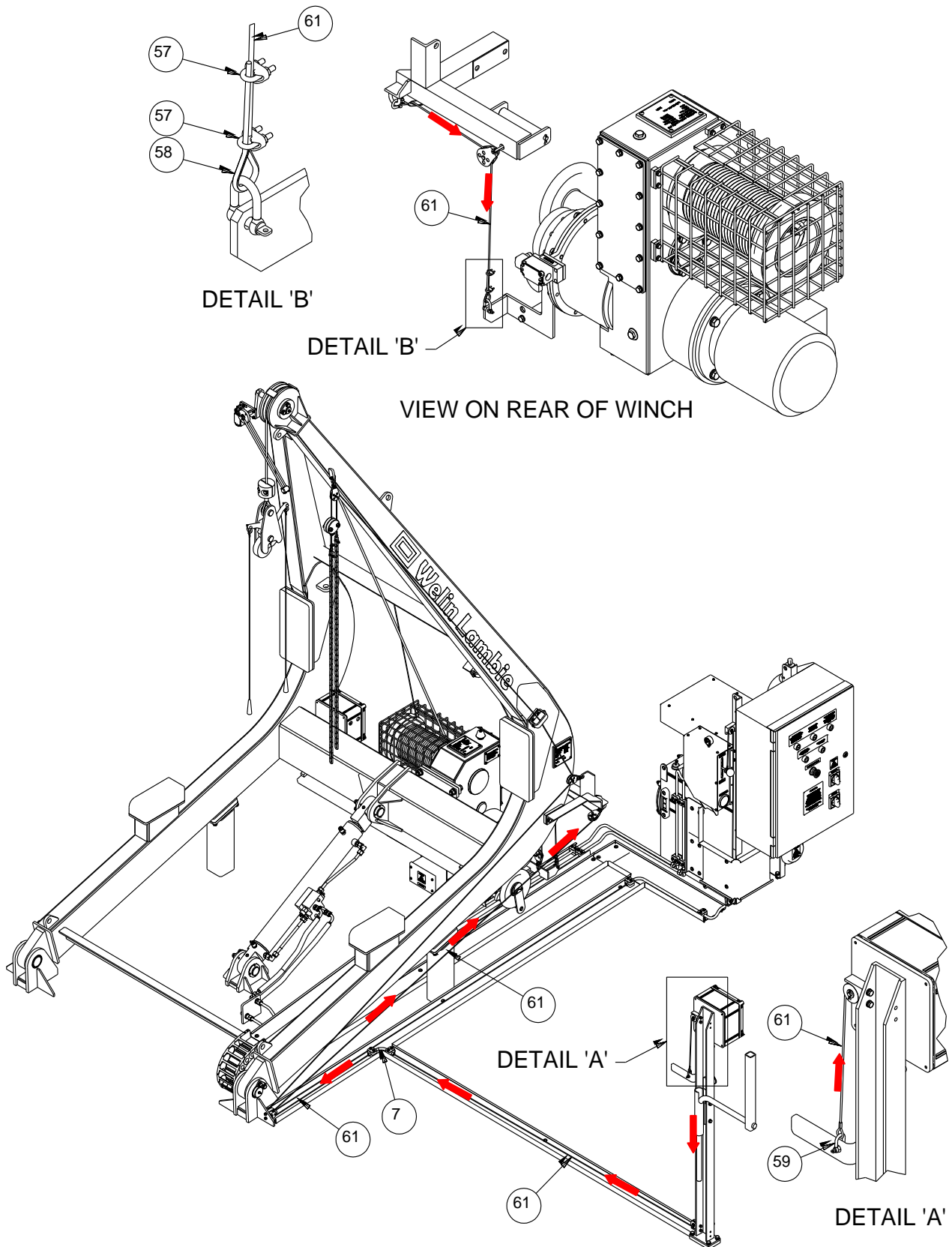


Figure 8.14: Reeving Remote Brake Control Rope - Deck

### 8.3.14 Charging Winch Gearbox

The winch gearbox should be charged with oil before operation. Filler and drain plugs are provided at the top and bottom of the box, the drain plug is magnetic and should be wiped clean before replacing. A plug is fitted at the oil level height, which should be removed when filling, and oil added (Code 'B') until level with the bottom of the hole. Replace the plug and wipe off any oil runs. See figure 8.15: Charging Winch Gearbox.

Refer to lubrication chart in Chapter 4 for correct oil grade.

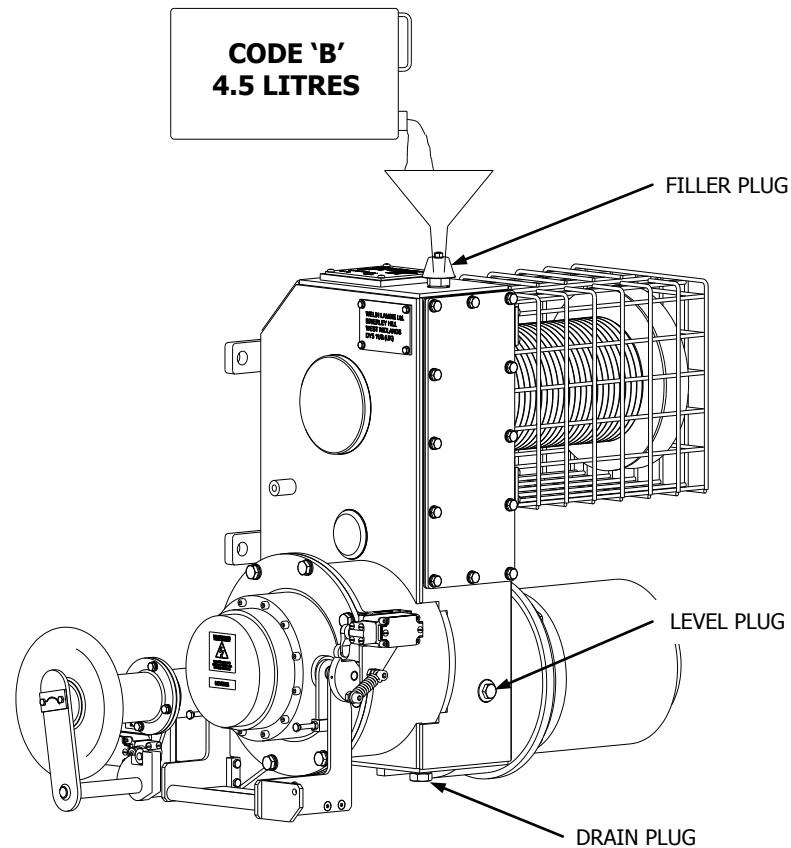


Figure 8.15: Charging Winch Gearbox

## 8.4 HYDRAULIC INSTALLATION

### 8.4.1 Accumulator Pre-Charge Procedure

Pre-charge setting for the accumulator: 76 bar (1100 psi).

**IMPORTANT:** Accumulator charging contains inherent risks associated with the unexpected release of high pressure gaseous energy. Take into account the following:

- Gas jet effects and the acceleration of loose particulate.
- Asphyxiation due to the release of nitrogen gas in a confined space.
- Accumulator acceleration in the event of unexpected release of gas.
- Note the maximum working pressure of the accumulator and do not over pressurise.
- Ensure that any protective caps (usually plastic) are removed prior to pre-charging.
- Noise may be emitted in the event of sudden release of gas.
- Avoid direct contact with oil mists.
- Select the correct charging equipment in good working condition ensuring that pressure gauges are safety pattern type and all hoses must be designed to be used with gas.

#### **USE ONLY OXYGEN FREE DRY NITROGEN GAS**

**WARNING:** It is recommended that a regulator valve is fitted in the gas line when charging accumulators with a shell rating less than that of the gas supply.

The accumulator pre-charge should be set as follows:

**IMPORTANT:** Check the pressure gauge on the safety block reads zero before continuing with procedure.

- With zero hydraulic pressure in the accumulator, isolate from the rest of the system by rotating the shut off valve to 'OFF' (closed). Refer to figure 8.16: Accumulator Safety Block.



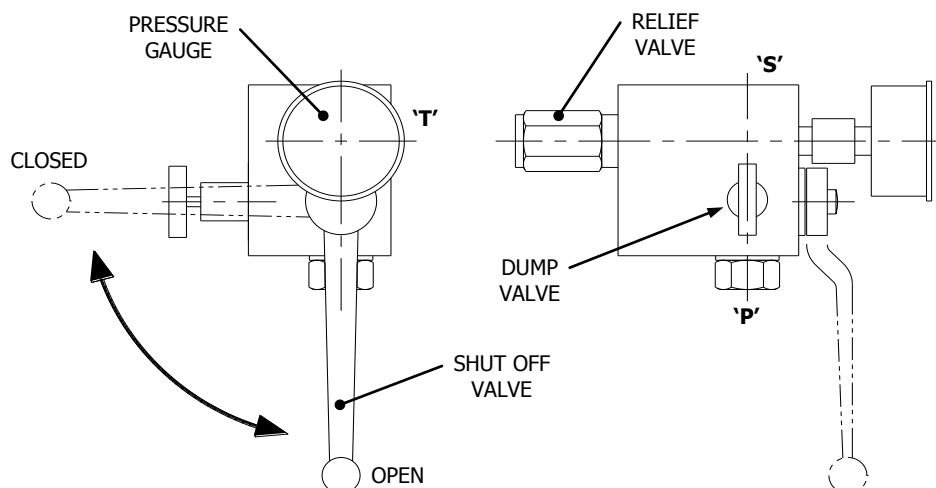


Figure 8.16: Accumulator Safety Block

- Remove the sealing cap from the gas charge connection. Refer to figure 8.17: Accumulator Pre-Charge Setup.
- Fit charging assembly using the thread adaptor, having ensured the hand wheel 'A' is fully retracted (counter-clockwise), bleed screw 'B' is open and pressure gauge fitted.

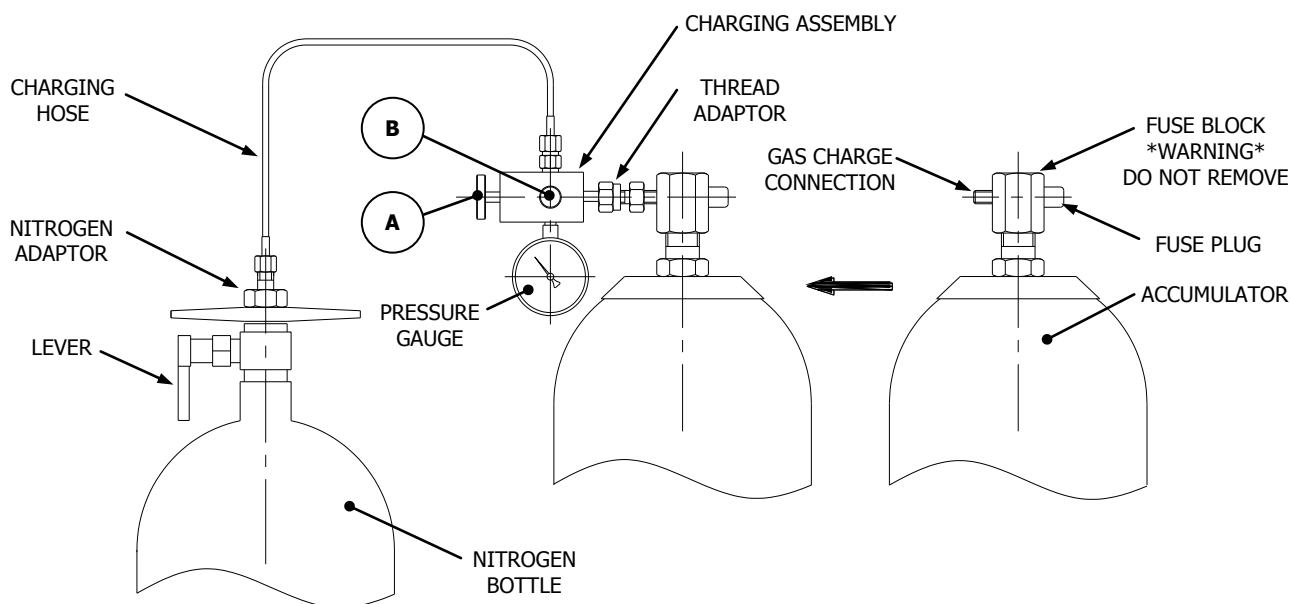


Figure 8.17: Accumulator Pre-Charge Setup

- Connect charging hose to charging assembly and to the nitrogen supply using the appropriate adaptor. ( $N^2$  cylinder).
- Attach lever to nitrogen bottle valve. Rotate the hand wheel 'A' on the charging assembly (clockwise) to open the gas valve. Do not screw hand wheel down tight. Slowly open the nitrogen supply and allow gas to gently enter the accumulator until

a pressure slightly in excess of final pressure is obtained (i.e. 76 bar –1100 psi).  
Close the nitrogen supply.

