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## SMD Operations Procedures Manual

### 8.1.1.29 OPERATION OF SHORT COIL CURING PRESS

Text Pages 1 through 16  
Attachment(s) 1, 2, 3, 4

#### Hand Processed Changes

<u>HPC No.</u>	<u>Date</u>	<u>Page Nos.</u>	<u>Initials</u>
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### **8.1.1.29 Operation of Short Coil Curing Press**

#### **1.0 Purpose and Scope**

- 1.1 This Procedure provides instruction in various operating aspects of the Short Curing Press (Press) located in building 924.
- 1.2 The information is meant for persons who will operate the controls of the Press.

#### **2.0 Responsibilities**

- 2.1 Authorized operators (Operators) of the Press will perform the tasks described here. A list of Operators is maintained by the Coil Fabrication Plant Manager.
- 2.2 The Operator shall complete the following documentation:
  - 2.2.1 Daily log book for coil programs. Entries shall include any information that the Operator deems important to pass along to the Coil Fabrication Supervisor, the CE, or the next work shift, including:
    - A. work accomplished regarding coil production;
    - B. coil discrepancies;
    - C. repairs to the Press (brief description);
    - D. lessons learned;
    - E. irregularities during operation of the Press.
  - 2.2.2 Maintenance log. Entries shall include:
    - A. detailed description of each repair and maintenance procedure;
    - B. detailed record of parts and material used (fittings, valves, oil,...).
  - 2.2.3 Magnet Traveler.
  - 2.2.4 Manually Operated Valve (MOV) Check List (Attachment 2).
  - 2.2.5 Short Curing Press Safety Interlock Test Form (Attachment 3).

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### **3.0 Prerequisites**

#### 3.1 Training

3.1.1 Operators shall be trained by the Coil Winding/Curing Technician Supervisor before using this Procedure.

3.1.2 Operator shall trained as an "affected employee" as defined by BNL ESH Standard 1.5.1, "Lockout/Tagout Requirements".

#### 3.2 Initial State of Press

3.2.1 Control panel controls shall be set to their "initial" settings (see sec. 5.4) before activating the control console.

#### 3.3 Equipment

3.3.1 Personal protection equipment:

A. full face shield;

B. protective suit (hood, jacket, pants).

#### 3.4 Calibrations

3.4.1 Verify that the following equipment has an unexpired calibration label.

A. MAIN HYDRAULIC PRESSURE digital readout (control panel).

B. END PRESSURE digital readout (control panel).

C. FIXTURE TEMPERATURE digital readout (control panel).

D. MANDREL TEMPERATURE digital readout (control panel).

### **4.0 Precautions**

4.1 Verify that machine guards and splash shields are in place.

4.2 Verify that the work area within the yellow border is clear of unauthorized, unprotected personnel; put chains in place across entrances to the Press area..

4.3 Verify that the door to the Pump Room is closed and a "Restricted Area" sign is in place on the door.

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- 4.4 If it is necessary to work in the Press area with the splash shields open, wear a face shield.
- 4.5 If it is necessary to enter the Pump Room during operation, wear full protective gear: hood, jacket, pants, face shield.
- 4.6 Use a feeler gage with an extended handle to take measurements inside the Press. Do not reach into the Press.
- 4.7 Use built-in handles on the tooling to slide the tooling in or out of the Press. Check that no one is standing near the Press opening.
- 4.8 After the formblock is inserted into the Press, install locking pins to secure the locking bar holding the formblock in place.
- 4.9 While at the controls, establish and maintain visual contact with personnel in the Press area. Use hand signals to communicate (see Attachment 4: "Hand Signals Between Control Operator and Technicians in the Press Area").
- 4.10 A test of the safety interlocks (5.7) shall have been performed within the last six months. A dated "Test of Safety Interlocks" form, posted near the Press, shall be used for verification.
- 4.11 Use the MOV check list (Attachment 2) to ensure that the Manually Operated Valves are in their proper positions.

