

Mesa-Pak Encapsulating System

Operator's Manual

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MESA

Technology

A Subsidiary of **Olin** Corporation

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SECTION 1

GENERAL DESCRIPTION

1.1 GENERAL

The Mesa-Pak Encapsulating System is a microprocessor-based device which performs die level encapsulation in a reel-to-reel format for surface mount applications. The encapsulant (typically epoxy) not only protects the active surface of a chip from mechanical and chemical contaminants, but also prevents accidental lead contact with the chip as well.

1.2 EQUIPMENT DESCRIPTION

The encapsulating system (Figure 1-1) consists of five major modules: a reel handler, a vapor degreaser, a work station (downset and dispense), a curing oven, and a computer/electronics console. The input reel handler and the takeup reel are housed in a compartment above the main assembly. The vapor degrease, work station, downset and dispensing station, and curing oven are all situated on the main assembly. The dispensing module is designed to accommodate tapes of various sizes by use of bolt-on option modules. A console below, and to the left of the main assembly houses the computer and system electronics.

1.3 SYSTEM CONFIGURATION

A normal, fully-configured system features the following elements:

- Reel Handling System - The input reel supplies bonded and tested TAB chips. The reel is supplied with tested good chips. An interleaf protective strip is removed at the input reel, and reinserted at the take-up reel.
- Degreasing System - Degreasing is an optional process that may be performed through the Freon vapor degreaser. The degreaser prepares the tape and chips for encapsulation by removing flux or other contaminants before the dispensing stage.
- Work Station - The work station includes a lead downset station which prepares the inner lead-bonded die for encapsulation. The system positions each chip at the downset station where an anvil presses the die through an opening in the platten. Because the surface is recessed below the film plane, the leads are formed away from the die, thus preventing shorts. See Figure 1-2 for a detail of the downset position.

After the appropriate amount of downset is formed, the tape is positioned at the dispensing position. The dispensed material covers the chip surface and flows beneath the bonded ends of the formed leads. Notice in Figure 1-2 that there is a small area between the lead and the chip after downset. This is where the encapsulant flows.

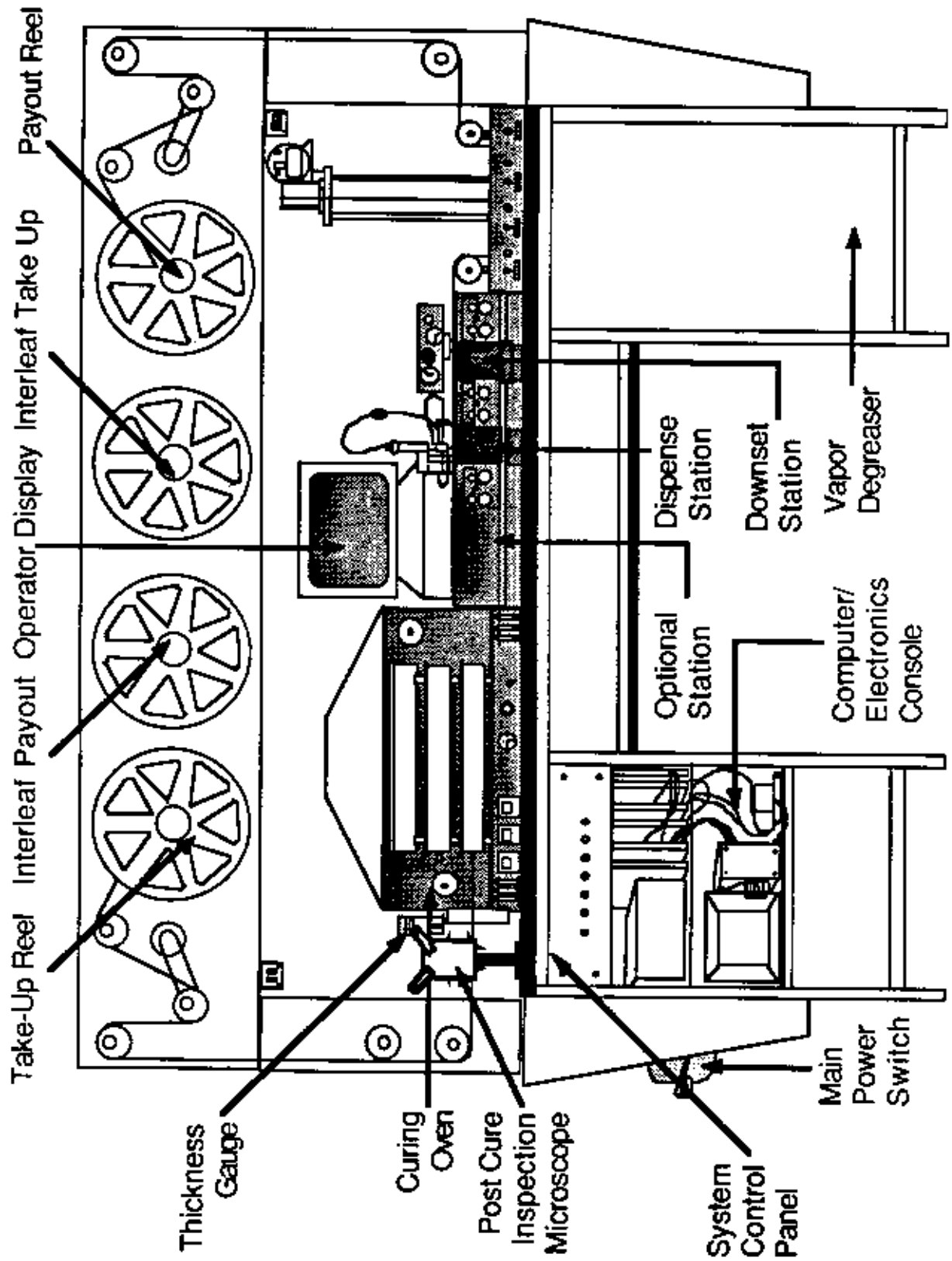


Figure 1-1. Mesa-Pak Encapsulating System Overall Configuration

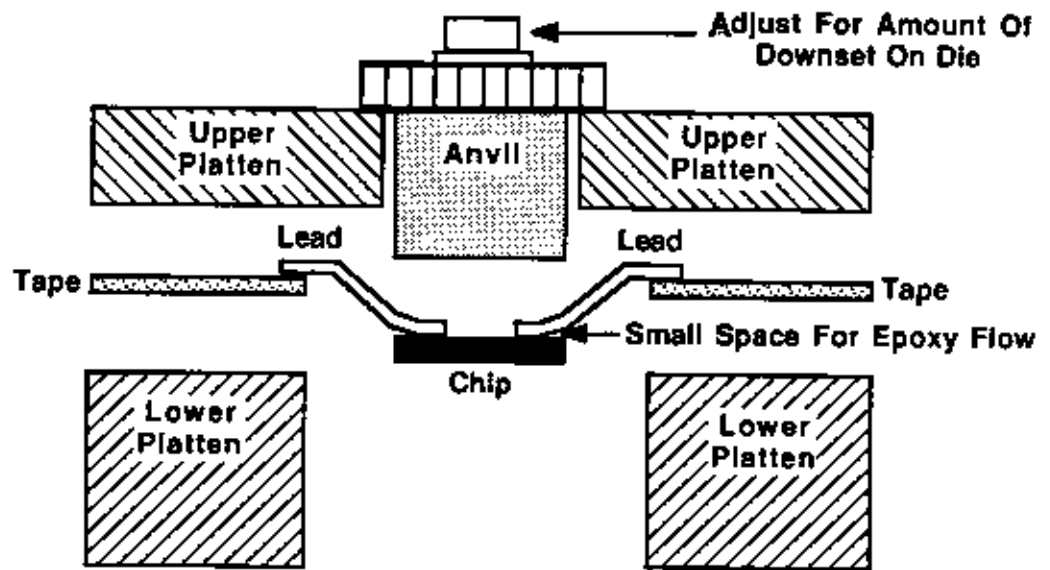


Figure 1-2. Downset Cross View

- Oven System - Following the application of encapsulant, the film enters the curing oven. Purge gas (either air or nitrogen) enters the chambers through individual distribution tube as the oven through the exhaust. Maximum oven temperature capability is 232 degrees Centigrade, however, oven temperature is adjusted for the encapsulant used. Digital controls monitor and regulate the temperature settings.
- Thickness Monitor System - After exiting the oven, the film travels past a measuring station where a digital gauge can be used to manually verify the proper post-cure encapsulant thickness.
- Operator Control Console - A terminal and display is used to interface with the microprocessor controller. The user can program and monitor through easy to use menus and displays. The entire range of system actions, from incrementing/decrementing tape positions, setting up the dispense pattern, opening and closing plattens, to setting and monitoring alarms can be manipulated at the operator control console.

1.4 REFERENCE DATA

Table 1-1, Equipment Specifications, provides a tabular listing of:

- Power Requirements
- Functional Characteristics
- Dimensions

Table 1-1. EQUIPMENT SPECIFICATIONS

POWER REQUIREMENTS:	VOLTAGE	208 VAC 3 phase, 15 amp or 110 VAC 35 amp.
	AIR	100 psig.
FUNCTIONAL CHARACTERISTICS:	TAPE FORMATS	Standard: 70mm, 35mm, 16mm, 8mm. Special: 11mm, 19mm, 24mm, Super 8mm, Super 16mm.
	DIE SIZES	Up to 12mm standard (.500 sq. in.). Larger sizes upon request.
	THROUGHPUTS	1000 units per hour minimum, depending on die size, tape pitch, and encapsulant type.
	OVEN SYSTEM	Temperature range 25° C to 232° C (77° F to 450° F).
	HEATED LENGTH	User selectable - 2,4, or 6 feet.
	OVEN ATMOSPHERE	Air or nitrogen (30 psig at 5 SCFM if required for curing oven).
	HEATING TYPE	Radiation and convection.
	CHAMBER TYPE	Stainless steel construction. Chamber is exhausted for fume control. Requires a 5 SCFM flow rate.
	DISPENSE SYSTEM	Pneumatic, positive displacement with stand-alone reservoir or replaceable epoxy cartridge.
	PRE-CLEAN	Vapor degrease, 2 stage vapor plus liquid utilizing Freon TF with a load-unload elevator for threading material.
	THICKNESS MONITOR	Digital thickness gauge for in-line sampling of finished product.