- Allow nitrogen pressure to stabilize (approx. 5 minutes).
- Retract hand wheel 'A' (counter-clockwise) to seal gas valve.  
Crack bleed screw 'B' to exhaust gas from charging hose and remove hose from charging assembly and replace hose connection sealing cap.  
Remove charging assembly and thread adaptor.  
Replace the sealing cap on the gas charge connection.  
Fully close the dump valve on the safety block.

#### 8.4.2 Filling Hydraulic Reservoir

The power pack hydraulic reservoir should be filled as follows:

- Remove filler plug on hydraulic reservoir and fill with filtered oil (10 µm) to 'Maximum' level on gauge. See figure 8.18: Filling Hydraulic Reservoir.
- Refit plug and clean away any excess oil.

Refer to lubrication chart in Chapter 4 for correct oil grade.

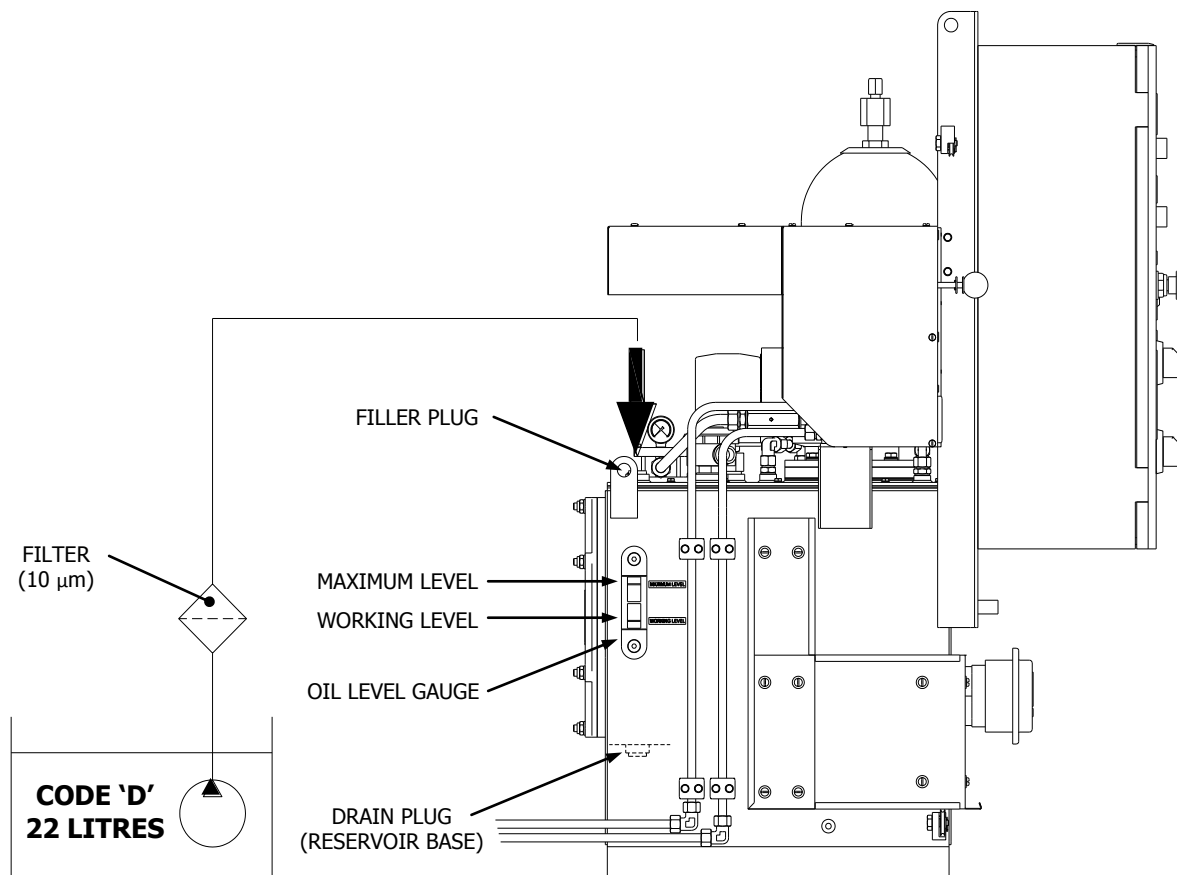


Figure 8.18: Filling Hydraulic Reservoir

## 8.5 ELECTRICAL INSTALLATION

The control panel (mounted on the hydraulic power pack), control station and davit are supplied completely assembled and have been fully function tested before leaving the factory. However, cable from the davit and control station has been disconnected for despatch at the control panel, and is coiled and fastened to the relevant assembly.

Suitable glands are fitted to all disconnected cables, and the corresponding cable entries in the control panel are sealed for protection. The cables should be run in protective tray previously fitted to deck. See figure 8.19: Cable Layout. Clips and ties are provided for securing the cable to the tray.

Also refer to the following Drawings:

- 5683-4304                      Hydraulic and Electrical Interface
- 2762-1301                    Electrical Assembly
- 2771-2404                    Wiring Diagram

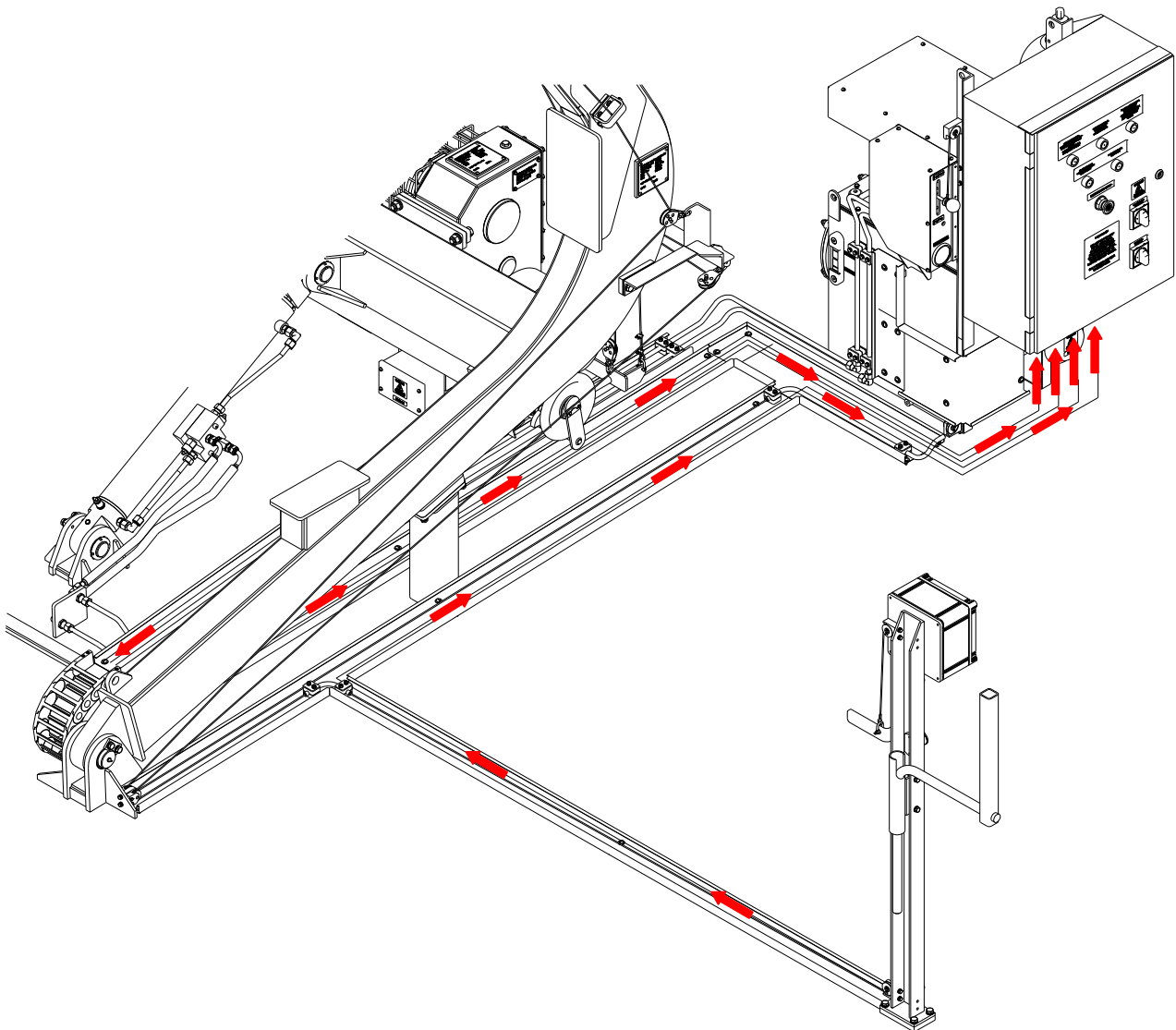


Figure 8.19: Cable Layout

When fitting to the control panel, the cable gland thread should be sealed with a suitable compound and the shroud fitted to complete assembly. Having connected the cables, reconnect the wires to corresponding terminal numbers in the control panel. Refer to figure 8.20: Control Panel Cable Entry.

**NOTE:** The cables are supplied 'overlong', and can be reduced in length if required.

The ships main power supply (600vAC: 3ph: 60Hz), and auxiliary power supply (110vAC: 1ph: 60Hz) cables should be brought to the control panel and fitted, using watertight glands, adjacent to the input terminals marked on the rail – customer to drill suitable size holes. Wire ends should be fitted with insulated crimp ferrules and fitted to terminals marked. Refer to figure 8.20: Control Panel Cable Entry.