#### **CAUTION**

**Leaks from the heat exchanger have the potential to cause a regulatory violation.**

- 4.12 Inspect oil cooler for oil leaks before each cure. Report any leaks to the Plant Manager. If the leak has the potential to impact the environment, call extension 2222 to report.
- 4.13 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.

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**WARNING**

**NOTIFY ESH COORDINATOR OR ECR PRIOR TO EQUIPMENT START-UP**  
The Short Coil Curing Press oil system is considered out of service and requires re-evaluation prior to being placed back into service.

**5.0 Procedure**

**WARNING**

**NOTIFY ESH COORDINATOR OR ECR PRIOR TO EQUIPMENT START-UP**  
The Short Coil Curing Press oil system is considered out of service and requires re-evaluation prior to being placed back into service.

5.1 Each type of coil has a written Magnet Assembly Procedure (MAP) that describes the sequential activities necessary to cure a coil using this Press. This includes information on:

- A. Preparation of tooling;
- B. Pre-operational checks to the Press system;
- C. Safety precautions in curing a coil;
- D. Turning on the hydraulics and heating/cooling oil;
- E. Activating power to the Press;
- F. The curing cycle;
- G. Data to be taken before, during, and after the coil is cured;
- H. Removing the coil from the Press;

5.2 Overview of the Short Curing Press

5.2.1 During the magnet coil winding process, the superconducting cable insulation system is impregnated with either an epoxy resin or a thermoplastic adhesive. The Short Coil Curing Press provides a means of activating the epoxy or thermoplastic adhesive while holding the wound coil in the required shape. Under manual and program control, the Press applies heat and pressure to the coil in timed cycles while the coil lays in a formblock. The result is a rigid coil pack which will produce the required magnetic field shape when excited.

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5.2.2 The amount of heat and pressure, and the cycle times, are determined by the appropriate MAP for the coil being cured.

5.2.3 The Press will accept magnet coils of up to 1.65 meters in length.

### 5.3 Operator Controls

5.3.1 Operator controls are located on the Control Panel adjacent to the Press. Refer to the Control Panel diagram in Attachment 1 of this document.

5.3.2 Capital letters indicate how the controls are marked.

5.3.3 The location numbers refer to the numbers inside the diamonds on the Control Panel diagram.

5.3.4 The sequence of listing does not indicate the sequence of operation.

5.3.5 The location and function of the indicators and controls are as follows:

- A. Location 1-- AC PWR red indicator light:  
Illuminates when the main input disconnect switch for the Press, located on the east wall, and the disconnect switch on Control Cabinet II, are placed in the ON position.
- B. Location 2-- Emergency Stop (CRASH) mushroom push button:  
Interrupts control power thus shutting down power to the oil heater and all the system motors, including the hydraulic pump motors. Control power is still present in the control panel and 460V, 3 phase voltage is present in the control cabinet.
- C. Location 4-- NORTH/SOUTH toggle switch:  
Directs hydraulic and hot oil flow to north or south formblock/mandrel assembly.
- D. Location 5-- STEP digital display:  
Displays the current step in the curing process according to the programmable controller.
- E. Location 6-- COIL TYPE thumbwheel switch:  
Sets the programmable controller to run the proper curing program.