Table 1-1. EQUIPMENT SPECIFICATIONS (Continued)

<p>FUNCTIONAL CHARACTERISTICS:</p>	<p>OPTICS</p> <p>REEL HANDLING SYSTEM</p> <p>CONTROL SYSTEM</p> <p>OPERATOR CONTROL CONSOLE</p>	<p>Primary: 10x to 100x binocular microscope for dispense monitoring.</p> <p>Secondary: 7x to 30x Bausch & Lomb stereo zoom for post-cure visual thickness measurement.</p> <p>Fully enclosed above main unit, with interleaf takeup and payout, and automatic tensioning.</p> <p>Microprocessor control over entire system functions.</p> <ul style="list-style-type: none"> • System set-up • Alarm monitoring • Manual-automatic mode select • Unit counter display 												
<p>DIMENSIONS:</p>	<p>SIZE</p>	<table border="1"> <thead> <tr> <th>Height</th> <th>Length</th> <th>Depth</th> <th></th> </tr> </thead> <tbody> <tr> <td>79</td> <td>104</td> <td>31</td> <td>inches</td> </tr> <tr> <td>200</td> <td>264</td> <td>78</td> <td>cm</td> </tr> </tbody> </table>	Height	Length	Depth		79	104	31	inches	200	264	78	cm
Height	Length	Depth												
79	104	31	inches											
200	264	78	cm											

SECTION 2

UNPACKING AND INSTALLATION

2.1 GENERAL

Information necessary for unpacking and preparation for use is contained in the following section. Instructions for repacking are included in case the Mesa-Pak Encapsulating System must be returned for calibration or repair.

2.2 UNPACKING

The machine comes packed in a reusable container. See Figure 2-1 for packing illustrations. Numbers in the diagram correspond to the bold outlined numbers in the steps. Open the Mesa-Pak Encapsulating System packaging carefully by performing the following actions:

- Remove metal strips holding the carton to the shipping pallet. **1**
- Remove clamps from the carton front side. **2**
- Set the front of the carton away from the unit.
- Move the machine to its final position while it is still on the pallet. **3**
- Unbolt the remaining sides from the base. **4**
- Cut away the tie down bands holding the machine to the pallet. **5**
- Forklift the machine off the pallet onto the floor. **6**
- Save all packaging material for reshipment.

Carefully verify that the shipment is complete according to the shipping list. Perform the following visual inspection to determine that no physical damage occurred during shipping:

- Check for missing locking screws.
- Check for loose or broken components, wires, and connectors.

2.3 WARRANTY INFORMATION

If the unit is damaged in any way or does not operate in accordance with the operating instructions, notify the Mesa Technology distributor or Mesa Technology service department immediately. In case of physical damage, the shipping agent should also be notified. The Mesa Technology warranty conditions are given in the back of this manual.

Retain packaging material and shipping container for inspection if the unit is damaged.

2.4 MESA-PAK ENCAPSULATION SYSTEM INSTALLATION

Set the unit in an environmentally secure area, as free from dust and other contaminants as possible. See Figure 2-2 for wiring and electrical information.

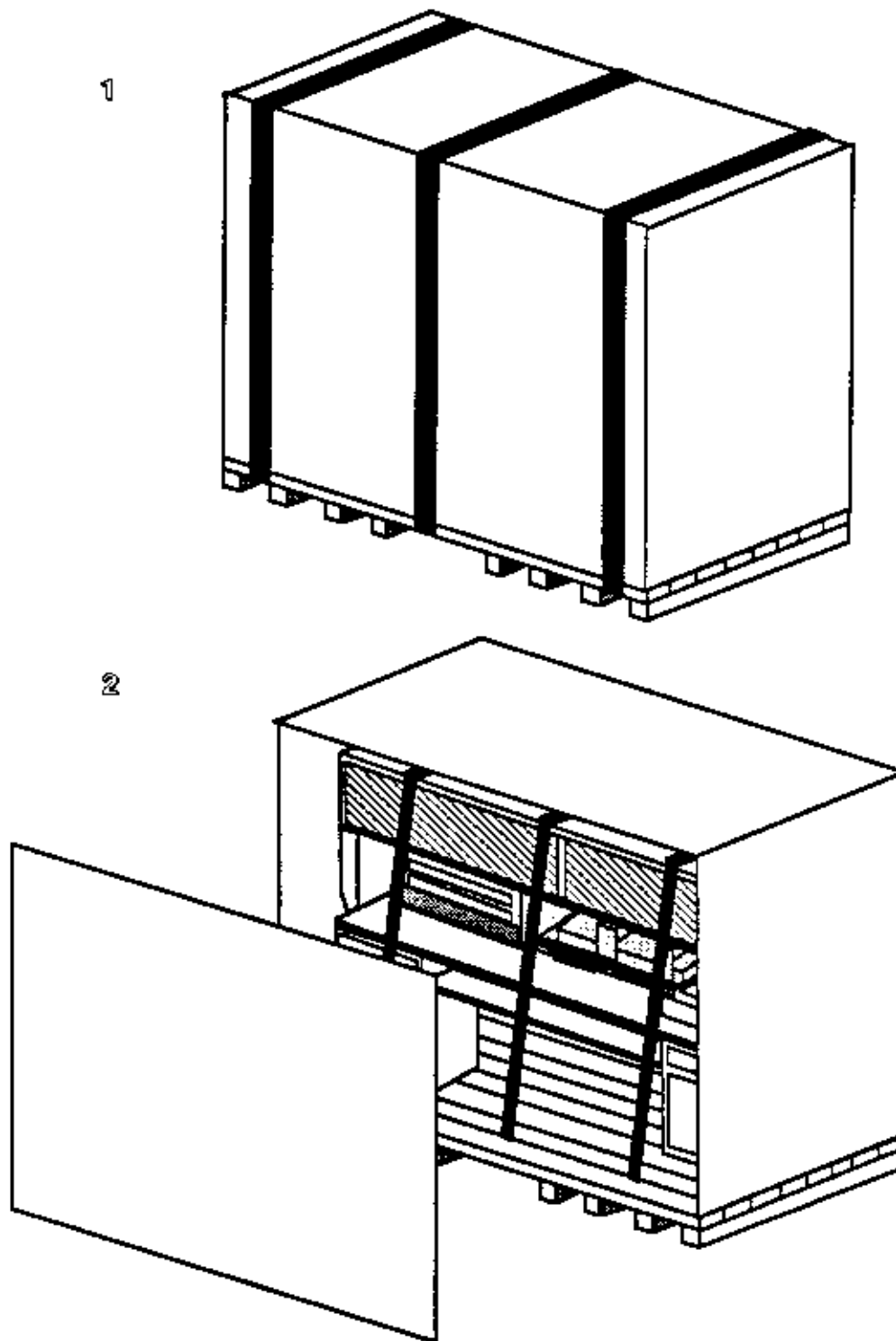
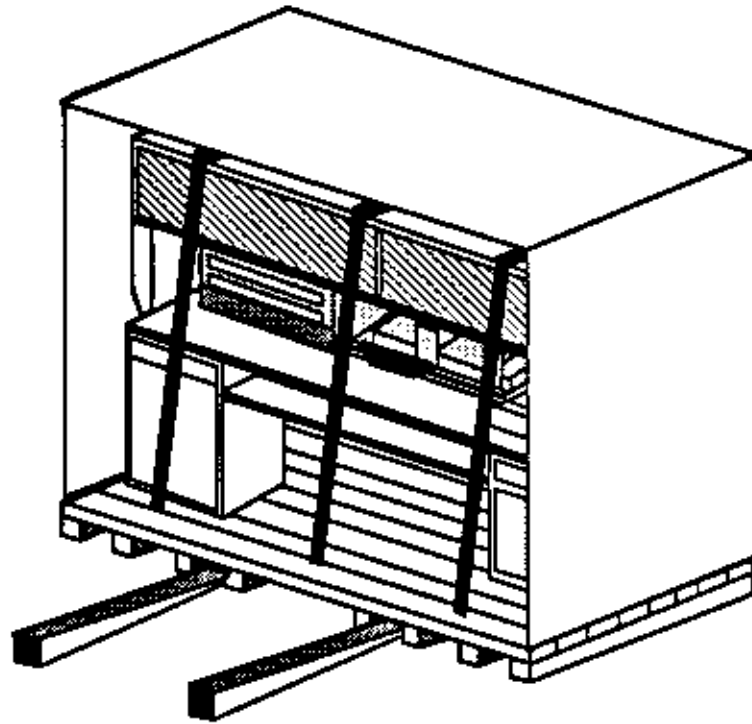


