SMD Operations Procedures Manual

8.1.1.1 OPERATION OF LONG COIL WINDER

Text Pages 1 through 24
Attachment(s) 1, 2, 3, 4, 5, 6

Hand Processed Changes

HPC No.	Date	Page Nos.	Initials

Revision No. 01 Approved:

Signature on File 2/24/03___
Division Head Date

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8.1.1.1 Operation of Long Coil Winder

1.0 Purpose and Scope

The purpose of this procedure is to provide information on various operating aspects of the Long Coil Winder (Winder), including:

A. a description of the operating controls of the Winder;

B. steps to perform to start, operate, and shut down the Winder;

C. steps to perform to test the safety interlocks;

D. an outline for a maintenance procedure.

This procedure does NOT include information on:

A. preparations prior to winding a coil;

B. steps to perform to wind a coil;

C. handling and storage of finished coils.

Detailed information in these areas is documented as part of the Magnet Assembly Procedure for the specific type of coil being wound.

2.0 Responsibilities

2.1 Authorized operators (Operators) of the Winder shall perform the tasks described herein. A list of Operators is maintained by the Cognizant Technical Supervisor.

2.2 The Operator is responsible for completing the following documentation:

2.2.1 Daily log book for coil programs with entries to include information that the Operator deems important to pass along to the Coil Fabrication Supervisor, the Cognizant Engineer, or the next work shift, including:

A. work accomplished;

B. coil discrepancies;

C. problems with the Winder;

D. brief description of repairs to the Winder;

E. lessons learned;

2.2.2 Maintenance log with entries to include:

A. detailed description of repairs and maintenance;

B. parts and materials used.

2.2.3 Traveller associated with the coil being wound.

2.2.4 Interlock test form.

2.2.5 Calibration chart for cable tensioning system.

3.0 Prerequisites

3.1 You must be an Authorized Operator for the Long Winder before using this procedure. A list of Authorized Operators is maintained by the Coil Fabrication Plant Manager.

3.2 You must be trained as a "knowledgeable employee" as defined by ESH Standard 1.5.1., " Lockout/Tagout Requirements".

3.3 The following special equipment is required:

A. safety glasses with side shields, or goggles;

B. 15 mil shim for lump detector set up.

4.0 Precautions

Some sections of this procedure will require the Operator to work in close proximity to two potential hazards: 1) moving machinery with potential pinch points, 2) cable under tension. The risk of injury can be minimized by taking the following precautions:

4.1 Do not operate the Winder unless all guards and shields are in place.

4.2 Do not wear loose clothing or hanging jewelry. Keep long hair tied up.

4.3 Wear eye protection while cable is under tension.

4.4 Do not stand or place body parts in front of moving machinery.

5.0 Procedure

5.1 Overview of Long Coil Winder

The Long Coil Winder provides a means of winding superconducting cable into magnet coils. The cable is wound off of its spool through a series of guide wheels, then onto a mandrel and centerpost assembly.

The cable spool is mounted to a rotating carriage that can move clockwise or counterclockwise.

The mandrel is mounted to a movable table that can move north or south.

The mandrel rests on bearing assemblies attached to the table to allow rotation in the east or west direction.

Carriage, table, and mandrel motion are controlled by: 1) the Operator in Manual Mode, or by 2) the Computer Controller in Automatic Mode.

As the coil is wound, lamination end spacer assemblies and copper wedges are inserted between the windings at specified locations to give the coil the proper shape and size.

5.2 Operator Controls

5.2.1 Manual Control Console

A. TABLE, MANDREL, CARRIAGE joysticks: control direction and speed of motion of their associated components.

B. SPOOL HEIGHT DOWN/OFF/UP selector switch: raises and lowers the spool in order to adjust cable payout angle.

C. CABLE TENSION digital display: displays cable tension in pounds.

D. DISPLAY RESET red push button: manually resets the digital displays to their "power on" state.

E. E-STOP red, mushroom-head push button: causes all machine motion to stop and cable tension to release by de-activating all motors and clutches.

F. PAUSE OVERRIDE black push button: overrides the "pause" function while depressed (see Section 5.2.5 for a description of the "pause" function).

5.2.2 Computer Control Rack

A. LOCK/CONTINUE keyswitch: disables the "Continue" function of the control system when in the LOCK position; this allows the Operator to leave the controls of the Winder temporarily without danger of unauthorized persons re-starting the Winder.

B. START green push button: activates power to the servo amplifiers and tension clutch controller.

C. E-STOP red, mushroom-head push button: causes all machine motion to stop and cable tension to release by de-activating all motors and clutches.

D. AC POWER amber indicator light: illuminates when the input disconnect switch (labeled "LONG WINDER POWER DISCONNECT SWITCH") is in the ON position

E. SERVO MOTOR red indicator light: illuminates when power to the servo motors is activated.

F. Keyboard, mouse, and screen: allows the operator to provide input to, and receive output from, the computer control system of the Winder.

G. "○/−" rocker switch located on the front panel of the computer: activates power to the computer.

H. RESET red push button located on the front panel of the computer: causes the computer to re-boot.

J. TENSION FAULT alarm buzzer: sounds when cable tension is "10 pounds from the reference tension.

K. SYSTEM ERROR red indicator light and RESET recessed mini-push button: illuminates when a Computer Controller error occurs; depressing the RESET push button resets the Controller.

