Hawboldt Industries (1989) Ltd.
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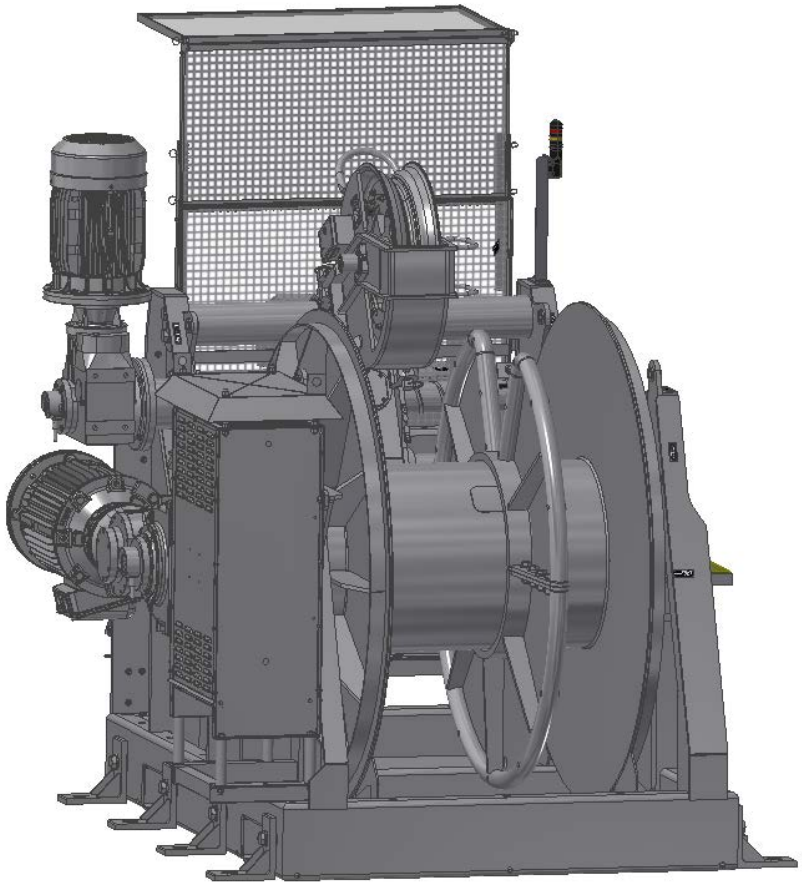
SPRE-3464

INSTALLATION, OPERATION & MAINTENANCE MANUAL



Customer: University of US San Diego	**Sales Order:** 38579
Purchase Order: 92043515	**Serial Number(s):** 1943-1
Purchase Date: 09 JUL 2019	

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REVISION HISTORY

Rev	Date	Description	Issued By
-	29-FEB-2020	First issue.	DHM

1.0: WARRANTY

This section contains the Hawboldt Industries (1989) Ltd. – Standard Terms and Condition of Sale.

Hawboldt Industries (1989) Ltd. – Standard Terms and Condition of Sale

HAWBOLDT INDUSTRIES (1989) LTD.
220 Hwy 14, Chester, NS B0J 1J0
herein referred to as "HAWBOLDT"

GENERAL CONDITIONS OF SALE

I. Design and improvement of our equipment is a continuous process. Hawboldt, therefore, reserves the right to make design improvements after receipt of an order. Photographs and other illustrations or advertising matter represent generally the goods offered, but are not binding in detail.

II. Delivery dates are estimated as accurately as possible, but are not guaranteed in any way unless otherwise specifically provided for in this proposal.

III. Unless otherwise specifically provided for in this proposal, this offer does not include a penalty clause of any kind and acceptance of this offer may not create, by its terms, any such penalty clause.

IV. Prices quoted herein are based on current duty and currency exchange rates where applicable, and Hawboldt reserves the right to adjust prices to compensate for any changes in these rates, should it be necessary to do so.

V. Notwithstanding any conditions printed on the Purchaser's order form, in accepting this offer the Purchaser agrees to the following TERMS AND CONDITIONS OF SALE which are also detailed on the Hawboldt Acknowledgment and Acceptance of Order Form, and these Terms and Conditions only will apply unless otherwise specifically provided in this proposal.

TERMS AND CONDITIONS OF SALE

l. **CONTRACT OF SALE -** This order is accepted on, and is subject to, the terms and conditions set forth on the face hereof and below, none of which may be varied or added to except in writing, signed by HAWBOLDT'S duly authorized representative. Any inconsistent matters, terms or conditions in Purchaser's order or confirmation will not be binding on Hawboldt. HAWBOLDT HEREBY EXPRESSLY OBJECTS TO ANY ADDITIONAL OR DIFFERENT TERMS IN ANY OF PURCHASER'S DOCUMENTS.

2. **COMPLETION -** Unless otherwise provided on the face hereof, time for the completion of manufacture of the machinery and equipment covered by this order (hereinafter called the "Machinery") shall be computed from the date of the Acknowledgment and Acceptance of Order, or from the date on which Hawboldt has received from the Purchaser any information, drawings, data, patterns, or other material which are to be supplied by the Purchaser and are necessary to proceed with the manufacture of the machinery, whichever is the latest. Hawboldt shall not be responsible for delays in delivery or any failure to deliver due to causes beyond its control including without limitations: acts of God or the public enemy; mobilization; blockades; embargoes, revolution; civil commotions, riots; fires; floods; winds; earthquakes; epidemics; quarantine restrictions; explosions; accidents; other catastrophes; strikes; slowdowns; lock-outs or other labour difficulties; the acts; laws or regulations of any government or governmental authority; federal, provincial, local or foreign, including safety, health and environmental regulations; unusual weather; delays of sub-contractors or suppliers; or inability to obtain shipping facilities, labour, raw materials, supplies, fuel or power.

3. **MINIMUM INVOICE -** The minimum single invoice or billing charge is $150.00

4. **PAYMENTS -** If payment of any part of the purchase price is not made as provided on the face hereof, Hawboldt reserves the right to discontinue manufacture of the Machinery until such payment has been made and to revoke any further credit, whereupon Hawboldt shall have the right to receive payment before any further shipment of Machinery. In the case of any delay in payment or in establishing agreed security for payment, time for completion may, at Hawboldt's option, be extended for a corresponding period. When any payment is due upon shipment or delivery and shipment is delayed for any cause beyond Hawboldt's control, payment shall be made when the machinery is ready for shipment. Purchaser agrees that any letters of credit or other guarantee of payment shall be maintained fully valid until final payment has been made. IF PAYMENT IS NOT MADE WITHIN THIRTY DAYS FROM THE DATE OF SHIPMENT UNDER THE TERMS OF THIS AGREEMENT, PURCHASER AGREES TO PAY HAWBOLDT AN ADDITIONAL SUM EQUAL TO 2% PER MONTH, 24% PER ANNUM OF THE UNPAID PURCHASE PRICE UNTIL PAYMENT IS MADE.

5. **SECURITY INTEREST -** Hawboldt retains a vendor's lien in the machinery to secure payment in full of the purchase price and any and all other payments which may be or become payable to Hawboldt hereunder. If possession of the Machinery is given to the Purchaser before full payment, the Purchaser shall execute any additional instruments including without limitation security agreements and financing statements necessary to perfect or maintain Hawboldt's vendor's lien and shall pay or reimburse Hawboldt for all filing and recording costs including without limitation, any taxes payable upon filing or recording. In the event of default in payment of any installment of the purchase price when due, the entire balance thereof shall, at Hawboldt's option, become immediately due and payable, and Hawboldt shall have and may exercise all the rights of a secured party then in force under the laws of the Province of Nova Scotia, Canada or such other province or state as may then have jurisdiction over the machinery, including without limitation the right to repossess the Machinery with or without legal process.

6. **DELIVERY AND PURCHASE PRICE -** Unless otherwise provided on the face hereof, delivery is to be made Ex-Works Hawboldt's plant, Chester, Nova Scotia, Canada. Risk of loss within the meaning of the Sale of Goods act of the Province of Nova Scotia shall pass to the Purchaser at the stated point of delivery. The purchase price includes ordinary packing for shipment, but if special packing or tie-down and blocking to anchor the machinery to the transport vehicle is required, Hawboldt is to be reimbursed for the cost thereof. The shipping charges are the responsibility of the customer. Unless otherwise stated in the purchase order, Hawboldt will select a suitable courier to deliver the goods. The goods will be delivered, with freight charges being on a "collect" basis. The goods will be insured unless otherwise specified by the customer. Any freight or insurance costs, which may be included in the purchase price, are based on rates at the date of the Acknowledgment and Acceptance of Order and any increase shall be paid by the Purchaser.

7. **WARRANTIES -** Hawboldt warrants that it will repair F.O.B. its factory or furnish without charge F.O.B. its factory, a similar part to replace any material in its machinery which, during the earlier of 1 year after the said machinery is put into operation or 18 months after the date of shipment of the machinery from its plant, is proved to the satisfaction of Hawboldt to have been defective at the time it was sold, provided that all parts claimed defective shall be returned, properly identified, to Hawboldt's factory, charges prepaid.

This Warranty to repair applies only to new and unused machinery, which, after shipment from the factory of Hawboldt, has not been altered, changed, repaired or treated in any manner whatsoever unless such alteration, change, repair or treatment has been previously authorized in writing by Hawboldt or has been performed by the authorized service representative of Hawboldt.

This Warranty to repair is the only Warranty either express, implied, or statutory, upon which the said machinery is sold; the company's liability in connection with this transaction is expressly limited to the repair or replacement of defective parts, all other damages and warranties, statutory or otherwise, being hereby expressly waived by the Purchaser.

Component parts and equipment not manufactured by Hawboldt are warranted only to the extent they are warranted by the supplier to Hawboldt. Hawboldt will use reputable suppliers.

Hawboldt shall not be liable for any incidental or consequential damages for breach of any warranty and the Purchaser's sole remedy for breach of any warranty or for any negligence of Hawboldt shall be as set forth herein.

Hawboldt makes no warranty that the machinery shall be merchantable or fit for any particular purpose nor does it make any other warranty, express or implied except as is expressly set forth herein. Hawboldt warrants that the machinery will conform to the description on the face hereof; that it will convey good title thereto; that such goods will be delivered free from any lawful security interest or other lien or encumbrance unknown to the purchaser except as otherwise expressly provided herein.

No representative of Hawboldt has authority to change this Warranty or this contract in any manner whatsoever and no attempt to repair or promise to repair or improve the machinery covered by this contract by any

Hawboldt Industries (1989) Ltd. – Standard Terms and Condition of Sale

representative of Hawboldt shall waive any consideration of the contract or change or extend this Warranty in any manner whatsoever.

8. **LIABILITY -** Purchaser agrees to hold Hawboldt harmless from, and to indemnify it against, any and all claims, demands, actions, and causes of action of any nature whatsoever, and any expenses incident to the defence thereof, for injury to or death of persons and loss of or damage to property arising in connection with the Machinery or the assembly, erection, operation, or use thereof.
Hawboldt shall be under no obligation after shipment to assemble, erect or test the machinery unless specifically provided for on the face hereof. If the contract provides for instruction or installation services, Hawboldt's sole obligation with respect thereto shall be to provide the purchaser at his expense, (unless otherwise provided herein) an experienced person or persons, who shall become the agent or agents of the Purchaser and remain such for the period provided. Hawboldt shall under no circumstances be liable to the Purchaser or anyone else for any acts or omissions of any such person or persons.

9. **TAXES -** All present and future sales, use, excise and similar taxes imposed by any federal, provincial, local or foreign government which Hawboldt may be required to pay or collect with respect to the machinery or the sale, transportation, storage, use or consumption thereof shall be for the account of the Purchaser to the extent permitted by law. Unless otherwise stated in the proposal, Federal and Provincial sales taxes are not included in prices quoted for domestic sale. With the exception of the province of Nova Scotia, the purchaser is responsible for remittance of Provincial taxes.

10. **NON-CANCELLABLE -** This order is not subject to cancellation or revision by the Purchaser except with Hawboldt's written consent. Cancellation charges will be:
(a) Fifteen percent (15%) of the total purchase price to cover Sales Administration and handling costs, plus
(b) The cost of all unfinished material and the shop labour with overhead plus component cancellation charges from Hawboldt's vendors if any, plus Engineering costs incurred with overhead, plus profit in proportion to the state of completion of the product at the time of cancellation of the order. Upon payment to Hawboldt as above provided, all equipment manufactured under the contract will become the property of the Purchaser.

11. **NON-ASSIGNABLE -** Neither this contract nor any interest herein is assignable or transferable without the express written consent of Hawboldt.

12. **WAIVER -** Any waiver by either the Purchaser or Hawboldt of a breach by the other of any provision of this contract of sale shall not be deemed a waiver of future compliance therewith, and all provisions shall remain in full force and effect, notwithstanding any such waiver.

13. **LIMITATION OF ACTION -** No action shall be brought by the Purchaser for any alleged breach by Hawboldt of this Contract of Sale more than one (1) year after the occurrence of the cause of such alleged breach of contract.

14. **APPLICABLE LAW -** This contract shall be governed and construed according to the law of the Province of Nova Scotia, Canada.

15. **DELAY IN SHIPMENT** - Prices quoted are based on shipment dates indicated. If shipment is delayed at the request of the customer, or because of incomplete shipping information/documentation, or a delay in receipt of customers order confirmation, or because of delay in receipt of Letter of Credit (if applicable), Hawboldt reserves the right to review extra costs resulting from delay and increase prices accordingly.

16. **INSPECTION AND TESTING -** The equipment quoted will be subject to standard Hawboldt inspection and testing before shipment. Any other inspection or testing required by the customer must be specified at time of the order and shall be at the customer's expense unless otherwise stated in the proposal. Customer will be responsible for costs of inspection and tests requested after Hawboldt's acceptance of the order and any costs resulting from delay in shipment.

17. **QUANTITIES** - Prices quoted are based on the purchase of the quantities indicated. Prices may be adjusted by Hawboldt if quantities other than those quoted are actually purchased.

SPECIAL CONDITIONS FOR EXPORT SALES

A. **EXPORT LICENSE -** if any Canadian regulation requires an export license, Hawboldt will apply for such license at its expense, and Purchaser agrees to furnish all information required for such license application. In case Hawboldt is unable to secure an export license, the contract between the parties shall be cancelled without liability on either party.

B. **IMPORT LICENSE -** If an import license is required, it is to be provided by Purchaser who will see that it remains valid and effective until the import has been completed.

C. **REGULATIONS -** The making and performance of the contract between the parties are subject to compliance with all applicable laws and regulations of the Canadian Government and agencies thereof, and in case any such law or regulation should prevent Hawboldt from performing or completing the contract in accordance with the terms thereof, then the contract may be terminated by Hawboldt upon written notice to the Purchaser. In such event, Hawboldt and any surety for Hawboldt will be relieved of all further obligation to proceed; any guaranty deposit or surety bond furnished by Hawboldt shall immediately be returned to Hawboldt and Hawboldt is to be paid the proportion of the contract price, including profit, represented by the expenditure made and the obligations contracted to the date of such termination. Upon return to Hawboldt of any guaranty deposit or surety bond and payment to Hawboldt as above provided, all equipment manufactured under the contract will become the property of the Purchaser.

D. **PAYMENT TERMS** - Unless other mutually agreed to payment terms are arranged in advance in writing, payment will be by Irrevocable Letter of Credit Confirmed by any Chartered Canadian Bank, payable at sight. Unless otherwise stated in the body of this proposal, equipment will be supplied ex-works (not including shipping preparation and loading) INCO International Chamber of Commerce, 2000 Revision, Publication 560, with payment to be made against the Confirmed Irrevocable Letter of Credit upon presentation of shipping documents. The Letter of Credit shall be established with Hawboldt 's bank, all charges for the account of the Buyer.

E. **SHIPMENT DATE** - Equipment offered in this proposal is "estimated" to be ready for shipment in the time frame indicated on the proposal. Shipment date is based on receipt of firm order, a Letter of Credit acceptable to Hawboldt, and down payment (if required) at our Chester, Nova Scotia Office. Shipping date will be confirmed at time of order.

F. **CURRENCY AND TAXES** - Unless otherwise stated prices quoted are in Canadian funds, and do not include any import duties, customs fees or taxes of country of import. No Canadian taxes are applicable or included.

G. **PACKAGING** - Unless otherwise stated prices quoted are on shipment in suitable ocean containers. However, Hawboldt has the facilities to partial crate or full crate the equipment quoted. Prices for this service can be quoted at the customer's request.

H. **FEES** - All handling and freight forwarding fees are to the account of the buyer.

I. **DOCUMENTATION REQUIREMENTS** - Received for Shipment Ocean Bills of Lading or Freight Forwarders Certificate of Receipt in cases where customer has specified use of a freight forwarder.

2.0: SPECIFICATION

2.1: DESCRIPTION

The SPRE-3464 winch is a portable general-purpose winch to be used for any type of deployment. The winch frame is designed to fit the UNOLS standard 2'x2' bolt pattern and has lift points for equal length slings and fork pockets. The electrical controls panel and braking resistor are integrated into the winch skid and require a single point power connection making installation quick and easy. It is a single drum, direct pull type unit driven by a right-angle helical bevel gearbox and totally enclosed non-ventilated (TENV) electric motor with integral failsafe. The failsafe brake is a parking brake only and should not be used for dynamic braking. Dynamic braking is achieved through the variable frequency drive and braking resistor.

The winch has a hollow stub shaft to accommodate a Focal 180 model slip ring. If using a slip ring the cable should connect to the slip-ring inside winch drum where there are a few service loops of cable before it is clamped to a fixing point.

The winch has a smooth drum so that it can accommodate various sized cable and line hardware. The cable is passed through a hole in the drum barrel along the flange and clamped on the inside of the barrel.

The winch uses a PLC controlled in-line levelwind which is capable of variable speeds for spooling cable of various diameters. The levelwind includes a sheave with large curved aluminum cheek plates for passing line hardware up to 6" diameter. The sheave contains sensors for payout and line speed data, as well as a load pin in the axle for tension measurement. A lead screw, driven by helical-bevel gearbox and electric motor, is used to traverse the level wind sheave across the drum. Sensors measuring drum and screw rotation are used to control the levelwind position and Hawboldt spooling system is used to manage the levelwind from the HMI on the control console. The levelwind can also be parked for deployments where it is not required to pass cable through sheave.

The winch is controlled from a control console mounted on the winch which houses operator devices as well as Hawboldt's sunlight readable HMI interface. This console gives full control and monitoring of winch and levelwind. A wired remote belly pack is also supplied that can be connected to the winch. Remote control is limited to winch operation only with limited monitoring (no HMI).

2.2: PERFORMANCE

The performance values shown below are the maximum and must not be exceeded.

Wire Layer	Approx. Diameter (inch)	Pull (lbs)	Line Speed (ft/min)
Bare Drum	25.03	10,000	92
Full Drum	63.10	3,950	232

2.3: SPECIFICATIONS

Parameter	Value
Weight (Operation)	9850 lbs (no drum flange)
Drum Capacity	2,400 m of 1” Wire
Bare Drum Diameter	24”
Flange Diameter	64”
Distance Between Flanges	34”
Main Electrical Supply	480VAC/3PH/60HZ/90A
Control Voltage	24 VDC

2.4: PAINT SPECIFICATION

This piece of equipment was painted at factory with the following 3 part paint system:

1 coat – International Interzinc 52 Zinc-Epoxy primer (green)

1 coat – International Interseal 670 HS Modified Epoxy tie-coat

1 coat – International Interfine 629 HS Modified Acrylic Top Coat (Color FS26270)

WARNING! Chipped, cracked or worn paint must be repaired to prevent corrosion of surfaces.

The winch frame has been hot dip galvanized for enhanced corrosion protection. Generally the galvanized coating can be repaired with cold galvanizing compound spray paint.

3.0: INSTALLATION

3.1: INSTALLATION

The General Arrangement drawing in the drawing section of this manual provides the layout of the winch including overall dimensions and footprint. The winch foundation should allow for easy installation and removal as well as ample drainage.

WARNING! A paint repair has been included in your shipment. Refer to Appendix C for directions on how to repair paint chips. If paint is not touched up after installation, components will start to rust.

WARNING! All bare metal surfaces on your winch have been coated with a rust prevention coating (Tectyl 506) prior to shipping. This coating should be removed from the levelwind guide rods and lead screw before use. Refer to Appendix C on instructions for removal.

3.1.1. ALIGNMENT

The winch levelwind has been designed for a maximum horizontal fleeting angle of +/-5^{o}. Ensure that the horizontal fleeting angle does not exceed this by measuring the cable angle with the level wind positioned at each flange. A vertical fleeting angle of +45^{o} to -10^{o} must also be maintained during normal operation.

These statements are true for use with the levelwind.

3.1.2. BOLT-DOWN INSTALLATION

The winch has 8x 1”-8 UNC threaded bosses in the frame for installing custom brackets for mounting to any bolt pattern.

The winch has been supplied with brackets installed to match the UNOLS 2’x2’ bolt pattern. If a non-UNOLS bolt pattern is required, simply remove these brackets and replace with the custom brackets.

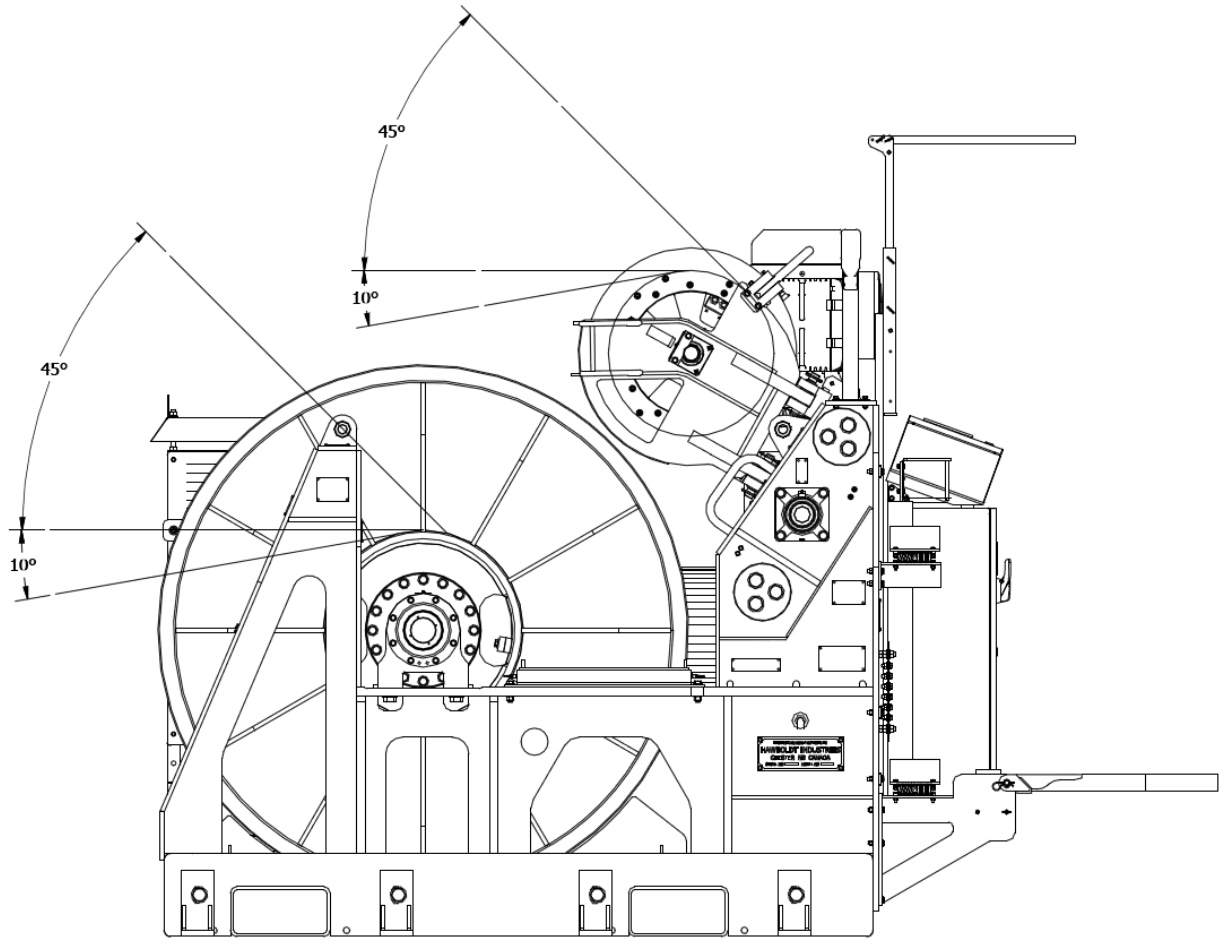
1”-8 UNC Gr.8 fasteners shall be used for mounting brackets to the winch frame.
1”-8 UNC 316 SS (ASTM F593H) fasteners shall be used mounting the brackets to the deck.

Torque specifications can be found in the Appendix of this manual.

Refer to the General Arrangement drawing in the drawings section of this manual for footprint details.

3.1.3. REEVING ARRANGEMENTS

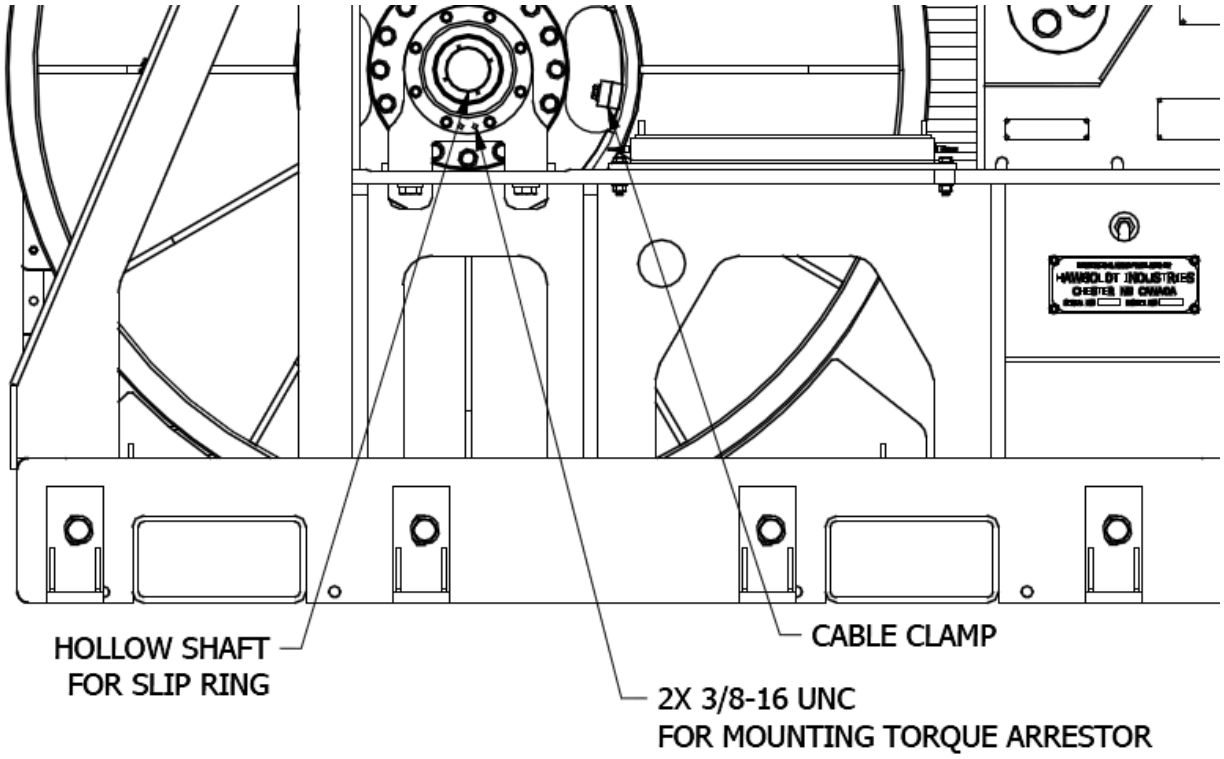
The winch can be used in two different orientations/reeving arrangements. The standard arrangement for the winch is to reeve the cable through the levelwind sheave. In this arrangement, tension and payout are monitored through sensors on the levelwind. The second arrangement is to have the cable exit directly off the drum. This arrangement allows for lower cable exit, however tension and payout cannot be monitored. The two acceptable arrangements are shown in the image below.



3.1.4. CABLE TERMINATION

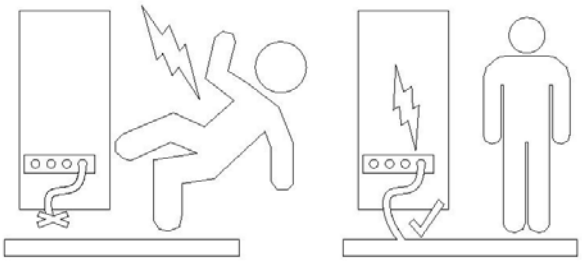
The winch drum includes provisions for Focal 180 Model slip ring as shown in the following image. The slip ring and cable are customer supply and will not be terminated by Hawboldt Industries. Openings in the drum core provide access to the cable and cable clamp. It is recommended that several service loops of cable should left wound inside the drum core to allow for re-termination of the cable.

Hawboldt has provided a cable clamp for ½" wire rope. Clamps for various size cables are available upon request.

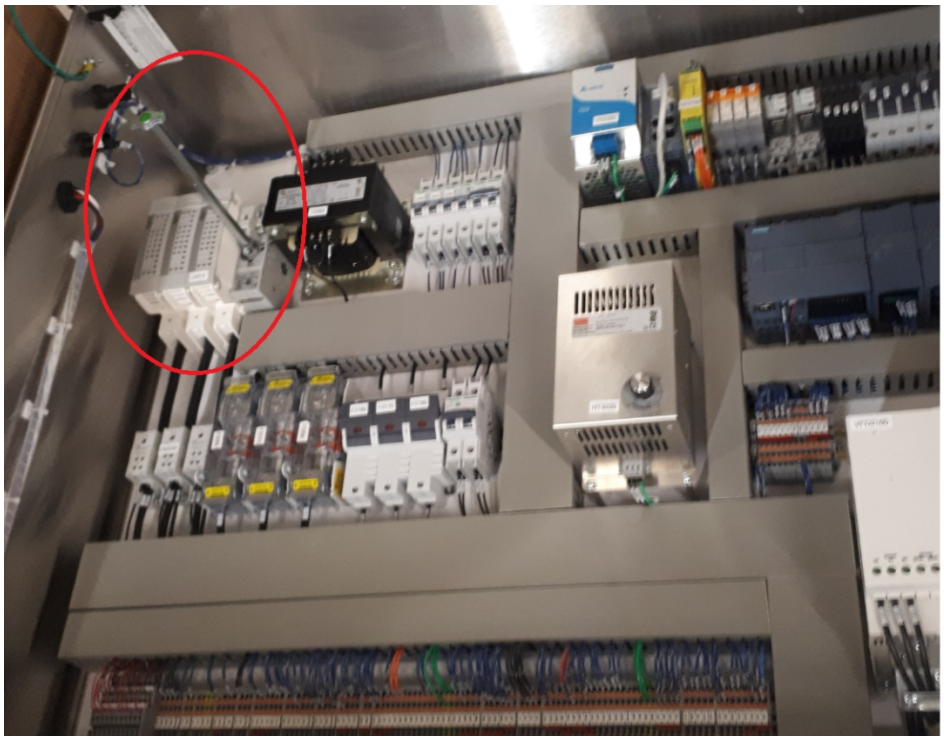


3.2: ELECTRICAL INSTALLATION

It is critical on installations that that the winch is bonded to the ship or mounting structure with 6 AWG copper wire or equivalent. This will increase the safety to the operational personal in case of electrical failure. This connection can be made the main bonding bar located to the left of the main panel.