Figure 2-1A. Unpacking Sequence

3



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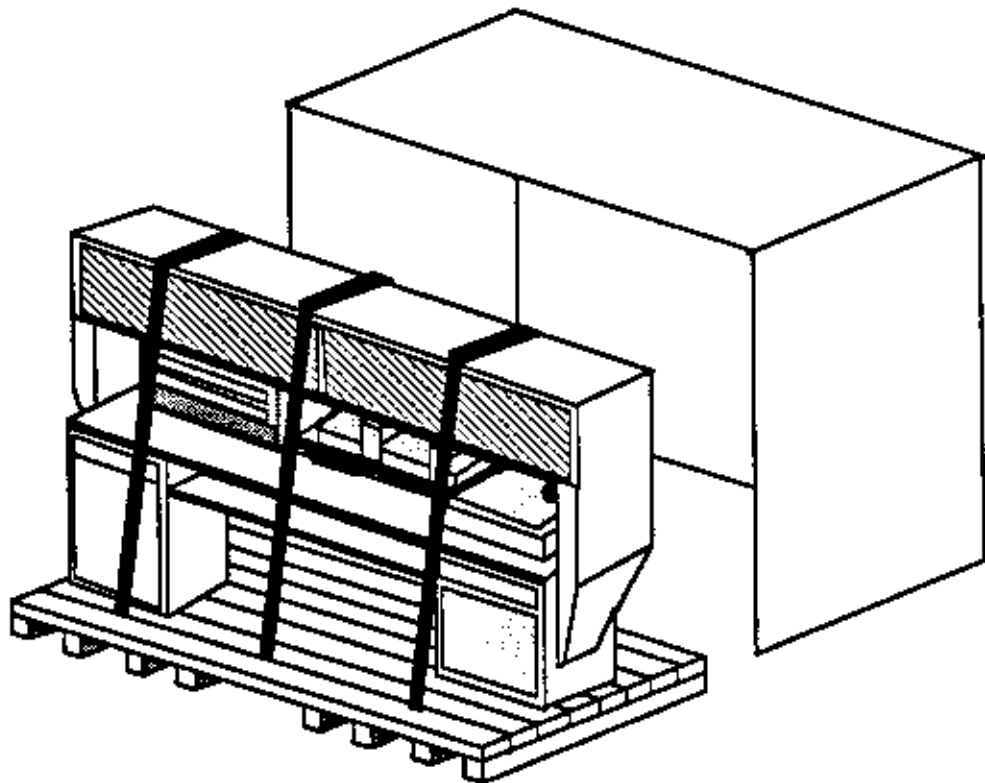
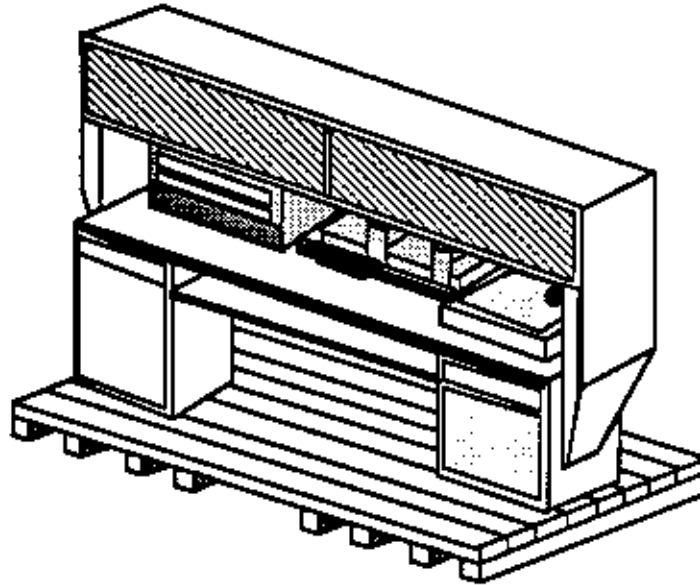


Figure 2-1B. Unpacking Sequence

5



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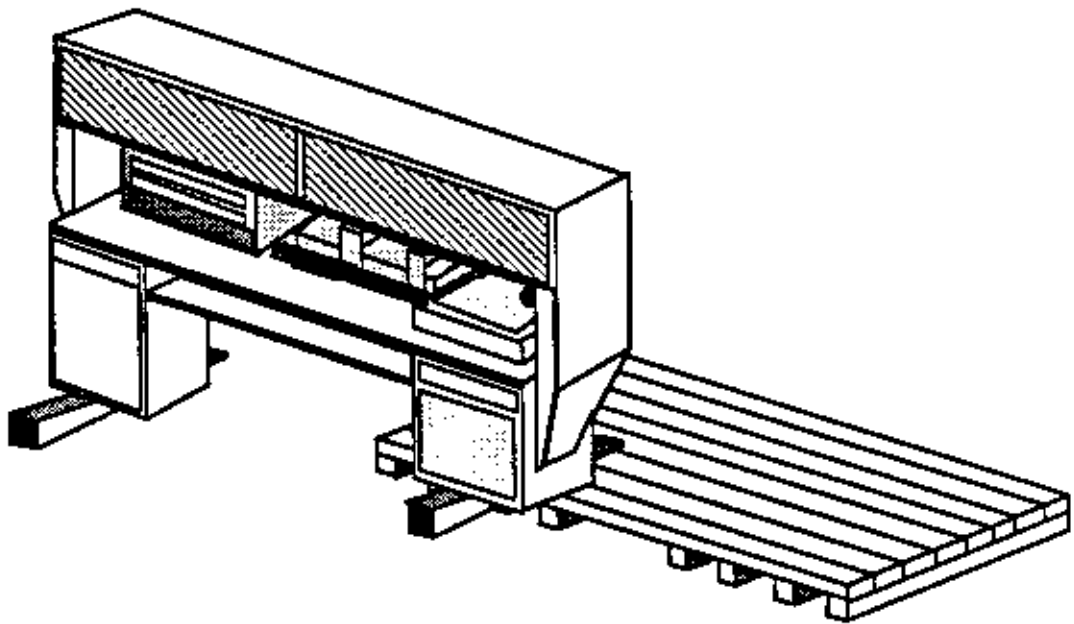
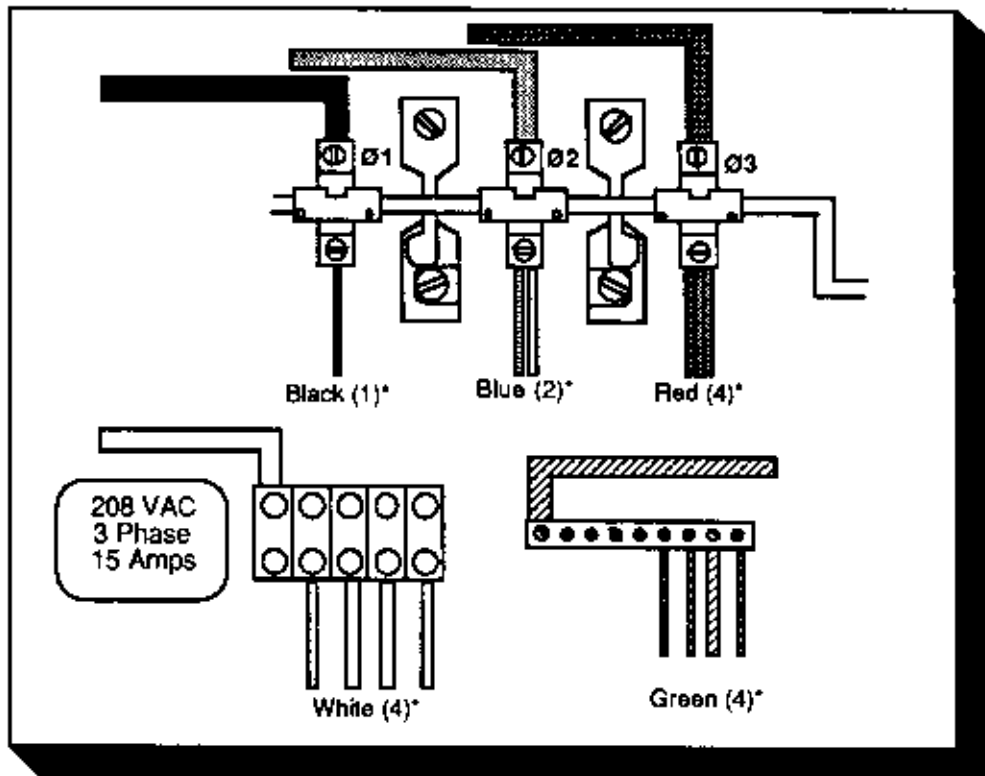


Figure 2-1C. Unpacking Sequence



*Wires supplied with system.

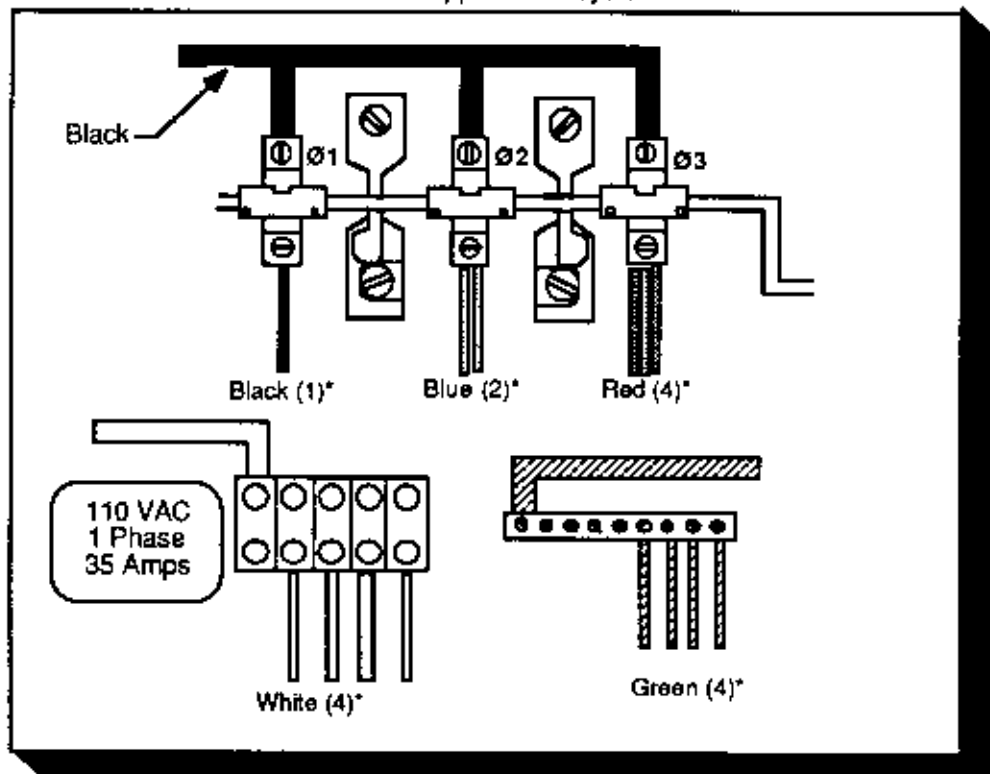


Figure 2-2. Wiring Diagram

2.5 REPACKING FOR SHIPMENT

If reshipment is required, the device should be repacked in the original packaging. If this is not available, pack the device using sufficient packing material and a wooden crate. If repacking for device repair is necessary, inform your local representative. Enclose a note with the device describing the malfunction, damage, etc. with your company name, address, and department.