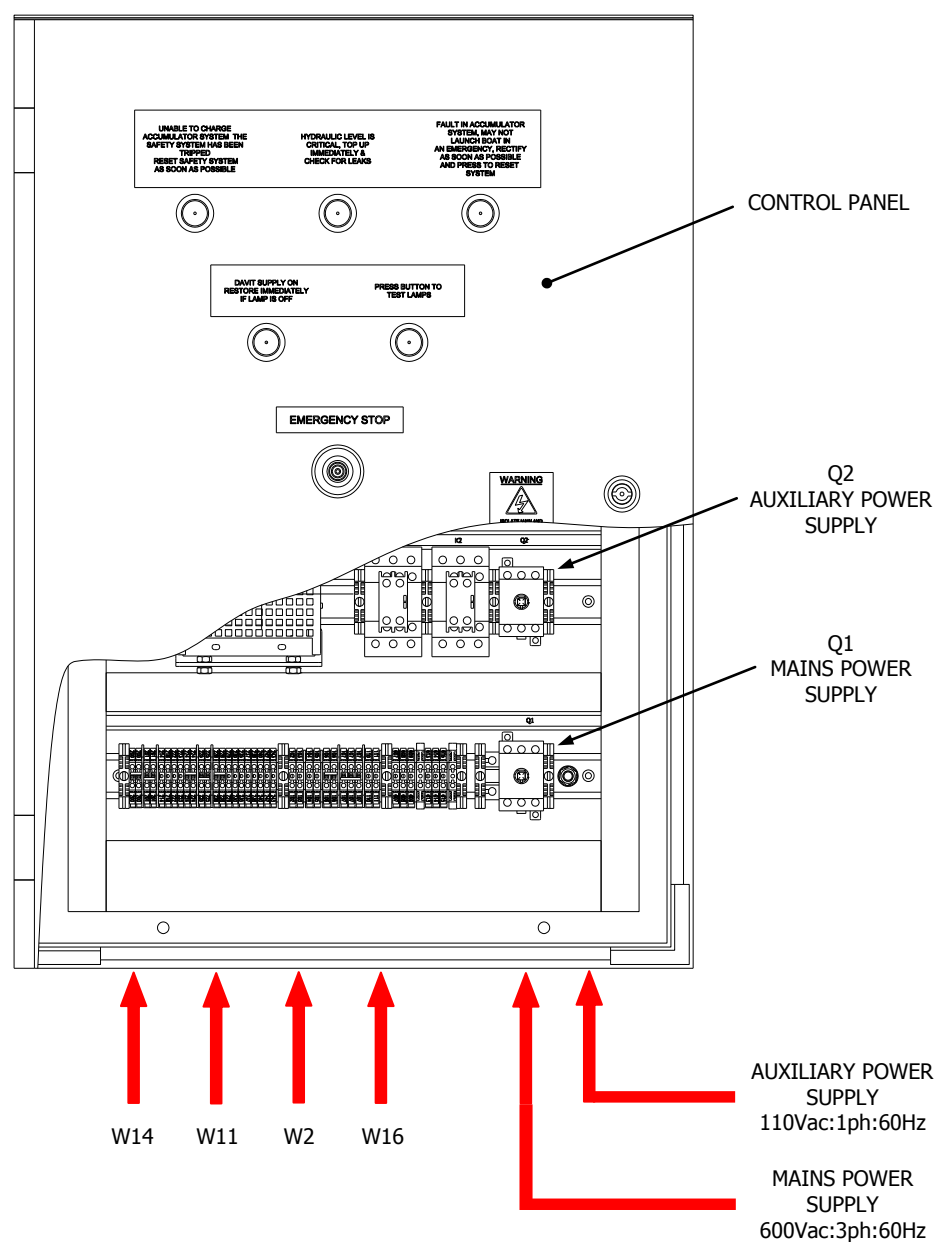


Figure 8.20: Control Panel Cable Entry

- Check all earth bonding straps are connected.
- Check mains (Q1) and auxiliary (Q2) supplies are in 'OFF' position.
- Check all circuit breakers (CB1 – CB6) are in 'OFF' position.

**IMPORTANT:** Check that the phase rotation is correct, using phase rotation meter (red/yellow/blue), before continuing with electrical installation.

- Set circuit breaker CB5 to 'ON' position, activating the hydraulic pump motor, winch motor, winch brake and terminal box, control panel and control station heaters. Also set circuit breakers CB3 and CB4 to 'ON' position, to activate the oil heaters in the hydraulic reservoir and winch.
- Switch auxiliary isolator (Q2) to 'ON' position, activating the anti-condensation and oil heaters. The heaters must be powered for 24 – 48 hours, to dispel any accumulated condensation during transport and storage, before operating the equipment.

**NOTE:** At this stage none of the indicators on the control panel or control station will be active.

**IMPORTANT:** The auxiliary isolator (Q2) must be 'ON' at all times to run the anti-condensation and oil heaters – except for maintenance.

### 8.5.1 Initial Safety Checks

Initial safety checks are as follows:

- Switch main and auxiliary isolators (Q1 and Q2) to 'OFF' position, and ensure all 'Emergency Stop' buttons, located at the control panel, control station and winch, are pulled out.
- Open control panel door and set circuit breakers CB1 and CB6 to 'ON' position, then close panel door.
- Switch both isolators, mains and auxiliary, to 'ON' position. The 'Safety System Tripped', at control station, and 'Unable to Charge System' on the control panel, indicators illuminate.
- Press 'Lamp Test' button on the control panel. All indicators illuminate while button remains pressed.
- Press 'Safety System Tripped' reset button, at control station. Indicator extinguishes. The 'Unable to Charge System' indicator on the control panel also extinguishes.

- At control station: Press 'Emergency Stop' button. The 'Safety System Tripped' on control station, and 'Unable to Charge System' on the control panel, indicators illuminate.
- At control station: Pull out 'Emergency Stop' button and press 'Safety System Tripped' reset button, indicator extinguishes, together with the 'Unable to Charge System' indicator on the control panel.
- At control panel: Press 'Emergency Stop' button. The 'Safety System Tripped' on control station, and 'Unable to Charge System' on the control panel, indicators illuminate.
- At control panel: Pull out 'Emergency Stop' button and press 'Safety System Tripped' reset button on the control station, indicator extinguishes, together with the 'Unable to Charge System' indicator on the control panel.
- At winch terminal box: Press 'Emergency Stop' button. The 'Safety System Tripped' on control station, and 'Unable to Charge System' on the control panel, indicators illuminate.
- At winch terminal box: Pull out 'Emergency Stop' button and press 'Safety System Tripped' reset button on the control station, indicator extinguishes, together with the 'Unable to Charge System' indicator on the control panel.
- At winch: Rotate the safety plate. Both 'Safety System Tripped' on control station and 'Unable to Charge System' on the control panel, indicators illuminate.
- Return the winch safety plate to its normal position, and press 'Safety System Tripped' reset button on control station, indicator extinguishes, together with the 'Unable to Charge System' indicator on the control panel.
- At winch: Lift the brake lever. Both 'Safety System Tripped' on control station and 'Unable to Charge System' on the control panel, indicators illuminate.
- Return the brake lever to its normal position, and press 'Safety System Tripped' reset button on control station, indicator extinguishes, together with the 'Unable to Charge System' indicator on the control panel.
- At control station: Press power 'ON/OFF' button. Button illuminates.
- At control station: Press power 'ON/OFF' button again. Power 'ON' button extinguishes.

**IMPORTANT:** Before continuing with safety checks ensure sufficient gap is present between the hook and striker arm, to prevent damaging the davit structure, should hoist limit switch fail to operate.

- At control station: Press power 'ON' button to activate the station. Then press the 'HOIST' button.

**NOTE:** From the brake side of the winch the rope drum should rotate in a clockwise direction.

**CAUTION:** Do not power hoist the 'light rope' i.e. without the boat attached. Hoist limit switch will not detect striker arm in sufficient time to cut off power, therefore damage to the davit structure will occur.

**NOTE:** The following checks require adequate free light rope to ensure the striker arm will not come into contact with davit head.

- Press 'HOIST' button, with light rope hoisting press the 'Emergency Stop' button. Hoist motion must stop.
- Press 'HOIST' button, with light rope hoisting operate the hoist limit switch by manually raising the striker arm. Hoist motion must stop.
- Press 'HOIST' button, with light rope hoisting lift the brake lever at the winch. Hoist motion must stop.
- Press 'OFF' button to deactivate the control station.

## 8.6 CHARGING HYDRAULIC SYSTEM

Charge hydraulic system as follows:

**IMPORTANT:** Ensure the accumulator dump valve is closed, and the safety block open before charging the hydraulic system.

- Switch main and auxiliary isolators to 'OFF' position.
- At control panel: open panel door and switch circuit breaker CB2 to 'ON' position, and then close the panel door.
- Switch main and auxiliary isolators to 'ON' position. The 'Davit Supply On' and 'Unable to Charge' indicators on the control panel illuminate, together with the 'Safety System Tripped' indicator at the control station. Now press the 'Safety System Tripped' reset button on the control station.
- When the hydraulic pump starts charging the accumulator, the 'Unable to Charge' and 'Safety System Tripped' indicators will extinguish.
- When the pressure has reached approximately 200 bar (2900 psi), the pump will be automatically switched off.

- With the accumulator fully charged the oil in the reservoir should be at 'Working' level.

**CAUTION:** The space between 'Maximum' and 'Working' oil level must exist to allow the accumulator to discharge oil back into the reservoir without overflowing.

- Any air in the system must now be purged out. Using the luff control valve move the arm outboard. If the arm vibrates while moving stop and start the movement until the vibration reduces. Stop at the outboard position and allow the accumulator to recharge. Move the arm to full inboard position and repeat process until arm is moving smoothly. Air should now have been purged from the system.
- Leave arm set at full inboard position.
- Inspect pipe work and fittings for signs of leaks and tighten joints as necessary.
- Switch the main and auxiliary isolators to 'OFF' position.
- At accumulator safety block gradually open dump valve to discharge oil back to the reservoir, until pressure gauge reads zero. Refer to figure 8.16: Accumulator Safety Block.
- Once oil level has stabilised top up reservoir to 'Maximum' level if required.
- Refer to lubrication chart in Chapter 4 for correct oil grade.

**CAUTION:** Do not fill reservoir above 'Maximum' oil level.

- Close dump valve on the accumulator safety block. Switch the main and auxiliary isolators to 'ON' position and press 'Safety System Tripped' reset button on the control station.
- The hydraulic pump will charge the accumulator to 200 bar (2900 psi), and automatically switched off. The oil will return to the 'Working' level.
- Hydraulic system should be now ready for use.

**NOTE:** If the system fails to charge (200 bar) within 5 minutes the 'Fault in System' indicator will illuminate. Check for any leaks and the safety block dump valve is closed. Press 'Fault in System' reset button to recommence charging system.



## 8.7 BOAT CHOCKS AND GRIPES

Provision has been provided on the arm structure to fit suitable facing blocks, customer supply, to prevent damage to the boat when stowed. Gripes for securing the boat in position have been supplied. See below for fitting details and refer to figure 8.21: Boat Chock and Gripe Assembly.

