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SMD Operations Procedures Manual

8.1.1.27 OPERATION OF BEAM TUBE WRAPPER

Text Pages 1 through 13
Attachment(s) 1, 2, 3

Hand Processed Changes

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Preparer(s): S. Plate

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8.1.1.27 Operation of Beam Tube Wrapper

1.0 Purpose and Scope

- 1.1 This Procedure provides instruction in the operation of the Beam Tube Wrapper (Wrapper) located in Building 902.
- 1.2 This information is meant for any person who will operate the controls of the Wrapper.

2.0 Responsibilities

- 2.1 Authorized operators (Operators) of the Wrapper will perform the tasks described here.
- 2.2 The Operator shall complete the following documentation:
 - A. Traveler.

3.0 Prerequisites

- 3.1 Training
 - 3.1.1 Operators shall be instructed by the Cognizant Technical Supervisor or designee before using this Procedure.
 - 3.1.2 Operator shall be an "affected employee" as defined by ESH Standard 1.5.1., "Lockout/Tagout Requirements".
- 3.2 Initial State of Wrapper
 - 3.2.1 Control panel controls shall be set to their "initial" settings (see para. 5.6) before activating the control console.
- 3.3 Calibration
 - 3.3.1 Verify that the following equipment has an unexpired calibration label:
 - A. OVEN TEMPERATURE digital display (control panel);
 - B. TUBE TEMPERATURE digital display (control panel);
 - C. Pull gage.

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4.0 Precautions

- 4.1 All guards and shields shall be in place.
- 4.2 Ensure that the cooling water is turned on before turning on the oven. The procedure is described in section 5.11.2.
- 4.3 Monitor oven temperature during curing by observing the OVEN TEMPERATURE display on the control panel. If the temperature exceeds 500 Deg C., shut off the oven by turning the OVEN POWER selector switch to the OFF position.
- 4.4 Insulated material exits the oven at high temperature during the curing process. Do not touch insulated material until it has cooled down.
- 4.5 A test of the interlocks shall have been performed within six months prior to operating machine. A dated Interlock Test Form should be posted near the Wrapper.
- 4.6 Limits of Operation
 - A. Maximum temperature that oven shall be permitted to reach is 500 deg. C.
 - B. Minimum and maximum beam tube outer diameter that can be accommodated on this machine: 0.165 inch to 3.00 inch max.
- 4.7 Specific steps of this procedure contain Electrical & Mechanical Assembly operations that impact the environment. Prior to performing these steps, personnel shall complete the applicable facility specific environmental training.
- 4.8 An exhaust hood system should be used while operating the wrapper. The control for the 902 Bus Bar Soldering/Beam Tube Wrapper is located on the south wall of Building 902, right of electrical panel P.P. 51. Ensure the dampers are open for the wrapper (2) and closed for the Bus Bar Soldering machine.
- 4.9 Operator must wear safety glasses when operating electrical disconnect switches.

5.0 Procedure

5.1 Overview

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The Beam Tube Wrapping Machine provides a means of wrapping insulation/film around certain magnet parts, primarily beam tubes. Other parts that are wrapped on the machine include: yoke warm-up heaters, bus bars.

Each magnet part that is wrapped on the machine has a written Magnet Assembly Procedure (MAP) that describes the sequential activities necessary to wrap the part.

In the wrapping process, insulation/film is wrapped around the magnet part as it is pulled through the wrapping head by a chain drive. If the MAP requires that the insulation be cured, then the wrapped section enters a Quartz Oven which heats the insulation to a temperature high enough to activate the adhesive, fixing it in place.

The temperature of the Oven, the chain drive speed and the degree of overlap of the insulation will vary with the requirements of the part being wrapped.

5.2 Operator Controls

5.2.1 Operator controls are located on the drive system cabinet in front of the machine. These include: an electrical control panel, and mechanical hand knobs to control a "Zero-Max" variable speed reducer and a "PIV" variable speed reducer.

