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## SMD Operations Procedures Manual

### 8.1.1.32 OPERATION OF DIRECT WIND TUBE WRAPPER

Text Pages 1 through 6  
Attachment(s) 5

#### Hand Processed Changes

<u>HPC No.</u>	<u>Date</u>	<u>Page Nos.</u>	<u>Initials</u>
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Division Head

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Date

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### **8.1.1.32 Operation of Direct Wind Tube Wrapper**

#### **1 Purpose and Scope**

- 1.1 The purpose of this procedure is to provide instruction in the operation of the Tube Wrapping Machine.
- 1.2 This procedure does not provide instructions for preparation, assembly, completion, storage, and documentation of the tube or wrapping material. Those instructions are found in the appropriate Magnet Assembly Procedure.
- 1.3 This machine has two functions, to wrap Kapton and to wrap S-2 glass roving.

#### **2 Responsibilities**

Authorized operators of the wrapping machine shall perform the tasks described here. A list of authorized operators is maintained by the Cognizant Technical Supervisor.

#### **3 Prerequisites**

##### Training

- 3.1 The operator shall be trained by the Cognizant Technical Supervisor before operation of the machine.
- 3.2 The operator shall be trained as an "Affected Employee" as defined in "Lockout/Tagout (LOTO)" subject area.

##### Equipment

None

#### **4 Precautions**

This machine contains rotating parts. Do not wear loose clothing or hanging jewelry. Keep long hair tied up. Otherwise, personal injury could result.

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## **5 Description of Controls**

- 5.1 Control system consists of Industrial PC, Motion Control Card plugged into PC1 bus of computer, three motor controllers, tension controller, software written in LabView 8.6, and foot paddle switch to start the motion.
- 5.2 Main disconnect switch rated for 208V, 3 phase 20A is mounted on right side of computer rack. It disconnects power to computer, motor controllers and auxiliary power supply.
- 5.3 Motor controller power enable (Motion On) and power disable (Motion Crash) push buttons are mounted on the front of rack. Tension control potentiometer is located on top left of the frame and tension control AC motor breaker is located on bottom right of frame.
- 5.4 Sequence to start the control system in ungeared manual mode is as follows:
  - 5.4.1 Turn on 3 phase main switch.
  - 5.4.2 Turn on computer. Turn on LabView program “ILC wrapper gearedmov1” by clicking on it.
  - 5.4.3 Press green ‘motion on’ push button to power up motor controllers.
  - 5.4.4 Click on white arrow in top left corner to execute the program.
  - 5.4.5 Flip “enable gearedmov1” switch to Off. Flip appropriate switches to enable and select the direction of each axes.
  - 5.4.6 Depress foot paddle to move enabled axes.

## **6 Loading tube into the Wrapper**

- 6.1 Determine if the tube shall be wrapped with Kapton or S-2 glass.
  - 6.1.1 Install the proper carriage onto the main lead screw. Either the Kapton winding head or the S-2 glass pulley carriage.
  - 6.1.2 Loosen the stop bolt for the tail stock limit switch take-up pulley.
  - 6.1.3 Slide the tail stock carriage into proper position and lock it down with the set screws in the bottom plate.

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## **NOTE**

**Set screws lock into the rail mounting counter bores, which are every 2.3 inches. Fine adjustment is accomplished by the adjustment of tail stock unit itself.**

- 6.1.4 Slide the limit switch take up pulley to remove any slack in the electrical cable. Then secure it by tightening the stop bolt.
- 6.1.5 The tube can now be loaded into the winder by inserting each end and securing the chucks to the tube.

