

Thermal Press User's Manual

DUKANE Part No. 403-550-01

04
05
06
07
08
09
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25



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ISO 9001:2000 Dukane products are manufactured in ISO registered facilities



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Thermal Press Manual Revision History

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-00	Thermal Press Manual – Original release	2003–Dec–05
-01	Update Table 10—I with revised connector pinouts Add Figure 10–3, Schematic for Operate Switches. Reference Figure 10–3 in Appendix A for Automation Signals Kit. Renummer Figures 10–3 thru 10–6 to 10–4 thru 10–7. Add cable part numbers for Automation Signals Kit. Remove text referencing signal timing information (not relevant). Update 24–Hour Emergency Service telephone number. New consolidated warranty.	2005–Jan–14

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TABLE OF CONTENTS

Section 1 – Introduction.....	1
Important User Information	3
Read This Manual First	3
Notes and Tips.....	3
Cautions and Warnings	3
Drawings and Tables	3
Manual Organization	4
Thermal Press Key Features	6
Section 2 – Safety Considerations	7
Health and Safety Tips.....	9
Plastics Health Notice	10
Electrical Safety.....	10
AC Power Ground	10
AC Power Receptacles	10
Grounding Lug	11
Mechanical Safety.....	11
Probe Heaters.....	11
Polycarbonate Guard	11
Pneumatic Safety	11
Section 3 – Unpacking and Setup.....	13
Shipping Contents	15
Press Placement.....	15
Lifting the Press	15
Bench Capacity	15
Leveling The Press	16
Heater Connectors	16
Activation Switches.....	17
Press Setup	18
Cable Connections	18
AC Power	18
Air Connection	20
Section 4 – Thermal Press Overview	21
Normal Cycle	23
Operate Switches Activated	23
Fixture Clamp Activated	23
Slide Table Retracts (Opt)	23
Platen Lowers	24
Trigger Switch Activated	24
Preheat Timer Activated	24
Mechanical Stop Contacted	24

Post Cool Valve Energized	24
Platen Retracts	25
Slide Table Extends (Opt)	25
Fixture Clamp Released	25
Temperature Zones	26
The Zone Concept	26
Heater and Zone Limits	26
Basic Press Operation	27
Starting a Weld Cycle	27
Turn AC Power ON	27
Release Pneumatic Lockout Device	27
Select heater Zones	27
Set Mechanical Stop & Dwell Time	27
Activate Both Operate Switches	27
Stopping a Weld Cycle	27
Section 5 – Controls and Displays	29
Major Controls	31
Power	31
AC Power Switch	31
Power Indicator	31
Temperature Controller	32
Temperature Display	32
Control Keys	32
Controller Indicator Lights	32
Touch Screen Display	32
Abort Switch	33
Main Abort Switch	33
Auxiliary Abort Switch	33
Operate Switches	33
Pneumatic Controls	33
Air Pressure Regulator	33
Regulator Gauge	34
Position and Speed	35
Mechanical Bottom Stop	35
Stroke Position Indicator	36
Hydraulic Speed Control	36
Hydraulic Speed Control	36
Slow Speed Adjustment	36
Slow Speed Indicator	36
Trigger Position Adjustment	37
Trigger Position Indicator	37
Trigger Indicator Light	37
Section 6 – Touch Screen Menus	39
Main Menu	41
POST COOL OFF	41

INSERT PREHEAT	41
SETUP Mode	42
CYCLE COUNT	43
DWELL TIMER	43
POST COOL TIMER	44
PREHEAT TIMER	44
TEMP ZONES PAGE	44
Warning Screens	45
TEMP ZONE Fault	45
Abort Mode Fault	45
Startup Fault	46
Section 7 – Temperature Controller	47
Controller Functions	49
Set Point	49
Temperature Units °C/°F	49
Software Menu	50
Thermocouple Type	51
Auto Tune	52
PID Control Theory	52
Thermal System Model	52
Feedback Control	53
PID Fundamentals	53
Proportional Controller	53
Derivative Controller	54
Integral Controller	54
PID Algorithm	54
PID Tuning	56
Derivative Action Differences	56
Integral Windup	56
Watlow Tuning Procedure	56
Williams Method	57
Modified CDHW Method	57
Zeigler–Nichols Based Method	58
Section 8 – Heaters and Thermal Probes	59
Heaters	61
350W 12mm Heaters	61
Cartridge Heaters	61
Thermocouples	62
Principles of Operation	62
J–Type Thermocouples	62
Thermal Probes	63
MATP™ Probes	63
Standard Probes	64
Titanium Probe Tips	64

Section 9 – Master/Slave Modules	65
Master Module	67
Power Limitations	67
Line Voltage	67
Rear Connectors	67
Installation	68
Slave Module	75
Power Limitations	75
Line Voltage	75
Rear Connectors	76
Installation	76
Section 10 – Press Connectors	77
Rear Press Connectors	79
Operate Switches connector	79
Fixture Clamp Connector	80
Post Cool Connector	80
Multipurpose Connector	81
Slide Kit Controller	82
Section 11 – Head Adjustment	83
Height Adjustment	85
Radial Adjustment	85
Section 12 – Process Operations	87
Inserting	89
Insertion Temperature	89
Insertion Dwell Time	90
Insertion Force	90
Insertion Down Speed	90
Insertion Post–Cool Time	91
Staking	91
Staking Dwell Time	91
Staking Force	92
Staking Post–Cool Time	92
Swaging	92
Swaging Temperature	92
Swaging Dwell Time	93
Swaging Force	93
Swaging Down Speed	93
Swaging Post–Cool Time	93
Degating	93
Marking and Embossing	94
Thermoplastic Selection	94
Plastics Health Notice	94
Material Factors	94

Section 13 – Troubleshooting	97
Temperature Controller	99
Error Messages	99
Blank Display	99
Thermal Press Faults	99
Touch Screen Saver	99
TEMP ZONE Fault	100
Abort Mode Fault	100
Startup Fault.....	100
Rear Connectors	101
+24V DC Output.....	101
Heaters	101
Heater Damage	101
Heater Calibration	101
Heater Runaway.....	101
Insertion Problems	102
Staking Problems	103
Section 14 – Maintenance	105
Touch Screen	107
Temperature Controller	107
Main Chassis	107
Probe & Heaters	107
Replacement Heaters.....	107
Compressed Air Filter	108
Section 15 – Contacting Dukane	109
Identify Equipment	111
Local Support	111
Main Office & Training Center	111
Department Phone Numbers	111
Department eMail Addresses.....	111
Internet Website	111
Support & Engineering eMail Addresses.....	112
Support & Engineering Phone Numbers	112
Warranty	113
Domestic	113
International	114
Tooling	114
Section 16 – Specifications	115
Regulatory Agency Compliance	117
CE Marking	117
Press Drawings and Dimensions.....	118
Approximate Weight	119

Operating Environment 119

Probe Drawings and Dimensions 120

 MATP™ Probe Drawing 120

 Standard Probe Drawing 120

AC Power Requirements 121

Interpreting the Model Number 121

Appendix A – Option Kits 123

Post Cool Kit 125

Linear In–Out Slide Kit 125

Left–Right Slide Kit 125

Rotary Slide Kit 126

Automation Signals Kit 126

Part–In–Place Sensing 127

Fixture Clamp Kit 127

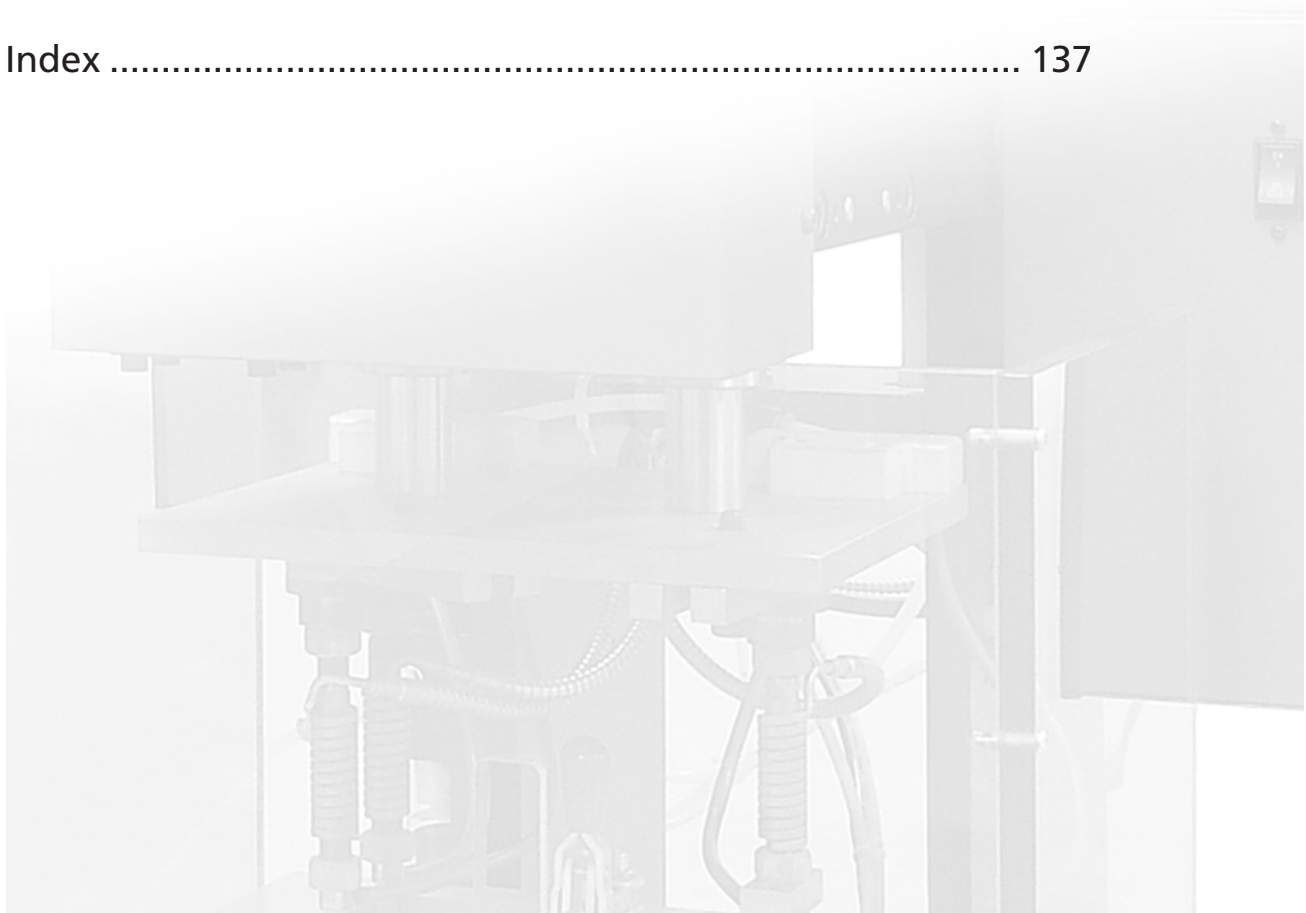
Modular Temperature Controller Unit 128

8–Module Custom Press 129

Appendix B – List of Figures 131

Appendix C – List of Tables 135

Index 137



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Introduction

- User Information
- Manual Organization
- Key Thermal Press Features

Important User Information	3
Read This Manual First	3
Notes and Tips	3
Caution and Warnings	3
Drawings and Tables	3
Manual Organization	4
Key Thermal Press Features	6

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Important User Information

Read This Manual First

Before operating the Thermal Press, read this User's Manual to become familiar with the system. This will ensure correct and safe operation. The manual is organized to allow you to learn how to safely operate a thermal press system. The examples given are chosen for their simplicity to illustrate basic setup procedures.

Notes and Tips

Throughout this manual we use NOTES to provide information that is important for the successful application and understanding of the product. A NOTE block is shown to the right.

Cautions and Warnings

In addition, we use special notices to make you aware of safety considerations. These are the CAUTION and WARNING blocks as shown here. They represent increasing levels of important information. These statements help you to identify and avoid hazards and recognize the consequences. One of three different symbols also accompany the CAUTION and WARNING blocks to indicate whether the notice pertains to a condition or practice, an electrical safety issue or a hand protection issue.

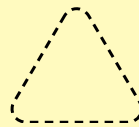
Drawings and Tables

The figures and tables are identified by the section number followed by a sequence number. The sequence number begins with one in each section. The figures and tables are numbered separately. The figures use arabic sequence numbers (e.g. -1, -2, -3) while the tables use roman sequence numerals (e.g. -I, -II, -III). As an example, Figure 3-2 would be the second illustration in section three while Table 3—II would be the second table in section three.

NOTE

Note statements provide additional information or highlight procedures.

CAUTION



Caution statements identify conditions or practices that could result in damage to the equipment or other property.

WARNING



Warning statements point out conditions or practices that could result in personal injury or loss of life.



Condition
or Practice



Electrical
Hazard



Heated
Surface

Manual Organization

- Section 1 – Introduction** covers the manual organization and the key features of the Dukane Series 48H Thermal Press
- Section 2 – Safety Considerations** discusses health, mechanical, electrical and pneumatic safety.
- Section 3 – Unpacking and Setup** provides information on Thermal Press lifting and placement, power, air and heater cable connections.
- Section 4 – Thermal Press Overview** describes the normal press operating cycle, heater zone concept and basic press operation.
- Section 5 – Controls & Displays** describes the function of the front panel controls, the touch screen display and the temperature controllers.
- Section 6 – Touch Screen Menu** gives a detailed description of the main, operational and alarm menus of the touch screen.
- Section 7 – Temperature Controller** gives a detailed description of the operating principles of a PID controller.
- Section 8 – Thermal Probes** describes heating coils, J-type thermocouples, MATP™ and standard thermal probes.
- Section 9 – Master/Slave Modules** describes how to install new modules to expand the number of heaters in a zone and or add new zones.
- Section 10 – Press Connectors** covers all the press connectors and describes the signals for standard cycle activation plus the option kits.

Section 11 – Head Adjustment describes how to adjust the height and radial position of the press head.

Section 12 – Process Operations describes the four main processes and what the important setup parameters are.

Section 13 – Troubleshooting provides helpful tips on solving the most common problems.

Section 14 – Maintenance provides a schedule of suggested preventive maintenance items.

Section 15 – Contacting Dukane provides information on obtaining support from the Dukane thermal press support team. It also contains the warranty information.

Section 16 – Specifications contains drawings with dimensions of the 48H Series Thermal Press, the operating environment specifications and AC power requirements.

Appendix A – Option Kits

Appendix B – List of Figures.

Appendix C – List of Tables.

Index

Key Features

- **Ultra Rigid H-frame** construction eliminates flexing and maintains alignment which reduces functional and cosmetic defects. Further, the head is infinitely adjustable 8.5 inches vertically and ± 10 degrees radially.
- **Setup Mode** allows you to jog the head down for fast and easy probe alignment.
- **Expandable Master/Slave Modules** means you only need to purchase the capability to meet your current requirements. You can add or expand zones later to meet changing requirements. The chassis contains an internal wiring harness with six sets of connectors. The master and slave modules are prewired and can be added in any order. No more knockout caps, or hand wiring cables to terminal strips.
- **Digital Temperature Control Regulation** for accurate and repeatable operation. Each heater zone can independently be set anywhere between 32°F and 1382°F (0° to 750°C) using Type-J thermocouples.
- **Digital Timer** for accurate and repeatable weld time, post cooling, and insert preheating. The timers cover from 0.0 to 999.9 seconds in 0.1 second increments.
- **Accepts Both Standard and MATP™ Probes** for maximum versatility. You can use your existing standard probes and install our MATP™ probes in critical adjustment areas.
- **Heater Zone Alarm** protects against reverse thermocouple connection, sensor mismatch, broken wires and other heater or controller problems.
- **Add On Rotary, Slide, Clamp and Post Cool Kits** enable you to expand the functionality of the Thermal Press at any time. The press is preprogrammed to recognize the option kits and enable their functionality as soon as they are installed.
- **ISO 9001 Certification** means that the Series 48H Thermal Press is manufactured to very high quality standards and assures you of Dukane's commitment to being a quality vendor and its goal of continuous improvement.

Safety Considerations

- General Safety Tips
- Plastics Health Notice
- Electrical Safety
- Mechanical Safety
- Pneumatic Safety

Health and Safety Tips	9
Plastics Health Notice	9
Electrical Safety	10
AC Power Ground	10
AC Power Receptacles.....	10
Grounding Lug	11
Mechanical Safety	11
Probe Heaters	11
Polycarbonate Guard	11
Pneumatic Safety	11

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Health and Safety Tips

Please observe these health and safety recommendations for safe, efficient, and injury-free operation of your equipment. In this manual, the term **press** refers to the complete group of components associated with the staking, swaging, degating or embossing of plastic parts, also known as a **thermal press system**. A typical system consists of a press and actuator, controls for the actuator, one or more thermal probes with heater and tip, probe temperature controller, connecting cables and start/stop switches,

Proper Installation - Operate system components only after they are properly installed and checked.

No Unauthorized Modifications - Do not modify your system in any way unless authorized to do so by Dukane Corporation. Unauthorized modifications may cause injury to the operator and/or equipment damage. In addition, unauthorized modifications will void the equipment warranty.

Keep the Cover On - Do not remove any equipment cover unless specifically directed to do so by Dukane Corporation. The heater modules produce high electrical voltages which could cause injury.

Grounded Electrical Power - Operate this equipment only with a properly grounded electrical connection. (See Electrical Safety Grounding Instructions on the next page.)

Comply with Regulations - You may be required to add accessories to bring the system into compliance with applicable OSHA regulations for machine guarding and noise exposure.



IMPORTANT

Never operate the Thermal Press with the heater control covers off. This is an unsafe practice and may cause injury.

Plastics Health Notice

Before using any Dukane welding system, be sure you are familiar with OSHA regulations from the U.S. Department of Labor about the particular type of plastic(s) you are using.

When plastic materials are being processed, they may emit fumes and/or gases that could be hazardous. Make sure you have adequate ventilation whenever these plastics are processed.

Electrical Safety


AC Power Ground

For safety, the power cords used on all Dukane products have a three-prong, grounding-type plug. The 20-Amp power cords used on the Thermal Press are shown in Figure 2-1. Do not cut off the power cord grounding prong, or alter the plug in any way. If an extension cord is needed, use a three-wire cord that is in good condition. The extension cord should have a 20 Amp rating to safely do the job. It must be plugged into a 20-Amp grounded receptacle. Do not use a two-wire extension cord with this product.

AC Power Receptacles

If you have a two-prong electrical receptacle, we strongly recommend that you replace it with a properly grounded three-prong type. If there is any question about the grounding of your receptacle, have it checked by a qualified electrician. See Figure 2-2 for examples of approved 20-Amp, 110V and 220V sockets.

CAUTION



If you have a two-prong electrical receptacle, we strongly recommend that you replace it with a properly grounded three-prong type. Have a qualified electrician replace it following the National Electric Code and any local codes and ordinances that apply. Refer to Figure 2-2.



Figure 2-1 20-Amp 110V and 220V Power Cords

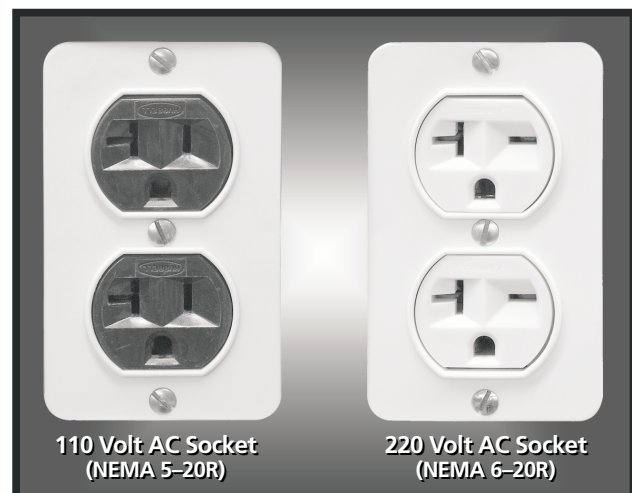


Figure 2-2 20-Amp 110V and 220V Receptacles

Grounding Lug

An electrical grounding stud is provided on the rear chassis above the AC power cord (see Figure 2–3). If you experience problems with electrical interference, attach a separate 14 AWG wire to an effectively grounded metal pipe. This will not compromise the electrical ground in the AC power cord and will minimize any external interference from leaking into the thermal press control circuitry.

Mechanical Safety

Probe Heaters

The thermal press uses heater coils which typically operate anywhere between 180°C (350°F) and 500°C (930°F). During operation, the heating coils, probes, platen and tooling get very hot and can cause severe burns if touched.

Polycarbonate Guard

Safety regulations require that this machine never be operated without point of operation guarding or two-hand tie down actuation or both. A polycarbonate guard is included with the machine for operator safety. A typical guard is shown in Figure 4–10. Machine operation is initiated by two hand actuation switches. These switches are shown in Figures 3–3, 4–10 and 5–1. Never operate this machine with any of the safety equipment disabled.

Pneumatic Safety

A safety isolation device is installed in series with the compressed air filter and is capable of isolating the compressed air supply from the pneumatic actuators on the press. This device complies with OSHA regulations. Always isolate and lockout the compressed air when performing any maintenance on the thermal press. The isolation device is shown in Figure 2–4.

Compressed air can develop a considerable amount of force. The force is large enough to inflict seri-

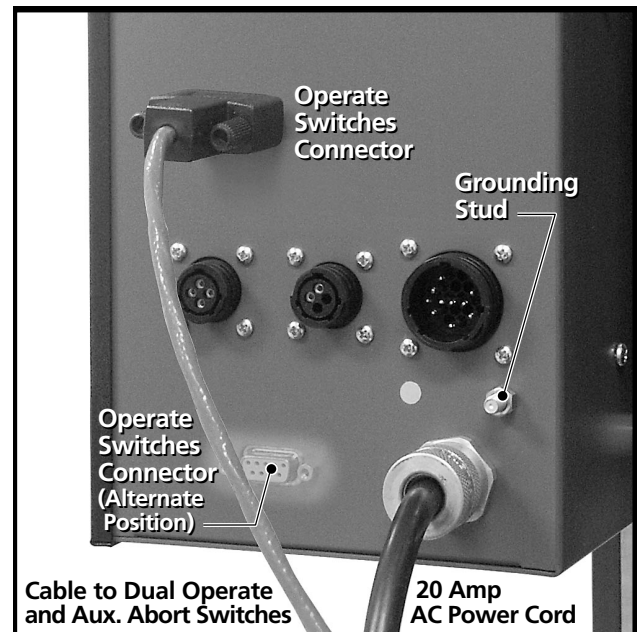


Figure 2–3 Grounding Lug

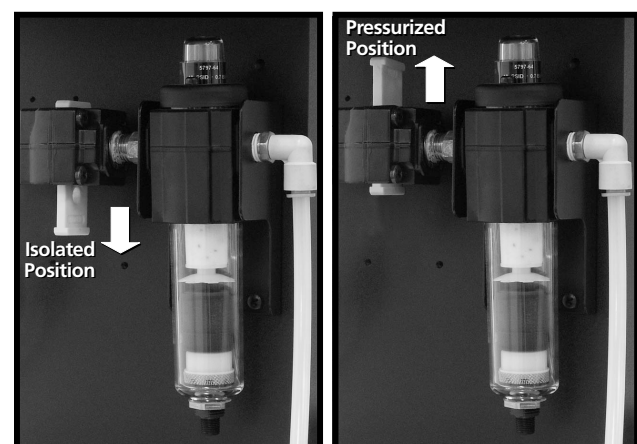
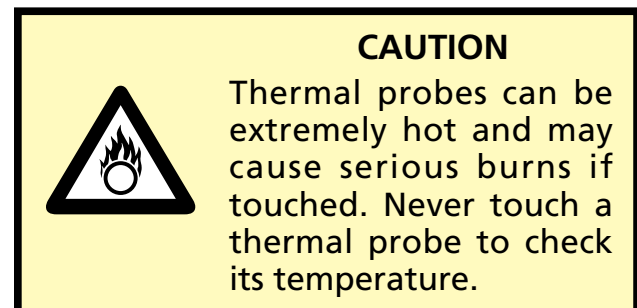


Figure 2–4 Compressed Air Safety Isolation Device

ous injury if one places their hand or other limb under the probes or platen. The Thermal Press uses an air cylinder which converts the air pressure to mechanical movement and has a force multiplication factor of between 12.5 and 37, depending upon the press capacity. This means that at the full 100 psi (6.9 bar), the air cylinder on even the smallest capacity press can exert 1,250 pounds (5,600 Nt) of force. This much force can result in serious injury.



CAUTION

Keep hands away from the probes and platen during operation. The air cylinder develops considerable force that could cause serious injury



Unpacking and Setup

- Press Placement
- Heater Connectors
- Activation Switches
- Cable Connections
- AC Power
- Air Connection

Shipping Contents	15
Thermal Press Placement	15
Lifting the Press	15
Bench Capacity	15
Leveling the Press	16
Heater Connectors	17
Activation Switches	17
Setup	18
Cable Connections	18
AC Power	18
Air Connection	20

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Shipping Contents

Quantity	Item	Part Number
1	Thermal Press	48HxxnTS [®]
**	Master Temperature Module(s)	110-398x**
**	Thermal Probe and Heater(s)	**
1	Thermal Press User's Manual	403-550-01

[®] Thermal Press Part Number depends upon Press Capacity and Power Rating. Refer to Section 16, Table 16—I and Figure 16-2.
^{**} Control modules, heater cables and probes as specified. See your Packing List.

Table 3—I Contents of Thermal Press Shipping Container

Carefully open the shipping container, and make sure it contains the items shown in Table 3—I. Inspect the Thermal Press for damage. Report any damage immediately to Dukane.

Press Placement

Lifting the Press

Attach a pair of lifting rings to the top of the press frame as indicated in Figure 3-1. The two holes are tapped for M12 x 1.75 metric threads. Use a sling or a chain with hooks to lift the press with a hoist or fork lift. The center of gravity is not located directly under the lifting rings, so the press will still tilt.

Bench Capacity

Carefully lift the press from its shipping container and place it on a work table capable of safely supporting the 500 pound (225 kg) weight of the press and its accessories. The press base (without any slide or turntable kits) requires an area at least 24 inches (60 cm) deep and 17 inches (43cm) wide. The standard optical activation switches require a space 30 inches (76 cm) wide at the front. Allow at least 10 inches (25 cm) behind the press for access to the cables, connectors and air supply. Combining these measurements results in a space at least 34 inches (86 cm) deep and 30 inches (76 cm) wide. Allow additional room for any Slide kits or Turntable kits. Also allow extra

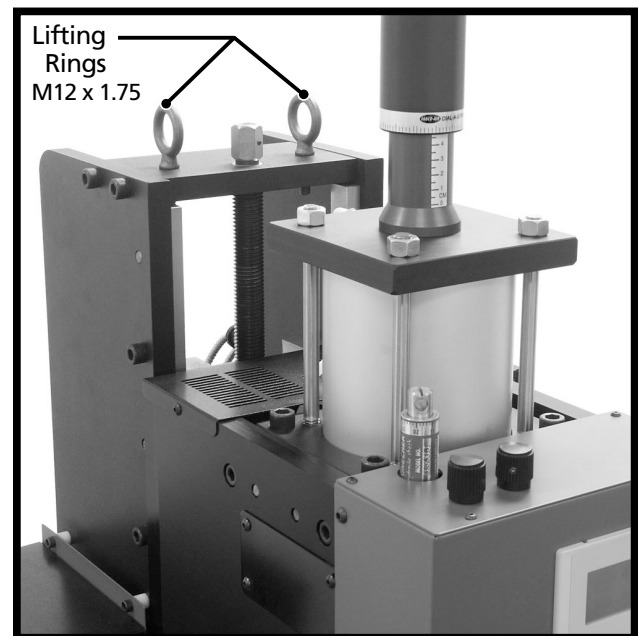


Figure 3-1 Lifting Rings Installed

space on either side of the Thermal Press for material handling, work pieces and fixtures.

Consider whether the operator is sitting or standing. The activation switches should be at a comfortable height to prevent operator fatigue. Provide ample room so the movement of the operator does not interfere with the work of another.

Leveling The Press

We recommend that the Thermal Press be leveled to within one degree. This can be accomplished using a carpenter's level. One degree corresponds to approximately one-quarter of an inch (6mm) deviation across the 16-inch width of the platen.

Heater Connectors

Each heater has its own power cable which connects to the rear of a Temperature Control Module. Figure 3–2 shows both a 110V and a 220V master controller module. Note that the heater connections are different for 110V and 220V to prevent using unmatched heaters and modules. The modules have a universal power supply and

will operate on either 110V or 220V. However, applying 220V to a 110V heater will quickly burn it out and a 220V heater powered with 110V will never reach stable operating temperature.

One heater cable from each zone must be connected to the inner most connector of the master module to regulate that zone's temperature. Only the innermost connector (right connector when viewed from rear) has the thermocouple sensing contacts. These can be seen clearly by looking at the top of the right heater connector. The other two connectors do not have thermocouple sensing contacts. The Slave modules also have thermocouple sensing contacts, but since they do not have a temperature controller, the sensing lines are inactive.

NOTE

The press is shipped with the probes, heaters and heater cables installed. Make sure you label the heater cables before disconnecting them from the heater control module.

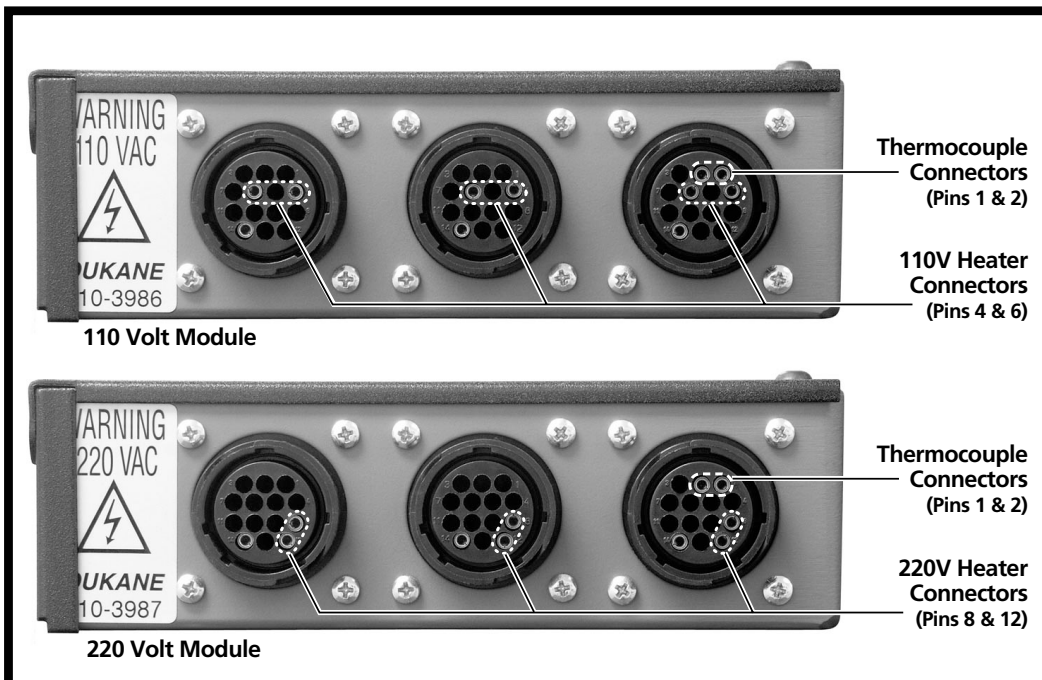
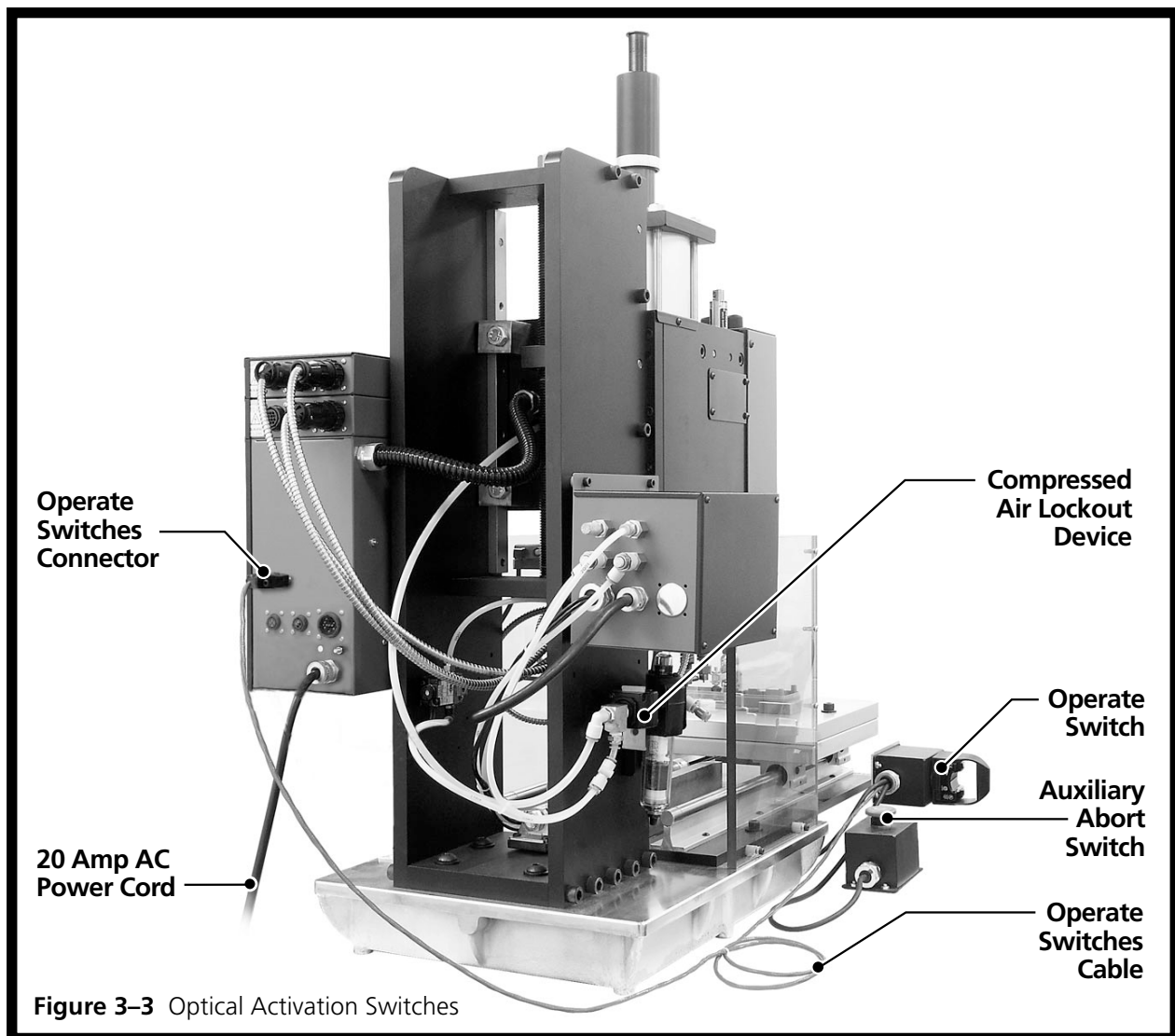


Figure 3–2 Heater Cable Connectors

Activation Switches

The dual activation switches are mounted on a separate aluminum panel. They are designed to be located at either side of the base in the front of the press. These activation switches comply with OSHA regulations and require simultaneous activation to start the press. They must be held in until the trigger is activated (i.e. when the trigger light comes on). In addition to the abort switch built into the front panel, an auxiliary abort switch is supplied which can be positioned next to the operate switches. One of the activation switch and the auxiliary abort switch is shown in Figure 3–3. The cable from the switches plugs into the back

of the Controller Chassis. Never replace the dual activation switches with a foot switch. The dual operate switches comply with OSHA safety regulations. Using a foot switch in place of the dual operate switches violates OSHA regulations.