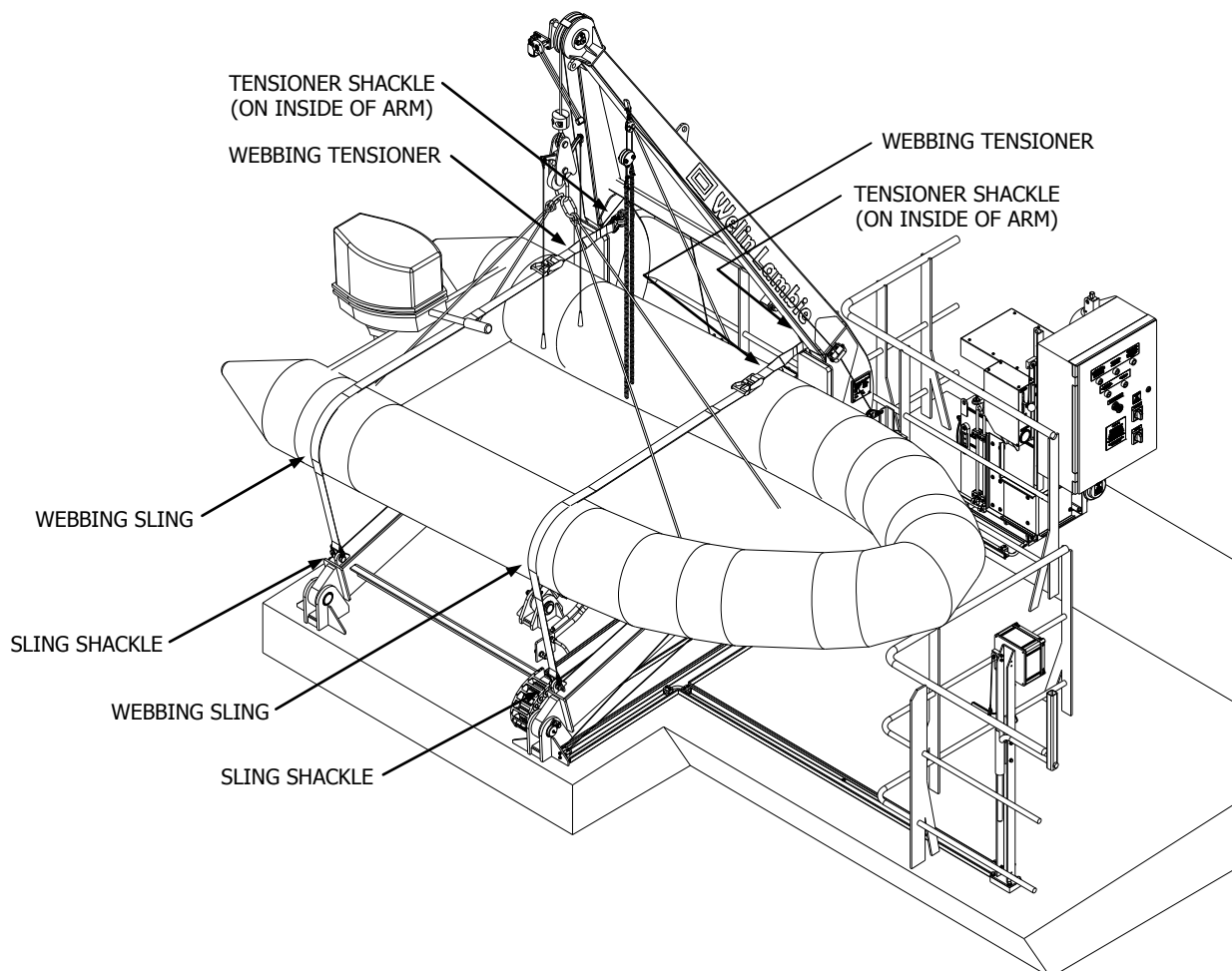


Figure 8.21: Boat Chock and Gripe Assembly

### 8.7.1 Chocks

With the boat in the stowed position a 50mm (2") thick wooden block, customer supply, should be fitted between the chock plates, mounted on the davit arm structure, and the keel and gunwale of the boat. These blocks should be shaped to suit the boat and faced with a suitable material to prevent wear.

### 8.7.2 Gripes

Fit boat gripes as follows:

- Anchor the shackle end of each webbing tensioner [36] to the lugs provided on the inside face of each arm.

- Anchor the shackle end of each webbing sling [35] to the lugs provided on each arm near the fore and aft pivots.
- With the boat stowed, each sling [35] should pass through the corresponding tensioner [36] and the assembly tensioned sufficiently to hold the boat securely in position.

## 8.8 FUNCTION CHECK LIST

Function checks should be carried out by qualified Welin Lambie engineers or personnel working under their supervision.

Check before commencing operation of the davit that any personnel in the immediate vicinity will not be in any danger.

Check surrounding area is free from foreign objects which may interfere with davit operation.

**WARNING:** Before operating any controls ensure that the personnel in the area are aware of and will not be endangered by your actions.

Set Up & Operation	Check	<input checked="" type="checkbox"/>
Ships power supply 'ON', davit main and auxiliary isolators 'ON'.	'Davit Supply On' indicator illuminated.	
<p>Boat gripes removed and ropes tensioned.</p> <p>At power pack: Manually operate luff valve to move boat to outboard position.</p> <p>At power pack: Manually operate luff valve to return boat to stowed position.</p> <p>From within boat: Pull down on the remote control rope to move boat to outboard position.</p>	<p>1) Luff motion starts. Releasing valve handle stops luff motion. 2) On reaching outboard position accumulator recharges to 200 bar.</p> <p>1) Luff motion starts. Releasing valve handle stops luff motion. 2) On reaching inboard position accumulator recharges to 200 bar.</p> <p>1) Luff motion starts. Releasing the remote control rope stops luff motion. 2) Accumulator recharges to 200 bar.</p>	

Set Up & Operation	Check	<input checked="" type="checkbox"/>
Main and auxiliary isolators 'ON', control station 'ON': Boat at full outboard position.	1) Safety system tripped indicator is not illuminated. 2) If illuminated, emergency stop button has been activated or turning handle fitted to winch.	
At control station: Pull down on remote control rope to lower boat.	Lower motion starts.	
While lowering, release remote control rope.	Lower motion stops.	
From within boat: Pull down on remote control rope to lower boat.	Lower motion starts.	
While lowering, release remote control rope.	Lower motion stops.	
At winch: Manually lift brake lever to lower boat.	Lower motion starts.	
While lowering, release brake lever gently.	Lower motion stops.	

Set Up & Operation	Check	<input checked="" type="checkbox"/>
At control station: Press 'Hoist' button.	1) Hoist motion starts. 2) Hoist motion stops when button is released. 3) Davit stops when over hoist limit switch is reached. 4) Hoist motion stops if 'Emergency Stop' button is pressed. 5) Hoist motion stops if safety plate is rotated from in front of turning handle shaft at winch. 6) Hoist motion will not start when 'Hoist' button is pressed if turning handle is fitted.	

**NOTE:** The above function checks assume all installation is complete, the boat attached and in the stowed position.

With all function checks complete, re-grease all nipples, check oil levels at the winch and hydraulic reservoir, and reset winch safety device.

## **8.9            TESTING**

After installation and all function checks have been completed, the davit can be tested to the requirements of the certifying authority.

## 9.0 APPENDIX

### 9.1 FOUL WEATHER STROPS AND HANG-OFF PENDANTS

A typical foul weather strop and hang-off pendant arrangement for this davit is shown below (Figure 9.1). It is for guidance, as exact arrangements, with precise lengths, are best developed onboard with the operating crew during practice procedures. For this reason, normally only the falls and hook are supplied as part of the davit installation.