5.2.2 Refer to Attachment 1: Electrical Control Panel Diagram. The function of the indicator lights and controls on the control panel are as follows (note: capital letters indicate how the Panel is marked):

- A. CONTROL POWER red indicator light: Control power is supplied to the system through the fused disconnect switch, labeled "BEAM TUBE WRAPPER". If the fused disconnect switch is ON, the CONTROL POWER red indicator light will be illuminated.
- B. ON/OFF key switch: The momentary ON spring-loaded key switch will energize the system when it is switched to the ON position, enabling the Oven, the Motor, and the Clutch/Brake. The momentary OFF position de-activates those systems. The switch is normally in the middle position.
- C. ON red indicator light: When the ON key switch energizes the system, the ON red light is illuminated. This indicates that the oven, motor, and clutch brake have power to their respective controls.

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- D. EMERGENCY STOP mushroom push button: De-energizes all the outputs of the Control Assembly (control power is still present in the Assembly). A similar EMERGENCY STOP push button, which has the same function, is on the Control Box on the opposite side of the table.
- E. HEAD DIRECTION selector switch: Controls direction of head rotation.
- F. JOG/STOP/RUN selector switch: Controls mode of motor operation. In order to jog the motor, the JOG position of the switch must be held in contact by the Operator. The JOG position of the switch is a momentary contact switch.
- G. MOTOR SPEED potentiometer: Gives linear control of the motor rotation speed.
- H. CLUTCH/BRAKE selector switch: The motor rotation drives the chain transport for the tube. When the CLUTCH/BRAKE selector switch is in ON position the motor rotation is also coupled to the wrapping head. In the OFF position, the motor drives the chain transport only.
- I. OVEN POWER selector switch: Energizes the Heater SCR Controller for the Quartz Oven when in the ON position. In the OFF position, the SCR Controller is de-energized.
- J. OVEN ON yellow indicator light: Indicates that the Heater SCR Controller is activated.
- K. MANUAL/AUTO OVEN CONTROL toggle switch: Gives the option of controlling the oven temperature with the MANUAL OVEN CONTROL or the AUTO OVEN CONTROL.
- L. MANUAL OVEN CONTROL potentiometer: Enabled when the MANUAL/AUTO OVEN CONTROL toggle switch is in the MANUAL position; controls oven temperature by controlling the input to the Oven SCR Controller.
- M. AUTO OVEN CONTROL temperature controller: Enabled when the MANUAL/AUTO OVEN CONTROL toggle switch is in the MANUAL position. The Omega CN9000 Temperature Controller

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is part of a feedback loop system that automatically regulates oven temperature to ± 3 deg.C. The Oven temperature is displayed continuously and the setpoint is displayed by depressing the (*) key. The setpoint can be changed by depressing the (*) key and the (8) or the (9) key simultaneously. For other programming steps, see the CN9000 manual.

- N. OVEN LEVEL jacks: A voltmeter can monitor a 0 to 50mVdc level which is proportional to power going to the Oven. These are test jacks for use during troubleshooting or system checks.
- O. TUBE TEMPERATURE digital readout: Displays the temperature of the magnet part as it exits the oven. The readout is connected to a thermocouple that contacts the magnet part.

5.2.3 Zero-Max controls: Controls travel speed and travel direction of the chain line. A selector lever selects the desired travel direction of the chain line. A locking lever controls the travel speed of the chain line.

5.2.4 PIV variable speed reducer: Controls rotational speed of the wrapping heads.

5.3 Setting Up the Part to be Wrapped

5.3.1 Refer to the appropriate MAP for the proper procedure. When these steps are complete, verify that:

- A. the part is properly supported along its length;
- B. the centerline of the part is in line with the centerline of the wrapping heads and oven;
- C. the part is clamped tightly so it will not wobble or go off line during wrapping.

5.4 Attaching the Chain Drive

5.4.1 Refer to the appropriate MAP for the proper procedure.

5.5 Activating System Power

5.5.1 Place the main fused disconnect switch, located on the exhaust hood frame and labeled "BEAM TUBE WRAPPING MACHINE", in the ON position.

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Verify that the CONTROL POWER red indicator light on the control panel is illuminated to indicate that control power is available to the electrical control console.