Press Setup

Cable Connections

The instructions here and the diagram in Figure 3–4 are meant to serve as a quick-start guide. Only one heater cable is shown connected. Heater zones and connections are discussed in greater details in Sections 8 and 9. The cables for the option kits are shown for completeness. Your system may vary from the diagram depending upon the number of heater modules and type of option kits installed. The connectors and their pinouts are discussed in greater detail in Section 10.

- Step 1. Ground the Thermal Press. This is a user-supplied 14-Gauge wire, ❶ in Figure 3–4. Refer to the section titled **Grounding Lug** in Section 2 for more information.
- Step 2. Attach the cable from the optical Operate switches to the Cycle Activation connector on the rear of the controller chassis. This is ❷ in Figure 3–4. Some models have the connector located in an alternate position at the bottom of the chassis.
- Step 3. Attach the heater cable to the innermost rear connector of the temperature controller. This is ❸ in Figure 3–4.
- Step 4. *Optional – If you have the pneumatic fixture clamp option, the cable from the Fixture-Clamp Solenoid should be attached to the Fixture-Clamp Connector. This is ❹ in Figure 3–4.*
- Step 5. *Optional – If you have the post cool option, the cable from the Post-Cool Solenoid should be attached to the Post-Cool Connector. This is ❺ in Figure 3–4. Your solenoid position may vary from that indicated in the drawing.*
- Step 6. *Optional – If you have the pneumatic slide kit, the cable from the Slide Kit Controller should be attached to the Multipurpose Connector. This is ❻ in Figure 3–4.*

AC Power

The AC power cord is permanently attached to the rear of the Modular Temperature Control Chassis. The cord is strain relieved at the chassis and has a molded on plug. Depending on the power rating of the press, the cord is terminated in either a 110 VAC, single phase, 20 Amp plug (NEMA 5–20R) or a 220 VAC, single phase, 20 Amp plug (NE MA 6–20R).

- Step 7. Plug the Thermal Press AC power cord (item ❷ in Figure 3–4) into an approved AC outlet of the correct voltage.

CAUTION



The power cord is equipped with a three-prong, grounded-type plug for your safety. Whenever a two-slot receptacle is encountered, we strongly recommend that it is replaced with a properly grounded three-lead receptacle. Have a qualified electrician do the replacement in accordance with the National Electrical Code and local codes and ordinances. **DO NOT** cut off the power cord grounding prong or alter the plug in any way.

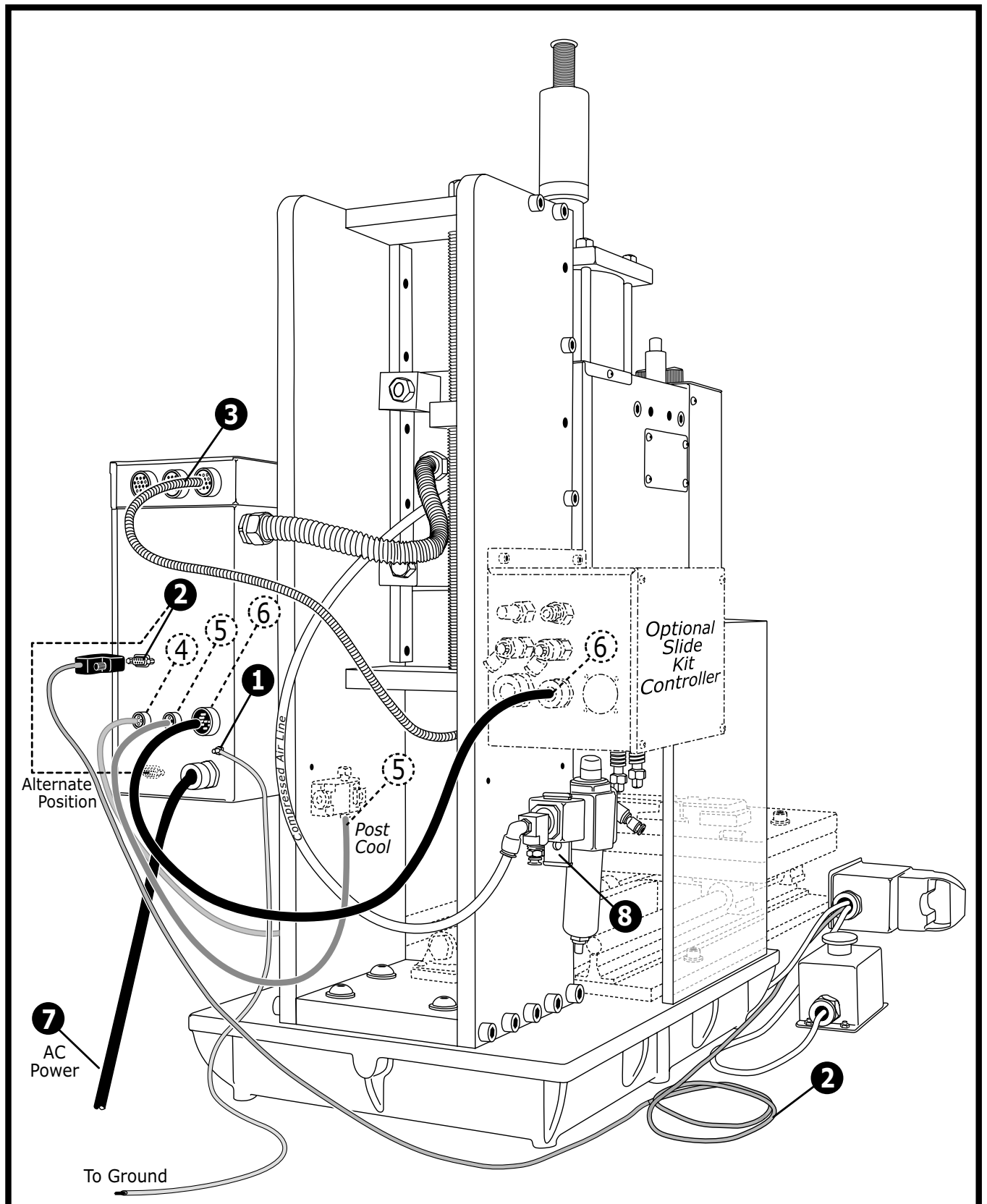


Figure 3-4 Thermal Press Cable Connections

Air Connection

The Thermal Press requires a clean, dry supply of compressed air at a nominal pressure of 100 psi (6.9 bar). The air supply should be capable of delivering at least 80 psi (5.5 bar) and not greater than 110 psi (7.6 bar). The air is attached to the fitting on the filter on the side of the press using a standard $\frac{5}{16}$ " NPT fitting. This location is shown in Figure 3-5.

- Step 8. Make sure the pneumatic safety device is in the locked out position (see Figure 3-5 and ⑧ in Figure 3-4), and will not allow compressed air into the solenoid valves. Securely attach the compressed air line to the air filter using a standard $\frac{5}{16}$ inch NPT fitting.

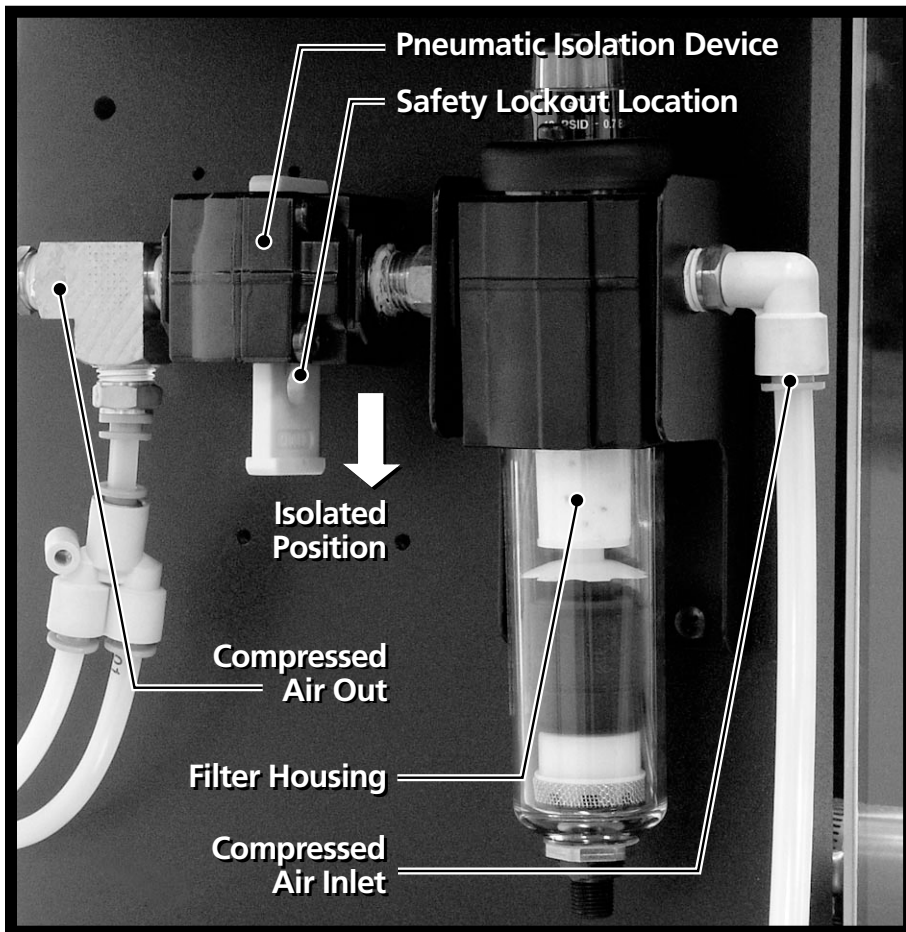


Figure 3-5 Compressed Air Fittings and Pneumatic Isolation Device in Lockout Position

Thermal Press Overview

- Normal Press Cycle
- Heater & Temp Zones
- Basic Press Operation

Normal Cycle	23
Operate Switches Activated	23
Fixture Clamp Activated	23
Slide Table Activated (Opt).....	23
Platen Lowers	24
Trigger Switch Activated	24
Preheat Timer Activated	24
Mechanical Stop Contacted	24
Post Cool Valve Energized	24
Platen Retracts	25
Slide Table Extends (Opt)	25
Fixture Clamp Released	25
Temperature Zones	26
The Zone Concept.....	26
Heater and Zone Limits	26
Basic Press Operation	27
Starting A Weld Cycle	27
Stopping A Weld Cycle	27

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Normal Cycle

At its most basic level, the thermal press is a pneumatic press with the facility to heat tooling. The upper tooling platen is pneumatically actuated. When the machine is actuated, the upper platen containing the heated tooling is brought into contact with the work piece. A series of process control timers sequence the operation and then retract the upper platen.

In describing a normal operation cycle, the optional Slide Kit, Post Cool and Fixture Clamp operations are covered for completeness. Only the Fixture Clamp and Post Cool steps are part of the built-in operation cycle. There is no detectable delay if pneumatic Fixture Clamps are not installed. If a slide kit is not installed, the steps to sense its position and activate it are bypassed. The presence of a slide kit is detected by the cable plugged into the multipurpose connector shown in Figure 3–4.

Operate Switches Activated

Figure 4–1 shows the press is in its starting position. The operator initiates a cycle by simultaneously engaging both operate switches. These switches are called out in Figure 4–1. The switches must be held until the Trigger Switch is activated (Trigger Light illuminates) as shown in Figure 4–4.

Fixture Clamp Activated²

The fixture clamp energize signal is activated regardless of whether or not pneumatic fixture clamps are installed. The clamps remain energized throughout the normal operating cycle. The press in the figure has a manually operated fixture clamp.

Slide Table Retracts¹ (Opt)

If a slide kit is installed, it is activated. The cycle pauses until the slide reaches its fully retracted position. Figure 4–2 shows the slide retracting to position the part under the probes. This step is bypassed if the press is not equipped with a slide kit.

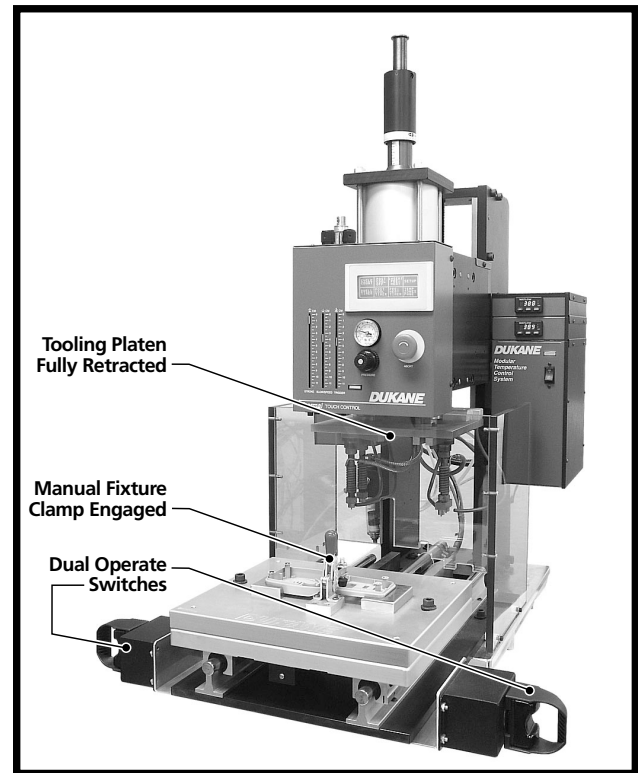


Figure 4–1 Thermal Press in Starting Position

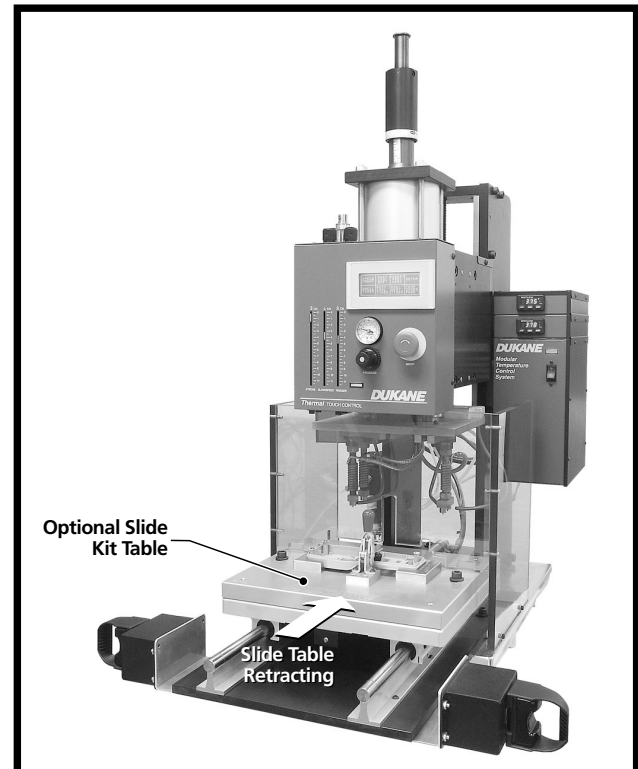


Figure 4–2 Slide Table Retracting

Platen Lowers

The main air valve is energized which allows it to admit air to the DOWN port of the main pneumatic cylinder. This causes the upper platen to begin descending as shown in Figure 4–3.

Trigger Switch Activated

The upper platen continues to descend until it activates the trigger switch. The trigger switch setting is indicated by the right flag on the front of the press control panel. It is labeled with the word TRIGGER at the bottom of the scale. The trigger indicator light next to the scale markings illuminates when the trigger switch is activated. This is illustrated in Figure 4–4. Setting the trigger position is covered in detail in Section 5 and 6.

Preheat Timer Activated

If the Preheat Timer option is not selected from the menu, the Dwell Timer is activated and the platen continues to descend.

If the Preheat Timer option is selected from the menu, the main air valve is de-energized as soon as the trigger switch is activated. This causes the platen to stop descending and remain at its current position for the duration of the Preheat Timer. At the end of the preheat cycle, the Dwell Timer cycle begins. The main air valve is re-energized and the platen continues to descend to its final bottom position.

Mechanical Stop Contacted

The main air valve remains energized until the Dwell Timer cycle expires. The platen descends until it contacts the bottom mechanical stop. The mechanical stop position is set by the large micrometer-type dial on the top of the press. Setting the bottom stop is covered in detail in Section 5.

Post Cool Valve Energized

If the Post Cool Timer disable option is selected from the menu (POST COOL OFF is lit), the platen retraction cycle is started. If the Post Cool Timer disable key is not overridden in the menu (POST

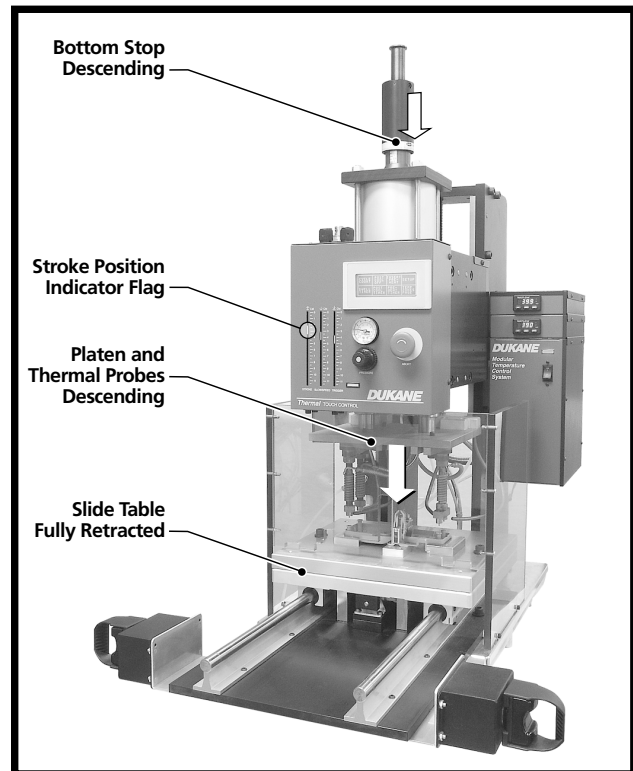


Figure 4–3 Main Air Valve Energized and Platen Descending

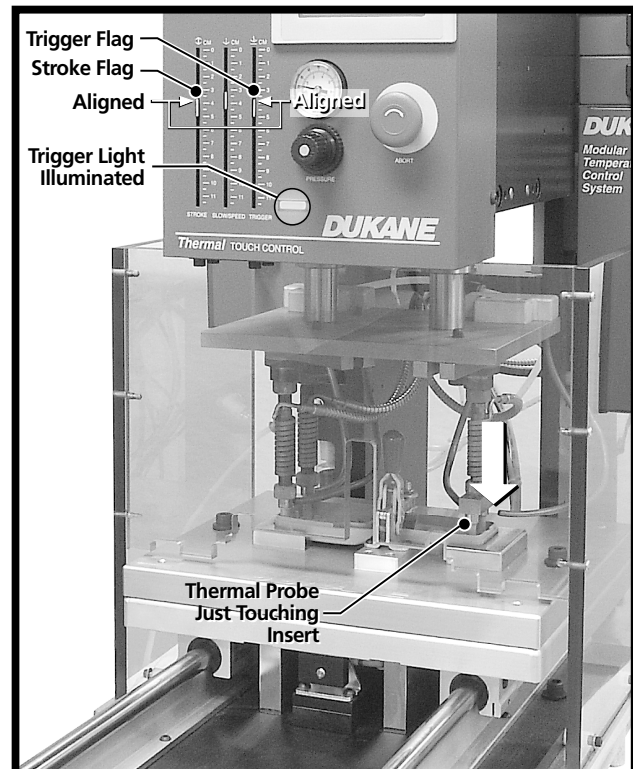


Figure 4–4 Trigger Switch Setting and Trigger Light

COOL OFF is not lit), the post cool air valve solenoid is energized. This causes the air from the distribution manifolds to flow through the nozzles and cool the part. The cycle is active for the duration of the POST COOL TIMER. This is illustrated in Figure 4–5. At the end of the post cool cycle, the post cool valve is de-energized.

Platen Retracts

The main air valve is energized and admits air to the UP port of the main pneumatic cylinder. This forces the tooling platen upward. The platen continues to rise until it returns to its starting position. This is shown in Figure 4–6.

Slide Table Extends¹ (Opt)

If a slide kit is installed, the slide table is extended. The press will not cycle again until the slide reaches its full extension position, as shown in Figure 4–6. This step is bypassed if the press is not equipped with a slide kit.

Fixture Clamp Released²

The pneumatic fixture clamp is signaled to release. If a manual fixture clamp is installed, it can now be disengaged. Once the clamps are released, the assembled part can be removed from the fixture. The cycle is now ready to start again.

- ¹ If a two–fixture, Left–Right slide kit or Turntable kit is installed, the cycle will be slight different than for an In–Out slide kit. The fixture shifts position, rather than retracting and extending as described.
- ² If a two–fixture, Left–Right slide kit or Turntable kit is installed, two clamp signals are used and are coordinated with the slide kit motion. Refer to Section 10 – Fixture Clamp Connector and Appendix A – Fixture Clamp Kit for more detailed information.

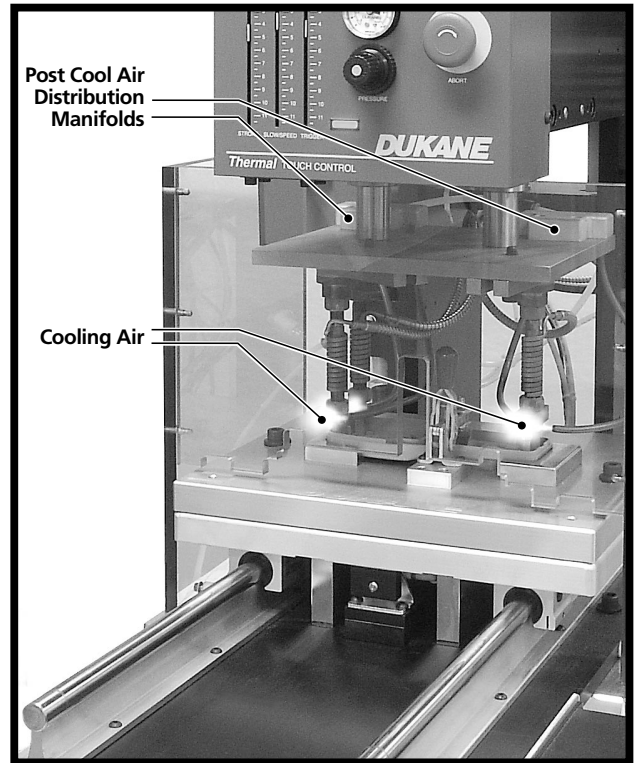


Figure 4–5 Post Cool Cycle with Cooling Air

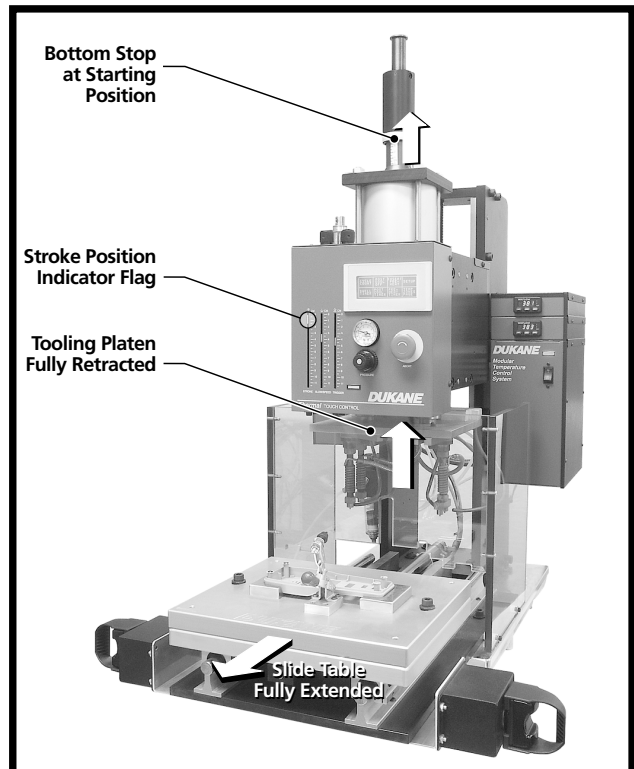


Figure 4–6 Platen Returning to Start Position

Temperature Zones

The Zone Concept

A temperature zone is consists of identical probes doing the same work. Identical probes means probes of the same length, with the same tips and fitted with the same wattage heater coils. Identical work means placing the same size of insert or swaging the same diameter post as shown in Figure 4-7. Figure 4-8 shows probes all doing the same type of work, but probe 3 is a different size and requires a seperate heater zone from probes 1 and 2. Figure 4-9 shows the same size probes, but probe 2 is performing an insert operation and requires a seperate heater zone from probes 1 and 3 which are dome staking.

Each zone requires a thermocouple to measure the temperature and a master control module to regulate the heating elements. If you are using Dukane coil heaters, the thermocouples are built in. A Series 48H Thermal Press has a limit of six controllers (master or slave) installed on a machine. Since a master unit controls one temperature zone, this means at most, six zones can be controlled by a Series 48H Thermal Press.

Heater and Zone Limits

One master controller can power up to three heaters (1050 Watts total). A master controller can also drive up to three additional slave units which can also power three heaters each. Since the master/slave connections are internal, one master and three slave units could conceivably be set up as a single zone powering 12 heaters (4200 Watts total).

The 120V press (48Hnn1TS) is limited to 2100 Watts. Using standard 350W heaters, this equals a maximum of six heating elements. These can be arranged as one heater per zone using six master controller modules for six temperature zones, or one temperature zone with six heaters driven from one master and one slave controller. Any

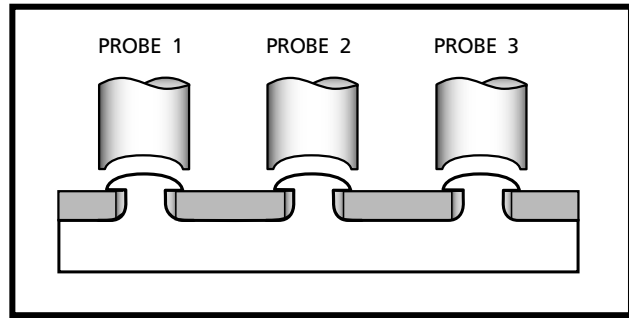


Figure 4-7 Single Heater Zone

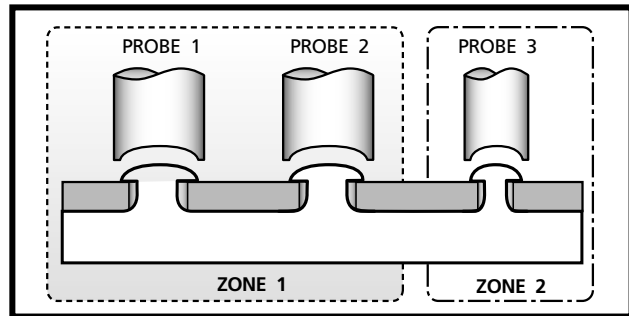


Figure 4-8 Dual Heater Zone – Mixed Probe Sizes

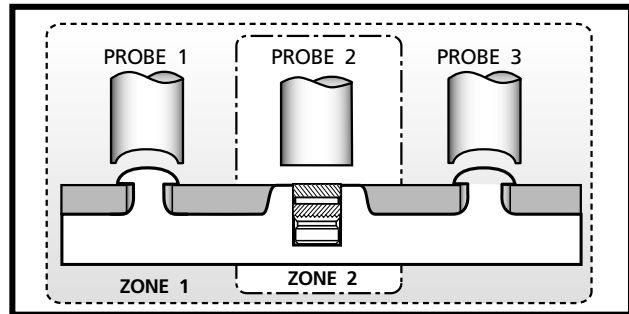


Figure 4-9 Dual Heater Zone – Different Work

other combination is acceptable as long as it doesn't exceed six control modules and 2100 Watts (six 350W heaters).

The 240V press (48Hnn2TS) is limited to 4200 Watts or twelve 350W heaters. Any combination is acceptable as long as it doesn't exceed six control modules and 4200 Watts (twelve 350W heaters).

POWER LIMITS

$$\text{Max. Number of Heaters} = \frac{\text{Press Power Rating}}{\text{Heater Power Rating}}$$

Basic Press Operation

Starting a Weld Cycle

The following instructions outline the basic steps to begin a weld cycle from a cold start.

Turn AC Power ON

Make sure the AC power cord is plugged into the appropriate receptacle. Make sure both Abort switches are in the reset position. Turn the power switch to the ON position. This is shown in Figure 4–10. The power indicator light will illuminate green indicating the low-voltage power supply is producing a control voltage.

Release Pneumatic Lockout Device

Release the pneumatic isolation device to allow compressed air into the solenoid valves. Figure 3–4 shows the isolated and pressurized positions.

Select Heater Zones

Turn on the desired heater zones using the touch screen menu (see TEMP ZONES PAGE in Section 6). Wait until the temperature controllers indicate the heaters have reached at operating temperature, and stabilized for several minutes. The controller displays the heater thermocouple temperature.

Set Mechanical Stop & Dwell Time

Adjust the stroke and weld time of the thermal press to accommodate your parts and tooling. This is covered in detail in the Sections 5 and 6. Load the parts into the fixture.

Activate Both Operate Switches

Simultaneously activate both the operate switches. The press will begin its cycle and automatically execute the programmed steps. If the settings need adjustment, make the required changes. For best results, only change one parameter at a time to obtain the optimum settings. Activate the operate switches again. Repeat these last two steps until you have achieved satisfactory operation.

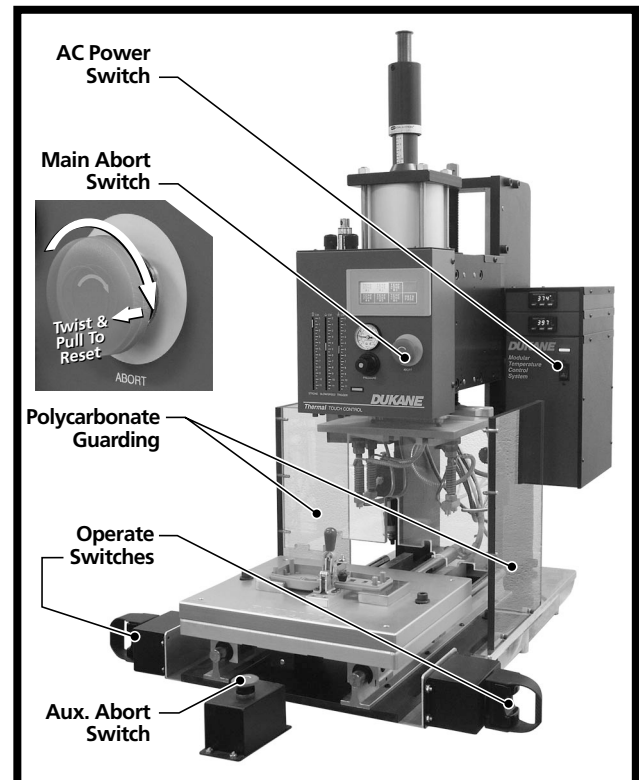


Figure 4–10 Operate & Abort Switches, AC Power and Polycarbonate Guarding

NOTE

Figure 4–10 shows a two-zone Thermal Press with the supplied Polycarbonate Guarding in place. It also shows an optional Post Cool kit and a Linear Slide Kit.

Stopping a Weld Cycle

To stop a weld cycle at any time, press either the Abort switch on the front control panel or the auxiliary Abort next to the Activation switches. This will cause the platen to stop moving. To clear an aborted weld cycle, reset all the Abort switches and then activate both operate switches. This will cause the platen to return to its starting position.