The main power connection can be made at the large main panel. If a receptacle, plug, and length of wire are not provided, a power connection can be made inside the main large panel at the disconnect switch. A hole will have to be drilled preferable in the bottom of the panel. Use an appropriate marine rated cable gland for the diameter of wire. A grounding lug is provided inside of the panel. Note the standing platform will have to be removed in order to open the main panel.



The winch requires ~440-480VAC, 3 Phase, 90amps. The phases can be in any order and will not affect the operation. A grounding lug is provided to the left of the disconnect switch on one of the back plate mounting bolts, or bolted to the panels grounding stud.

Refer to electrical schematic 7400371 and interconnection diagram 7400373 for connection details.

The customer is responsible for ensuring the termination meets all required safety standards and specifications.

The winch is supplied with a pluggable hard wired ~40’ remote belly pack that allows remote control of winch. To connect the belly pack, first remove the protective caps from the mating connectors. Inspect the electrical pins and cups on both connectors to ensure they are free from debris. If any pins or cups are damaged, they will need to be fixed before a good connection can be made. The plug can only be plugged in one way. Gently rotate the wired connector until it slides into the mating panel connector. To lock the connector in place, turn the outside cuff until it locks. Connecting belly pack is optional and winch can be operated from winch mounted local console without it. It is recommended to disconnect and store belly pack in a dry space if it is not in use.

After an electrical connection and bonding is made to the machine, power can be applied. To turn the machine on, rotate the large disconnect switch to the ON position. The alarm buzzer will immediately sound. This is normal as e-stops energize in a fault state. Press the “RESET” button to silence the alarm. If the alarm does not silence, ensure all the e-stop buttons are “pulled off”.


RESET
REMOTE CONTROL
LOCAL CONTROL
WINCH PAYOUT
LEVELWIND JOG
D401009
WINCH HAUL IN
D401010

4.0: SAFETY

4.1: WARNINGS

Before operating this equipment familiarize yourself with all controls and their function. Equipment should only be operated by fully trained personnel.

The holding power of the brakes and proper functioning of all machine controls must be verified before the equipment is operated to ensure the operating conditions.

4.2: SAFETY RECOMMENDATIONS

It is essential to take precautions to ensure the safety of the operator and the crew while operating the winch system. The operator is to have a thorough knowledge of the winch system capabilities and always be present at the controls while the winch is running. The following recommendations are offered as a guide to safe operation:

- The equipment must be well maintained and be in good operating condition.
- Never attempt to clean or lubricate equipment components while the equipment is running.
- Never operate the controls until it is certain that all crew are clear of moving gear.
- Never exceed the maximum load ratings.
- Be sure the equipment is properly lubricated before use. See section on lubrication and maintenance.
- Never use this equipment to carry or lift people. It is not designed for this purpose.
- Before starting the system, be sure all controls move freely and are in the neutral position.
- Operate the controls smoothly to prevent shock loads to both the equipment and rigging.

5.0: SYSTEM OPERATION

Before Operation Begins:

- **WARNING!** When operating the winch the condition of the equipment must always be monitored by the operator with a clear view of the equipment.
- Use smooth, gentle motion with the joysticks. Sudden movements may damage equipment.
- The failsafe gearbox brake is a parking brake only and should not be used for dynamic braking. If this brake is subjected to dynamic braking, the winch should be taken out of service immediately and the brake replaced. See section 6.3.4.

5.1: WINCH REGULAR OPERATION - STEP BY STEP GUIDE

The following step by step guide is recommended for regular daily operation of the winch.

1. On the ship deck, visually inspect the winch and its surroundings for any irregularities before operation. Inspect the following:
    a. The winch drum is clear to rotate.
    b. The level wind is clear to move.
    c. The level wind guide rods, and acme screw have a thin layer of grease.
    d. Check the maintenance log in Appendix A to ensure routine maintenance has been performed.
2. If not already on turn Starter Panel disconnect switch on to establish power.

    WARNING! It is recommended to always keep power on to panel even when winch is not in use. This ensures anti-condensation heaters are powered.
3. When it is safe to operate winch, ensure all E-Stops are depressed and reset the safety circuit by pressing Local Console Reset button.
4. Navigate to HMI Alarms screen. There should be no warnings/alarms active. If there are warnings/alarms active refer to Alarms screen for more information on how to alleviate.

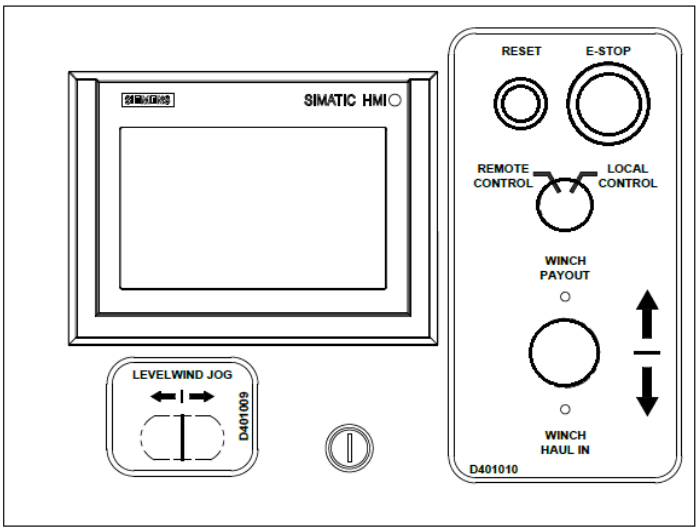
1. **Disconnect Switch:** Disconnects 480VAC supply power to the system. Switch must be in off position to open panel door.

   WARNING! Always ensure power is off before servicing equipment.

2. **Power On Light:** Illuminates blue when power is present.
3. **Alarm:** Illuminated and audible alarm.
4. **Ethernet Connectors:** [Right Side] Remote programming ports.
5. **Remote Connector:** Allows connecting remote belly pack cable while maintaining weather-tight panel seal. Both connector ends are supplied with caps that must be applied when belly pack is disconnected to maintain weather-tight panel seal.

5.1.1. LOCAL CONSOLE

This is the primary control console of the winch and the default control location at power-up. It is permanently affixed on the winch frame with direct view of the winch drum and level wind.



1. **Emergency Stop Button:** Trips the safety circuit which immediately stops the levelwind, winch drum, and engages the brake. Once de-pressed the safety circuit needs to be reset for winch to be operational. The safety is reset through the Reset button.
2. **Reset Button:** Resets the following:
    - Safety circuit: Once all E-Stop buttons are de-pressed and it is safe to operate press to reset safety circuit (instantaneous). This is a hardware reset and is the only method to reset safety.
    - Control system warnings/alarms: Reset control system warnings/alarms. Can also be reset from HMI Alarms screen.
3. **Winch Joystick:** Controls winch speed. The joystick has a center lock to prevent accidental operation of the winch. To operate winch, lift the joystick center lock and move it off center. The more the joystick is moved off center the faster the winch will turn. Moving the joystick forward will cause the winch to pay out; moving the joystick backward will cause the winch to heave. The maximum output of the joystick is configurable through the HMI main Line Control screen JS Max %; setting it lower than 100% allows for finer speed control across the joystick motion. The winch will only respond to joystick command if local control is active.

    WARNING! In case of a control system failure the conditions above will prevent operation of the winch. In emergency situations backup winch and level wind hydraulic controls can be used.

4. **Levelwind Jog Thumbstick:** Allows operator to jog level wind. Turning switch right moves level wind right (away from cable entry side); turning switch left moves level wind left (towards cable entry side). The jog speed is configurable through the HMI LW Control screen Jog Speed %.

    Please read the attached EZ spool and ProSpool manuals for jogging behavior while in auto spooling mode.

WARNING! Always maintain direct visual contact with the drum and level wind condition when jogging level wind.

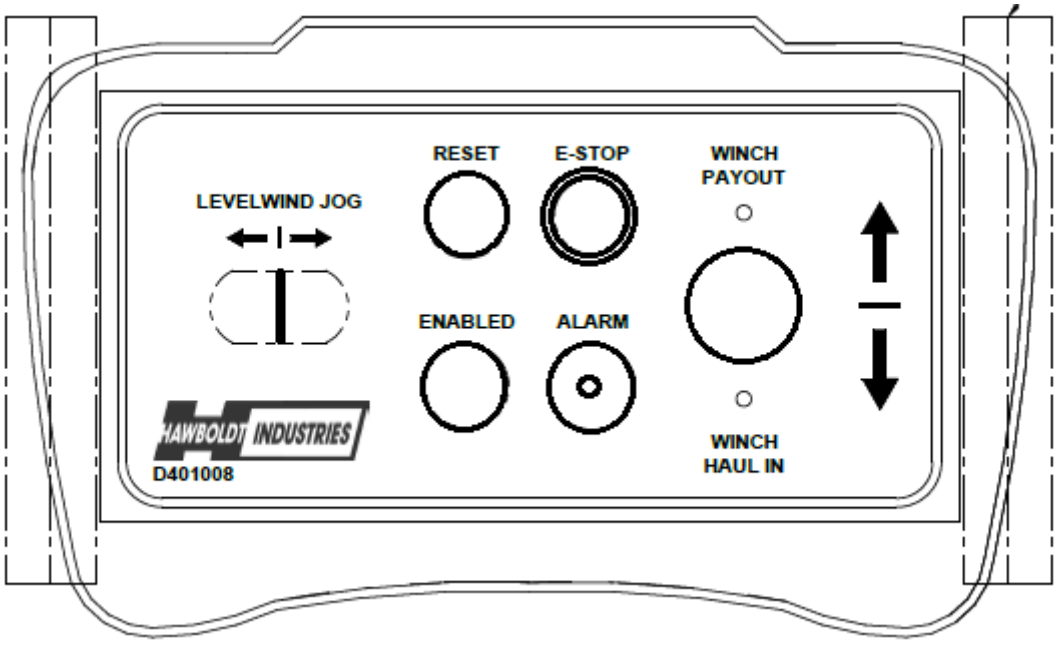
5. **HMI Touchscreen:** Includes all winch control and monitoring interface. The HMI is sunlight readable and rated for harsh outdoors use. The HMI is operational with any type of gloves.

5.1.2. REMOTE BELLY PACK

Remote belly pack is a secondary, optional control console that allows operating winch from a remote location. It is supplied with approximately 40' of cable to be connected to the main panel remote connector. Remote belly pack offers simplified controls of winch; however functions that require direct monitoring of winch condition are only available from local console.

WARNING! Remote control must only be granted after winch has been operated locally and qualified as ready for operation. When operating remotely the condition of the winch must always be monitored with a clear view directly or through appropriate closed circuit monitoring.

Remote belly pack is supplied with ergonomic handles and a neck strap for mobility.



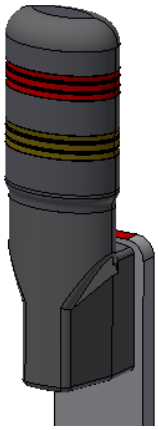
1. **Emergency Stop Button:** Trips the safety circuit which cuts power to the HPU pump and immediately engages the brake. Once de-pressed the safety circuit needs to be reset for winch to be operational.

WARNING! E-Stop button is only monitored if belly pack is connected to starter panel. If console is not connected pressing E-Stop will *not* trip safety circuit and *not* bring winch to a stop. If belly pack is not connected it is recommended to store it away from any operation stations.

2. **Enabled Indicator:** Illuminates when remote belly pack is in control.
3. **Winch Joystick:** Controls winch speed. To operate winch, ensure Remote Control switch is turned on and move joystick off center. The more the joystick is moved off center the faster the winch will turn. Moving the joystick forward will cause the winch to pay out; moving the joystick backward will cause the winch to heave. The maximum output of the joystick is configurable through the HMI main Line Control screen Joystick Max %; setting it lower than 100% allows for finer speed control across the joystick motion. The winch will only respond to joystick command if remote control is active, i.e. Remote Control switch light is on.
4. **Alarm Light/Buzzer:** Flashes/Buzzes when any warning or alarm is active. See the local HMI/Alarm Screen for a more detailed description.

5.1.3. BEACON LIGHTS

The winch is equipped with high luminance beacon lights mounted above the winch frame for 360° visibility. The beacon lights are intended to notify ship personnel when winch is being operated as well as when warning/alarms are active.



1. **Red Beacon Light (Top):** Solid for any Alarms, flashes for warnings.

   See the local HMI/Alarm Screen for a more detailed description.
2. **Amber Beacon Light (Bottom):** Illuminates steady when power is on. It flashes when the drum or level wind is running.

5.2: DESCRIPTION OF HMI OPERATIONAL SCREENS

5.2.1. START SCREEN

The start screen is the first screen available when the machine is first turned on, or when you press the HAWBOLDT logo on the main menu. **While in this screen the levelwind and winch inputs are disabled.**

PLC Comm.: Shows the current status of the communication between the PLC and the HMI. Blinking Green color is for good communication, and red error icon, or solid green color for PLC communication loss.

Main Menu Button: Touch this button to go the Main Screen

5.2.2. MENU SCREEN

The Menu screen is accessible from all screens by pressing the bottom Tension/Payout/Speed bar, which causes menu to slide up.

Top Display Console: Shows the current Tension, Payout, and Speed. Pressing this top bar will bring you to your last screen.

Date & Time: Can be set in "Screen Settings".
Hawboldt Logo: Button to bring you back to Start Screen (lock controls).

Login: Used to access setup and maintenance menus.

Line Control: Activates main winch display screen.

Screen Settings: Activates general display settings screen.

Alarms: Activates fault, warning, display screen.

Winch Runtime: Activates screen displaying the current total drum runtime, as well as maintenance interval alarm.

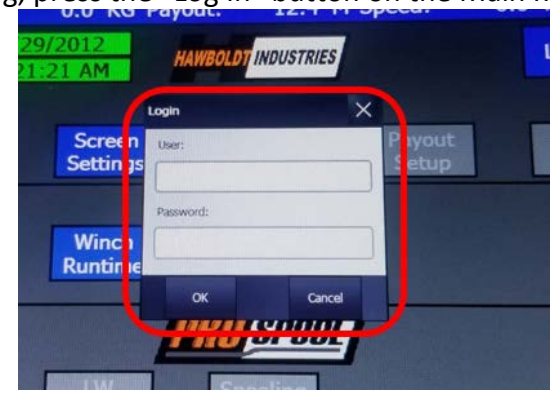
ProSpool / EZ Spool:

The operator can toggle between using two different spooling controls. Non applicable buttons will "hide". See "EZSPOOL VS PROSPOOL" chapter for a comparison of these mode to decide what one to use for your application.

Setup Buttons GRAY: "Tension Setup", "Payout Setup", "Speed Setup", "Winch Setup", [ProSpool] "LW Setup", and "Spooling Configs" can only be accessed when you log into "operate" or "admin" user. These buttons are gray when disabled, and will turn blue when you are logged in.

Log In:

To activate the log in dialog, press the "Log In" button on the Main Menu.



There are two levels of logging in. The first level, "operate", grants access to most of the setup screens. The second, "admin", grants access to all screens.

Username: operate
Password: 0046

Username: admin
Password: 2672

To log out, press the "Log Out" button. The user will also be logged out automatically after five minutes of inactivity.

5.2.3. LINE CONTROL

This screen primary function is to provide the operator large readable cable tension, payout length and speed displays, which are the most important values to monitor during winch operation.

Depending on the spooling mode selected, the lower buttons will change accordingly.

Tension, Payout, Speed Display: Display the current line information about the winch. These displays can be moved in different orders on the screen in another menu. The refresh rates, decimal points, warning & alarm levels are also set in different menus. The "max" values remain on the screen until "Max Reset" is pressed. The units can be changed with the drop down arrow next to the value.

Tension Graph: This graph time can be changed (10s, 60s, 5min, 30min, 60min), as well as the max and min in the "Screen Settings" menu. It displays a trend of the tension reading.

Reset payout: This will reset the payout count to the value in the "Payout Setup" screen. Not the value loaded will be in whatever payout units are currently being used (M, KM, FT, MI, NM).
Reset Max: Clears the current Max value form the indicators. The current max tension value will be evaluated and potentially inserted in the "top 10" the "Tension Setup" screen, along with the date and time that tension happened.

Reverse LW (EZ Spool Only): Only visible when "EZ Spool" is selected. This will reverse the feeding direction of the level wind if it happens to be feeding the wrong direction.

Level Wind Mode Selector (ProSpool and EZ Spool):

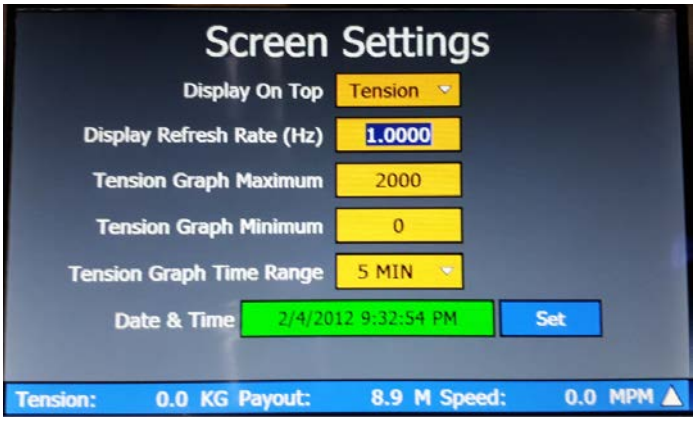
> **Manual LW**: Disables any automatic feeding. The level wind can be manually jogged into position.
>
> **Pro Auto LW / Easy Auto LW** – Enables automatic spooling, either ProSpool or EZ Spool depending on what is selected.
>
> **LW Park** – The level wind joystick(s) are disabled and the LW will remain where it is.

LW %: Scales the level wind joystick value. For fine control, a lower value of 10% can be used. For faster more reactive motions, use 80%.

Winch %: Scales the winch joystick maximum value. For fine control, a lower value of 30% can be used. For faster more reactive motions, use 100%.

Bottom Console: Shows the current Tension, Payout, and Speed. Pressing anywhere on this bottom bar will bring you to the “Main Menu”.

5.2.4. SCREEN SETTINGS



Display On Top: Choose between Tension, Payout and Speed to be displayed on the top of the “Line Control” Screen.

Display refresh rate (Hz): How often you want the tension, payout, and speed values to be updated in the read outs.

Tension Graph Maximum: Maximum value for the tension graph.

Tension Graph Minimum: Minimum value for the tension graph.

Tension Graph Time Range: Range of the tension graph.

Date and Time: Current date and time. The time and date must be entered in the same format it is displayed in. Date and time format is MM/DD/YYYY HH:MM:SS AM/PM.

Set: Press to change the time, press again to confirm.

Bottom Console: Shows the current Tension, Payout, and Speed. Pressing anywhere on this bottom bar will bring you to the “Main Menu”.

5.2.5. TENSION SETUP

[Log in Required] The tension setup screen allows you to change the decimal places of the tension display as well as calibrate the load pin.

Load Pin Calibration: Activated screens for load pin calibration.

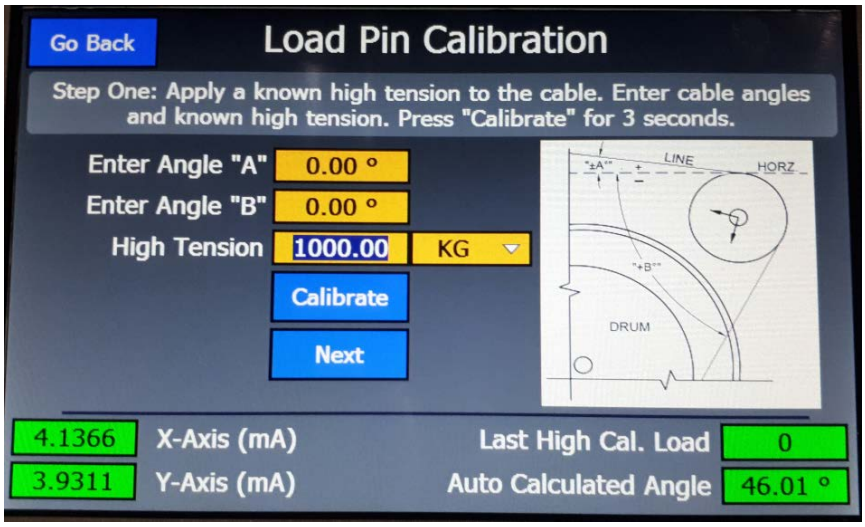
Peak Tension History: Activates a screen displaying the last 10 top tensions.

Decimal Places: Changes how many decimals are displayed.

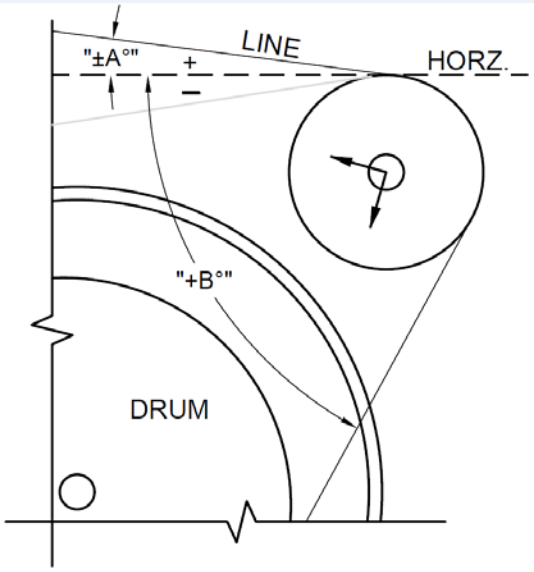
Warning & Alarm: These values are read only and come from the current ProSpool line configuration.

Load Pin Calibration (High):

Load pins should be calibrated periodically to ensure accurate readings. They should also be calibrated after being overloaded, or if they are new as well. Two point calibration can be carried out by following the instruction on the touch screen. After calibration, the tension display will be accurate even with variable line angle.



Enter Angle “A” & “B”: Enter the angle in +-degrees with the diagram as shown.



High Tension: Enter the known tension on the line. Select the units of the tension.

Calibrate: Once a known load has been applied to the cable, press and hold this button to save.

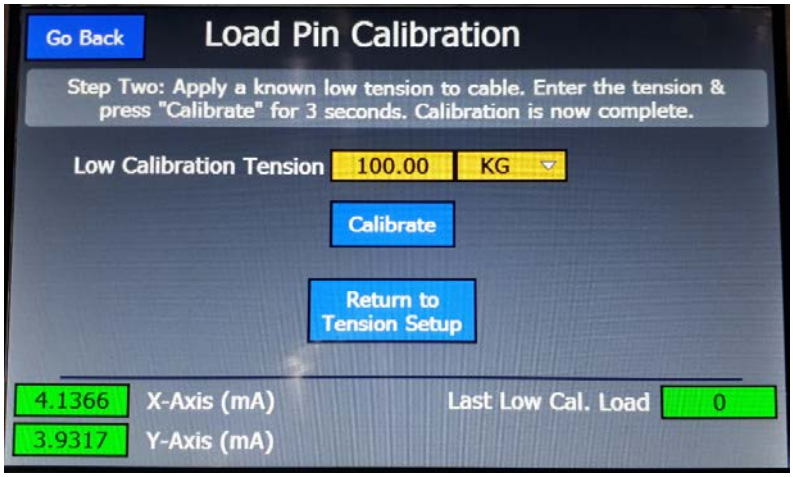
Next: Activate the low point save screen, which is the second part to two point calibration.

X & Y Axis (mA): Displays the current signal form the dual axis load pin. These should be between 3.5 – 22mA. If they are outside that range, the load pin may be damaged.

Last High Cal. Load: Displays the last calibration load value.

Auto Calculated Angle: The winch can automatically calculate the drum to sheave angle (“B”). This is used to ensure accurate tension reading even if the line exit angle changes.

Load Pin Calibration (Low):

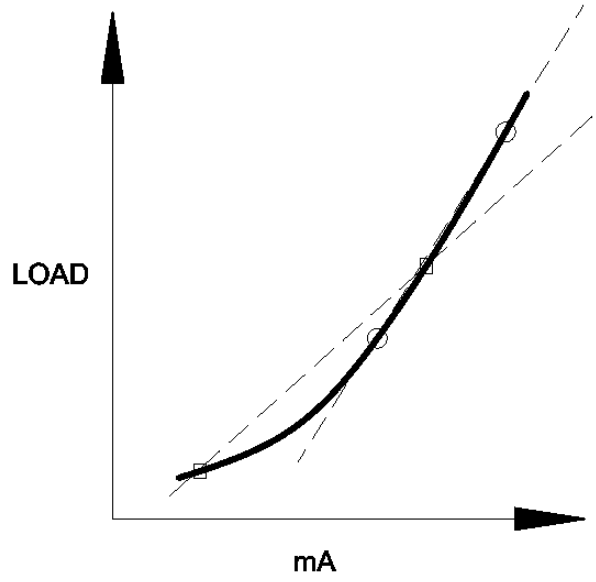


To complete calibration, remove the high load from the cable, and apply a smaller one.

Low Calibration Tension: Enter the known tension on the line. Select the units of the tension.

Calibrate: Once a known load has been applied to the cable, press and hold this button to save.

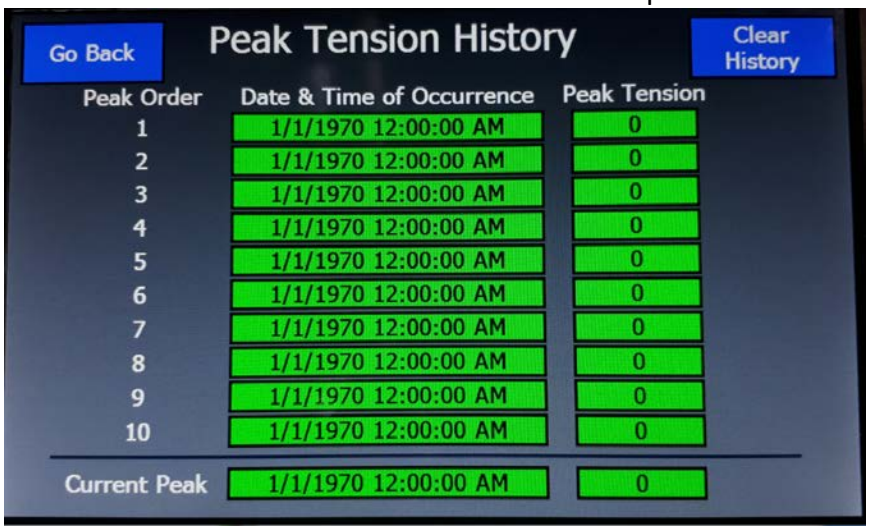
Note that the load pin signal is not linear. If you are mostly working with high loads, you will get more accurate results if you calibrate in the between the bottom third and top of the safe working range. If more accuracy is required in the lower range, calibrate with very low and top two thirds of the safe working range.



Return to Tension Setup: Brings you back to the tension setup screen.

Peak Tension History:

The tensions are evaluated and saved whenever “Max Reset” in pressed in the line.



History maintains peaks in descending order, with biggest peak stored under point 1 and smallest peak stored under point 10.

All peak tension values are displayed in the display unit set on Tension Setup screen.

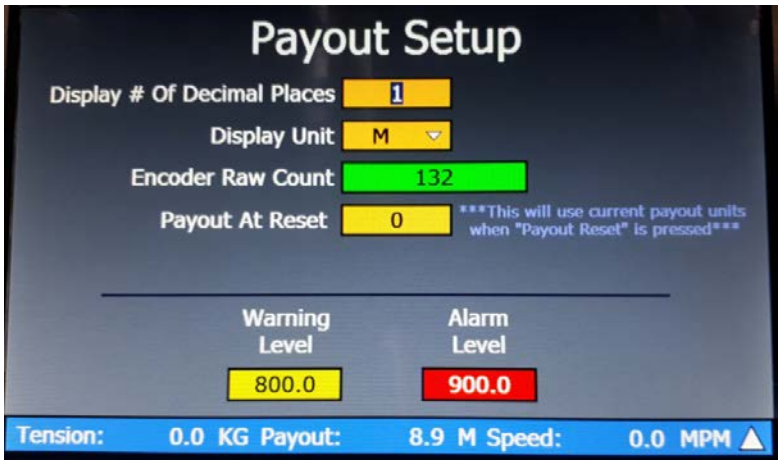
After 10 high peaks have been stored history will stop storing new peaks that might be considered high, but are not higher than what is already stored. After processing peak tension history it is recommended to clear it by pressing and holding Clear History button for 3 seconds. Clearing history resets all 10 peak tension points to 0, which allows storing new peaks.

Date & Time of Occurrence is displayed in the following format:

MM/DD/YYYY HH:MM:SS AM/PM

5.2.6. PAYOUT SETUP

[LOG IN REQUIRED]



Decimal Places: Changes how many decimals are displayed.

Display Units: Select what units payout is in.

Encoder Raw Count: Read only value displaying the sheave count. Mostly for trouble shooting.

Payout at Reset: When "Reset Payout" is pressed in the "Line Control" screen, this value will be loaded. Note that the value has no units, so whatever units you are currently using when the reset button is pressed will be applied.

Warning & Alarm: These values are read only and come from the current ProSpool line configuration.