Shipment(s) should be made to the Mesa Technology service department or supplier, as listed on the back cover of this manual.

2.6 SHIPPING INSTRUCTIONS

Before sending in an instrument for repair, please read the following instructions:

- Call one of our Customer Service Departments and request a Return Material (RMA) number. We will need the model number, serial number, the name and phone number of someone to contact concerning the repair, and the reason for repair.
- Please include a packing list describing the problems in detail. Include the name and phone number of the user.
- Reference the RMA number on all documents and on the outside of the shipping container.
- Package the instrument in the opposite order of the instructions given in 2-2 above and shown in Figure 2-1. Package it securely to prevent any damage during shipping.
- Ship the unit prepaid to the closest authorized Mesa Technology service center. In the event that an instrument has been damaged in shipping, a damage report will be made at Mesa Technology and a copy will be forwarded to you. Mesa Technology is not responsible for any damage incurred in shipping, and claims should be settled directly between the customer and the freight carrier. Before repair work can begin, a verbal P.O. is required with a hard copy to follow.

See the Warranty for additional details, and please call us at the factory if you have any questions.

SECTION 3**FUNCTIONAL DESCRIPTION****3.1 GENERAL**

This section provides a functional description of the Mesa-Pak Encapsulating System. The system feeds die tape, which has its protective spacing interleaf removed, to a downset mechanism. Optionally, the tape may be precleaned prior to loading to the downset. Once the die is set, encapsulating material is automatically dispensed according to patterns preprogrammed by the user. The tape then enters an oven for preliminary curing. A reel with interleaf tape then pays out to the takeup reel, which combines the interleaf with the processed tape from the oven to complete the process.

3.2 OVERALL HARDWARE FUNCTION DIAGRAM

Refer to Figure 3-1 for details in the following discussion. Numbers in the diagram correspond to the bold outlined numbers in the text of this section.

3.2.1 Throughput Mechanisms

The throughput mechanisms consists of the Feed Reel, 1, Interleaf Take-Up, 2, Preclean Tank, 3, Down-Set, 5, Dispense, 6, Take-Up Reel, 12, and the Interleaf Feed Reel, 13. The Feed Reel stores tape of various types and sizes and dispenses it to the system. The Interleaf Take-Up Reel strips the interleaf tape from the feed reel. The Preclean Tank is a 2-stage vapor phase liquid/vapor container, typically filled with Freon. A Loading Elevator with a threading mechanism lowers the tape, and raises it from the Preclean Tank. A Down-Set mechanism ensures that the proper amount of downset and position of die is maintained for dispensing. After the tape is processed through the system, interleaf tape is again added from the Interleaf Feed Reel, and then stored on the Take-Up Reel.

3.2.2 Operator Interfaces

Operator interfaces include the Operator Display/Control, 7, and the Inspection Stations, 4, 9, and 10. The Operator Display/Control is used to program and monitor the system dispensing configuration, alarms, the modes of operation, and provide unit counter displays. The Inspection Station, 4, is moveable, and is used to verify the flow and correct bonding of the dispensed material. A Three-Chamber Curing Oven, 8, features separate temperature meters and controls used to set and monitor temperatures within each chamber. Once the tape has received dispensed material, the optional microscope, 10, can be used to verify the correct placement of the encapsulant after it has been cured. An electronic thickness gauge, 9, is used to verify the overall thickness of the die and components.

3.2.3 System Control

System control is accomplished through the Control Console, 11, which houses circuitry for the stepper motors of the Down Set, 5, drive mechanism, and Dispenser, 6. The Control Console also houses the CPU for the Operator Display/Control.

SECTION 4

CONTROLS AND DISPLAYS

4.1 GENERAL

In this section, the location and function of all controls, indicators, displays, and menus, are shown. Note that this section does not provide information on theory or operation of the elements identified. Please refer to Section 5- Operating Procedures, for details on operation.

4.2 CONTROLS AND INDICATORS

Refer to Figure 4-1 for an overall view of the Encapsulating System controls and indicators. See Table 4-1 for a description of items identified in Figure 4-1. This section covers all controls and indicators located on the Encapsulating System front panels. Figures 4-2 through 4-9 show the various controls and indicators. Tables 4-1 through 4-4 describe the elements shown in Figures 4-2 through 4-9.

4.3 MENUS AND DISPLAYS

The Encapsulating System displays are presented on a monochrome CRT screen. Refer to Figures 4-10 through 4-12 for examples of these displays. The function key assignments are located on the bottom portion of each display, with the function of keys F2 through F10 varying, depending on the display selected. See Section 5 of this manual for a detailed description of menu functions.

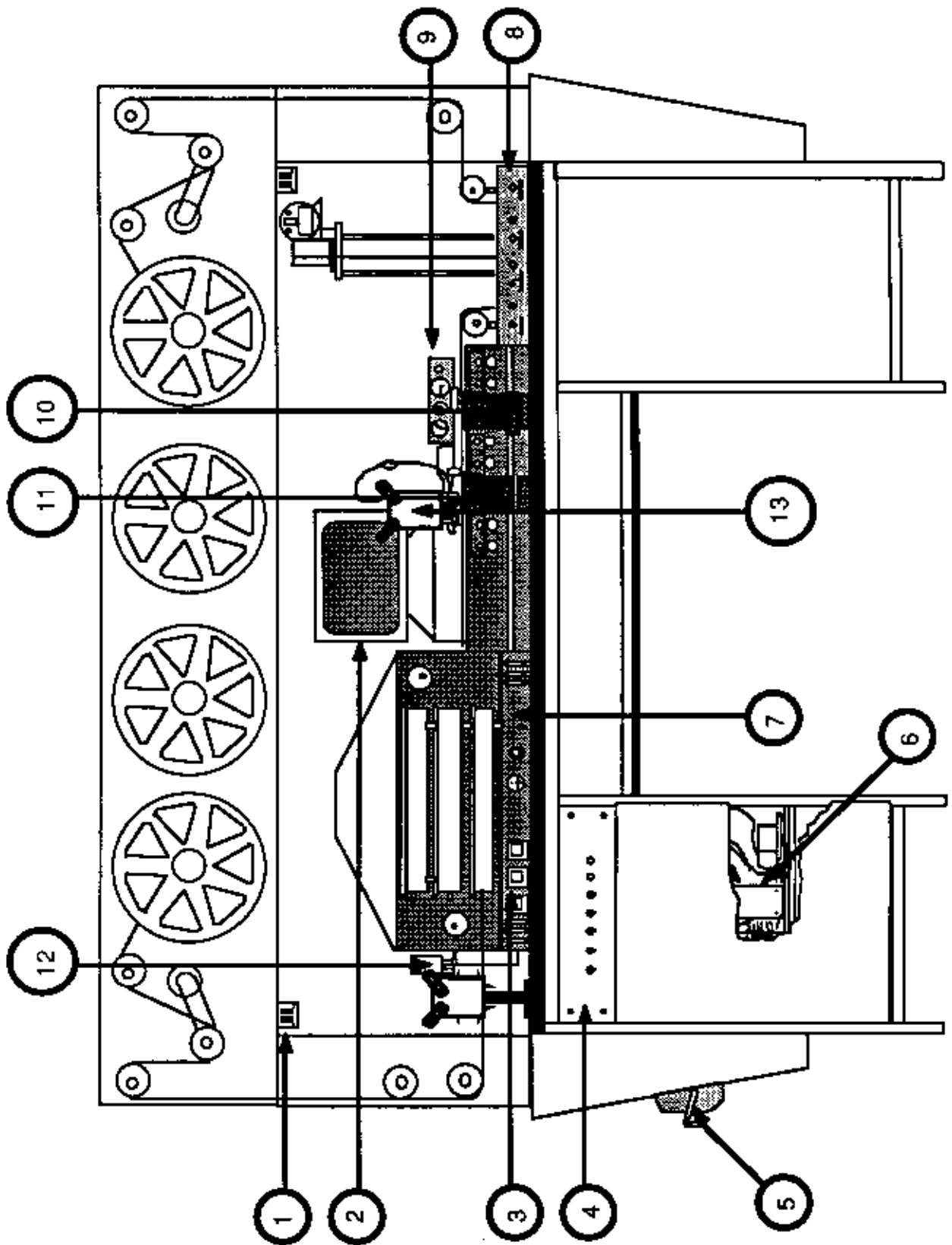


Figure 4-1. Mesa-Pak Encapsulating System Overall View

TABLE 4-1. SYSTEM ELEMENTS	
LOC COR	DESCRIPTION
1	Reel controls. See Figure 4-2.
2	Monochrome CRT monitor.
3	Oven temperature indicators. See Figure 4-3.
4	System control panel. See Figure 4-4 and Table 4-2.
5	Main power circuit breaker.
6	System reset switch (behind panel).
7	Oven control panel. See Figure 4-5.
8	Ultrasonic vapor degreaser control panel. See Figure 4-6 and Table 4-3.
9	Air control box. See Figure 4-7 and Table 4-4.
10	Downset station. See Figure 4-8.
11	Dispense station. See Figure 4-9.
12	Digital thickness gauge.
13	Main inspection microscope.