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Controls and Displays

- Power
- Temperature Controller
- Touch Screen Display
- Operate & Abort Switches
- Pneumatic Controls
- Stroke Speed Controls
- Stroke & Trigger Position

Major Controls	31
Power	31
AC Power Switch	31
Power Indicator	31
Temperature Controller	32
Display	32
Control Keys	32
Controller Indicator Lights	32
Touch Screen Display	32
Abort Switch	33
Operate Switches	33
Pneumatic Controls	33
Air Pressure Regulator	33
Regulator Gauge	34
Position and Speed	35
Mechanical Stop	35
Stroke Position Indicator	36
Hydraulic Speed Control	36
Slow Speed Adjustment	36
Slow Speed Indicator	36
Trigger Position Adjustment	37
Trigger Position Indicator	37
Trigger Indicator Light	37

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Major Controls

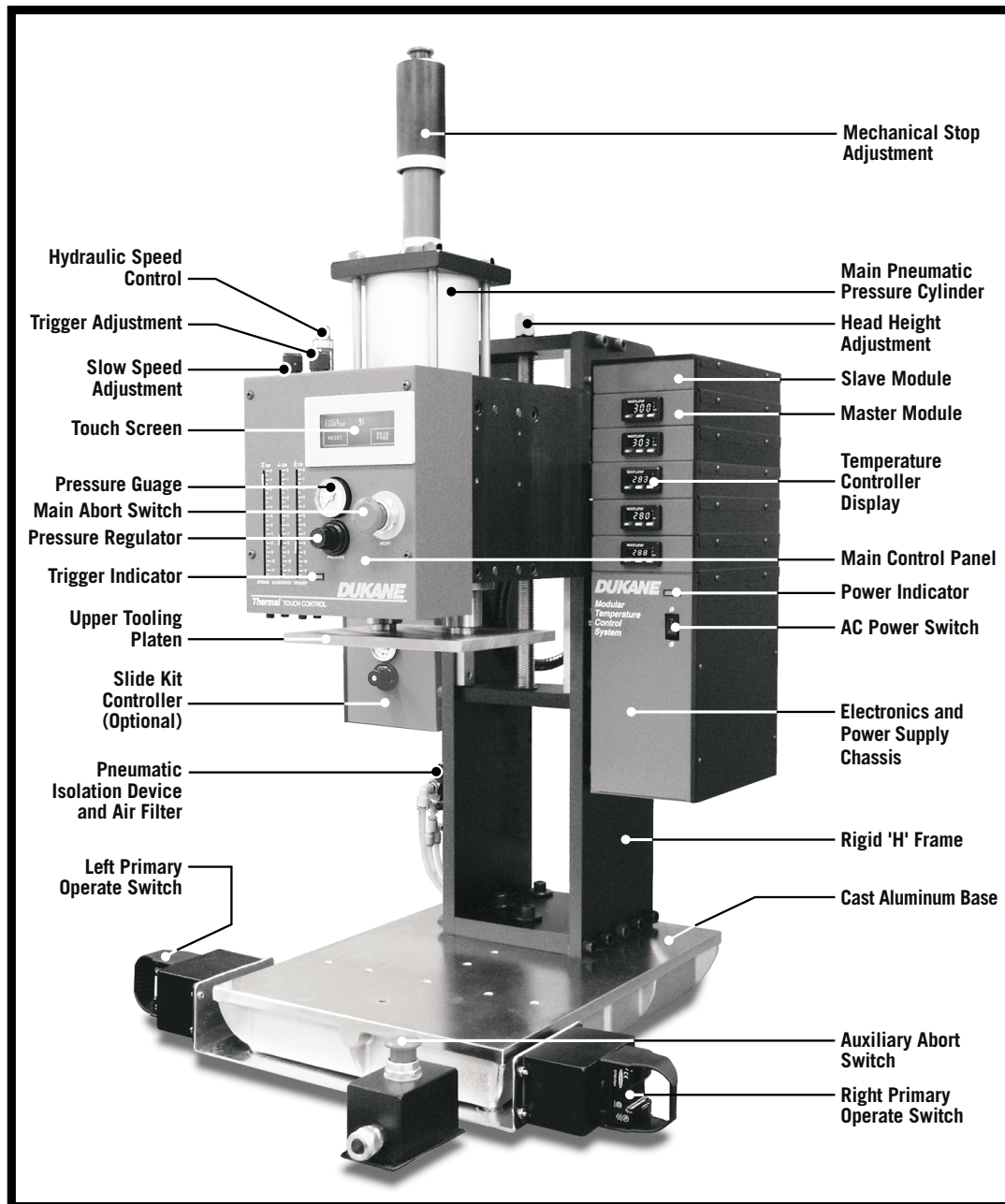


Figure 5-1 Major Controls Identified

Power

AC Power Switch

The AC power switch, shown in Figure 5-1, is also a 20A circuit breaker. The switch must be in its ON position (marked by the I) to supply power to the press. If the circuit breaker trips, it may be reset by flipping the switch fully OFF (marked by the O) and then back ON.

Power Indicator

The power indicator is located directly above the AC power switch in Figure 5-1. When illuminated green, it indicates the low voltage power supply is producing a stable control voltage. If the light produces any color other than green, turn the press off immediately and check for proper line voltage.

Temperature Controller Temperature Display

By default, the temperature controller shows the actual thermocouple temperature in °F. It can also be set to display the set point temperature, change from °F to °C, display combinations of actual temperature and the configuration menus. Refer to Section 7 for more detailed information. The display also shows error codes which are explained in Section 13.

Control Keys

Below the display are three control keys. Pressing the SET key displays the set point temperature. Refer to Section 7 and Figure 7-1 for instructions to change the temperature. The two adjacent arrow keys are used to choose data or select values. Pressing the two arrow keys simultaneously for three seconds, moves to a software menu or exits a menu. The control keys are also covered in Section 7.

Controller Indicator Lights

To the right of the temperature display are three indicator lights. The top two are labeled 1 and 2. These indicate which controller output is active. The bottom light is labeled RDY. The factory default setting only illuminates the top light (Output 1) to indicate heater power.

Touch Screen Display

The touch screen display is used for selecting the press functions, programming the press operations, displaying information and warning messages. The touch screen has a sleep mode. It will go blank five minutes after it was last touched. To bring the display out of sleep mode, just touch the screen. To disable the sleep mode, see Section 13 – Touch Screen Saver. The main setup screen display is shown in Figure 5-3. There are eight touch keys for selecting a function or accessing a data entry screen. In general, if a key is lit, that state is enabled. The keys are toggled on and off by touching them. The touch screen menu is covered in more detail in Section 6.

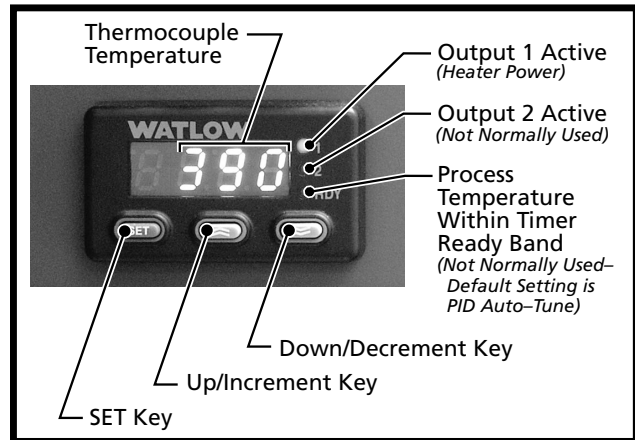


Figure 5-2 Temperature Controller Display, Control Keys and Indicator Lights



Figure 5-3 Main Control Panel and Touch Screen Display

Abort Switch

Main Abort Switch

Below the touch screen is a large red push-button switch. This is the main abort switch and is shown in Figure 5–1 and 5–4. Pushing it in will halt all press operations. This switch is also sometimes referred to as the emergency stop or E–stop switch. To raise the platen back to its starting position, reset the abort switch by turning it clockwise and pulling. Then activate the operate switches.

Auxiliary Abort Switch

An extra abort switch is attached to the wiring harness that connects the two primary operate switches. This auxiliary abort switch is shown in Figures 4–10 and 5–1. It has a red button, the same as the main abort switch on the front panel. The abort switches are wired so that activating either switch will halt all press operations. To raise the platen back to its starting position, both abort switches must be reset. Then activate the operate switches.

Operate Switches

The primary operate switches are shown in Figures 4–10 and 5–1. They are located on a separate panel which can be located in front of the base for operator comfort. To initiate a cycle, the switches must be pressed simultaneously and held in until the Trigger Position Light (Figure 5–9) comes on. If the switches are released too early, the cycle will abort and platen will return to its starting position.

Pneumatic Controls

Air Pressure Regulator

The air pressure regulator is located on the front control panel of the Thermal Press and is shown in Figure 5–5. The pressure regulator knob is a multi–turn control. Approximately four turns are required to change the setting from 0 to 100 psi. Turning the knob clockwise ↻ increases the pressure.

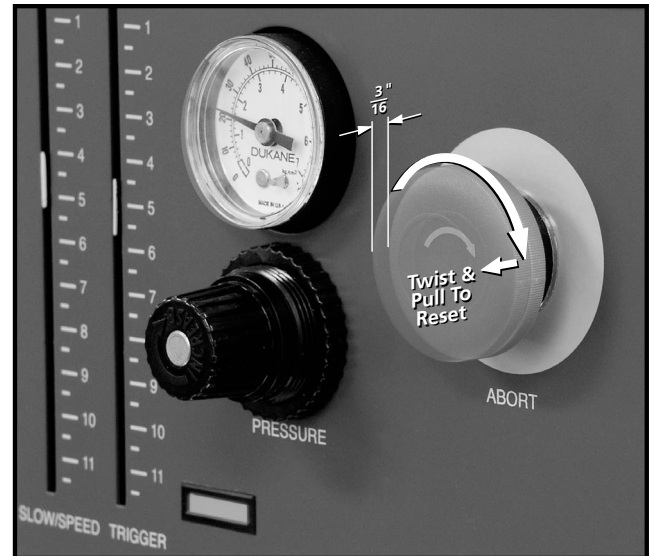


Figure 5–4 Resetting the Abort Switch

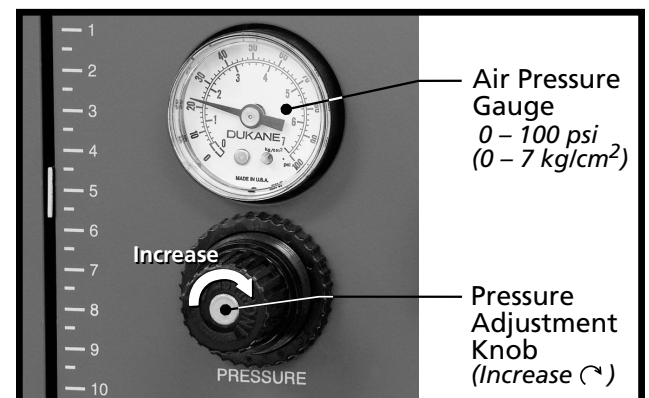


Figure 5–5 Air Regulator and Pressure Gauge

Regulator Gauge

The applied air pressure is indicated on the regulator gauge located directly above the regulator control knob. The gauge has a 1.5" diameter dial with a range of 0 to 100 psi (0 to 6.9 kg/cm²) and is shown in Figure 5-5. Air pressure applied to the main pneumatic cylinder results in a force proportional to the cylinder's area. Table 5-I gives the exact and approximate scale factors for converting air pressure into applied force for the different press models. Multiply the pressure gauge reading in psi by the scale factor to determine the applied force in pounds. To determine the required air pressure for a given force, divide the desired force by the scale factor (e.g. *48F10xTS press applying 1500 lbs ÷ 19.63 = 76.4 or 76 psi on the pressure gauge*). Table 5-II lists the applied force for air pressures in increments of 10 psi.

Press Capacity and Model No.	Scale Factor (Approximate)	Scale Factor (Exact)
1½ Ton 48H15xTS	38	38.0
1 Ton 48H10xTS	20	19.63
¾ Ton 48H08xTS	13	12.57

Table 5—I Table of Scale Factors for Applied Force (pounds)

Air (psi)	¾ Ton 48H08xTS	1 Ton 48H10xTS	1½ Ton 48H15xTS
10	$\frac{126 \text{ lbs}}{559 \text{ Nt}}$	$\frac{196 \text{ lbs}}{873 \text{ Nt}}$	$\frac{380 \text{ lbs}}{1,690 \text{ Nt}}$
20	$\frac{251 \text{ lbs}}{1,118 \text{ Nt}}$	$\frac{393 \text{ lbs}}{1,746 \text{ Nt}}$	$\frac{760 \text{ lbs}}{3,380 \text{ Nt}}$
30	$\frac{377 \text{ lbs}}{1,677 \text{ Nt}}$	$\frac{589 \text{ lbs}}{2,619 \text{ Nt}}$	$\frac{1,140 \text{ lbs}}{5,071 \text{ Nt}}$
40	$\frac{503 \text{ lbs}}{2,236 \text{ Nt}}$	$\frac{785 \text{ lbs}}{3,493 \text{ Nt}}$	$\frac{1,520 \text{ lbs}}{6,761 \text{ Nt}}$
50	$\frac{629 \text{ lbs}}{2,796 \text{ Nt}}$	$\frac{982 \text{ lbs}}{4,366 \text{ Nt}}$	$\frac{1,900 \text{ lbs}}{8,451 \text{ Nt}}$
60	$\frac{754 \text{ lbs}}{3,355 \text{ Nt}}$	$\frac{1,178 \text{ lbs}}{5,239 \text{ Nt}}$	$\frac{2,280 \text{ lbs}}{10,141 \text{ Nt}}$
70	$\frac{880 \text{ lbs}}{3,914 \text{ Nt}}$	$\frac{1,374 \text{ lbs}}{6,112 \text{ Nt}}$	$\frac{2,660 \text{ lbs}}{11,832 \text{ Nt}}$
80	$\frac{1,006 \text{ lbs}}{4,473 \text{ Nt}}$	$\frac{1,570 \text{ lbs}}{6,985 \text{ Nt}}$	$\frac{3,040 \text{ lbs}}{13,522 \text{ Nt}}$
90	$\frac{1,131 \text{ lbs}}{5,032 \text{ Nt}}$	$\frac{1,767 \text{ lbs}}{7,858 \text{ Nt}}$	$\frac{3,420 \text{ lbs}}{15,212 \text{ Nt}}$
100	$\frac{1,257 \text{ lbs}}{5,591 \text{ Nt}}$	$\frac{1,963 \text{ lbs}}{8,731 \text{ Nt}}$	$\frac{3,800 \text{ lbs}}{16,902 \text{ Nt}}$

Table 5—II Table of Applied Force for Air Pressure in Increments of 10 psi

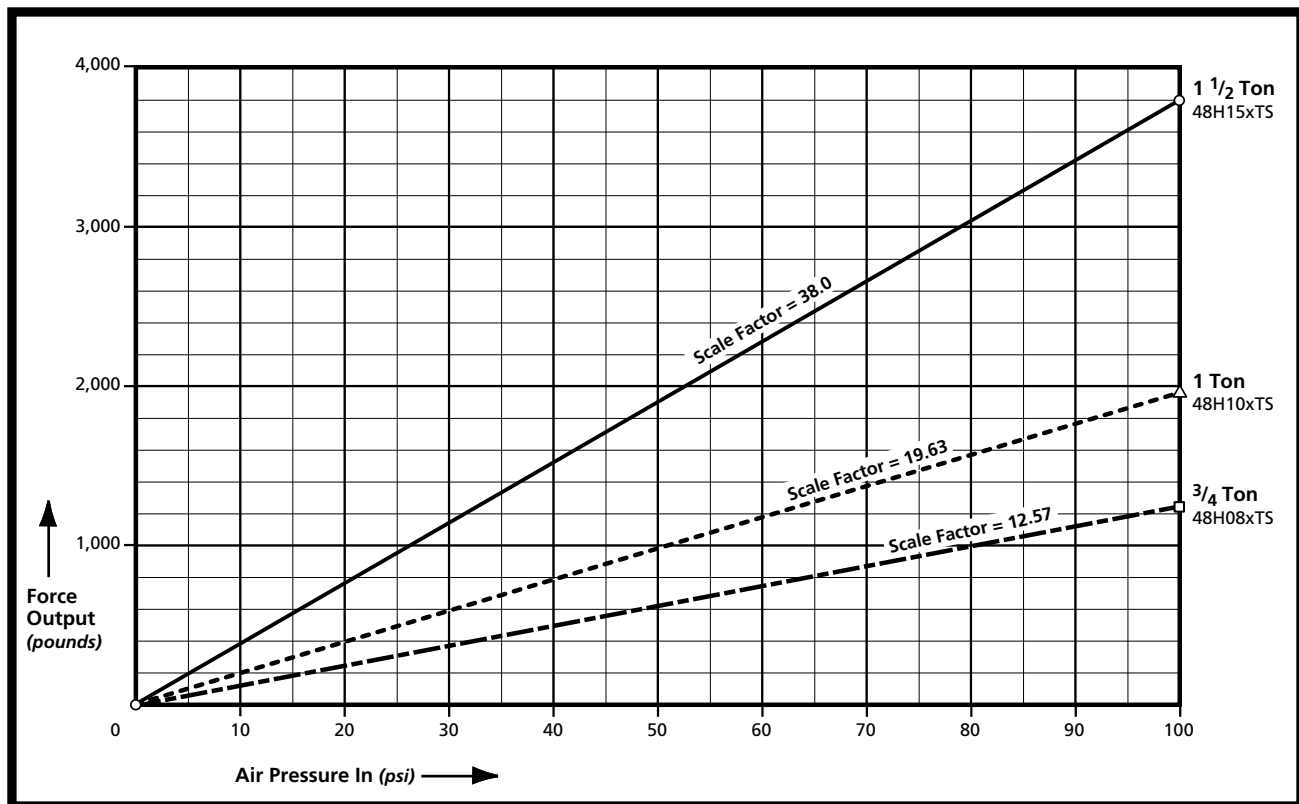


Figure 5-6 Graph of Applied Force as a Function of Air Pressure

Position and Speed Mechanical Bottom Stop

The large micrometer-type dial at the top of the press is the mechanical stop adjustment. This is a fine adjustment providing a total of 4.0" (10 cm) of vertical travel. The mechanical stop together with the coarse head height adjustment, determines the bottom stop position of the upper platen. This permits inserting/staking to a repeatable finished height. The mechanical stop's location in relation to the other controls is shown in Figure 5-1. A closeup of the adjustment mechanism is shown in Figure 5-7.

The fine-pitch threads move the stop a fixed amount for each turn of the dial. On the 48F08xTS press with a 4" diameter air cylinder (4.25" O.D.), the thread pitch is 0.0625" (0.159 cm) per revolution or 16 turns per inch (6.3 turns per cm).

On the 48F10xTS and 48F15xTS press with a single or dual 5" air cylinder respectively (5.25" O.D.), the thread pitch is 0.0714" (0.181 cm) per revolution or 14 turns per inch (5.5 turns per cm).

Rotating the black adjustment nut skirt will change the length of the stroke. When the platen is at the top of stroke, the more blue that is visible on the inner tube, the longer the stroke will be. A graduated vertical scale is also affixed to the inner cylinder indicating the length of the stroke. There is a set screw at the top of the outer black cylinder that allows the stop position to be locked in place.

To adjust the bottom stop position, press the SETUP key on the touch screen main page. The SETUP key is now lit as shown in Figure 5-8. Simultaneously touch both of the operate switches to jog the platen down until it reaches the bottom stop. Lowering the air pressure to about 20 psi will slow the descent rate. To raise the platen, press the SETUP key again to turn it off, then hold both operate switches until the platen returns to its initial position.

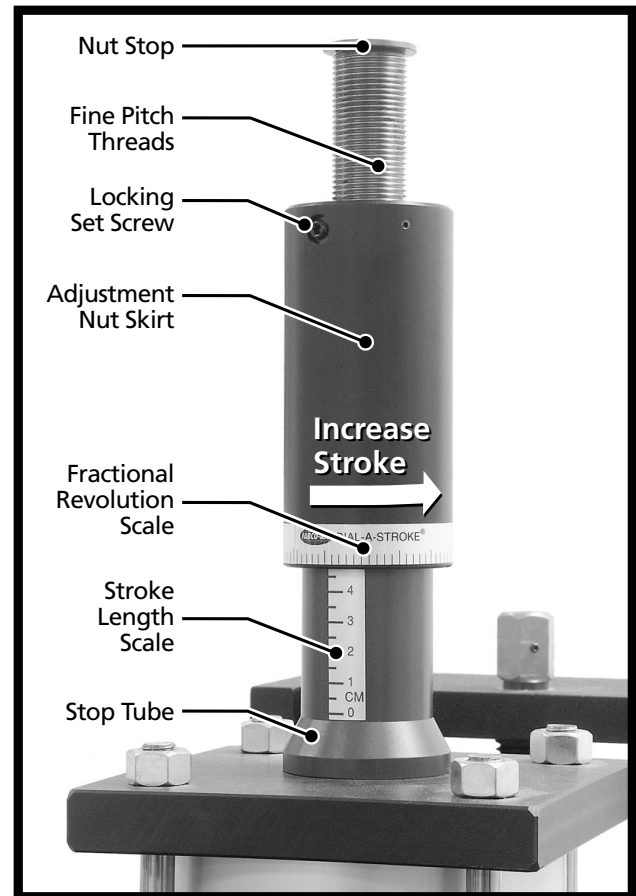


Figure 5-7 Bottom Stop Adjustment Mechanism

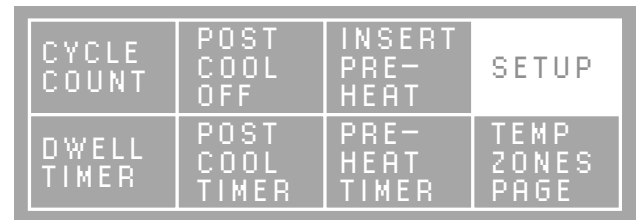


Figure 5-8 Thermal Press in SETUP Mode

The head position is initially set at the factory to accommodate your tooling. It can be raised or lowered by loosening the position clamps and turning the vertical lead screw. The procedure for adjusting the head height or radial position is covered in Section 11.

Stroke Position Indicator

The left flag is the stroke position and measures the downward extension of the air cylinder. The top of the flag indicates the position of the tooling platen relative to the machine stroke. The 48H series press has a maximum stroke of 4 inches (10 cm). Figure 5–9 show a stroke of 0 cm which means the platen is fully retracted. The scale next to the flag is graduated in cm.

Hydraulic Speed Control

On top of the main control panel, behind the two adjustment knobs, is a red cylinder. This is shown in Figure 5–10. This is attached to the platen and descends with it. The amount of hydraulic damping can be adjusted by turning the brass shaft at the top of the speed control. The attached scale indicates the relative amount of applied damping. The hydraulic speed control has a maximum capacity of 120 inch-pounds and one inch (2.5 cm) of stroke. It should not be used as a mechanical stop, *i.e.* the stroke flag should never travel more than one inch beyond the slow speed flag.

Slow Speed Adjustment

The black knob on top left of the main control panel is the slow speed position adjustment. This is shown in Figure 5–10. This knob adjusts the engagement position of the hydraulic speed control.

Slow Speed Indicator

The top of the center flag indicates the position at which the slow speed mode is engaged. Figure 5–9 shows the slow speed set to engage when the down stroke is 4 cm and 0.5 cm above the trigger position. The proper setting for the slow speed adjustment is not more than one–inch (2.5 cm) above the bottom stop and about 0.25 to 0.5 inch (0.6 to 1.2 cm) above the trigger position indicator.

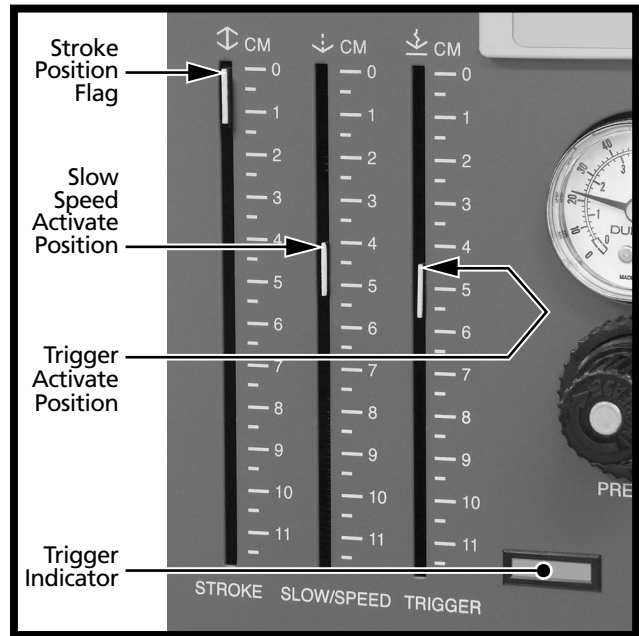


Figure 5–9 Indicator Flags and Trigger Light

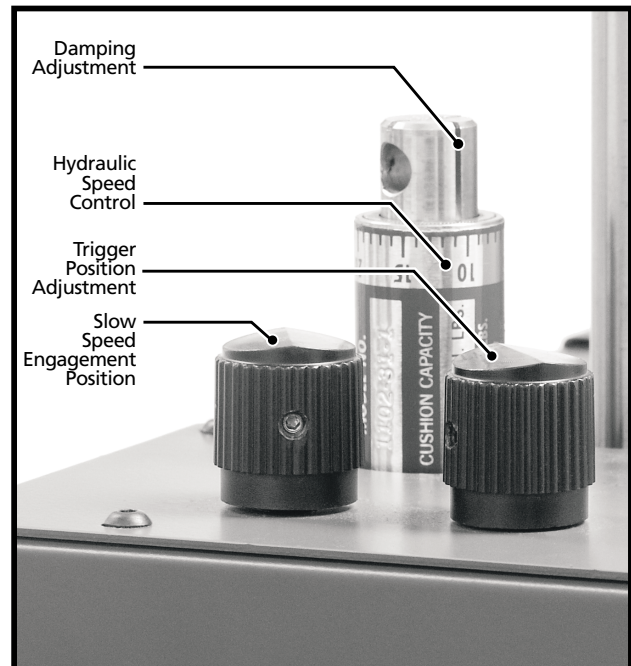


Figure 5–10 Trigger and Speed Adjustments

Trigger Position Adjustment

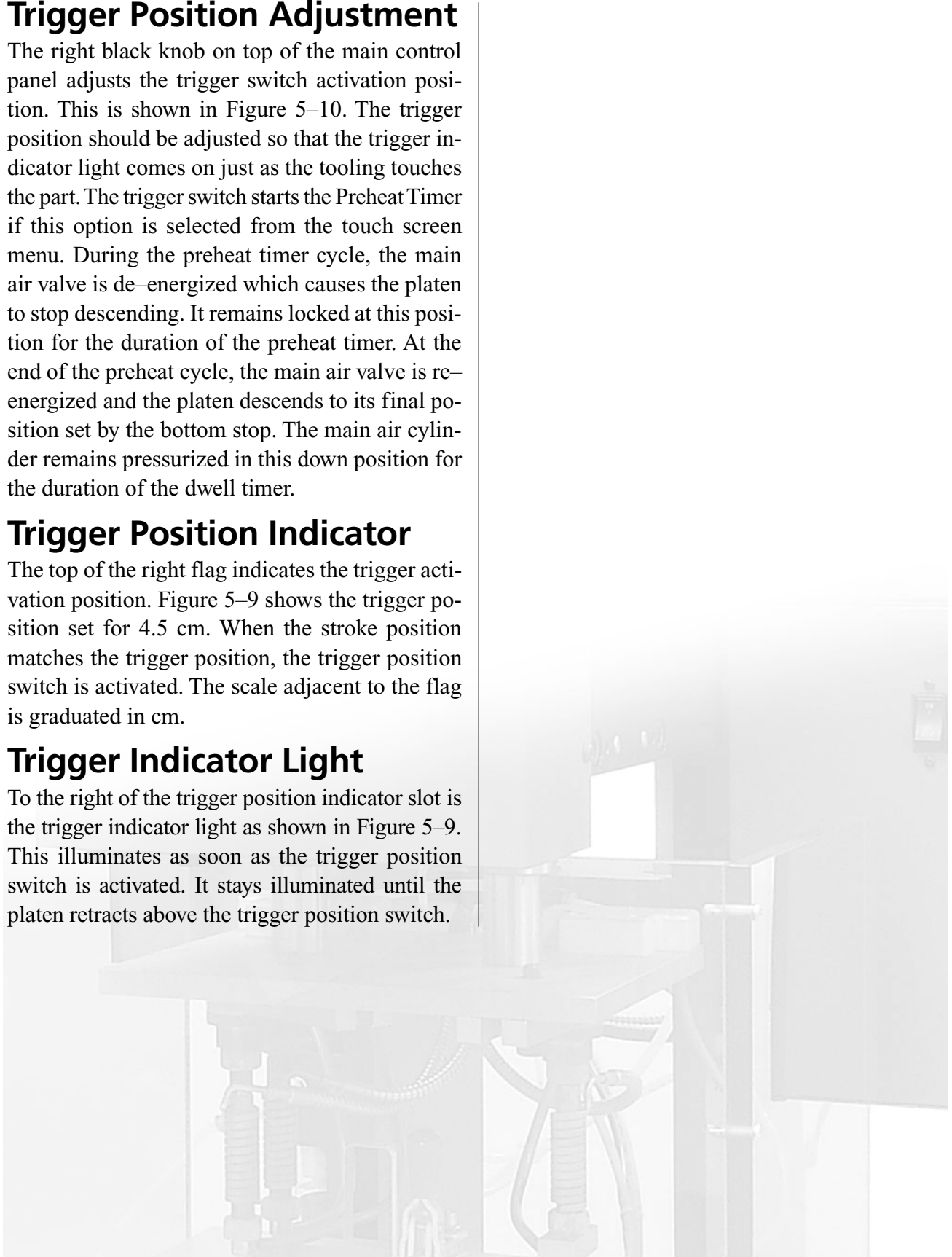
The right black knob on top of the main control panel adjusts the trigger switch activation position. This is shown in Figure 5–10. The trigger position should be adjusted so that the trigger indicator light comes on just as the tooling touches the part. The trigger switch starts the Preheat Timer if this option is selected from the touch screen menu. During the preheat timer cycle, the main air valve is de-energized which causes the platen to stop descending. It remains locked at this position for the duration of the preheat timer. At the end of the preheat cycle, the main air valve is re-energized and the platen descends to its final position set by the bottom stop. The main air cylinder remains pressurized in this down position for the duration of the dwell timer.

Trigger Position Indicator

The top of the right flag indicates the trigger activation position. Figure 5–9 shows the trigger position set for 4.5 cm. When the stroke position matches the trigger position, the trigger position switch is activated. The scale adjacent to the flag is graduated in cm.

Trigger Indicator Light

To the right of the trigger position indicator slot is the trigger indicator light as shown in Figure 5–9. This illuminates as soon as the trigger position switch is activated. It stays illuminated until the platen retracts above the trigger position switch.



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Touch Screen Menus

- Main Menu
- Post Cool Mode & Timer
- Insert Preheat Mode & Timer
- Setup Mode
- Cycle Count
- Dwell Timer
- Temp Zones
- Warning Screens

Main Menu	41
Post Cool Off	41
Insert Preheat	41
Setup Mode	42
Cycle Count	43
Dwell Timer	43
Post Cool Timer	44
Pre Heat Timer	44
Temp Zones	44
Warning Screens	45
TEMP ZONE Fault	45
Abort Mode Fault	45
Startup Fault	46

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Main Menu

When the thermal press is initially turned on, it defaults to the Main Menu which is shown in Figure 6–1. Three of the menu options on the top line are press to toggle on/off. These are POST COOL OFF, INSERT PREHEAT and SETUP. The other five menu items display a data entry screen when pressed. We will first cover the three toggle on/off screens.

POST COOL OFF

If the thermal press must be equipped with the post cool option kit, the post cool option is normally on. To disable post cool, you must press the screen so the button lights up indicating that post cool is now turned off. This is shown in Figure 6–2. The logic behind this key working in a reverse manner from the other two is that most thermal presses use post cool, so disabling post cool is the less common situation. Therefore the default value is post cool on. Post cool is an short blast of compressed air directed at the areas that were just heated. The duration of the post cool cycle is determined by the POST COOL TIMER.

If post cool is disabled (Figure 6–2), any value set in the post cool timer is ignored. If the press is not equipped with a post cool kit, and post cool is turned on (Figure 6–1), the dwell time will be extended by whatever value is set in the post cool timer. A timer value of zero will also disable the post cool cycle.

INSERT PREHEAT

The default state for the INSERT PREHEAT option is off. To enable the preheat cycle, you must press the screen so the button lights up as shown in Figure 6–3. This operation is normally used to preheat a metal insert before it is pressed into the plastic part. A collared insert has more surface area in contact with the heated probe than a non-collared design, and will heat up faster. Set the trigger position to the point where the probe just touches the top of the insert. The preheat operation starts as soon as the trigger is activated. The trigger indicator lights

CYCLE COUNT	POST COOL OFF	INSERT PRE- HEAT	SETUP
DWELL TIMER	POST COOL TIMER	PRE- HEAT TIMER	TEMP ZONES PAGE

Figure 6–1 Main Menu Screen

CYCLE COUNT	POST COOL OFF	INSERT PRE- HEAT	SETUP
DWELL TIMER	POST COOL TIMER	PRE- HEAT TIMER	TEMP ZONES PAGE

Figure 6–2 Main Menu With POST COOL Turned OFF

CYCLE COUNT	POST COOL OFF	INSERT PRE- HEAT	SETUP
DWELL TIMER	POST COOL TIMER	PRE- HEAT TIMER	TEMP ZONES PAGE

Figure 6–3 INSERT PREHEAT Turned ON

and the main air valve is de-energized which causes the platen to stop descending. It remains at this position for the duration of the PREHEAT TIMER. At the end of the preheat cycle, the main air valve is re-energized and the platen continues to descend to its final bottom position determined by the bottom stop setting. Be sure to set the correct value into the PREHEAT TIMER (covered on next page).

If the slow speed adjustment is set to engage before the trigger, the differential air pressure in the pneumatic cylinder will not equalize immediately. This is due to the resistance of the hydraulic damper, and in turn this will cause the tooling platen to creep down. This is normal and is especially evident during a trial run with no part or inserts. The inserts will offer some resistance and the downward creep will not be as evident. The lower the air pressure and the lower the damping, the less creep.

You can verify this, by setting the slow speed adjustment to engage below the trigger. The platen will now stop immediately at the trigger point if preheat is turned on. You can also lower the air pressure to about 15 psi and set the damper to about 2 or 3. Set the slow speed adjustment to engage 0.5 cm before the trigger point. With very little air pressure differential, and almost no resistance from the damper, the air pressure equalizes almost immediately and the platen remains fixed in position during the preheat cycle.

As mentioned in Section 5, the proper setting for the slow speed adjustment is not more than 1" (2.5 cm) above the bottom stop and about 0.25" to 0.5" (0.6 to 1.2 cm) above the trigger position indicator.