5.2.3 "Magpowr TRAC-1" Tension Clutch Controller

A. POWER ON/OFF toggle switch: turns power to the TRAC-1 system on or off.

B. POWER ON amber indicator light: illuminates when power to the TRAC-1 system is activated.

C. TENSION CONTROL ON/OFF toggle switch: activates/deactivates the cable tension clutch.

D. TENSION CONTROL Potentiometer and display: potentiometer adjusts force exerted by cable tension clutch; display shows cable tension as a percent of full tension (not used).

E. AUTO/MAN Toggle Switch: in the MAN position, directs control of cable tension to the TRAC-1 front panel controls; in the AUTO position, directs control of cable tension to the Computer Controller.

5.2.4 Lump Detector Controls

A. ON/OFF toggle switch: Turns power to the detector on or off.

B. RESET red push button: turns off the audio alarm and resets the detector.

C. Dial potentiometer: sets the amount of deflection necessary to trip the detector.

D. DC voltmeter display: not used.

5.2.5 Other Operator Controls

NOTE 1 ***A "pause" is a halt in the execution of the program without aborting the program; when the program "continues", it begins at the place where it was halted.***

NOTE 2 ***Machinery remains energized when paused.***

A. Hand-held controller:

PAUSE black push button: causes the Computer Controller to pause and stops Winder motion;

CONTINUE green push button: causes the Computer Controller, and Winder motion, to resume.

B. PAUSE/CONTINUE boxes mounted along the table:

PAUSE black push button: causes the Computer Controller to pause and stops Winder motion;

CONTINUE green push button: causes the Computer Controller, and Winder motion, to resume.

C. SPOOL HEIGHT UP and DOWN black push buttons, located on the carriage: raises and lowers the spool in order to adjust cable payout angle.

5.3 Initial Control Settings

Before activating power to the Winder, set operator controls to the following initial settings:

A. SPOOL HEIGHT selector switch to OFF.

B. TRAC-1 POWER ON/OFF toggle switch to OFF.

C. TRAC-1 TENSION CONTROL ON/OFF toggle switch to OFF.

D. TRAC-1 Potentiometer set to zero.

E. TRAC-1 AUTO/MANUAL selector switch set to AUTO.

F. LOCK/CONTINUE key switch in the LOCK position.

G. Computer power rocker switch in the "○" (off) position.

H. Lump Detector ON/OFF power switch in the OFF position.

5.4 Starting the Winder

5.4.1 Verify that ALL of the following statements are true:

1. The safety interlocks have been tested within the past 6 months.

   NOTE ***Refer to the dated "Interlock Test" form (Attachment 5) posted near the Winder for verification of statement 1.***

2. The safety interlocks have been tested after a major repair or maintenance procedure has been performed.

3. The safety interlocks have been tested after a software revision has been installed.

   NOTE ***Refer to the Coil Winder Log Book for verification of statements 2 and 3.***

IF all of the statements are NOT true,

THEN stop work and immediately notify the Technical Supervisor for Coil Winding or the Coil Fabrication Plant Manager. To test the safety interlocks, refer to Section 5.15 for the proper test procedure.

5.4.2 Verify that operator controls are set to their initial settings as described in Section 5.3.

5.4.3 Place the LONG WINDER POWER disconnect switch in the ON position. Verify that the amber AC POWER indicator light on the Computer Control Rack illuminates.

5.4.4 Activate power to the computer by placing the "–/○" rocker switch on the computer in the "–" (on) position.

5.4.5 When the "C:\" prompt is displayed, enter the name of the control software for the particular type of coil being wound (for instance, "WINDQ13"). Refer to the applicable Magnet Assembly Procedure for the correct software name.

5.4.6 When the screen prompts you to "Press Start Button", depress the green START push button located on the Computer Control Rack.

WARNING

Selecting an item from the Main Menu may cause Winder motion. Keep unauthorized persons away from the Winder.

5.4.7 Wait for the Main Menu to be displayed. Choose a task to perform by selecting the appropriate function key.

5.5 Setting the Winder to Operate in Manual Mode

NOTE ***Steps 5.5.1 and 5.5.2 need to be performed only if the Winder has been shut down.***

5.5.1 Set operator controls to the initial settings described in Section 5.3.

5.5.2 Start the Winder by performing all of the steps in Section 5.4.

5.5.3 From the Main Menu, select "Joystick" by pressing «F3».

NOTE ***Function key F3 toggles the Winder between Manual and Automatic operating modes.***

5.5.4 Move the carriage, table, or mandrel to the desired location by operating their associated joysticks. The amount of deflection determines speed of motion.

5.5.5 To set cable tension manually, perform the following steps:

1. Set the TRAC-1 TENSION CONTROL potentiometer to zero.

2. Set the AUTO/MANUAL toggle switch on the TRAC-1 Controller to the MANUAL position.

3. Place the TRAC-1 POWER ON/OFF and TENSION CONTROL ON/OFF toggle switches in the ON position.

4. Adjust the TRAC-1 Potentiometer to set the desired cable tension. Observe the CABLE TENSION digital display on the Manual Control Console, which indicates the cable tension in pounds (do not use the meter on the TRAC-1 front panel).

5.5.6 To Exit Manual Mode:

1. On the TRAC-1 front panel, set the potentiometer to zero, and place the POWER and TENSION CONTROL toggle switches in the OFF position.