## **7 S-2 Glass Overwrap**

- 7.1 Single pass overwrap.
  - 7.1.1 Turn on power switch to computer.
  - 7.1.2 Start program (ILC wrapper\_gearedmov1)
  - 7.1.3 Referring to Attachment 1, click on the white arrow at the top left of page.
  - 7.1.4 Turn on the power to the winder by pushing the “On” button on the front of the computer console. (The three lights should come on)
  - 7.1.5 Each axis can now be toggled on and off to move it into position by pressing the foot pedal. Refer to Attachment 1.
  - 7.1.6 Align the linear axis so that the rear vertical pulley is in line with where the S-2 glass wrap is to start.
  - 7.1.7 Route the s-glass as shown in Attachment 2.
  - 7.1.8 Set the low tension manual clutch on the spool to 5lbs.
  - 7.1.9 Be sure that the carriage tension cable is disconnected and secured to its pulley on the tension shaft.
  - 7.1.10 Turn on the tensioning power switch at the end of the wrapper, by the tension drive motor.
  - 7.1.11 Set the Magtrol tension controller to “run” and adjust to the required tension using a fish scale.

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7.1.12 Connect the S-2 glass roving to the coil tube.

7.1.13 Toggle the computer (on the screen) to gear drive mode, then input the required ratio and winding distance.

7.1.14 Depress foot pedal to start winding.

7.1.15 Once required distance is wound, release foot pedal.

7.1.16 Place a piece of tape at the end of the wind on the tube to stop it from unraveling.

7.1.17 Release the tension using the tension controller.

7.1.18 Cut and secure the end of the S-2 glass to the tube.

7.1.19 Shut off the tension motor and the power to the machine axis.

7.1.20 Rewind excess S-2 glass.

7.1.21 Open chucks and remove the tube.

7.2 Balance Overwrap (Double Pass)

7.2.1 Single pass overwrap.

7.2.2 Turn on power switch to computer.

7.2.3 Start program (ILC wrapper\_gearedmov1)

7.2.4 Referring to Attachment 1, click on the white arrow at the top left of page.

7.2.5 Turn on the power to the winder by pushing the “On” button on the front of the computer console. (The three lights should come on)

7.2.6 Each axis can now be toggled on and off to move it into position by pressing the foot pedal. Refer to Attachment 1.

7.2.7 Align the linear axis so that the rear vertical pulley is in line with where the S-2 glass wrap is to start.

7.2.8 Route S-2 glass as shown in Attachment 3.

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7.2.9 Set the low tension manual clutch on the spool to 1.5-2.0 lbs.

7.2.10 Connect the S-2 glass roving to the tube.

**NOTE**

**Tube should be aligned so that the wrap will begin at least 1” beyond the start of the required wrap point.**

7.2.11 Toggle the computer (on the screen) to geared drive mode. Input the required ratio and winding distance. Set winding directions to C.W. and West.

7.2.12 Depress foot pedal to wind.

7.2.13 Stop winding (release foot pedal) 3/8” **before** the end of winding spot on the coil is reached.

7.2.14 Unspool an extra 10 feet then cut the string.

7.2.15 Be sure the tension cable is attached to the tension sled, then position the sled about 2 feet back from the main winding carriage.

7.1.16 Turn on the tensioning power switch at the end of the wrapper, by the tension drive motor.

7.1.17 Set the tension of the tension sled to the required value by using a fish scale and adjusting the Magtrol tensioner.

**NOTE**

**The S-2 glass wraps around the tensioning pulley 180<sup>0</sup> thus the overall tension required at the sled by the tension cable is twice that of the S-2 glass.**

7.1.18 Route the S-2 glass as shown in Attachment 4.

7.1.19 Attach S-2 glass to the coil 3/8-1/2” from where the low tension wrap stopped.

7.1.20 Set the winding direction to C.C.W and East.

7.1.21 Press foot pedal and wind until the proper length is achieved.

7.1.22 Release foot pedal.

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7.1.23 Place a piece of tape where the winding stops to stop it from unraveling. Release tension from the controller.

7.1.24 Shut off tension drive motor and machine axis.

7.1.25 Cut off excess S-2 glass and remove coil from machine.

## **8 Test of Crash Buttons & Tension Carriage Brake**

This section:

1. Performs a functional check of the tension carriage brake. In the event of an unexpected break in the pre-preg string, the brake ensures that the tension carriage will not accelerate suddenly due to the tension in the clutch cable.
2. Performs a functional check of the 2 tension motor crash buttons.