SETUP Mode

The SETUP key enables you to jog the platen down to set the trigger point and check probe alignment. To activate the setup mode, press the touch screen so the setup key is illuminated as shown in Figure 6-4. Then momentarily touch both operate switches to jog the platen down. Short taps will jog the platen

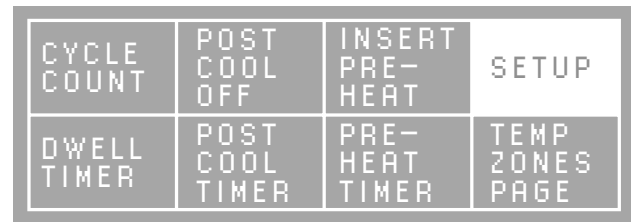


Figure 6-4 SETUP Mode Enabled

down until the bottom stop is reached. To return the platen, press the setup key again to turn it off. Then hold both operate switches until the platen returns to its starting position. Momentarily tapping the switches will jog the platen upward.

CYCLE COUNT

The counter is always enabled. When the CYCLE COUNTER key is pressed, a screen showing the current count and a reset button is displayed. This is shown in Figure 6–5. To reset the counter, press the RESET key. To exit the screen, press the MAIN PAGE key to return to the main menu.

DWELL TIMER

The DWELL TIMER determines the length of time the thermal probe remains at the bottom stop position. To access the timer preset values, press the DWELL TIMER key on the main menu. The data display screen appears showing the current value, as shown in Figure 6–6. To exit this screen, press the MAIN PAGE key. To change the dwell time value, press the DWELL TIMER PRESET key. A data entry screen appears as shown in Figure 6–7. The zero value in the upper right of the screen next to the CAN key, is the default value. To return to the DWELL TIMER display screen, press the CAN (Cancel) key. All timer values are entered in units of 0.1 second. To enter a value of 2.5 seconds, you must enter 25 by pressing the **2** key then the **5** key. As soon as the first digit is entered, the CAN key changes to CLR (Clear). This is shown in Figure 6–8. If you make a mistake, press the CLR key in the upper right to return the screen to the state shown in Figure 6–7. To set the timer to the entered value, press the ENT (Enter) key in the lower right. This will return you to the DWELL TIMER display screen shown in Figure 6–6. The desired value of 2.5 seconds is now displayed. To return to the main menu, press the MAIN PAGE key.

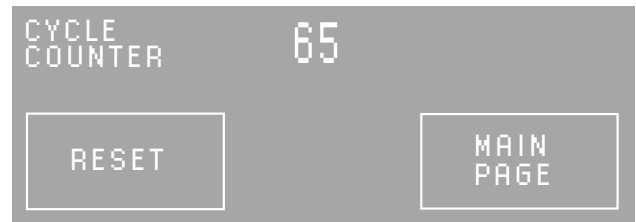


Figure 6–5 CYCLE COUNTER Display Screen

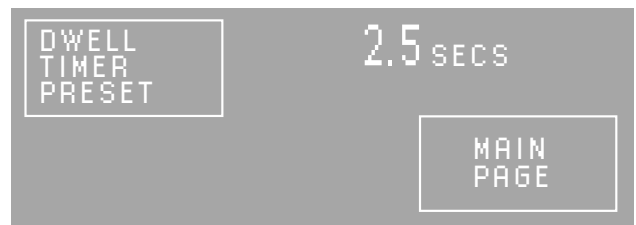


Figure 6–6 DWELL TIMER Display Screen

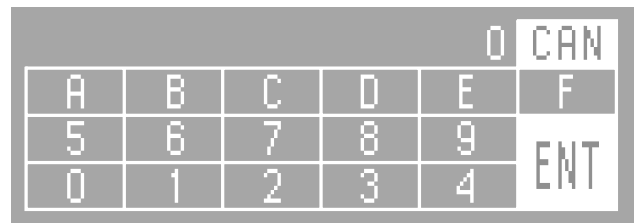


Figure 6–7 DWELL TIMER Data Entry Screen

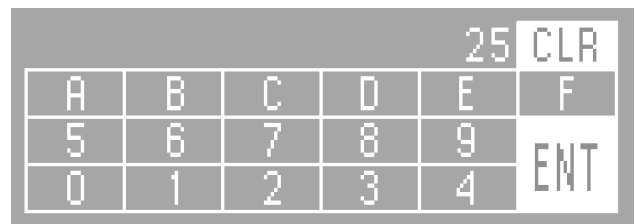


Figure 6–8 DWELL TIMER Set To 2.5 Seconds

NOTE

All timer values are entered in units of 0.1 seconds. To enter a value of 2.5 seconds, you must press the 2 key then the 5 key. This will be displayed as 25 in the upper right of the data entry screen. Pressing the ENT key will preset the value, then show the Timer Display Screen with the actual value of 2.5 seconds.

POST COOL TIMER

The POST COOL TIMER determines the length of time compressed air is directed at the areas that were just heated. The press must be equipped with a post cool kit to take advantage of this feature. Pressing the POST COOL TIMER key displays the POST COOL TIMER screen. This screen is similar to the DWELL TIMER screen, except the key in the upper left reads POST COOL PRESET as is shown in Figure 6–9. Operation and data entry is identical to the DWELL TIMER screens shown in Figures 6–7 and 6–8.

PREHEAT TIMER

The PREHEAT TIMER determines the length of time the platen is held at the preheat position. This is normally used to preheat metal inserts. Pressing the PREHEAT TIMER key displays the PREHEAT INSERT TIMER screen. This screen is similar to the DWELL TIMER and POST COOL TIMER screens, except the key in the upper left reads PREHEAT INSERT TIMER as is shown in Figure 6–10. Operation and data entry is identical to the DWELL TIMER screens shown in Figures 6–7 and 6–8.

TEMP ZONES PAGE

The TEMP ZONES PAGE key activates a touch screen for turning on up to six temperature zones. This is shown in Figure 6–11. A temperature zone or heater zone is controlled by a temperature controller (see Section 4 – Temperature Zones, Zone Concept). Generally the bottom master module controls zone 1 since it is installed first. The next master module is for zone two, etc. The internal wiring harness has six controller connectors. The shortest is zone one and is designed to plug into the bottom module.

To turn on a temperature zone, press the key for that zone on the touch screen display. The normal boot-up delay for a zone controller is up to three seconds. Each press of the key toggles the zone on and off. Zone one is shown activated in Figure 6–12. This causes the temperature controller for zone one to turn on the heater(s), until they reach the pre-

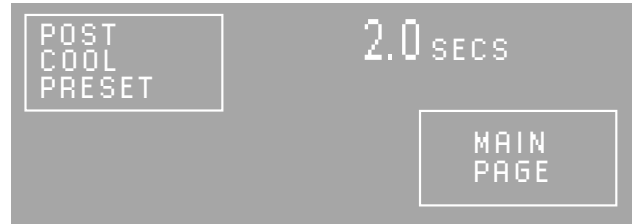


Figure 6–9 POST COOL TIMER Display Screen

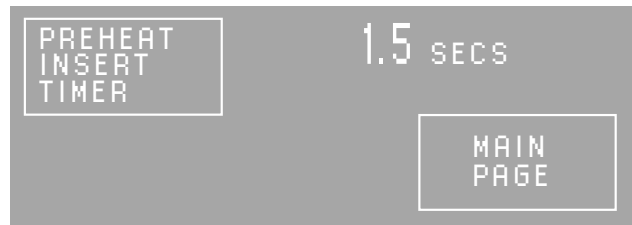


Figure 6–10 PREHEAT INSERT TIMER Display Screen



Figure 6–11 TEMP ZONES Display Screen

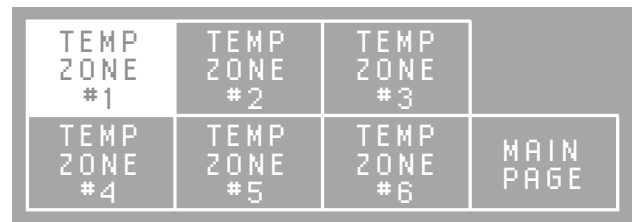


Figure 6–12 TEMP ZONE #1 Activated

set temperature. The temperature controller readout displays the thermocouple temperature as shown in Figure 6–13. The LED next to the temperature indicates that heater power is being applied. Press the MAIN PAGE key to return to the main menu,

Warning Screens

There are two type of warning screens. One indicating a heater alarm or fault. The other type indicates the thermal press is not in a reset position.

TEMP ZONE Fault

If a heater zone that does not exist is selected, a ZONE # FAULT screen will displayed approximately 5 seconds after the zone is selected. The key non-existent zone(s) will flash off and on. An example for heater zones #6 is shown in Figure 6–14. To reset the display, press the TEMP ZONE PAGES key and turn off the nonexistent zone(s).

If a zone's temperature controller detects an error, the controller display will show a coded error message. The most common faults are:

1. A thermocouple is not plugged into the zone's temperature sensing port – *ER 4*
2. The zone's thermocouple lead is broken or has a bad connection – *ER 4*

More information on the temperature controller is contained in the next section. Thermocouples are covered in Section 7 and 8, and the temperature sensing port is covered in Section 9 (Figure 9–3).

Abort Mode Fault

If either of the emergency stop (abort) switches are pressed in when the thermal press is turned on, an emergency stop fault screen is displayed as shown in Figure 6–15. Reset all emergency stop switches by turning the Abort button clockwise and pulling out (see Figure 5–4). Then momentarily tap both operate switches to clear the screen and display the main menu screen.

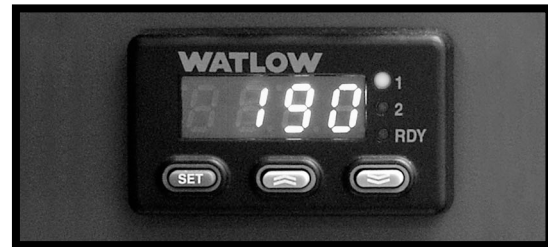


Figure 6–13 Temperature Controller Activated



Figure 6–14 TEMP ZONE Fault Display

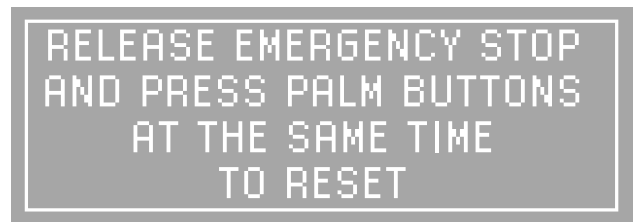
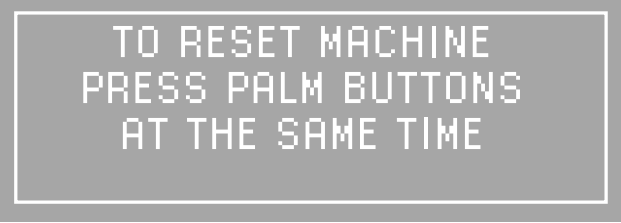


Figure 6–15 Abort Mode Fault Display

Startup Fault

If the press head and/or the slide kit platen are not at their reset position, a startup fault screen is displayed as shown in Figure 6–16. Press both operate switches simultaneously and the press system will initiate a complete cycle and return everything to its initial position.



TO RESET MACHINE
PRESS PALM BUTTONS
AT THE SAME TIME

Figure 6–16 Startup Fault Display



Temperature Controller

- Set Point
- Temperature Units °C/°F
- Thermocouple Tpe
- Auto Tune
- PID Theory of Operation
- PID Tuning

Controller Functions.....	49
Set Point.....	49
Temperature Units °C/°F.....	49
Software Menu.....	50
Thermocouple Type.....	51
Auto Tune.....	52
PID Control Theory.....	52
Thermal System Model.....	52
Feedback Control.....	53
PID Fundamentals.....	53
PID Algorithm.....	54
PID Tuning.....	56

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Controller Functions

The Watlow series 935A temperature controller is installed on the master module(s) of the thermal press. The master module controls one temperature/heater zone. The controller is accurate to $\pm 0.25\%$ of span, ± 1 LSD (Least Significant Digit), and has a sensor input sampling rate of 10 samples/second (10 Hz). The output update rate is once per second (1 Hz).

Set Point

To display the target set-point temperature for the heater, press the **SET** key. To change the set-point temperature, press and hold the **SET** key, and press the \uparrow or \downarrow key to change the set point. Release the **SET** key to complete the change.

Temperature Units °C/°F

The factory default settings for the temperature controllers is to display the thermocouple temperature in °F. This can be changed to °C if you prefer by going to the Configuration Menu.

1. Press both the \uparrow and \downarrow keys simultaneously for three seconds. This brings you to the Operations Menu which is displaying *RDY*.
2. Press the \uparrow key once to display the *CONF* prompt, or scroll through the Operations Menu with the \downarrow key until you see the *CONF* prompt. This is the entry point to the Configuration Menu.
3. Hold the **SET** key to display *no*. Press the \uparrow or \downarrow key to select *YES* to enter the Configuration Menu
4. Release the **SET** key to see the first prompt, which is *in*.
5. Press the \downarrow key until *ℓ.F* is displayed.
6. Press and hold the **SET** key and press either the \uparrow or \downarrow key to select *°C*. Release the **SET** key to change to °C.
7. To leave the Configuration Menu and return to the Display, press both the \uparrow and \downarrow keys simultaneously for three seconds.

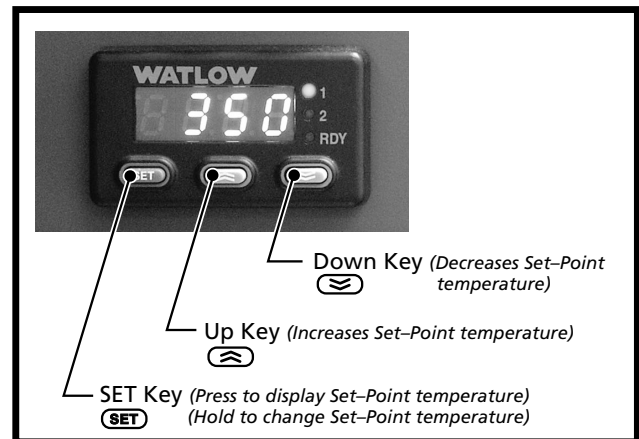


Figure 7-1 Displaying and Changing Set Point

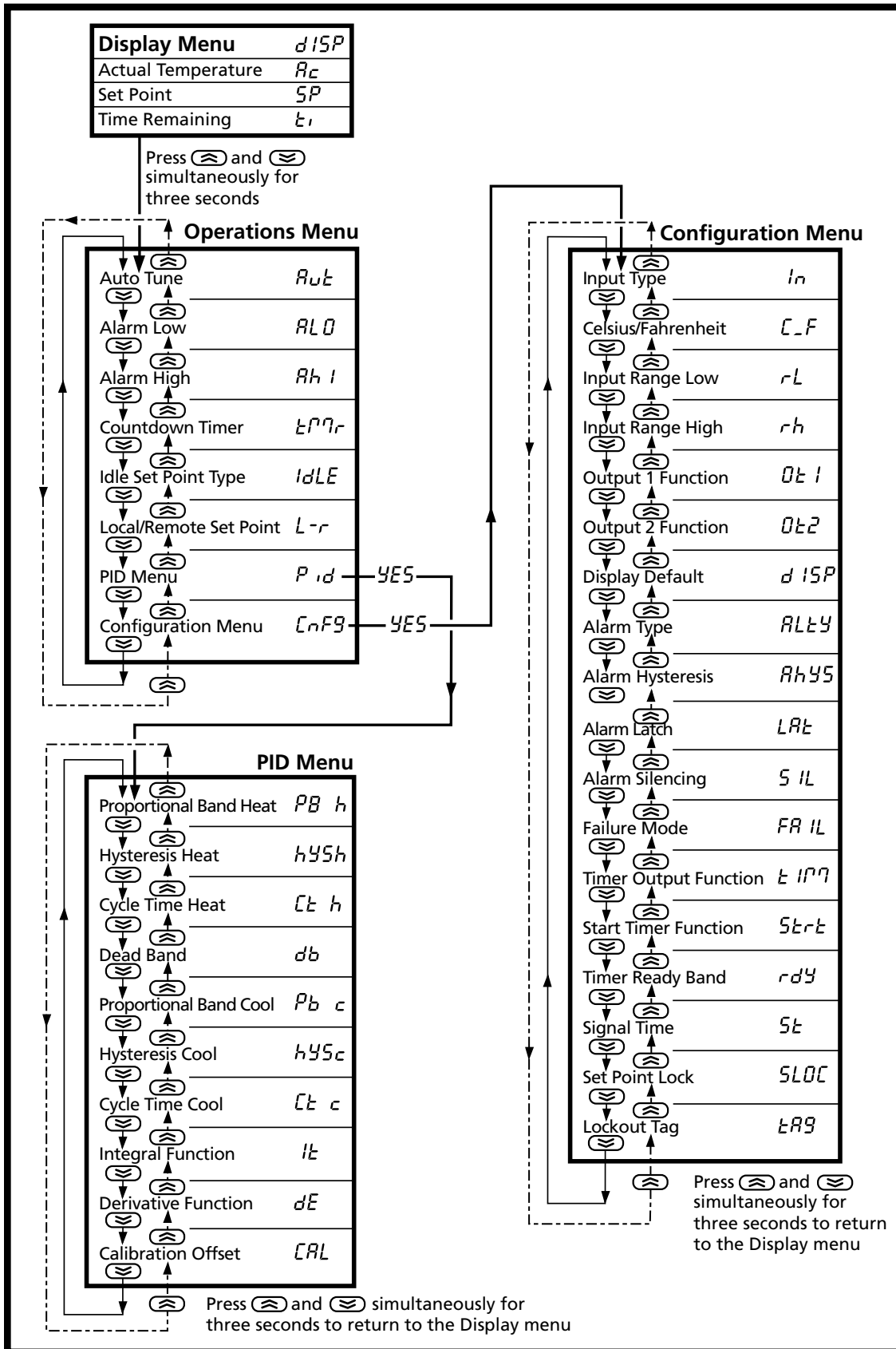














Figure 7-2 Temperature Controller Menu Structure

Software Menu

Figure 7–2 on the next page shows the complete software menu structure for the controller. The Operations Menu is accessed by holding both the  and  keys simultaneously for three seconds. The PID and Configuration Menu are accessed from the Operations Menu. The next section – “Thermocouple Type”, explains how to access the Configuration Menu. The PID menu is accessed in a similar manner.

Thermocouple Type

Table 7—I lists the alternate sensors which can be accommodated by the temperature controller. The standard Type–J thermocouple however, is the best sensor for almost all applications. If you ever need to change the thermocouple from the standard Type–J to another type (*not recommended*), you must access the Configuration Menu.

1. Press both the  and  keys simultaneously for three seconds. This brings you to the Operations Menu which is displaying *Run*.
2. Press the  key once to display or scroll through the Operations Menu with the  key until you see the *CFG* prompt. This is the entry point to the Configuration Menu.
3. Hold the **SET** key to display *no*. Press the  or  key to select *YES* to enter the Configuration Menu
4. Release the **SET** key to see the first prompt, which is *ln*.
5. Press and hold the **SET** key and press either the  or  key to choose the sensor type. See Table 7—I for the display codes.
6. Press both the  and  keys simultaneously for three seconds to return to the Display Menu.

Type	Display	Temperature Range
J t/c	J	+32°F to 1382°F 0°C to 750°C
K t/c	H	-328°F to 2282°F -200°C to 1250°C
T t/c	t	-328°F to 662°F -200°C to 350°C
N t/c	n	+32°F to 2282°F 0°C to 1250°C
S t/c	S	+32°F to 2642°F 0°C to 1450°C
E t/c	E	-328°F to 1470°F -200°C to 799°C
1° RTD	rtd	-328°F to 1292°F -200°C to 700°C
0.1° RTD	rtd Dot ↗	-199.9°F to 999.9°F -128.8°C to 537.7°C

Table 7—I Sensor Types and Temperature Ranges






NOTE

We recommend using Type–J thermocouples exclusively. They are one of the most popular types primarily because of a broad measurement range and superior voltage output (which can result in greater temperature resolution). J types should not be used above 760°C however, as an abrupt magnetic transformation will cause permanent decalibration. If a temperature controller is ever reprogrammed for a different type of sensor, notify Dukane before returning it for service. This is to prevent the programming changes from being misinterpreted as incorrect readings for a Type–J thermocouple.

Auto Tune

After changing the set-point temperature, you should run the auto-tune cycle. The entry point to the Operations Menu is shown in Figure 7-2. Auto-tuning requires at least three oscillations through the 90% set point in 85 minutes or less. most thermal press tooling will complete auto tuning in 10 to 15 minutes. To achieve good settings during auto tuning, allow the heater and probes to stabilize at its operating temperature. Auto-tune should be rerun each time the set point temperature is changed by more than 15 percent.

To run auto-tune —

1. Press both the  and  keys simultaneously for three seconds. This brings you to the Operations Menu which is displaying *Auto*.
2. Press and hold the  key and select *YES* with either the  or  key.
3. *Auto* will flash to indicate auto-tuning is in progress.
4. The display reverts to normal after the auto-tune cycle is complete.

PID Control Theory

Thermal System Model

An equivalent thermal circuit of the system is shown in Figure 7-3. It is composed of an electrical heater of heat capacity C_h connected via a thermal resistance R_{hp} to the probe with heat capacity C_p . The probe loses heat to the environment at temperature T_e by radiation through its thermal resistance R_p . The temperature controller monitors T_p and adjusts the power \dot{Q} dissipated in the heating elements, with the goal of maintaining the probe temperature T_p at the set-point temperature T_s . The dashed lines represent transducers. A temperature sensor at T_p and the conversion of electrical current flowing through the heater into heat (thermal current \dot{Q}). The temperatures are functions only of their initial value, \dot{Q} and time. Their values are governed by two coupled differential equations.



DEFINITION

The purpose of a PID controller is to regulate and control the time-domain behavior of many different types of processes. Often the transfer function (what output is generated by a particular input) is not known or too complex to model. A general-purpose PID however, can be tuned to produce a reasonably optimum response. PIDs perform much better than simple On-Off or Proportional controllers. The PID is tuned by observing the effect certain inputs have on the system output, following the steps of a tuning procedure.

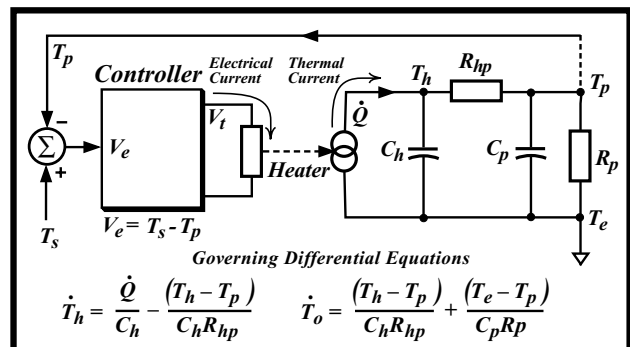


Figure 7-3 Thermal Model of Heater and Probe

Feedback Control

This system model illustrates a feedback system in which the controller is placed in the forward path, so that its output is the power applied to the heater. The feedback signal is provided by a temperature sensor attached to the heater. The sensor provides a voltage, that is correlated to the temperature and is summed with a reference (or command) signal to form an error signal V_e , which is the input to the controller. The controller changes its output until the error signal is zero. This occurs when the sensor temperature signal equals the reference signal and no power is applied to the heater. This however, does not provide us with a method whereby the temperature can be closely maintained at the set point, it does not take into account the heater lag and radiant heat losses, and does not allow us to perform this task as quickly as possible.

There is a class of general-purpose controller known as PID controllers. They are commonly used to regulate the time-domain behavior of many different types of dynamic systems whose transfer function is not well known. PID controllers are widely used because they provide good closed-loop response characteristics, they can be tuned using relatively simple design rules, and are easy to program.

PID Fundamentals

Proportional Controller

A simple proportional controller attempts to perform better than a simple On-Off type controller (see Figure 7-4) by applying power, \dot{Q} , to the heater in proportion to the difference between the probe temperature and the set point.

$$\dot{Q} = P \times (T_s - T_p)$$

Here P is known as the proportional gain of the controller. This type of controller reduces the rise time and will reduce, but not eliminate steady-state error. As the gain is increased, the system responds faster to changes in set-point, but becomes progressively underdamped and eventually unstable.

NOTE

Unless you are familiar with control system theory, we recommend you leave the PID functions at their factory default settings. Manual tuning requires you to set the Proportional Band, Integral and Derivative values, and can take from minutes to hours to obtain optimum values.

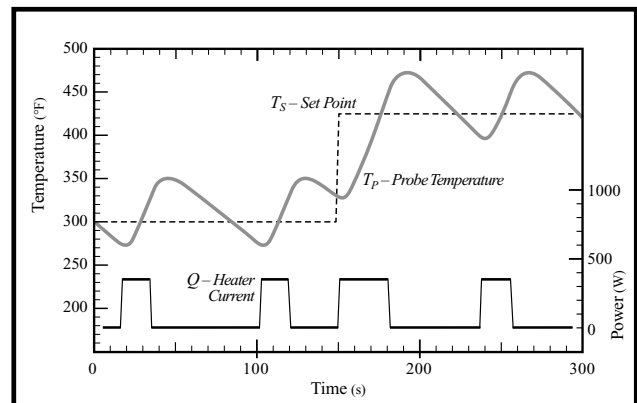


Figure 7-4 Probe Temperature With On-Off Control

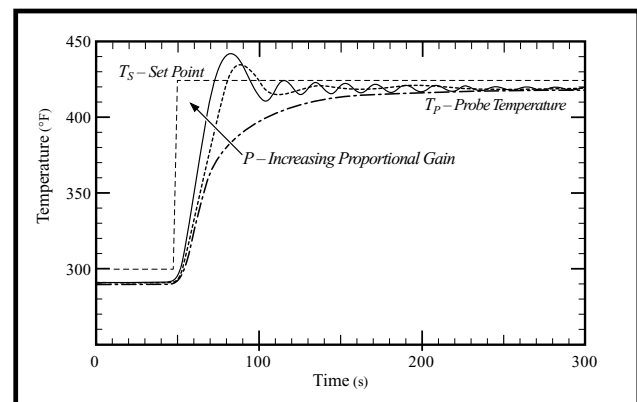


Figure 7-5 Temperature With Proportional Control

Derivative Controller

By adding a term proportional to the time derivative of the error signal, the stability and overshoot problems of the proportional controller at high gain can be compensated for. We now have —

$$\dot{Q} = P \times ((T_s - T_p) + D \times \frac{d}{dt} (T_s - T_p))$$

This is known as *PD* control. The value of the damping constant *D*, can be adjusted to achieve a critically damped response to changes in the set-point. Too little damping results in overshoot and ringing while too much results in a very slow response (see Figure 7–6).

Integral Controller

The probe temperature still lies below the set point because some difference is required to keep the heater supplying power because the heater can only source, not sink heat. This steady-state error can be eliminated by adding an integral term to the control function which now becomes —

$$\dot{Q} = P \times ((T_s - T_p) + D \times \frac{d}{dt} (T_s - T_p) + I \times \int (T_s - T_p) dt)$$

Where *I* is the Integral Gain parameter, sometimes known as the Controller Reset level. This is now a *PID* control function. The effect of the integral is to change the heater power until the time averaged value of the temperature error is zero. Sometimes when the temperature sensor is susceptible to noise or electrical interference, the derivative action can cause the heater power to fluctuate wildly. It may then be desirable to reduce the derivative action or to set it to zero.

PID Algorithm

There is not just one single PID algorithm and they are known by many different names. There is also no standard terminology or nomenclature and the action for similar modes varies. Some manufactures call Proportional Band the Proportional Gain. See “Name Game” at right for the relationship between the terms. The variation in forms means that different PID algorithms sometimes require very

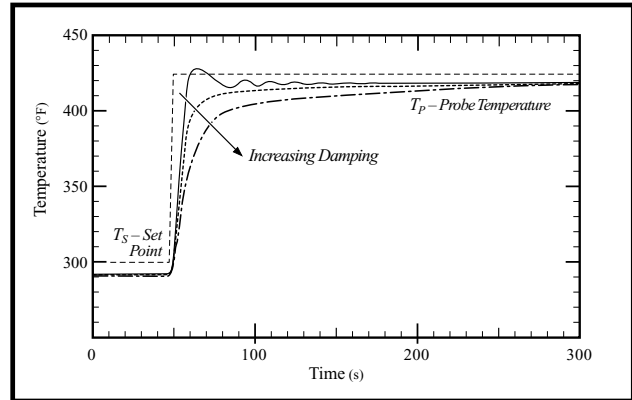


Figure 7–6 Proportional + Derivative Control

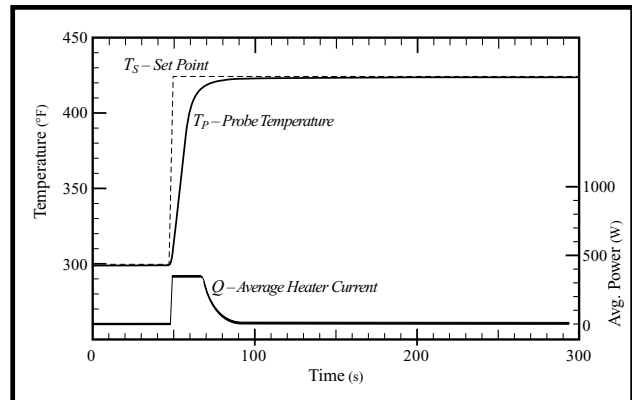


Figure 7–7 Proportional + Derivative + Integral Control

NAME GAME

- P Proportional Band = 100/Gain
where Gain = $\Delta\text{Output}/\Delta\text{Input}$
- I Integral = 1/Reset
- D Derivative = Rate

On controllers using *Gain*, increasing this setting makes the loop more sensitive and less stable. Decreasing *Proportional Band* on controllers using it has the same effect.

different integral and derivative tuning parameters. We will look at the most common forms and give guidelines for tuning each.

The ideal *PID* algorithm is defined by the relationship between the controller input and the controller output. It is the sum of proportional, integral and differential elements. By rewriting the control function for \dot{Q} in terms of V_t , we get —

$$V_t = K_p E_t + K_d \frac{de}{dt} + K_i \int_0^T e(\tau) d\tau$$

where: $K_p = P$ $E_t = T_s - T_p$
 $K_d = D$ and $K_i = I$

This clearly illustrates the proportional, derivative and integral gains that make up a PID controller. The Laplace transform of this equation gives the transfer function $K(s)$.

$$K(s) = \frac{v_s}{e_s} = \left(K_p + K_d s + \frac{K_i}{s} \right)$$

By selecting new definitions for the gain terms, and then substituting the RHS for LHS we get —

$$K_p = K_{C2} \quad K_i = K_{C2} / T_I \quad K_d = K_{C2} T_D$$

we now have —

$$K(s) = \left(K_{C2} + K_{C2} T_D s + \frac{K_{C2}}{T_I s} \right)$$

We used K_2 instead of K_1 since this expression gives us what is normally called the second form of the PID algorithm. The block diagram for this representation is shown in Figure 7–4. This is known as the non–interactive or parallel form. We really want to get the first form of the PID algorithm, since this contains the parameters in their unmodified state. To achieve this, we need to make some substitutions —

Controller Gain = $K_{C1} = F K_{C2}$
Integral or Reset Time = $T_{I1} = F T_{I2}$
Derivative Time = $T_{D1} = T_{D2} / F$
 where $F = 0.5 + \sqrt{0.25 - T_{D2} / T_{I2}}$

Terminology

K_C = Controller Gain = 100/Proportional Band
 T_I = Integral or Reset Time = 1/Reset Rate in repeats/minute
 T_D = Derivative Time
 K_{C1}, K_{C2} and K_{C3} relate to the P part of PID
 T_{I1}, T_{I2} and T_{I3} relate to the I part of PID
 T_{D1}, T_{D2} and T_{D3} relate to the D part of PID
 s is the Laplace notation for the derivative with respect to time
 $1, 2$ and 3 refer to the 1st, 2nd or 3rd form of the equations

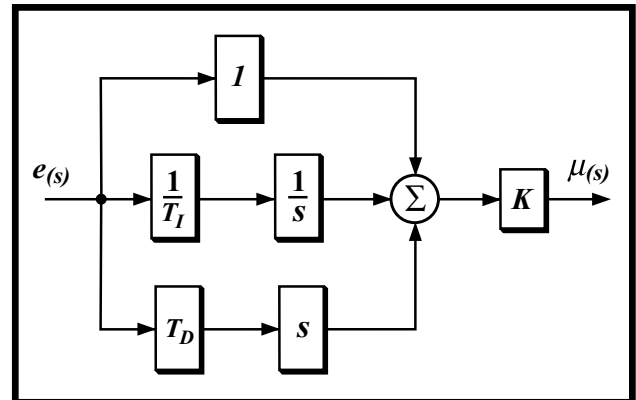


Figure 7–8 PID Block Diagram – Parallel or Non–Interactive Form

This gives us the series form where the four parameters are directly correlated —

$$K(s) = K_{C1} \left(1 + \frac{I}{T_I s} \right) (1 + T_D s) / \left(1 + \frac{T_{D1} s}{K_{D1}} \right)$$

Notice however from the block diagram in Figure 7–9, that implementing the algorithm is not as straight forward as the parallel form in Figure 7–8. The parameters directly correlate to their functions, but they are also now interacting in the time domain.

PID Tuning

Derivative Action Differences

Derivative action depends on the slope of the error, unlike P and I. If the error is constant, derivative action has no effect. In theory, derivative action should always improve dynamic response. In some systems, the problem of noisy signals can cause derivative action to increase system noise and possibly drive the controller into saturation. The largest variation among controllers is the way they handle derivative action. Virtually no two are the same. The differences are due to the different methods of filtering, whether the derivative works on set point changes or not, and how the derivative interacts with the integral action.

Integral Windup

Summation is used to calculate the contribution of the integral term. This can cause problems leading to a phenomenon known as integral windup. This causes long periods of overshoot in the response due to domination by the previous errors, if the new error is opposite in sign to the previous errors. The system recovers when the contribution of new error cancels the accumulation of the previous errors.

Watlow Tuning Procedure

A manual tuning procedure is provided on page 32 of the separate Watlow Series 935A manual included with the thermal press. Familiarize yourself with their procedure first. We will present some alternate methods.

TIP

In the Series algorithm, T_I is typically set to about 4 to 8 times T_D to keep the term under the squareroot real, in the equation for F . If $T_I < 4 T_D$, then the reset and derivative times (as differentiated from the settings) become complex numbers which can confuse tuning.

