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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

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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 SBMS Subject Area, "Lockout/Tagout (LOTO)".

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 5.5.8.
- 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 is posted near the Wrapper.
- 4.6 Limits of Operation
 - A. Maximum temperature the 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 all appropriate PPE including safety glasses when operating electrical disconnect switches.

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5.0 Procedure

Overview

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.

5.1 Operation of Northrop/Grumman Wrapping Head

5.1.1 Purpose and Scope

The purpose of this document is to provide instructions for:

- 5.1.1.1 Operating the Northrop/Grumman Wrapping Machine (Wrapping Machine), located in Building 902;
- 5.1.1.2 Testing the safety interlocks of the Wrapping Machine.

The following is not found in this document:

- 5.1.1.3 Detailed instructions for the wrapping of specific items (warm-up heaters, buses...), which are found in the applicable Magnet Assembly Procedure.
- 5.1.1.4 Instructions for operating the oven section of the Wrapping Machine. The oven has been electrically disconnected and is not operational.

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5.1.1.5 This document is intended for authorized operators of the Wrapping Machine.

5.2 Responsibilities

5.2.1 The Cognizant Technical Supervisor shall:

5.2.1.1 Ensure that operators have been instructed before operating the Machine.

5.2.2 The Authorized Operator shall periodically test the safety interlocks.

5.3 Prerequisites

5.3.1 Training

The Operator shall receive instruction from the Cognizant Technical Supervisor, or designee.

5.3.2 Manpower

The Wrapping Machine may be operated by one person.

5.4 Precautions

5.4.1 The main hazard associated with operating the Northrop/Grumman Wrapping Machine is moving and rotating parts. To minimize the hazard:

CAUTION

Prior to use, ensure interlocks have been tested satisfactory within the past six months.

5.4.1.1 Test the safety interlocks every six months and before machine use if it has not been operated in last six months, and promptly repair any failed interlocks.

5.4.1.2 Keep cover panels, chain drive guards, and plexiglass shields in place during operations.

5.4.2 The links at the ends of the feed cables will not fit through the Teflon inserts at the ends of the support tubes. The motion limit switches should protect against damage. Nevertheless, the Operator should use caution when the links are near the Teflon inserts.

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- 5.4.3 To prevent damage to the feed rate mechanism, do not attempt to turn the PIV crank unless the motor is running and the feed line is moving.
- 5.4.4 All appropriate PPE including safety glasses are required when operating safety switches and circuit breakers.

5.5 Procedure

Section I: Initial Settings

- 5.5.1 Main disconnect switch, located under the wrapping head assembly and labeled "Main Disconnect", in the "OFF" position.

NOTE:

The machine is powered by circuit breaker #18 in panel RP P2-2 located on the Southwest wall of building 902.

- 5.5.2 Motor speed dial set to zero.
- 5.5.3 Motor "ON/OFF" toggle switch set to "OFF".
- 5.5.4 Motor "START/STOP" toggle switch set to "STOP".
- 5.5.5 "HEAD CLUTCH" switch set to "OFF".
- 5.5.6 All indicator lights should be extinguished.

NOTE:

Other control settings are not important at this time. The section labeled "CURING OVEN" is to be followed if heating of the wrapped product is required. Otherwise skip the following section.

Section II: Curing Oven

- 5.5.7 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

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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.

5.5.8 To turn on the cooling water:

5.5.8.1 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.

5.5.8.2 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.

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

5.5.9.1 Place the OVEN CONTROL toggle switch in the MANUAL position.

5.5.9.2 Set the OVEN CONTROL potentiometer to zero.

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5.5.9.3 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.

5.5.9.4 Adjust the potentiometer upwards while observing the OVEN TEMPERATURE readout until the desired temperature is reached.

5.5.9.5 Adjust the potentiometer as necessary to keep the oven temperature within the desired range.

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

5.5.10.1 Place the OVEN CONTROL toggle switch in the AUTO position.

5.5.10.2 Verify that the oven temperature set point, as observed on the CN9000 Temperature Controller, is as specified in the MAP, by pressing the "*" key.

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.

5.5.10.3 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.

5.5.10.4 Observe the OVEN TEMPERATURE display on the control panel. The oven temperature should stay within ± 3 deg. C. of the setpoint temperature automatically.

5.5.10.5 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.

Section III: Activating Power

5.5.11 Place the main input disconnect switch in the "ON" position.

5.5.12 Depress the green push button labeled "POWER ON".

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Section IV: Setting the Amount of Overlap

- 5.5.13 Perform the steps in Sections I and II.
- 5.5.14 Set the motor "ON/OFF" toggle switch to "ON".
- 5.5.15 Set the motor "FORWARD/REV" toggle switch to "FORWARD".
- 5.5.16 Set the motor "START/STOP" toggle switch to "START" (the switch is a momentary contact switch and will snap back to a neutral position.)
- 5.5.17 Set the "HEAD CLUTCH" switch to "ON".
- 5.5.18 Slowly turn the "MOTOR SPEED" dial until the wrapping heads begin rotating and the line begins moving.
- 5.5.19 Adjust the "MOTOR SPEED" dial until the digital display labeled "HEAD RPM" indicates 100 RPM.
- 5.5.20 Adjust the feed rate by turning the PIV crank.