5.2.7. SPEED SETUP

[LOG IN REQUIRED]

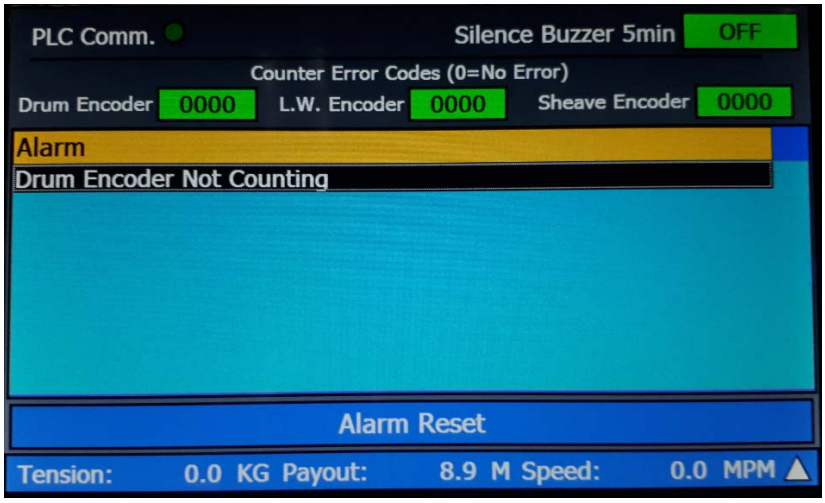
Decimal Places: Changes how many decimals are displayed.

Display Units: Select what units speed is in.

Warning & Alarm: These values are read only and come from the current ProSpool line configuration.

5.2.8. ALARMS

This screen displays the current alarms, warnings, and diagnostic cautions in the system. Alarms will have a steady tone buzzer. Warnings will have a timed tone buzzer, and diagnostic cautions will not produce any alarm, but will appear on the “Alarm” screen list. Pressing the “Reset Button” or the soft key “Alarm Reset” will attempt to clear the error. If the error persists, it will need to be fixed.



Alarm Text	Cause	Effect	Corrective Action
LW VFD Fault	Level wind VFD has faulted	Level wind will not move	Open the panel, and read fault code on VFD, review VFD manual
Winch VFD Fault	Winch VFD has faulted	Winch will not move	Open the panel, and read fault code on VFD, review VFD manual
Breaker Trip Local Panel DC3	CB4031 Tripped	Local control power failure	Reset breaker, if re-trip, find fault
Breaker Trip PLC Out DC4	CB6191 Tripped	PLC output failure, no winch or LW	Reset breaker, if re-trip, find fault
Breaker Trip BP, Sensors, DC5	CB8290 Tripped	Sensor and belly pack power failure	Reset breaker, if re-trip, find fault
Estop Active	Estop is active	No winch or LW	Reset push buttons, reset
Payout Alarm Level	Payout Level High	Solid alarm	Set max higher, or heave in
Tension Alarm Level	Tension Level High	Solid alarm	Set max higher, or relieve load
Speed Alarm Level	Speed Level	Solid alarm	Set mac higher, or reduce

	High		speed
Brake Resistor Temp Alarm	Brake resistor air temp >160*C	Solid alarm	Reduce regen (payout load holding)
Brake Chopper Ground Fault	Electrical current leak	Winch will not run	Increase trigger threshold, find ground fault before further use.

Warnings	**Cause**	**Corrective Action**
Belly Pack Not Conn. For Remote	"Remote" control is selected but belly pack is not connected	Connect belly pack
X-Axis Tension Pin Failure	Load pin signal error	Fix connection, replace load pin
Y-Axis Tension Pin Failure	Load pin signal error	Fix connection, replace load pin
REM L.W. JS Sig. Out Of Range	Remote level wind joystick error	Fix connection, replace joystick
REM Winch JS Sig Out Of Range	Remote winch joystick error	Fix connection, replace joystick
LOC L.W. JS Sig Out Of Range	Local level wind joystick error	Fix connection, replace joystick
LOC Winch JS Sig Out Of Range	Local winch joystick error	Fix connection, replace joystick
ProSpool LW Not Homed	PS level wind not homed	Home level wind
ProSpool Home EOT	PS home end of travel	Fix connection, replace sensor
ProSpool End EOT	PS end, end of travel	Fix connection, replace sensor
ProSpool LW Following Err	PS cannot keep up to set point	Increase "P" value, jog closer to SP when moving to auto.
ProSpool LW Auto Dir Err	PS output is sending the level wind the wrong way	"invert" the output in prospool setup
Payout Warning Level	Payout at warning level	Set warning level higher, or heave in
Speed Warning Level	Speed at warning level	Set warning level higher, or reduce winch speed
Tension Warning Level	Tension at warning level	Set warning level higher, or reduce load
Brake Resistor Temp Warning	Brake resistor is getting hot	Reduce regen (payout load holding)
VFD Panel Too Hot	VFD panel is above alarm level	Reduce loading, cool panel down

Diagnostic Caution	Corrective Action / Description
LOC L.W. JS Switch Err B	joystick error condition, fix wiring / replace joy stick
LOC L.W. JS Not Calibrated	Joystick requires calibration
LOC Winch JS Switch Err Both	joystick error condition, fix wiring / replace joy stick
LOC Winch JS Switch Err A	joystick error condition, fix wiring / replace joy stick
LOC Winch JS Switch Err B	joystick error condition, fix wiring / replace joy stick
LOC Winch JS Not Calibrated	Joystick requires calibration
Drum Encoder Not Counting	Drum encoder may be disconnected or broken
Sheave Encoder Error	Sheave prox. sensors may be disconnected or broken
Sheave HSC Error	High speed counter has issue (see error output in Alarms)
LOC L.W. JS Switch Err A	joystick error condition, fix wiring / replace joy stick
LOC L.W. JS Switch Err Both	joystick error condition, fix wiring / replace joy stick
Local Winch Joystick No Signal	joystick error condition, fix wiring / replace joy stick
REM L.W. JS Switch Err Both	joystick error condition, fix wiring / replace joy stick
REM L.W. JS Switch Err A Switch	joystick error condition, fix wiring / replace joy stick
REM L.W. JS Switch Err B Switch	joystick error condition, fix wiring / replace joy stick
REM Winch JS Switch Err Both	joystick error condition, fix wiring / replace joy stick
REM Winch JS Switch Err A Switch	joystick error condition, fix wiring / replace joy stick
REM Winch JS Switch Err B Switch	joystick error condition, fix wiring / replace joy stick
Remote Winch JS Not Calibrated	Joystick requires calibration
REM L.W. JS Not Calibrated	Joystick requires calibration
ProSpool LW Motion Err	PS is trying to move level wind, but no motion was detected
ProSpool LW HSC Alarm	High speed counter has issue (see error output in Alarms)
ProSpool Drum HSC Alarm	High speed counter has issue (see error output in Alarms)
Remote Belly Pack Active	The belly pack is connected and active
Active EOT Slow Zone	Slow zones are set up, and the LW is currently in one
EOT Slow Zone Not Set Up	No slow zones set up

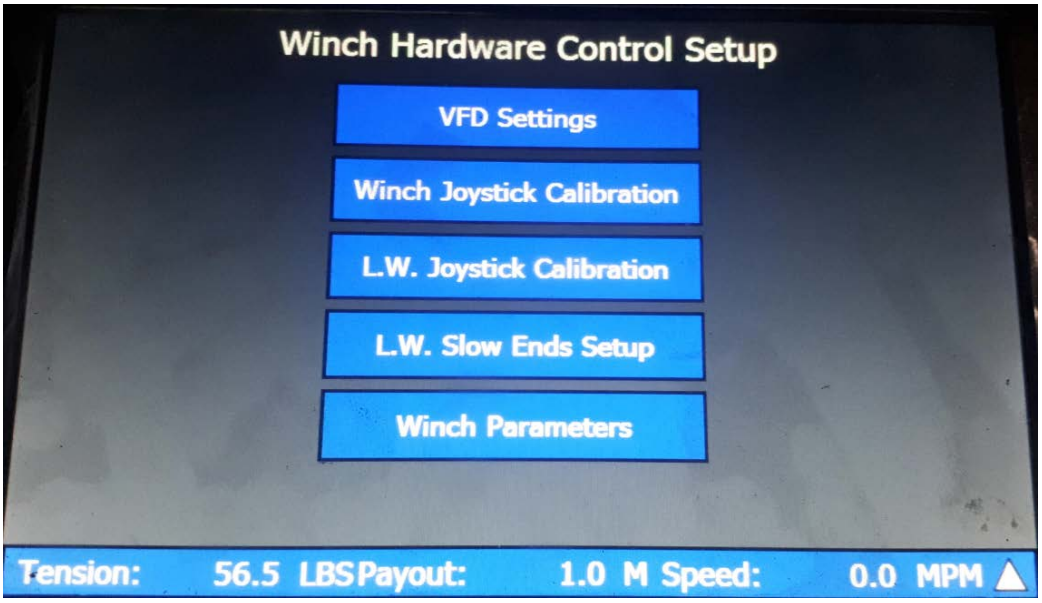
5.2.9. WINCH RUNTIME

Total Runtime: Displays the current total drum run time of the winch.

Runtime Since Last Maintenance: Displays the current elapsed drum run time since the last maintenance reset.

Maintenance Required Warning Hours: The interval amount between maintenance hours. This can be reset, and changed when logged in.

5.2.10. WINCH SETUP



[LOG IN REQUIRED ALL FIELDS]

VFD Settings: Navigate to VFD settings, panel temp alarm, current leak menu.

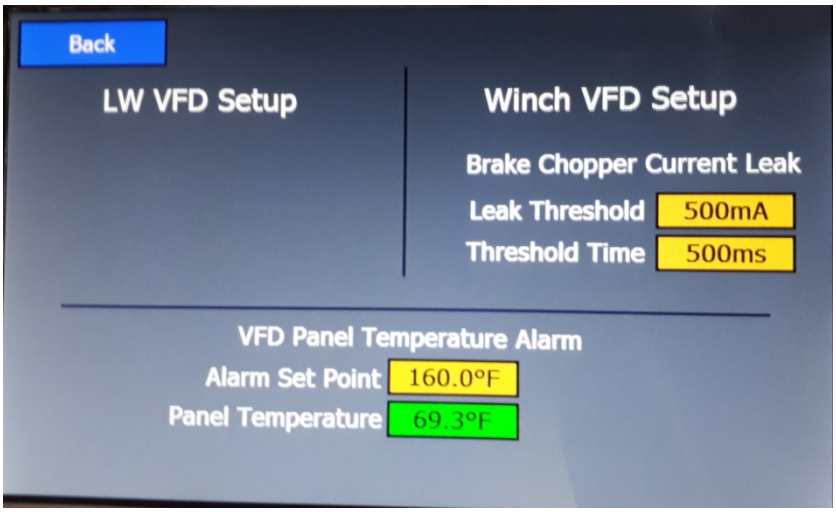
Winch Joystick Calibration: Navigate to calibration of winch joystick (belly pack and local).

L.W. Joystick Calibration: Navigate to calibration of level wind joystick (belly pack and local).

L.W. Slow Ends Setup: Navigate to set up the slow ends set points.

Winch Parameters: Navigate to winch parameters (sheave pitch diameter).

5.2.11. VFD SETTINGS



Actual variable frequency drive parameters are entered on the drives themselves, see the attached settings list.

Current Leak Detection: For the winch drive, it has a brake chopper with a brake resistor mounted on the front right side, ahead of the winch gearbox. During “regeneration” operations, the power being created from the inertia of the drum, or load lowering will be converted to DC voltage in the drive. When this voltage is high enough, it is converted to heat over the “brake resistor”. Due to the nature of the brake resistor handling high DC voltage (~700VDC), it is critical any ground faults are detected before they cause an issue. To ensure the safety of the personal and operation of the winch, the machine MUST BE BONDED to the ship or mounting structure.

To detect current leaking, a current transducer has been placed around the power lines going to the brake resistor. If any current is detected leaving the system, the winch will be shut down.

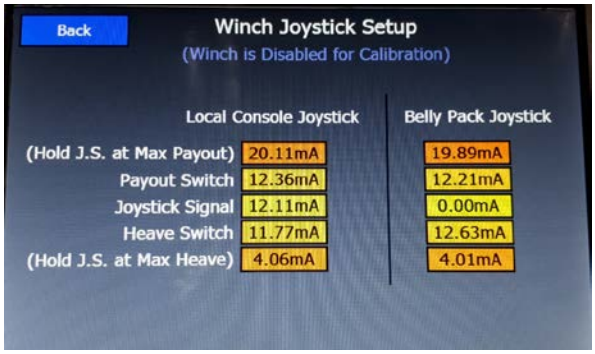
Leak Threshold: How much current is allowed to leak to the surrounding environment in mA. Note that above 500mA is considered very dangerous

Threshold Time: How long that the max current setting is allowed to leak for in milliseconds before shutting the drive down.
VFD Panel Temperature Alarm: The VFD cabinet has a temperature transmitter which can notify the operator the panel is getting to hot. The frequency drives will eventually fault if they get too hot.The alarm will provide a warning beep and indicator with warning text.

Alarm Set Point: Enter VFD max operating temperature in *F.

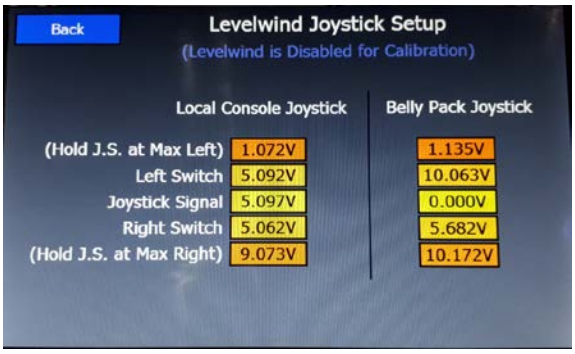
5.2.12. WINCH JOYSTICK CALIBRATION

If a joystick is ever replaced or the PLC is re-programmed, you may need to calibrate the joystick. Note that this is for the winch joystick(s) at the local console, and belly pack. You will need to switch the control to whatever joystick you are trying to calibrate. **The winch will be disabled during calibration, and the drum will not spin.**



5.2.13. L.W. JOYSTICK CALIBRATION

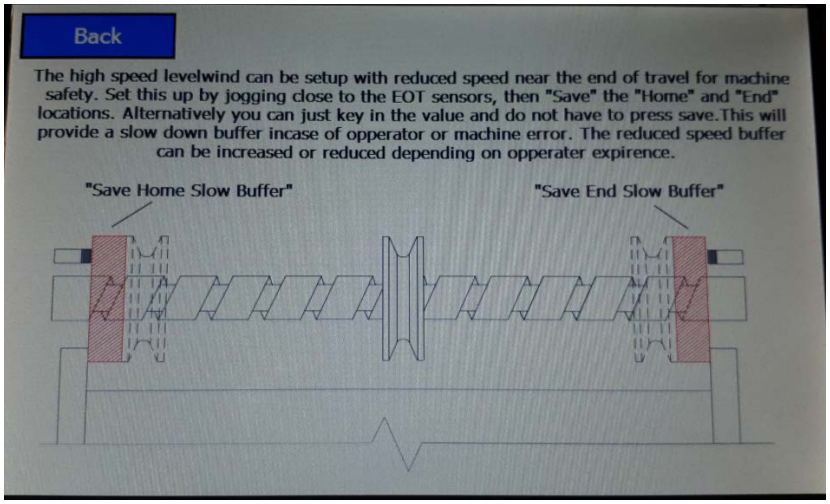
If a joystick is ever replaced or the PLC is re-programmed, you may need to calibrate the joystick. Note that this is for the level wind joystick(s) at the local console, and belly pack. You will need to switch the control to whatever joystick you are trying to calibrate. **The level wind will be disabled during calibration and the drum will not spin.**

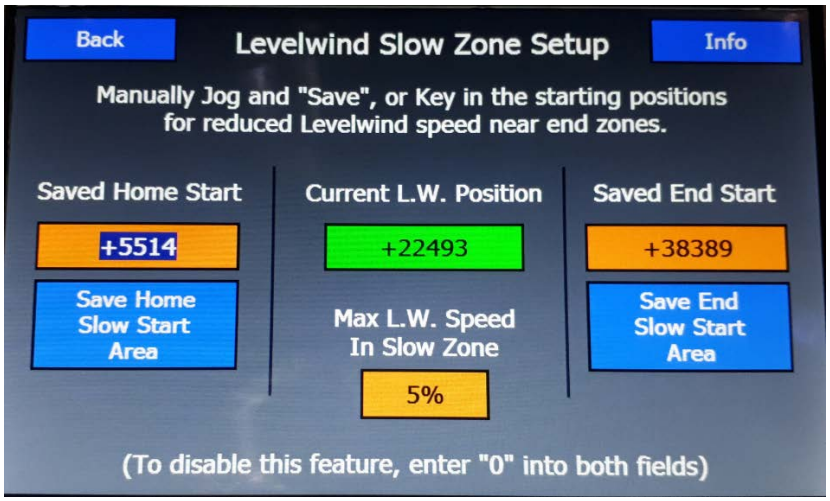


5.2.14. L.W. SLOW END SETUP

Due to the speed of level wind on this winch, an inexperienced user can accidently crash the level wind into the winch frame if they do not slow down near the ends of the level wind travel. To prevent this from happening, “Slow Zones” can be set. Pressing the “Info” button activates a small screen describing how to set up the zones.

Note that the count is taken from the level wind encoder. If you reset the encoder in ProSpool, you will need to reset these ends.



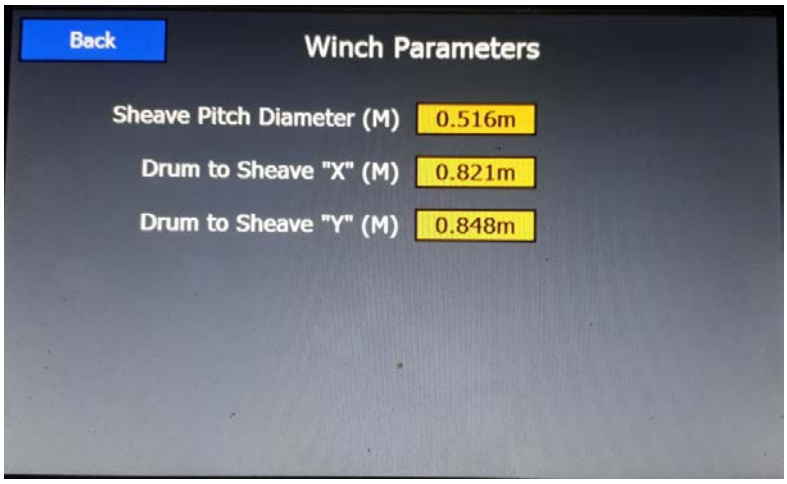


Save Home Slow Start Area: Jog to where you want the level wind to begin to slow down, press save until the number updates.

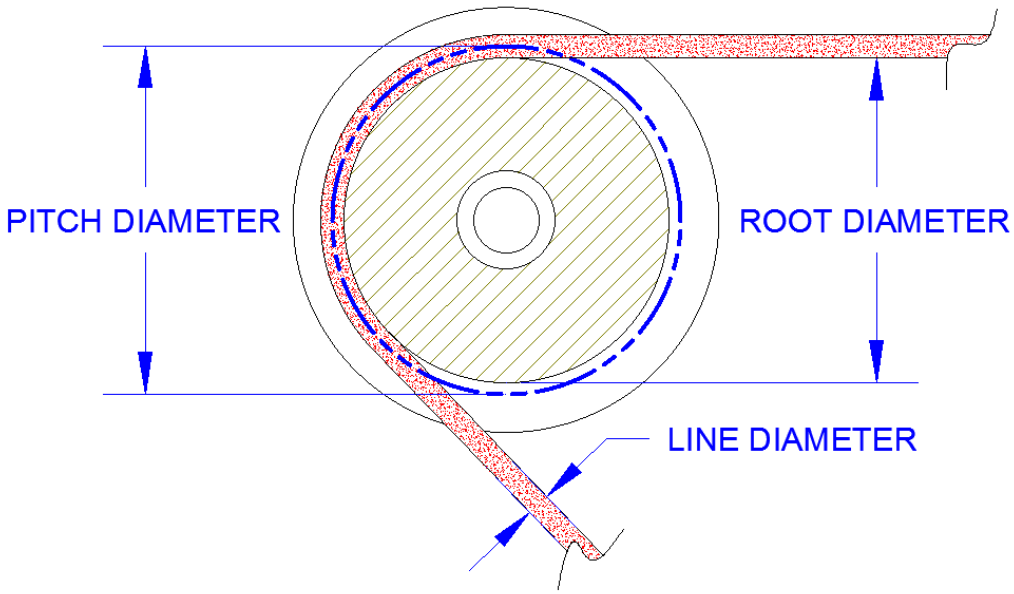
Save End Slow Start Area: Jog to where you want the level wind to begin to slow down, press save until the number updates.

Max L.W. Speed in Slow Zone: Max Speed the level wind can travel in the direction of the end of travel in the slow zone. Set between 5-10%.

5.2.15. WINCH PARAMETERS



Sheave Pitch Diameter (M): Is the sheave root diameter, plus the line diameter. It is important this value is accurate for payout and speed to be reading correctly. Note this value is always in meters.



Drum to Sheave "X" And "Y": This values should never be changed. Ensure they are as follows.

X = 0.821m & Y = 0.848m

5.2.16. EZ SPOOL VS PROSPOOL

ProSpool is best suited for complex and demanding spooling application. It is generally used for perfectly round/pitched cable on “grooved shell” with a highly accurate machined drum.
ProSpool allows for 10 different cable/drum configurations to be entered. It provides animated graphics and displays the current drum “layer” and “wrap”. It requires a lot of setup, and understanding to use proficiently.

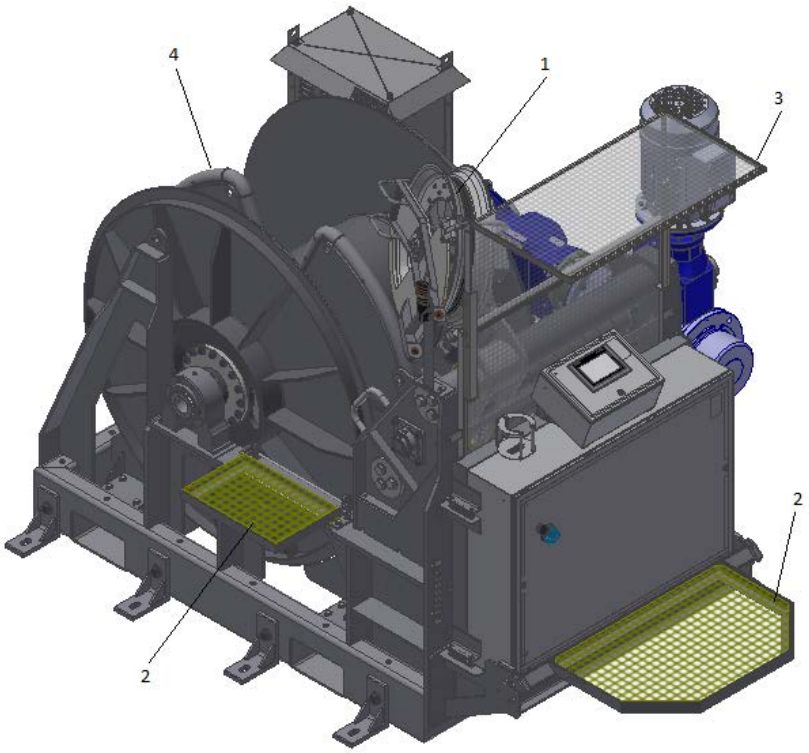
EZ Spool is best suited for general purpose cable/rope/tether spooling. It requires very little settings or understanding to operate well. It has a stripped back user interface and provides only critical feedback.

ProSpool and EZ Spool manuals are attached in Appendix D of this manual.

5.3: WINCH MECHANICAL FEATURES

The winch has a number of mechanical features which are used in the regular operation of the winch. These include:

1. Levelwind sheave opening for cable removal
2. Operator platform deployment and stow
3. Safety Screen deployment and stow
4. Center flange removal and installation

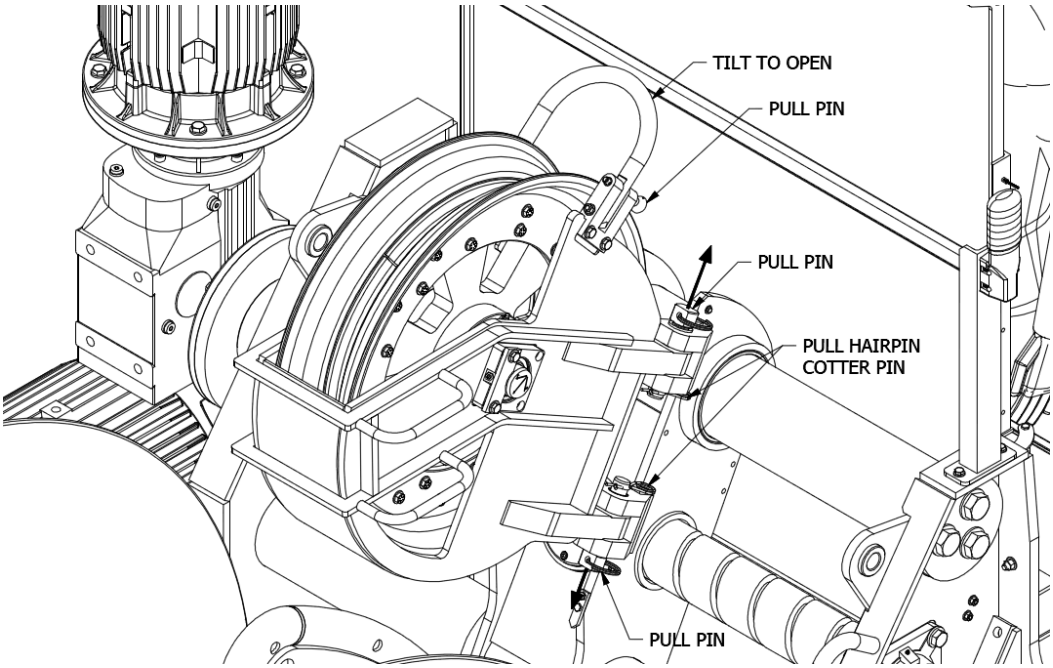


5.3.1. LEVELWIND SHEAVE OPENING

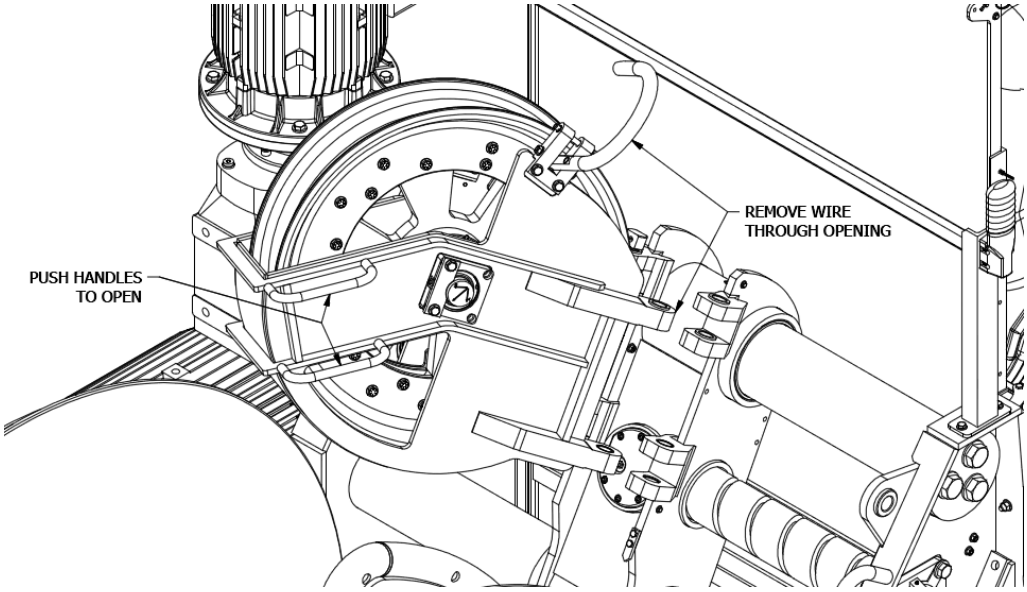
The levelwind sheave is mounted on a hinge to allow for the removal of the cable from the sheave. To do this the two 1” pins on the **non-drive side** of the levelwind carriage The side platform may be lowered for easier access to the levelwind. Steps to remove cable from sheave:

1. Remove retaining pin from cable keeper on top of sheave assembly and open cable keeper.

2. Remove cotter pins holding sheave pins in place and withdraw the two main pins on the **non-drive side** of the winch.



3. Push sheave towards drive side of winch, allowing it to rest on the stops on the opposing side.



4. Remove cable from sheave, close sheave and reinstall sheave pins & cotter pins. Close cable keeper.

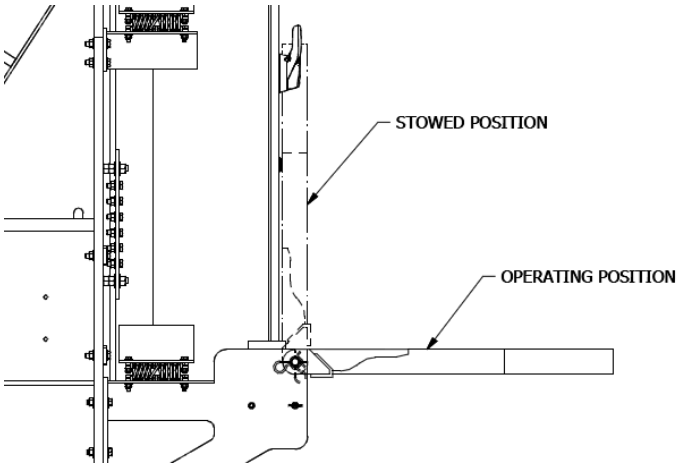
WARNING: The main pins must be reinstalled correctly with hairpin cotter pins. Incorrect installation of these pins may result in the sheave opening while under load which could result in injury or death.

WARNING: main pins on drive side of sheave should only be removed for sheave maintenance and only after disconnecting wires leading from levelwind sheave to levelwind carriage.

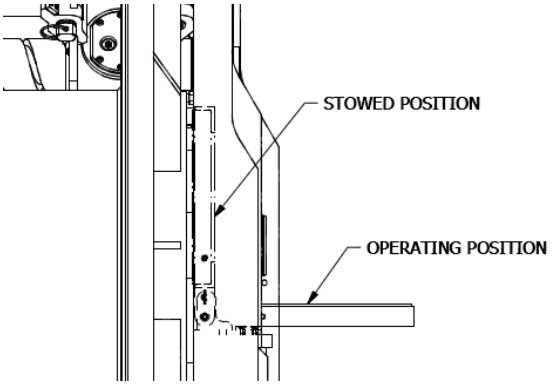
5.3.2. FOLDING PLATFORMS

The winch has two platforms, the rear operator's platform and the side maintenance platform. The side platform has an adjacent step and handle built into the winch frame for ease of access.