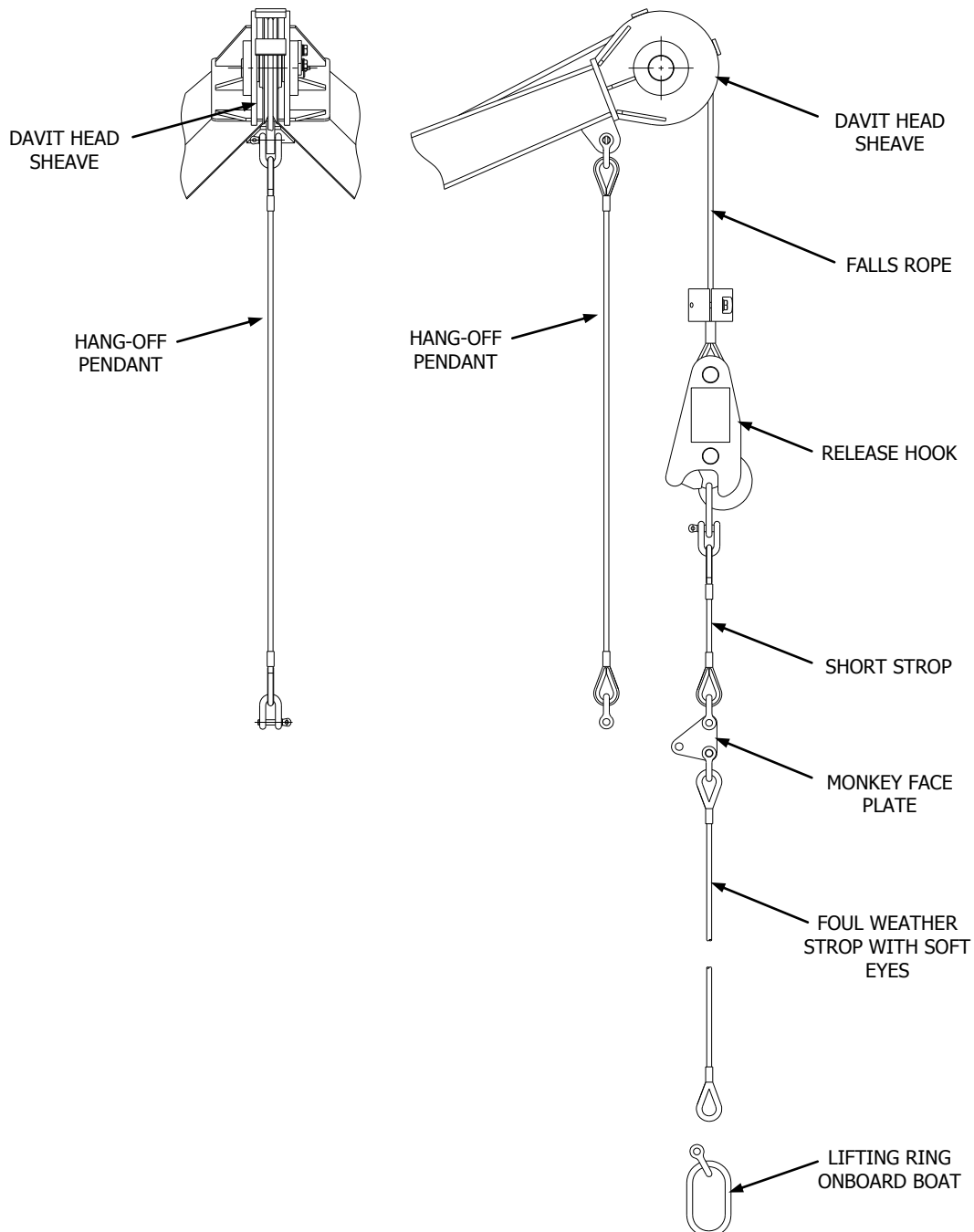
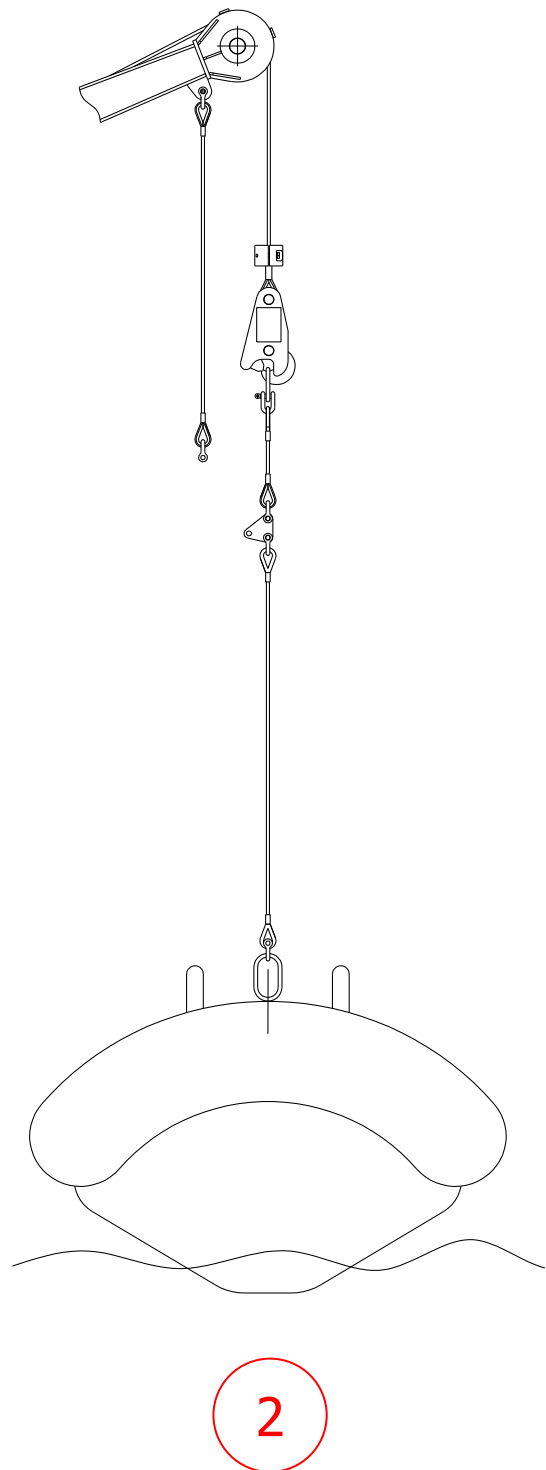
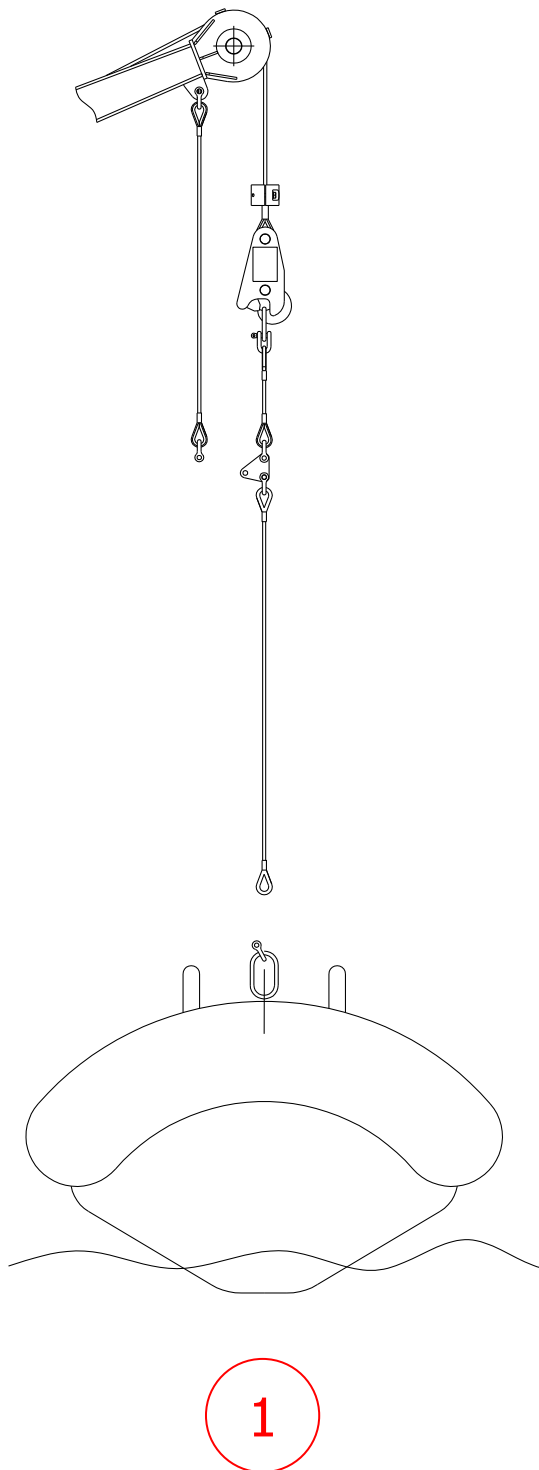
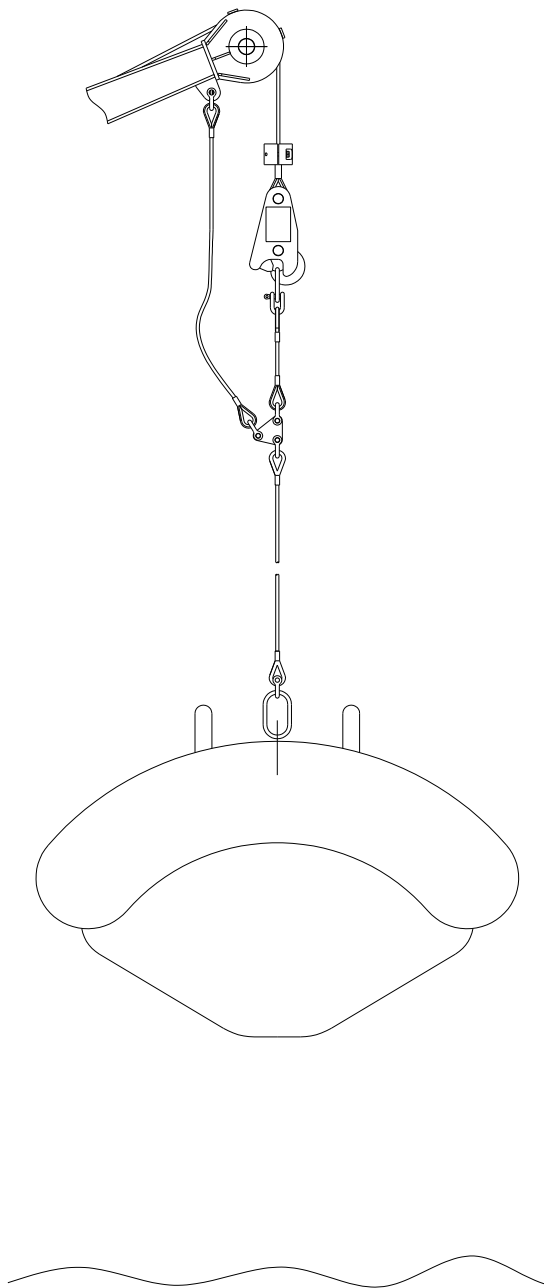


Figure 9.1: Typical Strop Arrangement  
(Side View & End View on Davit)

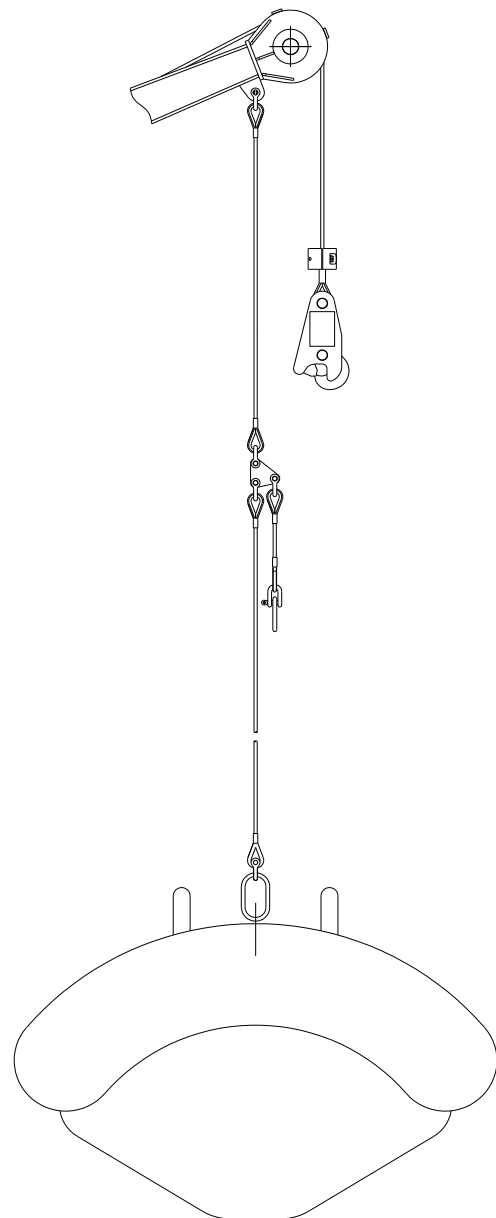
### 9.1.1 Typical Procedure



1. Lower the soft foul weather strop to be shackled to the on-board lifting ring.
2. When safe to do so, hoist the boat clear of the water to a safe disembarkation deck on the mother ship.