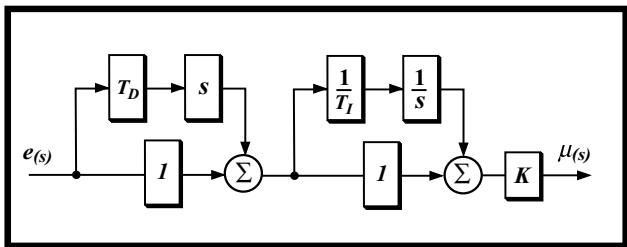


Figure 7–9 PID Block Diagram – Series or Interactive Form

Williams Method

Remember the various term relationships:

- *Proportional Band* is the fractional change in temperature that gives a maximum change in heater power, so a large number for gain corresponds to a small number for proportional band.
 - A short value of the *Derivative Time* constant means a small value of the derivative gain T_D .
 - A long value of the *Integral Time* constant (minutes/repeat) means a small value of the integral or reset time T_I , in repeats/minute.
1. Bring the system to a stable temperature about 50°F to 100°F below the normal operating temperature.
 2. Set the temperature set–point to the normal operating temperature. Turn off the derivative and integral actions, and increase gain to maximum, or until the system just oscillates.
 3. If the system is not oscillating, jump to step 5, otherwise reduce the gain by a factor of about two.
 4. Observe the effect of increasing T_D on oscillations caused by suddenly increasing T_S by about 5%. Choose a value of T_D that gives a critically damped response.
 5. Slowly increase the integral setting T_I until oscillations just start. Then reduce this value by a factor of two or three. This should be enough to stop the oscillations.

Modified CDHW Method

1. Set the set–point to the normal operating temperature. Turn off the derivative and integral actions and allow the system to stabilize.
2. Increase gain until the system just starts oscillating. Note the period of the oscillation.
3. Reduce the gain by about 30% (0.7 times its current value).

4. Suddenly increasing or reducing T_S by about 5% should induce underdamped oscillations. Try several values of derivative level and choose a value that gives a critically damped response. T_D will be about one-third of the oscillation period noted in step 2.
5. Slowly increase the integral level until oscillations just start. Then reduce this level by a factor of two or three. This should be enough to stop the oscillation. It is generally a good idea to use the lowest integral level that gives adequate performance. This method aims to produce a critically-damped system and trades stability and noise for response time.

Zeigler–Nichols Based Method

1. Set the set-point to the normal operating temperature. Turn off the derivative and integral actions, set the proportional gain to minimum and allow the system to stabilize.
2. Progressively increase the gain until suddenly increasing or reducing T_S by about 5% induces oscillations that are self-sustaining.
3. The gain at this stage will be set to the ultimate gain G_μ . The period of oscillations is known as the ultimate period t_μ . Note the value of each quantity.
4. Set the controller parameters as follows:
Gain = $0.6 \times G_\mu$
Integral = $2 / t_\mu$
Derivative = $t_\mu / 8$
5. For a less aggressive system that is slightly underdamped, reduce the system gain to about 0.45 to $0.5 \times G_\mu$. This method was developed for the traditional series or interacting controller design.

Heaters & Thermal Probes

- Heaters
- Thermocouples
- MATP™ Probes
- Standard Probes

Heaters	61
350W 12mm Heaters	61
Cartridge Heaters	61
Thermocouples	62
Principles of Operation	62
J-Type Thermocouple	62
Thermal Probes	63
MATP Probes	63
Standard Probes	64
Titanium Probe Tips	64

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Heaters

350W 12mm Heaters

The thermal press was designed to use a standard 12mm (1/2 inch) 350 Watt heater coil. They have a nominal I.D. of about 12mm or 1/2 inch. A photo of one is shown in Figure 8–1. The heater consists of resistance wire which heats up as current passes through it. The heater also has a thermocouple embedded into the assembly so the heater temperature can be determined. The temperature controller acts as a thermostat to maintain the average heater temperature at the set point by measuring the thermocouple output voltage.

Since the thermal press is available in both 110VAC (48Hnn1TS) and 220VAC (48Hnn2TS) models, the heaters must have the same voltage ratings as the thermal press. The 110V heater coil with armored cable and connector has Dukane Part No. 438–886. The 220V heater coil with armored cable and connector has Dukane Part No. 438–887. Figure 8–4 on the next page shows a complete heater, cable and connector assembly.

A 110V heater used in a 220V press will quickly burn out. A 220V heater used in a 110V press will take a very long time to reach operating temperature and have long cycle times. Figures 8–2 and 8–3 shows the difference in the heater power pin locations of a 110V heater and a 220V heater.

Cartridge Heaters

Cartridge heaters are used primarily to heat a large surface plate or in custom installations. They are inserted into the mass to be heated. The 48H thermal press can be also used with cartridge heaters. You can mix cartridge heaters and 12mm heaters as long as they are not in the same heater zone. Make sure the heater voltages match the controller and that the maximum power rating of the press is not exceeded. Also verify the type of thermocouple supplied with the cartridge heater.



Figure 8–1 12mm 350 Watt Heater Coil

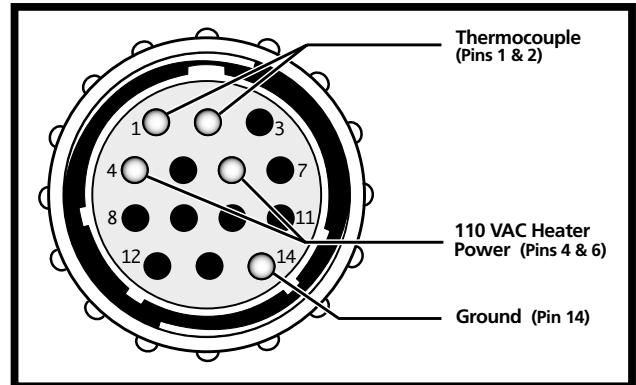


Figure 8–2 110V Connector – Cable End (438–886)

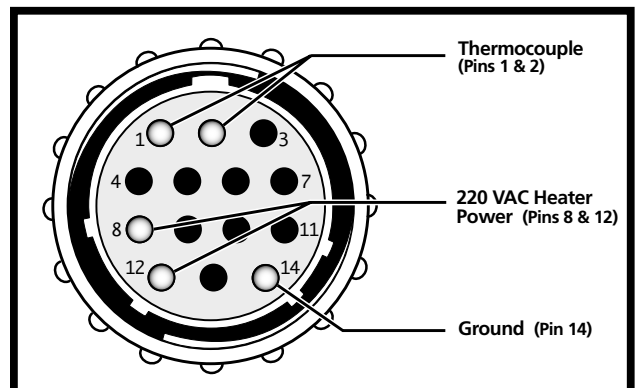


Figure 8–3 220V Connector – Cable End (438–887)

Thermocouples

Principles of Operation

Thermocouples are widely used for measuring temperature because they operate over a wide temperature range and they are rugged. A thermocouple consists of two wires, each a different metal, welded at one end. The 48H series Thermal Press is setup for a Type J thermocouple which uses Iron for the positive lead and an alloy of Constantan (55% Copper and 45% Nickel) for the negative lead. When the junction of the two wires is heated, the thermal agitation causes many of the electrons to become free from their atoms. As a result of this excess electron density the free electrons diffuse toward the cold end of the wire. The charged ions at the heated end however attract these free electrons back, creating an electric field which gives rise to a voltage source (see Figure 8-5).

A thermocouple is based on this voltage difference due to the temperature difference between a hot and a cold junction, and the fact that different metals create different voltages. A sensitive meter is then used to measure the difference in the voltages in the positive Iron lead and the negative Copper–Nickel lead which is then correlated to a change in temperature. This potential difference is rather small however – about $30\mu\text{V}/^\circ\text{F}$ at 400°F .

The time constant of a thermocouple (time required to reach 63.2% of the final full voltage) varies with construction. Typical time constants range between 0.2 and 1.5 seconds. The thermocouple can be considered to be a temperature dependent voltage source with a very small output resistance, close to an ideal voltage source.

J-Type Thermocouples

A J-type thermocouple is the preferred type for most temperature control processes. Compared to other types, it has a superior voltage output which can result in better temperature resolution and more immunity to electrical noise. With the temperature

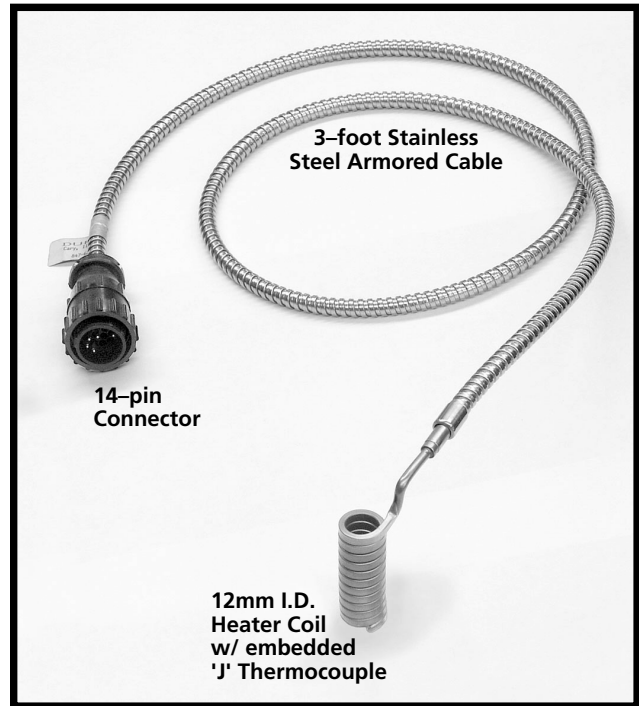


Figure 8-4 Complete Heater and Cable Assembly

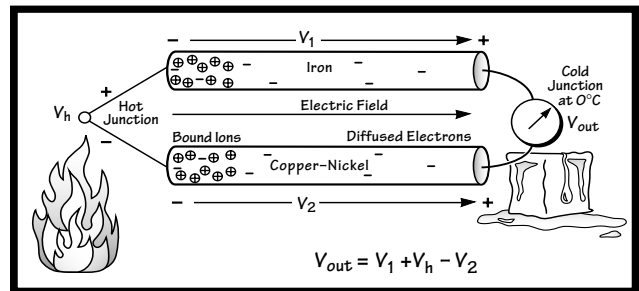


Figure 8-5 Thermocouple Principle of Operation

controller, the J-type thermocouple has an effective range from +32°F to 1,382°F (0°C to 750°C). J types should not be used above 760°C (1,400°F) as an abrupt magnetic transformation will cause permanent decalibration. Table 7—I in the Section 7 lists the various types of thermocouples and their usable temperature ranges.

Thermal Probes

MATP™ Probes (Model TT39)

Dukane's MATP™ (Multi-Adjustable Thermal Probe) is available on the 48H series thermal press. The MATP probe offers advanced features which overcome the limitations of conventional probes. The most serious design flaw in a conventional probe is the inability to independently adjust the height, lateral or radial position of the probe while the probe is at operating temperature. Our design goals were to enable these adjustments to be made while hot, using common hand tools and to maintain compatibility with existing systems. A drawing of the MATP probe is shown in Figure 8-6.

New features designed into the probe are a fork mounting ① to permit using a platen with a standard grid-mounting hole pattern. The probe features an integrated ceramic insulation disc ② which allows adjustment without concern for the insulator falling out. The probe has a built-in height locking adjustment ④ that is easily accessible even when the probe is hot. The probe shaft is designed to accommodate conventional 12mm I.D. heating coils ⑤ (not included) and is internally machined with industry standard 1/4-28 threads to permit using existing tips. Both the socket ③ and the shaft ⑥ are machined from a high thermal-conductivity alloy to reduce thermal mass and heating time. Finally the probe incorporates a locking swivel adjustment ⑦ which is independent of the height adjustment. This permits fine tuning position-sensitive or multi-point tips without disturbing the height or lateral settings. The tip shown in a drawing is a two-point staking tip.

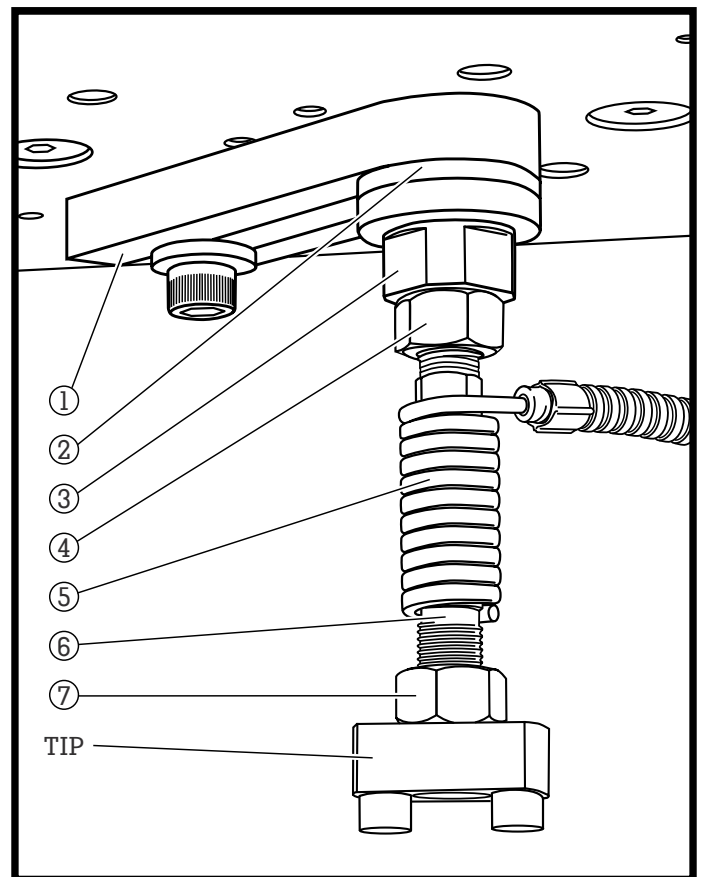


Figure 8-6 MATP™ (Multi-Adjustable Thermal Probe)

Standard Probes (Model TT24)

Dukane can also supply standard probes which are machined to the specified length. These probes are designed for applications where the setup does not change. The platen is drilled to accept the probe at the specified position as shown in Figure 8-7. An insulating disc ① with the same hole pattern as the probe base ② goes between the ③ probe and the upper platen. The mounting base has a small amount of clearance machined into the four mounting slots to permit small lateral adjustments. The standard length (including the insulator) is 4-inches (100mm) and custom lengths are available (Model TT24CL).

Titanium Probe Tips

Probe tips are normally titanium or stainless steel. They are machined with $1/4-28$ threads to screw into the end of standard or MATP™ probes. Figure 8-7 shows a tip ④ attached to the standard probe ③.

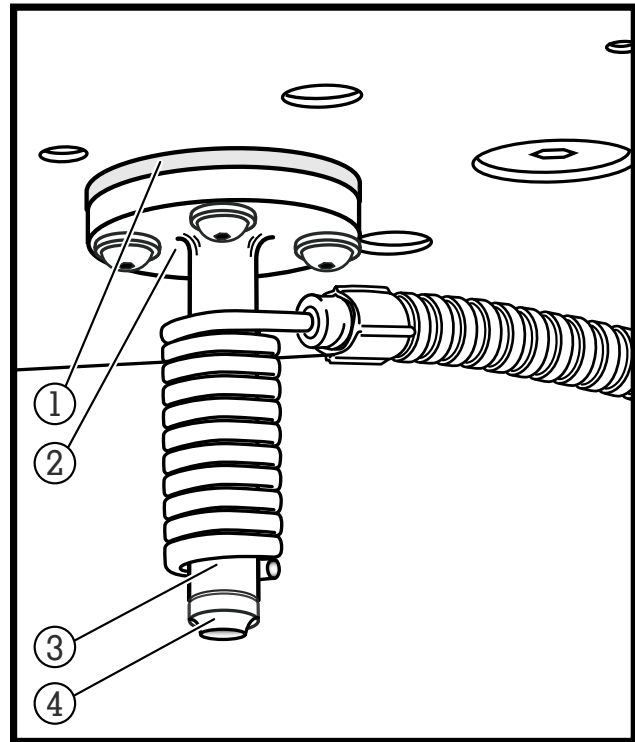


Figure 8-7 Standard Probe and Heater



Master/Slave Modules

- Master Module
- Slave Module
- Power Limitations
- Line Voltage
- Installation
- Rear Module Connectors

Master Module	67
Power Limitations	67
Line Voltage	67
Rear Connectors	67
Installation	68
Slave Module	75
Power Limitations	75
Line Voltage	75
Rear Connectors	76
Installation	76

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Master Module

The thermal press has at least one master module. A master module contains a temperature controller on the front panel to control a heater zone (see *Temperature Zones – The Zone Concept* in Section 4). Figure 9–1 shows two master modules installed on a 1– $\frac{1}{2}$ ton thermal press.

Power Limitations

Each master module is capable of supplying 1050 Watts of output power to three heaters. This specification is the same for both the 110VAC and 220VAC modules. However, the contacts and heater cables limit the output power to 350 Watts per connector. Each master controller can also drive up to three additional slave units which can also provide up to 1050 watts of output power per module. Note that this configuration can only be fully utilized with the 220V – 48Hnn2TS press, since the 110V press has a maximum output power of 2100 Watts (six 350 Watt heaters). Also refer to *Temperature Zones – Heater and Zone Limits* in Section 4 for a detailed explanation of the Series 48H thermal press power limits

Line Voltage

The master (and slave) modules must be matched to the AC power rating of the press and heaters if they are to function properly. The master modules are available in a 110VAC model (110–3896) for the 48Hnn1TS thermal press and a 220VAC model (110–3897) for the 48Hnn2TS press. Both modules are identical when viewed from the front. They are labeled with their AC voltage and part number on the rear panel (see Figure 9–2).

Rear Connectors

To prevent using heaters with the incorrect power rating in the thermal press, the heater power pins have different pin numbers on the 110V and 220V modules. This is shown in Figure 9–3. Note that the innermost connector has an additional pair of pins for

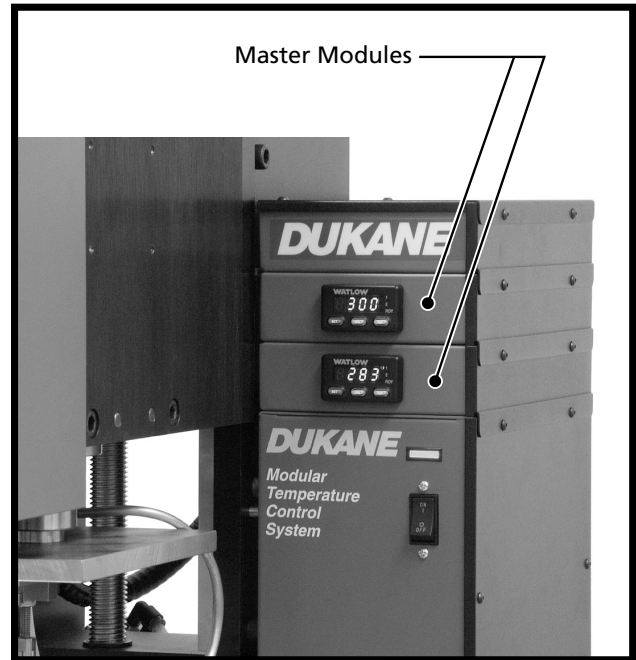


Figure 9–1 Master Modules

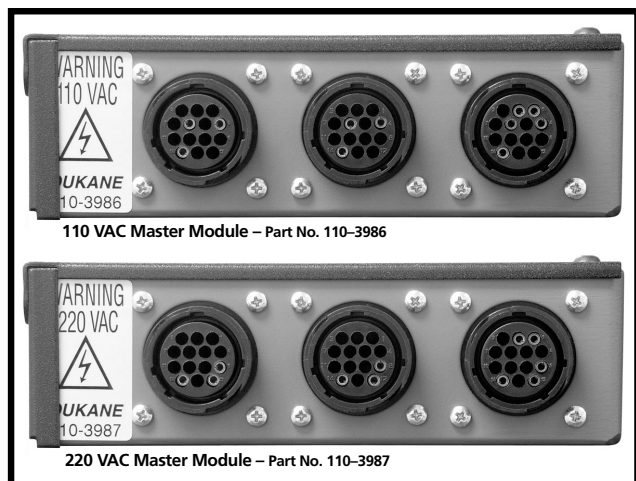


Figure 9–2 Master Module AC Voltage Rating and Part Number Labels

the thermocouple sense leads. The heater connected here controls the temperature for that heater zone.

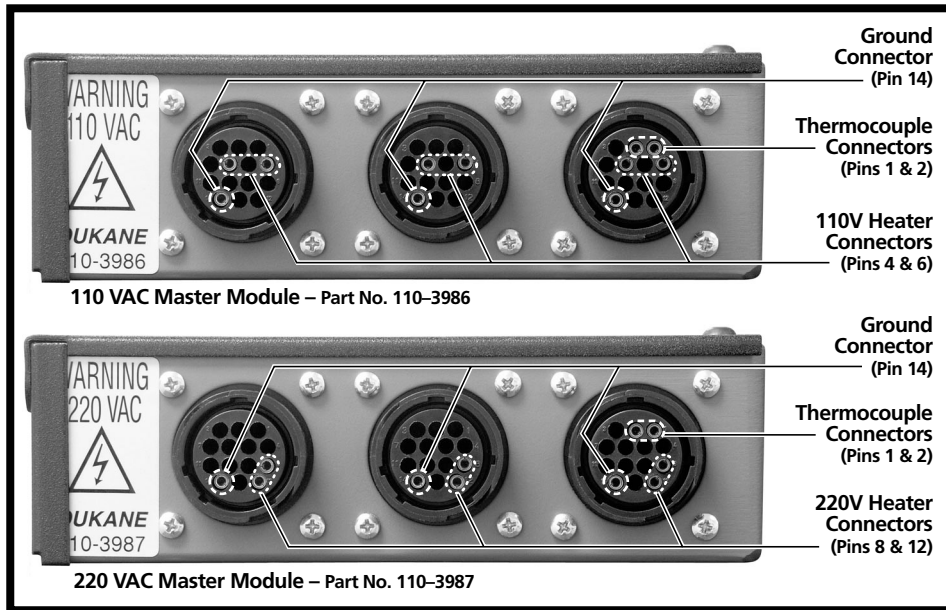


Figure 9-3 110V and 220V Master Module Heater Pin Assignments

Installation

Installing an additional master module requires only a phillips-head screwdriver and 2.5mm hex-head wrench to fit the M4-0.7 button-head cap screws on the side and top cover on the modules.

1. Loosen Cover Screws

Turn the thermal press AC power switch off. Remove the two screws from the side panel of the lowermost module (see Figure 9-4). Do not remove the cover from the main electronics chassis. Next, remove the two screws from the top cover of the existing module stack on the thermal press. The cap screws accept a 2.5mm hex key. If you do not have a 2.5mm key, a 3/32-inch hex key should also fit, but use care to avoid stripping out the hex-head in the cap screw.

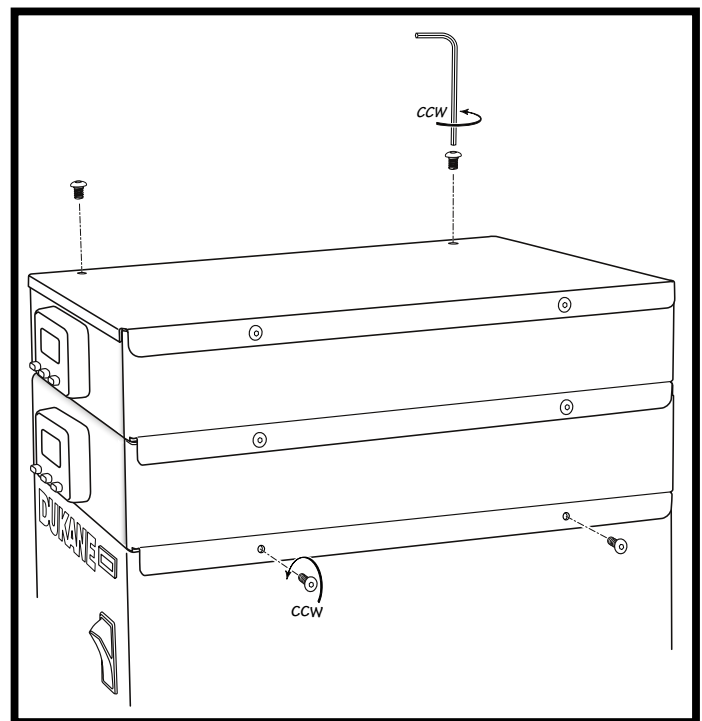


Figure 9-4 Loosen and Remove Cover Screws

2. Remove Cover Assembly

Leave the side panels attached to each other and to the top cover. You can now remove the entire cover unit as one assembly as shown in Figure 9–5. Set the cover assembly and the four screws aside.

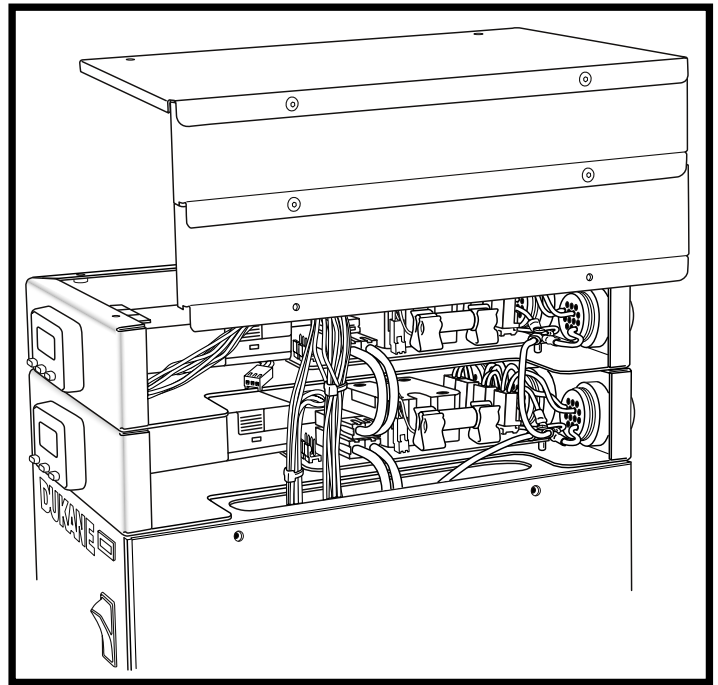


Figure 9–5 Remove Cover Assembly

3. Install Ground Jumper Cable

Locate the short ground jumper wire with the fork terminals on each end that came with the module. One end attaches from the ground connection of the existing module. Loosen the mounting screw using a phillips screwdriver as shown in Figure 9–6. Securely attach the one end of the grounding cable to the top module and retighten the mounting screw.

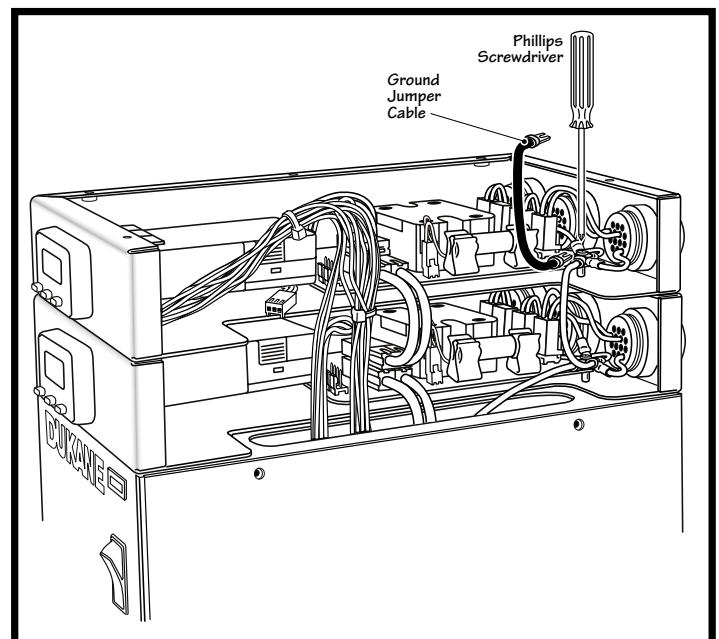


Figure 9–6 Install Ground Jumper Cable in Existing Module

4. Locate Heater Control Cables

Ignore this step if installing a slave module. Unwrap the coiled control-cable harness. The harness is composed of six groups of wires, with three wires in each group (Red, Orange and Black) each attached to a three-socket connector. Locate the shortest unused group (see Figure 9-7). This will be used for the new module. If you are installing more than one module, select the appropriate number of cable groups. Coil up the remaining wires. You will place them in the top module at the end of the installation procedure.

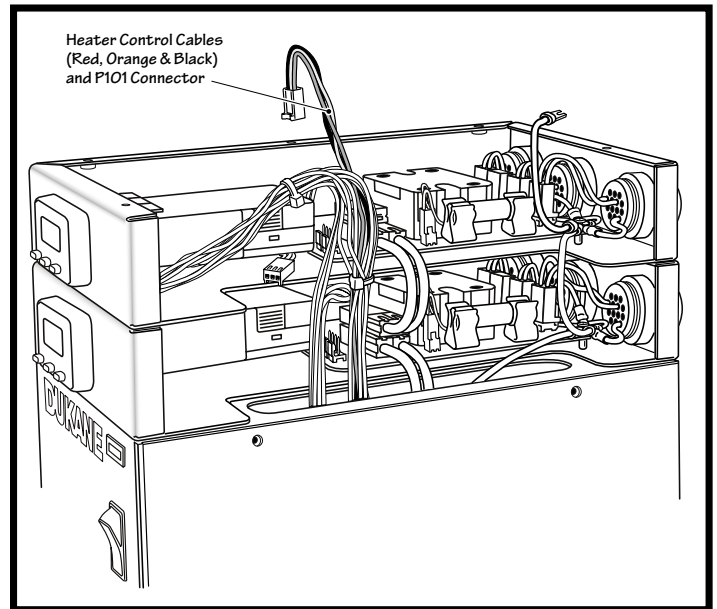


Figure 9-7 Locate Heater Control Cables

5. Position New Module

Place the new module on top of the stack. Align the three pins on the bottom of the module with the corresponding holes in the top of the existing module stack as shown in Figure 9-8. The cases should easily fit together. If they do not mate properly, check to make sure there are no wires caught between them. Do not force them together.

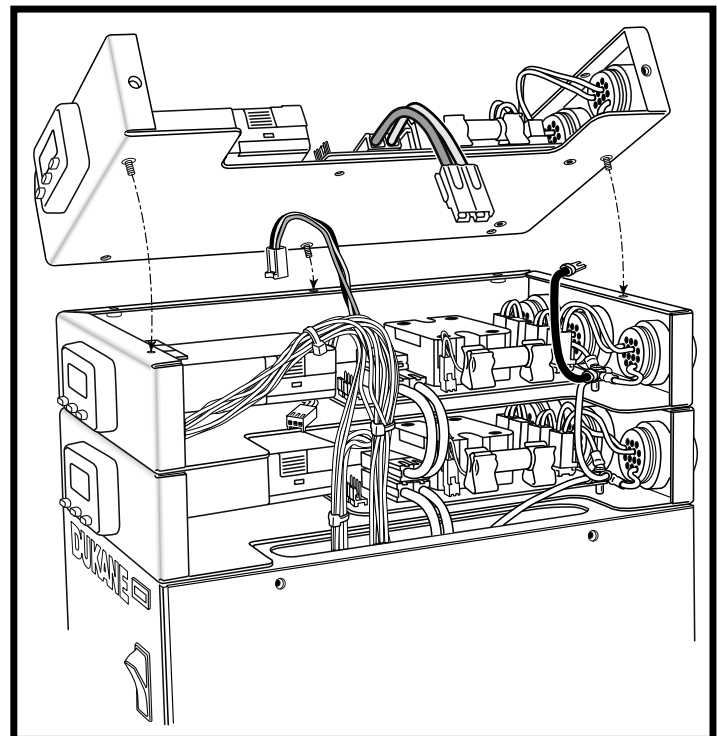


Figure 9-8 Position New Module

6. Secure New Module

Using two of the supplied hex-head screws, secure the new module to the existing stack as shown. Place a screw in each of the two mounting holes located in the bottom of the chassis. Place the hex key through the top hole in the chassis to align it over the hex-head screw at the bottom (refer to Figure 9–9). You may have to lift the chassis slightly to start each screw. Start both screws before tightening them securely.

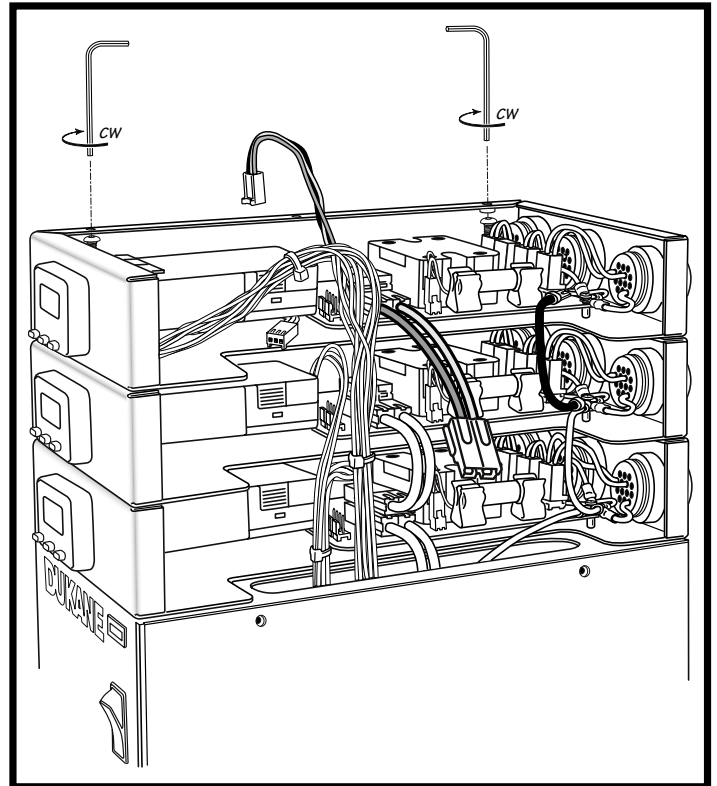


Figure 9–9 Securing New Module to Stack

7. Attach Ground Jumper Cable

Loosen the mounting screw for the ground connection using a phillips screwdriver as shown in Figure 9–10. Securely attach the ground jumper installed in step 3 to the ground connection of the new module and retighten the mounting screw.