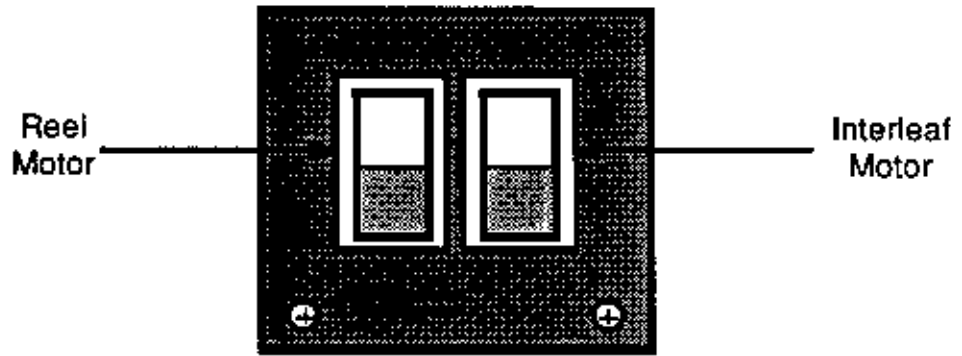


Figure 4-2. Reel Controls

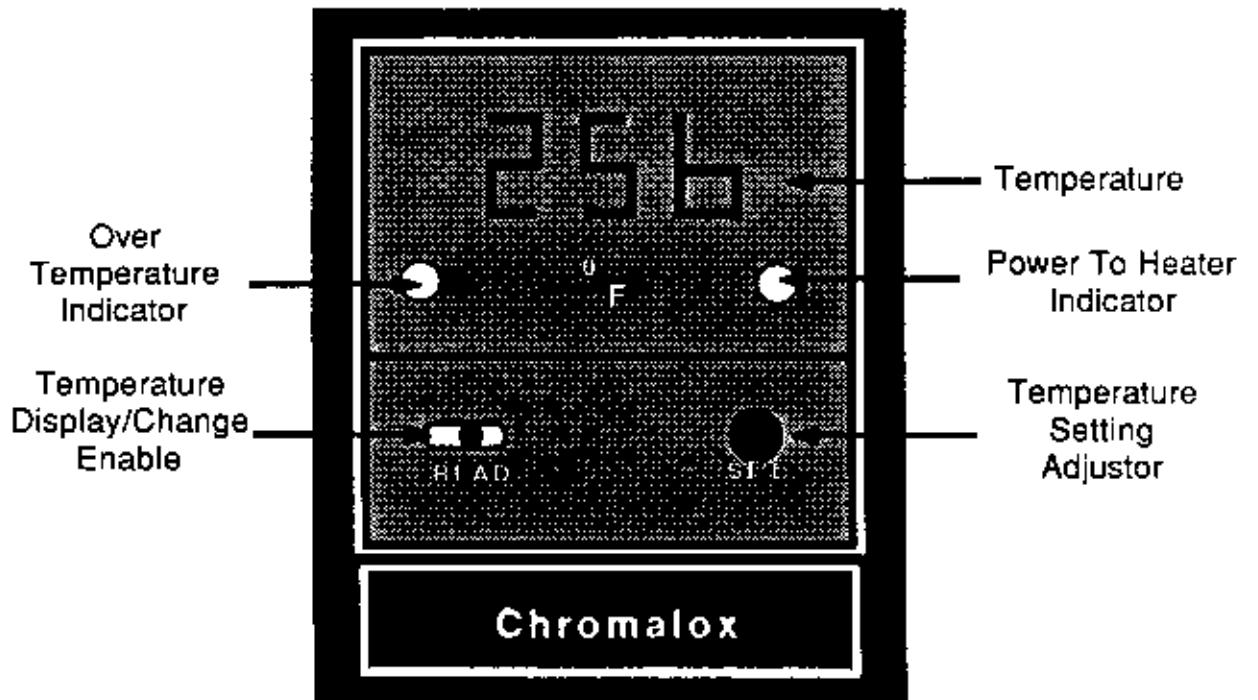


Figure 4-3. Oven Temperature Indicator

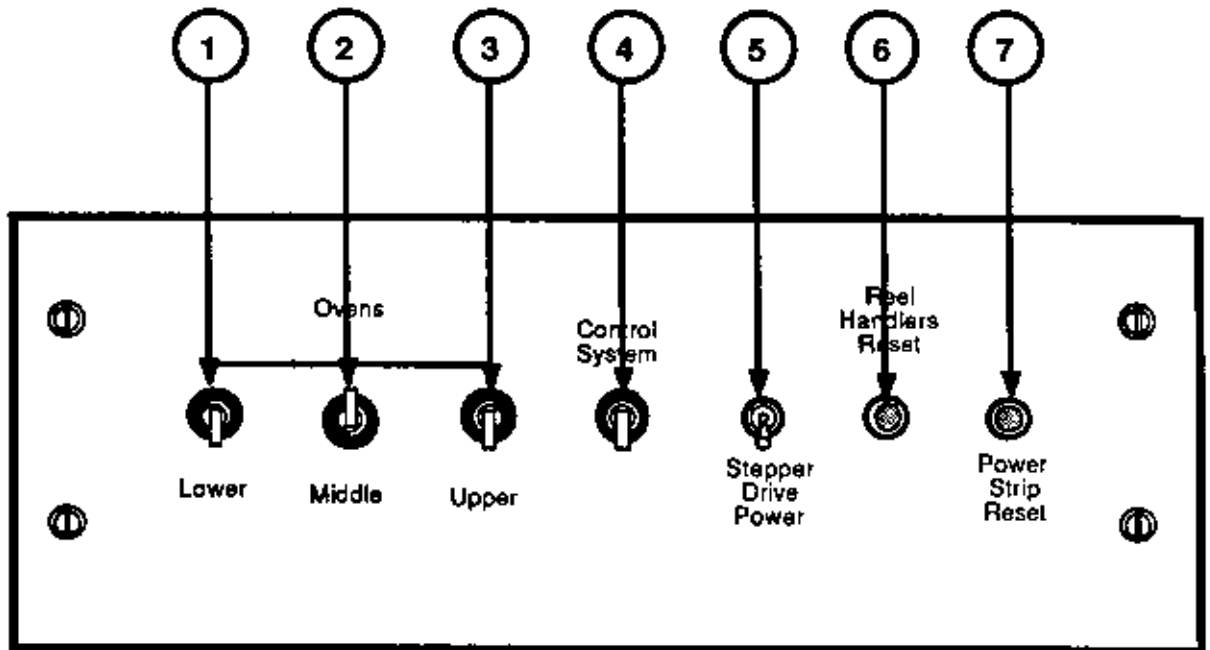


Figure 4-4. System Control Panel

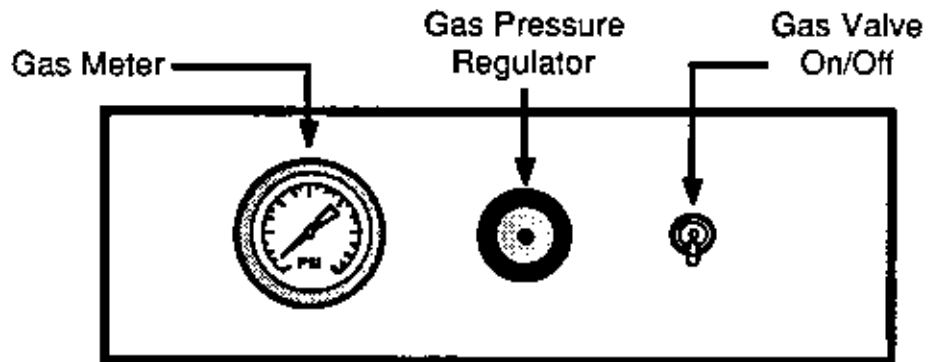


Figure 4-5. Oven Air/Gas Control Panel

TABLE 4-2. SYSTEM CONTROL PANEL	
LOC COR	DESCRIPTION
1	Lower oven power switch.
2	Middle oven power switch.
3	Upper oven power switch.
4	Control logic power switch.
5	Stepper drive power toggle switch.
6	Reel handlers reset button.
7	Power strip reset button.