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- F. Location 7-- END OF STEP ALARM & RESET:  
When a program step ends, an audible alarm sounds. The RESET push button shuts off the alarm.
- G. Location 8-- START push button:  
Activates control power for the system.
- H. Location 9-- OFF green lighted push button:  
Turns off the hot oil system (heater, hot oil pump).
- I. Location 10-- OPERATE red lighted push button:  
Turns on hot oil system (heater, hot oil pump) and starts timer.
- J. Location 11-- FAULT/RESET white lighted push button:  
Clears faults as indicated on fault lights. If a fault remains, the push button will stay lit.
- K. Location 12-- ADVANCE white push button:  
Allows manual control of the program timer. If, for example, the desired temperature is reached sooner than anticipated, depressing this button advances the timer to the next step.
- L. Location 13-- RESTART white push button:  
Sets program timer back to zero.
- M. Location 14-- HOLD red lighted push button:  
Pauses program timer. If, for example, the tooling has not reached the desired temperature in the anticipated time, depressing this push button will hold the program in the step.
- N. Location 15-- TIMER display:  
Displays program timer in minutes.
- O. Location 16-- SHORT FLOW (GPM) display:  
Displays total flow of hot oil as measured on return side in gallons per minute.
- P. Location 17-- FORMBLOCK FLOW (GPM) display:  
Displays hot oil flow through formblock as measured on return side in gallons per minute.
- Q. Location 18-- HYD OIL LOW fault red light:

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Indicates that the hydraulic pump is not operating due to a low level of oil in the pump reservoir. If this occurs, maintenance is required.

- R. Location 18-- OIL TEMP HIGH fault red light:  
Indicates that the temperature of the heating oil is too high and the heater is shut off.
- S. Location 18-- OIL LEVEL LOW fault red light:  
Indicates that the heating/cooling oil circulating pump is shut off due to a low level of oil in the pump reservoir. If this occurs, maintenance is required.
- T. Location 18-- PUMP PWR FAULT red light:  
Indicates the loss of A.C power to the heating/cooling oil circulator pump (may be caused by a phase fault, an open circuit breaker, or other reason).
- U. Location 18-- PUMP PRESS FAULT red light:  
Indicates pressure in the heating/cooling oil circulation system is above or below the set pressures of 150 psia max, 5 psia min.
- V. Location 18-- FAN PWR FAULT red light:  
Indicates the loss of A.C power to the cooling fan motor (may be caused by a phase fault, an open circuit breaker, or other reason).
- W. Location 18-- OIL LEVEL HIGH red light:  
Indicates that the level of heating/cooling oil in the reservoir is too high. The pump shuts down to prevent an oil spill. Maintenance is required.
- X. Location 19-- Controller state yellow indicator lights (HEAT, MIX, COOL, DONE):  
Under program control to indicate what process is currently underway.
- Y. Location 19-- LIGHT TEST push button:  
Tests indicator lights and fault lights at locations 18 and 19).

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- Z. Location 20-- COMMAND TEMP display:  
Displays the setpoint temperature of the program controller as it controls the heating/cooling oil temperature.
  
- AA. Location 21-- PUMP PRESSURE display:  
Displays heating/cooling oil circulating pump feed pressure.
  
- BB. Location 22-- RETURN PRESSURE display:  
Displays heating/cooling oil circulating pump return pressure.
  
- CC. Location 23-- Yellow indicator lights for electrically operated hot oil valves:  
  
BYPASS-- When the "Bypass" valve is closed, hot oil is directed to the air cooler and the water heat exchanger. When the valve is open, the water heat exchanger is bypassed and hot oil is directed to the air cooler only.  
  
COOL-- When valve is open, hot oil is directed through the air cooler.  
  
HEAT-- When valve is open, oil is directed through the heater.  
  
FORMBLOCK-- When open, oil is directed through the formblock.  
  
MANDREL-- When open, oil is directed through the mandrel.  
  
RETURN-- Main valve in the oil return line.
  
- DD. Location 24-- PUMP ON yellow indicator light:  
Indicates that heating/cooling oil circulating pump is on.
  
- EE. Location 25-- HEAT ON yellow indicator light:  
Indicates that oil heater is on.
  
- FF. Location 26-- FAN ON yellow indicator light:  
Indicates that cooling fan is on.
  
- GG. Location 27-- WATER COOL ON toggle switch and red indicator light:

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The switch operates a valve which directs flow of hot oil through the water heat exchanger and operates the water solenoid. The red light indicates that power is applied to those circuits.