### **NOTE**

**This test shall be performed at a 6 month interval.**

### **WARNING**

**To avoid serious injury, keep the area between the tension carriage and the tension clutch clear of people and objects. See Attachment 6.**

- 8.1 Reference previous sections to initialize machine settings.
- 8.2 Obtain a section of the pre-preg filament of sufficient length to form a loop as shown in Attachment 6. The filament shall have a tensile strength of >75 lbf. Knot the filament to form a closed loop. Install the loop over the pulleys as shown in Attachment 6.
- 8.3 Set the tension clutch controller to "OFF". With the lead screw immobilized, start the tension motor. Press the 1<sup>st</sup> CRASH button. If the motor shaft stops, THEN check the appropriate box on the Test Form. If the motor does NOT stop, THEN stop work, write "fail" on the Test Form, and notify the Cognizant Engineer, the Cognizant Technical Supervisor, and the ES&H Coordinator.
- 8.4 Repeat 8.3 for the other crash button.

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#### **NOTE**

**This portion of the test requires two operators**

#### **CAUTION**

**Safety Glasses and leather gloves shall be worn during this part of the test**

- 8.5 Verify that the area between the tension carriage and the tension clutch is clear of people and objects.
- 8.6 Operator 1: Positioned next to the main control panel at the location of the Crash Button on the tension motor control panel.
- 8.7 Operator 1: With the lead screw immobilized, energize the tension clutch sufficiently to apply 50 lbf tension to the tension cable. Set the lead screw to begin moving the wrapping spool carriage table in a direction away from the tension carriage.
- 8.8 Operator 1: Remaining at the location of the crash button, be prepared to CRASH the tension motor should the brake fail and the tension carriage begin to accelerate towards the tension clutch.
- 8.9 Operator 2: When the wrapping spool carriage is nearing the end of its travel at the main panel end, use a pair of wire cutters to sever the pre-preg filament loop installed above.
- 8.10 Verify that that the tension carriage does not move more than 1 inch in the direction of the tension clutch. Should the movement be less than 1 inch, THEN check the appropriate box on the Test Form. If the pulley table moves greater than 1 inch, THEN stop work, write "fail" on the Test Form, and notify the Cognizant Engineer, the Cognizant Technical Supervisor, and the ES&H Coordinator.

#### **9 Procedure (For Winding Kapton)**

- 9.1 Set the Kapton spool holder to the proper helix angle for the pilen and diameter to be used.
- 9.2 Be sure the tension carriage is out of range for the tube to be wound.
- 9.3 Turn on power switch to computer.
- 9.4 Start program (ILC wrapper\_gearedmov1)
- 9.5 Referring to Attachment 1, click on the white arrow at the top left of page.

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- 9.6 Turn on the power to the winder by pushing the “On” button on the front of the computer console. (The three lights should come on)
- 9.7 Each axis can now be toggled on and off to move it into position by pressing the foot pedal. Refer to Attachment 1.
- 9.8 Adjust the linear axis so that the Kapton spool carriage is at the start point of the insulation area at the lead end.
- 9.9 Adjust the height of the tube so that the Kapton is in line (approximately) with the bottom of the tube.
- 9.10 Pass the Kapton underneath the tube and attach it with a piece of tape.
- 9.11 Toggle the computer (on the screen) to geared drive mode. Input the required ratio and winding distance. Set winding directions to C.W. and West.
- 9.12 Depress foot pedal to wind.
- 9.13 When the entire length of the tube has been wrapped, release the foot switch.
- 9.14 Cut the Kapton and attach the end to the tube with a piece of tape to stop it from unraveling.
- 9.15 Shut off the power to the winder.

## **10 Documentation**

None

## **11 References**

- 11.1 SBMS, "Lockout/Tagout (LOTO)" subject area.