NOTE:

Power to the beam tube wrapping machine is supplied by a safety switch located on the mezzanine to the right of electrical panel P2.2.

5.6 Initial Control Settings

**CAUTION
Equipment Damage**

Failure to set controls properly could result in equipment or product damage.

5.6.1 Before activating power to the control console, set the control panel controls to the following initial settings:

- A. OVEN POWER switch in the OFF position.
- B. CLUTCH/BRAKE switch in the OFF position.
- C. FWD/REV switch in the OFF position.
- D. JOG/RUN switch in the STOP position.
- E. MOTOR SPEED control potentiometer at the ZERO position.

5.7 Activating Power to the Control Console

5.7.1 Verify that the control panel controls are set to their initial positions (sec. 5.6).

5.7.2 Turn the momentary key switch on the control panel to the ON position. Verify that the ON red indicator light is illuminated, indicating that the control panel controls are activated.

5.8 Mounting of Tape Spools and Adjusting Tape Angle and Tape Tension

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CAUTION
Equipment Damage

Always install two spools of equal weight so that the wrapping heads are balanced. Do not install one spool. Failure to do this could cause equipment damage.

- 5.8.1 Open the door on the wrapping head cover. Verify that the door interlock has de-activated control power to the wrapping heads.
- 5.8.2 Mount spools onto the spool mounting base provided at the tips of the rotating arms.
- 5.8.3 Tighten the control knob on the spool mount to hold the spool in place. This control knob also controls the brake on the spool, which creates tension on the tape between the magnet part and the spool during wrapping. Adjust tape tension as follows:
 - 5.8.3.1 Pull a piece of tape off of the spool.
 - 5.8.3.2 Attach a push-pull gage to the end of the tape.
 - 5.8.3.3 Pull the gage while adjusting the control knob. Set tape tension to the proper tension as specified in the MAP.
- 5.8.4 A swivel joint between the mounting base and the rotating arm allows the spool angle to be adjusted so that the tape wrapped onto the magnet part will have the correct helix angle. Lock the swivel joint by tightening the knurled nut.
- 5.8.5 Close and secure the wrapping head cover doors before attempting to activate the control console.

5.9 Wrapping Heads Drive System

- 5.9.1 Overview: The drive motor is coupled to the wrapping head assembly through a PIV variable speed reducer. The maximum speed of rotation is 190 revolutions per minute.
- 5.9.2 To rotate the wrapping heads:

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CAUTION
Unwanted Motion

The following steps will cause the chain line to move if the zero-max is not in the neutral position.

- 5.9.2.1 Verify that two spools of the same weight are mounted.
- 5.9.2.2 Verify that the control panel controls are in their initial positions (5.6).
- 5.9.2.3 Turn the key switch to the ON position.
- 5.9.2.4 Turn the JOG/RUN selector switch to the RUN position.
- 5.9.2.5 Turn the CLUTCH/BRAKE selector switch to the ON position.
- 5.9.2.6 Turn the MOTOR SPEED control potentiometer up from zero slowly until the heads begin rotating.
- 5.9.3 To reduce or increase the rotational speed of the wrapping heads:
 - 5.9.3.1 Reduce or increase the motor speed by adjusting the MOTOR SPEED control potentiometer, or;
 - 5.9.3.2 Change the ratio of the PIV by turning the PIV adjusting knob.
- 5.9.4 To change the rotational direction of the wrapping heads, reverse the motor direction:
 - 5.9.4.1 Turn the MOTOR SPEED potentiometer to zero to stop the heads from rotating.
 - 5.9.4.2 Set the FWD/REV selector switch to OFF, then to REV.
 - 5.9.4.3 Turn the MOTOR SPEED potentiometer up slowly until the heads are rotating in the reverse direction.
- 5.9.5 To stop rotation of the wrapping heads:

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5.9.5.1 Stop the motor by turning the MOTOR SPEED potentiometer to zero.

5.10 Motorized Chain Drive Transport System

5.10.1 Overview: The drive motor is coupled to the chain line through a Zero-Max variable speed reducer. The travel speed of the chain line is continuously variable from 0 to 15 feet per minute in either direction.