- HH. Location 28-- RETURN OIL TEMP display:  
Displays hot oil temperature as measured at entrance of heater.
- II. Location 29-- FEED OIL TEMP display:  
Displays hot oil temperature as measured at exit of heater.
- JJ. Location 30-- FIXTURE TEMPERATURE 8-position selector switch and display:  
Allows monitoring of formblock temperature (degrees C.) as indicated by thermocouples attached to formblock.
- KK. Location 31-- MANDREL TEMPERATURE 8-position selector switch and display:  
Allows monitoring of Mandrel temperature (degrees C.) as indicated by thermocouples attached to mandrel.
- LL. Location 32-- CONTROL POWER red indicator light:  
Indicates that the control power for the hydraulic components has been activated.
- MM. Location 33-- HYD OIL LOW green indicator light:  
Indicates a low level of hydraulic oil in the pump reservoir. It indicates that maintenance is required.
- NN. Location 34-- RESET push button:  
Hydraulic system reset. Must be depressed 1) before hydraulic pumps will turn on, or 2) to reset after a hydraulic system fault.
- OO. Location 35-- MANUAL/AUTO selector switch and green indicator light:  
Selects the desired control functions: manual or program control.
- PP. Location 36-- MAIN HYDRAULIC PRESSURE display:  
Displays pressure in psi to the hydraulic cylinders that apply vertical force to the formblock.

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QQ. Location 37-- MAIN HYDRAULIC PRESSURE adjustment:  
Controls (by adjustment of a potentiometer) the hydraulic pressure to cylinders that apply vertical force to the formblock. This adjustment is only to be made when the selector switch at location 39 is in the "HIGH ENGAGE" POSITION.

RR. Location 38-- START and STOP push buttons:  
Starts and stops the main hydraulic pump for vertical cylinders.

SS. Location 39-- LOW DISENGAGE/LOW ENGAGE/HIGH ENGAGE selector switch:

In the LOW DISENGAGE position, the press is disengaged from the tooling. The ENGAGE green indicator light and the HIGH red indicator light are off.

In the LOW ENGAGE position, the press will engage the tooling at low pressure (< 500 psi) when the hydraulic pump is on. The ENGAGE green indicator light turns on.

In the HIGH ENGAGE position, the vertical pressure will be controlled by the potentiometer (location 37) in the range of 500 to 3000 psi.

***NOTE For AUTO operation, this switch must stay in the "HIGH ENGAGE" position.***

TT. Location 40-- END PRESSURE display:  
Displays lead and return end sideways pressure.

UU. Location 41-- display:  
Not functional.

VV. Location 42-- STOP and START push buttons:  
Stops and starts the end pressure pump. The ON red indicator light turns on when the pump is on.

WW. Location 43-- DISENGAGE/ENGAGE selector switch:  
In the DISENGAGE position, the end cylinders are retracted. In the ENGAGE position, the end cylinders exert longitudinal pressure. The ENGAGE green indicator light turns on.

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**NOTE** *For AUTO operation, this switch must stay in the "ENGAGE" position.*

**CAUTION**

**Failure to set controls to their initial settings before activating the control console could result in equipment or product damage.**

5.4 Initial Control Panel Settings

5.4.1 Before activating the control console (by depressing the START push button on the control panel), set the following controls to these "initial" settings:

- A. MANUAL/AUTO selector switch (35) in the MANUAL position.
- B. Main hydraulic pressure selector switch (39) in the LOW DISENGAGE position.
- C. Main hydraulic pressure control potentiometer (37) at the lowest setting (fully counter-clockwise).
- D. End hydraulic pressure selector switch (43) in the DISENGAGE position.
- E. Cooling water toggle switch (27) in the OFF position.