2. Press «F3».

5.6 Starting a Fresh Winding

5.6.1 Mount cable spool onto carriage.

5.6.2 Set operator controls to the initial settings described in Section 5.3.

5.6.3 Start the Winder by performing all of the steps in Section 5.4.

5.6.4 From the Main Menu, select "Joystick" by pressing «F3».

5.6.5 Using the three joysticks on the Manual Control Console, move the carriage, table, and mandrel to the following positions:

1. Carriage to the west side of the table track;

2. Table with its lead end at or near the "X" mark on the table track;

3. Mandrel with the centerpost facing East.

5.6.6 Press «F3» again to toggle back to Auto Mode.

5.6.7 Turn the LOCK/CONTINUE key switch to the CONTINUE position.

WARNING

The Winder will move automatically when the next step is performed. The Operator shall ensure that unauthorized persons are standing clear of the Winder.

5.6.8 From the Main Menu, select "Wind" by pressing «F1». The components of the Winder will move to their "home" positions.

5.6.9 Wait until the screen displays:

"ANCHOR THE CABLE, SWITCH ON TENSION, AND PRESS CONTINUE"

5.6.10 Route the cable through the guide wheels as shown on Attachment 3.

5.6.11 Anchor the cable to the mandrel

5.6.12 Adjust payout angle if necessary by using either the SPOOL HEIGHT DOWN/OFF/UP selector switch on the Manual Control Console, or the SPOOL HEIGHT UP and DOWN black push buttons on the carriage.

WARNING

The next step will cause cable tension to activate. If the cable is not properly secured to the mandrel, the spool will rotate, causing possible injury or equipment damage.

5.6.13 On the TRAC-1 front panel, set the controls as follows:

WARNING

Follow the order shown to prevent the Winder from moving unexpectedly.

1. Set the Potentiometer to zero.

2. Place the AUTO/MANUAL toggle switch in the AUTO position.

3. Place the POWER and TENSION CONTROL toggle switches in the ON position.

5.6.14 Depress one of the CONTINUE green push buttons located along the table track. The tension clutch will activate, placing the cable under tension. The amount of cable tension is set by the computer.

5.6.15 Wait for the screen to display:

"SETUP LUMP DETECTOR, THEN PRESS CONTINUE"

5.6.16 Set up the Lump Detector by performing all of the steps in Section 5.13.

WARNING

The Winder will move automatically when the next step is performed. The Operator shall ensure that unauthorized persons are standing clear of the Winder.

5.6.17 Depress one of the CONTINUE green push buttons located along the table track. The carriage, table, and mandrel will move to the first programmed stop.

NOTE ***To stop motion between a programmed stop, depress any of the PAUSE black push buttons. To resume motion, depress a CONTINUE green push button.***

5.6.18 When the program pauses, install the required parts into the turns of the winding . The two digital displays on the Manual Control Console will display the current turn number and the part number of the required part.

5.6.19 Depress the CONTINUE green push button to continue winding to the next programmed stop.

5.6.20 Repeat steps 5.6.18 and 5.6.19 until all turns have been completed.

5.7 Unwinding a Coil

If it is necessary to unwind one or more turns of the coil, perform the following steps:

5.7.1 Allow the Winder to complete the current programmed step.

5.7.2 Select "Unwind" from the Main Menu by pressing «F4». The components of the Winder will move in the reverse direction until the previous programmed stop is reached. The cable will be rewound onto the spool.

5.7.3 To resume winding, select "Wind" from the Main Menu by pressing «F1».

5.8 Winding After a Break

If the winding process is disrupted (such as by a momentary power failure), then perform the following steps to resume winding:

5.8.1 Reset the computer using one of the following methods:

A. Press «Ctrl-Alt-Del» on the computer keyboard.

B. Press the RESET red push button located on the front panel of the computer.

5.8.2 When the "C:\" prompt is displayed, enter the name of the control software

5.8.3 When the screen prompts you to "Press Start Button", depress the green START push button located on the Computer Control Rack.

5.8.4 From the Main Menu, select "Joystick" by pressing «F3».

5.8.5 Manually position the carriage, table, and mandrel to their "home" positions by operating the joysticks on the Manual Control Console.

5.8.6 Press «F3» to toggle out of Manual Mode into Auto Mode.

5.8.7 Select "Wind after break" by pressing «F5».

5.8.8 When prompted, enter the turn number to be wound.

5.8.9 When prompted, depress the CONTINUE green push button. The Winder will resume programmed motion.

5.9 Re-Starting After a "System Error" Occurs

If the Computer Controller fails during winding, all motion will stop and cable tension will release. The red indicator light labeled "SYSTEM ERROR", located below the computer, will illuminate. Perform the following steps to restart the Winder.

5.9.1 Depress the white RESET mini-push button located next to the SYSTEM ERROR red indicator light. Verify that the red indicator light extinguishes.