5.10.2 To move the chain line in the forward direction (right to left):

CAUTION Unwanted Motion

The following steps will cause the wrapping heads to rotate if the "clutch/brake" switch is set to "on".

5.10.2.1 Set the control panel controls to their initial settings (5.6).

5.10.2.2 Turn the key switch to the ON position.

5.10.2.3 Set the Zero-Max selector switch to the FWD position.

5.10.2.4 Place the JOG/RUN selector switch in the RUN position.

5.10.2.5 Adjust the MOTOR SPEED Control Potentiometer (MOTOR SPEED potentiometer) upwards slowly until the chain line is traveling in the forward direction.

NOTE:

If the chain line does not move, that may indicate that the Zero-Max speed reducer is set to zero output. Set the MOTOR CONTROL potentiometer on "3", and adjust the Zero-Max until the chain moves.

5.10.3 To reverse chain line travel direction (left to right):

NOTE:

Since the Zero-Max is not coupled to the wrapping heads, reversing the output of the Zero-Max will not affect the rotation direction of the wrapping heads.

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- 5.10.3.1 Turn the MOTOR SPEED potentiometer to zero to stop chain line forward motion.
- 5.10.3.2 Set the control panel controls to their initial settings (5.6).
- 5.10.3.3 Set the Zero-Max selector switch to REV.
- 5.10.3.4 Turn the key switch to the ON position.
- 5.10.3.5 Set the JOG/RUN selector switch to the RUN position.
- 5.10.3.6 Turn the MOTOR SPEED potentiometer up slowly until the Tube is traveling in the reverse direction (left to right).

5.11 Curing Oven

- 5.11.1 Overview: For some insulated magnet parts, the Kapton tape must be heated to a temperature high enough to activate the adhesive, fixing it in place. This is accomplished by transporting the insulated part through a quartz oven.

By adjusting transport speed and oven temperature, and observing the TUBE TEMP display on the control panel, the operator must insure that the temperature that the magnet part must reach for proper curing of the tape adhesive is maintained during the entire curing process. This temperature is specified in the MAP.

The oven temperature may be controlled manually (by adjusting a potentiometer) or automatically (by a feedback loop system incorporating a temperature controller).

CAUTION 1 Equipment Damage

Cooling water must be on when the oven is on. Failure to do this may cause a severe burn hazard or equipment damage. Do not admit cold water into a hot oven.

CAUTION 2 Personnel Injury – Burns

Always use the handle to open and close the curing oven.

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5.11.2 To turn on the cooling water:

- 5.11.2.1 Open the water valve located against the south wall near the Wrapper. A second valve, which normally is left open at all times, is located inside the control assembly.
- 5.11.2.2 Verify that water is flowing to the oven jacket.

CAUTION
Personnel Injury – Burns

The insulated magnet part is hot as it exits the oven. Do not touch. After the insulated part travels past the shielded area, it may still be too hot to touch without protective gloves.

5.11.3 To set the oven temperature manually and turn on the oven:

- 5.11.3.1 Place the OVEN CONTROL toggle switch in the MANUAL position.
- 5.11.3.2 Set the OVEN CONTROL potentiometer to zero.
- 5.11.3.3 Place the OVEN POWER selector switch in the ON position. Verify that the OVEN ON yellow indicator light is illuminated to indicate that the oven is activated.
- 5.11.3.4 Adjust the potentiometer upwards while observing the OVEN TEMPERATURE readout until the desired temperature is reached.
- 5.11.3.5 Adjust the potentiometer as necessary to keep the oven temperature within the desired range.

5.11.4 To set the oven temperature automatically and turn on the oven:

- 5.11.4.1 Place the OVEN CONTROL toggle switch in the AUTO position.
- 5.11.4.2 Verify that the oven temperature set point, as observed on the CN9000 Temperature Controller, is as specified in the MAP, by pressing the "*" key.

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The setpoint can be changed by depressing the "*" key and the "8" or the "9" key simultaneously. For other programming steps, see the CN9000 manual.