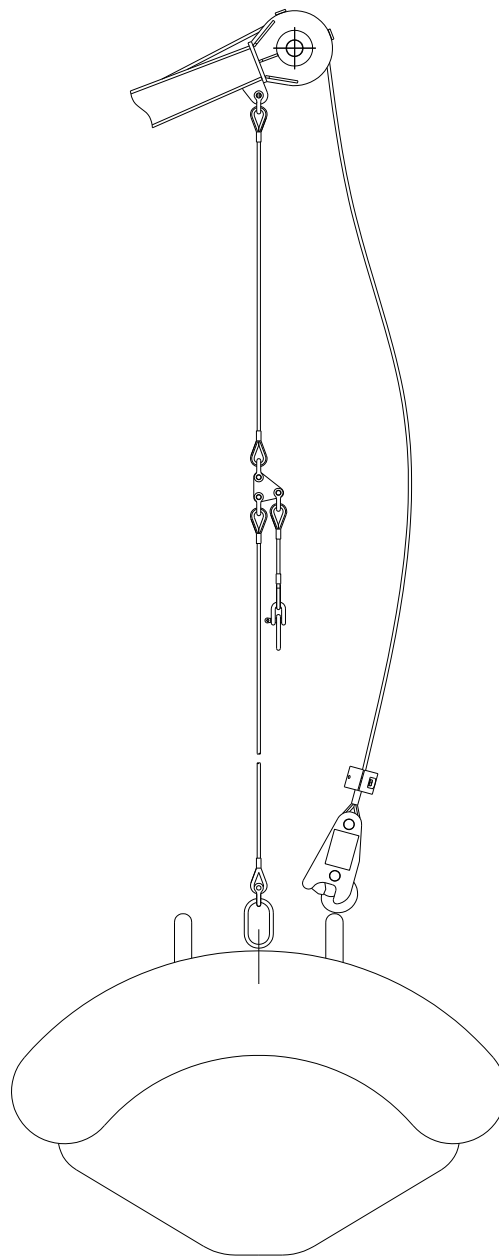


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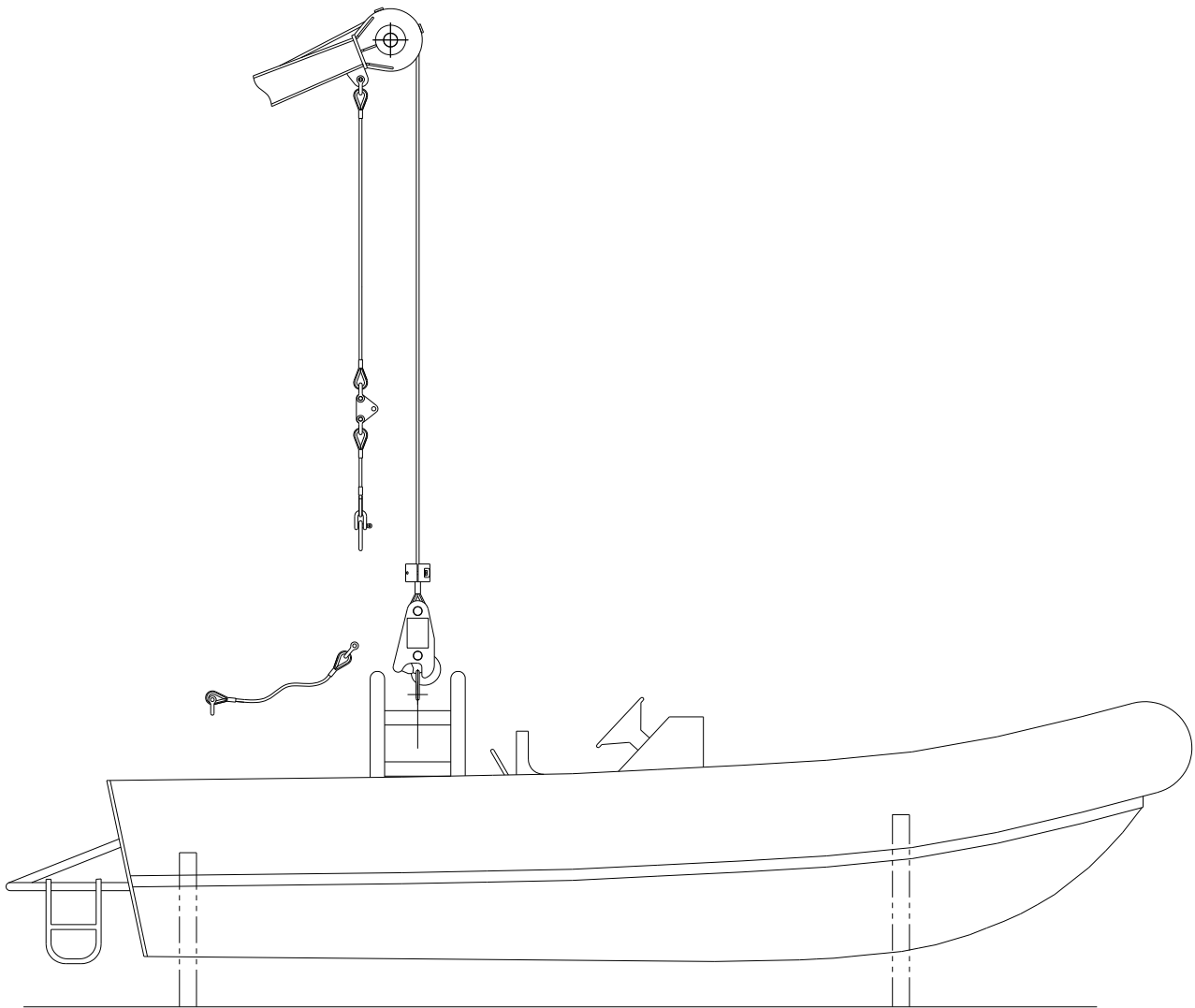
3. With passengers disembarked and with only essential crew remaining, hoist the light boat to allow attachment of the hang-off pendant.
4. Lower the falls rope until the weight is taken by the hang-off pendant. Detach the short stop to free the hook.



5

5. Lower the free hook and attach to the onboard lifting ring. Once secured, take the load on the hook and detach the hang-off pendant. Secure the free hang-off pendant so it cannot interfere with hoisting.





6

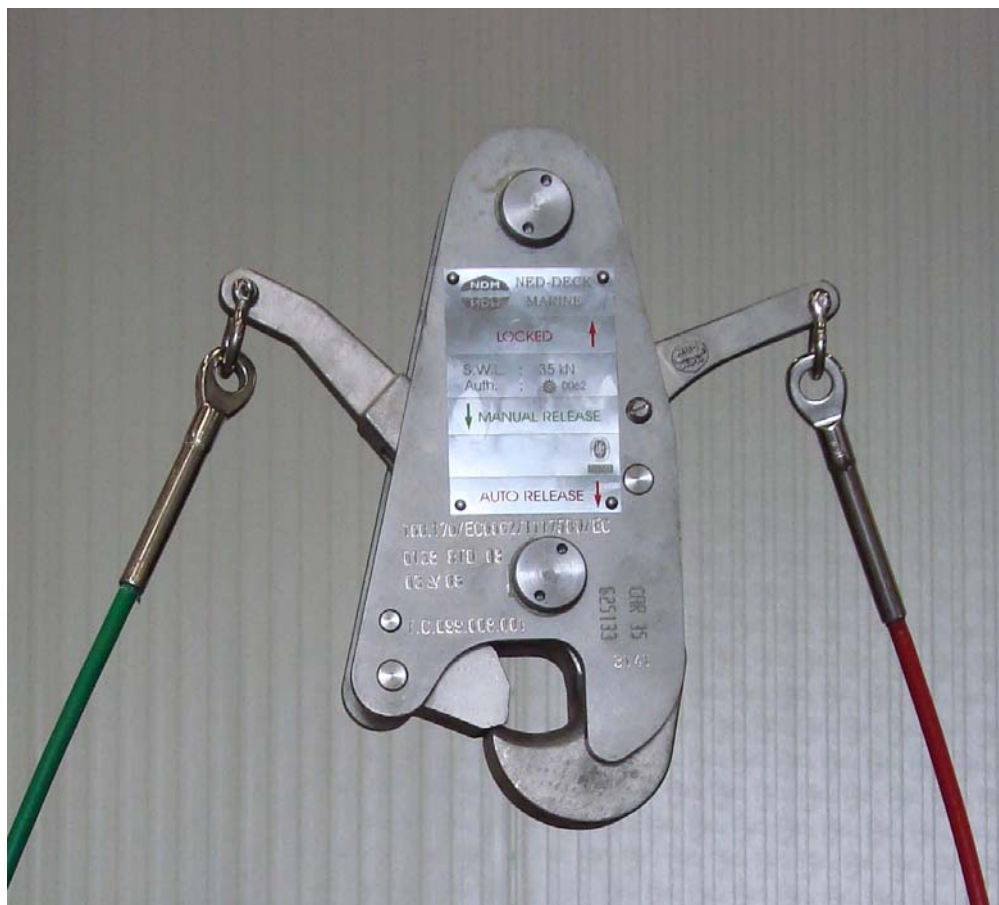
6. Hoist and slew boat to designated stowage location and secure to normal onboard procedure.

The foul weather stop, hang-off pendant and associated components should be cleaned and secured, or disconnected for safe storage, in readiness for future use.





## CAR 35 Release Hook.



Supplied by Ned-deck marine

Ambachtsweg 10  
3771 MG Barneveld  
Holland

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*Revision / Date*  
A / 27-07-2009





27-7-2009

Operation CAR 35 Release Hook

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## 1. CAR 35 Release Hook.

The CAR 35 release hook meets the high SOLAS standards for off-load release hooks, as described in the MSC.81(70) and applicable LSA code, and is dimensioned to suspend davit launched life rafts up to 40 persons and rescue craft with a davit load not exceeding 3.500 kg.

Remember that with this release hook, in both automatic and manual release modes, the actuating lever has to be locked in the automatic release position just before the craft enters the water.

For your information:

- Use non-rotating wire rope.
- Use a painter line where possible.
- Use a shackle Ø19 mm up to Ø27 mm.

During installation of the hook, only the top shaft should be disassembled. Full disassembly of the hook can cause un-repairable damage to the system and dangerous situations which can lead to injuries or death of personnel.

### 1.1. Hook particulars.

Hook manufacturer:	Ned-Deck Marine.
Hook type:	CAR 35 Automatic release hook. Off-load release type.
Maximum working load:	35 kN
Static proof load:	87,5 kN
Dimensions (without Lanyard):	285 x 260 x 70 mm
Total approx. Weight:	6,1 kg
Auto Release Mode (hook load limit):	0,208 kN
Auto Release Mode (actuating force):	0,157 kN

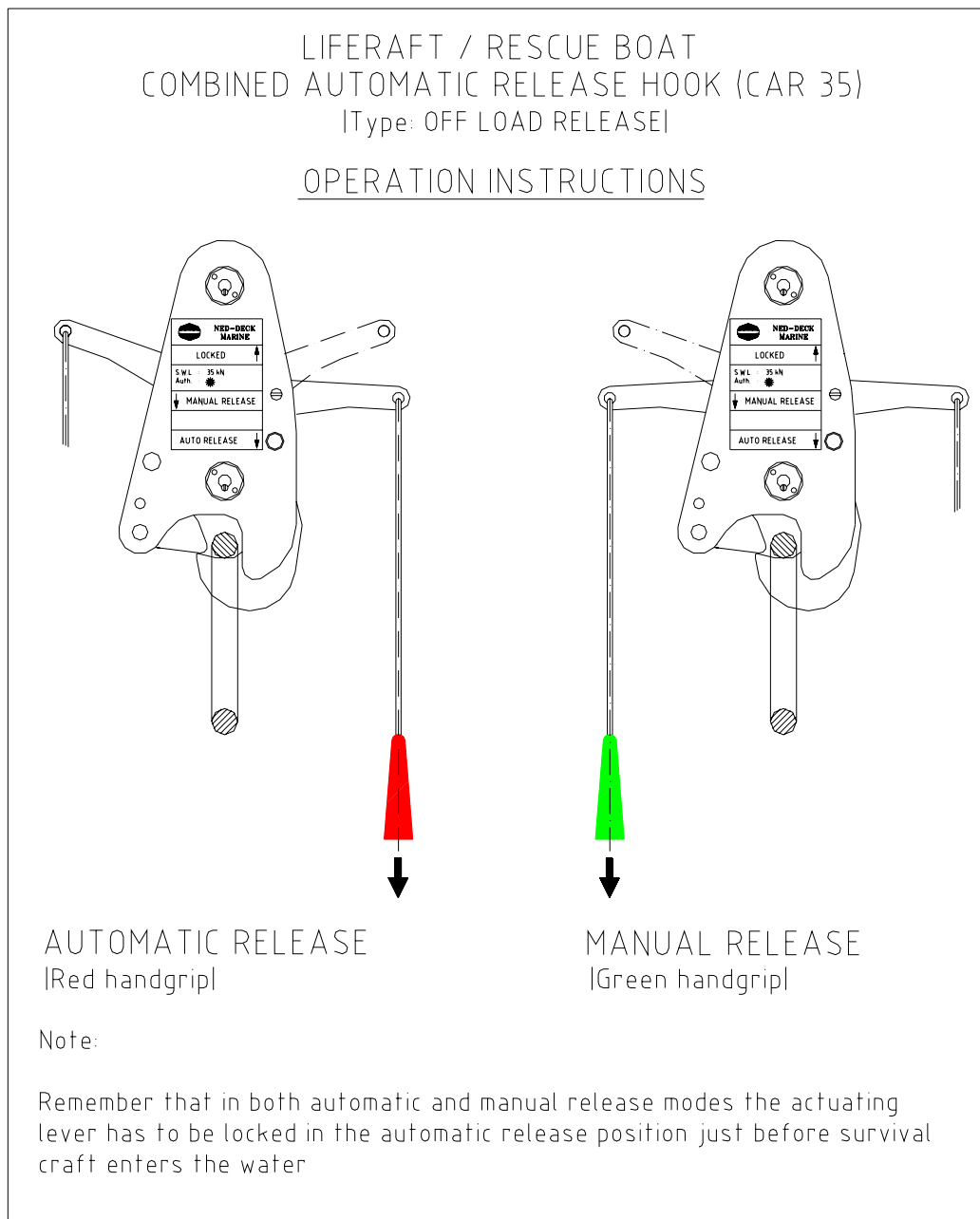


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Operation CAR 35 Release Hook