5.9.2 Perform all of the steps in Section 5.8 , "Winding after a Break".

5.9.3 If the "System Error" occurs again during the same run, stop work, and notify the Cognizant Engineer.

5.10 Using the "Pause Override" Feature

NOTE ***"Pause Override" is used in the event that the carriage motion limit switch is held in an engaged position, causing the Computer Controller to lock in the "Pause" mode. This would occur if the carriage is accidentally moved into the table. The feature allows the Operator to manually move the carriage away from the table.***

5.10.1 While holding depressed the PAUSE OVERRIDE black push button:

1. Depress and release one of the CONTINUE green push buttons;

2. Toggle «F3» by pressing it twice;

3. Operate the CARRIAGE joystick to move the carriage away from the table.

5.10.2 When the limit switch is de-activated, release the PAUSE OVERRIDE push button.

5.11 Wrapping Film on the Completed Winding

5.11.1 From the Main Menu, select "Film wrap" by pressing «F8». The carriage will move to the east side of the Winder.

5.11.2 Install the film wrapping assembly.

5.11.3 Connect the film tensioner AC plug to a 120VAC outlet located on the Winder.

5.11.4 Using a radius gauge, measure the amount of film on the spool.

5.11.5 Using the information from the radius gauge, adjust the tension control potentiometer for the proper film tension.

5.11.6 Depress one of the CONTINUE green push buttons. The mandrel will start rotating, pulling the film off of its spool and wrapping it around the coil.

5.11.7 Use the PAUSE and CONTINUE push buttons to complete the wrapping.

5.11.8 To exit the film wrapping mode, press «F8».

5.12 Shutting Down the Winder

5.12.1 Select "Program abort" from the Main Menu by pressing «F7».

5.12.2 Set operator controls to their initial settings as per Section 5.3

5.12.3 Place the LONG WINDER POWER disconnect switch in the OFF position. Verify that all of the indicator lights on the Control Rack extinguish.

5.12.4 Complete the Coil Winder Log Book.

5.13 Setting Up the Lump Detector:

NOTE ***The Lump Detector should be set for a 15 mil trip level before each new winding is started (Main Menu choice "F1").***

When menu choice "F1-Wind" is chosen from the Main Menu, the table, mandrel, and carriage will move towards their home position. After homing, anchor the cable to the mandrel and press one of the CONTINUE green push buttons. You will be prompted to "Set up the Lump Detector". At that point, perform the following steps:

5.13.1 Verify that cable is properly threaded through the guide wheels. Refer to Attachment 3, "Cable and Guide Wheel Diagram".

5.13.2 Place Lump Detector ON/OFF toggle switch in the ON position.

5.13.3 Insert 15 mil shim between cable and detector.

5.13.4 Adjust Lump Detector potentiometer upward (counter clockwise) until alarm trips.

5.13.5 Depress the RESET red push button. If alarm does not stop, adjust potentiometer downward (clockwise) in small increments, hitting RESET push button at each increment, until alarm stays off.

5.13.6 Remove shim. The Lump Detector is set.

5.14 Calibration of TRAC-I Cable Tensioning System

NOTE 1 ***This procedure should be performed by an Authorized Operator at the start of every production run and once a month thereafter during production.***

NOTE 2 ***Adjustment of the TRAC-1 system (if necessary) should be performed by a qualified Calibration Technician with a generic Energized Work Permit.***

NOTE 3 ***The Operator should complete the TRAC-1 Calibration Report (Attachment 4.***

NOTE 4 ***A calibrated force gauge is required.***

5.14.1 On the "Calibration Report" (Attachment 4), record the "ID#", calibration date, and calibration expiration date of the force gauge, which are noted on stickers affixed either to the gauge or to the gauge's case.

IF the calibration sticker is expired,

THEN do not use the gauge; notify the Coil Fabrication Supervisor, who will arrange to calibrate the gauge.

5.14.2 Perform steps 5.5.1 to 5.5.4 to set the Winder for Manual Mode. DO NOT turn on cable tension at this time.

5.14.3 Manually or automatically position the carriage, table, and mandrel to their "home" positions.

5.14.4 Secure a 2-3 foot length of cable to the centerpost. The type of cable should match the tooling.

5.14.5 Attach the force gauge to the cable.

5.14.6 Mount a spool of cable to the carriage.

5.14.7 Run the cable through the guide wheels. Attach it to the other end of the force gauge.

5.14.8 Position the carriage so that the cable is in a straight line parallel to the centerpost from the last guide wheel, through the force gauge, to the point of attachment on the centerpost.

5.14.9 Rest the gauge on the mandrel. Zero the gauge.

5.14.10 Record the CABLE TENSION digital display reading in the "Indicated Tension" column of the Calibration Report for 0 lbs. of actual tension.

5.14.11 Set the TRAC-1 TENSION CONTROL potentiometer to zero.

5.14.12 Place the AUTO/MANUAL toggle switch on the TRAC-1 enclosure in the MANUAL position.

5.14.13 Place the TRAC-1 POWER ON/OFF and TENSION CONTROL ON/OFF toggle switches in the ON position.

5.14.14 While observing the force gauge, adjust the TENSION CONTROL potentiometer to set cable tension to the first test point as read on the force gauge.

5.14.15 Record the CABLE TENSION digital display reading in the "Indicated Tension" column in the "Before Adjustment" section.

5.14.16 If the Indicated Tension is within the Specified Tolerance, then check off the "P" box. Otherwise, check off the "F" box.