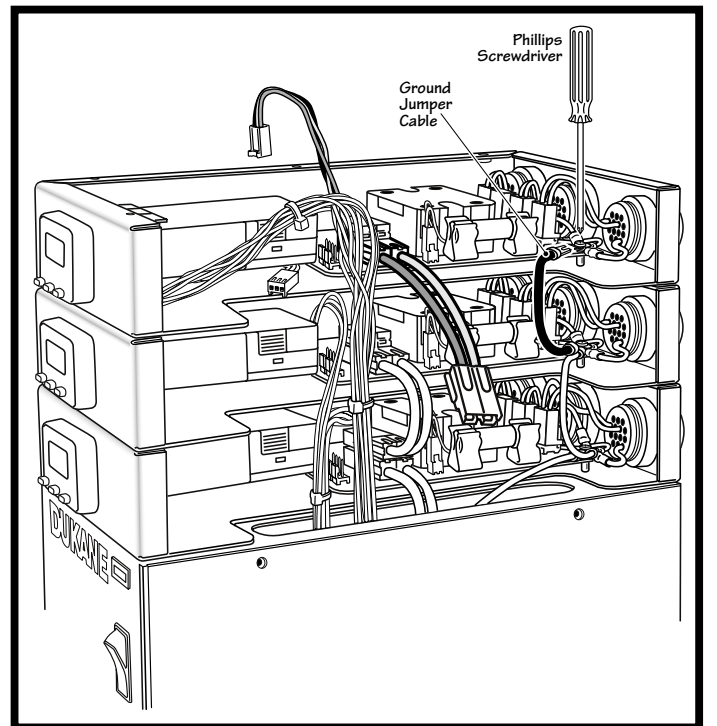


Figure 9–10 Attach Grounding Jumper to New Module

8. Connect Heater Power Cable

Locate the heater power cable (thick Tan and Blue wires). It should already be attached to the lower pair of contacts of the heater power connector on the new module. The connector ends are keyed so they can only be inserted one way. Attach the cable to the upper half of the socket on the module directly below it as shown in Figure 9-11.

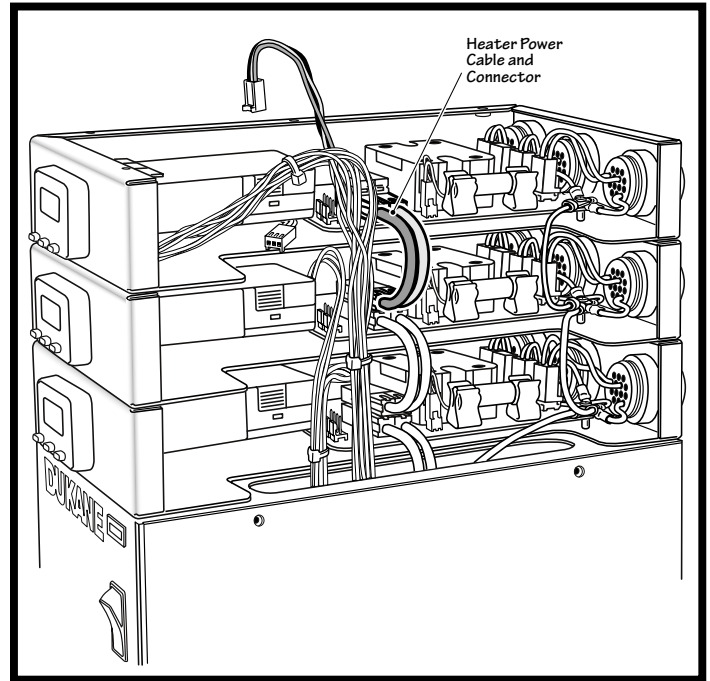


Figure 9-11 Connect Heater Power Cable

9. Connect Controller Cable

Ignore this step if installing a slave module. Attach the controller cable located in step 4 to the jack labeled P101 on the PC board. The connector is keyed to prevent reverse installation. Both the heater power cable and controller cable are shown in detail in the figure at the bottom of this page.

Coil the remaining controller cables up and slide them under the front panel temperature controller as shown in Figure 9-12.

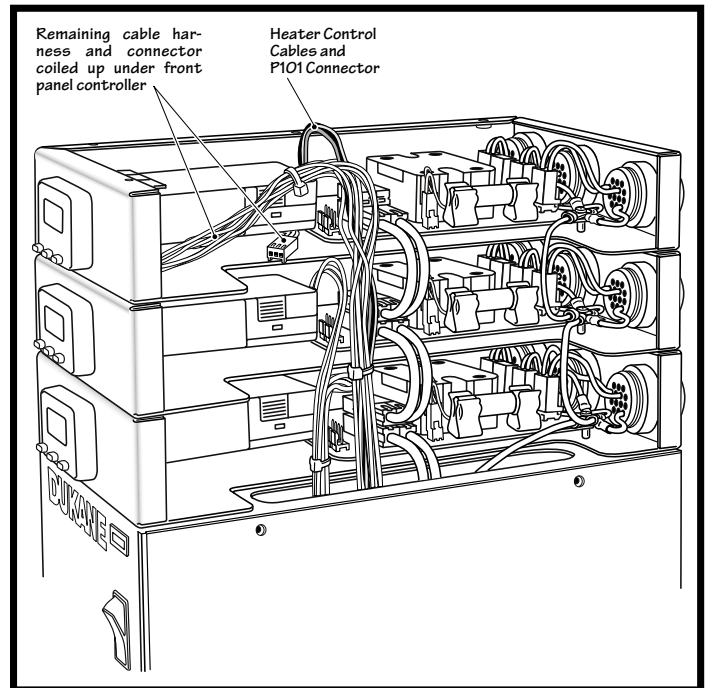


Figure 9-12 Connect the Controller Cable to P101

10. Connector Detail

The heater controller cable which plugs into the P101 jack has the red wire on the inside and black wire closest to the outside. The jack is labeled P101 on the PC board. The heater power cable has the blue wire towards the front and the tan wire towards the rear of the controller.

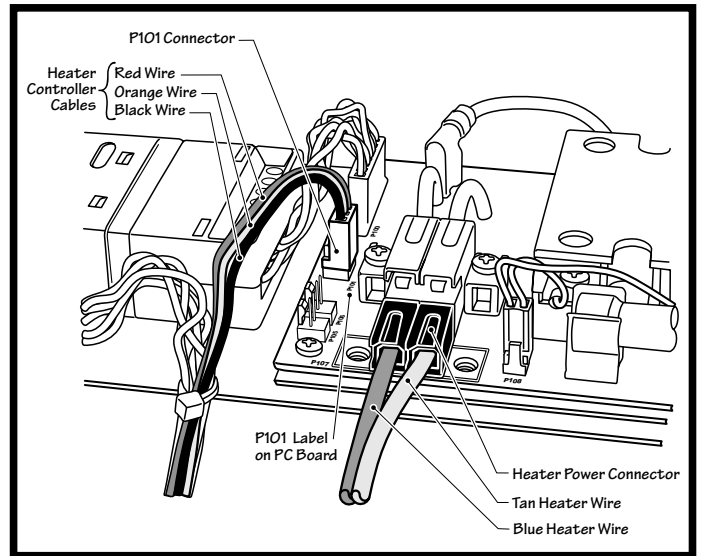


Figure 9-13 Master Module Power and Control Connector Detail

11. Attach New Panel to Assembly

Using the other two hex-head screws provided, attach the side panel from the new module to the bottom of the existing cover assembly. Start both screws, but do not tighten them completely to allow for a final fit in the next two steps. The lip of the panel should be at the bottom as shown in Figure 9-14.

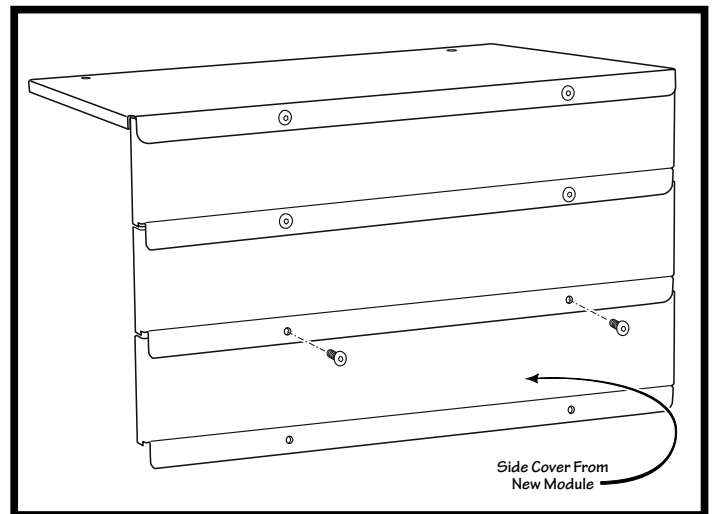


Figure 9-14 Attach New Panel to Cover Assembly

12. Install Cover Assembly

Place the cover assembly over the module stack as shown in Figure 9–15. The cover should fit properly. If the cover does not line up correctly, slightly loosen one or more of the cover assembly screws to allow the side panel to move.

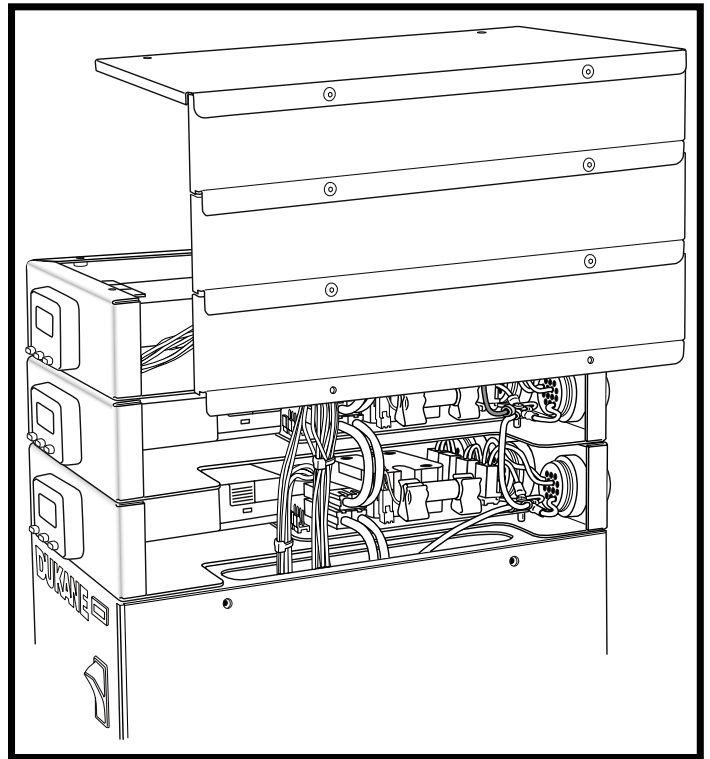


Figure 9–15 Install Cover Assembly

13. Secure the Cover Assembly

Using the four hex-head screws you set aside in step 1, secure the cover assembly to the module stack. Attach each screw loosely until all the screws are installed. Use a 2.5mm hex key to tighten the screws as well as any screws you may have loosened in steps 11 or 12.

Attach the probe cable(s) to the newly installed module. Remember to start attaching the cables to the module at the innermost connector first.

Turn on the AC power and you are ready to begin setting up the parameters for the new heater module.

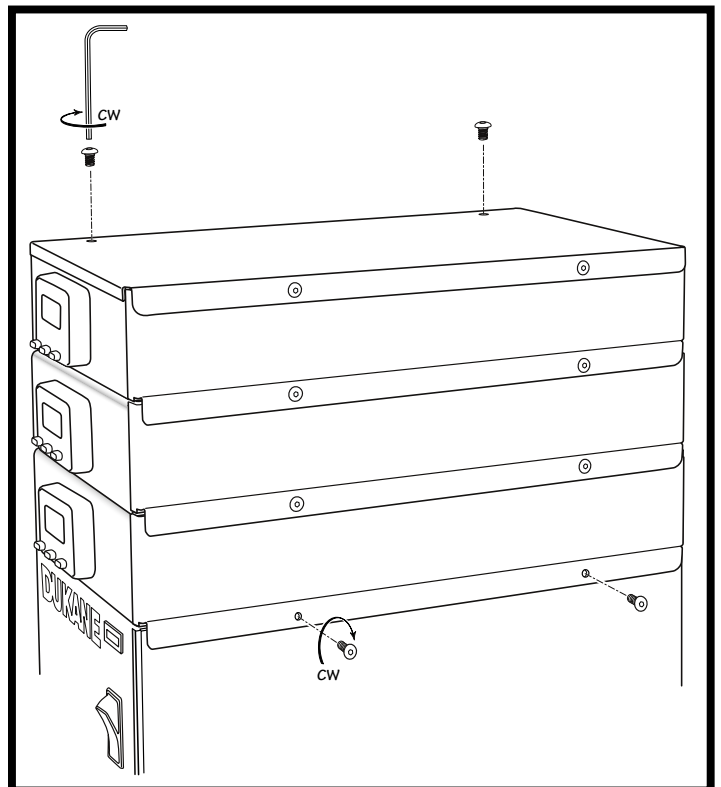


Figure 9–16 Securing the Cover Assembly

Slave Module

A slave module expands the power output capacity of a master module. It does not have a temperature controller. It is slaved to the master module for that heater zone and powers additional heaters. Figure 9–17 shows a slave module installed above its master module on the thermal press.

Power Limitations

Each slave module is capable of supplying 1050 Watts of output power for three heaters. This specification is the same for the 110VAC and 220VAC modules. The contacts and heater cables limit the output power to 350 Watts per connector. Up to three additional slave units can be connected to a master module.

Line Voltage

The slave module must be matched to the AC voltage rating of the press, master module and heaters if they are to function properly. The slave modules are available in a 110VAC model (110–3898) for the 48Hnn1TS thermal press and a 220VAC model (110–3899) for the 48Hnn2TS press. Both modules look identical from the front. They are labeled with their AC voltage and part number on the rear panel (see Figure 9–18).

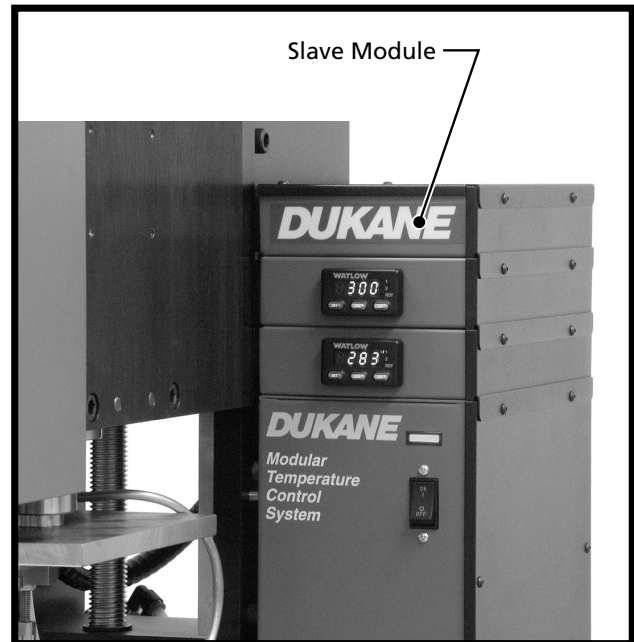


Figure 9–17 Slave Module

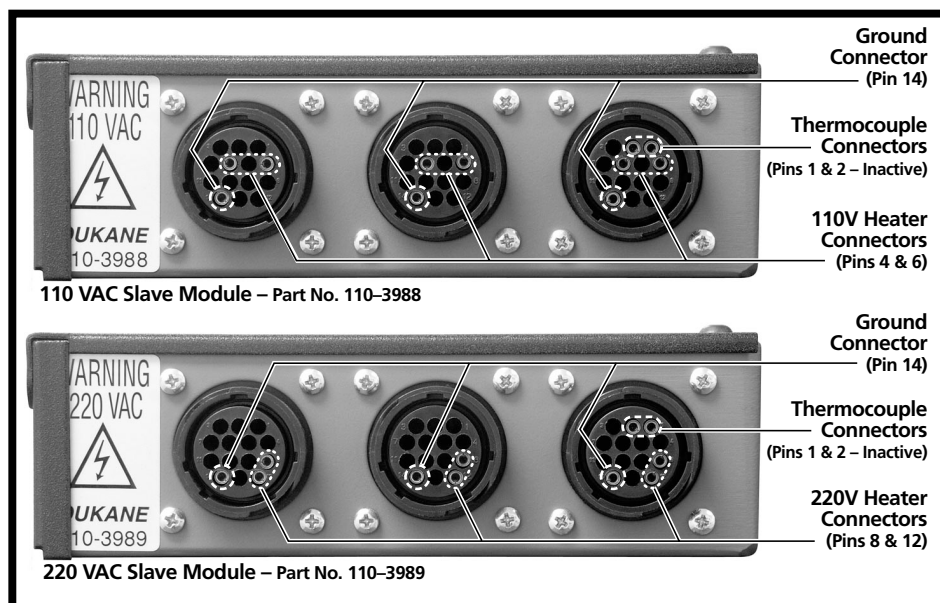


Figure 9–18 110V and 220V Slave Module Heater Pin Assignments

Rear Connectors

To prevent using heaters with the incorrect power rating in the thermal press, the heater power pins have different pin numbers on the 110V and 220V modules as shown in Figure 9–18. There is no difference in the pinouts on a master or a slave module of the same voltage rating. Note that the innermost connector has an additional pair of pins for the thermocouple sense leads. Since the slave module does not have a controller, these pins are inactive.

Installation

Installing an additional slave module follows the same procedure as the installation of a master module with the exception that steps 4 and 9 are omitted because the slave module does not have a controller. Instead a two-wire slave controller cable (supplied with each slave module) is connected to P105 or P106 of the master module. A slave module may be connected directly to a master module or indirectly through another slave module, by daisy-chaining the P105/P106 connections. P105 and P106 have their connections in parallel so it doesn't matter which connector you use on the master or slave modules. Up to three slave modules may be controlled by a master module. The connector detail for a slave module is shown here in Figure 9–19. This drawing replaces Figure 9–13 in the module installation sequence when installing a slave module.

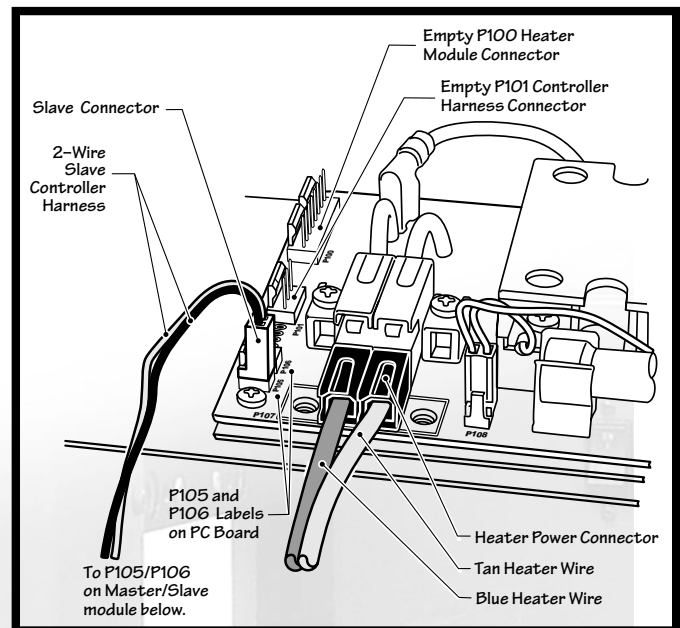


Figure 9–19 Slave Module Power Connector Detail

Press Connectors

- Operate Switches Connector
- Pneumatic Fixture Clamp
- Post Cool Connector
- Multipurpose Connector
- Signal Descriptions
- Connector Pinout

Rear Connectors	79
Operate Switches Connector	79
Fixture Clamp Connector	80
Post Cool Connector	80
Multipurpose Connector	81
Slide Kit Controller	82

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Rear Connectors

The thermal press has all of its electrical connectors located in on the rear panel of the power supply and electronics chassis. The connectors are identified in Figure 10–1.

Operate Switches Connector

The operate connector is a DB 9–socket connector. The normal position is above the Pneumatic Fixture Clamp connector. Some models of the press have the Operate Connector located at the bottom of the chassis. The pin numbers for the connector are shown in Figure 10–2. The pin assignments are given in Table 10–I and the schematic diagram is shown in Figure 10–3. The cable from the dual operate switch assembly and auxiliary abort switch plugs into this connector. This is identified as cable 2 in Figure 3–4.

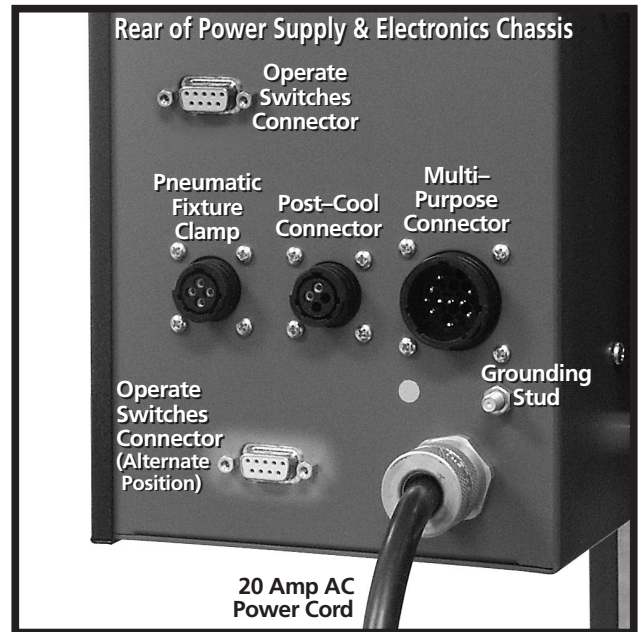


Figure 10–1 Thermal Press Rear Connectors

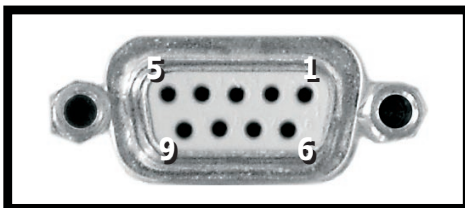


Figure 10–2 Operate Connector Pin Numbers

Pin	Signal Name	Signal Description
1	Oper Sw 1	Optical Operate Switch #1 Output
2	Oper Sw 2	Optical Operate Switch #2 Output
3	Abort	Abort Switch Isolated Connection
4	Not Used	Spare Input Pin
5	+24V DC	24VDC Power for Optical Switches
6	+24V DC	24VDC Power for Optical Switches
7	+24V DC	24VDC Power for Optical Switches
8	Gnd	Ground
9	Abort	Abort Switch Isolated Connection

Table 10–I Pin Assignment and Signal Description for Operate Switches Connector

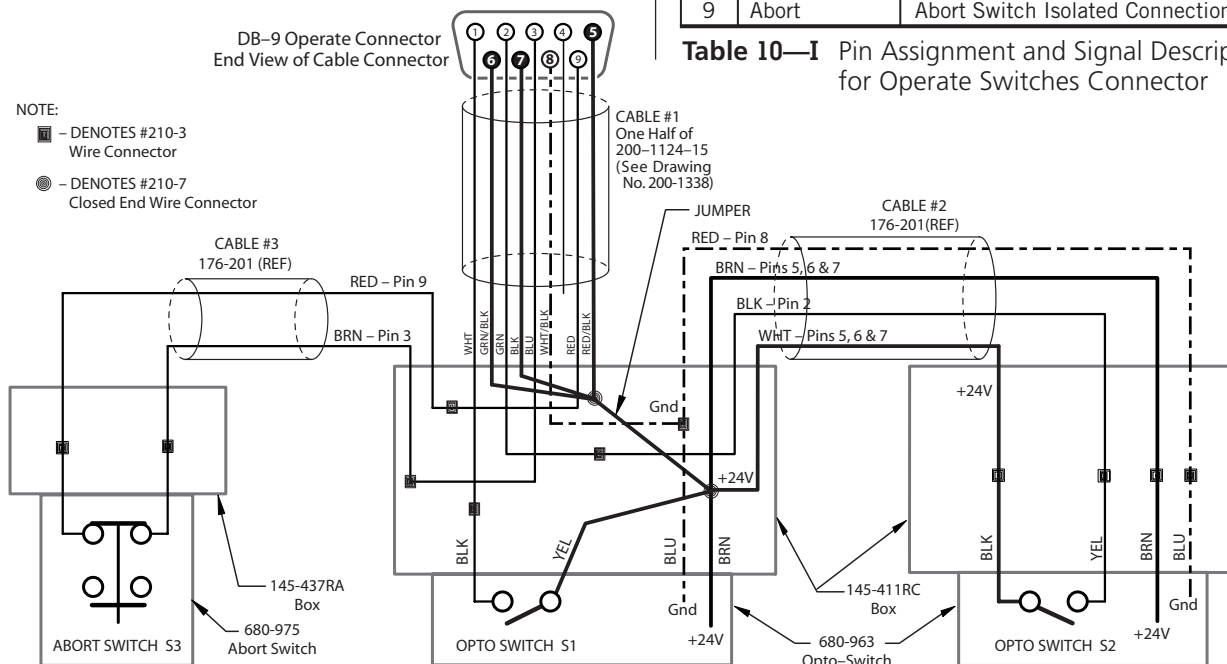


Figure 10–3 Operate Switches Schematic

Fixture Clamp Connector

The 48H series press has the capability to actuate and release a pneumatic fixture clamp. The press supplies two outputs which can sink a maximum of 100mA. The pin assignments of the fixture clamp connector are shown in Figure 10–4. Pin 2 energizes the clamp mechanism and pin 4 activates the clamp release. Pins 2 and 4 are low–side drivers to ground and pins 1 and 3 supply +24 VDC power to the pneumatic clamp solenoids. The control cable from the pneumatic clamp solenoid is identified as ④ in Figure 3–4.

Note that the fixture clamp signal is activated regardless of whether or not pneumatic fixture clamps are installed. The signal remains active for the duration of the operation cycle. If an in–out slide kit is installed, both fixture clamp signals are activated simultaneously. If a two–fixture left–right slide kit or turntable kit is installed, fixture clamp #1 will sequence properly for fixture #1 and clamp #2 will sequence with fixture #2.

Post–Cool Connector

The 48H series press also has the capability to activate a post–cool solenoid. The hardware can be installed later without any modification to the press. This solenoid feeds cooling air to the distribution manifold, through the cooling nozzles to cool the part(s). This operation is shown in Figure 4–5 and is controlled from the POST COOL OFF and POST COOL TIMER menus. These are covered in detail in Section 6. The pin assignments for the post–cool connector are shown in Figure 10–5. Pin 1 supplies +24V and pin 3 is the low–side driver to ground. The control cable from the post–cool solenoid is identified as ⑤ in Figure 3–4. The placement of the post–cool solenoid may vary depending upon application.

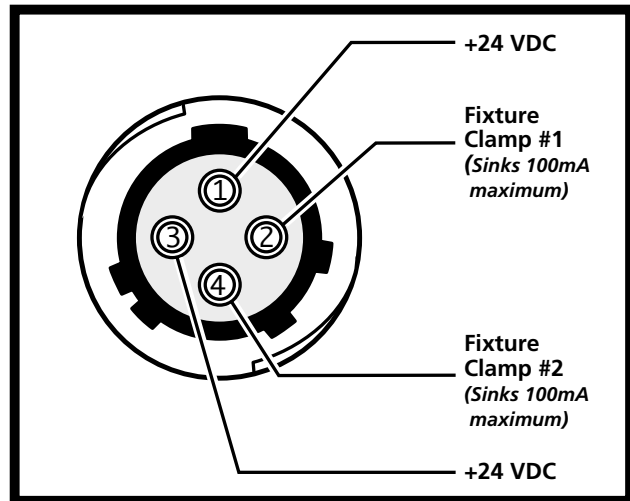


Figure 10–4 Pneumatic Fixture Clamp Connector

Pin	Signal Name	Signal Description
1	+24VDC	Fixture Clamp Power
2	Fix #1	Fixture Clamp #1 Energize (Active Low)
3	+24VDC	Fixture Clamp Power
4	Fix #2	Fixture Clamp #2 Energize (Active Low)

Table 10–II Pin Assignment and Signal Description for Fixture Clamp Connector

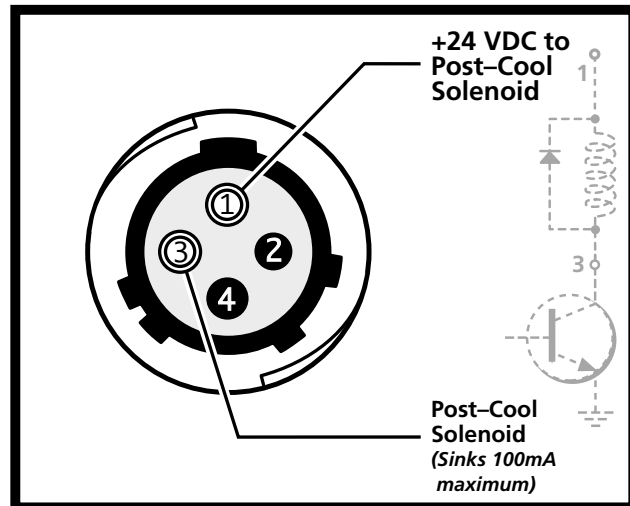


Figure 10–5 Post–Cool Panel Connector

Pin	Signal Name	Signal Description
1	+24V DC	Post Cool Solenoid Power (100mA max.)
2	n/c	No Connection
3	PC Sol	Post Cool Solenoid Driver (Active Low)
4	n/c	No Connection

Table 10–III Pin Assignment and Signal Description for Post–Cool Connector

Multipurpose Connector

The 48H series press is preprogrammed to handle slide kits and rotary tables. These accessories can be added later without any modification or re-programming of the press. The control cable is permanently mounted to the slide kit controller chassis and plugs into the multipurpose connector on the press. This is identified as ⑥ in Figure 3–4. The press provides activation signals to extend and retract the slide table, readout of the table position switches, part-in-place readout and a coded ID to automatically recognize the type of slide kit. The signal description and pin assignments for the multipurpose connector are given in Tables 10—IV, 10—V and 10—VI.

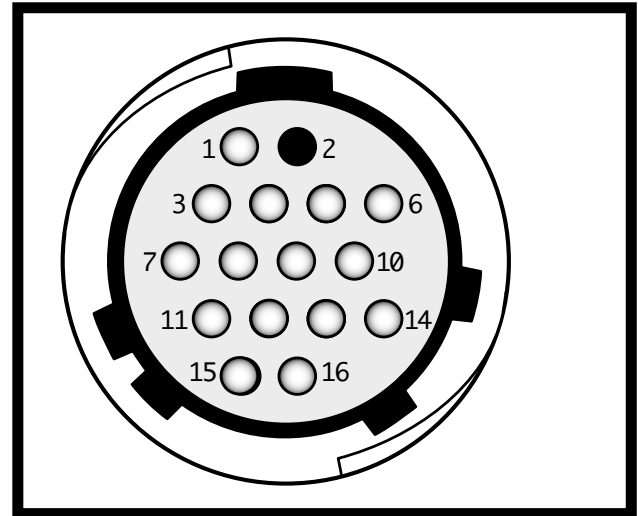


Figure 10–6 Multipurpose Panel Connector

Pin	Name	Signal Description
1	+24VDC	+24V Power (Limited to 100mA)
2	—	No Connection
3	Pos Sw1	Slide Position 1 Limit Switch (N.O.)
4	TOS	Top-Of-Stroke (N.O. Close at TOS)
5	TOS	Top-Of-Stroke (N.O. Close at TOS)
6	Pos Sw2	Slide Position 2 Limit Switch (N.O.)
7	ID 1	Optional Slide Kit ID Bit 1
8	ID 2	Optional Slide Kit ID Bit 2
9	ID 3	Part Presence Sensor Input
10	+24VDC	+24V Power (Limited to 100mA)
11	Slide In	Move Slide In/Right (Activate Low)
12	Sys En	System Enabled (N.O. Close = ENABLE)
13	Sys En	System Enabled (N.O. Close = ENABLE)
14	Slide Out	Move Slide Out/Left (Activate Low)
15	Ground	Slide Kit Power and Signal Return
16	+24VDC	+24V DC Switched (Power OFF when Abort switch pushed)

Table 10—IV Pin Assignment and Signal Description for Multipurpose Connector

Pos 1 Pin 3	Pos 2 Pin 6	Option Slide Kit
Out		In/Out Slide Kit
	In	In/Out Slide Kit
Left		Left/Right Slide Kit
	Right	Left/Right Slide Kit
0°		180° Turntable Kit
	180°	180° Turntable Kit

Table 10—V Slide Table Positions for Limit Switch Inputs

Pin 8	Pin 7	Option Kit Identifier
0	0	No Option Kit
0	1	In/Out Slide Kit
1	0	Left/Right Slide Kit
1	1	180° Turntable Kit

Note: 1 = Pin at +24 VDC
0 = Pin Open

Table 10—VI Slide Kit Description for ID Combinations

Slide Kit Controller

The optional slide kit controller chassis is depicted at the right side of Figure 4-3. An enlarged section is shown here in Figure 10-7 with the rear connections labeled. The multipurpose cable is identified as ⑥. The front panel contains an air pressure gauge and an adjustable regulator. They can be seen at the left side in Figure 5-1. The pressure gauge and regulator for the pneumatic slide table are the same as those for the press, which are mounted on the front of the main control panel. The Slide kit controller comes with the optional slide kits. Appendix C lists describes the slide kits.

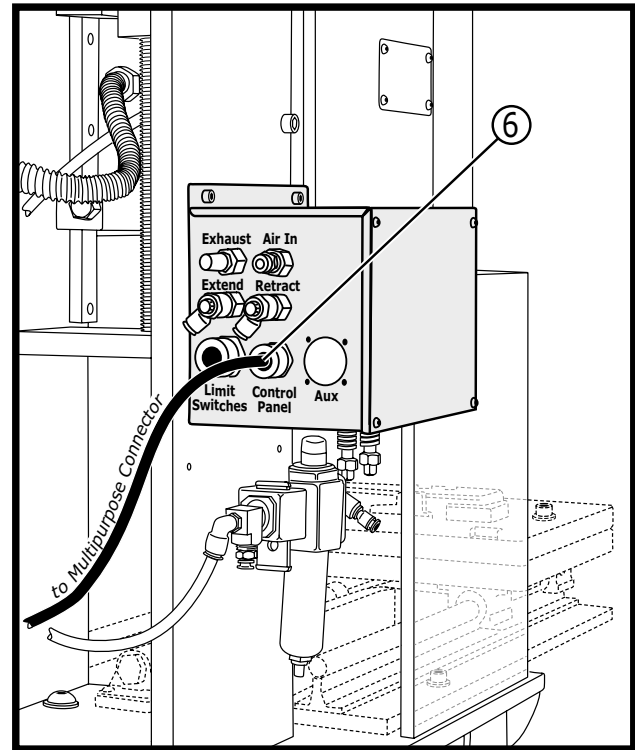


Figure 10-7 Optional Slide Kit Controller



Head Adjustment

- Height Adjustment
- Radial Adjustment

Height Adjustment	85
Radial Adjustment	85

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Height Adjustment

The head height is adjusted by the vertical lead screw. There are four clamps locking the head in position that must be loosened before the lead screw can be turned. The clamps are accessible from the rear of the press and are each secured by a M14 hex-head bolt. The clamps, lead screw and locking bolts are identified in Figure 11–1. Turn the lead screw to adjust the head to the desired position and then tighten the clamps to lock the head in place.