5.5 To Start Up the Press

5.5.1 Refer to the appropriate MAP for the proper system checks to make before starting up the Press.

**CAUTION**

**ENVIRONMENTAL SPILL POTENTIAL**

**OIL/WATER Cooler should not be in service. The Oil/ail cooler (located outside of Building 924) needs to be verified there are no leaks. Secondary containment recommended.**

5.5.2 Place the Manually Operated Valves for the heating/cooling system in the proper position. Use the Manually Operated Valve Check List for verification.

5.5.3 Check that all required fused disconnect switches in the Pump Room are in the ON position.

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- 5.5.4 Place the disconnect switch on the east wall, labeled SHORT CURING PRESS, in the ON position.
- 5.5.5 Check that the disconnect switch on Control Cabinet II is in the OFF position.

**CAUTION**  
**ELECTRICAL SHOCK HAZARD**  
**Hazardous voltages are present under protective barriers inside the left side compartment of Control Cabinet II.**

- 5.5.6 Open the left side door of Control Cabinet II.
  - 5.5.7 Place the Heater Disable Switch in the ENGAGE position.
  - 5.5.8 Place the program controller in the RUN or RUN/PROGRAM mode.
  - 5.5.9 Close and secure the door.
  - 5.5.10 Place the disconnect switch on the Control Cabinet II in the ON position.
  - 5.5.11 Verify that the control panel controls are set to their "initial" settings (5.4).
  - 5.5.12 Depress the START push button (8).
  - 5.5.13 Reset system faults by depressing the RESET (34) and FAULT RESET (11) push buttons.
  - 5.5.14 Reset the system timer by depressing the RESTART (13) push button.
  - 5.5.15 Refer to the appropriate MAP to continue operation of the Press.
- 5.6 To Shut Down the Press
- 5.6.1 Ensure that post-cure measurements have been taken.
  - 5.6.2 Reduce main hydraulic pressure to 500 psig. Lower the formblock by switching main hydraulic cylinder selector switch to LOW DISENGAGED position.

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- 5.6.3 Depress the OFF push button (9) to shut off the heating/cooling oil system (oil heater and oil pump).
- 5.6.4 Depress the STOP push button (38) to shut off the main hydraulic pump for the vertical cylinders.
- 5.6.5 Depress the STOP push button (42) to shut off the end hydraulic pump for the end cylinders.
- 5.6.4 Set the control panel to the initial settings (see 5.4).
- 5.6.5 Place the disconnect switch on Control Cabinet II in the OFF position.
- 5.6.6 Place the disconnect switch on the east wall, labeled SHORT CURING PRESS, in the OFF position.

## 5.7 Safety Features

### 5.7.1 Interlock on Control Cabinet II:

Within Control Cabinet II is main power (480V/3 phase/60 Hz) and control power (120V/1 phase/60 Hz, and 12VDC). This is a two door cabinet with control power access through the left door and main power access through the right door. A metal barrier separates the two sides. The right door is mechanically interlocked with the main disconnect switch on the outside of this cabinet. Putting this main disconnect switch to the OFF position kills all power to the Short Curing Press facility. This includes the Press and the hydraulic and heating/cooling oil service from the Pump Room.

The left door may be entered to access the programmable controller. With the left door open, 12VDC components and control wiring is exposed. 120VAC components and control wiring are mounted behind Lexan protective barriers.

### **CAUTION ELECTRICAL SHOCK HAZARD**

**Hazardous voltages are present inside the cabinet even after the emergency stop push button is depressed.**

- 5.7.2 Emergency Stop Push Buttons: There are six Emergency Stop push buttons in the Short Coil Curing facility. They are located on the Control Panel, at both ends of the Press, on Control Cabinet II, in the Pump Room,

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and on the south wall. Depressing any push button will shut off power to the components of the system.

- 5.7.3 Limit Switches: Limit switches inside the Press permit hot oil pump operation and supply of hydraulic oil to the cylinders only when the formblock has been inserted into the Press.
- 5.7.4 Splash Shields: Splash shields are located around the Press to protect against oil leaks.
- 5.7.5 Restricted Access: The Press area is a restricted area during operation as indicated by a yellow border around the Press facility, access chains at the Press entrance areas, and warning signs.