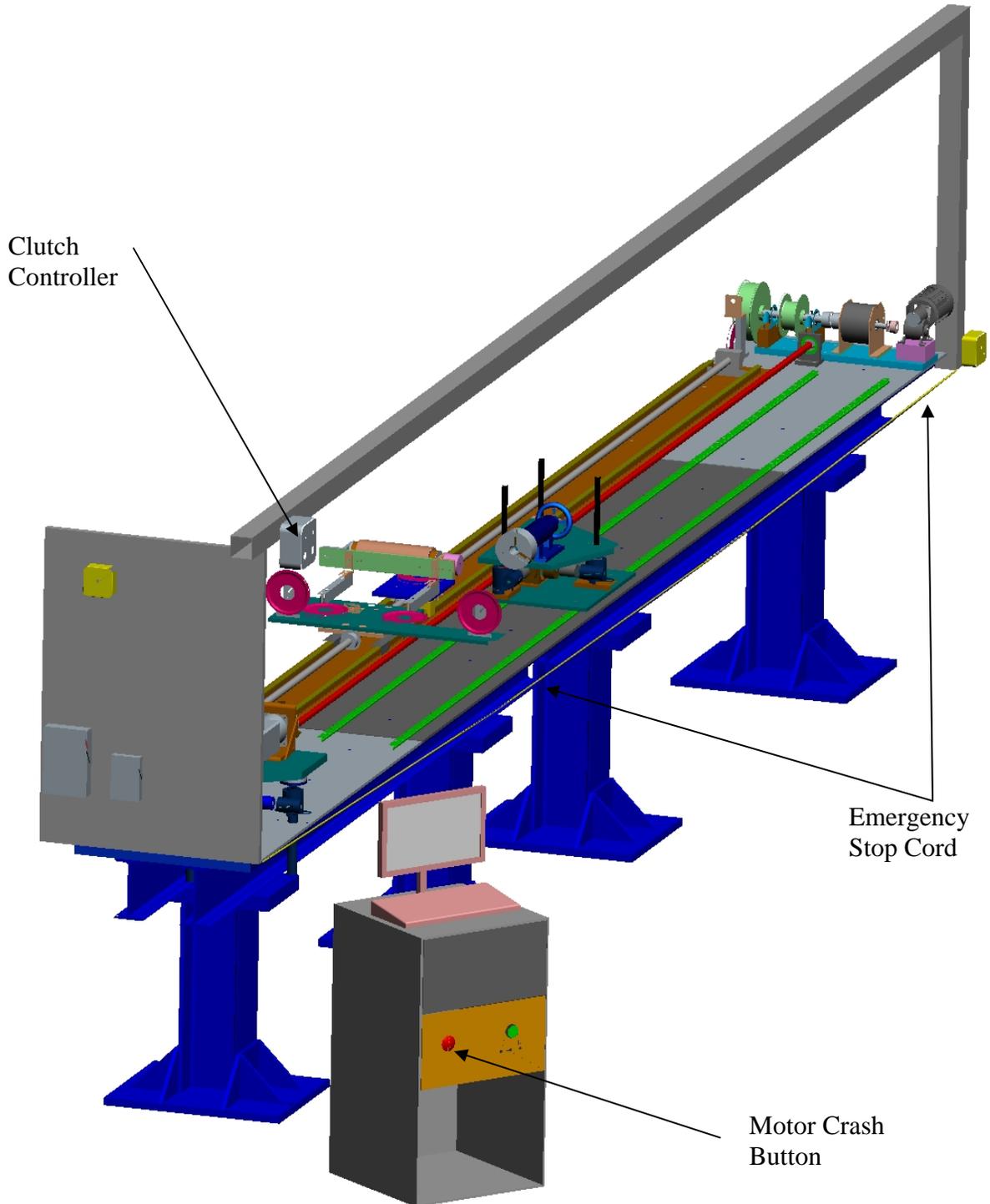
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## **12 Attachments**

