SMD Operations Procedures Manual

8.1.1.22 OPERATION OF BUS SOLDERING LINE

Text Pages 1 through 10

Hand Processed Changes

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8.1.1.22 Operation of Bus Soldering Line

1 Purpose and Scope

1.1 The purpose of this procedure is to provide step by step instruction in the operation of the Bus Soldering Line.

1.2 This procedure does not provide instructions for preparing, assembling, completing, storing, and documenting the bus/superconducting (sc) cable material. Those instructions are found in the appropriate Magnet Assembly Procedure.

1.3 For complete technical information on the Water Recirculator unit and the Induction Heating unit, refer to the following documents, which are available from the Cognizant Technical Supervisor:

a. "Instruction Manual for Water Recirculator RWAG-5A", manual no. 13190353, published by Lepel Corporation.

b. "Induction Heating Power Supply Instruction Manual", part no. 29711-027, published by Lepel Corporation.

2 Responsibilities

Authorized operators of the Bus Soldering Line will 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 instructed by the Cognizant Technical Supervisor before operating the Line.

3.2 The operator shall be trained as an "affected employee" as defined by Subject Area: Lockout/Tagout (LOTO) for Installation, Demolition, or Service and Maintenance

Equipment:

3.3 Leather Palm Gloves (Stock # K-62980, or equivalent), if handling of hot material is necessary.

3.4 Proper Personal Protective Equipment (PPE) shall be worn when handling chemicals or mechanically cleaning equipment. This includes but not limited to safety glasses and disposable latex gloves. Contact your ESH Coordinator or Facility Representative.

3.5 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.

3.6 Air emissions for the bus bar soldering machine have been classified as trivial under the Laboratory's site-wide air permit (Title V). Any modification to the process must be reviewed for air emission impact and change of permit status.

3.7 Prior to operating the RF induction heater, contact Industrial Hygiene to perform a baseline RF survey.

3.8 The two large red CRASH buttons (one on the south side of the RF cooling cabinet and one on the west side of the tractor unit) are identical in purpose. Either may be used to instantly abort all operations for operator safety concerns and/or to prevent equipment damage. Pressing a crash button during bus soldering may cause the work to overheat, possibly damaging the superconducting cable. Therefore, use only when necessary as it is not intended to be a substitute for the normal shutdown procedure per paragraph 5.3.

4 Precautions

4.1 Do not touch parts being heated.

4.2 Use gloves if it is necessary to handle hot bus work after soldering.

NOTE

AFTER 10 MINUTES, THE BUS WORK MAY BE HANDLED WITHOUT GLOVES.

4.3 Do not touch water cooled flexible RF leads while RF power is on.

4.4 Keep metal objects off the induction coil.

4.5 Do not operate the induction heater with access panels removed or missing.

4.6 Do not operate the induction heater if guards on the RF output leads and heating coil are not in place.

4.7 Watches, rings, and other personal metal objects will become hot if located close to the induction coil or RF transformer.

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

4.9 Do not allow personnel wearing pacemakers to operate or stand near the equipment.

4.10 Induction Heater generates an RF Field. Barriers (18 inches minimum) must be maintained around the heating element when energized. See BNL SBMS Radiofrequency/Microwave Radiation.

5 Procedure

5.1 Before Activating Power to the Line

5.1.1 Initial Control Settings

Induction Heater Unit:

a. LOCAL/REMOTE toggle switch set to REMOTE;

b. MANUAL/TIMED toggle switch set to MANUAL;

c. DIAL/AUX toggle switch set to DIAL.

Motor Controller:

d. AC POWER ON/OFF toggle switch in the OFF position;

e. REV/FWD/STOP switch set to REV;

f. Set Control Dial to 20%.

Puller Unit:

g. Air control valve handle set to DISENGAGED position.

Recirculator Unit:

h. Red PUMP STOP push button and red FAN STOP push button depressed.

5.1.2 Check water level in the radiator element of the Recirculator unit by observing the sight gauge. If the level is low, then fill with distilled water.