The rear platform is held in the stowed position by two ¼" pins, which when removed allow the platform to be lowered into a horizontal position. In the lowered position the platform is help in place by metal stops on the electrical enclosure frame.



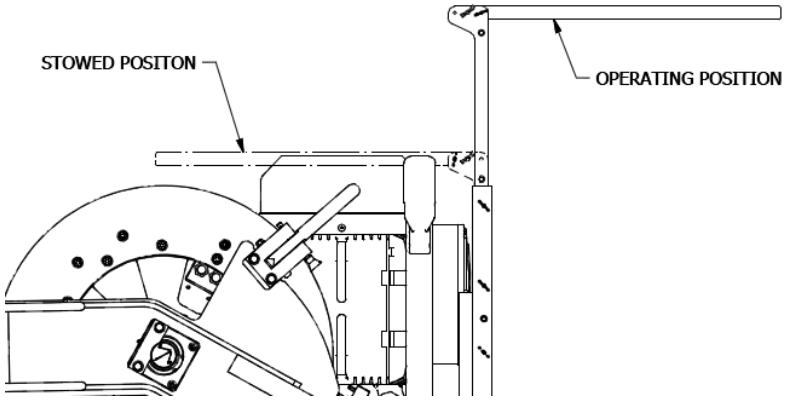
The side platform is help in the stowed position by two ¼" pins which when removed allow the platform to lower and rest on a nylon pad mounted on the frame of the winch.



5.3.3. OPERATOR SCREEN

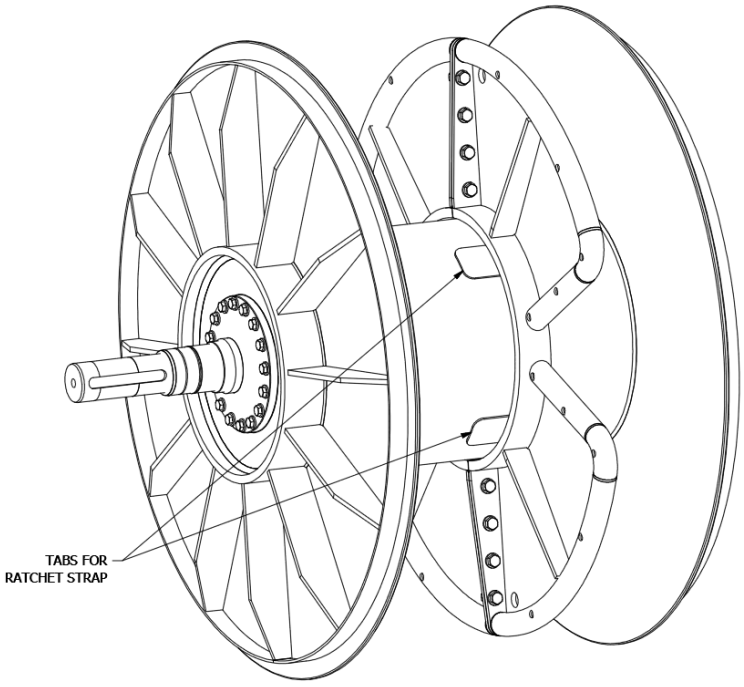
The operator position is protected from the winch by a screen made of 1/8" welded SS316 mesh. The screen consists of a lower portion that is fixed in place, an upper piece that is pinned

in position and is lowered for shipping, and an overhead portion that is moved into a stowed position for shipping.



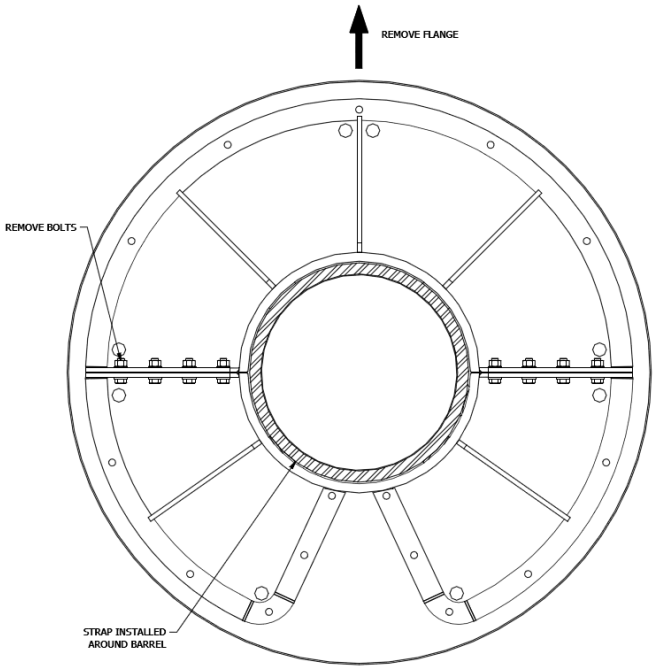
5.3.4. CENTER FLANGE REMOVAL

The center flange is fastened to the drum with 3/4”-10 x 2-1/4” bolts, four per side. The flange half containing the notch has two tabs that are flush with the barrel of the drum.

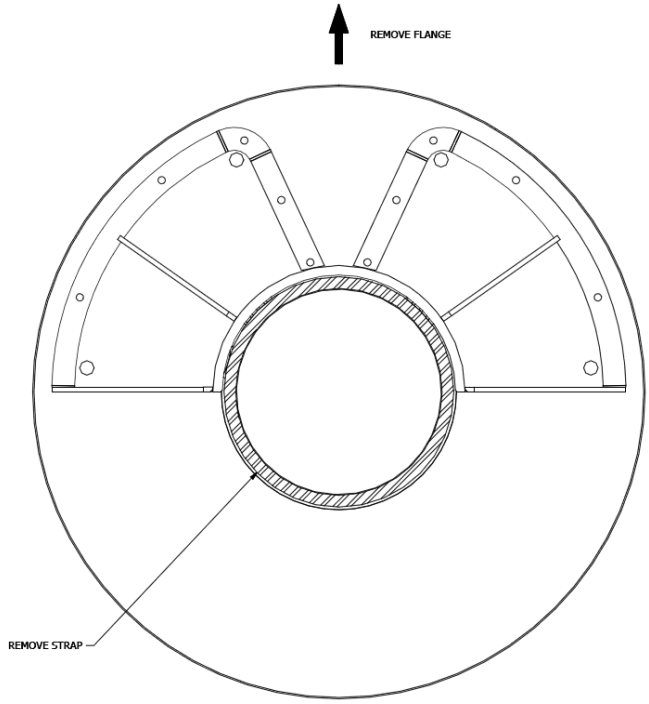


To remove the center flange, rotate the drum so the notched flange half is facing downwards and fasten a ratchet strap firmly around the barrel and across the two tabs. This is to hold the notched flange on the drum while the other half is removed. Once the strap is affixed to the

drum, a crane should be attached to the un-notched flange half, which is facing upwards, to take the weight of the flange half when the bolts are loosened off. Next loosen and remove the 8 bolts and lift the un-notched flange off with the crane.



Finally, rotate the drum so the notched half is facing upwards, attach the crane, and loosen the ratchet strap to lift the notched flange half off the drum.



6.0: MAINTENANCE

6.1: STORAGE

It is the responsibility of the customer to assure deck machinery is properly stored and maintained once the goods are received.

The equipment may be stored out of doors provided that it is well greased and any damaged painted areas are repaired.

WARNING! A paint repair kit has been included in your shipment. Refer to Appendix C for directions on how to repair paint chips. If paint is not touched up after installation, components will start to rust.

WARNING! All bare stainless steel surfaces on your winch have been coated with a rust prevention coating (Tectyle 506) prior to shipping. This coating should be removed from the levelwind guide rods and lead screw before use. Refer to Appendix C on instructions for removal.

Precautions should also be taken when an installed system is shut down for long periods of time. If possible, the system should be started every two or three weeks to ensure internal parts are lubricated and to prevent the premature failure of seals and to reduce levels of condensation.

6.2: LUBRICATION

Although Hawboldt Industries uses materials and finishes well suited for use in severe marine environments it is imperative that a comprehensive lubrication maintenance program be utilized to assure long term reliability. If the unit is not used for extended periods, all points requiring periodic lubrication are to be attended to every 6 months and prior to restarting. Any excess grease is to be wiped off.

The lubrication section of the maintenance log (Appendix A) should be used to ensure proper lubrication intervals are maintained.

Refer to the Lubrication Drawing in the Drawings Section for grease point locations.

Refer to gearbox maintenance manuals for proper lubrication instructions.

6.2.1. BALL AND ROLLER BEARING LUBRICATION

There are multiple bearing housings on this winch containing bearings and radial shaft lip seals. These housings are designed to flush the old grease through the bearing and out the lip seals.

Apply grease through the grease nipple until fresh grease can be seen exiting the housing. It is recommended, if possible, to rotate the bearings slowly while greasing to ensure proper distribution of grease. Remove excess grease with a rag after all moving parts have stopped.

The levelwind bearing housing is designed to purge grease on the screw thread side. No grease should exit on the encoder side.

The drum shaft bearing housings are designed to purge grease on both sides of the bearing housing.

WARNING: If the grease is exiting on the wrong side, then the bearing will not receive proper lubrication which may result in premature failure. Check the seal condition and orientation.

6.2.2. BUSHING LUBRICATION

All bushings are designed with passages for grease lubrication and grease fittings for application with a grease gun. Apply grease until fresh grease can be seen exiting the sides of the bushings, and remove excess grease with a rag.

6.2.3. SCREW & GUIDE ROD LUBRICATION

The levelwind screw and guide rods facilitate the linear motion of the levelwind carriage and require a thin film of grease at all times in order to function properly and to avoid premature wear. Grease can be applied to the acme screw and guide rods by brush or spray can.

Grease should also be applied to the levelwind blade housing and carriage bushings to ensure that the internal components are well lubricated.

Maintain a thin film, and apply new grease every 20 hours of operation, or a minimum of once a month.

6.2.4. GEARBOX OIL

The operator is responsible for routine maintenance on the main drive gearbox. The following activities shall be performed as part of gearbox maintenance:

- For first time use, after 100 hours of duty (run-in) change the gearbox oil.
- Oil changes should be performed when the gearbox is hot so that particles maintain suspended in the oil, and to facilitate drainage.
- Subsequent oil changes should be performed at the intervals recommended in the gearbox manual.
- Do not mix different types of oil.
- Periodically check the levels (about once a month) and top up if necessary.

For additional information on gearbox maintenance refer to the gearbox maintenance manual in the component literature section.

Utilize the maintenance log in Appendix A to schedule and record gearbox maintenance.

6.3: MECHANICAL MAINTENANCE

Hawboldt Industries mechanical components are designed for high duty operation. It is imperative that a comprehensive maintenance program be utilized to ensure long term reliability. The mechanical maintenance section of the maintenance log (Appendix A) should be used to ensure proper maintenance intervals are maintained.

Components that require mechanical maintenance include:

- Ball and Roller Bearings
- Tightening of Critical Bolts
- Parking Brake

In addition to these items, please review the component literature section for additional maintenance information on sub-components.

6.3.1. BALL AND ROLLER BEARINGS

Ball and roller bearings may require replacement prematurely if a proper lubrication schedule is not maintained, or as expected after many hours of use. Replacement of ball and roller bearings can be logged using the mechanical maintenance log in Appendix A.

Signs of a worn bearing could be recognized by abnormal bearing noise, unstable motion, or misalignment during operation.

6.3.2. TIGHTENING OF CRITICAL BOLTS

All bolts should be checked for looseness and tightened periodically to ensure that they have not loosened due to vibration of equipment during operation. Critical bolts must be tightened to the specified torque values. Hawboldt recommends checking bolts after the first 100 hours of operation, and once every 6 months thereafter. Tightening of critical bolts can be logged using the mechanical maintenance log in Appendix A.

Critical bolts are bolts which are in the primary load path of the winch. The torque specifications for critical bolts are shown on the assembly drawings. The torque specifications on the assembly drawings are based on a k value of 0.15, lubricated. Reference torque charts can be found in Appendix B.

After the bolts have been tightened the paint must be touched up to avoid corrosion.

6.3.3. PARKING BRAKE

The failsafe motor brake should be tested periodically to verify its holding torque. Hawboldt recommends that the brake be tested once every 6 months or 1000 hrs of operation (whichever occurs first) to 125% of the rated winch pull. If the brake slips when loaded to 125% or less, the brake pack must be replaced.

The failsafe motor brake is a parking brake only and should not be used for dynamic braking. Here a few ways in which the brake can be subjected to dynamic braking:

- Insufficient electrical power to fully release the brake
    - Example: Stick-slip while paying in or out.
    - Example: “Dragging” noises while paying in our out.
- Slippage due to excessive loading.
    - Example: Joystick centered and brake applied, but the load causes winch to payout
        - If this occurs, the operator should put the winch in heave immediately.
- Brake applied while drum is rotating
    - Example: E-stop is pressed while the winch is paying out under load

If this brake is subjected to dynamic braking, the performance of the brake may be compromised. If any of the above scenarios have occurred or are suspected, the winch brake must be inspected for wear and replaced if damaged.

6.4: DECALS

Your equipment was shipped from the factory with a set of decals applied.

Should any of these decals be missing, they could prevent the proper operation and/or maintenance of the unit which may result in personal injury or property damage.

If any of these decals are missing, please contact us for a replacement.

Order the decal(s) by stating decal description, number, and quantity. A complete list of decals can be found in the drawings section of this manual.

6.5: SPARE PARTS

Two sets of offshore spares have been supplied with the winch. The following table contains a list of offshore spare parts:

HAWBOLDT PART NUMBER	MANUFACTURER	DESCRIPTION	QTY
34-00304-396	Hawboldt	Sheave Hinge Pin	4
34-00304-431	Hawboldt	Sheave Bumper Plate	4
34-00304-591	Hawboldt	Sheave Hinge Pin Bushing, 1” LG	8
34-00304-900	Hawboldt	Helical Blade, 4” Screw	1
34-00304-590	Hawboldt	Sheave Hinge Pin Bushing, 1.5” LG	4
34-00304-039	Hawboldt	Sheave Liner	1
34-00304-484	Hawboldt	Sleeve Bushing	6
34-00304-904	Hawboldt	Flanged Bushing	2
5408423	SKF	Radial Shaft Seal – Drum Bearing, Outside	1
5408451	SKF	Radial Shaft Seal – Drum Bearing, Inside	1
5408555	SKF	V-Ring Seal	1
5406547	SKF	Radial Shaft Seal –Encoder Shaft	2
5405122	SKF	Angular Contact Bearing – Levelwind Drive	3
5408454	SKF	Spherical Roller Bearing – Drum Bearing	1
5400027	SKF	Flanged Bearing – Levelwind Idler	1
5405795	SKF	Radial Shaft Seal – Levelwind Drive	1
5408661	SKF	Lock Nut – Levelwind Screw	1
5408565	SKF	Tapered Roller Bearing – Sheave	2
5408574	SKF	Washer – Sheave	1
5408573	SKF	Radial Shaft Seal – Sheave	2
5408577	SKF	Spherical Plain Bearing – Load Pin	2
34-00304-586	Sensy	Load Pin – 14 KIP – Dual Axis	1
5408630	McMaster-Carr	Quick Release Pin	4
5408708	McMaster-Carr	Lanyard	4
5408698	McMaster-Carr	Lanyard	4
5406174	McMaster-Carr	Hex Nut, Bronze	20
5405981	McMaster-Carr	Quick Release Pin	1
5407212	McMaster-Carr	Quick Release Pin	4
5408716	McMaster-Carr	Lanyard	2
5409030	McMaster-Carr	Clevis Pin	2
5409031	McMaster-Carr	Flanged Bushing	6
5408631	McMaster-Carr	Clevis Pin	2
5405988	Omron	Proximity Sensor – NC	2
5403849	Omron	Proximity Sensor – NO	2
5408517	Parker	O-Ring – 2-160, 70 Duro	1
5402865	Parker	O-Ring – 2-375, 70 Duro	1

5408440	Parker	O-Ring – 2-167, 70 Duro	2
5405222	Stright-Mackay	Zinc Anode	2
5406446	Turck	Incremental Encoder	2
5406451	Turck	Encoder Cable	2
N/A	Generic	Grease Fitting, 90 Deg	1
N/A	Generic	Grease Fitting, Straight	5
34-00304-085	IDEC	Light, Beacon	1
	Stromag	Motor Mounted Parking Brake	1
5406839	Hawboldt	Paint Touch-up Kit	1
5404607	SIEMENS	PLC	1
5404756	SIEMENS	PLC card	1
5406021	SIEMENS	PLC Card	1
5406400	SIEMENS	HMI	1
5408563	ABB	Winch VFD	1
5408564	ABB	Levelwind VFD	1
5409025	AccuAmp	Current Leak Transducer	1
5408352	DELTA	DC power supply	1
5407909	Danfoss	Thumb joystick (10-90%)	1
5408650	PQ	Main joystick (20ma-12ma-4ma)	1
5406915	SOURIAU	Plug Receptacle	1
5406916	SOURIAU	Connector Plug	1
5406244	SOURIAU	Connector cap receptacle	1

7.0: FACTORY ACCEPTANCE TEST

This section contains the completed Factory Acceptance Test (FAT) reports.

Factory Acceptance Test for

General Purpose Electric Mooring Winch
Model# *SPRE-3466/S*

Document Approvals

Hawboldt Industries

Project Leader: _____ Date: _____

Test Technician: _____ Date: 22 Jan 20

Quality Assurance Representative: _____ Date: 22-JAN-'20

University of California San Diego

Customer Representative: _____ Date: 1/22/2020

Customer Representative: _____ Date: _____

Document Name:	FAT 1942 / 1943
Issue Date:	15-Jan-'20
Hawboldt Project Number:	1943
Product Serial Number:	1943
Test Date:	20-Jan-'20
Revision:	1

Factory Acceptance Test

Model Number: SPRE-3466/S Serial No. **1943**

REVISION STATUS SHEET

Issue No.	*Issue Date*	*Revision #*	*Revision Date*	*Description of Change*	*Prepared By*
1	13-Jan-'20	0	13-Jan-'20	Original Issue	ARM
2	15-Jan'20	1	15-Jan-'20	Changed test values, Changed test order Added Level Wind Tests	ARM

Factory Acceptance Test

Model Number: SPRE-3466/S Serial No. **1943**

TABLE OF CONTENTS

Factory Acceptance Test

Model Number: SPRE-3466/S Serial No. **1943**

1.0 GENERAL

All tests will be coordinated by the Quality Specialist and the Engineering Department. In the event that a discrepancy should arise during or subsequent to any testing performed, the Engineering Department shall be consulted for resolution. Test results will be recorded on the applicable test data sheets contained within this procedure.

2.0 PURPOSE OF TEST

The purpose of this test is to subject the winch; Model # ***SPRE-3466/S*** subject to fulfill the performance and testing criteria outlined in this document.

3.0 APPLICABLE DOCUMENTS

a) Purchase Order #: PO 92043515

b) Drawing #: 34-00304-000 Revision A

c) Quote #: Q12536A

4.0 TEST FACILITY

Hawboldt Industries (1989) Ltd.
220 Windsor Rd, Highway #14,
Chester, Nova Scotia, B0J 1J0

5.0 AVAILABLE TEST EQUIPMENT & TEST APPARATUS

Table 1: Equipment

Item	Qty	Device	Description / Model Number
1	1	Power Source	Hydraulic Test Stand
2	1	Resistive loads	A-Frame Test Stand
3	1	Test Rope	
4	1	Stopwatch	Reed Instruments, SW 600
5	1	Pressure Gauge	
6	1	Dynamometer	

Note: If required, equivalent equipment may be used at the discretion of Hawboldt Industries.

6.0 CALIBRATION

All test facilities, test equipment and reference standards used to calibrate measurement equipment utilized in conducting the tests specified herein were calibrated in accordance with ISO 9001-2015. Calibration records are available for items that required calibration.

7.0 EQUIPMENT SPECIFICATIONS

Table 2: Dimension Confirmations

Dimension	Nominal	Actual
Bare Drum Diameter	24"	24 3/16"
Flange Diameter	~~66"~~ 64" ARM 20-JAN-'20	64 5/16"
Distance Between Flanges	34"	34 1/8"
Overall Height	96 - 1/2"	96 1/2"
Overall Length	127 – 5/8"	129" (STEP DOWN) (105" STEP UP)
Overall Width	75 – 2/5"	76"
Overall Dry Weight (No Oil or Wire)	9000 LBS	

Note: Actual dimensions are to match the nominal dimensions within a tolerance of +/- 1/16" unless otherwise stated.

Table 3: Component Identification

Component	Make	Model	Serial Number
~~Hydraulic~~ Motor ELECTRIC	MGM	SM 160 MB4	19391358

ARM 20-JAN-20 SEE NOTES PAGE

8.0 SPEED TEST

8.1 Objective:

- To test the maximum line speed under no load.

8.2 Setup:

- Remove all wire ropes from the winch. Place a mark on the drum flange and an aligning mark on the winch frame. Bare drum OD is approximately 24" inches, so 1 revolution of the bare drum is equivalent of 6.283 ft. Therefore to achieve a line pull of 92ft/min @ bare drum a RPM of 13 will be required.

$$\frac{24}{12} \times \pi = 6.283 \frac{ft}{rev}; \qquad \frac{92\ ft/min}{6.283\ ft/rev} = 13.051 \cong \textbf{13 rev/min}$$

8.3 Procedure:

- Clear the area of non-essential personnel.
- Stroke the valve to the full speed position and measure the bare drum speed.

8.4 Acceptance Criteria:

- The bare drum speed is to be at least 13 RPM in both pay-in and pay-out positions.

Table 4: Speed Test Measurements

Measurements			
Characteristic Measured	**Specified Min**	**Measured Value**	**Pass/Fail**
Bare drum speed			
Pay-in	13 RPM	17 RPM	PASS
Pay-out	13 RPM	17 RPM	PASS

8.5 Verification Sign-Off:

Hawboldt Test Technician: _____ Date: 20 Jan 20

Hawboldt Quality Specialist: _____ Date: 20 - JAN - 20

Notes/Remarks:

Factory Acceptance Test

Model Number: SPRE-3466/S Serial No. **1943**

9.0 LEVEL WIND SPEED TEST

9.1 Objective:

- To test the maximum level wind speed under no load.

9.2 Setup:

- Remove all wire ropes from the winch. Put level wind to home position.

9.3 Procedure:

- Clear the area of non-essential personnel.
- Stroke the valve to the full speed position and measure the level wind speed from end to end.

9.4 Acceptance Criteria:

- The level wind should be able to go from end to end in 4 to 5 sec. in both directions.

Table 5: Speed Test Measurements

Measurements			
Characteristic Measured	**Specified Range**	**Measured Value**	**Pass/Fail**
Bare drum speed			
Pay-in	4-5 Sec	4.5 sec	Pass
Pay-out	4-5 Sec	4.5 sec	Pass

9.5 Verification Sign-Off:

Hawboldt Test Technician: _____ Date: 22 Jan 20

Hawboldt Quality Specialist: _____ Date: 22-JAN-'20

Notes/Remarks:

Factory Acceptance Test

Model Number: SPRE-3466/S Serial No. **1943**

10.0 STATIC PULL TEST

10.1 Objective:

- To demonstrate stall pull within specified limit of 10, 000 lbs (4,536 kg) bare drum.

10.2 Setup:

- Mount the winch to a suitable anchor point.
- Securely attach on end of wire to drum, and the other to an suitable anchor point.
- A dynamometer will be mounted between the winch and test bed cleat to measure the force applied.

10.3 Procedure:

- Clear the area of non-essential personnel.
- Stroke valve to the heave position and record the maximum continuous line pull.

10.4 Acceptance Criteria:

- The winch will satisfactorily meet the continuous duty pull of 10, 000 lbs (4,536 kg) bare drum.

Table 6: Winch Pull Test Measurements

Measurements			
Characteristic Measured	**Specified Limit**	**Measured Value**	**Pass/Fail**
Stall Pull	≥ 10,000 lbs	12,000 LBS	PASS

10.5 Verification Sign-Off:

Hawboldt Test Technician: _____ Date: 22 Jan 20

Hawboldt Quality Specialist: _____ Date: 22-JAN-'20

Notes/Remarks:

Factory Acceptance Test

Model Number: SPRE-3466/S Serial No. **1943**

11.0 BREAK PULL TEST

11.1 Objective:

- To test the winch brake at a load of **1.5 X SWL = 1.5 X 10, 000 lbs = 15, 000 lbs.**

11.2 Setup:

- Wind several wraps (6 minimum) onto the drum, and attach the free end to a test cylinder and hard point on the deck.

11.3 Procedure:

- Connect the free end of the test rope to the test cylinder and load cell in series.
- Clear the area of non-essential personnel.
- Operate the winch to take up slack in the test rope.
- Release the joystick and observe the brake is applied.
- Operate the test Cylinder until the pull of 15, 000 lbs. is obtained.
- Observe the winch for slippage. Record any observations in the Notes/Remarks section below.

11.4 Acceptance Criteria:

- The brake must hold a load of **1.5 X SWL = 1.5 X 10, 000 lbs = 15, 000 lbs.**
- The brake must hold the load for 2 minutes, or as instructed by the Customer Rep., with no movement in winch drum.

Table 7: Break Pull Test Measurements

Measurements			
Characteristic Measured	**Specified Min**	**Measured Value**	**Pass/Fail**
Applied load	15, 000 lbs	15, 050 LBS (DROPPED 50 LBS)	PASS
Brake Test	No movement for 2 min	2:03 (MIN:SEC)	PASS

11.5 Verification Sign-Off:

Hawboldt Test Technician: _____ Date: 22 Jan 20

Hawboldt Quality Specialist: _____ Date: 22-JAN-'20

Notes/Remarks: 15,200 LBS @ 2:00 MIN THROUGH SHEAVE HELD FINE
(W) LOAD PIN ACCURACY ISSUE - FIXED 22-JAN-'20

Factory Acceptance Test

Model Number: SPRE-3466/S Serial No. **1943**

12.0 LEVEL WIND DYNAMIC TEST

12.1 Objective:

- Dynamic load test @ ~~10,000~~ **lbs** bare drum pull **through level wind.**

12.2 Setup: 9,850 LBS USED ACM 22-JAN-'20

- Wind several wraps (6 minimum) onto the drum, and attach the free end to a load.
- Measure and record the weight of the test load using a dynamometer.
- A lift weight should be positioned under the test mast and connected to the winch using the wire rope.

12.3 Procedure:

- Clear the area of non-essential personnel.
- Lift the load and stop paying in instantly and observe the results.
- Lower the load and stop paying out instantly and observe the results.

12.4 Acceptance Criteria:

- The load should not fall.

Table 8: Dynamic Load Test Measurements

Measurements		
Weight Lifted	**Characteristic Measured**	**Pass/Fail**
~~10,000~~ lbs 9,850	Pay-In Load suspension	PASS
	Pay-Out Load Suspension	PASS

12.5 Verification Sign-Off:

Hawboldt Test Technician: _____ Date: 22 Jan 20

Hawboldt Quality Specialist: _____ Date: 22-JAN-'20

Notes/Remarks: 9850 LBS USED

13.0 TEST EQUIPMENT AND CALIBRATION SUMMARY

The following items, used in this procedure, have been calibrated in accordance with ISO 9001-2015.

Table 9: Calibrated Equipment Due Dates

ITEM	EQUIPMENT/MAKE/MODEL	SERIAL NO.	LAST CAL.	CAL. DUE
1	HI-117 ⟷	DILLON; DYNAMOMETER DED×2700549	25-OCT-19	25-OCT-20

14.1 Verification Sign-Off:

Hawboldt Test Technician: _____ Date: 22 JAN 20

Hawboldt Quality Specialist: _____ Date: 22-JAN-'20

Notes/Remarks:

Factory Acceptance Test

Model Number: SPRE-3466/S

Serial No. **1943**

TEST REMARKS

① CUT BOLT ENDS OF OP. STAND OR CHANGE BOLT ✓

② LOAD PIN ACCURACY
↳ MUST BE WITHIN 3% - VERIFIED ✓

③ REMOVE LIFTING LUGS FROM BRAKE RESISTOR ✓

④ REMOVE SHARP EDGES → CUP HOLDER ✓
BRAKE RESISTOR ✓

LOAD PIN CALIBRATION: ✓
→ USED 9850 LBS

→ TEST BELLY PACK + ALARMS ✓

⑤ LVL WIND HANDLE BUSTED ✓

~~BREVINI GEAR BOX~~ SWAPPED BREVINI GEARBOX
~~ITEM B00 28465~~ WITH FAM B00 28635
~~FAM BPH323K~~ 1939 S/N 03443215 ARM
~~S/N 03459639~~ 10-MAR-26

STROMAG
D - 06844
TYP: 4 BZFM 25M
401-07430
NR : 6219 00591

BONITRON
MODEL: M377 5RG - H030C - 3R - 316SSE - 180L
S/N: 2870

8.0: COMPONENT LITERATURE

This section contains a list of the manufacturer's information.

HAWBOLDT PART NUMBER	MANUFACTURER	MODEL CODE	DESCRIPTION
5408916	ABB	ACS880-01-052A-5	Winch VFD
5408564	ABB	ACS355-03U-23A1-4+J404	Levelwind VFD
5408621	BONITRON	M3775RG-H030C-3R-316SS	Braking Resistor
5408400	BREVINI	BPH323K/102.5/IEC200 B3 (D.100)	Gearbox
5408411	EMOD	SMFKOB 200L/4T	Electric Motor
5408557	MGM	SM 160 MB4 KW_11.0 230/460/60 B5 CL_F S2_30MIN IP56	Electric Motor
5406402	IDEC	LD6A-2GQB-RYC	Beacon Light
5403849	OMRON	E2A-M18KS08-WP-B1 5M	Proximity Sensor (Normally Open)
5405988	OMRON	E2A-M18KS08-WP-B2 5M	Proximity Sensor (Normally Closed)
34-00304-586	SENSY	5000-FORC001023	Load Pin
N/A	SKF	N/A	Bearing Maintenance
5408558	STM	OMF 112/3 F1 50 1/13.1 160B5	Gearbox
5408411	Stromag	4 BZFM 25	Parking Brake
5406446-5406451	TURCK	Ri360P0-EQR24M0-INCRX2-H1181	Incremental Encoder
5408650	PQ	M115SL15S72	Joystick
5407909	Danfoss	JCS120-0005	Thumb Joystick

9.0: DRAWINGS

This section contains a list of the drawings provided.