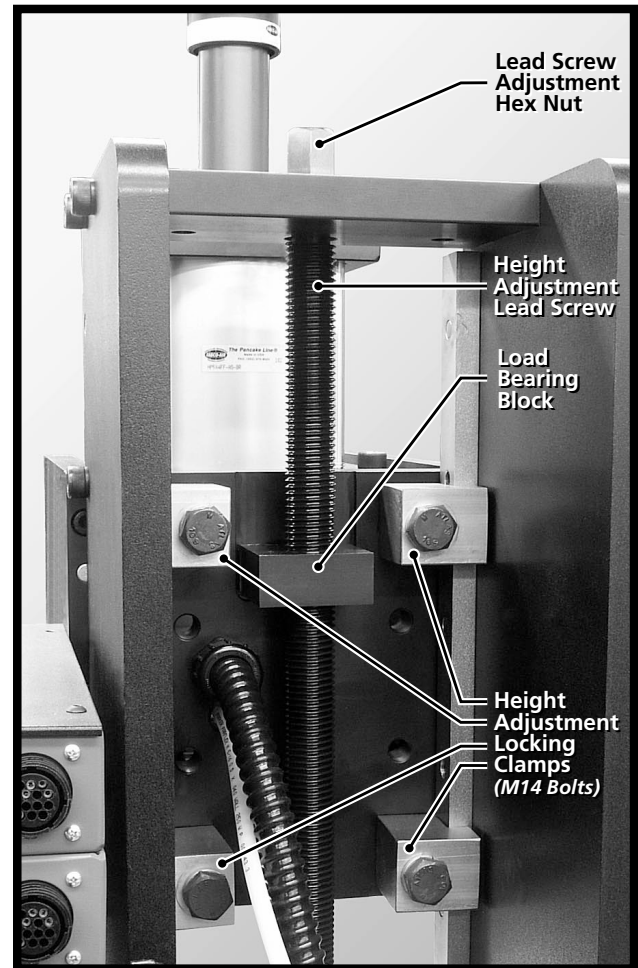


Figure 11–1 Head Height Adjustment Mechanism

Radial Adjustment

The radial position of the head can be adjusted $\pm 10^\circ$, by loosening the five $\frac{1}{2}$ –13 button-head bolts holding the base, as shown in Figure 11–2. Move the head to the desired position and then tighten the bolts to lock the base in position.

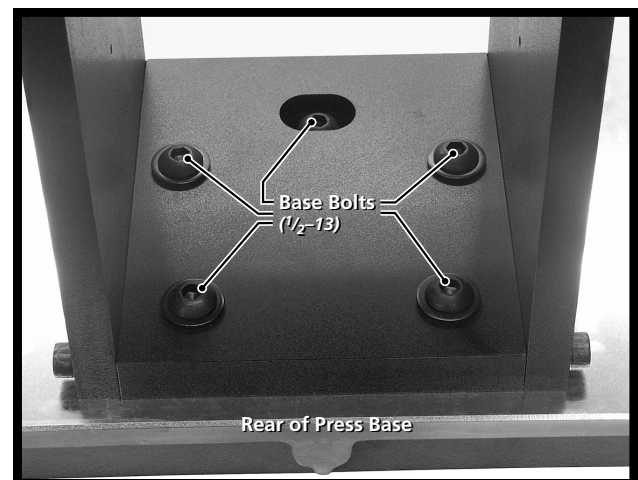


Figure 11–1 Head Radial Position Adjustment

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Process Operations

- Inserting
- Staking and Swaging
- Degating
- Marking and Embossing
- Process Parameters
- Thermoplastic Selection

Inserting	89
Insertion Temperature	89
Insertion Dwell Time	90
Insertion Force	90
Insertion Down Speed	90
Insertion Post–Cool Time	91
Staking	91
Staking Dwell Time	91
Staking Force	92
Staking Post–Cool Time	92
Swaging	92
Swaging Temperature	92
Swaging Dwell Time	93
Swaging Force	93
Swaging Down Speed	93
Swaging Post–Cool Time	93
Degating	93
Marking and Embossing	94
Thermoplastic Material Selection	94
Plastic Health Notice	94
Material Factors	94

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Inserting

One of the common operations performed with a thermal press is securing a threaded insert into a plastic socket. Other items that can be inserted include, but are not limited to, bushings, terminals, ferrules, hubs, pivots, retainers, feed-through fittings, fasteners, hinge plates, binding posts, handle locating pins and decorative attachments. The advantage of a thermal press is that many inserts of different sizes may be secured simultaneously on multiple levels, if they are all going in the same direction. Inserts close to each other can use a dual-point tip. Avoid situations where multiple inserts of different sizes need to be set with a single probe. The insertion process may require the insert to be preheated before pressing it into its socket. The INSERT PREHEAT and PREHEAT TIMER options are covered in Section 6. The trigger position is set at the point where the probe tip contacts the top of the insert. Typical values for the PREHEAT TIMER are in the 0.5 to 1 second range for small inserts. Larger inserts will require a longer time as will dual point tips. The DWELL TIME might be in the 1 to 2 second range for small single inserts. The POST COOL option can be used to ensure the plastic is solidified before withdrawing the probe. Figure 12–1 illustrates the steps in a basic inserting operation.

Insertion Temperature

Generally, the insert needs to be between 50°C and 75°C (90°F to 135°F) hotter than the melt temperature of the plastic in order to thermally set the insert. If the heat differential is too low, you risk cold-setting the insert which results in low torque and pullout strength. In order to achieve the required heat differential, the tip needs to be about 25°C (45°F) hotter than the insert. So under normal circumstances, the temperature setting for thermal inserting will be about 50°C to 75°C (90°F to 135°F) higher than the glass transition temperature (or melt temperature) of the plastic.

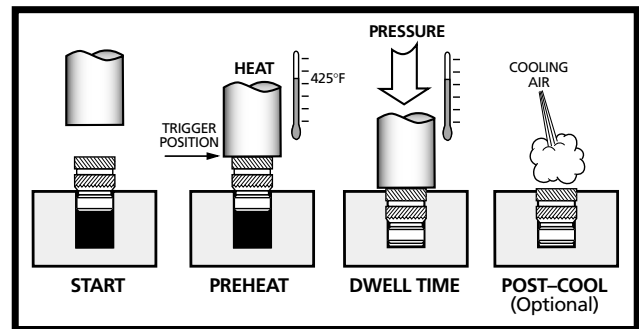


Figure 12–1 Inserting Operation



TEMPERATURE DIFFERENCES

When comparing temperature differences in °C and °F, the constant 32°F disappears. Δ is the symbol for difference $\Delta T = (T_2 - T_1)$

Deg °C = (Deg °F - 32°F) ÷ 1.8 but
 Δ Deg °C = Δ Deg °F ÷ 1.8

Deg °F = (Deg °C × 1.8) + 32°F but
 Δ Deg °F = Δ Deg °C × 1.8

e.g. Processing at 250°C, and setting the controller 50°C higher to 300°C, corresponds to processing at 482°F ((250°C × 1.8) + 32°F) and setting the controller to 572°F. This is a difference of 90°F, (50°C × 1.8) not 122°F (90°F + 32°F).

If the glass transition temperature and/or the thermal conductivity of the material is fairly high, this setting may need to be increased.

In extreme cases of high temperature, high thermal conductivity materials (e.g. Polycarbonate), and tips with a large thermal mass, a temperature controller setting of 300°C (550°F) or more may be required to maintain the temperature differential between the glass transition temperature and the probe tip. If cycle times become too long, keeping the inserts preheated before they are used will reduce the amount of heat energy that needs to be added.

Insertion Dwell Time

The weld or dwell time needs to be long enough to ensure that the press reaches the mechanical stop on every cycle. The hole size and density of plastic around the hole can vary considerably from cavity to cavity and even cycle to cycle. If some inserts are not fully seated, then increasing the dwell time may be the corrective action needed. If some inserts are set too deep, then the dwell time may be too long. Excessive dwell time causes too much heat soaking, and the inserts begin to melt deeper into the boss.

Insertion Force

The down force should be sufficient to provide consistent down speed during the insertion cycle. Down force has a significant impact on the insertion speed and needs to be carefully adjusted. The larger the inserts, and the more inserts that are set at once, the higher the force needs to be. Observe the speed of insertion available with a given force, and determine if a faster or slower speed will produce more consistent results. Generally the proper setting is a combination of a higher down force (pressure) and a lower speed.

Insertion Down Speed

Down speed should be slow enough to allow heat to be conducted from the insert to the plastic, but not so slow that molten plastic appears around the insert. A common mistake is to set the downspeed too fast (except with very small inserts). If the insert joint is weak, reducing the head speed will usually increase the strength. However, weak inserts can also result from going too slow and allowing excessive heat to degrade the thermoplastic boss. There is an optimal setting which will result in a correctly set insert.

Insertion Post-Cool Time

In thermal inserting, there is a tendency for inserts to *'float'* upward or downward once the tips are retracted. The best solution for this problem is

a combination of proper heat management and ensuring that the insert has cooled below the glass transition temperature of the plastic before the tips are retracted. Excessive post-cool time can result in a poor process repeatability as overcooled tips may not recover to operating temperature before the next cycle. When working with large inserts or low thermal conductivity inserts (e.g. steel), the use of a vortex cooler to lower the post-cool air temperature can shorten the cycle time.

Staking

Another operation frequently performed with a thermal press is staking. This is often referred to as *heading* or *riveting*. Here a round post fits through a hole in the part. The post is melted and spread out like a rivet to capture or retain another component, usually made of a different material. Good design practice forms the finished head to at least twice the diameter of the staking post. Best results are achieved when the material to be held in place has a higher melt temperature than the plastic post by at least 50°C (90°F). The basic steps are illustrated in Figure 12–2. Common shapes include button-head, rosette-head, flush (countersunk), hollow stake and knurled stake. In this operation, post-cool is strongly recommended. The trigger position is set at the point the probe tip contacts the top of the post to be staked. When the heated tip contacts the boss or post, it creates a localized heated volume. As the boss melts, the light pressure from the tip forms the head into a shape determined by the tip configuration.

Staking Dwell Time

Dwell or weld time is typically one to five seconds, but can vary considerably by application. Sufficient time must be allowed for the head to be fully formed and some heat soak of the material to occur so that any material memory is overcome.

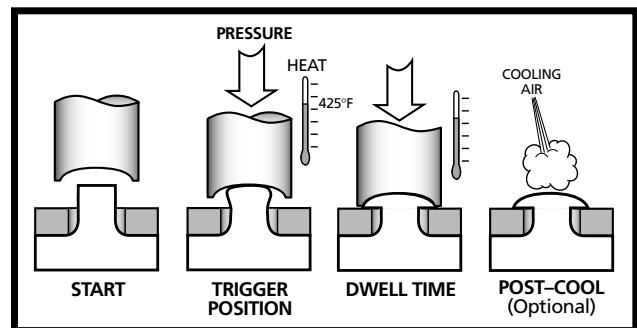


Figure 12–2 Staking Operation

Staking Force

It is the progressive melting of the plastic boss under continuous light pressure at a controlled speed that forms the head. Low pressure, rather than high pressure is usually recommended.

Staking Post–Cool Time

Post cool is used to bring the temperature of the plastic below the glass–transition temperature so that the newly formed head remains tight and is not damaged upon tip retraction. Excessive post–cool time can result in a poor process repeatability as overcooled tips may not recover to operating temperature before the next cycle.

Swaging

Swaging (also called folding and/or shaving), is similar to staking except only a portion of the post is melted and folded over. Unlike staking which is used in the interior, swaging is designed to hold the edge of the part in place. With a thermal press, many swagging (and staking) operation on multiple levels, can be performed at once using multiple probes. Best results are achieved when the material to be swaged has a higher melt temperature than the plastic tab by at least 50°C (90°F). Figure 12–3 shows the basic steps in a swagging process. In swaging, preheat is not generally used, but post–cool is strongly recommended.

Swaging Temperature

The tip temperature should be between the glass transition temperature of the boss and the temperature that causes degradation of the plastic. Stronger heads are usually made using a slower process with less heat as long as the surrounding area of parts are not damaged. The general practice is to set the tip temperature about 100°C (180°F) higher than the glass transition temperature of the thermoplastic boss, and then adjust from there.

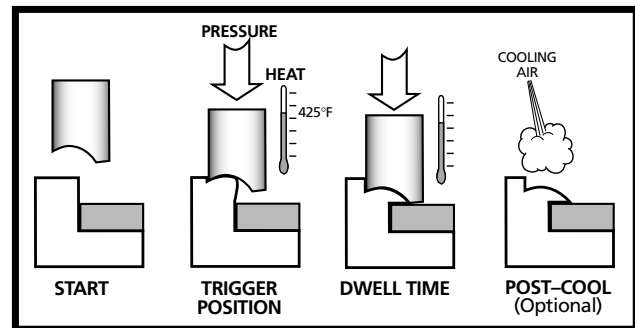


Figure 12–3 Swaging Operation

Swaging Dwell Time

Weld or dwell time is typically one to five seconds, but can vary considerably by application. Sufficient time must be allowed for the head to be fully formed and some heat soak of the material to occur so that any material memory is overcome.

Swaging Force

This is more difficult to quantify a typical value since it depends upon the application. Sufficient force must be applied to ensure that the assembly is fully sealed and that the head material is squeezed during the heat soak and post-cool time. Too much force, however, can result in part damage.

Swaging Down Speed

Down speed should be carefully controlled with the hydraulic speed control. Forming the head at the proper speed is critical to assure proper material flow. If the down speed is too slow, material will be damaged by oxidation through exposure to the air. If the down speed is too fast, the material will cold flow, added stresses will build up and reduced strength will result.

Swaging Post-Cool Time

The post-cool time should be sufficient to assure that the plastic swage has cooled below the glass transition temperature of the plastic before the tips are retracted. If the material is released too soon, the swages may be loose. Excessive post-cool time can result in a poor process repeatability as over-cooled tips may not recover to operating temperature before the next cycle.

Degating

Degating is a simple way to separate parts from their molded gates or sprues. The probe tip is a hardened, flush-trimmed cutting edge as shown in Figure 12-4. When heated, it easily cuts away the parts from their runners leaving a clean end with no part damage.

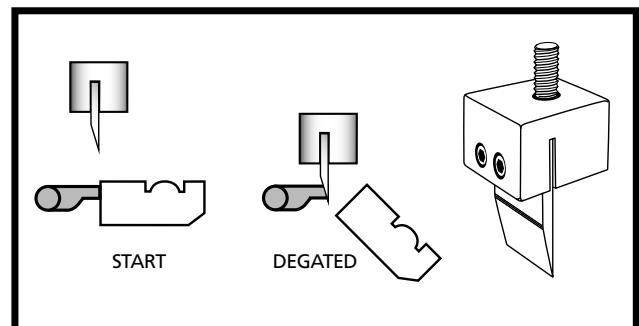


Figure 12-4 Degating Operation

Marking and Embossing

Thermal marking and embossing is accomplished by pressing heated numbers and letters into a part, such that the information is permanently impressed into the surface.

Thermoplastic Selection

Essentially all thermoplastic materials can be processed with a thermal press. Amorphous materials can be more easily processed than semi-crystalline and liquid crystal polymers are somewhere in between. The proper settings to produce the correct melt collapse speed can produce successful results with almost any thermoplastic material. Low-friction materials and those with low stiffness can also be handled with a thermal press.

Plastics Health Notice

There are however, some materials that deserve special mention. This is not a complete list and is only a small sample. Make sure you are familiar with the applicable regulations regarding the particular type(s) of plastic you are using.

POM – Polyoxymethylene (Acetal, Delrin) is highly aromatic and melts at a relatively high temperature. Its fumes are quite noxious and require special ventilation.

PVC – Polyvinyl Chloride (Novablend, Polyvin) can emit chlorine gas under certain processing conditions, and should also be properly vented.

Material Factors

PA – Polyamide (Nylon) is heat sensitive and can be quite difficult to process. It exhibits low viscosity when melted, melts at a relatively high temperature and is easily damaged by excessive heat.

Thermal staking and inserting are not affected by fibrous reinforcement material. The only exception is that insert holes in reinforced materials might have weak knit lines that will split if the insert is

WARNING



Before using the thermal press, make sure you are familiar with the applicable regulations regarding the particular type(s) of plastic you are using. In the USA, check with the U.S. Department of Labor.

not hot enough, or if the pressure applied is too great.

Fillers and reinforcements typically decrease the tensile strength of the material. They are generally abrasive and cause tip wear. Again, the material weakness is at the knit line of the insert hole.

Hygroscopicity is the tendency of a material to absorb water from the air over time. If the moisture is not removed from the material before it is heated above its melt temperature, foaming, flash and weak bonds can result.

The chart below lists the processing temperature of some common thermoplastics. These are given only as a guide for you to compare the relative temperature differences of various plastics.

Abbv	Chemical Name	Common Trade Names	Processing Temperature	
ABS	Acrylic–Butadiene–Styrene	Cyrolac, Lustran, Magnum	375 – 525 °F	190 – 275 °C
ASA	Acrylic–Styrene–Acrylonitrile	Centrex, Geloy, Luran	460 – 540 °F	240 – 280 °C
HDPE	High–Density Polyethylene	Aspun, Clysar, Dowlex	275 – 575 °F	135 – 300 °C
PA	Polyamide	Nylon, Ultramid, Zytel	450 – 550 °F	230 – 290 °C
PBT	Polybutylene Terephthalate	Celanex, Ultradur, Valox	400 – 550 °F	205 – 290 °C
PC	Polycarbonate	Lexan, Calibre, Novarex	500 – 650 °F	260 – 345 °C
PEEK	Polyetheretherketone	Arlon, Victrex PEEK	700 – 750 °F	370 – 400 °C
PEI	Polyetherimide	Ultem	600 – 750 °F	315 – 400 °C
PES	Polyethersulfone	Ultrason, Victrex PES	675 – 750 °F	355 – 400 °C
PET	Polyethylene Terephthalate	Clearuf, Mylar, Valox	500 – 600 °F	260 – 315 °C
PETg	Polyethylene Terephthalate Glycol	Spectar	450 – 560 °F	230 – 295 °C
PI	Polyimide	Kapton, Matrimid, Vespel	350 – 465 °F	175 – 240 °C
PMMA	Polymethyl Methacrylate	Acrylic	350 – 570 °F	175 – 300 °C
PMP	Polymethylpentane	TPX	550 – 600 °F	290 – 315 °C
POM	Polyoxymethylene	Acetal, Delrin	350 – 450 °F	175 – 230 °C
PP	Polypropylene	Endura, HiGlass, Marlex	370 – 500 °F	190 – 260 °C
PPO	Polyphenylene Oxide	Noryl	425 – 600 °F	220 – 315 °C
PPS	Polyphenylene Sulfide	Fortron, Ryton, Supec	600 – 650 °F	315 – 345 °C
PS	Polystyrene	Dylark, Polyrex, Styron	325 – 525 °F	165 – 275 °C
PU	Polyurethane	Estane, Isoplast, Neuthane	385 – 450 °F	195 – 230 °C
PVC	Polyvinyl Chloride	Geon, Novablend, Polyvin	315 – 410 °F	155 – 210 °C
SAN	Styrene–Acrylonitrile	Luran, Lustran, Tyril	415 – 515 °F	215 – 270 °C
TPO	Thermoplastic Polyolefin	Flexathane, Sarlink, TEO	275 – 325 °F	135 – 165 °C

Table 12—I Processing Temperatures for Common Thermoplastics

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Troubleshooting

- Heater Output
- Thermal Press Faults
- Temp. Controller Faults
- Process Problems

Temperature Controller	99
Error Messages	99
Blank Display	99
Thermal Press Faults	99
Touch Screen Saver	99
Temp Zone Fault	100
Abort Mode Fault	100
Startup Fault	100
Rear Connectors	100
Heaters	100
Inserting Problems	101
Staking Problems	102

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Temperature Controller Error Messages

If a temperature controller detects an error, the controller display will show a coded error message (see Figure 13-1). Errors are non-latching and correcting the cause of the error will clear the error message. The most common faults are:

1. A thermocouple is not plugged into the zone's temperature sensing port – *ER 4*
2. The zone's thermocouple lead is broken or has a bad connection – *ER 4*
3. Reversed thermocouple leads – *ER 1*
4. Sensor type mismatch – *ER 2* or *ER 3*. Check thermocouple type in the Configuration Menu.
5. Electrical noise – *ER 5*. Check for electrical interference. Make sure wire from grounding stub is attached to a solid earth ground (see Figures 2-3 and 3-4). Cycle AC power to see if error clears.

Blank Display

If the controller display is blank, the controller is inoperable. Check line voltage at terminals 7 and 8 on controller. Refer to pages 41-43 of the companion Watlow Series 935A manual.

Thermal Press Faults

Touch Screen Saver

The factory default settings are set to turn off the touch screen after five minutes. To disable the screen saver or change the sleep time, turn the thermal press off. Place the fore and middle finger tips of your left hand on the upper and lower left corners of the screen as shown in Figure 13-2. Turn the AC power switch back on. Keep your finger tips on the screen as it cycles through the *Run Mode* and *Dukane Corporation...* splash screens. The third screen will display the internal system menu screen as shown in Figure 13-3. Press *Initial Settings* then press

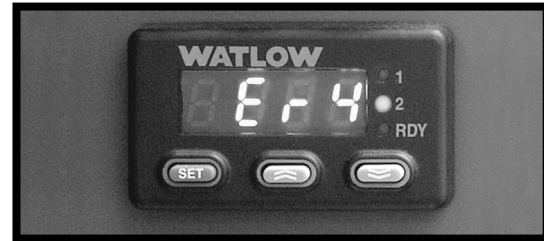


Figure 13-1 Temperature Controller Error Message

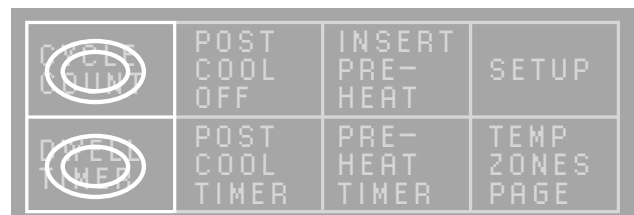


Figure 13-2 Finger Placement To Access System Menu

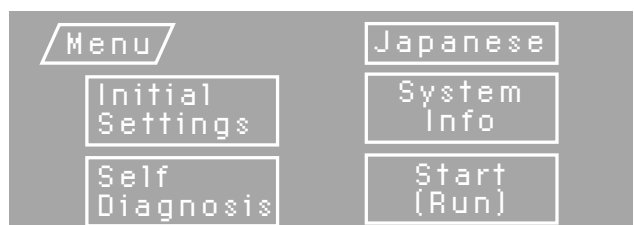


Figure 13-3 Internal System Menu Display

System Operat'n to display the *Stand-by Time*. Reduce the value to zero to turn off the screen saver. Then press the *Start(Run)* menu key to return to the main menu.

TEMP ZONE Fault

If a heater zone that does not exist is selected, a ZONE # FAULT screen will displayed approximately 5 seconds after the zone is selected. The key non-existent zone(s) will flash off and on. An example for heater zones #6 is shown in Figure 13-4. To reset the display, press the TEMP ZONE PAGES key and turn off the nonexistent zone(s).

If a zone's temperature controller detects an error, the controller display will show a coded error message. The most common faults are:

1. A thermocouple is not plugged into the zone's temperature sensing port – *ER 4*
2. The zone's thermocouple lead is broken or has a bad connection – *ER 4*

Abort Mode Fault

If either of the emergency stop (abort) switches are pressed in when the thermal press is turned on, an emergency stop fault screen is displayed as shown in Figure 13-5. Reset all emergency stop switches by turning the Abort button clockwise and pulling out (see Figure 5-4). Then momentarily tap both operate switches to clear the screen and display the main menu screen.

Startup Fault

If the press head and/or the slide kit platen are not at their reset position, a startup fault screen is displayed as shown in Figure 13-6. Press both operate switches simultaneously and the press system will initiate a complete cycle and return everything to its initial position.



Figure 13-4 ZONE FAULT Display

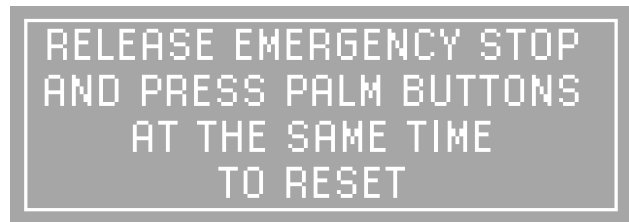


Figure 13-5 Abort Mode Fault Display



Figure 13-6 Startup Fault Display

Rear Connectors

The thermal press has all of its electrical connectors located in on the rear panel of the power supply and electronics chassis. See Figure 3–4 or Figure 10–1 to identify the connectors.

+24V DC Output

The +24 VDC outputs on the Pneumatic Fixture Clamp, Post–Cool and Multipurpose connectors are live only when both abort switches have been reset. The cable from the operate switches must also be plugged in to the rear connector.

Heaters

Heater Damage

The heater coils are preformed at the factory with a selected geometry. If you need a special geometry at the armored-cable to heater–coil interface, contact Dukane before attempting to alter the coil geometry yourself. Bending the coil support tube may break one of the thermocouple wires, damage the heater wire insulation or destroy the integrity of the coil jacket. Also avoid kinking or damaging the armored cable jacket for the same reasons. Figure 13–7 shows a heater that had its geometry altered and the armored jacket damaged, eventually resulting in an destroyed heater.

Heater Calibration

All heaters contain a thermocouple and it is typically placed in the center of mass of the heater. The probe tip may be from 50°F to 100°F cooler than the thermocouple. To determine the exact average temperature of the tip, use a contact temperature probe for an accurate reading. Optical pyrometers do not generally display accurate results when directed at thermal tips or heater coils.

Heater Runaway

The heater connected to the socket with the thermocouple leads controls the temperature of all heaters operating from that master/slave set. If the

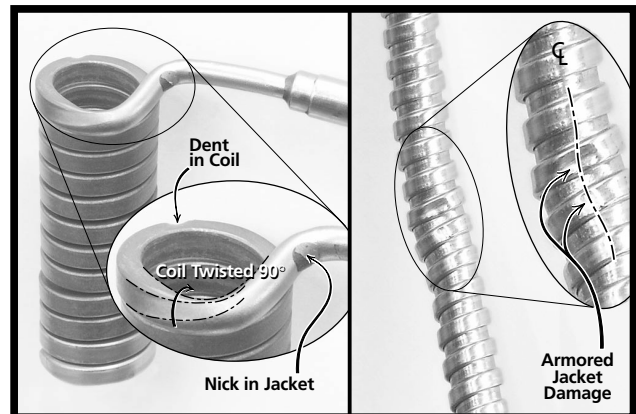


Figure 13–7 Distorted Heating Coil and Damaged Armor-Flex Cable

thermocouple becomes damaged, it may cause the heaters to run at a much higher temperature than the controller is set for. The heaters will begin to glow red at about 800°F (425°C). This is well above the normal processing temperature for almost all thermoplastics, and is a good indication that the zone is exhibiting thermal runaway. Turn the system off and connect a different heater/probe assembly to the thermocouple sensing connector. Turn the system on and verify the heater is running close to the set point of the controller.

Insertion Problems

1. If the boss or the plastic around the boss cracks after insertion, the insert may be pushed in before the plastic has melted. In this case reduce the downspeed, or increase the temperature. If there is too much interference between the insert and the hole, you will have to increase the hole diameter or use a smaller insert.
2. If plastic flows over the top of the insert, the dwell time is too long. In this case, decrease the dwell time.
3. If you are working with soft materials, filled or reinforced materials, or high-stiffness materials, extra consideration must be given to the boss wall thickness. Bosses with thin walls are prone to cracking as a result of weak knit lines or molded-in stress. Thin boss walls in softer materials can sometimes stretch rather than melt resulting in a weak insert bond.
4. A collared insert has more surface area in contact with the heated probe than a non-collared design, and will heat up faster.
5. Avoid situations where multiple inserts of different sizes need to be set with a single probe. This negates the ability to use different temperature settings appropriate to different size inserts.

6. It is difficult to set inserts flush using a thermal insertion technique, but it is relatively easy to set them to a precise distance from the fixtured side of the part. If an insert is set below the surface of the boss, it is subject to being broken loose if its mating fastener is over torqued. An insert set above the surface of the boss simply tightens up on the fastener without placing extra stress on the plastic if over torqued.
7. Longer inserts are stronger, but take longer to install. If the blind hole into which the insert is placed is too shallow, molten plastic will flow back up the center hole of the insert. Excessive force may then be applied when the fastener begins bearing on that material.
8. When placing solid inserts such as studs, it is critical to allow extra space under the insert in a blind hole. If there is insufficient space to pile up flash and compress the air trapped under the insert, the insert can lock in the hole before fully seating.

Staking Problems

1. If a ragged or irregularly shaped stake head forms, the staking cavity is probably too large because the volume of plastic in the tip is insufficient. Change to a tip with a smaller cavity, or increase the stud height and/or diameter.
2. If there is excessive flash around the stake head, the staking cavity is probably too small because the volume of plastic in the tip is excessive. Use a tip with a larger cavity or decrease the stud height and/or diameter.
3. Avoid placing staking posts of different sizes so close together that they will have to be staked using a single probe. This negates the ability to adjust temperatures for different post sizes.
4. Avoid placing stake posts close to details that project upward toward the staking tooling. Sometimes radiant heat from the staking tip will disfigure nearby details. Also post cool is much more effective in an open area.
5. Avoid placing staking posts close together on different levels in a congested area.

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Maintenance

- Touch Screen
- Temperature Controller
- Chassis
- Probe & Heaters
- Replacement Heaters
- Air Filter Replacement

Touch Screen	107
Temperature Controller Display	107
Main Chassis	107
Probe and Heaters	107
Replacement Heaters	107
Compressed Air Filter	108

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Touch Screen

Do not use any solvents or abrasive cleaners on the front panel. Do not spray cleaner directly onto the front panel. Apply a small amount of computer cleaner to a soft towel first. Clean the panel with the moistened towel. Do not allow any liquid to collect around the AC power switch.

Temperature Controller

Do not spray cleaner directly onto the display or the menu buttons. Apply a small amount of computer cleaner to a soft towel first and clean the display and buttons with the towel. You may also use a soft toothbrush to clean in hard to reach areas.

Main Chassis

Keep the exposed head–height adjustment lead screw clean and lightly oiled. The rails of the slide kits should be kept clean and lightly oiled. Clean and/or replace the compressed air filter element regularly.

Probe & Heaters

Keep the probe tips clean from excess plastic. Do not attempt to alter the coil geometry yourself. Bending the coil support tube may break one of the thermocouple wires, damage the heater wire insulation or destroy the integrity of the coil jacket. Contact Dukane if you need a special geometry at the armored-cable to heater–coil interface. Avoid kinking or damaging the armored cable jacket for the same reasons.

Replacement Heaters

Heaters are considered consumable and require periodic replacement. Original Dukane heaters have consistent performance from heater to heater. We recommend that you use Dukane heaters as replacements. For your convenience, in most of the world, you can order replacement heaters through our online store.



CAUTION

Never use anything sharp on the touch screen. Only use your finger. The screen is intended for industrial use, but can be damaged by scratching or puncturing.

Only use a with a damp (not wet), soft cloth to clean the display . Never spray any liquid directly on the screen. Do not attempt to clean the screen with any solvents.

Compressed Air Filter

The air filter is shown in Figure 14–1. The clear bubble window at the top normally shows a green indicator when the filter (5 micron element) is functioning properly. When the filter element needs replacement, the indicator turns red. Under normal operating conditions, the filter should not need to be changed for one to two years. Replacement filters are available from Norgren (Part No. 5925–03). Before attempting to change the filter, turn off the compressed air supply, and then disconnect the air supply from the filter inlet. To change the filter, twist the clear filter housing one-quarter turn to the left, then pull down. Remove the old filter and install the new one. Replace the filter housing by pushing up until the housing is fully seated, and then twist one-quarter turn to the right.

The filter has an internal float in the bottom of the housing. When water condenses and accumulates, the float rises to automatically drain the water. There is a fitting at the bottom of the housing (1/8" NPT Male thread) to attach a drain hose to direct the water away from the press base.

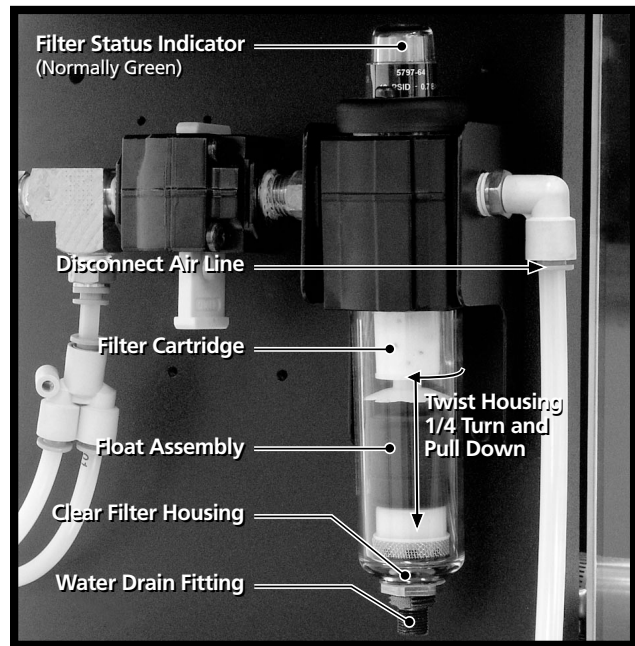


Figure 14–1 Air Filter Replacement

WARNING



Never attempt to remove the filter housing while the compressed air is on. Turn off the compressed air supply, and disconnect the air line from the filter inlet.