- 5.11.4.3 Place the OVEN POWER selector switch in the ON position. Verify that the OVEN ON yellow indicator light is illuminated, indicating that the oven is activated.
- 5.11.4.4 Observe the OVEN TEMPERATURE display on the control panel. The oven temperature should stay within ± 3 deg. C. of the setpoint temperature automatically.
- 5.11.4.5 Start the exhaust fan for the wrapper. Ensure the two (2) dampers on the Torrids are open and lined up as needed to draw fumes out of the building and the damper for the Bus Bar Soldering machine is closed.

5.12 To Shut Down the Wrapper

- 5.12.1 Turn the key switch to the OFF position to de-energize the control console.
- 5.12.2 Set the control panel controls to their initial settings (5.6).
- 5.12.3 Place the main input disconnect switch, labeled "BEAM TUBE WRAPPING MACHINE" in the OFF position.
- 5.12.4 Shut off the exhaust fan for the wrapper.

5.13 Test of Safety Interlocks

Notes on Test Procedure

- A. Procedure may be performed with or without spools on the wrapping heads.
- B. Procedure shall be performed every six months by the Cognizant Technical Supervisor for the Wrapper.

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Test Procedure

- 5.13.1. Turn on the main input disconnect switch, located on the wall next to the wrapping machine and labeled "BEAM TUBE WRAPPING MACHINE".
- 5.13.2. Verify that the CONTROL POWER red indicator light on the Wrapping Machine Control Panel is illuminated.
- 5.13.3. Verify that the speed control potentiometer is set to zero (fully counter-clockwise), the OVEN POWER switch is OFF, and the CLUTCH/BRAKE switch is OFF.
- 5.13.4. On the Control Panel, turn the key switch to the ON position and verify that the ON red indicator light illuminates.
- 5.13.5. Turn the Clutch/Brake selector switch to the "ON" position. Turn the JOG/RUN switch to the RUN position.
- 5.13.6. Increase the speed control potentiometer until the wrapping heads are rotating.
- 5.13.7. Depress the EMERGENCY STOP mushroom push button on the control panel (location 1). Observe that the ON red indicator light shuts off and head rotation stops.
- 5.13.8. Check off the appropriate box on the Beam Tube Wrapper Interlock Test Form (Attachment 3).
- 5.13.9. Repeat steps 5.13.3 through 5.13.8 for locations 2,3, and 4. On location 3 and 4, open the covers, rather than depress the STOP button.
- 5.13.10. Initial and date the form.
- 5.13.11. If a failure occurs at any step of the procedure, stop work, write "fail" on the form, and immediately notify the cognizant engineer and the ES&H Coordinator.

6.0 Documentation

- 6.1 Traveler.
- 6.2 Beam Tube Interlock Test Form.

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7.0 References

- 7.1 Magnet Assembly Procedure for magnet part being wrapped.
- 7.2 ESH Standard 1.5.1, "Lockout/Tagout Requirements".
- 7.3 Omega CN9000 Temperature Controller Instruction Book.