DRAWING NUMBER	TITLE
F400942	SPRE 3464 – ELEC SCRIPPS
7400371	SPRE-3464 ELECTRICAL SCHEMATIC
7400373	SPRE-3464 INTERCONNECT DIAGRAM
7400372	SPRE-3464 PANEL PAYOUT
34-00304-000	SPRE 3464 GENERAL ARRANGEMENT
34-00304-001	SPRE 3464 GENERAL ASSEMBLY
34-00304-007	ASSEMBLY – DRUM
34-00304-028	ASSEMBLY – PANELS
34-00304-031	ASSEMBLY – SCEW AND HOUSING
34-00304-032	ASSEMBLY – ENCODER AND GUARD
34-00304-033	ASSEMBLY – OPERATOR GUARD
34-00304-035	ASSEMBLY – LEVELWIND CARRIAGE
34-00304-037	ASSEMBLY - SHEAVE
34-00304-055	ASSEMBLY – SHEAVE BEARING
34-00304-056	CABLE KEEPER ASSEMBLY
34-00304-057	ASSEMBLY – SIDE PLATFORM
34-00304-058	ASSEMBLY – REAR PLATFORM
34-00304-061	ASSEMBLY – LEVELWIND GEARBOX
34-00304-070	ASSEMBLY – UPPER GUARD
34-00304-079	CABLE GUIDE FITTING ASSEMBLY
34-00304-081	DECAL LAYOUT – SPR3-3464
34-00304-082	SPRE-3464 LUBRICATION DIAGRAM
34-00304-085	ASSEMBLY – BEACON KIT
34-00304-089	ASSEMBLY – BONDING/GROUNDING KIT

10.0: MCD DOCUMENT

This section contains the Maximum Capability Document (MCD) per UNOLS requirements.

Maximum Capability Document

Hawboldt SPRE-3464 General Purpose – 1942-1

This document has been prepared in accordance with Appendices A and B from the UNOLS RVSS. This machine is primarily used with the following tension members:

Wire rope tension members of varying size and breaking strength

Synthetic tension members of varying size and breaking strength

0.322” Tension members, with a 11,600 lbf breaking strength

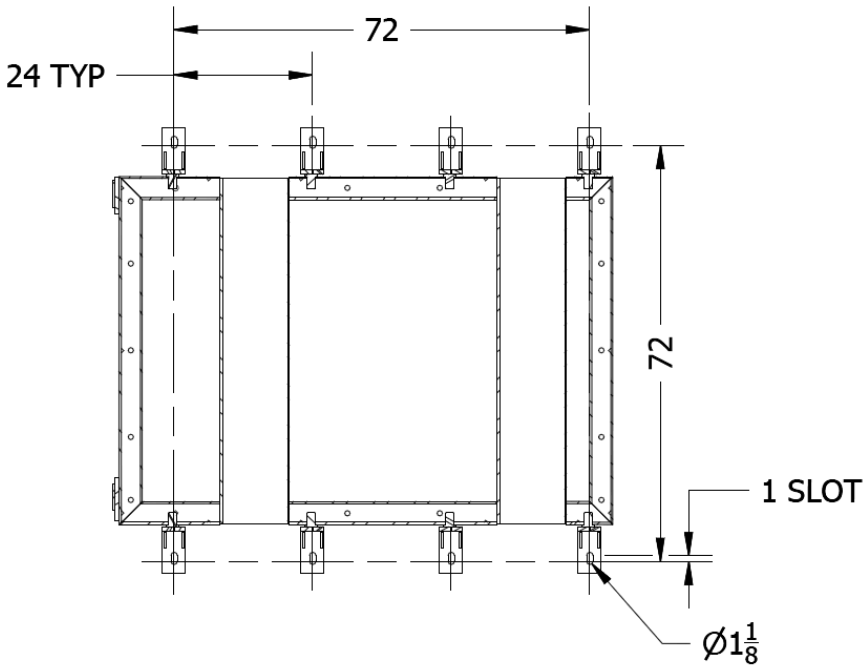
The machine’s levelwind sheave has a sheave liner grooved for ø1/2” wire. Other size sheave liners are available. Per Appendix A, Tables A.8.1 to A.8.4, the machine qualifies for the following Factor of Safety (FS) based on tension member breaking strength:

- FS = 1.5 when used with wire rope and matching sheave groove.
- FS = 2.0 when used with EM cable and matching sheave groove.
- FS = 2.5 when used with wire rope or EM cable and oversized sheave groove.

System Characterizations

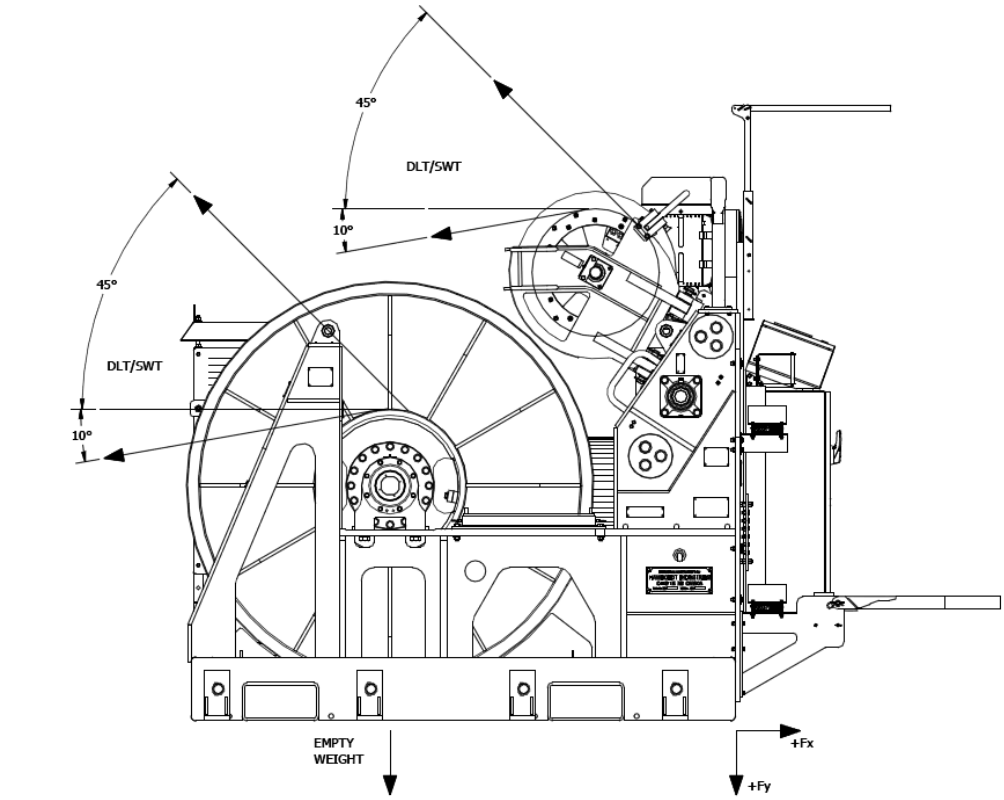
Empty Weight	9,200 lbf
SWT of Winch	10,000 lbf
SWT Fleet Tolerance	+45°/-10° vertical, +/- 5° horizontal
DLT of Winch	20,000 lbf
Max. Line Speed @ Bare Drum	92 ft/min
Power Requirements	480VAC/3PH/60HZ
Bare Drum Pull	10,000 lbf
Full Drum Pull	3,950 lbf

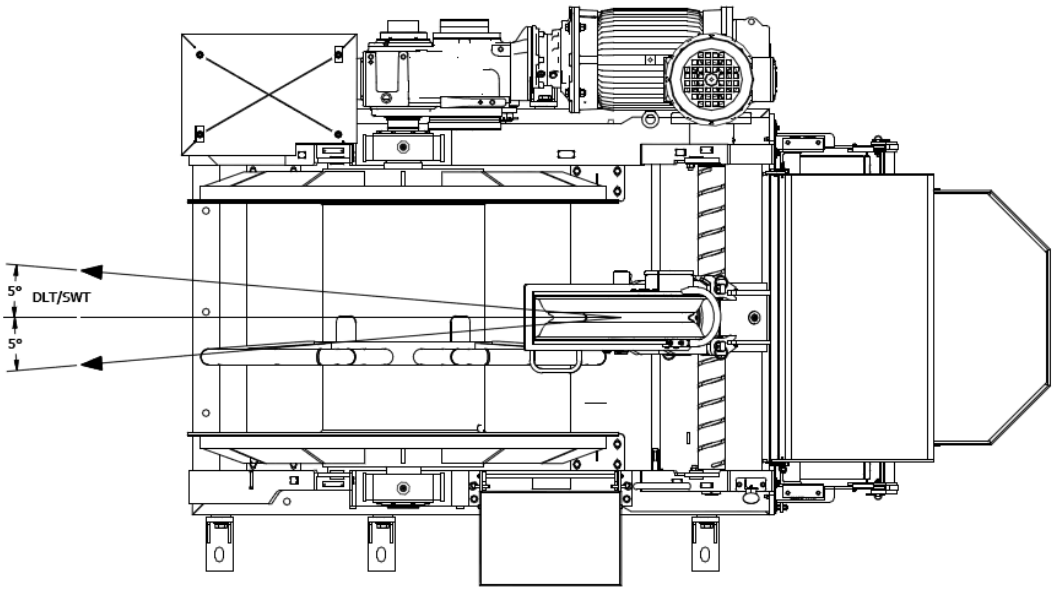
Bolt Pattern



The winch can be mounted with 8 bolts on a UNOLS 2'x2' bolt pattern using the Hawboldt supplied mounting brackets shown in the image above. Alternative mounting brackets can be used however the installer is responsible for re-calculating the bolt loads.

Free Body Diagram





Forces are maximum forces per bolt, at SWT & DLT, for the 8 bolt pattern. The analysis is valid for a vertical fleet angle of +45°/-10° and horizontal fleet angle of +/-5°. The analysis is also valid for both reeving options shown, with and without levelwind.

	Reaction @ SWT	Reaction @ DLT	Mounting Fasteners
Fx [lbf]	1,250	2,500	1”-8 UNC
Fy [lbf]	2,450	6,650	316 SS (σ_y=40 ksi)

Mounting fasteners shall be lubricated and torqued to 273 ft.lb (K=0.15).

APPENDIX A – MAINTENANCE LOGS

The following tables can be used to log maintenance tasks.

Lubrication Maintenance Log

HAWBOLDT INDUSTRIES

This maintenance log is used to record lubrication. Lubrication instructions can be found in Section 6 of this maintenance manual.

HOURS	DATE	INITIALS	Drum Bearings Grease	Sheave Bearing Grease	Levelwind Carriage Bushings Grease	Screw Blade Grease	Screw Bearings Grease	Guide Rods & Screw Grease	Main Gearbox Oil	Levelwind Gearbox Oil	Torque Arm Grease	NOTES

Mechanical Maintenance Log

This maintenance log is used to record mechanical maintenance. Mechanical maintenance instructions can be found in Section 6 of this maintenance manual.

HOURS	DATE	INITIALS	Ball & Roller Bearings	Tightening of Critical Bolts	Parking Brake		NOTES

APPENDIX B – BOLT TORQUE CHARTS

FASTENAL®

TORQUE-TENSION REFERENCE GUIDE

TORQUE-TENSION RELATIONSHIP FOR A307A, GRADE 5, 8 & 9 BOLTS

Nominal Dia. (in.)	Threads per inch	ASTM A307 Grade A				SAE J429 Grade 5					SAE J429 Grade 8					FNL Grade 9				
		Clamp Load (Lbs.)	Tightening Torque			Clamp Load (Lbs.)	Tightening Torque				Clamp Load (Lbs.)	Tightening Torque				Clamp Load (Lbs.)	Tightening Torque			
			K = 0.15	K = 0.17	K = 0.20		Ecoguard™	K = 0.15	K = 0.17	K = 0.20		Eco-guard™	K = 0.15	K = 0.17	K = 0.20		Eco-guard™	K = 0.15	K = 0.17	K = 0.20
Coarse Thread Series																				
1/4	20	859	32 in-lbs	37 in-lbs	43 in-lbs	2029	61 in-lbs	76 in-lbs	86 in-lbs	10 1in-lbs	2864	86 in-lbs	107 in-lbs	122 in-lbs	143 in-lbs	3357	101 in-lbs	126 in-lbs	143 in-lbs	168 in-lbs
5/16	18	1416	66	75	88	3342	125	157	178	209	4719	177	221	251	295	5531	207	259	294	346
3/8	16	2092	10 ft-lbs	1 1 ft-lbs	13 ft-lbs	4940	19 ft-lbs	23 ft-lbs	26 ft-lbs	31 ft-lbs	6974	26 ft-lbs	33 ft-lbs	37 ft-lbs	44 ft-lbs	8174	31 ft-lbs	38 ft-lbs	43 ft-lbs	51 ft-lbs
7/16	14	2870	16	18	21	6777	30	37	42	49	9568	42	52	59	70	11214	49	61	70	82
1/2	13	3831	24	27	32	9046	45	57	64	75	12771	64	80	90	106	14969	75	94	106	125
9/16	12	4912	35	39	46	11599	65	82	92	109	16375	92	115	130	154	19193	108	135	153	180
5/8	11	6102	48	54	64	14408	90	113	128	150	20340	127	159	180	212	23840	149	186	211	248
3/4	10	9030	85	96	113	21322	160	200	227	267	30101	226	282	320	376	35281	265	331	375	441
7/8	9	12467	136	155	182	29436	258	322	365	429	41556	364	455	515	606	48707	426	533	604	710
1	8	16355	204	232	273	38616	386	483	547	644	54517	545	681	772	909	63899	639	799	905	1065
1-1/4	7	26166	409	463	545	53786	672	840	952	1121	87220	1090	1363	1545	1817	102229	1278	1597	1810	2130
1-3/8	6	31182	536	607	715	64096	881	1102	1249	1469	103939	1429	1768	2025	2382	121826	1675	2094	2373	2792
1-1/2	6	37942	711	806	949	77991	1170	1462	1657	1950	126473	1897	2371	2688	3162	148237	2224	2779	3150	3706
Fine Thread Series																				
1/4	28					2319	70 in-lbs	87 in-lbs	99 in-lbs	116 in-lbs	3274	98 in-lbs	123 in-lbs	139 in-lbs	164 in-lbs	3837	115 in-lbs	144 in-lbs	163 in-lbs	192 in-lbs
5/16	24					3702	139	174	197	231	5226	196	245	278	327	6125	230	287	325	383
3/8	24					5599	21 ft-lbs	26 ft-lbs	30 ft-lbs	35 ft-lbs	7905	30 ft-lbs	37 ft-lbs	42 ft-lbs	49 ft-lbs	9265	35 ft-lbs	43 ft-lbs	49 ft-lbs	58 ft-lbs
7/16	20					7568	33	41	47	55	10684	47	58	66	78	12523	55	68	78	91
1/2	20					10197	51	64	72	85	14396	72	90	102	120	16873	84	105	120	141
9/16	18					12940	73	91	103	121	18268	103	128	146	171	21412	120	151	171	201
5/8	18					16317	102	127	144	170	23036	144	180	204	240	27000	169	211	239	281
3/4	16					23776	178	223	253	297	33566	252	315	357	420	39343	295	369	418	492
7/8	14					32479	284	355	403	474	45853	401	502	568	669	53743	470	588	666	784
1	14					43343	433	542	614	722	61190	612	765	867	1020	71720	717	896	1016	1195
1-1/4	12					59548	744	930	1055	1241	96565	1207	1509	1710	2012	113182	1415	1768	2004	2358
1-3/8	12					72967	1003	1254	1421	1672	118324	1627	2034	2305	2712	138686	1907	2384	2701	3278
1-1/2	12					87747	1316	1645	1865	2194	142292	2134	2668	3024	3557	166778	2502	3127	3544	4169

ELECTRODEPOSITED ZINC & LUBRICATED PREVAILING-TORQUE ALL-METAL TYPE NUTS

Locknut Size	Threads per inch	Steel Hex Locknut						Steel Hex Flange Nut					
		Grade C			FNL Grade 9			Grade F			Grade G		
		Clamp Load (lbs.)	Tightening Torque		Clamp Load (lbs.)	Tightening Torque		Clamp Load (lbs.)	Tightening Torque		Clamp Load (lbs.)	Tightening Torque	
			min	max		min	max		min	max		min	max
Coarse Thread Series													
1/4	20	2864	93.1 in-lbs	144 in-lbs	3357	100.7 in-lbs	134.3 in-lbs	2029	76.1 in-lbs	96.4 in-lbs	2864	107.4 in-lbs	136 in-lbs
5/16	18	4719	192	251	5531	207	277	3342	157	198	4719	221	280
3/8	16	6974	28.3 ft-lbs	37 ft-lbs	8174	30.7 ft-lbs	40.9 ft-lbs	4940	23.2 ft-lbs	29.3 ft-lbs	6974	32.7 ft-lbs	41.4 ft-lbs
7/16	14	9568	45	59	11214	49	65	6777	37	47	9568	52	66
1/2	13	12771	69	90	14969	75	100	9046	57	72	12771	80	101
9/16	12	16375	100	130	19193	108	144	11599	82	103	16375	115	146
5/8	11	20340	138	180	23840	149	199	14408	113	143	20340	159	201
3/4	10	30101	245	320	35281	265	353	21322	200	253	30101	282	357
7/8	9	41556	394	515	48707	426	568						
1	8	54517	591	772	63899	639	852						
1-1/8	7	68695	837	1095	80516	906	1208						
1-1/4	7	87220	1181	1545	102229	1278	1704						
Fine Thread Series													
1/4	28	3274	90 in-lbs	130.9 in-lbs	3837	105.5 in-lbs	153.5 in-lbs						
5/16	24	5226	180	261	6125	211	306						
3/8	24	7905	27.2 ft-lbs	39.5 ft-lbs	9265	31.8 ft-lbs	46.3 ft-lbs						
7/16	20	10684	43	62	12523	50	73						
1/2	20	14396	66	96	16873	77	112						
9/16	18	18268	94	137	21412	110	161						
5/8	18	23036	132	192	27000	155	225						
3/4	16	33566	231	336	39343	270	393						
7/8	14	45853	368	535	53743	431	627						
1	14	61190	561	816	71720	657	956						
1-1/8	12	77015	794	1155	90268	931	1354						
1-1/4	12	96565	1106	1609	113182	1297	1886						

METRIC FASTENERS

Nominal Dia. (mm)	Pitch	4.6 Class 4.6				8.8 Class 8.8				10.9 Class 10.9				12.9 Class 12.9			
		Clamp Load (lbs)	Tightening Torque			Clamp Load (lbs)	Tightening Torque			Clamp Load (lbs)	Tightening Torque			Clamp Load (lbs)	Tightening Torque		
			K = 0.15	K = 0.17	K = 0.20		K = 0.15	K = 0.17	K = 0.20		K = 0.15	K = 0.17	K = 0.20		K = 0.15	K = 0.17	K = 0.20
4	0.7	333	7.9 in-lbs	8.9 in-lbs	10.5 in-lbs	858	20.3 in-lbs	23 in-lbs	27 in-lbs	1228	29 in-lbs	32.9 in-lbs	38.7 in-lbs	1436	33.9 in-lbs	38.4 in-lbs	45.2 in-lbs
5	0.8	538	15.9	18.0	21.2	1387	40.9	46.4	54.6	1985	58.6	66.4	78.1	2319	68.5	77.6	91.3
6	1	763	27.0	30.7	36.1	1968	69.7	79.0	92.9	2816	99.8	113.1	133.0	3291	116.6	132.1	155.4
7	1	1095	45.3	51.3	60.3	2822	116.6	132.2	155.5	4039	167	189	223	4720	195	221	260
8	1.25	1389	65.6	74.4	87.5	3580	169.1	191.6	225.4	5123	242	274	323	5987	283	320	377
10	1.5	2200	10.8 ft-bs	12.3 ft-lbs	14.4 ft-lbs	5671	27.9 ft-lbs	31.6 ft-lbs	37.2 ft-lbs	8115	39.9 ft-lbs	45.2 ft-lbs	53.2 ft-lbs	9484	46.7 ft-lbs	52.9 ft-lbs	62.2 ft-lbs
12	1.75	3197	18.9	21.4	25.2	8240	48.7	55.1	64.9	11792	69.6	78.9	92.8	13781	81.4	92.2	108.5
14	2	4379	30.2	34.2	40.2	11289	77.8	88.1	103.7	16154	111.3	126.1	148.4	18879	130.0	147.4	173.4
16	2	5943	47	53	62	15320	121	137	161	21924	173	196	230	25622	202	229	269
18	2.5	7301	65	73	86	18822	167	189	222	26934	239	270	318	31477	279	316	372
20	2.5	9286	91	104	122	23938	236	267	314	34256	337	382	449	40034	394	446	525
22	2.5	11509	125	141	166	29669	321	364	428	42457	460	521	613	49619	537	609	716
24	3	13372	158	179	211	34471	407	461	543	49329	582	660	777	57649	681	771	908
27	3	17428	232	262	309	44924	597	676	796	64288	854	968	1139	75132	998	1131	1331
30	3.5	21266	314	356	419	54819	809	917	1079	78448	1158	1312	1544	91680	1353	1534	1804
33	3.5	26310	427	484	570	67821	1101	1248	1468	97055	1576	1786	2101	113425	1842	2087	2455
36	4	30982	549	622	732	79866	1415	1603	1886	114291	2024	2294	2699	133569	2366	2681	3154

* Tightening Torque (in-lbs through M8; M10 & over ft-lbs)

A2 OR A4 METRIC STAINLESS STEEL FASTENERS

Nominal Dia. (mm)	Pitch	Torque (in-lbs through M8; M10 & over ft-lbs)	
		Dry	Lubricated
3	0.5	7.5 in-lbs.	7.0 in-lbs.
4	0.7	17.5	16.2
5	0.8	35.4	32.7
6	1	60.3	55.8
8	1.25	146.2	135.2
10	1.5	24.1 ft-lbs	22.3 ft-lbs
12	1.75	42.1	38.9
14	2	67.2	62.2
16	2	104	96
18	2.5	144	133
20	2.5	204	188
22	2.5	208	193
24	3	264	244

CAUTION: All material included in these charts is advisory only, and its use by anyone is voluntary. In developing this information, Fastenal has made a determined effort to present its contents accurately. Extreme caution should be used when using a formula for torque/tension relationships. Torque is only an indirect indication of tension. Under/over tightening of fasteners can result in costly equipment failure or personal injury.

ALLOY STEEL LOW HEAD SOCKET HEAD CAP SCREW

Nominal Size		Alloy Steel Socket Head Other Configurations Torque (in-lbs.)			
Size	Inch	Flat Head	Button Head	Shoulder Screw	Low-Head
#1	0.073	2.5	2	-	
#2	0.086	4.5	4	-	
#3	0.099	7	7	-	
#4	0.112	9	8.5	-	5
#5	0.125	13	13	-	9.5
#6	0.138	17	15	-	9.5
#8	0.164	32	30	-	19
#10	0.190	60	55	-	30.5
1/4	0.250	125	105	50	75
5/16	0.313	225	200	125	150
3/8	0.375	375	350	265	275
1/2	0.500	1100	950	470	600
5/8	0.625	1900	1700	1150	1300
3/4	0.750	3500	-	2000	-
7/8	0.875	5750	-	-	-
1	1.000	8000	-	-	-

For additional technical information, contact Fastenal Engineering at engineer@fastenal.com.

ASTM A574 SOCKET HEAD CAP SCREWS

Nominal Size or Basic Screw Dia.		Threads per inch	Tensile Stress Area (sq. in.)	ASTM A574			
				Clamp Load (lbs)	Tightening Torque		
					K = 0.15	K = 0.17	K = 0.20
Coarse Thread Series							
#1	0.0730	64	0.0026	275	3.0 in-lbs	3.4 in-lbs	4.0 in-lbs
#2	0.0860	56	0.0037	388	5.0	5.7	6.7
#3	0.0990	48	0.00492	511	7.6	8.6	10.1
#4	0.1120	40	0.006	633	10.6	12.1	14.2
#5	0.1250	40	0.008	835	16	18	21
#6	0.1380	32	0.0091	954	20	22	26
#8	0.1640	32	0.014	1471	36	41	48
#10	0.1900	24	0.0175	1841	52	59	70
1/4	0.2500	20	0.0318	3341	125	142	167
5/16	0.3125	18	0.0524	5505	258	292	344
3/8	0.3750	16	0.0775	8136	38 ft-lbs	43 ft-lbs	51 ft-lbs
7/16	0.4375	14	0.1063	11162	61	69	81
1/2	0.5000	13	0.1419	14899	93	106	124
5/8	0.6250	11	0.226	22883	179	203	238
3/4	0.7500	10	0.3345	33864	317	360	423
7/8	0.8750	9	0.4617	46751	511	580	682
1	1.0000	8	0.6057	61332	767	869	1022
1-1/4	1.2500	7	0.9691	98123	1533	1738	2044
1-1/2	1.5000	6	1.4053	142282	2668	3023	3557
Fine Thread Series							
#0	0.0600	80	0.0018	189	1.7 in-lbs	1.9 in-lbs	2.3 in-lbs
#1	0.0730	72	0.0028	292	3.2	3.6	4.3
#2	0.0860	64	0.0039	413	5.3	6.0	7.1
#3	0.0990	56	0.0052	549	8.2	9.2	10.9
#4	0.1120	48	0.0066	693	11.7	13.2	15.5
#5	0.1250	44	0.0083	872	16	19	22
#6	0.1380	40	0.0101	1065	22	25	29
#8	0.1640	36	0.0147	1546	38	43	51
#10	0.1900	32	0.02	2099	60	68	80
1/4	0.2500	28	0.0364	3819	143	162	191
5/16	0.3125	24	0.0581	6097	286	324	381
3/8	0.3750	24	0.0878	9222	43 ft-lbs	49 ft-lbs	58 ft-lbs
7/16	0.4375	20	0.1187	12465	68	77	91
1/2	0.5000	20	0.16	16795	105	119	140
5/8	0.6250	18	0.256	26876	210	238	280
3/4	0.7500	16	0.373	39161	367	416	490
7/8	0.8750	14	0.5095	53495	585	663	780
1	1.0000	14	0.6799	71388	892	1011	1190
1-1/4	1.2500	12	1.0729	112659	1760	1995	2347
1-1/2	1.5000	12	1.581	166007	3113	3528	4150

ASTM A193 B7

Nominal Dia.	Threads per inch	ASTM A193 B7			
		Clamp Load (lbs)	Tightening Torque		
			K=0.12 (ft-lbs.)	K = 0.15 (ft-lbs.)	K = 0.17 (ft-lbs.)	K = 0.20 (ft-lbs.)
Coarse Thread Series						
1/4	20	2506	75.2 in-lbs	94 in-lbs	106.5 in-lbs	125.3 in-lbs
5/16	18	4129	155	194	219	258
3/8	16	6102	22.9 ft-lbs	28.6 ft-lbs	32.4 ft-lbs	38.1 ft-lbs
7/16	14	8372	37	46	52	61
1/2	13	11175	56	70	79	93
5/8	11	17798	111	139	158	185
3/4	10	26339	198	247	280	329
7/8	9	36362	318	398	451	530
1	8	47702	477	596	676	795
1-1/8	7	60108	676	845	958	1127
1-1/4	7	76318	954	1192	1351	1590
1-3/8	6	90947	1251	1563	1772	2084
1-1/2	6	110664	1660	2075	2352	2767
UN8 Thread Series						
1-1/8	8	62248	700 ft-lbs	875 ft-lbs	992 ft-lbs	1167 ft-lbs
1-1/4	8	78727	984	1230	1394	1640
1-3/8	8	97138	1336	1670	1892	2226
1-1/2	8	117483	1762	2203	2497	2937
Fine Thread Series						
1/4	28	2864	85.9 in-lbs	107.4 in-lbs	121.7 in-lbs	143.2 in-lbs
5/16	24	4573	171	214	243	286
3/8	24	6916	25.9 ft-lbs	32.4 ft-lbs	36.7 ft-lbs	43.2 ft-lbs
7/16	20	9349	41	51	58	68
1/2	20	12596	63	79	89	105
5/8	18	20157	126	157	178	210
3/4	16	29371	220	275	312	367
7/8	14	40121	351	439	497	585
1	14	53541	535	669	758	892
1-1/8	12	67388	758	948	1074	1264
1-1/4	12	84494	1056	1320	1496	1760
1-3/8	12	103534	1424	1779	2017	2373
1-1/2	12	124506	1868	2334	2646	3113

- If using API bolting requirements, refer to applicable API specification for tightening torque values.
- These recommendations are for non-gasketed metal-to-metal joints.