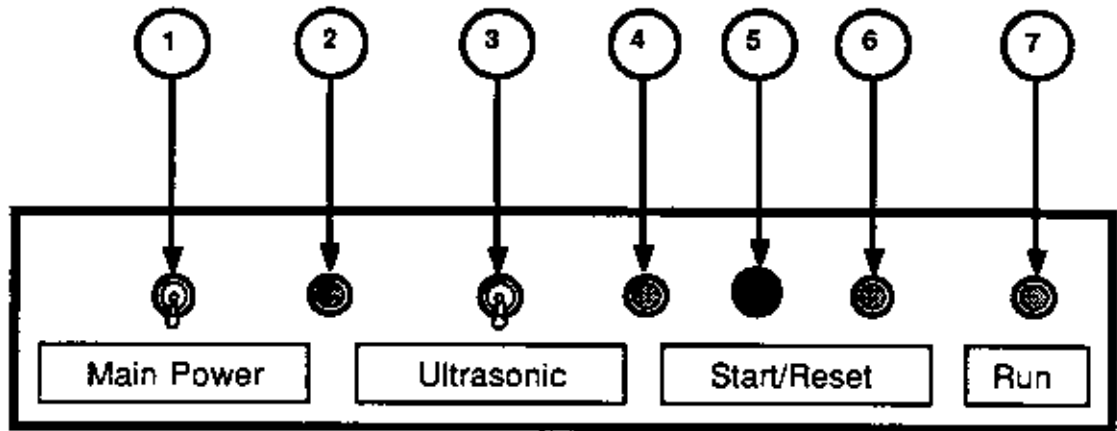


Figure 4-6. Ultrasonic Vapor Degreaser Control Panel

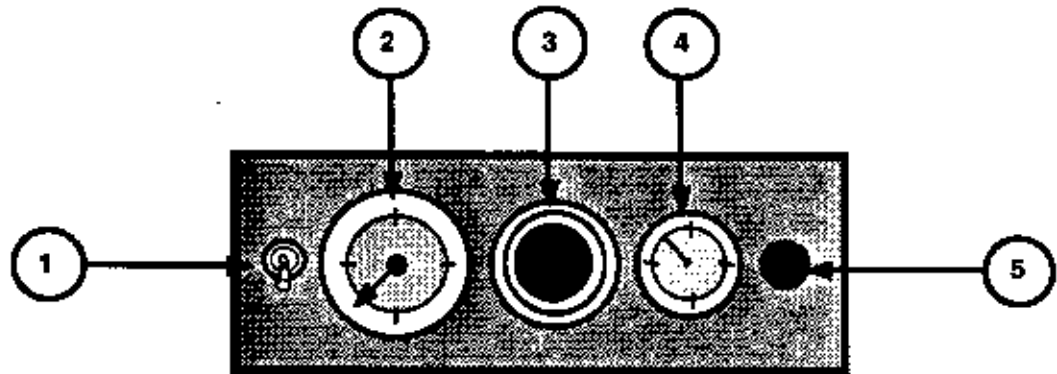


Figure 4-7. Air Control Box

TABLE 4-3. DEGREASER CONTROL PANEL	
LOC COR	DESCRIPTION
1	Main power on/off toggle switch.
2	Main power on indicator lamp.
3	Ultrasonic power on/off toggle switch.
4	Ultrasonic power on indicator lamp.
5	Start/Reset button, when main power is on.
6	Start/Reset indicator lamp.
7	Run indicator lamp.

TABLE 4-4. AIR CONTROL BOX	
LOC COR	DESCRIPTION
1	Air control box power on/off toggle switch.
2	Dispense valve air pressure gauge. Should be set at 90 PSI for normal operations.
3	Main system operating control knob.
4	Dispense pressure gauge.
5	Dispense pressure control knob.

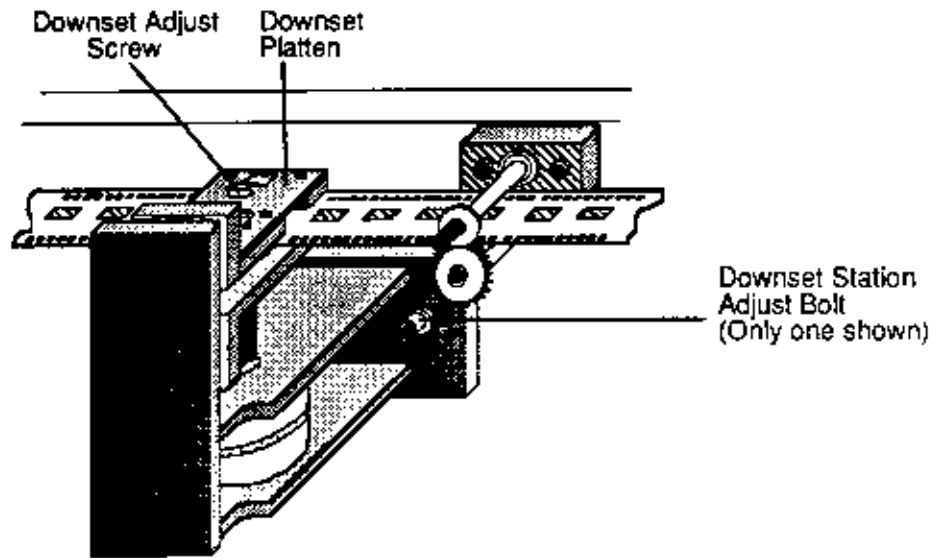


Figure 4-8. Downset Station

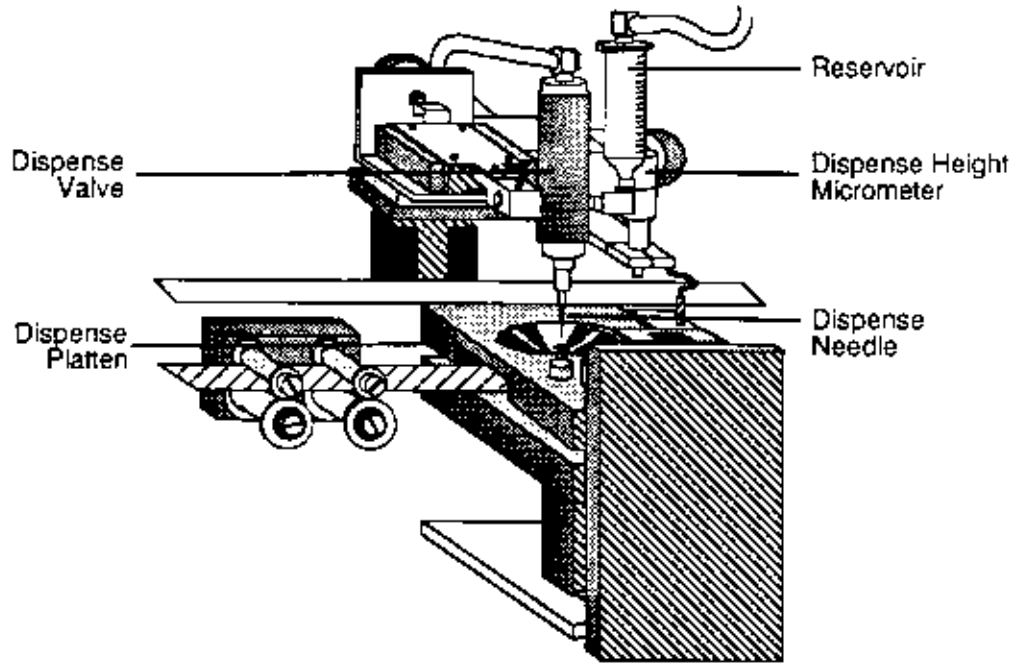
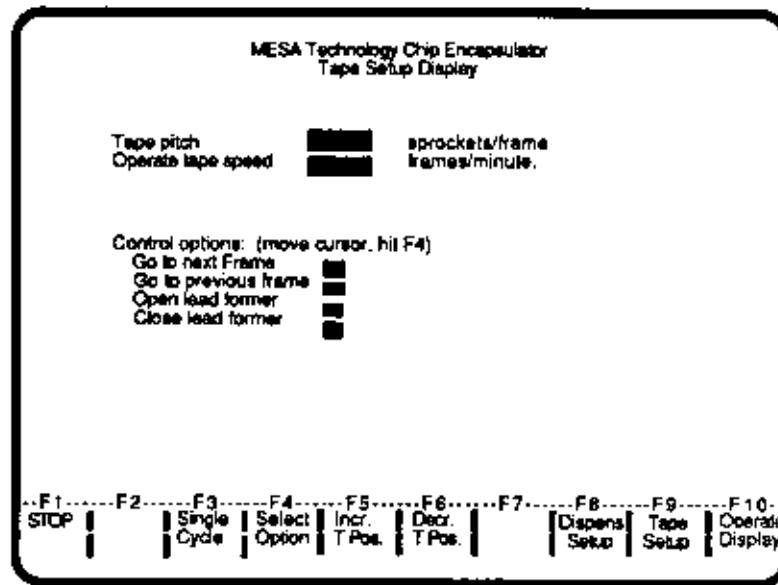


Figure 4-9. Dispense Station



(Default Menu At Power Up)

Figure 4-10. Tape Display

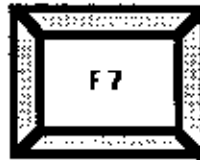
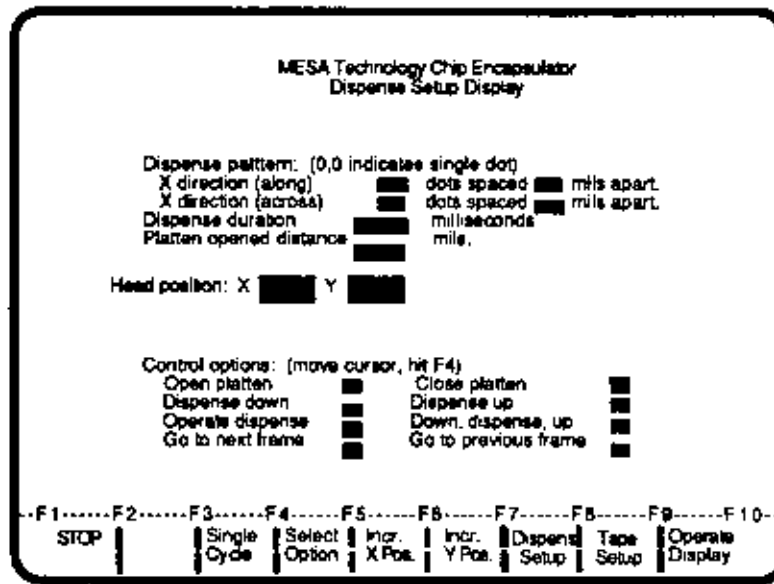


Figure 4-11. Dispense Display

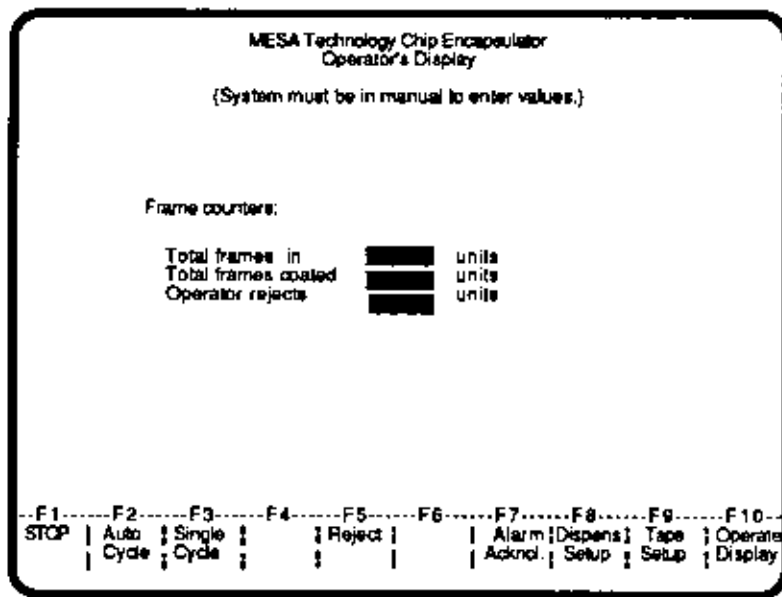


Figure 4-12. Operate Display

SECTION 5

OPERATING PROCEDURES

5.1 GENERAL

Operating instructions for the Mesa-Pak Encapsulating System are presented in this section. Note that there are no details concerning encapsulant patterns and curing oven settings. These factors will vary, depending on the substrate or die type used. It is recommended that qualified engineering or chemical personnel determine the initial setup parameters (tape speed, dispensing patterns, oven curing temperature, etc.) for new or previously unused materials.