## 2. General instruction plates.

Operation instruction plate:



**NED-DECK MARINE**  
Survival Systems & Deck Equipment

Ambachtsweg 10  
3771 MG Barneveld  
The Netherlands

Tel.: (31) 342-422105  
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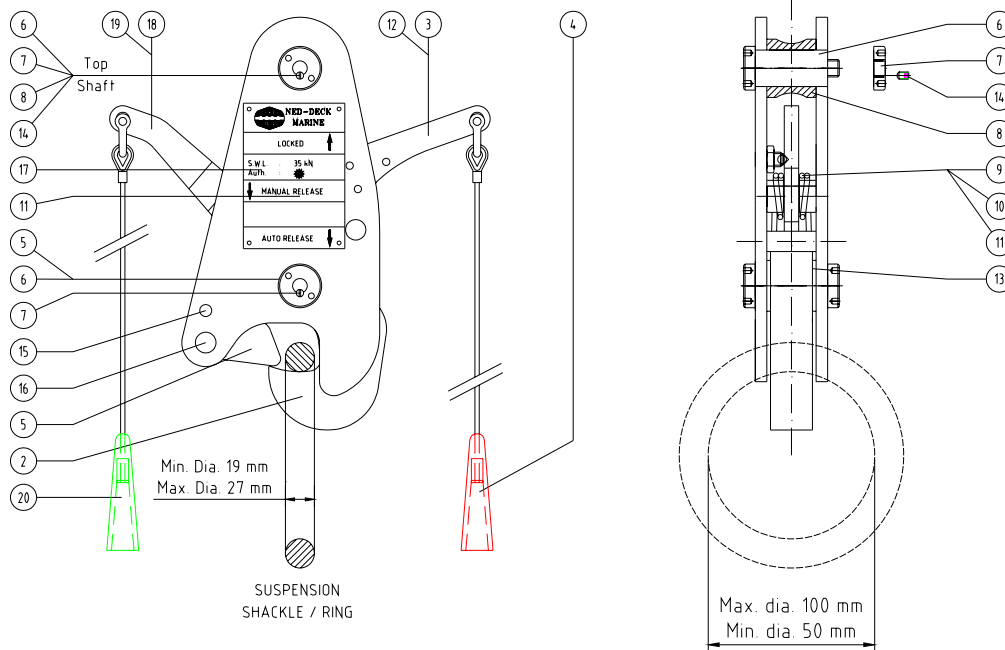
Installation instruction plate:



# NED-DECK MARINE

Survival Systems & Deck Equipment

## LIFERAFT / RESCUE BOAT COMBINED AUTOMATIC RELEASE HOOK (CAR 35)



### HOOK INSTALLATION DETAILS

#### DISASSEMBLY (top shaft only):

- Loosen securing screw (14)
- Loosen nut (07)
- Remove shaft (06)
- Remove distance bush (08)

#### ASSEMBLY (top shaft only):

- Place bush (08) into spliced eye of corresponding wirerope fall
- Re-insert bush between side plates and re-insert the shaft (06)
- Re-tighten nut (07)
- Place securing screw (14)

NOTE: - USE NON ROTATING WIRE  
- USE PAINTERLINE  
- USE SHACKLE 19mm UP TO 27mm

### PARTS LIST CAR 35

ITEM - Component	QTY
01 - Side plate	2
02 - Hook	1
03 - Actuating lever	1
04 - Actuating cord grip (red)	1
05 - Latch	1
06 - Shaft	2
07 - Nut	2
08 - Distance bush	1
09 - Bush	2
10 - Spring	1
11 - Shaft	2
12 - Shaft	1
13 - Bearing bush	2
14 - Securing screw	3
15 - Shaft	1
16 - Shaft & Spring	1
17 - Type plate	1
18 - Actuating lever	1
19 - Shaft	1
20 - Actuating cord grip (green)	1
- Assembly tools (delivered separately)	



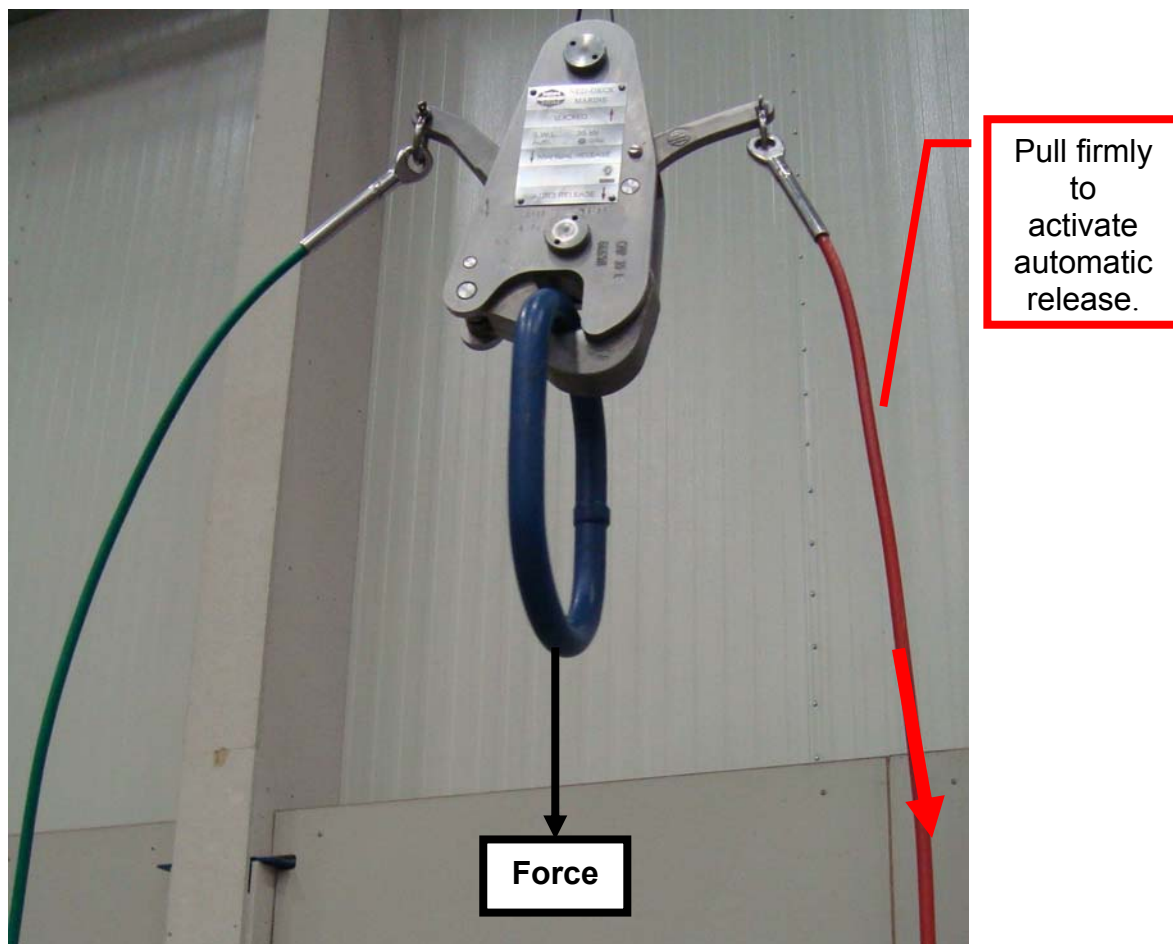


### 3. Function

#### 3.1. Automatic (Red hand grip) and manual (Green hand grip) release.

The “Red hand grip” is designed for off-load release. This function is being used during all operations. When we activate the off-load release, the hook shall not open with a load in the hook > 30 kG. When the load is released, the hook shall open (opening between 5 – 30 kG force). Common use is to pull the “Red hand grip” during lowering. When waterborne, the hook will automatically open and the rescue boat can sail away from the vessel.

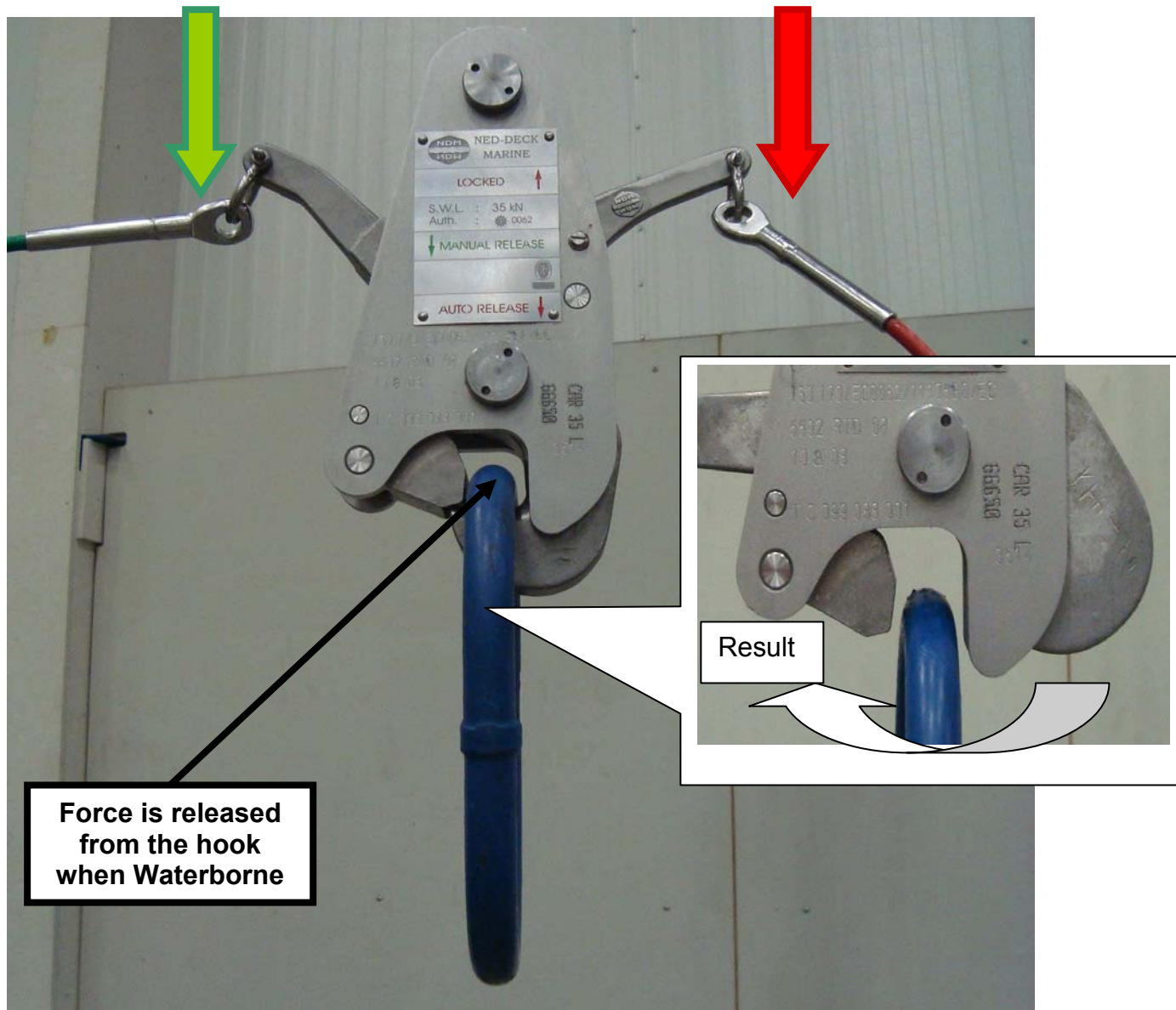
- When lowering, pull the “Red hand grip” to activate the automatic release as shown in the below figure.