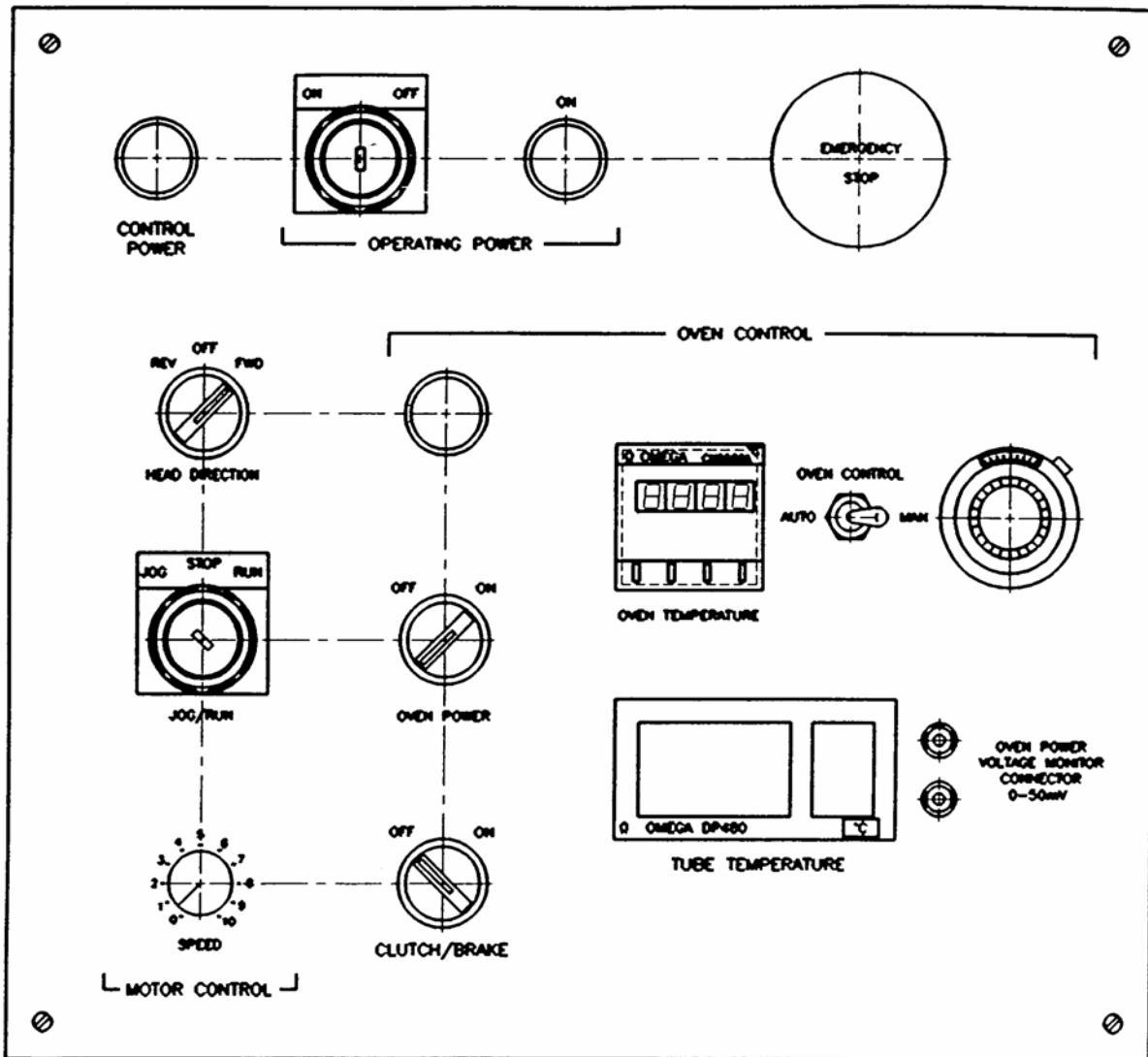
8.0 Attachments

- 1. Electrical Control Panel Diagram
- 2. Machine Diagram
- 3. Beam Tube Interlock Test Form