NOTE:

The wrapping pitch is calculated by dividing the feed rate by the rate of revolution:

$$\text{pitch (In. Per Rev.)} = \frac{\text{feed rate (IPM)}}{\text{head revolution rate (RPM)}}$$

For instance, a desired pitch of 0.5 inches will be obtained by setting the feed rate to 50 IPM and the head rate to 100 RPM.

Once the ratio is set, the PIV crank should not be touched except for minor adjustments as necessary.

The motor speed may be adjusted without changing the ratio.

- 5.5.21 When the desired ratio is set, turn the "MOTOR SPEED" dial to zero and place the motor "ON/OFF" toggle switch in the "OFF" position.

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Section V: Setting Up Material to be Wrapped

- 5.5.22 Refer to the applicable Magnet Assembly Procedure for detailed instructions on setting up material to be wrapped.
- 5.5.23 To facilitate mounting the spools, a red push button located next to the wrapping heads, inside the plexi glass shield, may be depressed to release the head clutch. This will allow the head to be manually spun. Before depressing this push button, the steps in Section I and II must have been performed. Otherwise, the push button will not be operable.

Section VI: Running the Wrapping Machine

- 5.5.24 Set the motor "ON/OFF" toggle switch to "ON".
- 5.5.25 Set the motor "FORWARD/REV" toggle switch to the desired direction.
- 5.5.26 Set the motor "START/STOP" toggle switch to "START" momentarily.
- 5.5.27 Set the "HEAD CLUTCH" switch to "ON".
- 5.5.28 Slowly turn the "MOTOR SPEED" dial until the wrapping heads begin rotating and the material to be wrapped begins feeding into the Machine, and continue turning the dial until the desired speed is reached.
- 5.5.29 If the motor is stopped during wrapping (for instance, to reverse the feed direction), then it will be necessary to push the motor "START/STOP" toggle switch to the "START" position to restart the motor.

Section VII: Shutting off the Wrapping Machine

- 5.5.30 For an emergency shutdown:
 - 5.5.30.1 Depress the large red push button on the control panel labeled "Emergency Stop".
- 5.5.31 For a normal shutdown:
 - 5.5.31.1 In the section of the control panel labeled "MOTOR", set the "MOTOR SPEED" dial to zero, the "ON/OFF" toggle switch to "OFF", the "START/STOP" toggle switch to "STOP".
 - 5.5.31.2 Set the "HEAD CLUTCH" switch to "OFF".

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5.5.32 Place the main input disconnect switch in the "OFF" position.

Section VIII: Testing the Safety Interlocks

NOTE:

The interlocks shall be tested every six months during operations.

Door Interlock and Emergency Stop Switch

5.5.33 Perform the steps in Sections I and II.

5.5.34 Set the motor "ON/OFF" toggle switch to "ON".

5.5.35 Set the motor "FORWARD/REV" toggle switch to "FORWARD".

5.5.36 Set the motor "START/STOP" toggle switch to "START".

5.5.37 Set the "HEAD CLUTCH" switch to "ON".

5.5.38 Slowly turn the motor "MOTOR SPEED" dial until the wrapping heads begin rotating and the line begins moving.

5.5.39 Trip the interlock by opening the plexiglass shield door. Verify that machine motion stops and the amber light, located above the green "POWER ON" push button, extinguishes.

5.5.40 Close the door and repeat steps 5.5.33 to 5.5.39 except trip the interlock by depressing the emergency stop switch.

Limit Switches

5.5.41 Repeat steps 5.5.38 to 5.5.43.

5.5.42 Increase the feed rate so that the drive is moving at a typical operational speed.

5.5.43 When the forward limit is reached, verify that machine motion stops and the "FWD LIMIT" red indicator light turns on.

5.5.44 Repeat steps 5.5.38 to 5.5.43, except set the drive to move in the reverse direction.

5.5.45 Increase the feed rate so that the drive is moving at a typical operational speed.

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5.5.46 When the reverse limit is reached, verify that machine motion stops and the "REV LIMIT" red indicator light turns on.

5.5.47 Complete the checklist (see Attachment 1) and post the checklist on the Machine.

6.0 Documentation

6.1 Traveler.

6.2 Beam Tube Interlock Test Form.

7.0 References

7.1 Magnet Assembly Procedure for magnet part being wrapped.

7.2 SBMS Subject Area, "Lockout/Tagout (LOTO)".

7.3 Omega CN9000 Temperature Controller Instruction Book.

8.0 Attachments

1. Beam Tube Interlock Test Form
2. Machine Diagram

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Attachment 1

Northrop/Grumman Wrapping Machine: Safety Interlock Test Checklist

Door interlock located on plexiglass shield	Pass. . Fail. .	Pass. . Fail. .	Pass. . Fail. .	Pass. . Fail. .	Pass. . Fail. .	Pass. . Fail. .
Emergency stop switch	Pass. . Fail. .	Pass. . Fail. .	Pass. . Fail. .	Pass. . Fail. .	Pass. . Fail. .	Pass. . Fail. .
Forward limit switch	Pass. . Fail. .	Pass. . Fail. .	Pass. . Fail. .	Pass. . Fail. .	Pass. . Fail. .	Pass. . Fail. .
Reverse limit switch	Pass. . Fail. .	Pass. . Fail. .	Pass. . Fail. .	Pass. . Fail. .	Pass. . Fail. .	Pass. . Fail. .
Date Tested						
Initials of Tester						
Expiration Date						

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Attachment 2 - Machine Diagram