5.14.17 Repeat steps 5.14.14 to 5.14.16 for all of the test points called out in the "Actual Tension" column.

5.14.18 IF all of the readings are within the Specified Tolerance,

THEN perform the following steps:

1. Dismantle the setup.

2. Complete the "Calibration Report". Keep one copy on file; post one copy on the TRAC-1 Controller.

5.14.19 IF one or more readings are outside the Specified Tolerance,

THEN perform the following steps:

1. DO NOT dismantle the setup.

2. Notify the Coil Fabrication Supervisor immediately. The Supervisor will arrange for a qualified Calibration Technician to adjust the TRAC-1 Tension Controller.

3. Work with the Calibration Technician by operating the Winder as required.

4. After the TRAC-1 system is adjusted, test the system at all of the test points called out in the "Actual Tension" column of the Calibration Report.

5.14.20 IF all of the readings are within the Specified Tolerance after adjustment,

THEN perform the following steps:

1. Record the final run of readings on the Calibration Report in the "After Adjustment" section..

2. Dismantle the setup.

3. Complete the "Calibration Report". Keep one copy on file; post one copy on the TRAC-1 Controller.

NOTE ***The Division Calibration Group is required to notify the Cognizant Engineer when a system fails calibration on***

the first run, and to provide data to aid in determining the impact, if any, on previous production runs.

5.14.21 IF the TRAC-1 system can NOT be adjusted so that all readings are within the Specified Tolerance,

THEN perform the following steps:

1. Immediately notify the Cognizant Engineer and the Coil Fabrication Supervisor so that repair of the system can be arranged as soon as possible.

2. Do not dismantle the setup. Others may want to verify your findings.

3. WHEN the system is repaired, and all readings are within the Specified Tolerance,

   THEN repeat all of the steps in Section 5.14.20.

5.15 Interlock Test Procedure

NOTE 1 ***Interlocks shall be tested on a six month interval during production, or after major maintenance or repair, or after a software revision.***

NOTE 2 ***A listing and description of the safety interlocks on the Winder follows. All interlocks are functional when the Winder is operated in AUTO or MANUAL modes, except where stated otherwise:***

A. Limit switch for table motion.

Stops table motion before the table disengages from the drive gear.

B. Limit switch for carriage motion.

Prevents the carriage from hitting the table.

C. Two red, mushroom-head push buttons labeled "E-STOP".

One is located on the Computer Control Rack. The other is located on the Manual Control Console.

Depressing an "E-STOP" push button will cause all motor power and clutch tension to shut off.

D. Four red pull cords along both sides of the table.

The pull cords have the same function as the "E-STOP" push buttons.

E. Two optical switches.

Disallows all table motion if a person stands in the space between the carriage and the table while the Winder is operating in AUTO mode.

Not functional in MANUAL mode.

F. One yellow pull cord for carriage motion.

Mounted on the side of the carriage. Hitting the cord will cause carriage motion to stop.

NOTE 3 ***Refer to the Interlock Test Form (Attachment 5) as an aid to locate and test each device. As each device is tested, check off the appropriate box.***

NOTE 4 ***If a device fails, stop work, and immediately notify the Coil Winding Technical Supervisor, the Cognizant Engineer, and the ES&H Coordinator.***

5.15.1 Table Motion Limit Switches

1. Visually inspect the switches for damage.

2. Set operator controls to the initial settings described in Section 5.3.

3. Start the Winder by performing steps 5.4.3 to 5.4.7. It is not necessary to mount the cable spool yet.

4. From the Main Menu, select "Joystick" by pressing «F3».

5. Using joystick control, move the table to its north limit. The table should stop before it disengages from the drive screw.

6. Depress one of the E-STOP push buttons. Servo motor power should de-activate.

7. Push the table a few inches toward the center of the Winder until the limit switch releases. The red SYSTEM ERROR indicator light should illuminate.

8. Depress the RESET white recessed push button next to the SYSTEM ERROR light. The SYSTEM ERROR light should extinguish.

9. Reset the computer using one of the following methods:

   A. Press «Ctrl-Alt-Del» on the computer keyboard.

   B. Press the RESET red push button located on the front panel of the computer.

10. When the "C:\" prompt is displayed, type the name of the control software.

11. When the screen prompts you to "Press Start Button", depress the green START push button located on the Computer Control Rack.

12. From the Main Menu, select "Joystick" by pressing «F3».

13. Repeat steps 5-12 for the south limit.

5.15.2 Carriage Motion Limit Switches

1. Visually inspect the switches for damage.

2. Using joystick control, move the carriage clockwise.

3. While the carriage is moving, push the switch by hand. The carriage should stop.

4. While holding depressed the PAUSE OVERRIDE black push button:

   a. Depress and release one of the CONTINUE green push buttons;

   b. Toggle «F3» by pressing it twice;

   c. Operate the CARRIAGE joystick to move the carriage away from the table.

5. When the limit switch is de-activated, release the PAUSE OVERRIDE push button.

6. Repeat steps 2-5 for motion in a counter-clockwise direction.

NOTE ***Test all of the remaining interlocks during the normal course of completing a winding, with the Winder in AUTO mode and "Wind" selected from the Main Menu.***

5.15.3 "E-STOP" Push buttons and Pull Cords

1. Start a fresh winding by following the steps in Section 5.6 (steps 5.6.1 and 5.6.2 do not need to be performed unless the Winder is shut down).

2. With servo motor power and cable tension activated, and the Winder in motion during AUTO mode, depress the "E-STOP" red mushroom push button on the Computer Control Rack.