Since operation of the Mesa-Pak Encapsulating System is automatic after the initial setup, this section provides information on how to operate the system controls and displays. This section is divided into three parts: operator interfaces, system initialization and setup, and scheduled maintenance procedures.

5.2 OPERATOR INTERFACES

The operator console, which consists of a terminal and CRT display, is the primary means of user interface to the Mesa-Pak Encapsulating System. Once the system is properly threaded, and all die-related processes are programmed, the operator console can be used to manually operate the system. It can also be used to issue alarms when user-determined parameter limits are met.

5.2.1 How To Use Function Keys

The function keys are labelled F1 through F10, and are arranged in a row on the top portion of the keyboard. These function keys are used for both changing the CRT from one display/menu to another and for executing certain commands within a selected display.

5.2.2 How To Enter Parameters

Parameters are expressed either as numbers to be entered into inverse video fields labelled in the displays, or as simple descriptive commands. Directional keys on the keyboard are used to place the blinking cursor in the field to be changed.

5.2.2.1. Numerical Values. To change numerical values in any field do the following:

- Use the directional keys to position the cursor over the field to be changed.
- Enter the value desired.
- Press the "ENTER" key (or "RETURN").
- The new parameter value is displayed in place of the old one.
- Incorrectly entered numbers may be erased by pressing the "RUBOUT" key.

5.2.2.2. Commands. Some displays present a list of commands that are presented to the user as fields that are toggled on and off. To select any of these commands, do the following:

- Use the directional keys to position the cursor over the field to be changed.
- Press the function key assigned as "SELECT OPTION" in the display.
- The command is executed.

5.2.3 How To Thread The Mesa-Pak Encapsulating System

Tape is thread through the system as shown in Figure 5-1. Threading order is from the payout reel to the tensioning arm, into the vapor degreaser (# used), past the downset and dispense stations, into the curing oven, to the takeup reel tensioning, and then finally onto the takeup reel. When tape requiring different setup parameters is to be encapsulated, leader tape threaded from the takeup reel through the oven may be used during the initial calibration phase.

5.3 SYSTEM INITIALIZATION AND SETUP

If the system has not been operated before, refer to Section 2 - Unpacking and Installation, of this manual for detailed information regarding installation and wiring procedures. System initialization consists of the following actions to be done in this order:

- Turn-On/Check-Out
- Tape Setup
- Dispense Setup
- Operation Parameters Setup

5.3.1 Turn-On/Check-Out

Before normal operation, perform the following procedures:

1. Verify that installation procedures have been correctly followed.
2. Set the Main Power Circuit Breaker to the ON position (up).
3. Set the following System Control Panel switches ON to the up position:
 - CONTROL SYSTEM
 - STEPPER DRIVE POWER
 - OVENS (Select the appropriate oven desired - Lower, Middle, or Upper)
4. Check the presence of low voltage power by verifying the operation of the following system elements:
 - Operator Control Console CRT showing the "Tape Setup Display".
 - Reel Controls Power Switch/Indicators.
 - Oven Temperature Indicators (for ovens selected).
- 5. If the Vapor Degreaser is to be used, set the following switches up on its control panel:
 - MAIN POWER. Verify that the indicator lamp is LIT.
 - ULTRASONIC. Verify that the indicator lamp is LIT.

* See the Instruction Manual for details on the Ultrasonic Cleaning Console.

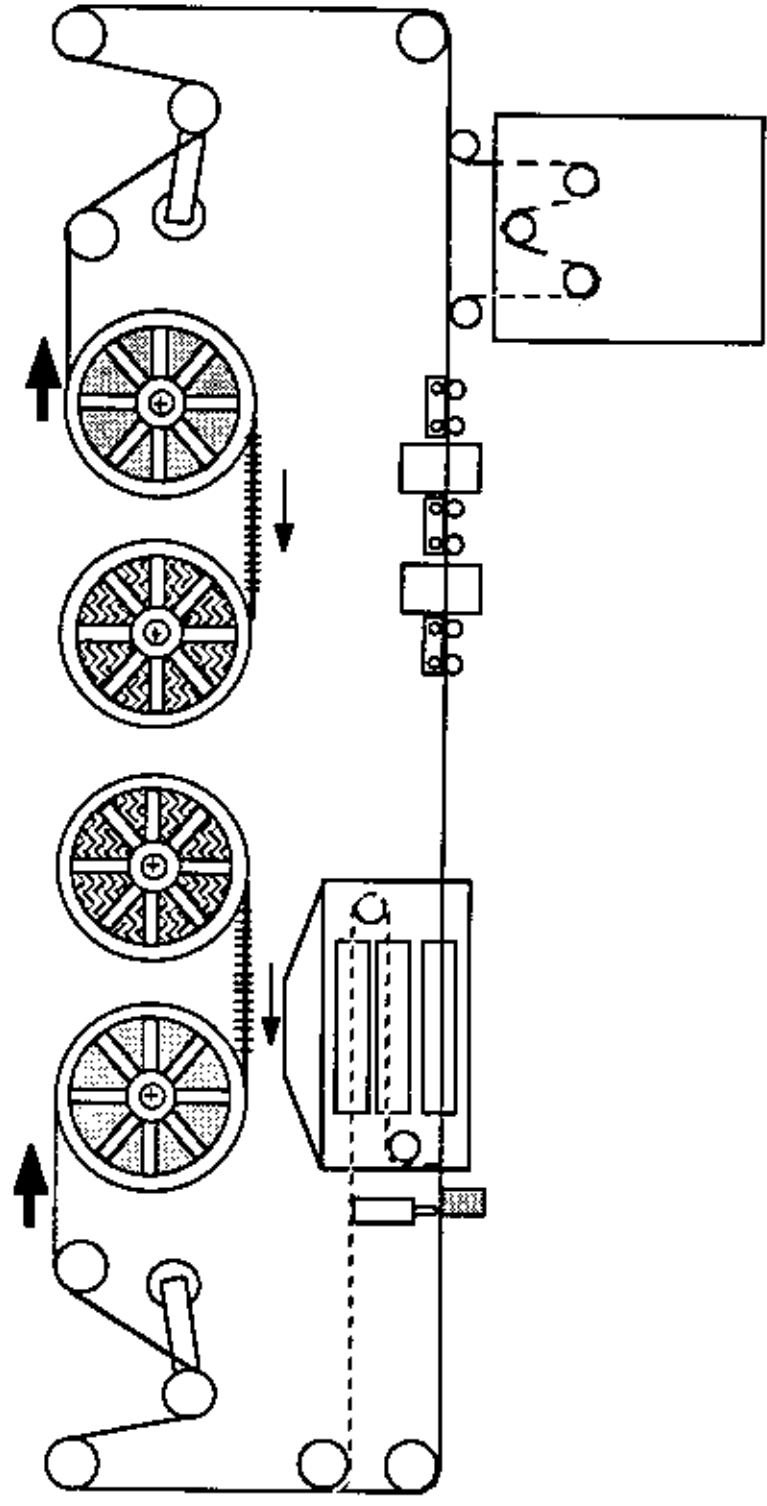


Figure 5-1. Tape Threading Diagram

5.3.2 Tape Setup

The tape setup procedures ensure that the tape passes through the system at a desired speed, that the correct amount of downset is applied to the die, and that the amount of time each encapsulated die spends in the curing oven is correct. Before beginning the tape setup procedures, make certain that tape is properly threaded through the Mesa-Pak Encapsulating System, as described in paragraph 5.2.3 above. The default display shown at initial power up of the system is always the "Tape Setup Display". This display, and the commands it provides, is used when a new tape must be calibrated to the system. Bold outlined numbers in the text correspond to the figures referenced in the following section. See Figure 5-2 for an illustration of the "Tape Setup Display". Table 5-1 describes the function of the display elements shown in Figure 5-2. To setup the tape perform the following steps:

1. Enter the number of sprockets per frame (tape pitch) in the corresponding field of the "Tape Setup Display". See Figure 5-2, item 1.
2. Enter the operational tape speed, in frames per minute, in the corresponding field of the "Tape Setup Display". See Figure 5-2, item 2.
3. Open the downset platten (if not already open) by selecting the "Open Lead Former" command in the "Tape Setup Display". See Figure 5-2, item 5.
4. Loosen the two Downset Station adjust bolts shown in Figure 5-3, item 1. Do not yet move the station.
5. Turn off the "Stepper Drive Power" switch and turn the tape positioning dial shown in Figure 5-3, item 2 until a die comes under the dispense platten. Turn on the "Stepper Drive Power" switch.
6. Move the downset station so that the die is under the center of the die set jaw. Tighten the downset station adjust bolts.
7. Close the downset platten by selecting the "Close Lead Former" command in the "Tape Setup Display". See Figure 5-2, item 5.
8. Set the proper amount of lead downset with the downset adjust screw shown in Figure 5-3, item 3. Also refer to Figure 1-2 for proper downset view.
9. Verify the downset by executing the "Open Lead Former" command in the "Tape Setup Display" (Figure 5-2, item 5) and then executing the "Go to next frame" command, item 3. This action will open the platten and advance the tape forward one position so that the lead-formed die can be inspected.
10. If the downset is not satisfactory, execute the "Go to previous frame" command in the "Tape Setup Display", item 4, and repeat steps 7 through 9 above. Or close the platten and repeat steps 3 through 9 again.