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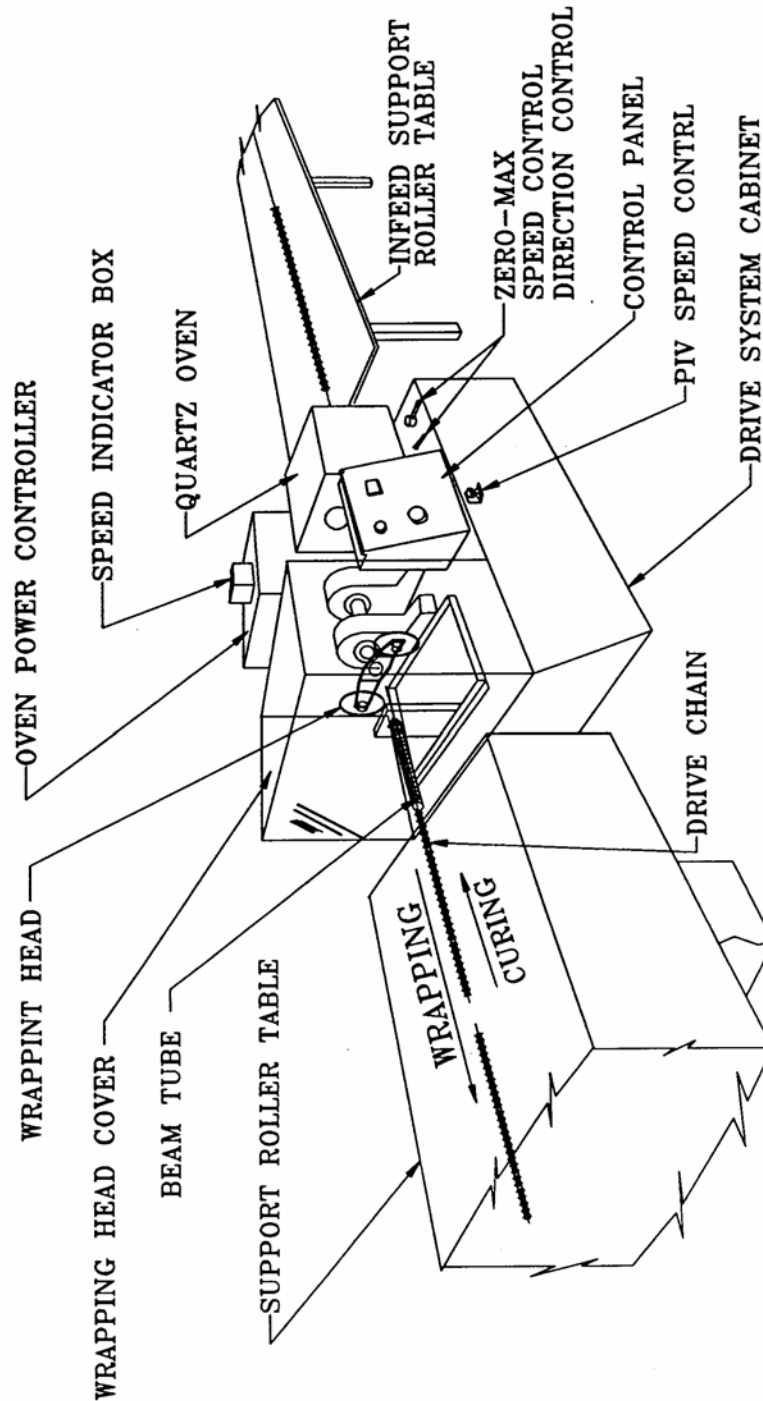
Attachment 1

Electrical Control Panel Diagram



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Attachment 2 - Machine Diagram

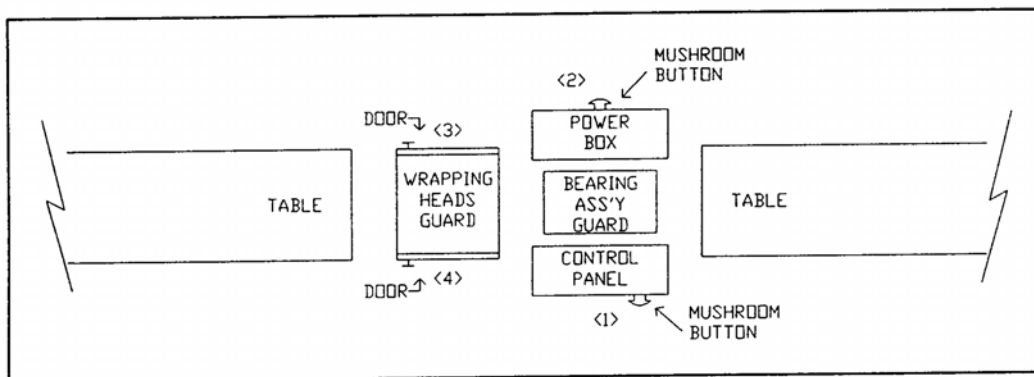


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Attachment 3

Beam Tube Interlock Test Form

DATE----->									
LOCATION									
<1>									
<2>									
<3>									
<4>									
INITIALS->									



Notes on test procedure:

1. Procedure may be performed with or without the wrapping heads loaded with film.
2. Procedure shall be performed every six months by the Cognizant Technical Supervisor for the wrapping machine.

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