5.1.3 Check that the air hose is connected to the Puller unit.

5.2 Activating Power to and Operating the Line

5.2.1 Verify circuit breakers 2/4/6 and 8 in circuit breaker panel RP51 are in the ON position (the circuit breaker panel is located on the South wall).

NOTE

THE OPERATOR MUST BE WEARING THE APPROPRIATE PPE PRIOR TO OPERATING CIRCUIT BREAKERS.

5.2.2 Turn on the air by operating the valve located on the South wall.

5.2.3 Verify the vent system is operating (check if switch is ON and air is flowing).

5.2.4 Verify the air control valve on the Puller unit in the DISENGAGED position. This will pressurize the air cylinder and cause the puller belts to separate.

5.2.5 Thread the leader bar through the Puller from the exit end, tabbed end first. Pass it through the induction coil.

5.2.6 Connect the bus to the leader by fitting the leader tab into the notch on the bus.

5.2.7 Thread the sc cable through the induction coil from the entrance end.

5.2.8 Set up the sc cable and solder to the bus bar.

a. Tape the sc cable to the leader.

b. Place the ribbon solder roll to the appropriate position.

c. Set up the flux bath assembly and thread the solder through.

NOTE

LATEX GLOVES ONLY GIVE MARGINAL PROTECTION (FROM INCIDENTAL CONTACT/EXPOSURE). IF THE GLOVE IS CONTAMINATED, IT SHOULD BE REMOVED AND A NEW GLOVE PUT ON.

d. Attach the solder to the bus bar per the assembly procedure.

NOTE

ENSURE UNUSED SOLDER IS RECYCLED OR DISPOSED OF PROPERLY

e. Using pushpins, attached the cover over the feed assembly.

5.2.9 Manually move the leader, bus, and sc cable back toward the exit end until the point of attachment between the leader and the bus is just inside the ceramic insulator on the induction coil. This is done so that the point of attachment does not catch on the edge of the ceramic while under machine control.

5.2.10 Verify that cooling air to the bus is turned on by placing your hand next to the exit holes of the air pipe.

WARNING

FAILURE TO TURN ON THE ARGON GAS COULD RESULT IN A FIRE.

5.2.11 Turn on the flow of argon gas through the center of the ceramic insulator on the heating coil. Verify that gas flow is set as per the traveler.

NOTE

THE ARGON DISPLACES REACTIVE OXYGEN INSIDE THE COIL.

5.2.12 On the Induction Heater unit, place the ON/OFF power switch in the ON position. Verify that power to the Remote Controller activates by observing the LED display on the Remote Controller.

5.2.13 On the Water Recirculator unit, depress the green FAN START push button and the green PUMP START push button. When the pump and fan turn on, verify the following:

a. No water leaks.

b. Water temperature between 70°F and 90°F (from gauges on unit).

c. Pressure is approximately 50 psi (from gauges on unit).

5.2.14 Check that the Motor Controller is set to the correct speed by performing the following steps:

a. Verify that the Puller unit air control valve is set to DISENGAGED and that the puller belts are separated.

b. On the Motor Controller, place the POWER ON/OFF switch in the ON position. The belts will begin turning.

c. Observe the belt speed as displayed on the "Speed Computer" atop the Motor Controller. Refer to the MAP for the correct speed. If necessary, adjust the speed using the potentiometer on the Motor Controller.

d. On the Motor Controller, place the POWER ON/OFF switch in the OFF position. Verify that the belts stop turning.

5.2.15 Set the Puller unit air control valve to ENGAGED. The puller belts should come together on the bus.

5.2.16 On the Induction Heater unit, depress the RESET push button. The green READY annunciator should light. If it does not, then a fault exists. The fault must be located and cleared before continuing.

5.2.17 On the Remote Controller, verify the following:

a. thermocouple contacting the bus is connected to the thermocouple input;

b. voltage output (banana plugs) is connected to the voltage input (BNC) on Induction Heater unit;

c. high set point is correct (refer to machine log);

d. potentiometer is set for the correct working voltage (refer to machine log).