The Pump room is a restricted area during Press operation.

- 5.7.6 Automatic Fault Detection: the Press electronics system will automatically detect a variety of system faults and shut off the appropriate component.
- 5.7.7 MOV Check List: Proper positioning of the Manually Operated Valves for the heating/cooling system is essential for safe operation. A check list assists the Operator in positioning the valves (Attachment 2).

## 5.8 Test of Safety Interlocks

- 5.8.1 The test shall be completed at an interval not to exceed six months.
- 5.8.2 The Interlock Test Form (Attachment 3) shall be checked off, dated, and initialed by the tester. A copy shall be posted near the Press.
- 5.8.3 The test procedure is as follows:
  - 5.8.3.1 After the coil to be cured has been placed in the required formblock, put the main disconnect switch on the east wall in the ON position.
  - 5.8.3.2 Put the Programmable Controller in the RUN or RUN/PROGRAM position.
  - 5.8.3.3 Place the input disconnect switch on Control Cabinet II in the ON position.

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- 5.8.3.4 Depress the START push button (location 8 of Control Panel diagram) on the Control Console. Reset the HYD OIL LOW fault by depressing the RESET push button (34), then press the FAULT/RESET push button (11) to clear the red fault lights (the PUMP PRESS fault is cleared with the RESTART push button).
- 5.8.3.5 Depress the Emergency Stop push button on the Control Console and verify that power to all components shuts off except for power to the CONTROL POWER red indicator light (32).
- 5.8.3.6 Repeat steps 5.8.3.4 and 5.8.3.5 for all emergency stop push buttons of the Short Curing Press facility as shown on the location diagram on the Interlock Test Form.
- 5.8.3.7 Check off, date, and initial the Interlock Test Form. Note in the daily log that the test was completed successfully.
- 5.8.3.8 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.

#### 5.9 Pump Room Access During Press Operation

- 5.9.1 Wear full protective gear: hood, face shield, jacket, pants.
- 5.9.2 Enter room, close door, and make adjustments.
- 5.9.3 Leave room, close door.

### 6.0 Documentation

- 6.1 Traveler
- 6.2 Daily log book
- 6.3 Maintenance log
- 6.4 Manually operated valve check list
- 6.5 Interlock Test Form

### 7.0 References

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- 7.1 ESH Standard 1.5.1, "Lockout/Tagout Requirements".
- 7.2 Magnet Assembly Procedure for each type of RHIC coil.