STAINLESS STEEL AND NON-FERROUS FASTENERS (INCH SERIES)

Nom Dia	Threads per inch	18-8 and 316 Stainless Steel		Silicon Bronze	Monel	Brass	2024-T4 Aluminum
		Dry	Lubricated				
Coarse Thread Series							
2	56	2.5 in-lbs	2.3 in-lbs	2.3 in-lbs	2.5 in-lbs	2.0 in-lbs	1.4 in-lbs
4	40	5.4	4.9	4.8	5.3	4.3	2.9
5	40	8.0	7.2	7.1	7.8	6.3	4.2
6	32	10.0	9.0	8.9	9.8	7.9	5.3
8	32	18.4	16.5	18.4	20.2	16.2	10.8
10	24	26.6	24.0	21.2	25.9	18.6	13.8
1/4	20	63.6	57.3	68.8	85.3	61.5	45.6
5/16	18	131	118	123	149	107	80
3/8	16	19.4 ft-lbs	17.4 ft-lbs	18.3 ft-lbs	22.2 ft-lbs	16.0ft-bs	11.9 ft-lbs
7/16	14	31.0	27.9	29.1	35.6	26.4	19.0
1/2	13	47	43	40	48.7	35.2	26
5/8	11	94	85	86	111	76	60
3/4	10	125	113	118	153	104	82
7/8	9	202	182	178	231	159	124
1	8	303	273	265	344	235	184
Fine Thread Series							
2	64	2.7 in-lbs	2.4 in-lbs	2.8 in-lbs	3.1 in-lbs	2.5 in-lbs	1.7 in-lbs
4	48	5.9	5.3	6.1	6.7	5.4	3.6
5	44	8.3	7.5	8.7	9.6	7.7	5.1
6	40	11.2	10.1	11.2	12.3	9.9	6.6
8	36	19.3	17.4	20.4	22.4	18.0	12.0
10	32	30.4	27.4	29.3	34.9	25.9	19.2
1/4	28	73	65	87	106	77	57
5/16	24	145	131	131	160	116	86
3/8	24	22.0 ft-lbs	19.8 ft-lbs	20.0 ft-lbs	24.5 ft-lbs	17.7 ft-lbs	13.1 ft-lbs
7/16	20	34.6	31.2	30.9	37.6	27.3	20.2
1/2	20	53	48	42	51	37	27
5/8	18	107	96	96	123	85	67
3/4	16	140	126	115	149	102	80
7/8	14	223	201	177	230	158	124
1	14	340	306	240	311	212	166

NOTES:

1) The torque values can only be achieved if nut or tapped hole has a proof load greater than or equal to the bolt's minimum tensile strength.
2) For A307A, J429 Grade 5 and 8, FNL Grade 9, EcoGuard™, A574, A193 B7, Class 4.6, 8.8, 10.9, and 12.9 externally thread fasteners and Prevailing Torque All-Metal Nut chart, the torque values were calculated from the formula Torque=KDF, where
   K is the estimated torque coefficient
   (for full details contact engineer@fastenal.com).
   K = 0.12 when using EcoGuard™ coated nut, bolt and washer
   K = 0.15 for "lubricated" conditions including EcoGuard™, some oil, tapping fluid, etc.
   K = 0.17 for some anti-seize, thread lockers, and some plain conditions
   K = 0.20 for zinc and dry conditions
   K = 0.12 is listed for A193 B7, which would be used for some general PTFE coatings
   When using zinc plated lubricated with wax prevailing torque lock nuts, the K value can vary between 0.12–0.18. Use Prevailing Torque All-Metal Nut chart if using this style of nut.
   D = Nominal Diameter
   F = Clamp Load
   For J429 Grade 5 and 8, FNL Grade 9, A574, Class 4.6, 8.8, 10.9 and 12.9, the clamp loads are listed at 75% of the proof loads specified by the standard. For A307 Grade A, 75% of 36,000 PSI is utilized. A193 B7 uses 75% of the yield strength. The prevailing torque lock nut clamp loads are listed at 75% of the proof loads specified for the appropriate grade bolt: Grade C – SAE J429 Grade 8, FNL Grade 9 – FNL Grade 9 bolt, Grade F – SAE J429 Grade 5, Grade G – SAE J429 Grade 8.
3) With the exception of the F835 Countersunk and Button Head, Alloy Steel Socket Shoulder and Alloy Steel Low Head Socket Head Cap Screw, torque values for inch series charts up through and including 5/16-in diameter are in inch-pounds; diameters 3/8-in and larger are in foot-lbs. Torque values for metric fasteners up through and including M8 are in inch-pounds; diameters M10 and larger are in foot-lbs.
4) Torque values for F835 Countersunk and Button Head, Alloy Steel Socket Shoulder and Alloy Steel Low Head Socket Head Cap Screw are given for "as-received" screws in rigid joints when torqued with standard hex keys; all are listed in inch-pounds.
5) Stainless Steel and Non-Ferrous are suggested maximum torque values based on actual lab testing.
6) Stainless steel fasteners tend to gall while being tightened. The risk of galling or thread seizing can be reduced by: using lubrication, tightening fasteners with low RPMs and without interruptions, applying only light pressure, and avoiding prevailing torque lock nuts when possible.

CONVERSION FACTORS:

To convert inch-pounds (in-lbs) to Newton meters (Nm), multiply by 0.113
To convert foot-pounds (ft-lbs) to Newton meters (Nm), multiply by 1.35
To convert pounds (lbs) to Newtons (N), multiply by 4.448
To convert inches (in) to millimeters (mm), multiply by 25.4

Note: When using Zinc Plated (lubricated with wax) Top Lock Nuts, the K value can vary between 0.12-0.16.

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APPENDIX C – ADDITIONAL EQUIPMENT PRESERVATION

Safety Data Sheet

Revision Date 03-10-2015
Revision Number 3

DAUBERT CHEMICAL COMPANY, INC.

SECTION 1 Identification of the substance/mixture and of the company/undertaking

Product identification used on label	
Product identifier	3009 TECTYL 506
Details of the supplier of the safety data sheet	Daubert Chemical Company 4700 S. Central Avenue Chicago, IL 60638 708-496-7350
Emergency telephone number	Chemtrec: (800) 424-9300
Relevant identified uses of the substance or mixture and uses advised against	Corrosion Preventive Compound

SECTION 2 Hazards identification

Classification of the chemical in accordance with paragraph (d) of §1910.1200;

GHS Hazard Symbols

GHS Classification	Aspiration Hazard Category 1 Skin Corrosion/Irritation Category 2 Serious Eye Damage/Eye Irritation Category 2B Flammable Liquid Category 3 Specific Target Organ Systemic Toxicity (STOT) - Single Exposure Category 3 Acute Toxicity - Inhalation Vapour Category 4
Signal Word	Danger
Hazard Statements	Flammable liquid and vapour. May be fatal if swallowed and enters airways. Causes skin and eye irritation Harmful if inhaled. May cause respiratory irritation. May cause drowsiness or dizziness.
Precautionary Statements	
Prevention	Keep away from heat/sparks/open flames/hot surfaces. – No smoking. Keep container tightly closed. Ground/bond container and receiving equipment. Use explosion-proof equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Avoid breathing dust/fume/gas/mist/vapours/spray. Wash thoroughly after handling.

	Use only outdoors or in a well-ventilated area.
	Wear protective gloves/protective clothing/eye protection/face protection.
Response	IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
	IF ON SKIN: Wash with plenty of soap and water.
	IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
	Call a POISON CENTER or doctor/physician if you feel unwell.
	Specific treatment: None known
	Do NOT induce vomiting.
	If skin irritation occurs: Get medical advice/attention.
	If eye irritation persists: Get medical advice/attention.
	Take off contaminated clothing and wash before reuse.
	Use dry chemical, water fog, CO2, foam or sand/earth for extinction.
Storage	Keep container tightly closed.
	Store in a well-ventilated place. Keep container tightly closed.
	Store in a well-ventilated place. Keep cool.
	Store locked up.
Disposal	Dispose of contents/container in accordance with local/regional/national/international regulation for hazardous wastes.

SECTION 3 Composition/information on ingredients

Chemical Name	CAS #	%
Hydrotreated light distillate (Petroleum)	64742-47-8	10 - 30
Stoddard solvent	8052-41-3	10 - 30

Note: Specific chemical identities and/or exact percentages have been withheld as a trade secret.

SECTION 4 First aid measures

Inhalation	If symptoms are experienced remove source of contamination or move victim to fresh air and obtain medical advice.
Eyes	Flush eyes with plenty of water for at least 20 minutes retracting eyelids often. Tilt the head to prevent chemical from transferring to the uncontaminated eye. Get immediate medical attention.
Skin Contact	Wash with soap and water. Remove contaminated clothing and launder. Get medical attention if irritation develops or persists.
Ingestion	Do not induce vomiting and seek medical attention immediately. Provide medical care provider with this SDS.
Note to Doctor	Treat symptomatically.

SECTION 5 Firefighting measures

Extinguishing media	Use alcohol resistant foam, carbon dioxide, or dry chemical extinguishing agents. Water may be ineffective but water spray can be used extinguish a fire if swept across the base of the flames. Water can absorb heat and keep exposed material from being damaged by fire.

Fire and/or Explosion Hazards	Vapors may be ignited by sparks, flames or other sources of ignition if material is above the flash point giving rise to a fire (Class B). Vapors are heavier than air and may travel to a source of ignition and flash back. Empty containers that retain product residue (liquid, solid/sludge, or vapor) can be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose container to heat, flame, sparks, static electricity, or other sources of ignition. Any of these actions can potentially cause an explosion that may lead to injury or death.
Fire Fighting Methods and Protection	Do not enter fire area without proper protection including self-contained breathing apparatus and full protective equipment. Fight fire from a safe distance and a protected location due to the potential of hazardous vapors and decomposition products. Flammable component(s) of this material may be lighter than water and burn while floating on the surface.
Hazardous Combustion Products	Carbon dioxide, Carbon monoxide, Sulfur compounds, Hydrocarbons

SECTION 6 Accidental release measures

Personal precautions, protective equipment and emergency procedures	Exposure to the spilled material may be irritating or harmful. Follow personal protective equipment recommendations found in Section VIII of this SDS. Additional precautions may be necessary based on special circumstances created by the spill including; the material spilled, the quantity of the spill, the area in which the spill occurred. Also consider the expertise of employees in the area responding to the spill.
Methods and materials for containment and cleaning up	Prevent the spread of any spill to minimize harm to human health and the environment if safe to do so. Wear complete and proper personal protective equipment following the recommendation of Section VIII at a minimum. Dike with suitable absorbent material like granulated clay. Gather and store in a sealed container pending a waste disposal evaluation.

SECTION 7 Handling and storage

Precautions for safe handling	Avoid contacting and avoid breathing the material. Use only in a well ventilated area. As with all chemicals, good industrial hygiene practices should be followed when handling this material. Wash thoroughly after handling. Do not get in eyes, on skin and clothing. Ground and bond containers when transferring material. "Empty" containers retain product residue (liquid and/or vapor) and can be dangerous.
Conditions for safe storage, including any incompatibilities	Store in a cool dry place. Isolate from incompatible materials.Keep container closed when not in use. Keep away from sources of ignition.
Incompatible materials	Strong oxidizing agents, Strong alkalies, Acids

SECTION 8 Exposure controls/personal protection

Control parameters

Chemical Name	ACGIH TLV	ACGIH STEL	OSHA PEL
Hydrotreated light distillate (Petroleum)	212 ppm (8 hrs)		
Stoddard solvent	100 ppm TWA; 525 mg/m3 TWA		500 ppm TWA; 2900 mg/m3 TWA

Engineering Measures	Local exhaust ventilation or other engineering controls are normally required when handling or using this product to avoid overexposure. Engineering controls must be designed to meet the OSHA chemical specific standard in 29 CFR 1910. Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits
Respiratory Protection	Proper ventilation (at a minimum) will be required when handling this product. Use respirators (NIOSH approved) only if ventilation cannot be used to eliminate symptoms or reduce the exposure to below acceptable levels. Follow a respiratory protection program that meets 29 CFR 1910.134 and ANSI Z88.2 requirements whenever work place conditions warrant the use of a respirator.
Eye Protection	Wear chemically resistant safety glasses with side shields when handling this product. Do not wear contact lenses.
Skin Protection	Wear protective gloves. Inspect gloves for chemical break-through and replace at regular intervals. Clean protective equipment regularly. Wash hands and other exposed areas with mild soap and water before eating, drinking, and when leaving work.
Gloves	Chemically resistant gloves

SECTION 9 Physical and chemical properties (Typical, not specification)

Physical State	Liquid
Color	Amber
Odor	Slight Solvent Odor
Odor Threshold	No data available
pH	No data available
Melting Point, °C	No data available
Boiling Point, °C	No data available
Flash Point	>= 100 °F(38 °C)
Evaporation Rate	No data available
Flammability (Solid, Gas)	No data available
Lower Flammable/Explosive Limit, % in air	No data available
Upper Flammable/Explosive Limit, % in air	No data available
Vapor Pressure	2 mmHg
Vapor Density	>1 (Air=1)
Specific Gravity @ 25°C	0.86
Solubility in Water	Negligible; 0-1%
Octanol/Water Partition Coefficient	No data available
Autoignition Temperature	No data available

Decomposition Temperature	No data available
Viscosity	No data available
Volatiles, % by weight	44
VOC, lb/gal	3.21
VOC, grams/liter	385
VOC minus exempt solvents & water, lb/gal	3.21

SECTION 10 Stability and reactivity

Chemical stability	Stable under normal conditions. Hazardous polymerization will not occur.
Possibility of hazardous reactions	Under normal conditions of storage and use, hazardous reactions will not occur.
Conditions to avoid	Contamination. Elevated temperatures.
Incompatible materials	Strong oxidizing agents, Strong alkalies, Acids
Hazardous decomposition products	Decomposition and hazardous decomposition products are unlikely.

SECTION 11 Toxicological information

Likely Routes of Entry	Inhalation, Skin contact, Eye contact
Target Organs Potentially Affected by Exposure	Central Nervous System, Respiratory Tract, Skin, Eyes, Kidneys, Liver, Nervous System
Chemical Interactions That Change Toxicity	No chemical interaction known to affect toxicity.
Medical Conditions Aggravated	Skin contact may aggravate existing skin disease, Respiratory disease including asthma and bronchitis

Immediate (Acute) Health Effects by Route of Exposure

Inhalation Irritation	Can cause moderate respiratory irritation, dizziness, weakness, fatigue, nausea and headache.Other possible symptoms include; wheezing and coughing due to pulmonary edema (fluid build-up in lungs).
Skin Contact	Can cause moderate skin irritation, defatting, and dermatitis. Not likely to cause permanent damage.
Eye Contact	Can cause moderate irritation, tearing and reddening, but not likely to permanently injure eye tissue.
Ingestion Irritation	Irritating to mouth, throat, and stomach. Can cause abdominal discomfort, nausea, vomiting and diarrhea. Substance is harmful if swallowed. Large exposure may be fatal.
Ingestion Toxicity	Harmful if swallowed.

Long-Term (Chronic) Health Effects

Carcinogenicity	Not listed by ACGIH, IARC, NIOSH, NTP OR OSHA.
Reproductive and Developmental Toxicity	No data available to indicate product or any components present at greater than 0.1% may cause birth defects.
Inhalation	Upon prolonged and/or repeated exposure, can cause severe respiratory irritation, dizziness, weakness, fatigue, nausea, headache and possible unconsciousness.
Skin Contact	Upon prolonged or repeated contact, can cause moderate skin irritation, defatting, and dermatitis. Not likely to cause permanent damage.

Component Toxicology Data

Chemical Name	CAS Number	LD50/LC50
Stoddard solvent	8052-41-3	Oral LD50 Rat > 5000 mg/kg Inhalation LC50 (4h) Rat > 5500 MG/CU M

SECTION 12 Ecological information

Overview	No ecological information available
Mobility	No data
Persistence	No data
Bioaccumulation	No data
Degradability	No data

Ecotoxicity Data

Chemical Name	CAS Number	Aquatic EC50 Crustacea	Aquatic ERC50 Algae	Aquatic LC50 Fish
No data available				

SECTION 13 Disposal considerations

Waste Description for Spent Product	Spent or discarded material is a hazardous waste.
Disposal Methods	Dispose of by incineration following Federal, State, Local, or Provincial regulations.
Waste Disposal Code(s)	D001

SECTION 14 Transport information

Full Shipping Name for Export, Air, Sea (any quantity) or vessels of 119 gal. or more:	UN1268, PETROLEUM DISTILLATES, N.O.S., (Naphtha Solvent), 3, PG III
Domestic Ground in vessels < 119 gal.	Not Regulated

SECTION 15 Regulatory information

TSCA Status	All components in this product are on the TSCA Inventory or exempt.
Canadian DSL status:	All chemical substances in this material are included on or exempted from listing on the Canadian DSL.

Chemical Name	CAS #	Regulation	Percent
No 313-listed chemicals in this product		SARA 313	

SECTION 16 Other information

Revision Date	03-10-2015
Disclaimer	Although the information contained herein is believed to be reliable, it is furnished without warranty of any kind. This information is not intended to be all-inclusive as to the manner and conditions of use, handling, and storage.
Version	Revised
Comments	Approved: J. Kump / M. Duncan

Tectyl® INDUSTRIAL PRODUCTS

PRODUCT INFORMATION

DAUBERT CHEMICAL COMPANY, INC.

TECTYL® 506

Description

TECTYL® 506 is a solvent cutback corrosion preventive compound. The dry film is firm, amber, and translucent. TECTYL® 506 is excellent for protection of metallic surfaces against corrosion in long-term indoor or outdoor exposure and during domestic and overseas shipment.

Laboratory Data

Typical Properties

Flash, PMCC*, Minimum	**106°F**
Density, Weight/Gallon @ 77°F (25°C)	**7.4 ± 0.1 lbs./gallon**
Specific Gravity @ 60°F (15.6°C)	**0.89**
Recommended Dry Film Thickness over Metal Profile	**1.3 mils**
Theoretical Coverage @ Recommended DFT	**592 sq. ft./gallon**
Non-Volatile % by Weight	**55 ± 2**
Non-Volatile % by Volume	**48 ± 2**
Volatile Organic Content (VOC), Maximum	**3.48 lbs./gallon**
Approximate Dry to Touch Time @ 77°F (25°C)	**1 hour**
Cure Time	**24 hours**
High Temperature Flow Point, Minimum	**300°F**

Accelerated Corrosion Tests:

5% Salt Spray (Hours)	
ASTM B-117 @ Recommended DFT (2x4x1/8 in. Polished Steel Panels)**	**2496**
100% Relative Humidity (Hours)	
ASTM D-1748 @ Recommended DFT (2x4x1/8 in. Polished Steel Panels)	**1500**

*PMCC (Penske Martin Closed Cup)
**ASTM (American Society for Testing and Materials)

Surface Preparation

The maximum performance of TECTYL® 506 can be achieved only when the metal surfaces to be protected are clean, dry and free of rust, oil and mill scale. Daubert Chemical Company recommends that the metal substrate temperature be 50-95°F (10-35°C) at the time of product application.

Application

TECTYL® 506 is formulated to be used as supplied. Ensure uniform consistency prior to use. Continued stirring is generally not required. If the product thickens due to cold storage or loss of solvent during use, contact Daubert Chemical Company. DO NOT THIN TECTYL® 506. Incorrect thinning will affect film build, dry time and product performance. Daubert Chemical Company recommends that the ambient and product temperature be 50 - 95°F (10 - 35°C) at time of application. TECTYL® 506 can be spray or dip applied. DO NOT FREEZE TECTYL® 506.

Removal

TECTYL® 506 can be removed with TECTYL® HPS solventborne thinner, vapor degreasing, hot alkaline wash, or low pressure steam. TECTYL® 506 can be removed from fabrics by normal dry cleaning procedures. Avoid the use of chlorinated or highly aromatic solvents when removing from painted surfaces, as these solvents may adversely affect paint.

Storage

Store TECTYL® 506 at temperatures between 50-95°F (10-35°C). Mild agitation is recommended prior to use.

Caution

Adequate ventilation is required for cure and to ensure against formation of a combustible liquid. THE PARTIALLY CURED FILM SHOULD NOT BE EXPOSED TO IGNITION SOURCES SUCH AS FLARES, FLAMES, SPARKS, EXCESSIVE HEAT, OR TORCHES. Refer to Daubert's Material Safety Data Sheet for additional handling and first aid information.

Note:

The addition of any product over or under this coating is not recommended. The use of additional coatings could result in chemical incompatibility, thus adversely affecting the performance of this coating as stated in the lab data section. If a product other than Daubert Chemical Company's recommended product is required, written authorization must be obtained from Daubert Chemical Company.

3/24/04:kp

REFER TO MATERIAL SAFETY DATA SHEET FOR HEALTH AND SAFETY INFORMATION.

Interfine 629HS

Modified Acrylic

PRODUCT DESCRIPTION

A low VOC, high performance, two pack isocyanate free cross linking acrylic finish with low solar absorption (LSA) pigmentation which provides good durability in terms of colour and gloss retention.

INTENDED USES

As a cosmetic finish on above water areas.
For use at Newbuilding and Maintenance & Repair.

PRODUCT INFORMATION

Colour	HYA001-LSA Lt W/work Grey. Selective shades are available in Low Solar Absorption pigmentation
Finish/Sheen	Gloss
Part B (Curing Agent)	HYA340
Volume Solids	65% ±3% (ISO 3233:1998)
Mix Ratio	7.0 volume(s) Part A to 1.0 volume(s) Part B
Typical Film Thickness	50 microns dry (77 microns wet)
Theoretical Coverage	13.00 m²/litre at 50 microns dft, allow appropriate loss factors
Method of Application	Airless Spray, Brush, Roller
Flash Point (Typical)	Part A 32°C; Part B 40°C; Mixed 40°C
Induction Period	Not applicable

Drying Information	10°C	15°C	25°C	40°C
Touch Dry [ISO 9117/3:2010]	2 hrs	90 mins	60 mins	45 mins
Hard Dry [ISO 9117-1:2009]	30 hrs	24 hrs	18 hrs	6 hrs
Pot Life	10 hrs	5 hrs	2 hrs	60 mins

Overcoating Data - see limitations

	Substrate Temperature							
	10°C		15°C		25°C		40°C	
Overcoated By	Min	Max	Min	Max	Min	Max	Min	Max
Interfine 629HS	30 hrs	ext	24 hrs	ext	18 hrs	ext	6 hrs	ext

Note Drying and overcoating times quoted are measured at 50 microns dry, at higher film thickness times will be increased.

REGULATORY DATA

VOC

339 g/lt as supplied (EPA Method 24)
212 g/kg of liquid paint as supplied. EU Solvent Emissions Directive (Council Directive 1999/13/EC)

Note: VOC values are typical and are provided for guidance purposes only. These may be subject to variation depending on factors such as differences in colour and normal manufacturing tolerances.

SYSTEMS AND COMPATIBILITY

Interfine 629HS should only be applied over epoxy anticorrosive primers or tiecoats. The primer to be used will depend upon vessel area and application location. Typical primer/tie coats include:

Interbond 808
Intergard 400
Intergard 840

Consult your International Paint representative for the system best suited for the surfaces to be protected.

SURFACE PREPARATIONS

Use in accordance with the standard Worldwide Marine Specifications.
All surfaces should be fresh water washed to remove all dirt and contamination.
High pressure fresh water wash or fresh water wash, as appropriate, and remove all oil or grease, soluble contaminants and other foreign matter in accordance with SSPC-SP1 solvent cleaning.

NEWBUILDING/MAJOR REFURBISHMENT

Interfine 629HS should always be applied over a recommended primer coating scheme. The primer surface should be dry and free from all contamination, and Interfine 629HS must be applied within the overcoating intervals specified (consult the relevant product data sheet).Areas of breakdown, damage etc., should be prepared to the specified standard (e.g. Sa2½ (ISO 8501-1:2007) and primed prior to the application of Interfine 629HS

REPAIR

Interfine 629HS should always be applied over a recommended primer coating scheme. The primer surface should be dry and free from all contamination, and Interfine 629HS must be applied within the overcoating intervals specified (consult the relevant product data sheet).Areas of breakdown, damage etc., should be prepared to the specified standard (e.g. Sa2½ (ISO 8501-1:2007) and primed prior to the application of Interfine 629HS
Interfine 629HS may be applied directly over aged Interfine 629HS following thorough fresh water washing and degreasing provided the coating to be overcoated is in an intact and tightly adherent condition. Loose or flaking coatings should be removed back to a firm edge and Interfine 629HS or an appropriate primer should be used to repair the area before application of the full coat.

Consult International Paint for application of Interfine 629HS over other existing coatings.

Consult your International Paint representative for specific recommendations.

Interfine 629HS

Modified Acrylic

APPLICATION

Mixing	Material is supplied in 2 containers as a unit. Always mix a complete unit in the proportions supplied. (1) Agitate Base (Part A) with a power agitator. (2) Combine entire contents of Curing Agent (Part B) with Base (Part A) and mix thoroughly with power agitator.
Thinner	Not recommended. Use International GTA220 only in exceptional circumstances (max 5% by volume). DO NOT USE ANY OTHER THINNER. DO NOT thin more than allowed by local environmental legislation.
Airless Spray	Recommended Tip Range 0.32-0.48 mm (13-19 thou) Total output fluid pressure at spray tip not less than 155 kg/cm² (2200 p.s.i.)
Conventional Spray	Use suitable proprietary equipment. Thinning may be required.
Brush	Suitable.
Roller	Suitable.
Cleaner	International GTA822
Work Stoppages and Cleanup	Do not allow material to remain in hoses, gun or spray equipment. Thoroughly flush all equipment with International GTA822. Once units of paint have been mixed they should not be resealed and it is advised that after prolonged stoppages work recommences with freshly mixed units. Clean all equipment immediately after use with International GTA822. It is good working practice to periodically flush out spray equipment during the course of the working day. Frequency of cleaning will depend upon amount sprayed, temperature and elapsed time, including any delays. Do not exceed pot life limitations. All surplus materials and empty containers should be disposed of in accordance with appropriate regional regulations/legislation.
Welding	In the event welding or flame cutting is performed on metal coated with this product, dust and fumes will be emitted which will require the use of appropriate personal protective equipment and adequate local exhaust ventilation. In North America do so in accordance with instruction in ANSI/ASC Z49.1 "Safety in Welding and Cutting."

SAFETY

All work involving the application and use of this product should be performed in compliance with all relevant national Health, Safety & Environmental standards and regulations.

Prior to use, obtain, consult and follow the Material Safety Data Sheet for this product concerning health and safety information. Read and follow all precautionary notices on the Material Safety Data Sheet and container labels. If you do not fully understand these warnings and instructions or if you can not strictly comply with them, do not use this product. Proper ventilation and protective measures must be provided during application and drying to keep solvent vapour concentrations within safe limits and to protect against toxic or oxygen deficient hazards. Take precautions to avoid skin and eye contact (ie. gloves, goggles, face masks, barrier creams etc.) Actual safety measures are dependant on application methods and work environment.
EMERGENCY CONTACT NUMBERS:
USA/Canada - Medical Advisory Number 1-800-854-6813
Europe - Contact (44) 191 4696111. For advice to Doctors & Hospitals only contact (44) 207 6359191
R.O.W. - Contact Regional Office

Interfine 629HS

Modified Acrylic

LIMITATIONS

This product is not recommended for use in immersed conditions.
For brush and roller application, and in some colours, two coats of Interfine 629HS may be required to give uniform coverage, especially when applying Interfine 629HS over dark undercoats and when using certain lead-free bright finish colours such as yellows and oranges. Best practice is to use a colour compatible intermediate or anticorrosive coating under Interfine 629HS.
This product will not cure adequately below 5°C. For maximum performance ambient curing temperatures should be above 10°C.
High relative humidity, fog or condensation occurring during or immediately after Interfine 629HS application may result in a matt finish and a film with inferior properties. Premature exposure to ponding water (eg. on external decks) will cause colour change, especially in dark shades. Low temperatures will increase these effects.
Overcoating information is given for guidance only and is subject to regional variation depending upon local climate and environmental conditions. Consult your local International Paint representative for specific recommendations.
Apply in good weather. Temperature of the surface to be coated must be at least 3°C above the dew point. For optimum application properties bring the material to 21-27°C, unless specifically instructed otherwise, prior to mixing and application. Unmixed material (in closed containers) should be maintained in protected storage in accordance with information given in the STORAGE Section of this data sheet. Technical and application data herein is for the purpose of establishing a general guideline of the coating application procedures. Test performance results were obtained in a controlled laboratory environment and International Paint makes no claim that the exhibited published test results, or any other tests, accurately represent results found in all field environments. As application, environmental and design factors can vary significantly, due care should be exercised in the selection, verification of performance and use of the coating.
In the overcoating data section 'ext' = extended overcoating period. Please refer to our Marine Painting Guide - Definitions and Abbreviations available on our website.

UNIT SIZE

Unit Size	Part A		Part B	
	Vol	Pack	Vol	Pack
20 lt	17.5 lt	20 lt	2.5 lt	2.5 lt

For availability of other unit sizes consult International Paint

UNIT SHIPPING WEIGHT (TYPICAL)

Unit Size	Unit Weight
20 lt	33.1 Kg

STORAGE

Shelf Life: 18 months minimum at 25°C. Subject to reinspection thereafter. Store in dry, shaded conditions away from sources of heat and ignition.

WORLDWIDE AVAILABILITY

Consult International Paint.

IMPORTANT NOTE

www.international-marine.com

APPENDIX D – PROSPOOL & EZ SPOOL MANUALS

About

This document outlines how to set up and use the ProSpool program. ProSpool uses information about the winch and line geometry to accurately position the winch levelwind to assist the line in spooling on, and off the winch drum. If used with a grooved shell and machined winch drum, the best possible spooling performance can be achieved.

Intro

ProSpool has three operational modes.

“Manual LW”, which allows the levelwind to be jogged by the user and no automatic functions occur.

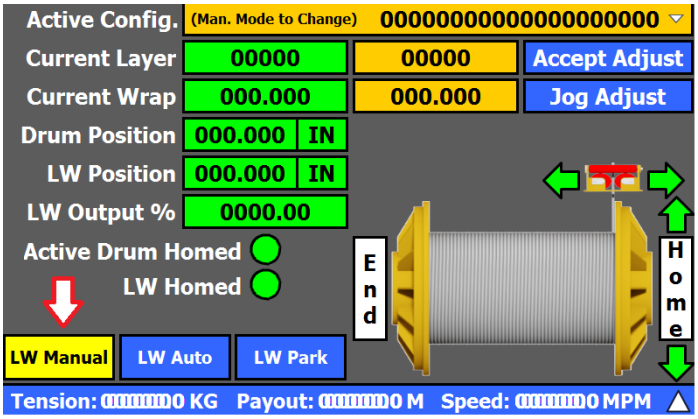
“LW Auto”, will position the levelwind on its own to a calculated set point based on setup for the line selected. You can manually jog the levelwind, but it will immediately return to the auto set point after the jog. You can jog in manual, but once switched back to auto the LW will drive to the calculated set point.

“Park”, prohibits any levelwind motion, including manual jog commands.

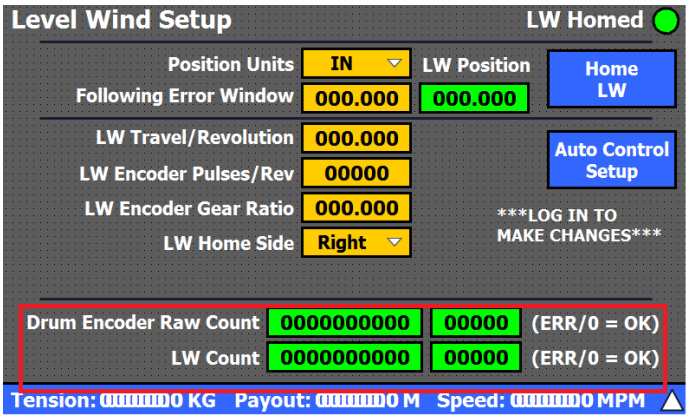
Initial Setup

Initial Checks: These checks only need to be done once, or when drum or level wind encoders are replaced. Log in to make the “LW Setup” and “Spooling Configs” menus available. The machine must be running, and the levelwind and drum must be free to move for these tests.