1. Overall View
2. Computer Control & Panel
3. Far Panel Controls
4. Wrapping Setup – Initial
5. Wrapping Setup – Final
6. Tension Carriage Brake Check Diagram
7. Tension Carriage Brake Check Form

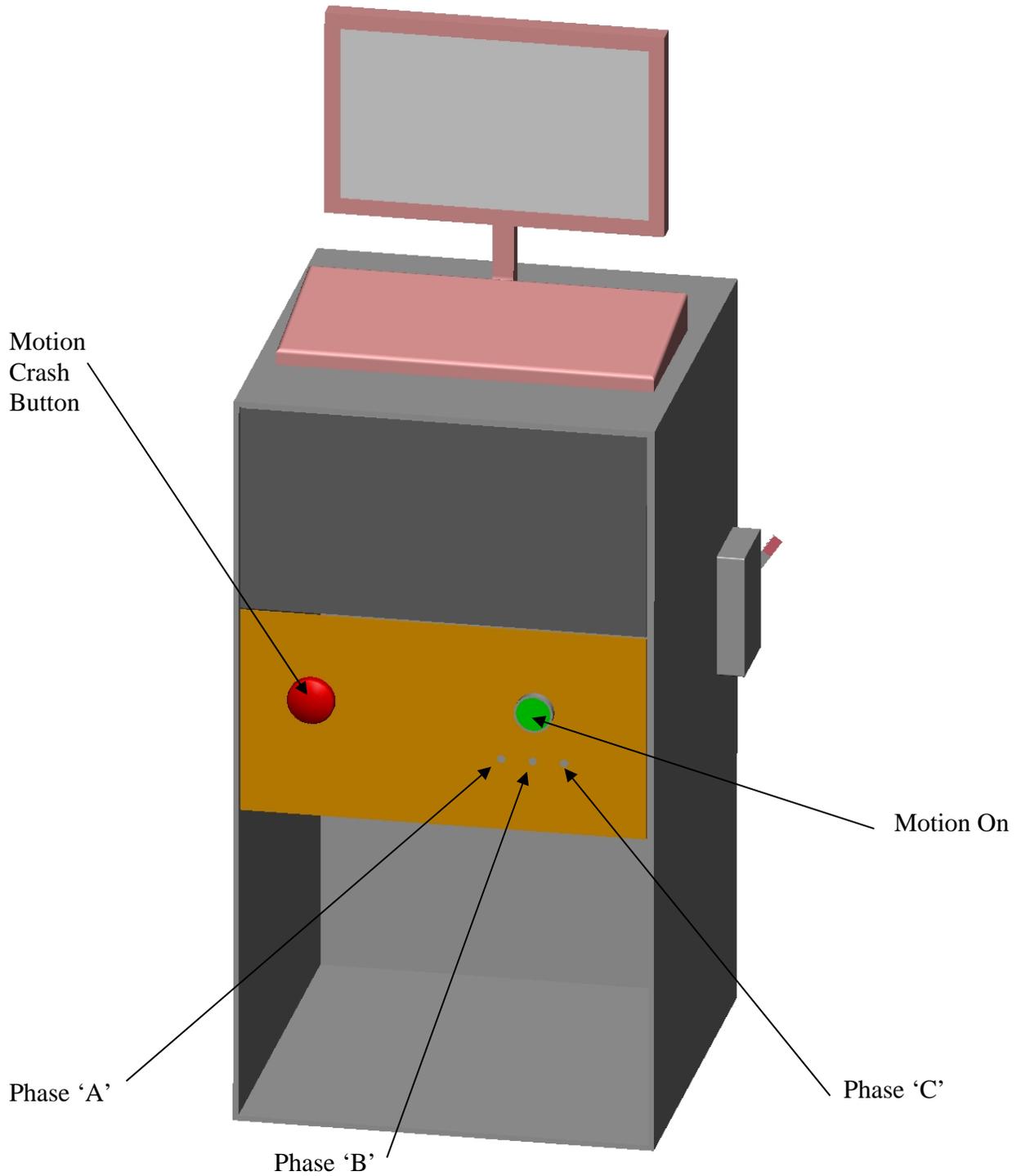
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Attachment 1 – Overall View