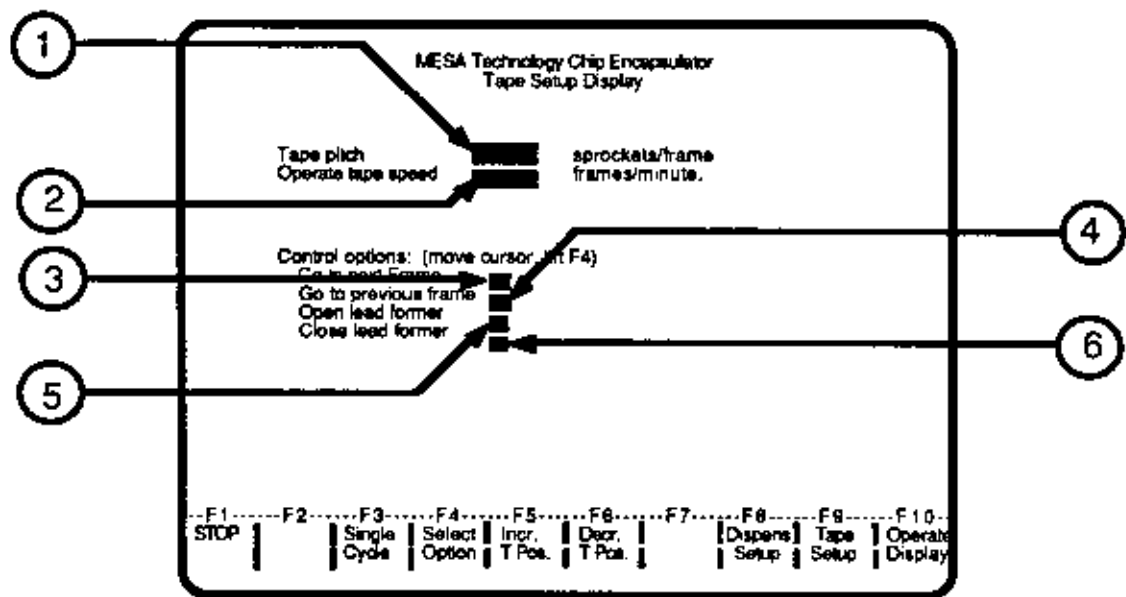


Figure 5-2. Tape Setup Display

TABLE 5-1. TAPE SETUP DISPLAY ELEMENTS	
LOC COR	DESCRIPTION
1	Field used to enter the number of sprockets per frame.
2	Field used to enter speed of tape to be processed through the system.
3	Advances tape by one frame.
4	Moves the tape back one frame.
5	Opens the downset station platten.
6	Closes the downset station platten.

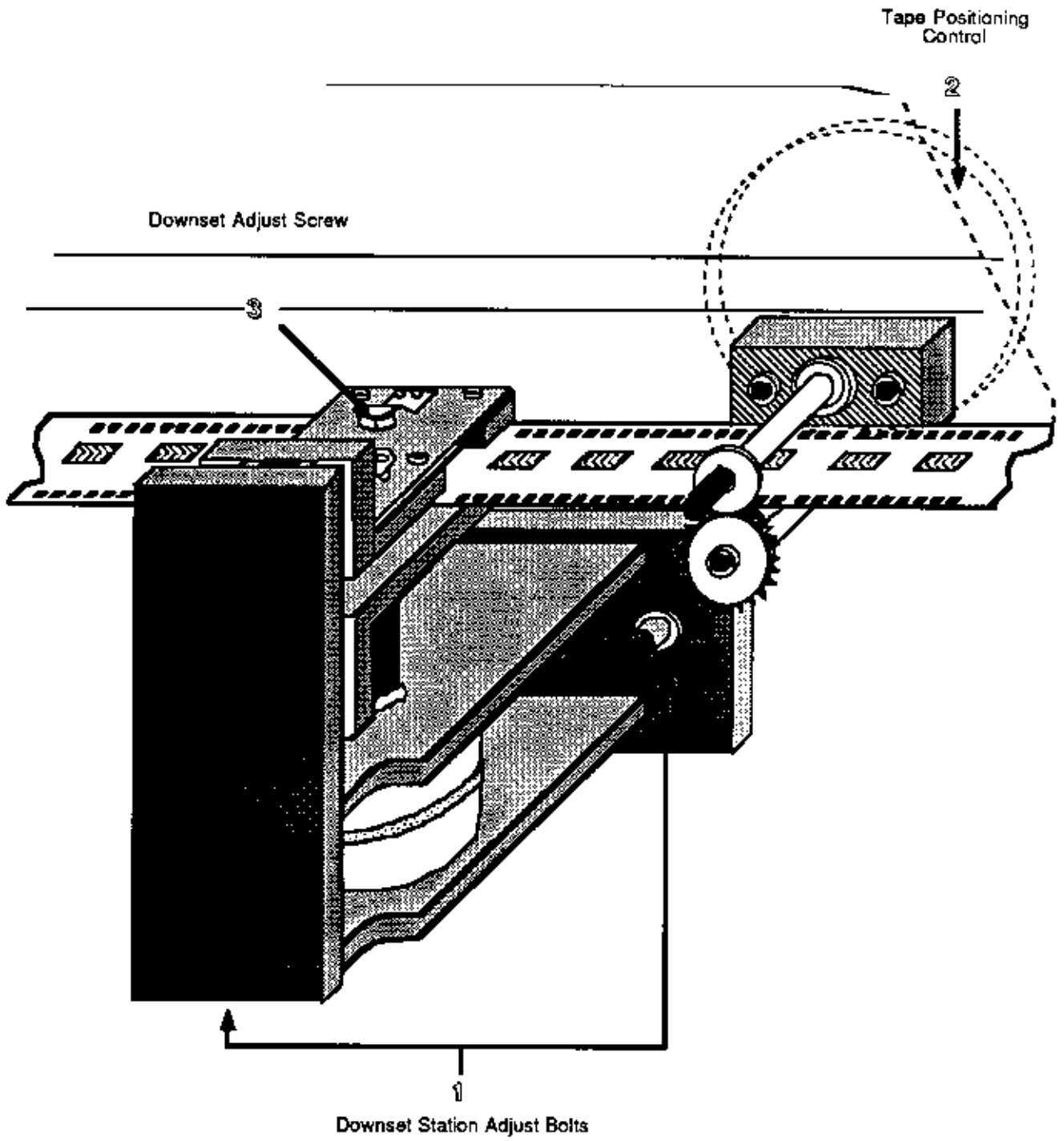


Figure 5-3. Downset Station Positions

5.3.3 Dispense Setup

The dispense setup procedures provide control over the amount, duration, and pattern of dispensed encapsulant on the die. Three parameters determine the amount of encapsulant that will be placed on the die:

- How long the valve is open
- Air pressure on top of the encapsulant
- Size of the needle used

These parameters must be known, and recorded, before normal operation. Again, an engineer or chemist should generally be responsible for determining these variables. Because movement of the dispense needle is controllable to 1/1000ths of an inch, manual control of such tolerances is impossible. The "Dispense Setup Display" provides the means of controlling dispense parameters. Figure 5-4 shows the "Dispense Setup Display" and Table 5-2 describes the display elements. Bold outlined numbers in the following text correspond to the figures referenced in this section.

5.3.3.1 Dispense Pattern. The pattern to be dispensed is obviously dependent upon the size of the die and the characteristics of the encapsulant used (viscosity, etc.). For small dies one "dot" may be sufficient. Larger dies may require many individual applications of encapsulant. A good general rule of thumb is that the total pattern size should not exceed 1/2 the size of the die itself.

5.3.3.2 Dispense Setup Procedure. Once the correct pattern to be used, the size of needle, the type of encapsulant, and the proper amount of downset, have all been determined, the dispensing cycle must be programmed. An entire dispense "cycle" is comprised of the following actions:

- Close platten
- Lower dispense head
- Dispense material
- Raise dispense head
- Open platten
- Move tape

See Figure 5-5 for a detailed illustration of the dispense station elements. Notice the directional elements, and their corresponding controls in the display. A microscope is needed to perform the dispense setup procedures. To program the dispense function, perform the following procedure:

1. Press "F7" to show the "Dispense Setup Display".
2. Move the die to a position immediately under the dispense platten.
3. Close the platten by selecting the "Close platten" command in the "Dispense Platten Display". See Figure 5-4, item 13.
4. Execute the "Dispense down" command in the "Dispense Platten Display". See Figure 5-4, item 10.

TABLE 5-2. Dispense Setup Display Elements

LOC COR	DESCRIPTION
1	Field used to enter position in "X" axis along the direction of tape travel.
2	Associated with item no. 1. Used to enter the amount of space between dispense points.
3	Field used to enter position in "Y" axis (across the tape).
4	Associated with item no. 3. Used to enter the amount of space between dispense points.
5	Provides control over the amount of time each dispense action occurs.
6	Provides control over the height, in steps, the Dispense Platten will open.
7	Field used to enter the desired change in position of the dispense head in the "X" axis.
8	Field used to enter the desired change in position of the dispense head in the "Y" axis.
9	Command causes the dispense platten to open the amount of space programmed in item 6, above.
10	Command causes the dispense needle to lower.
11	Command causes the dispense valve to open the amount of time programmed in item 5.
12	Command which advances the tape one frame forward.
13	Command causes dispense platten to close on die.
14	Commands the dispense head to rise.
15	Commands the system to lower the dispense head, dispense material, and then raise the head again.
16	Command causes tape to back up one frame.