First enter the “LW Control” menu and set the mode to “manual”. Then navigate back to the main menu.



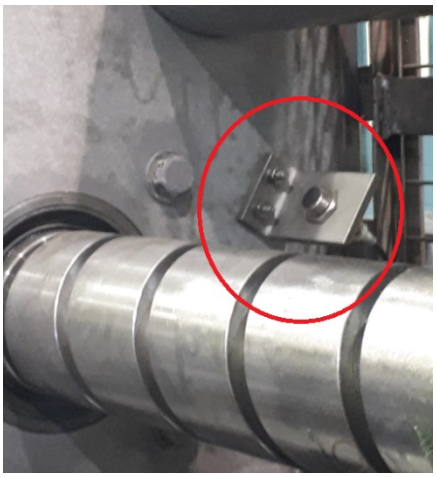
Now enter “LW Setup”. The first is to ensuring that the encoders are working properly.



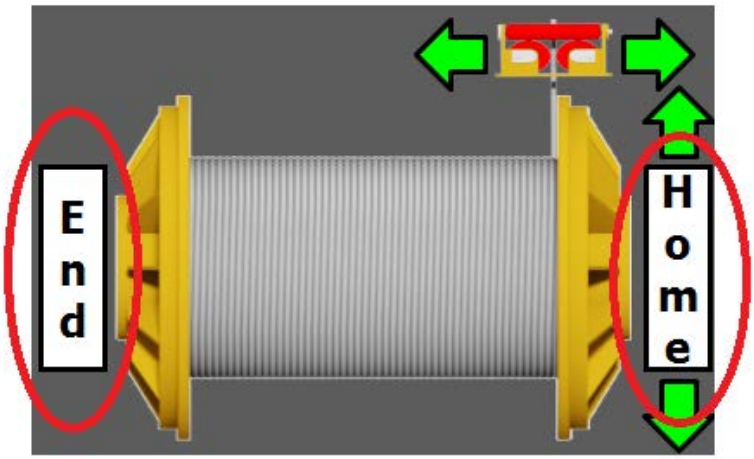
“Drum Encoder Raw Count” should be counting up as the drum hauls line in. “LW Count” should be counting up and down as the levelwind is manually jogged from side to side. If they are not counting correctly or at all, troubleshoot the system for damaged or faulty components.

Next we need to make sure the end of travel sensors are working. These sensors will ensure the levelwind will stop before crashing into the frame. This may happen by operator error, encoder failure, or if the levelwind is moved while the machine is powered down, then placed in “ProSpool Auto Mode”.

Navigate back to the “LW Control” menu and manually jog the levelwind near the end of travel switch. These may be physical switches or proximity sensors at both ends of the levelwind.

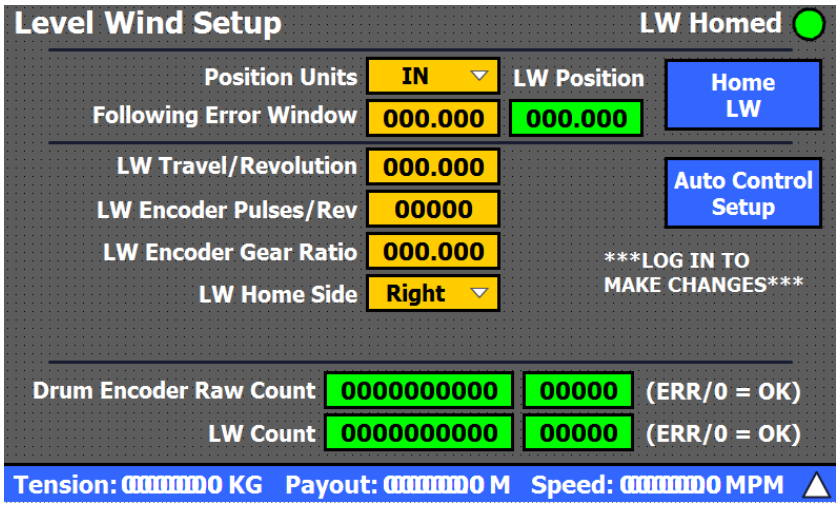


As you approach the end of travel sensor, carefully jog over it. In the “LW Control” screen, the corresponding “END”, and “HOME” icons on the drum will turn red. An alarm may sound. If nothing happens, and the levelwind can move past the sensor, the sensor will have to be adjusted. If the sensor is adjusted, it may be broken or disconnected.



Lastly for the initial checks; if there are sensors on the levelwind sheave for payout and speed, or a tension pin. Ensure they are working correctly (*not covered in this manual*).

Initial Software Setup: If it’s the first time using ProSpool, or an encoder has been replaced, the levelwind settings have to be checked. Navigate to the “LW Setup” menu.

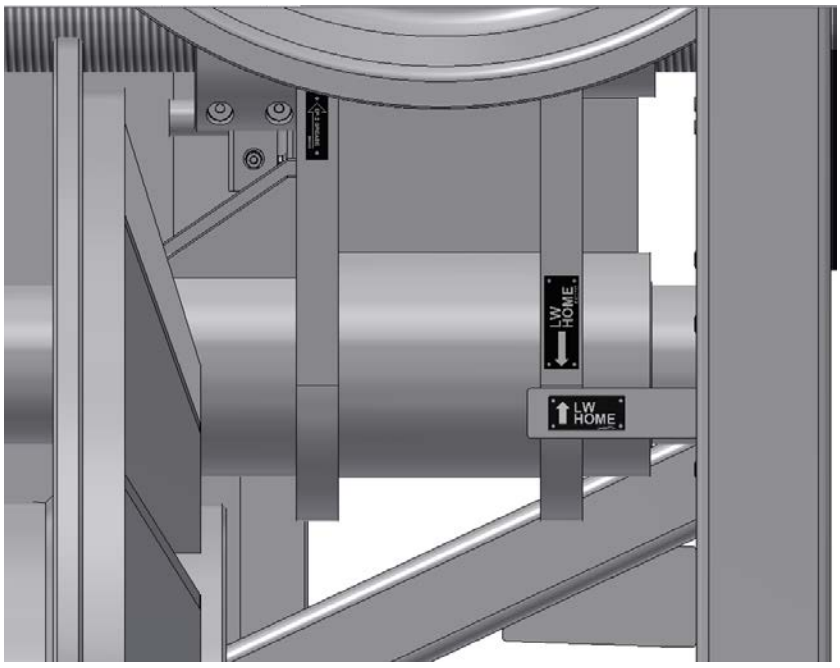


LW Homed Icon: This will be red if the levelwind is not currently homed, green if it has been homed.

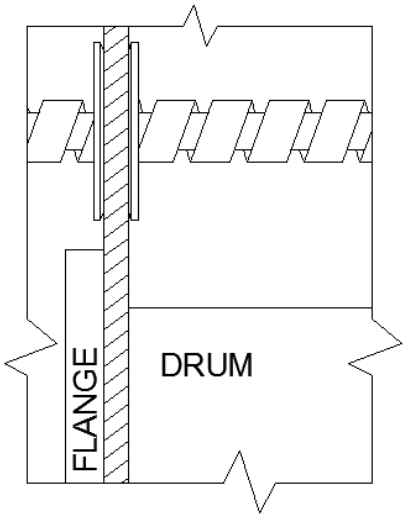
Position Units: Select the units (in or mm) you wish to use for the ProSpool Settings.

Following Error Window: How far away from the calculated set point can the levelwind be in auto mode. If it remains outside this window for too long, manual mode will be activated. This is typically 1/10 the total levelwind travel.

Home LW: The levelwind home can be anywhere, but typically alignment decals are provided to position the levelwind near the drum “home”. The drum “home” side is the side of the drum where the line first starts to spool. The line usually passed though the drum core, or out the side of the flange and then clamped to the drum. On new Hawbolt machinery, a decal on the level wind carriage can be aligned to a stationary decal on the winch frame for simple levelwind home position.



If the winch does not have alignment decals, place the line on the same side as the drum home, with the line flush against the drum flange.



Once the levelwind is in this position press “Home LW”; this will be the LW zero reference that “home offset” will be applied to for each line configuration.

Note that after levelwind home is set, the “LW Count” has to increase, as you move into the spooling zone. **If it is not counting up, reverse the encoder “A” and “B” signal wires. If it’s not counting at all, troubleshoot the encoder sensor.**

LW Travel/Revolution: Enter a linear dimension the levelwind will travel per revolution (screw pitch). The units will be either inches or mm (depending on what was set above).

LW Encoder Pulses/Rev: Enter the levelwind encoder resolution per rev. Depending on the sensors being used, this value can greatly differ.

LW Encoder Gear Ratio: If the encoder is not directly mounted to the levelwind screw, it may be on the other side of a gearbox. The ratio will have to be entered.

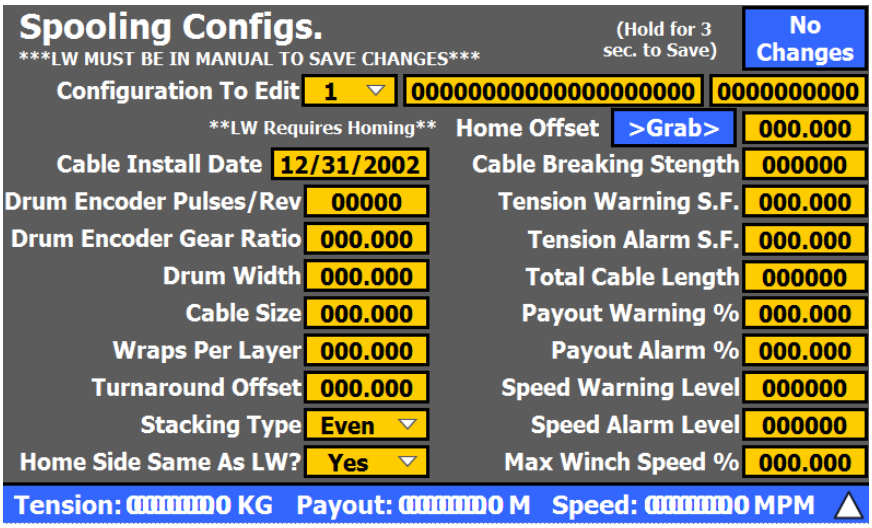
LW Home Side: This is for the drum display, to show what side to start from.

Auto Control Setup: Activates a “P-Loop” setup screen, which will have to be tuned once while in auto mode. This menu will be covered below.

Spooling Config Setup

For each type of line or winch drum geometry change, a “spooling configuration” has to be set up once. ProSpool allows for 10 different spooling configurations. After a configuration is edited, it can be saved,

and the configuration can simply be selected when it is time to be used. This will allow for one winch to be used with different drums, or a drum divider, or different lines. Navigate to the “Spooling Configs” menu to set up a line.

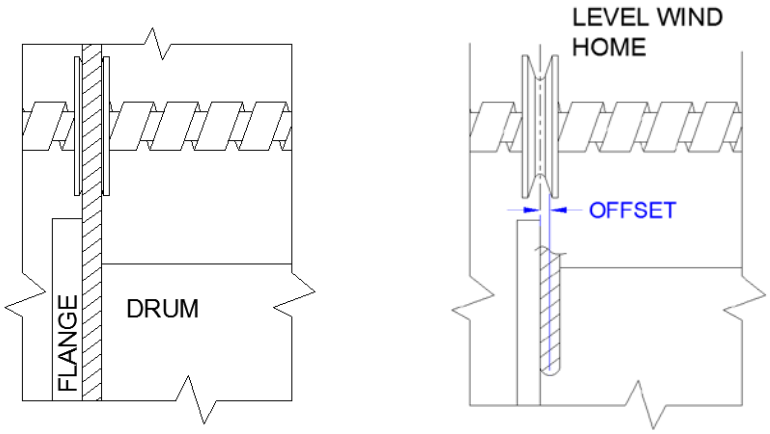


Configuration To Edit: Select an available slot (1-10). The line can also have a short name and serial number.

Home Offset: This can be either manually entered, or “Grab”, which is the current levelwind location. The purpose of “home offset” is to give each line configuration relative distance from the levelwind home location. This is important if each configuration has different diameter line. This ensure the levelwind starts at the correct position for the diameter line being used.

If you are able to jog the levelwind with the line on the sheave, you can “Grab” the home offset when the line is just starting to touch the flange. If you cannot jog with the line, the dimension can be manually entered.

Home Offset dimension “>Grab>”, versus manually entering a dimension from a known LW home



To manually enter an offset, you must know where the levelwind home was taken, and then enter a dimension that would place the line flat against the drum flange. This can be easily calculated if you used the drums flange as the levelwind home. The offset would just be the radius of the line.

Cable Install Date: Can be entered and used for cable inspections.

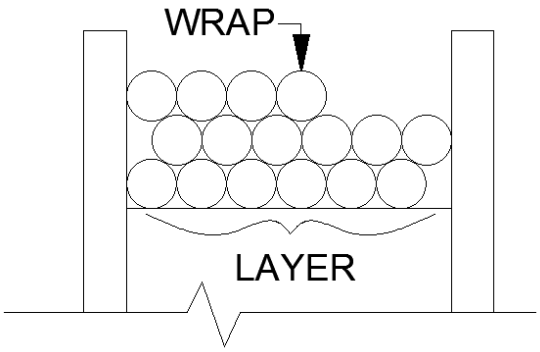
Drum Encoder Pulses/Rev: Enter the drum encoder resolution per rev. Depending on the sensors being used, this value can greatly differ.

Drum Encoder Gear Ratio: If the encoder is not directly mounted to the drum, it may be on the other side of a gearbox. The ratio will have to be entered.

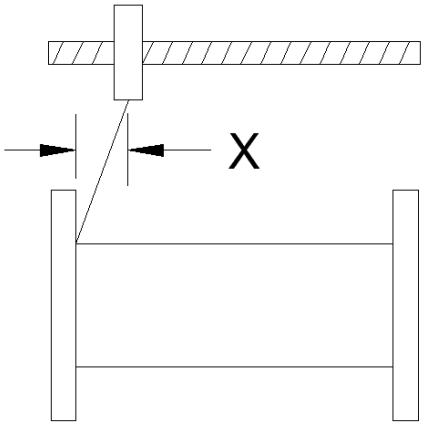
Drum Width: Enter the inside flange to inside flange dimension of the drum.

Cable Size: Enter the diameter of the line being used.

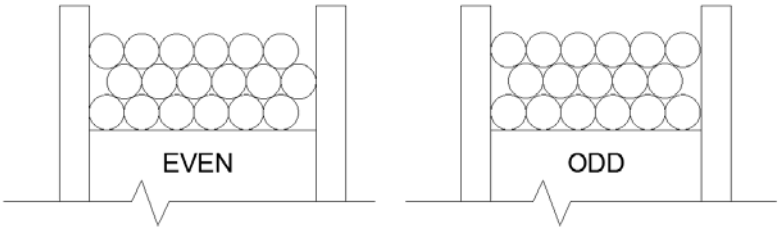
Wraps Per Layer: Enter how many "wraps" of the line are expected to fit in the "Drum Width". This diagram would be six wraps per layer.



Turn Around Offset: Enter how far the levelwind should be away from the inside flanges while it waits for the line to start feeding back. Typically this is half the line diameter.



Stacking Type: Select even or odd stacking type. “Odd” stacking has one less wrap every other layer. “Even” has the same number of wraps, for every layer.



Home Side Same as LW?: If the drum home is the same as the levelwind home side, select yes. If it is not, select no. The drum “home” side is the side of the drum where the line first starts to spool. The line usually passed though the drum core, or out the side of the flange and then clamped to the drum.

If a load pin is used, fill out the cable tension alarm and warning level boxes. Leave as “0” to disable.

Cable Breaking Strength: Enter the lines known braking strength.

Tension Warning S.F.: Is the warning safety factor applied to the cable breaking strength and provided an alarm warning.

Tension Alarm S.F.: Is the alarm safety factor applied to the cable breaking strength and provided an alarm warning.

If a sheave encoder is used for winch payout and speed, fill out the alarm and warning level boxes.

Total Cable Length: Is the total amount of cable on the drum. The units are whatever is currently selected from payout setup (M, KM, FT, MI, NM).

Payout Warning %: Is the percent of the “total cable length” that a warning alarm will sound.

Payout Alarm %: Is the percent of the “total cable length” that an alarm will sound.

Speed Warning Level: Is the line speed in the current selected units (MPM, KPH, FPM, MPH, KNOT), that a warning will sound.

Speed Alarm Level: Is the line speed in the current selected units (MPM, KPH, FPM, MPH, KNOT), that a alarm will sound.

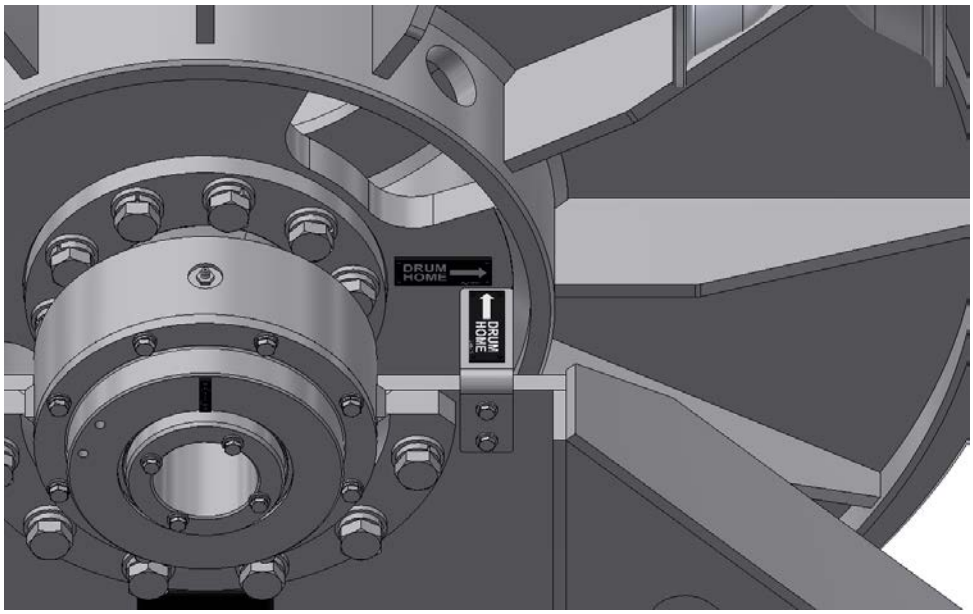
If the ProSpool PLC is controlling the winch drum drive, fill out the max winch speed. There may be a winch joystick scaling % outside of ProSpool; during operation the program will use the smaller value.

Max Winch Speed %: Is the max winch speed allowed for the line.

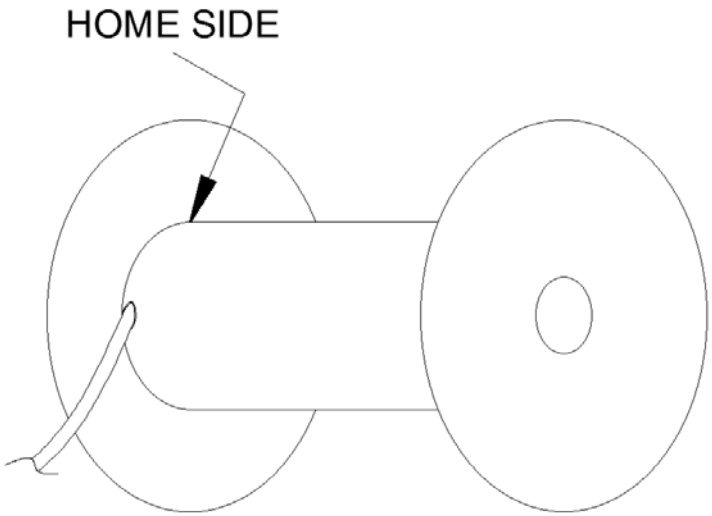
Drum Home

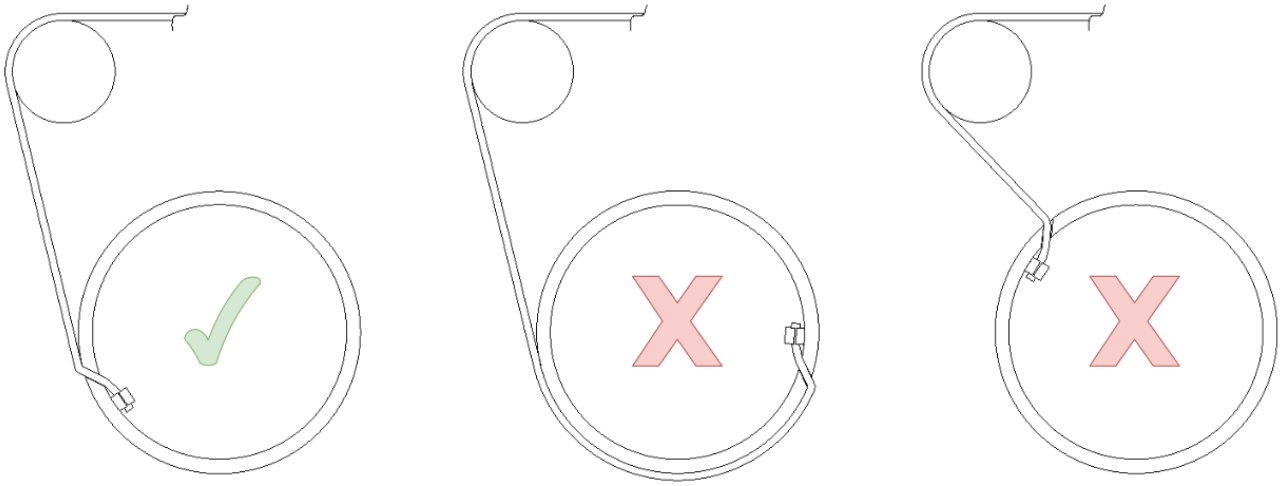
"Drum Home" is used to ensure the exact layer, and wrap are being displayed on the screen. This step can only be done when there is no line on the drum, and only needs to be done once. Note, ProSpool can still operate without this step, but if it is not feeding correctly you will have to manually adjust layers and wraps described below in "Spooling Test/Auto Mode Error Correction".

Drum home is with an empty drum, and the cable is tangent from the cable exit on the drum, to the levelwind sheave. On new Hawbolt machinery, a decal is provided on the drum to indicate the drum home position while you are on the first wrap.



If there is no decal available, these illustrations further describe drum home/layer 1/wrap1 position.





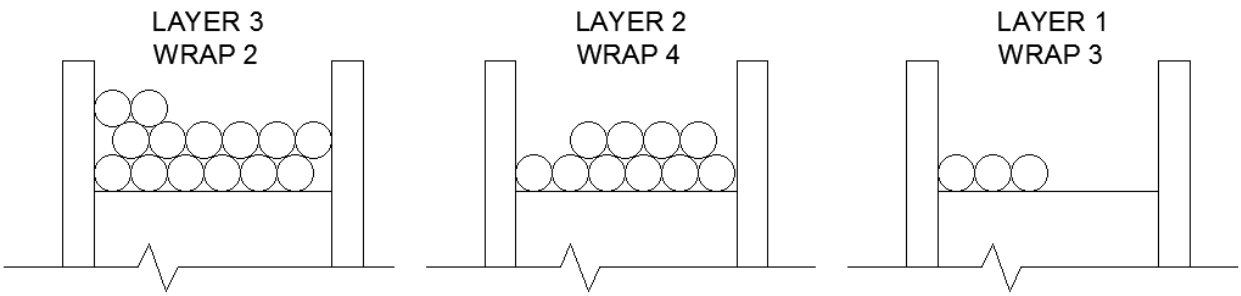
At the drum home position described, the display should show “layer 1 and wrap 1”. If the home layer and wrap are incorrect, they need to be set to “layer 1 and wrap 1”. Updating the wrap and layer is described below in “Auto Mode Error Correction”. Note with nothing on the drum, this means that drum is spooling first layer and first wrap. Notice that the wrap displays “1”, although there are no wraps spooled yet, as system displays current wrap being spooled, not number of completely spooled wraps. After spooling one complete wrap (turning drum one full turn), display shows layer 1 and wrap 2. Drum now has one complete wrap spooled and is starting to spool second wrap.

Spooling Test

Now that the initial checks, levelwind setup, and spooling configuration have been entered; it is time to test spooling. At this point, we need to find out how many “layers” of line are on the drum and how many “wraps” on the current layer. If the drum is empty, you are simply on “Layer 1” and “Wrap 1”. Navigate to the “LW Control” menu. Ensure the mode is still set to “Manual”, and select the “Active Config” which is the configuration for the current line and drum being used.

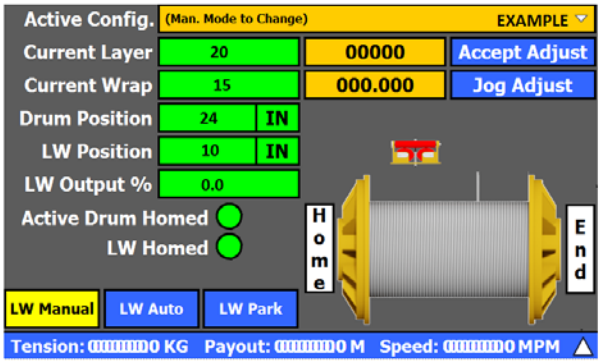
ProSpool uses the “layer” to know which way the levelwind should be feeding between drum flanges. Even layers will feed in one direction, and odd layers will feed in the other. Then it used the “wrap” to know where to place the levelwind, since we entered “wraps per layer” into the spooling configuration.

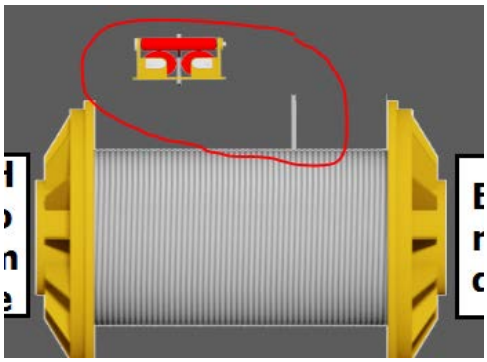
If there is a known amount of line on the drums enter the current wraps and layer. Here are some examples.



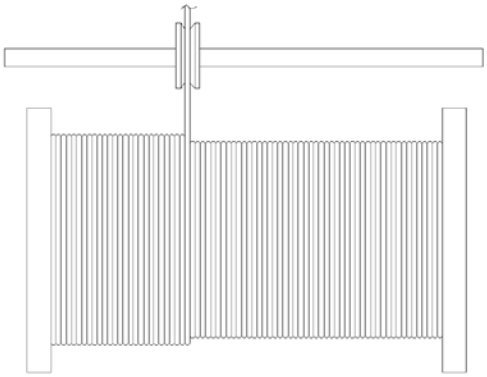
If it is impossible to calculate, or find out how many layers are on the drum, it is best to enter a value mush higher then what could be on there. Due to limitations in the program, ProSpool is unable to go below layer 1. If it does, ProSpool will continually feed the levelwind in layer ones direction. At the end of the layer, it will return to the opposite side of the drum and try to feed layer one again. This can potentially cause damage to the line or levelwind if it is under load.

After we enter a “Current Layer” and “Current Wrap”, the screen will show us where it is calculating the line to be, and where the levelwind position is. Here is an example of entering estimated layers and wraps.

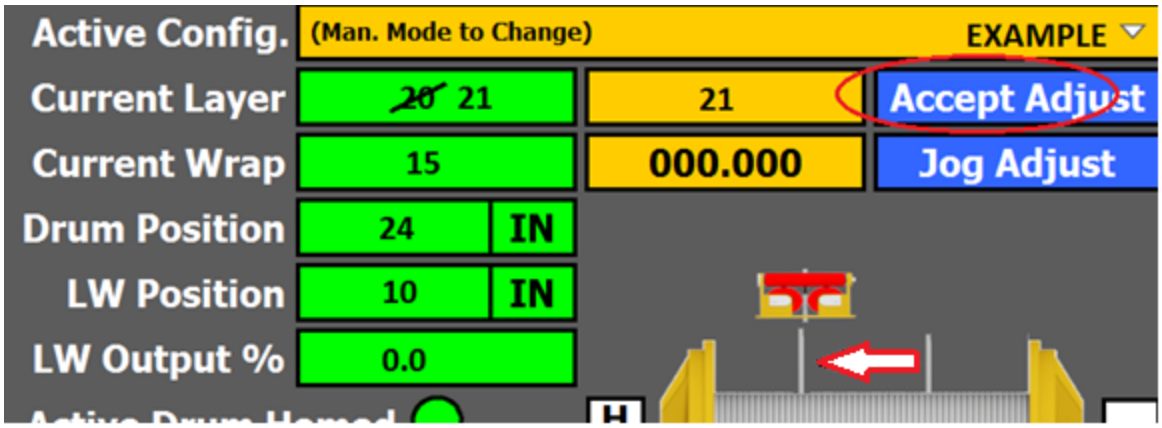




In this example we can see there the cable does not line up with the levelwind. In reality, the winch and levelwind may look like this.



We can see that “wraps” are being applied to the wrong side and if we tried to use auto mode, and the levelwind would be feeding the opposite direction then the drum. This means we need to add or subtract one layer in order to for the program to feed in the correct direction for that layer.



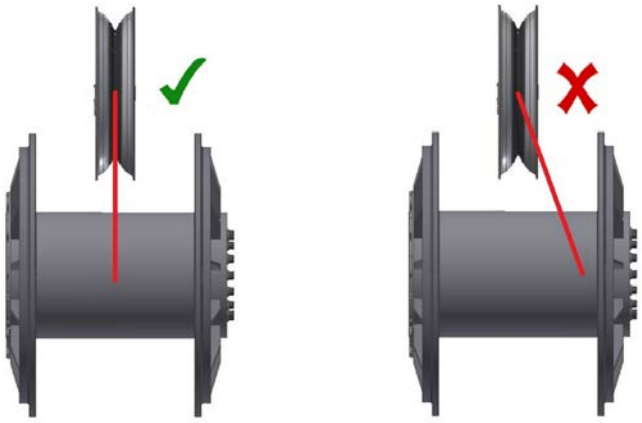
If we enter a new layer, and press “Accept Adjust”, we will see the cable coming off the drum “jump” to a new calculated position.

Now that the levelwind is close to the calculated drum position, we can test the auto function. **Be prepared to move the LW to manual or park if this is the first time using auto**. Press “LW Auto”. The buttons should illuminate and the levelwind may move slightly into the calculated position.