- When waterborne the load is taken away from the hook and it opens automatically. See figure below.



The “Green hand grip” is designed for on-load release till approx 150 kg. For example, when the craft is waterborne, and there is a strong current, the craft can pull on the wire rope and therefore keep the load on the hook system. This means, that under these circumstances the off-load release system will fail. Therefore an extra on-load release (Green hand grip) has been provided. This system can be activated by pulling the “Green hand grip” and releases the hook at all times. Up to a weight of 150 kg, the required pulling force is approx. 60 kg.





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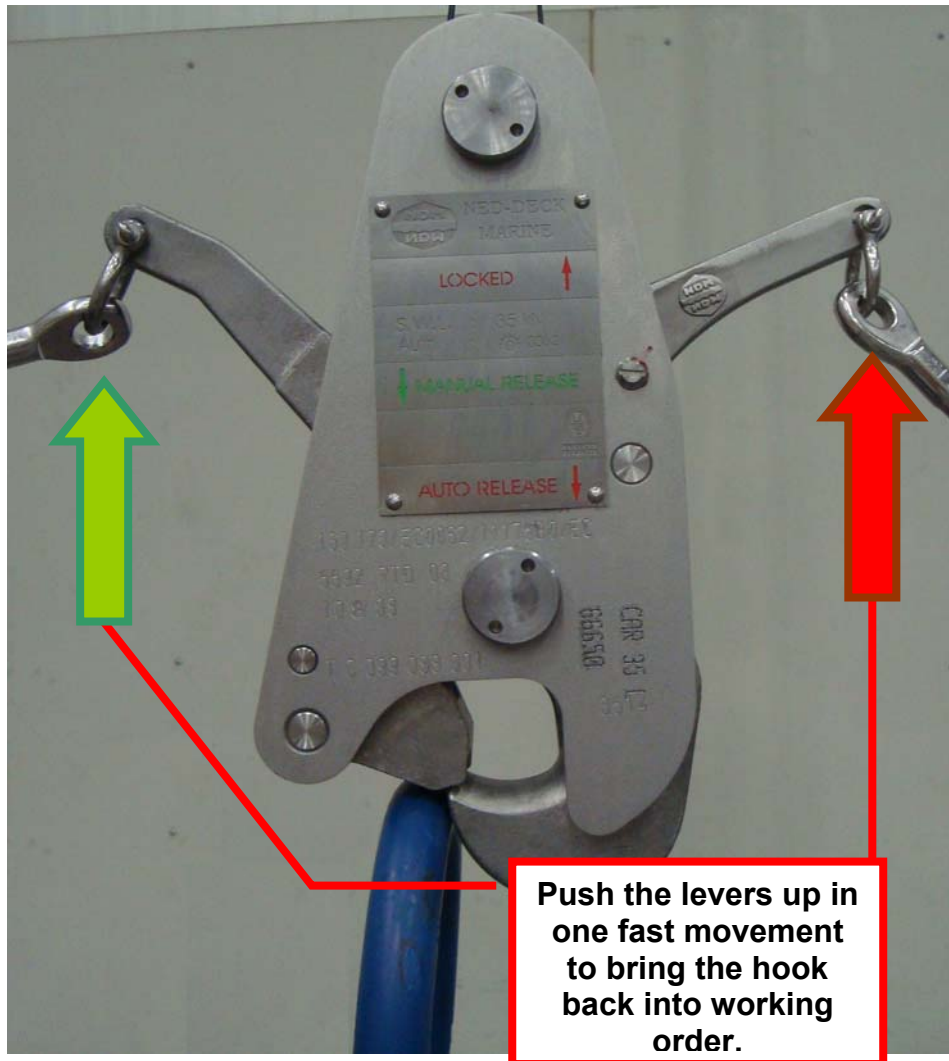
Operation CAR 35 Release Hook

### 3.2. Loading the link into the hook.

Before we place the link into the hook, we must bring the hook back into working order.

The following procedure must be followed:

- Swing (press firmly) the hook and release lever back into working position. See insert below.

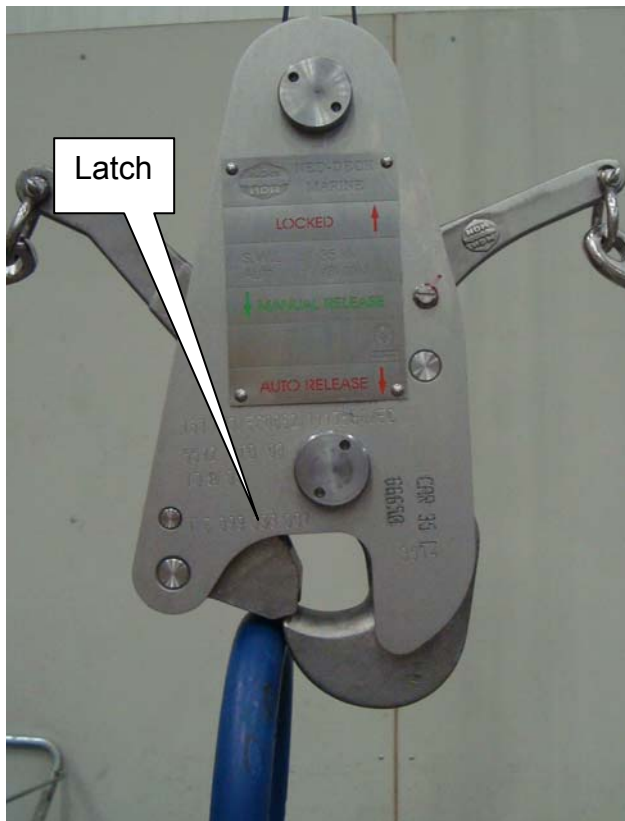




## Operation CAR 35 Release Hook

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- When ready for loading the hook, press the suspension link of the rescue craft into the hook (as shown below). The latch will rotate up and the suspension link slides in to place and will be locked automatically.



**Correct position.**

If the link is positioned incorrectly, we can release the hook by pulling firmly on the "Red hand grip". Now we can reposition the hook as described above and place the link correctly.

h the  
ension  
ough the  
firmly!

Result



27-7-2009

Operation CAR 35 Release Hook



## 4. Maintenance program

According to the latest IMO/SOLAS rules and regulations (MSC 1206) release hook mechanisms require annual services by the manufacturer or an authorized service station.

In compliance with before mentioned regulations and for our customer's convenience,  
Ned-Deck Marine has implemented the unique '**CAR 35 Replacement Program**':

The CAR 35 combined automatic release hook, used onboard your vessel, will require annual service by the manufacturer, Ned-Deck Marine (NDM). To save time and labour of a service engineer visit, NDM will send you a reconditioned, updated and newly certified CAR 35 hook by courier to your vessel or an agent/port of your choice.

Upon arrival you can swap your 'old' hook with the newly certified CAR35 hook sent by NDM.

At this point you have installed a newly certified hook and are in compliance with Class regulations.

You are only required to return the currently used (old) hook to the NDM office in The Netherlands.

This will save you lot's of time and money! Prices for the newly certified and reconditioned CAR 35 hooks can be obtained from our service department

Should you wish to enter this '**CAR 35 Replacement Program**', please inform us your IMO number, vessel name, delivery address and contact person, invoice address & VAT details



WELIN LAMBIE LTD

## NETT WEIGHT DATA SHEET

Equipment weights for tech spec 6094-82120-53 rescue boat davit

Irvine PO # 909540H

Contract No. : 7773		Customer : HALIFAX SHIPYARD		Weight Taken By :	
Davit Type : PIV 1.0A		Quantity : 1		Certified By : M A McGuinness	
Part No.	Part Description	Nett Weight - kg		Date	
		Each	Total		
5802-0701	control station stand assembly	11.7	11.7	17-Feb-2011	
	(as drawn & with trailing cables)				
5601-1901	davit assembly	417	417	17-Feb-2011	
	(as drawn with 'A' frame, winch, etc)				
5723-3401	hydraulic power pack assembly	198	198	17-Feb-2011	
	( as drawn with pump motor & accumulator &				
	control panel, etc)				
5683-4304	set of cold weather / ice covers	3.5	3.5	17-Feb-2011	
5601-1902	davit installation assembly	108.3	108.3	17-Feb-2011	
	(as drawn, but excludes all assemblies above)				
	all are as weighed, dry weights (i.e. No oils)				
Page 1 of 1		Total Weight : <b>738.5</b> <b>kg</b>			



**A.J.T. EQUIPMENT LTD**

PREMIER ESTATE, THE LEYS, BROCKMOOR,

BRIERLEY HILL, WEST MIDLANDS. DY5 3UP

Tel: +44 (0) 1384 482848 Fax: +44 (0) 1384 482849

Email: admin@ajtequipment.co.uk

www.ajt-testing.com

**CERTIFICATE OF CALIBRATION****~ LOAD MEASURING EQUIPMENT ~**

<b>Customer:</b> WELIN LAMBLE LTD BRITANNIA HOUSE OLD BUSH STREET BRIERLEY HILL WEST MIDLANDS DY5 1UB			<b>Equipment Description:</b> 5 TONNE ACCUWAY LOAD CELL		
			<b>Serial No:</b>	D.C.H 119	
			<b>Date of Calibration :</b>	25/01/2011	
			<b>Validation Period:</b>	12 Months	
			<b>Certificate No:</b>	M13705	
TRUE FORCE UNITS	LOAD MEASURING EQUIPMENT INDICATED FORCE IN UNITS			AVERAGE FORCE UNITS	0% ERROR APPLIED LOAD
	1	2	3		
TONNES	TONNES	TONNES	TONNES	TONNES	
0.500	0.496	0.494	0.496	0.495	-0.93
1.000	0.992	0.990	0.991	0.991	-0.90
1.500	1.489	1.486	1.488	1.488	-0.82
2.000	1.985	1.982	1.984	1.984	-0.82
2.500	2.48	2.47	2.48	2.477	-0.93
3.000	2.98	2.97	2.98	2.977	-0.78
4.000	3.98	3.97	3.98	3.977	-0.58
5.000	4.98	4.98	4.98	4.980	-0.40

**BASIS OF TEST:**

IN ACCORDANCE WITH INTERNATIONAL STANDARD ISO 7500-1:2004(E) PART 2.

TENSION/COMPRESSION TESTING MACHINES -

VERIFICATION AND CALIBRATION OF THE FORCE MEASURING SYSTEM

**METHOD OF CALIBRATION:**

BY STRAIN GAUGE LOAD CELL(S) AND ASSOCIATED DIGITAL INDICATOR,

CERTIFIED TO BS EN ISO 376 : 2004

**ACCURACY OF CALIBRATION**

+/- 1% OFF APPLIED LOAD

**CALIBRATION DEVICE REFERENCE:**

AJT01

CERTIFICATE No: T7629

**TEST TEMPERATURE**

Deg.C:

23.1

AJT Equipment Ltd ~ Authorised Signature

Date

QD018



CHECKED FOR  
WELIN LAMBLE LTD.  
BY *NH*  
DATE 27/01/11

## NOTES

## NOTES



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**Welin Lambie**

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