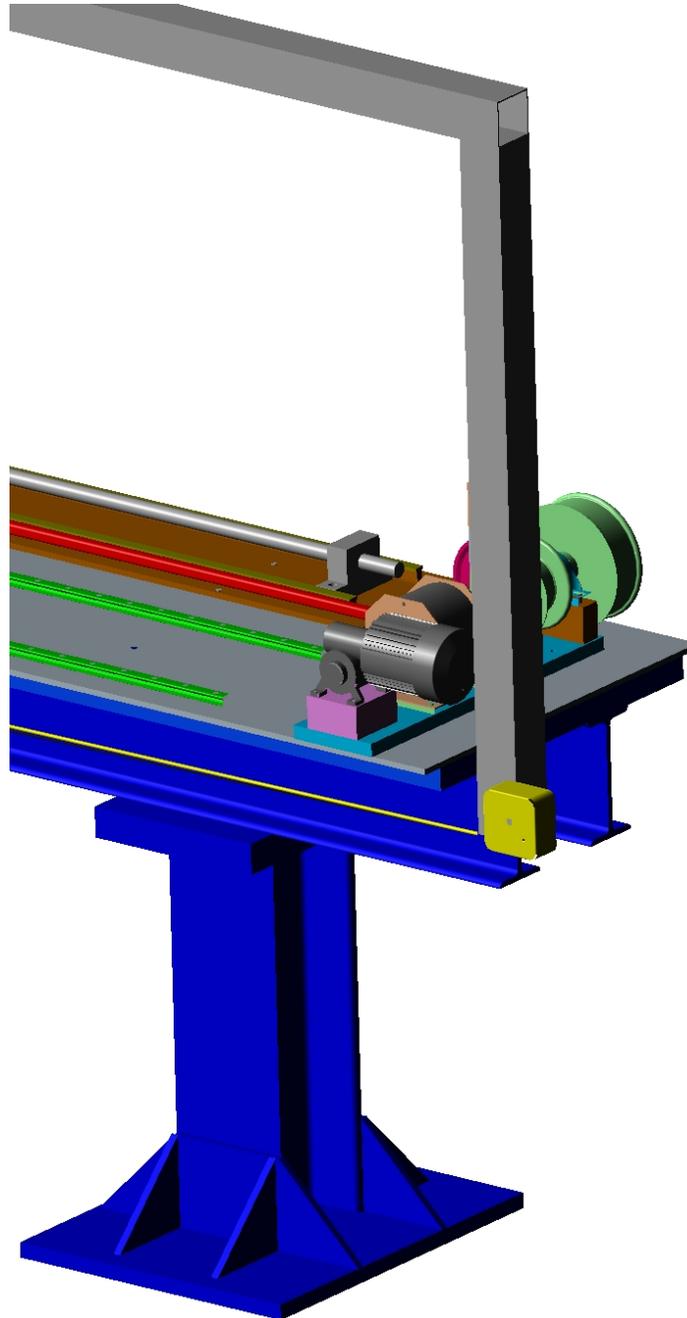
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Attachment 2 – Computer Control & Panel