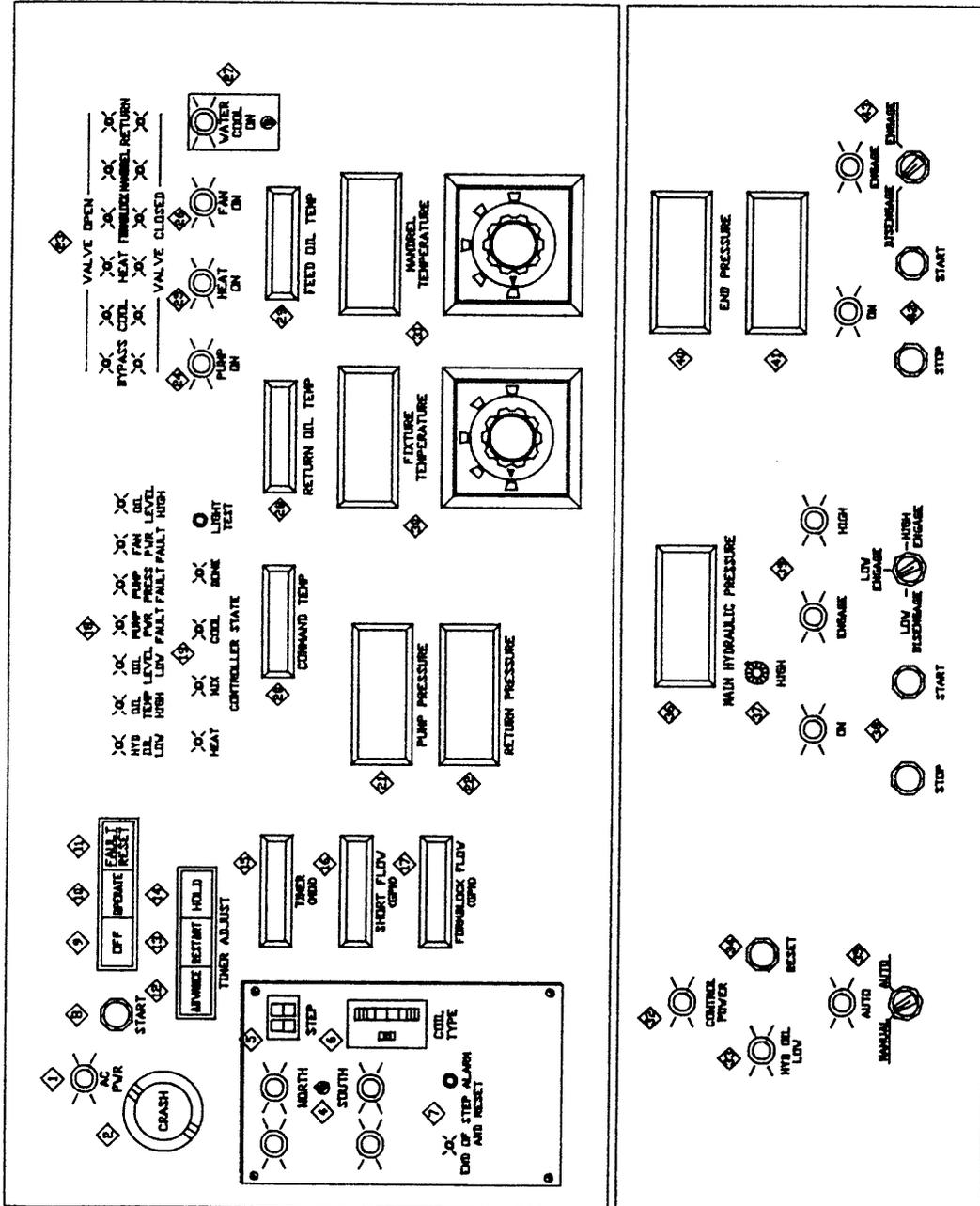
## **8.0 Attachments**

- 1. Control Panel Diagram
- 2. Manually Operated Valve Check List
- 3. Interlock Test Form
- 4. Hand Signals

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Attachment 1

Control Panel Diagram



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**Attachment 2**

**Manually Operated Valve Check List**

Hot Oil Heating/Cooling System Safety Check:

There are several manually operated valves in the heating/cooling system pump room that must be in the proper operating position during the curing cycle. These valves are labeled. The following check off list must be completed prior to operating the system to assure the valves are in the proper positions. The valve is in the “open” position when the handle is in line with the system transfer line.

<b>Valve #</b>	<b>Position</b>	<b>Check off</b>
MOV 100/200	Always open	_____
MOV 101/201	Open	_____
MOV 102/202	Closed	_____
MOV 110/210	Closed	_____
MOV 103/203	Open	_____
MOV 104/204	Open	_____
MOV 105/205	Closed	_____
MOV 106/206	Closed	_____

Above work done by:

Name	Date	Life #

Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
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#### Attachment 4

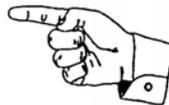
#### Hand Signals Between Control Operator and Technicians in the Press Area



"raise mandrel"



"lower mandrel"



"increase pressure"