3. Verify that power to the servo motors and power to the tension clutch is de-activated.
   NOTE ***Performing the next step may cause the carriage, table, or mandrel to jerk slightly.***

4. Depress the green START push button located on the Computer Control Rack. Tension should be restored to the cable and power restored to the motors.

5. Depress one of the CONTINUE green push buttons located along the table. The Winder will resume programmed motion.

6. Repeat steps 2-5 for the "E-STOP" red mushroom push button located on the Manual Control Console, and for each of the four red pull cords located along the sides of the table track.

5.15.4 Optical Switches

WARNING

Perform step 1 carefully. A severe pinch hazard exists.

1. At a point in the AUTO mode operation when the table is in motion, block the path between the light source and the light detector with a strip of cardboard. Keep hands away from the table. The table should stop moving.

2. Depress one of the CONTINUE green push buttons located along the table. Table motion should resume.

3. Repeat steps 1 and 2 for the other optical switch.

5.15.5 Carriage Yellow Pull Cord

1. At a point in the AUTO mode operation when the carriage is in motion, hit the pull cord. The carriage should stop moving.

2. Depress one of the CONTINUE green push buttons located along the table. Carriage motion should resume.

5.15.6 When all devices have been successfully tested, date and initial the completed "Interlock Test" form. Post a copy near the Winder.

5.16 Maintenance Routine

NOTE 1 ***A maintenance routine should be performed once a month during coil production and twice a year during R&D work.***

NOTE 2 ***A maintenance log should be kept, with entries to include:***

A. ***Service performed.***

B. ***Service date.***

C. ***Initials of service technician.***

D. ***Notes of unusual wear and tear or other unusual conditions.***

5.16.1 Inspect table bearings. Add grease as required.

5.16.2 Inspect carriage bearings. Add grease as required.

5.16.3 Inspect chains, sprockets. Adjust tension as necessary.

5.16.4 Inspect drive mechanisms, shaft, journals that engage mandrel.

5.16.5 Inspect rotating support bearings. Replace as necessary.

6.0 Documentation

6.1 Coil Winder Log Book.

6.2 Traveller.

6.3 Interlock Test Form.

6.4 Maintenance Log.

7.0 References

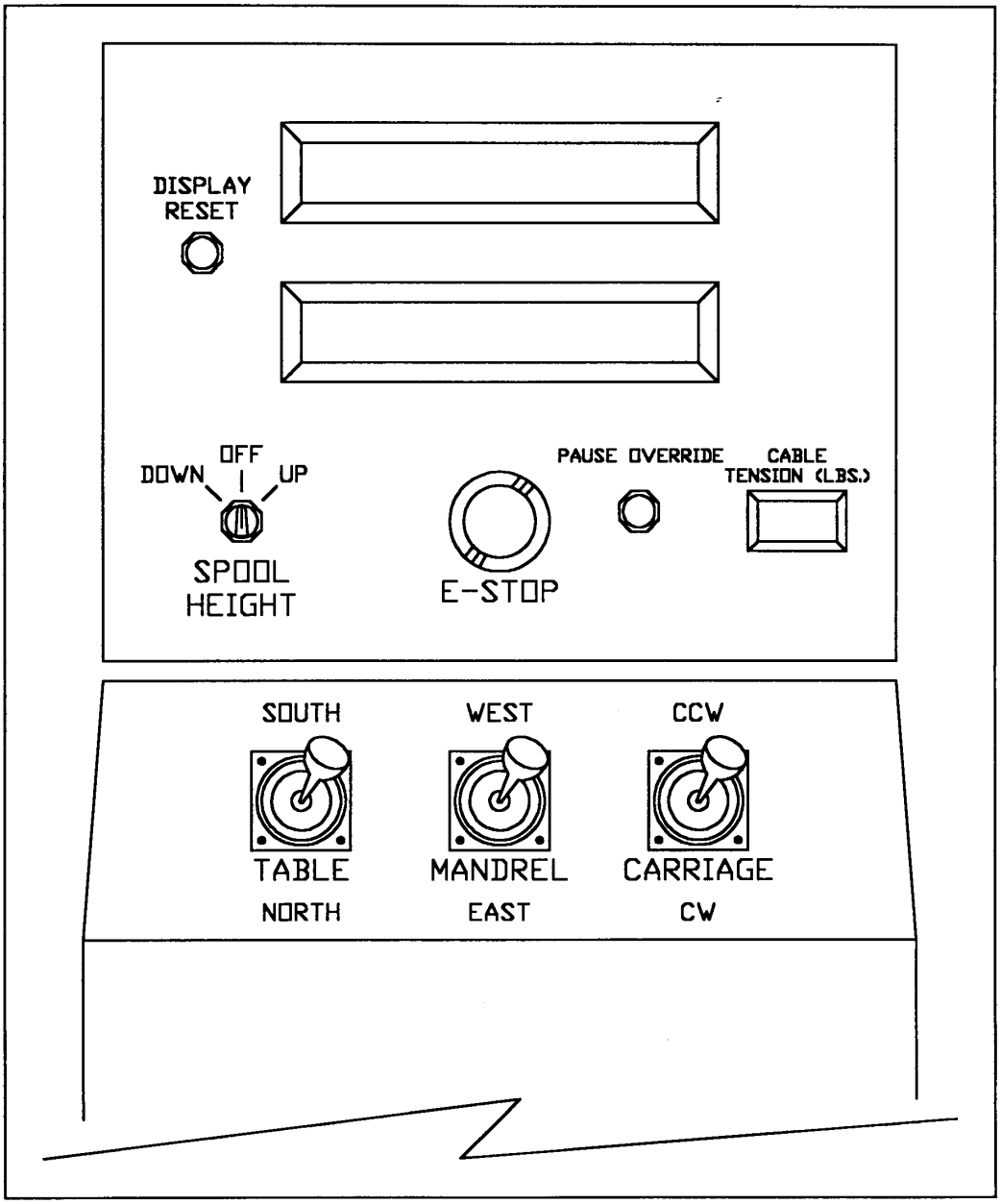
7.1 ESH Standard 1.5.1., " Lockout/Tagout Requirements".