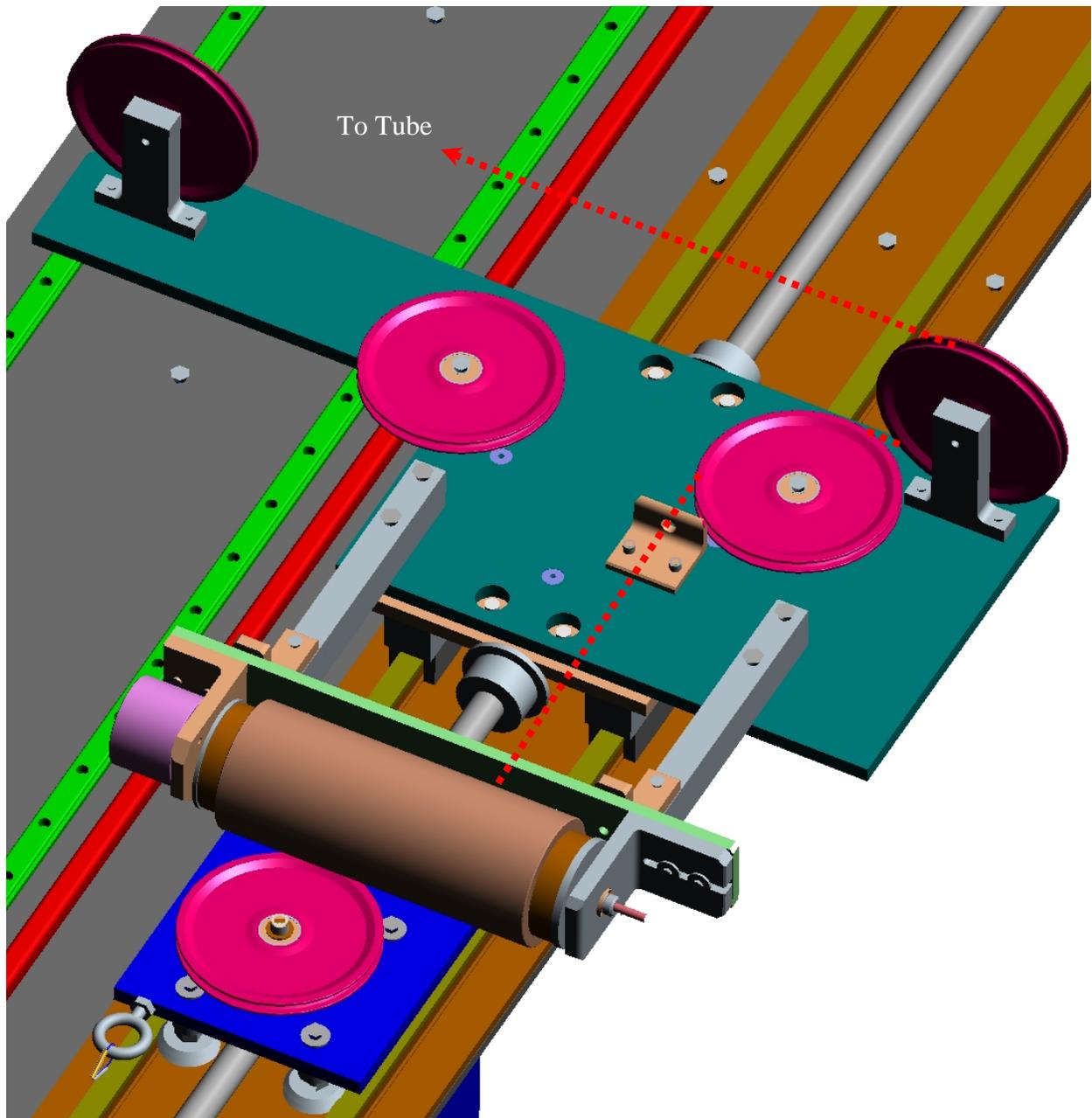
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### Attachment 3 – Far Panel Controls