WARNING

PERFORMING THE NEXT STEP WILL TURN ON THE INDUCTION HEATING COIL. MATERIAL INSIDE THE COIL WILL QUICKLY BECOME VERY HOT.

5.2.18 On the Induction Heater unit, depress the green HEAT ON push button. Wait 10 seconds for the bus to become hot.

5.2.19 Observe the four meters on the Induction Heater labeled "450 V", "200 kHz", "5 Kilowatts", "33 Amps" for proper readings as per the machine log.

5.2.20 Place the AC POWER ON/OFF switch on the Motor Controller in the ON position. The belts will begin pulling the bus and solder through the induction heater.

CAUTION

HOT SURFACES - PERSONNEL INJURY FROM BURNS. GLOVES SHALL BE WORN AND SIGNS POSTED IF ASSEMBLY IS ABOVE 140F.

5.2.21 Continue until the bus has passed completely through the puller and is resting on the U-rail.

NOTE

SOLDER BALLS CAN FORM FROM EITHER EXCESSIVE HEAT OR SOLDER. ENSURE THAT THEY ARE RECYCLED OR DISPOSED OF PROPERLY

5.3 Shutting down the Line

5.3.1 On the Induction Heater unit, depress the HEAT OFF push button.

5.3.2 On the Motor Controller, place the AC POWER ON/OFF toggle switch in the OFF position.

5.3.3 On the Water Recirculator unit, depress the red FAN STOP push button and the red PUMP STOP push button.

5.3.4 On the Puller unit, place the air valve handle in the DISENGAGED position to separate the belts. Then place the handle in the NEUTRAL position. The belts should remain separated.

5.3.5 Turn off the argon gas.

5.3.6 Turn off the air.

5.3.7 Shut of ventilation fan.

5.3.8 Open circuit breakers 2/4/6 and 8 in circuit breaker panel RP51.

5.4 Interlock Test Procedure

NOTE

INTERLOCKS SHALL BE TESTED ON A SIX-MONTH INTERVAL DURING PRODUCTION, OR AFTER MAJOR MAINTENANCE OR REPAIR, OR AFTER A SOFTWARE REVISION.

CAUTION

PRESSING A CRASH BUTTON DURING BUS SOLDERING MAY CAUSE THE WORK TO OVERHEAT, POSSIBLY DAMAGING THE SUPERCONDUCTING CABLE.

5.4.1 A listing and description of the safety interlocks on the Winder follows.

CRASH buttons:

- One on the south side of the RF cooling cabinet
- One on the west side of the tractor unit

5.4.2 Using the instructions contained in Sections 5.1- 5.2, engage the heaters & tractor drive. Leave the tractor empty.

5.4.3 Engage the 1st of the 2 crash buttons. Verify by sound that the contacts have disengaged. Verify that tractor motion has ceased.

5.4.4 Repeat for 2nd button

NOTE

IF A DEVICE FAILS, PAUSE WORK, AND IMMEDIATELY NOTIFY THE TECHNICAL SUPERVISOR, THE COGNIZANT ENGINEER, AND THE ES&H COORDINATOR

5.4.5 Fill out the interlock test form and post near the machine.

6 Documentation

None

7 Attachments

Attachment 1 – Interlock Test Form

8 References

8.1 "Instruction Manual for Water Recirculator RWAG-5A", manual no. 13190353, published by Lepel Corporation.

8.2 "Induction Heating Power Supply Instruction Manual", part no. 29711-027, published by Lepel Corporation.

8.3 Subject Area: Lockout/Tagout (LOTO) for Installation, Demolition, or Service and Maintenance

9 Version History Log

Revision	Description of Changes	Reviewers	Effective Date
07	• Implemented Version History Log • No technical changes made	P. Doutney J. Escallier H. Hocker M. Anerella M. Samms A. Volk	1/31/25

Attachment 1 – Interlock Test Form

DATE	SOUTH SIDE OF THE RF COOLING CABINET	WEST SIDE OF THE TRACTOR UNIT	INITIALS