8.0 Attachments

1. Manual Control Console
2. Computer Control Rack
3. Cable and Guide Wheel Diagram
4. TRAC-1 Calibration Report
5. Interlock Test Form

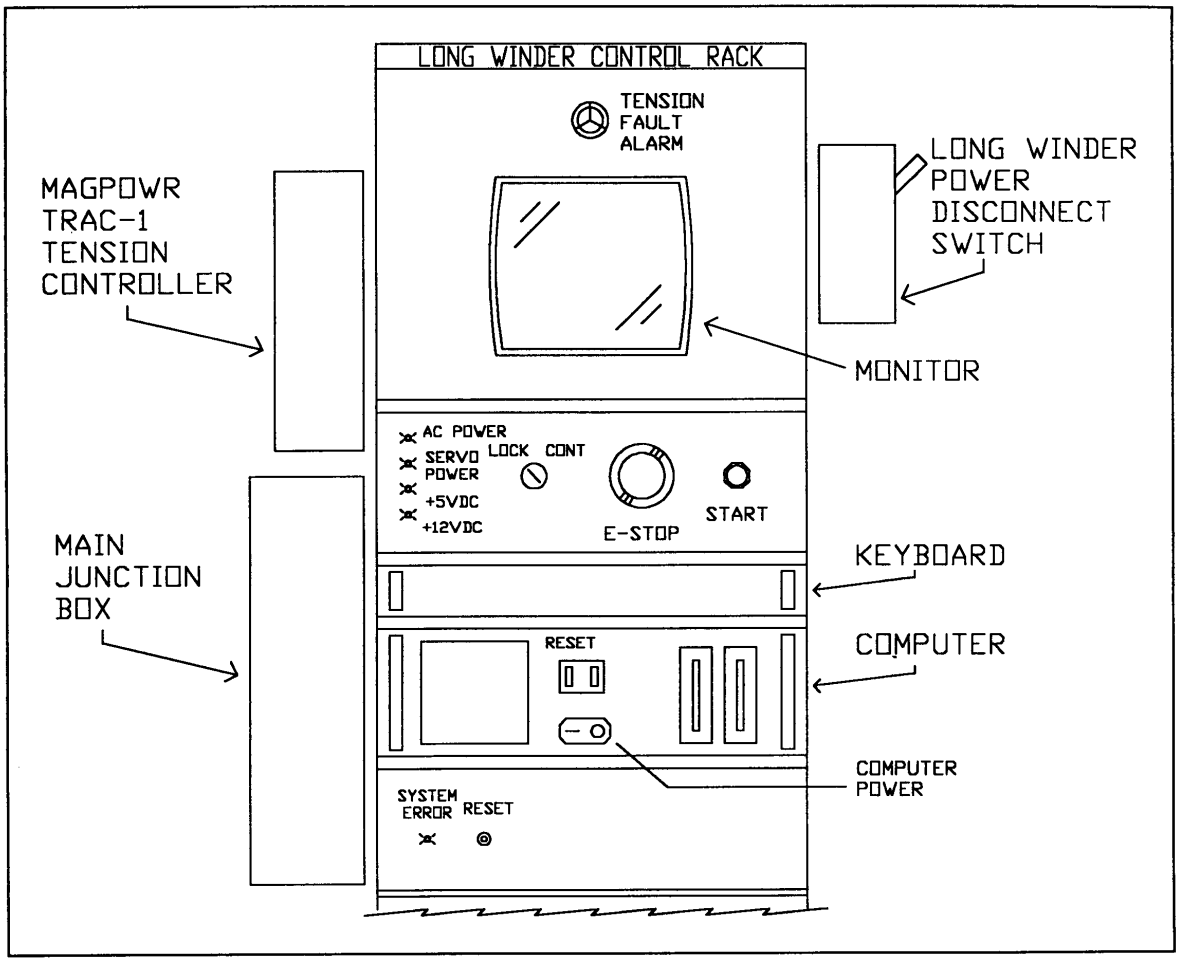
Attachment 1

Manual Control Console



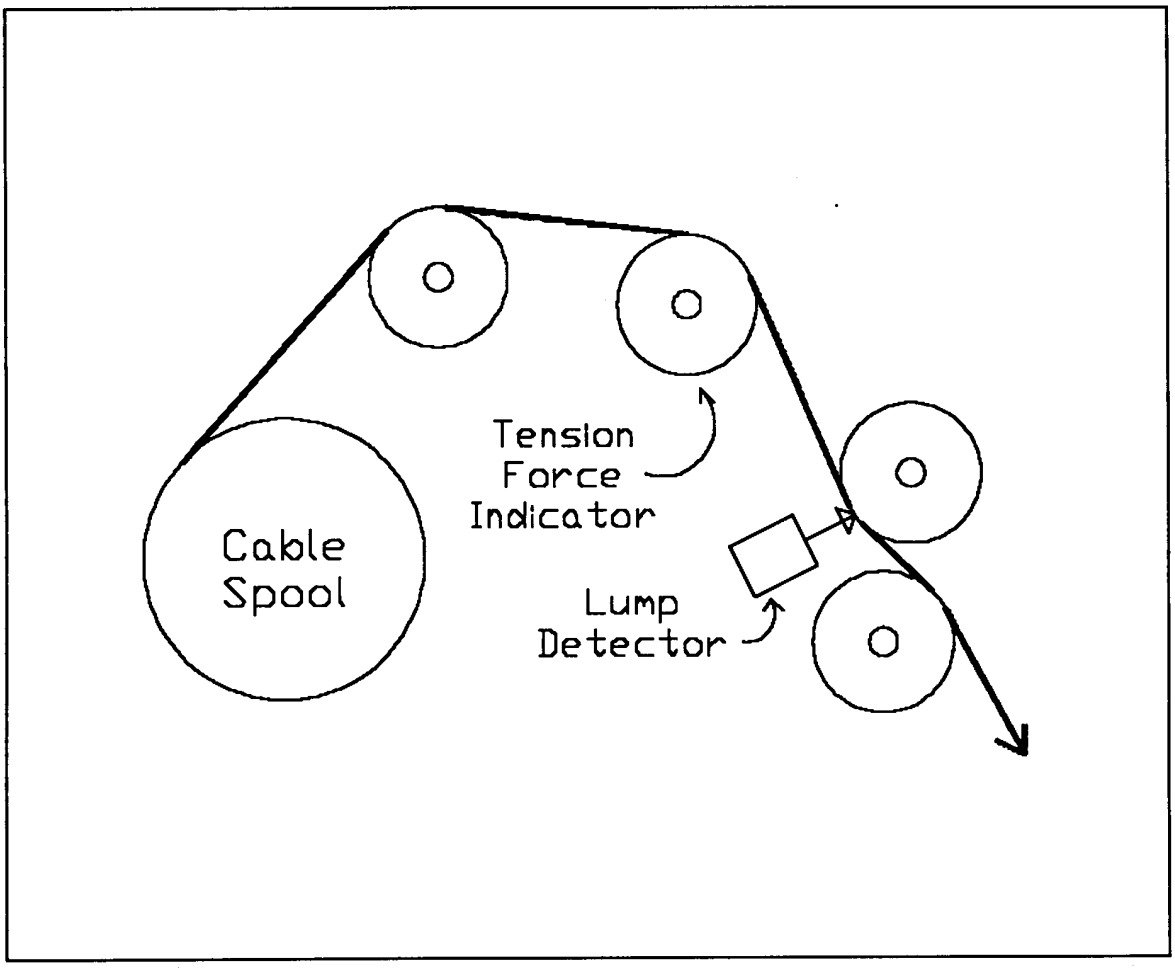
Attachment 2

Computer Control Rack



Attachment 3

Cable and Guide Wheel Diagram



Attachment 4
Calibration Report

Calibration of TRAC-1 Cable Tensioning System on Long Coil Winder

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THIS ASSET WAS CALIBRATED USING TEST EQUIPMENT WHOSE ACCURACY IS TRACEABLE TO THE NIST, OR ACCEPTED VALUES OF NATURAL PHYSICAL CONSTANTS.

==

Procedure: SMD-OPM 8.1.1.1, Section 5.14
Specified tolerance: "3.0 lbs.

TEST DATA

Before Adjustment				After Adjustment					
Actual Tension	Indicated Tension	P	F	Actual Tension	Indicated Tension	P	F	Date	Init
0				0					
20				20					
45				45					
Force gauge ID#	Calib Date:			Calib. Exp:					
0				0					
20				20					
45				45					
Force gauge ID#	Calib Date:			Calib. Exp:					
0				0					
20				20					
45				45					
Force gauge ID#	Calib Date:			Calib. Exp:					
0				0					
20				20					
45				45					
Force gauge ID#	Calib Date:			Calib. Exp:					
0				0					
20				20					
45				45					
Force gauge ID#	Calib Date:			Calib. Exp:					
0				0					
20				20					
45				45					
Force gauge ID#	Calib Date:			Calib. Exp:					
0				0					
20				20					
45				45					
Force gauge ID#	Calib Date:			Calib. Exp:					
0				0					
20				20					
45				45					
Force gauge ID#	Calib Date:			Calib. Exp:					

Attachment 5

Interlock Test Form

	Designation	T	T	T	T	T	T	T	T
Limit Switches	Table limit switch North								
	Table limit switch South								
	Carriage limit switch CW								
	Carriage limit switch CCW								
E-STOP Buttons	CB-1								
	CB-2								
Red Pull Cords	PC-1								
	PC-2								
	PC-3								
	PC-4								
Optical Switches	OS-1								
	OS-2								
Carriage Yellow Pull Cord	CPC-1								
	Date---->								
	Initials---->								

Location Diagram