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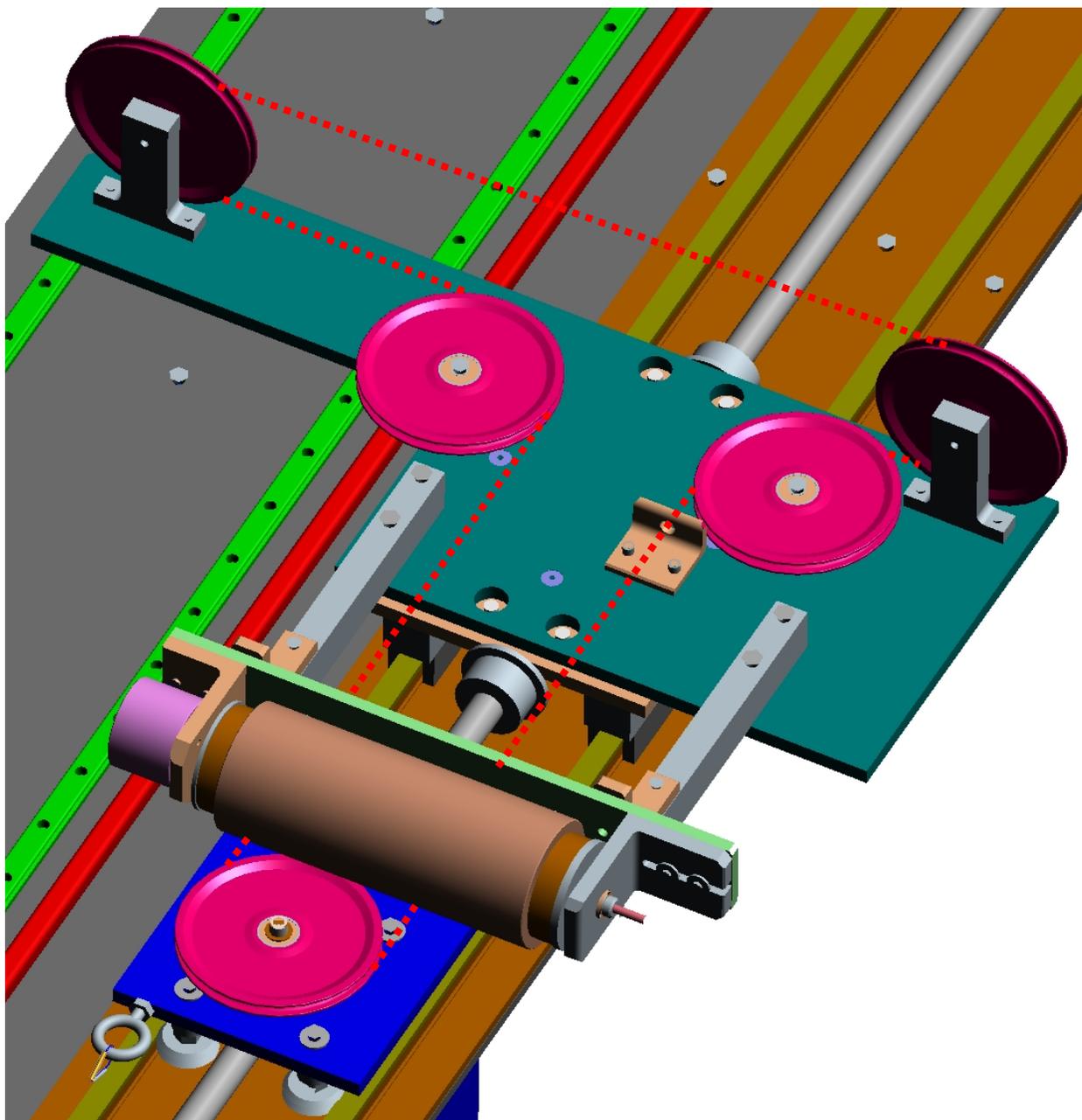
Attachment 4 - Initial Coil Wrapping Setup





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Attachment 6 – Tension Carriage Brake Test Diagram



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**Attachment 7 – Crash Button & Tension Carriage Brake Test Form**

- Post this form near the wrapper
- Do not operate the wrapper if the all tests have not been performed within 6 months
- Perform test per Section 8 of the OPM

<b>Date</b>	<b>Tested By</b>	<b>Tension Carriage Brake Pass /Fail</b>	<b>Crash Button – Main Panel Pass/Fail</b>	<b>Emergency Pull Cable Pass/Fail</b>