If the mode immediately switches back to manual mode, it means either the levelwind, or current drum is not homed. If the levelwind takes off, and it moves away from the drum position, switch to manual mode and review “Invert Output” in “Auto Control Setup” menu.

If auto mode is working correctly, it will now track with the drum as line is paid out, or hauled in. Ensure there is at least a small load on the line while doing this.

<u>Auto Mode Error Correction</u>

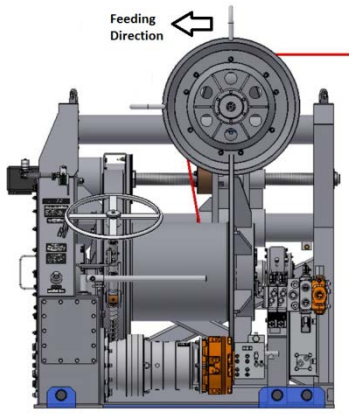


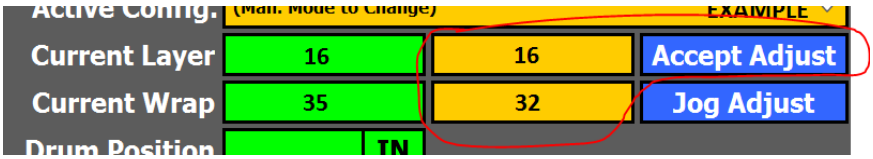
In some cases the levelwind may fall behind, or get ahead the drum feeding position. The graphic display will in the “LW Control” screen will show everything is lined up, but in reality it is off. This can happen if some layers have less wraps then others form a poorly spooled drum, or a few wraps were added or subtracted from the drum while the winch was not on. Correcting the position can be done two ways.

Manually Entering Wraps:

Note that to adjust layers or wraps, you must be in manual mode

If the levelwind is not aligned (ahead or behind actual), count the actual wraps from the flange; enter this value into the adjustment box next to the “Current Wrap” display. Note the system displays current wrap being spooled, not number of completely spooled wraps. So if you count 31 wraps, you should actually enter 32. Be careful to keep the “layer” the same! Press “Accept Adjust” to load the new position.





Entering New Wraps With Jog:

Note that to adjust layers or wraps, you must be in manual mode

While in manual mode, press the “Jog Adjust” button to prime ProSpool, you are about to jog. Jog the levelwind to the correct position. Once it is lined up, press “Accept Adjust”. The levelwind position will add or subtract the correct amount of wraps.

“P” Loop Tuning:

If the levelwind is falling behind and never seems to catch up, or it continually jerks back and forth and never settles to the set point, the “P Gain”, and “Dead band” will have to be adjusted in the “Auto Control Setup” menu.

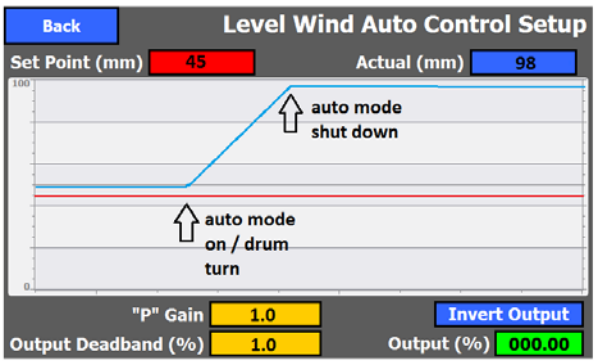
Auto Control Setup

The Auto Control Setup menu contains settings that only need to be set once. After they are set and tested, they should not require any further tuning.

At this point, auto has been used, and they may be some undesired effects. Here are solutions to these issued.

Invert Output Issue: While in auto mode, the levelwind position will “take off” and quickly move away from the drum position. This is because the levelwind is being told to go the wrong direction when trying to get to the drum position set point.

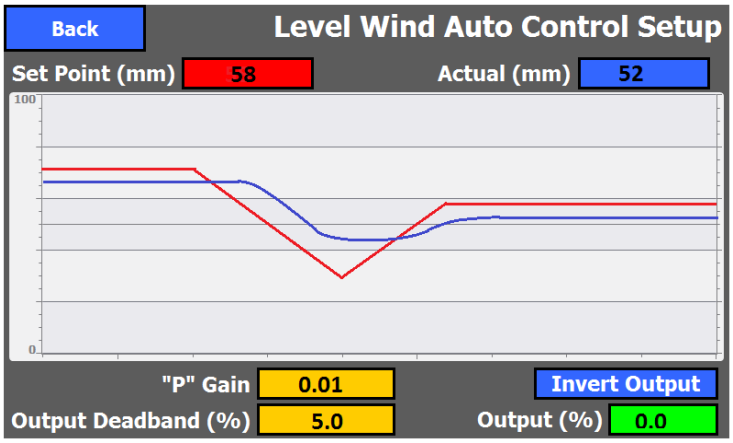
If you are in the Auto Control Setup Menu when this happens, the graph will look like this. We can see the set point remains the same, and the levelwind is being sent away from it.



To fix this, simply press the “Invert Output” button in the bottom right. This setting will be automatically saved.

LW Slow to React: While in auto mode, the levelwind is very sluggish and may not get completely close to the drum position set point. This is probably happening to a “P Gain” value that is too low.

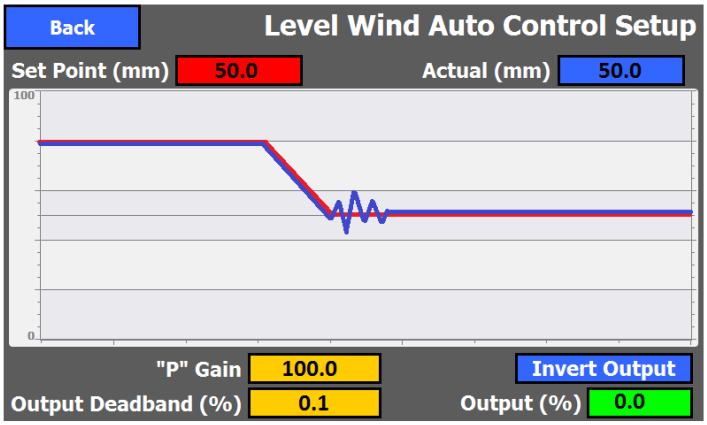
If you are in the Auto Control Setup Menu when this happens, the graph will look like this. We can see the actual trails the set point by a lot. As it does get close to set point it will slow down more or even stop.



To fix this, increase the “P Gain” value until it becomes more reactive.

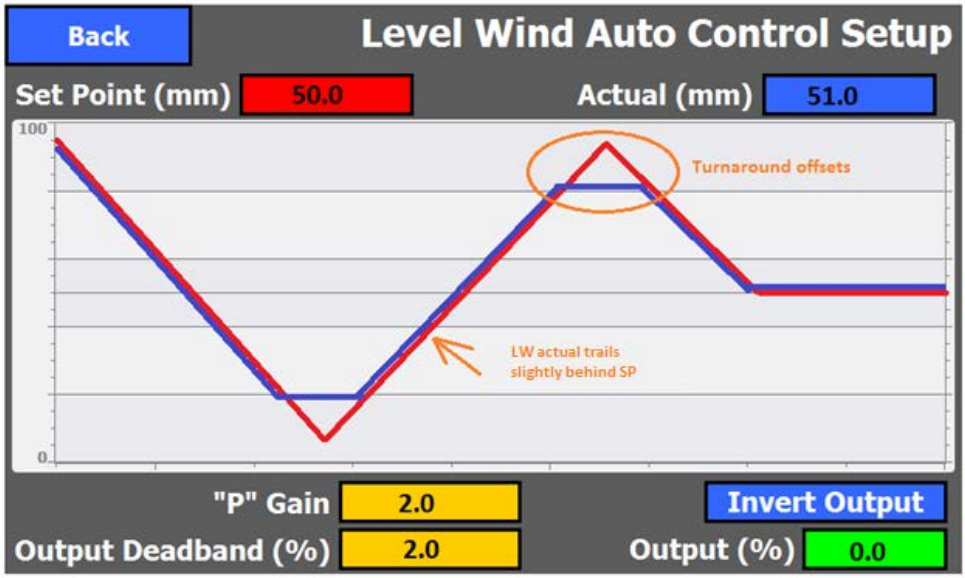
LW is Jumpy / Jerks Back and Forth: While in Auto mode, the levelwind will quickly move to the drum set point, but it may over shoot it, it may jump back and forth near the drum set point. This can either be from the “Dead band” being too low, or the “P Gain” is too high.

If you are in the Auto Control Setup Menu when this happens, the graph will look like this. We can see the levelwind actual “hunt” around the set point until it settles down.



To fix this ensure the “Output Deadband (%)” is at least 1.0. Then turn down the “P Gain” until the levelwind meets the set point smoothly.

Ideal Settings: If the “P Gain”, “Dead band”, and “Invert Output” are set correctly; the “Auto Control Setup” graph will look like this as ProSpool spools the drum.



Regular Operation

After all the setup is done and tested, ProSpool auto mode can be active and you can move to any other screen for winching operations. The levelwind can be jogged, but immediately after a jog, the levelwind will move back to the auto set point. If you switch it to manual, you can jog and the levelwind will remain stationary. When you move back to auto mode, the levelwind will automatically jog back to the drum set point.

About

This document outlines how to set up and use EZ Spool. EZ Spool is a simplified spooling program that uses very little settings, and provides accurate positioning. It has a stripped back user interface for simplicity.

Intro

EZ Spool has three operational modes.

"**Manual LW**", which allows the levelwind to be jogged by the user and no automatic functions occur.

"**EZ Auto LW**", will position the levelwind on its own to a calculated set point based off setup variables. While in auto mode, you can jog on the fly and if the jog lands inside the spooling zone, the auto mode will continue from this point. If you jog outside the "spooling zone", the automatic spooling will be paused and the LW can be moved by jogging. Once you jog back into the spooling zone, the auto mode will reactivate, and pick up where the jog landed. It will continue spooling in the same direction that it was feeding when the levelwind exited the spooling zone. Auto mode also has a "Reverse LW" button that simply reversed the feeding direction on the fly.

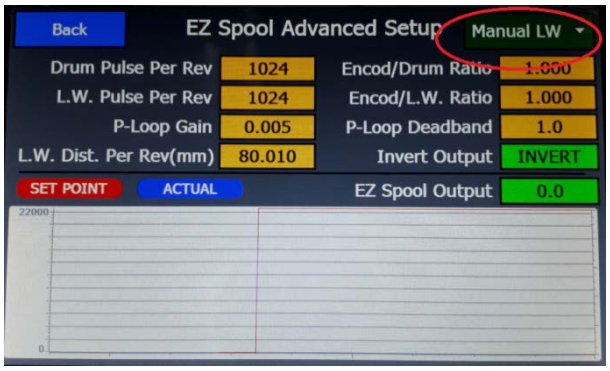
"**LW Park**", prohibits any levelwind motion, including manual jog commands.

Initial Setup

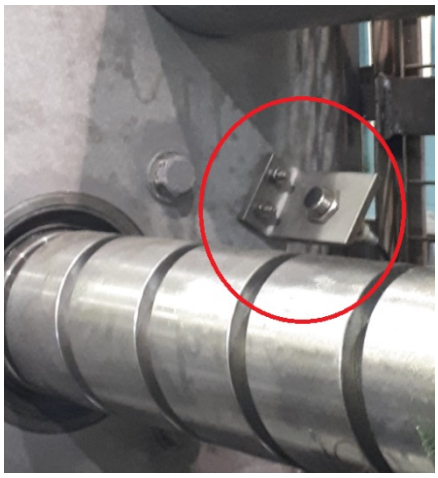
Hardware Checks

These checks only need to be done once, or when sensors are replaced. The machine must be running, and the levelwind and drum must be free to move for these tests.

Find an EZ Spool mode control box, and set it to "Manual LW". You may need to activate EZ Spool If "ProSpool" is also available on the system.



It is assumed the winch drum and levelwind encoders are working correctly. The count is usually available in other menus of the PLC. The counts should move up and down as the drum and levelwind are moved. It does not matter which direction they are counting, or where their “zero” is. We do need to make sure the end of travel sensors are working. These sensors will ensure the levelwind will stop before crashing into the winch frame. This may happen by operator error, encoder failure. These sensors are usually a “proximity” sensor at both ends of the levelwind.

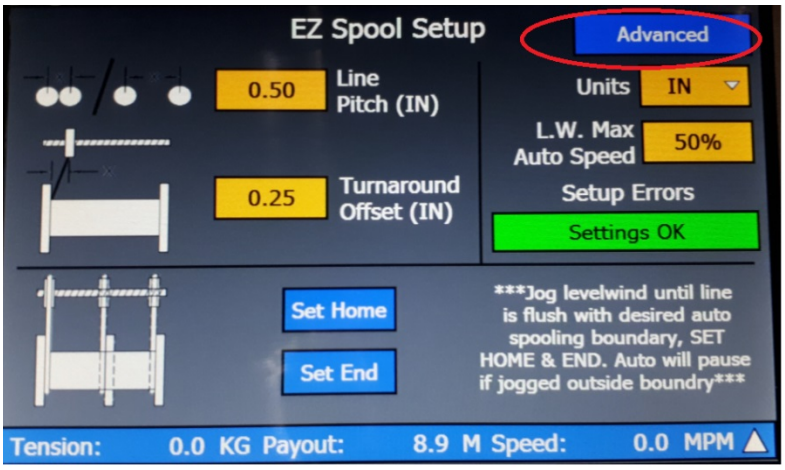


As you approach the end of travel sensor, carefully jog over it. The levelwind should automatically shut down. If nothing happens, and the levelwind can move past the sensor, the sensor will have to be adjusted. If the sensor is adjusted, it may be broken or disconnected.

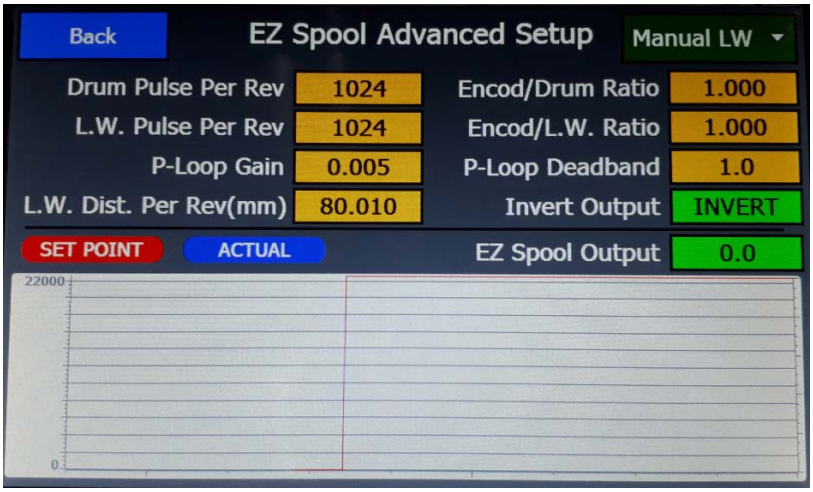
Initial Software Setup

If it’s the first time using EZ Spool. Some settings will have to be entered once. From the main menu, find the “EZ Spool Setup” menu button.

Next enter the “Advanced” menu, no log in is required.



In the advanced menu, fill out the winch hardware information.



Drum Pulse Per Rev: Enter the drum encoder resolution per rev. Depending on the sensors being used, this value can greatly differ.

Encod/Drum Ration: If the encoder is not directly mounted to the drum, it may be on the other side of a gearbox. The ratio will have to be entered.

L.W. Pulse Per Rev: Enter the levelwind encoder resolution per rev. Depending on the sensors being used, this value can greatly differ.

Encod/L.W. Ratio: If the encoder is not directly mounted to the levelwind, it may be on the other side of a gearbox. The ratio will have to be entered.

P-Loop Gain: Sets how reactive the levelwind moves to set point. To high and the levelwind will be "jumpy". Too low and the levelwind will be sluggish and fall behind. See **Auto Control Tuning** for more in-depth description.

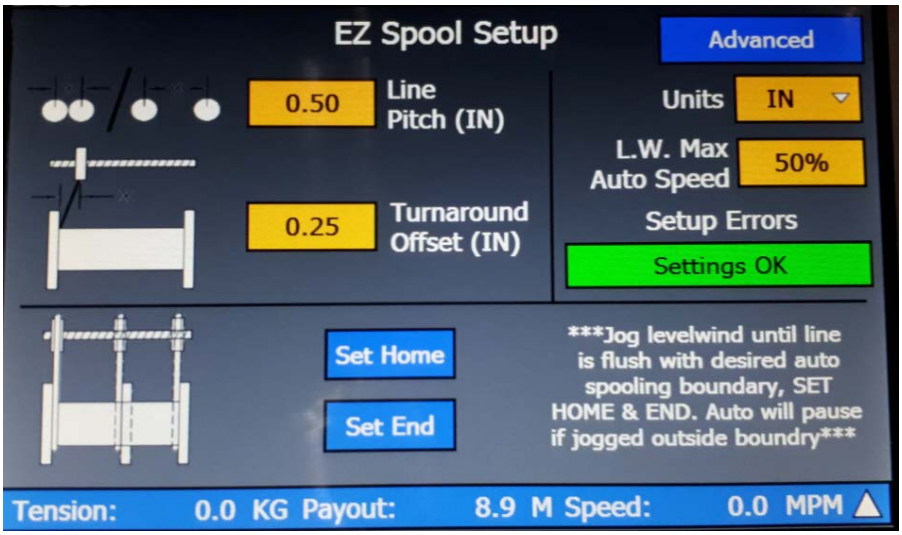
P-Loop Dead Band: Set between 0.5 and 3.0 to allow the levelwind to stop when it is close to the set point, and not overshoot it.

L.W. Dist. Per Rev(mm): Enter a linear dimension the levelwind will travel per revolution (screw pitch). The units are in mm.

Invert Output: Reverse what way to send the levelwind to get it closer to set point.

EZ Spool Setup

The set up will have to be used when a different spooling pitch or "spooling zone" is required.



Units: Select between (mm) and (in) for the units.

L.W. Max Auto Speed: Set the maximum speed allowable for auto mode (0-100%).

Line Pitch: Set how far apart you wish the line to be spooled (center to centre).

Turnaround Offset: Set how far you wish the levelwind to stay back from the Home and End set points. This is typically ½ of the line diameter.

[Set Home]: Jog to the beginning of a desired spooling zone. The line should be flush with a drum flange or drum core divider. Press and hold until check mark appear, signaling the new position has been saved.

[Set End]: Jog to the end of a desired spooling zone. The line should be flush with a drum flange or drum core divider. Press and hold until check mark appear, signaling the new position has been saved.

Setup Errors [Settings OK]: If there is a setting or setup issue preventing the program from running, it is displayed here.

'Line Pitch is Zero'	Line pitch must be set higher than zero.
'Set End/Home'	The spooling boundaries are not set. Note these are cleared if another program re-sets the drum or levelwind counter (ProSpool Home/LW home)
'PGain is Zero'	P-gain must be above zero.
'Dist. / Rev is Zero'	The levelwind distance per revolution must be greater than zero.
'Drum PPR is Zero'	The drum pulses per rev must be greater than zero.
'Drum PPR Ratio Zero'	The drum to encoder ratio must not be zero.
'L.W. PPR is Zero'	The levelwind pulses per rev must be greater than zero.
'L.W. PPR Ratio Zero'	The levelwind to encoder ratio must not be zero.
'End Of Travel Switch'	An end of travel switch is currently active.
'Max Auto Speed Zero'	The max auto speed has to be greater than zero.
'Max Spd < Deadband'	The P-loop deadband must be less than max winch speed.
'Home > End Set Pnt'	The Home set point from the LW encoder counter has to be less than the End set point. Swap setting Home [SET] and End [SET] if this error persists.

Once all the settings are entered, and “Setup Errors” displays “Settings OK”; we can navigate to the “Advanced” screen to ensure the automatic position is working correctly.

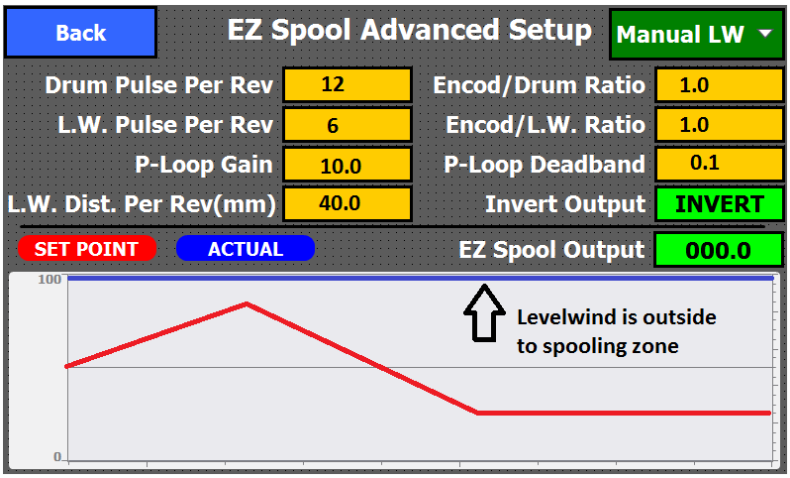
Auto Control Tuning

While the machine is on, and the drum and levelwind are free to move, as well as all the setting have been entered; we can now activate “EZ Auto LW”. We will check the functionality of the p-loop and then can continue with regular operations. Checking and setting the p-loop only needs to be done once.

First select “EZ Auto LW” from the mode selector box.

As the drum is turned, and the levelwind is inside the boundaries, auto mode should be moving the levelwind. Below are some issues that may arise if settings are off.

******If "EZ Auto LW" is not positioning the levelwind, ensure the levelwind is inside the [Home] and [End] bounds that were set. ******



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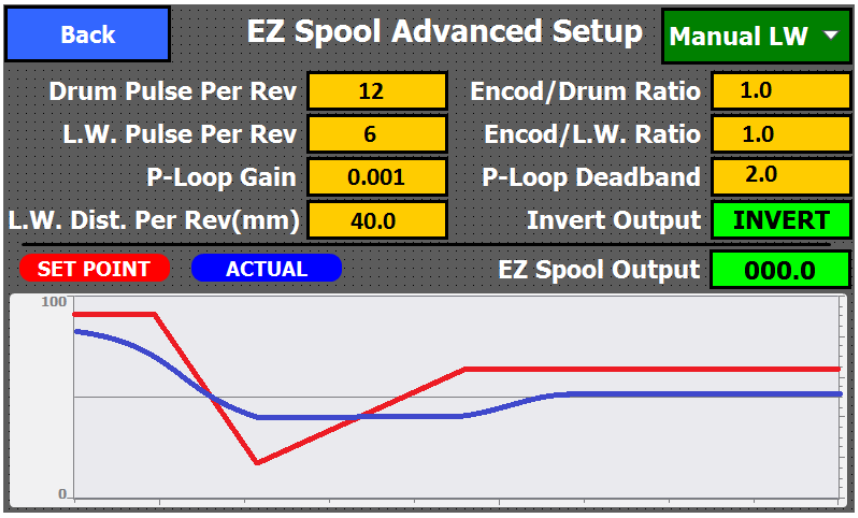

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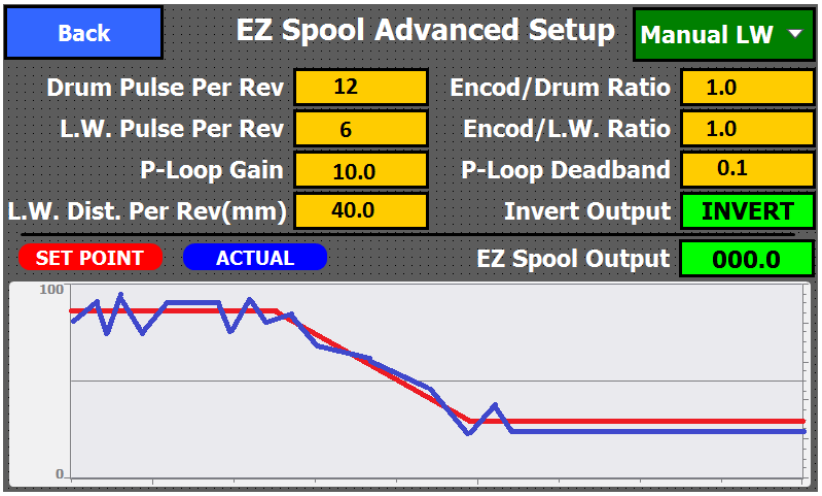
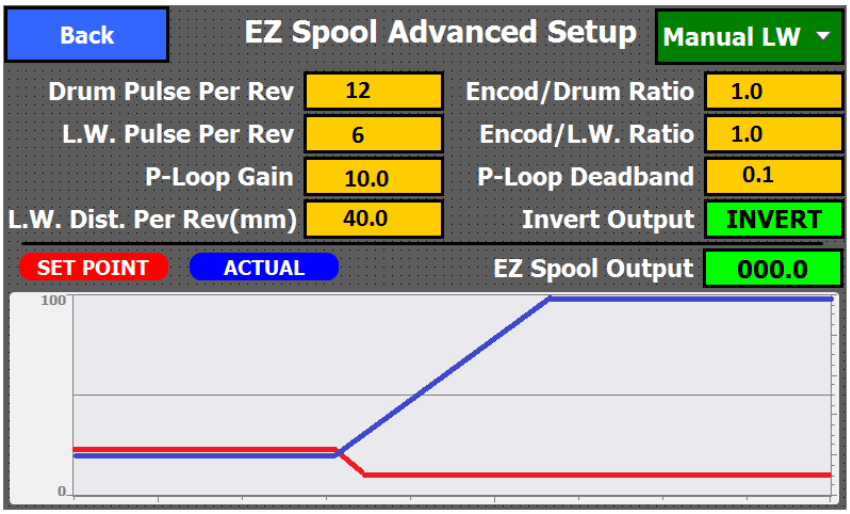
If you are in the Auto Control Setup Menu when this happens, the graph will look like this. We can see the levelwind actual “hunt” around the set point until it settles down.



To fix this ensure the “Output Deadband (%)” is at least 1.0. Then turn down the “P Gain” until the levelwind meets the set point smoothly.

Invert Output Issue: While in auto mode, the levelwind position will “take off” and quickly move away from the drum position. This is because the levelwind is being told to go the wrong direction when trying to get to the drum position set point.

If you are in the Auto Control Setup Menu when this happens, the graph will look like this. We can see the set point remains the same, and the levelwind is being sent away from it.



To fix this, simply press the “Invert Output” button in the bottom right. This setting will be automatically saved.

Regular Use

Once all the setup is complete, EZ Spool can be used from the selection box. It also has a “Reverse LW” button that will reverse the EZ Auto feeding direction on the fly if the spooling encounters an issue.

The “EZ Setup” screen will only need to be accessed again if the line pitch has to be changed of the spooling zone [Home] and [End] have to be re-set.

APPENDIX E – VFD SETTINGS

The winch has two variable frequency drives, one for the levelwind, and the winch. The setting have been entered and tested at Hawboldt Industries. Modifying these settings may result in loss of control of the winch or level wind. Do not adjust these settings unless advised by experienced personal.

Levelwind Settings - ACS355-03U-23A1-4+J404 **(Ensure to set analog signal jumper reference to current)**

Parameter	Setting	Description
1001	2	DI1 on, DI2 direction
1003	3	Enable multi direction
2001	-1750	Min rpm
2002	1750	Max rpm
2003	40A	Max Current (higher then FLA)
1103	1	AI1 for input ref
1104	5	min hz value
1105	80	Max hz value
1301	20	20% for a 4-20ma input
1302	100	100% for 4-20ma input
1401	2	Relay for heat page 207
1405	90	off delay 90.0 seconds of no run turn on heaters
1604	3	Digital IN3 for fault reset
1804	0	Transistor out as digital
1805	4	Use fault as output
2007	5	5hz min frequency
2008	80	80hz max frequency
2202	1	Ramp up time
2203	0.1	Ramp down time
2602	2	Flux braking (1 = some, 2 = most)
2601	1	Enable flux braking
9905	460	460V motor
9906	23	23 FLA motor
9907	60	60hz nominal
9908	1750	nom rpm
9909	13	12 kw motor
9910	1	Run ID (Done at Hawboldt)

Winch Settings ACS880-01-052A-5 **(Ensure to set analog signal jumper reference to current)**

PARAMETER		**NAME**	**HAWBOLDT SETTING**
10	24	RO1 source	Open brake command
10	29	RO2 OFF delay	60
10	30	RO3 source	Fault
12	16	AI1 filter time	0.01
12	27	AI2 min	4
12	29	AI2 scaled at AI2 min	100
12	30	AI2 scaled at AI2 max	1760
13	12	AO1 source	Zero
13	22	AO2 source	Zero
20	2	Ext1 start trigger type	Level
20	11	Run enable stop mode	Ramp
20	30	Enable signals warning function	0b0010
21	3	Stop mode	Ramp
21	4	Emergency stop mode	Coast stop (Off2)
22	11	Speed ref1 source	AI2 scaled
23	11	Ramp set selection	Acc/Dec time 1
23	12	Acceleration time 1	3
23	13	Deceleration time 1	0.5
25	2	Speed proportional gain	15
25	3	Speed integration time	0.5
30	11	Minimum speed	-1750
30	12	Maximum speed	1750
30	13	Minimum frequency	-60
30	14	Maximum frequency	60
30	15	Maximum start current enable	Enable
30	16	Maximum start current	80
30	17	Maximum current	60
30	30	Overvoltage control	Disable
31	25	Stall current limit	150%
31	26	Stall speed limit	10000
31	27	Stall frequency limit	500
31	28	Stall time	60
35	11	Temperature 1 source	PTC DI6
43	6	Brake chopper function	Enabled with thermal model
43	8	Brake resistor thermal tc	200
43	9	Brake resistor Pmax cont	25.6
43	10	Brake resistance	25
43	11	Brake resistor fault limit	105
44	2	Brake torque memory	-21.3

44	6	Brake control enable	Selected
44	8	Brake open delay	0.3
44	9	Brake open torque source	Brake torque memory
44	10	Brake open torque	1%
44	13	Brake close delay	3
44	14	Brake close level	50
44	15	Brake close level delay	0.1
44	17	Brake fault function	Warning
45	17	Tariff currency unit	USD
46	1	Speed scaling	1765
46	2	Frequency scaling	60
95	1	Supply voltage	440...480 V
96	1	Language	English
99	6	Motor nominal current	52
99	7	Motor nominal voltage	480
99	8	Motor nominal frequency	60
99	9	Motor nominal speed	1760
99	10	Motor nominal power	30
99	12	Motor nominal torque	163