Contacting Dukane

- Identifying Equipment
- Local Support
- Main Office & Training
- FAX & eMail
- Phone Numbers
- Internet Website
- Warranty

Contacting Dukane	111
Identify Equipment	111
Local Support	111
Main Office and Training Center	111
Department Phone Numbers	111
Internet Website	111
Support & Engineering eMail	112
Support & Engineering Phone Numbers	112
Warranty	113
Domestic	113
International	114
Tooling	114

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Contacting Dukane Identify Equipment

When contacting Dukane about a service-related problem, be prepared to give the following information:

- Press model number, line voltage and serial number
- Any fault indicators from the press status display
- Description of the problem and steps taken to resolve it

Many problems can be solved over the telephone, so it is best to call from a telephone located near the equipment.

Local Support

Your local Dukane representative has received factory training and can answer all of your questions regarding Dukane equipment.

Main Office & Training Center

Mailing Address: Dukane Ultrasonics
2900 Dukane Drive
St. Charles, IL 60174 USA

Main Phone: (630) 797-4900

Sales: (630) 797-4918

Main Fax: (630) 797-4949

Service & Parts Fax: (630) 584-0796

Department Phone Numbers

You can reach each department by dialing directly.

Application Support (630) 797-4930

For applications and/or process technology questions.

Engineering (630) 797-4950

For engineering of standard and customized systems.

Service & Parts (630) 762-4090

For equipment servicing or replacement parts.

Tooling (630) 797-4930

For information on tooling, fixtures and horns.

Department email Addresses

Applications: usapps@dukcorp.com

Engineering: useng@dukcorp.com

Service & Parts: uservice@dukcorp.com

Tooling: ustooling@dukcorp.com

Internet Website

Dukane Ultrasonics is on the internet at:

www.dukcorp.com/us

and then go to your area of interest.



INTERNET

At our website you can:

- Get an introduction to a variety of plastic joining technologies.
- Learn about our products and view layout drawings.
- Order literature.
- Download Design Worksheets
- View a calendar of current training seminars.
- Purchase parts and accessories through our online store.

Division eMail Addresses

- Applications: usapps@dukcorp.com
- Engineering: useng@dukcorp.com
- Food Processing: usfoodproc@dukcorp.com
- International Sales: usintl@dukcorp.com
- Marketing: usmktg@dukcorp.com
- Sales: ussales@dukcorp.com
- Support/Service & Parts: usservice@dukcorp.com
- Technical Writing: ustechwriting@dukcorp.com
- Tooling: ustooling@dukcorp.com
- Training: ustraining@dukcorp.com

Division Phone Numbers

Application Support (630) 797-4930

For applications and/or process technology questions.

Engineering (630) 797-4950

For engineering of standard and customized systems.

Food Processing (630) 797-4920 or -4938

For information about food processing applications.

International (630) 797-4915

For questions about international locations, support, etc.

Marketing (630) 797-4906

For product literature, and trade show information.

Metal Welding (630) 797-4953

For information about any aspect of metal welding.

Sales Extension (630) 797-4918

Your local Dukane representative is the main source of product and order information, however you may have a need to contact Sales.

Service & Parts (630) 762-4090

For equipment servicing or replacement parts.

Technical Writing (630) 797-4907

For information and comments about user's manual content.

Tooling Support (630) 797-4930

For information about tooling, horns, and fixturing.

Training Hotline— (630) 797-4904

We offer a curriculum of educational programs at our corporate headquarters in St. Charles, Illinois. Please call the Dukane Ultrasonics Training Hotline for a free Education Catalog or with any questions you may have.



DUKANE CORPORATION**NORTH AMERICAN WARRANTY POLICY**

Subject to the terms, limitations and exclusions set forth below, Dukane Corporation IAS Division (Dukane) warrants to the original Purchaser, unless otherwise expressly agreed to in writing by Dukane, that all equipment and tooling designed and built by Dukane will be free from defects in material or workmanship. Normal wear items are not covered by this warranty. Warranty duration shall be defined as documented herein and in conjunction with any exceptions or exclusions in the accompanying Dukane quotation to the Purchaser.

Equipment Type	Equipment Warranty Duration	Other Comments
Custom Systems	12 months on all Dukane designed and built content that is not part of our standard product.	Dukane standard product included in custom systems are covered by the applicable product warranty.
Hot Plate Welder	24 months	none
Laser Welder	For all laser sources, Original equipment manufacturer (OEM) warranty is applicable.	All internal laser optics and external beam delivery optics are warranted for only 30 days.
Spin Welder	24 months	none
Thermal Press	24 months	none
Ultrasonic Welder	36 months	See WARRANTY EXCLUSIONS OR EXCEPTIONS below.
Vibration Welder	24 months	none
All Production Tooling	12 months, one-time replacement. (6-month, one-time replacement for carbide tipped horns)	none
Prototype Tooling	<ul style="list-style-type: none"> • All tooling made from Renshape 460 (Renwood) are only warranted for 200 part-cycles. • All other prototype tooling is warranted as described in each specific proposal. 	Prototype Renshape 460 (Renwood) tools employ reusable content, and therefore remain the property of Dukane.

All Dukane warranties commence on the date of the original shipment of the equipment or tooling, and duration is based upon a single shift per day, five day per week operation. The warranty period on rentals of new equipment that are converted to a purchase are deemed to have commenced on the initial date of rental.

These warranties are limited to equipment and tooling operated and maintained per Dukane's written instructions, and used under normal operating conditions. These warranties do not include normal wear or normal wear items, and do not cover damage attributable to misuse, improper installation, faulty repair, unauthorized alteration or modification, neglect, or accident. Misuse includes operation of equipment with tooling that is not qualified for the equipment or properly installed on the equipment.

The warranty on all Dukane equipment and tooling purchased and installed in North America is a parts and labor warranty only. Equipment installed outside of North America, regardless of where it was purchased, is covered by Dukane's International Warranty Policy. In all cases, when on-site service is required, Travel & Living (T&L) expenses will be billed at cost. Warranty service labor (including travel time) at the customer's site is provided on a Monday through Friday (excluding holidays), 7 a.m. to 7 p.m. basis. Any warranty service requested outside of these hours is available on a charge basis equal to 150% of Dukane's prevailing rate for technical service work.

Any equipment or tooling that proves to be defective in material or workmanship during the stated warranty period will be repaired or replaced at the sole discretion of Dukane Corporation when Dukane is promptly notified in writing. During the warranty period, defective equipment, components, or tooling that are returned properly packed with all transportation charges prepaid will be repaired or replaced and returned to the end-user without charge. Shipments of warranty parts will be via standard, non-expedited delivery service. Expedited shipment requests are subject to freight charges to the Purchaser.

Computers, PLCs, CRTs, LCDs, touch screens, and keyboards separate and/or incorporated as an integral part of a system will carry a one (1) year warranty from the date of shipment when used under normal operating conditions, and not subjected to misuse, abuse, or neglect. For all other equipment, components, or parts included in equipment or systems from Dukane, but not manufactured by Dukane or its affiliates, this warranty shall be limited in time and extent to the warranty given to Dukane by the OEM.

EQUIPMENT WARRANTY EXCLUSIONS OR EXCEPTIONS:

When specified in our quotation, a limited warranty may apply to certain components of the equipment, and/or for certain types of applications of the equipment, including those noted below.

- This warranty is void if the ultrasonic welder and/or tooling [i.e., horn(s) and fixture(s)] are used for applications requiring metal-to-metal contact, when the ultrasonic exposure period (weld cycle) exceeds 250 milliseconds.
- Ultrasonic Equipment and tooling used in continuous duty cycle modes such as, but not limited to, continuous cut and seal, and food processing are warranted for 2000 hours or 12 months from shipment, whichever occurs first.
- Any ultrasonic horn or tool quoted and sold as "Experimental" is not warranted.
- This warranty does not cover failures of equipment and components attributable to improper cooling or overheating of the transducer.
- Ultrasonic Horn Analyzers have a 12-month warranty.
- Ultrasonic Transducers have a one-time replacement warranty.
- Normal wear items and consumables excluded from any warranty coverage include, but are not limited to, filters, fuses, light bulbs, lubricants, gaskets and seals, cast urethane fixture components, laser flashlamps, laser beam delivery optics, and lasing gases.

The forgoing warranty is the sole and exclusive warranty and is made in lieu of all other warranties, express, implied or statutory, including without limitation any warranties of merchantability, fitness for a particular purpose, description, quality, productiveness or any other warranty. The remedy set forth in this warranty policy is the sole and exclusive remedy of Purchaser and in no event shall Dukane be liable for any compensatory, consequential, special, punitive or contingent damages or for damages arising from any delay in performance by Dukane under this warranty.

DUKANE CORPORATION

INTERNATIONAL WARRANTY POLICY

Subject to the terms, limitations and exclusions set forth below, Dukane Corporation IAS Division (Dukane) warrants to the original Purchaser, unless otherwise expressly agreed to in writing by Dukane, that all equipment and tooling designed and built by Dukane will be free from defects in material or workmanship. Normal wear items are not covered by this warranty. Warranty duration shall be defined as documented herein and in conjunction with any exceptions or exclusions in the accompanying Dukane quotation to the Purchaser.

Equipment Type	Equipment Warranty Duration	Other Comments
Custom Systems	12 months on all Dukane designed and built content that is not part of our standard product.	Dukane standard product included in custom systems are covered by the applicable product warranty.
Hot Plate Welder	12 months	none
Laser Welder	For all laser sources, Original equipment manufacturer (OEM) warranty is applicable.	All internal laser optics and external beam delivery optics are warranted for only 30 days.
Spin Welder	12 months	none
Thermal Press	12 months	none
Ultrasonic Welder	12 months	See WARRANTY EXCLUSIONS OR EXCEPTIONS below.
Vibration Welder	12 months	none
All Production Tooling	12 months, one-time replacement. (6-month, one-time replacement for carbide tipped horns)	none
Prototype Tooling	<ul style="list-style-type: none"> All tooling made from Renshape 460 (Renwood) are only warranted for 200 part-cycles. All other prototype tooling is warranted as described in each specific proposal. 	Prototype Renshape 460 (Renwood) tools employ reusable content, and therefore remain the property of Dukane.

All Dukane warranties commence on the date of the original shipment of the equipment or tooling, and duration is based upon a single shift per day, five day per week operation. The warranty period on rentals of new equipment that are converted to a purchase are deemed to have commenced on the initial date of rental.

These warranties are limited to equipment and tooling operated and maintained per Dukane's written instructions, and used under normal operating conditions. These warranties do not include normal wear or normal wear items, and do not cover damage attributable to misuse, improper installation, faulty repair, unauthorized alteration or modification, neglect, or accident. Misuse includes operation of equipment with tooling that is not qualified for the equipment or properly installed on the equipment.

The warranty on all Dukane equipment and tooling purchased and installed in North America is a parts and labor warranty only. Equipment installed outside of North America, regardless of where it was purchased, is covered by Dukane's International Warranty Policy. In all cases, when on-site service is required, Travel & Living (T&L) expenses will be billed at cost. Warranty service labor (including travel time) at the customer's site is provided on a Monday through Friday (excluding holidays), 7 a.m. to 7 p.m. basis. Any warranty service requested outside of these hours is available on a charge basis equal to 150% of Dukane's prevailing rate for technical service work.

Any equipment or tooling that proves to be defective in material or workmanship during the stated warranty period will be repaired or replaced at the sole discretion of Dukane Corporation when Dukane is promptly notified in writing. During the warranty period, defective equipment, components, or tooling that are returned properly packed with all transportation charges prepaid will be repaired or replaced and returned to the end-user without charge. Shipments of warranty parts will be via standard, non-expedited delivery service. Expedited shipment requests are subject to freight charges to the Purchaser.

Computers, PLCs, CRTs, LCDs, touch screens, and keyboards separate and/or incorporated as an integral part of a system will carry a one (1) year warranty from the date of shipment when used under normal operating conditions, and not subjected to misuse, abuse, or neglect. For all other equipment, components, or parts included in equipment or systems from Dukane, but not manufactured by Dukane or its affiliates, this warranty shall be limited in time and extent to the warranty given to Dukane by the OEM.

EQUIPMENT WARRANTY EXCLUSIONS OR EXCEPTIONS:

When specified in our quotation, a limited warranty may apply to certain components of the equipment, and/or for certain types of applications of the equipment, including those noted below.

- This warranty is void if the ultrasonic welder and/or tooling [i.e., horn(s) and fixture(s)] are used for applications requiring metal-to-metal contact, when the ultrasonic exposure period (weld cycle) exceeds 250 milliseconds.
- Ultrasonic Equipment and tooling used in continuous duty cycle modes such as, but not limited to, continuous cut and seal, and food processing are warranted for 2000 hours or 12 months from shipment, whichever occurs first.
- Any ultrasonic horn or tool quoted and sold as "Experimental" is not warranted.
- This warranty does not cover failures of equipment and components attributable to improper cooling or overheating of the transducer.
- Ultrasonic Horn Analyzers have a 12-month warranty.
- Ultrasonic Transducers have a one-time replacement warranty.
- Normal wear items and consumables excluded from any warranty coverage include, but are not limited to, filters, fuses, light bulbs, lubricants, gaskets and seals, cast urethane fixture components, laser flashlamps, laser beam delivery optics, and lasing gases.

The forgoing warranty is the sole and exclusive warranty and is made in lieu of all other warranties, express, implied or statutory, including without limitation any warranties of merchantability, fitness for a particular purpose, description, quality, productiveness or any other warranty. The remedy set forth in this warranty policy is the sole and exclusive remedy of Purchaser and in no event shall Dukane be liable for any compensatory, consequential, special, punitive or contingent damages or for damages arising from any delay in performance by Dukane under this warranty.

Specifications

- Regulatory Compliance
- Dimensions
- Operating Environment
- Model Power Ratings
- AC Power Requirements
- Model Number Coding

Regulatory Agency Compliance	117
Press Dimensions and Drawings	118
Operating Environment	119
Probe Dimensions and Drawings	120
AC Power Requirements	121
Interpreting The Model Number	121

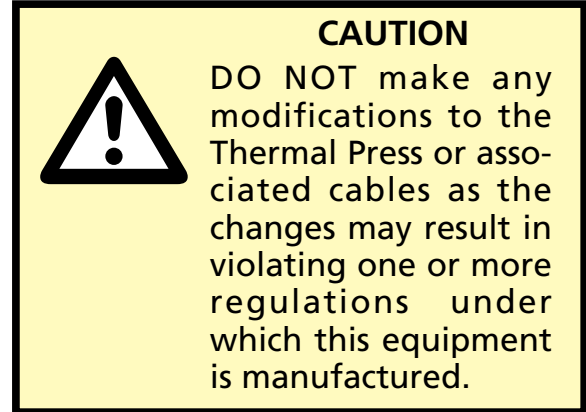
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Regulatory Agency Compliance

CE Marking

This mark on your equipment certifies that it meets the requirements of the EU (European Union) concerning interference causing equipment regulations. CE stands for Conformité Européenne (European Conformity). The Thermal Press complies with the following CE requirements.

- The EMC Directive 89/336/EEC for heavy industry —
EN55011 and
EN50082 using
EN61000-4-2
EN61000-4-3
EN61000-4-4
EN61000-4-5
EN61000-4-6
EN61000-4-8
ENV50204
- The Low Voltage Directive 73/23/EEC.
- The Machine Directive 89/392/EEC using EN60204-1:1993 Safety of Machinery – Electrical Equipment of Machines. Part 1: Specification for General Requirements.



48H Series Press Dimensions

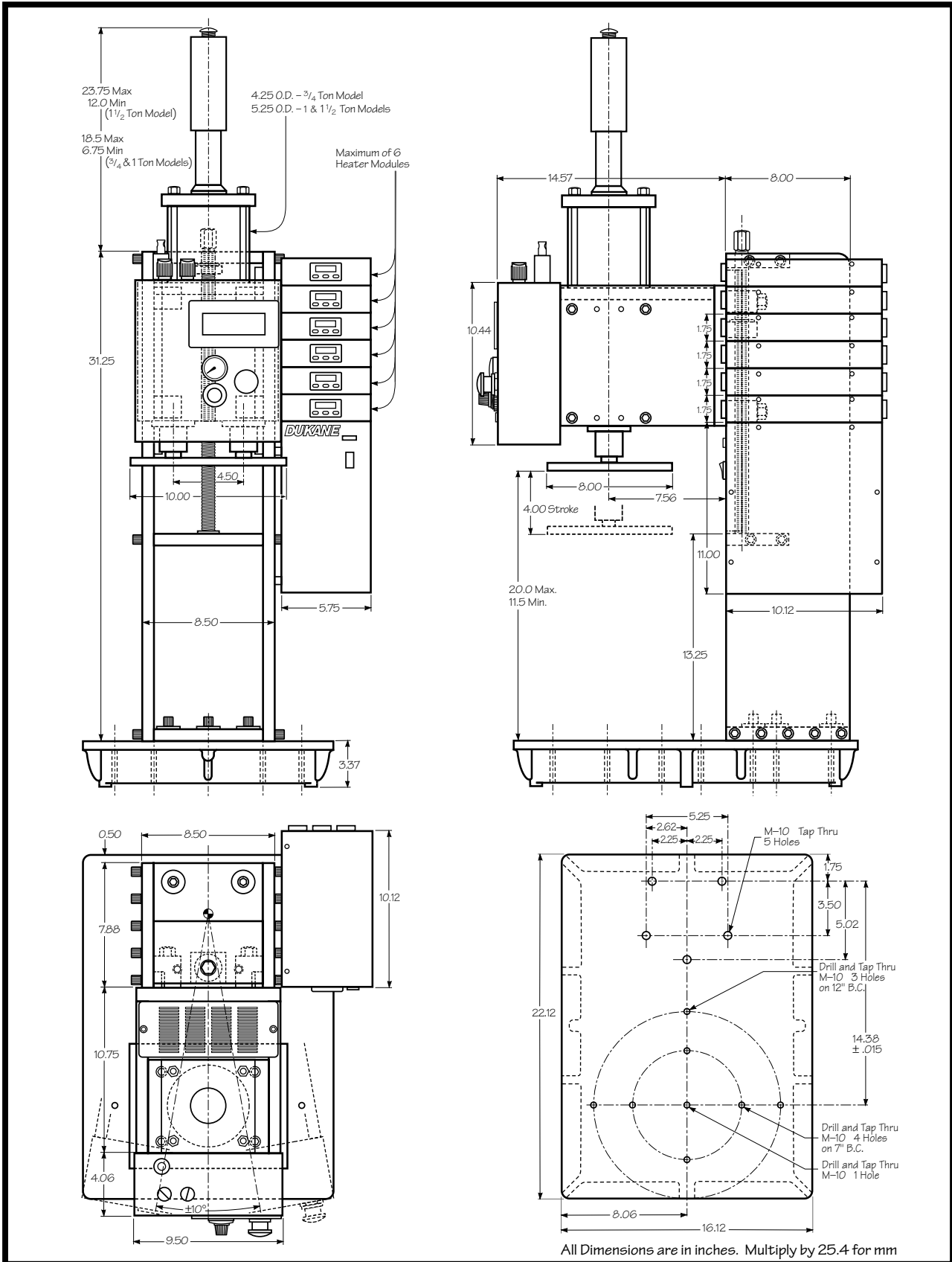


Figure 16-1 Series 48H Thermal Press Dimensions

Approx Weight: 400 pounds (182 kg) without option kit
500 pounds (227 kg) with option kit

Operating Environment

Operate the Thermal Press within these guidelines:

Temperature:	40°F to 95°F (+5°C to +35°C)
Altitude:	4570 m (15,000 ft)
Air Particulates:	Keep the Thermal Press dry Minimize exposure to moisture, dust, dirt, smoke and mold
Humidity:	5% to 95% Non-condensing @ +5°C to +30°C
Vibration:	10 minutes along each of the 3 major axis 10 Hz to 55 Hz in one minute cycles Hold for 5 minutes at 55 Hz Displacement (inches pk-pk) 0.015
Shock:	1.0 G, 1/2 sine, 11 msec duration 0.3 G rms from 5 to 500Hz, 5 minutes each axis

Nonoperating storage guidelines:

Temperature:	-4°F to 158°F (-20°C to +70°C)
Altitude:	12,190 m (40,000 ft)
Air Particulates:	Keep the Thermal Press dry Minimize exposure to moisture, dust, dirt, smoke and mold
Humidity:	5% to 95% Non-condensing @ 0°C to +30°C
Vibration:	15 minutes along each of the 3 major axis 10 Hz to 55 Hz in one minute cycles Hold for 10 minutes at 55 Hz Displacement (inches pk-pk) 0.015
Shock:	5.0 G, 1/2 sine, 11 msec duration 2.0 G from 5 to 500Hz, 5 minutes each axis

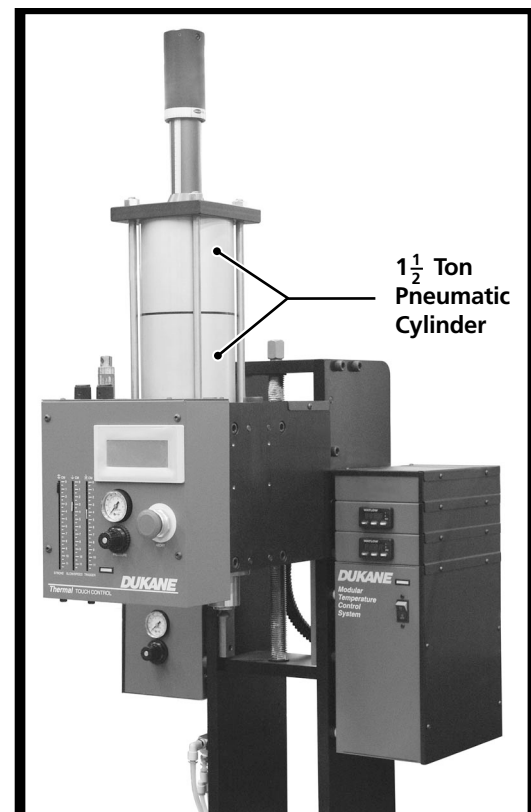


Figure 16-2 1-1/2 ton Thermal Press

Probe Dimensions

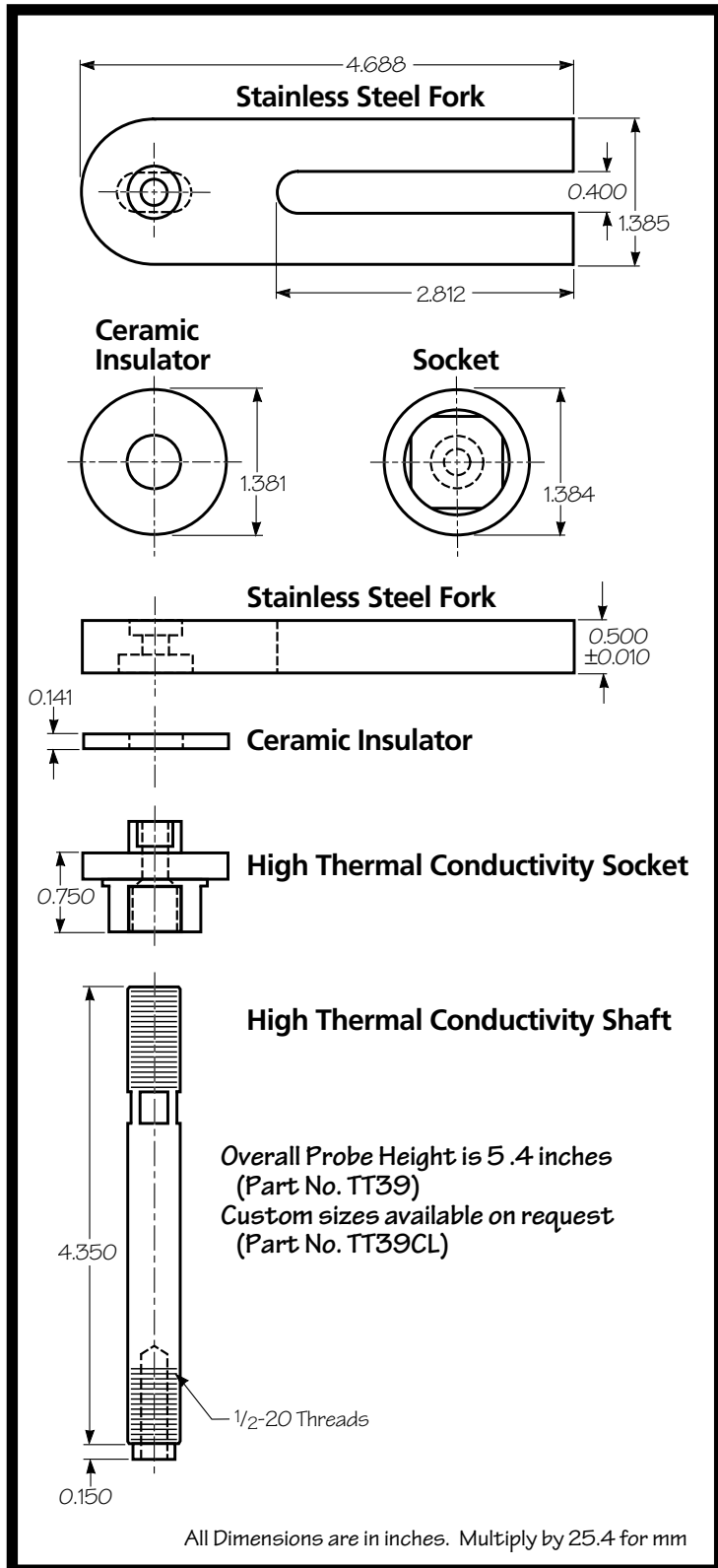


Figure 16-3 MATP™ Probe Drawing and Dimensions

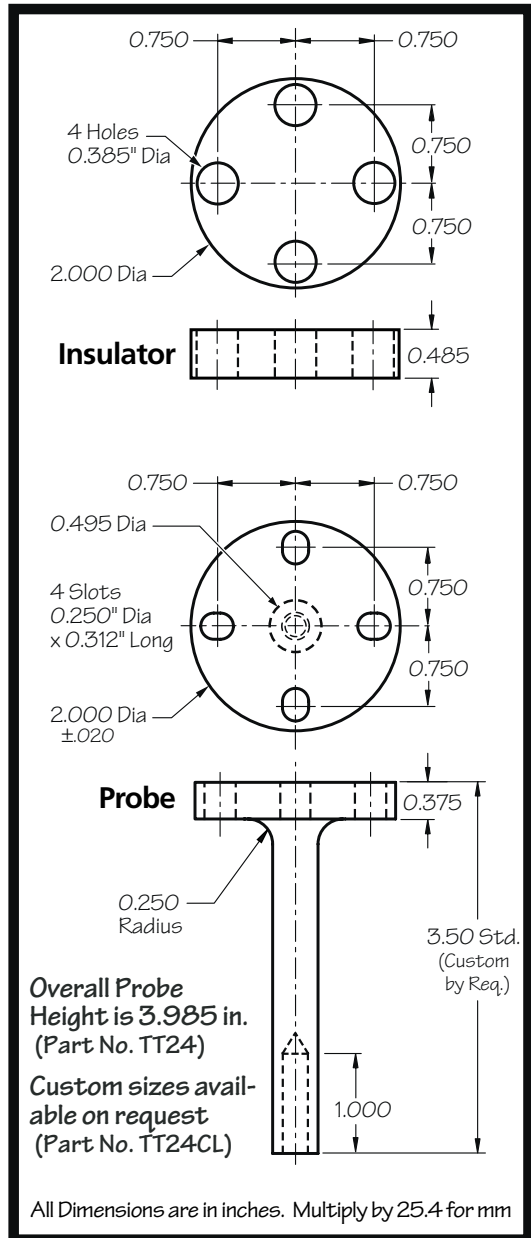


Figure 16-4 Standard Probe and Dimensions

AC Power Requirements

The AC input power requirements depend on the heater power capacity of the thermal press. Table 16—I below, lists the AC requirements for each 48H Series Thermal Press model number.

Clamping Force	Thermal Press Model Number	Heater Capacity (Watts)	Input Power Requirements (Voltage @ Max Current)
3/4 Ton	48H081TS	2100	110VAC 50/60 Hz @ 20 Amps
	48H082TS	4200	220VAC 50/60 Hz @ 20 Amps
1 Ton	48H101TS	2100	110VAC 50/60 Hz @ 20 Amps
	48H102TS	4200	220VAC 50/60 Hz @ 20 Amps
1 1/2 Ton	48H151TS	2100	110VAC 50/60 Hz @ 20 Amps
	48H152TS	4200	220VAC 50/60 Hz @ 20 Amps

Table 16—I Thermal Press Model and AC Power Requirements

Interpreting the Model Number

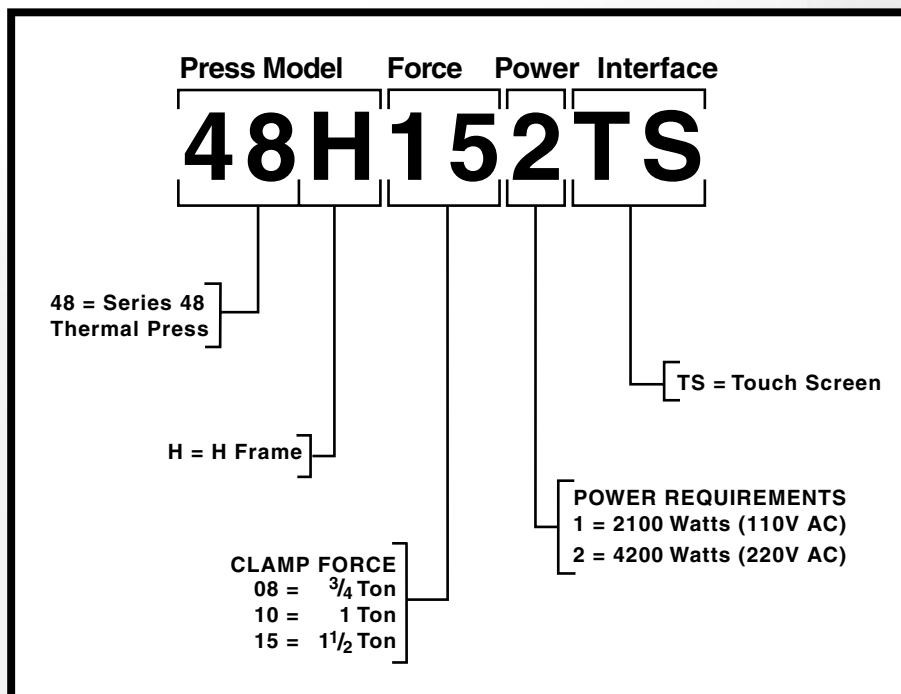


Figure 16–5 Interpreting the Thermal Press Model Number

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Option Kits

- Post Cool Kit
- In/Out & Left–Right Slide Kits
- Automation Signals Kit
- Part–In–Place Sensing
- Fixture Clamp Kit

Post Cool Kit.....	125
Linear In/Out Slide Kit	125
Linear Left/Right Slide Kit	126
Linear 180° Rotary Kit	126
Automation Signals Kit	126
Part–In–Place Sensing	126
Fixture Clamp Kit	126
Modular Temperature Controller Unit	127
8–Module Custom Presses	127

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Post–Cool Kit (Model TT80*n*V)

The post-cool kit includes —

- Electrically operated air valve
- Distribution manifold
- Pneumatic fittings
- Individual copper delivery tubes

Replace the *n* in the model number with 1 for a one–point cooling kit, 2 for a two–point cooling kit, up to 6 for a six–point cooling kit. Call for more than six points. The post–cool kit is covered by a one year warranty. Figure A–1 shows a post–cool kit installed and in operation.

Linear In–Out Slide Kit (Part No. 438–898)

The Linear In–Out slide kit is a bolt on, plug–in installation. It improves operational safety and ergonomics. It is drilled and tapped to the same bolt pattern as the base and is approximately 4–inches (100 mm) in height. It features a twin–rail linear ball bushing system and a cushioned cylinder with flow control and in–out position sensing. The pneumatic controller shown in Figure 10–7 is included as part of the In–Out slide kit. Figure A–2 shows a linear In–Out slide kit mounted on the thermal press.

Left–Right Slide Kit (Part No. 438–899)

The Linear Left–Right slide kit is a bolt on, plug–in installation. It allows an operator to load a second fixture while the machine is in operation and it improves operational safety and ergonomics. It is drilled and tapped to the same bolt pattern as the base and is approximately 4–inches (100 mm) in height. It features a twin–rail linear ball bushing system and a cushioned cylinder with flow control and left–right position sensing. The pneumatic controller shown in Figure 10–7 is included as part the Left–Right slide kit.

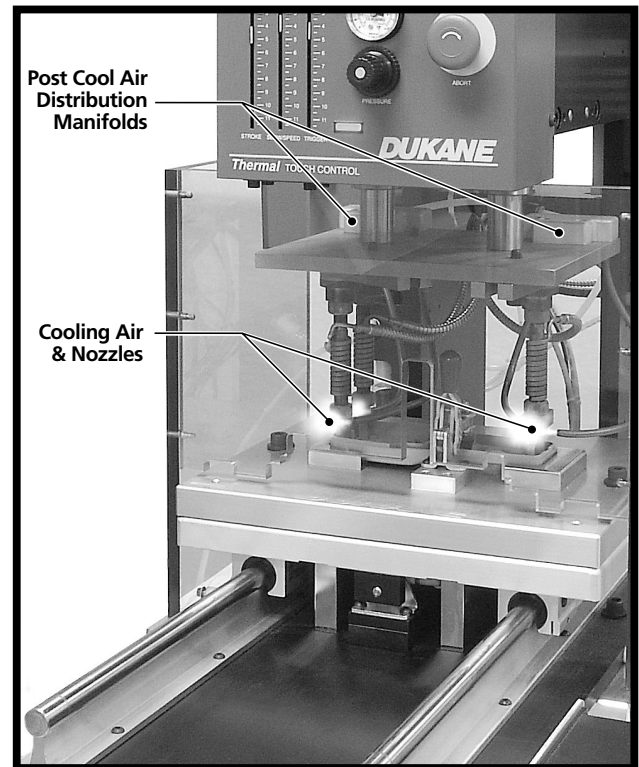


Figure A–1 Post Cool Kit

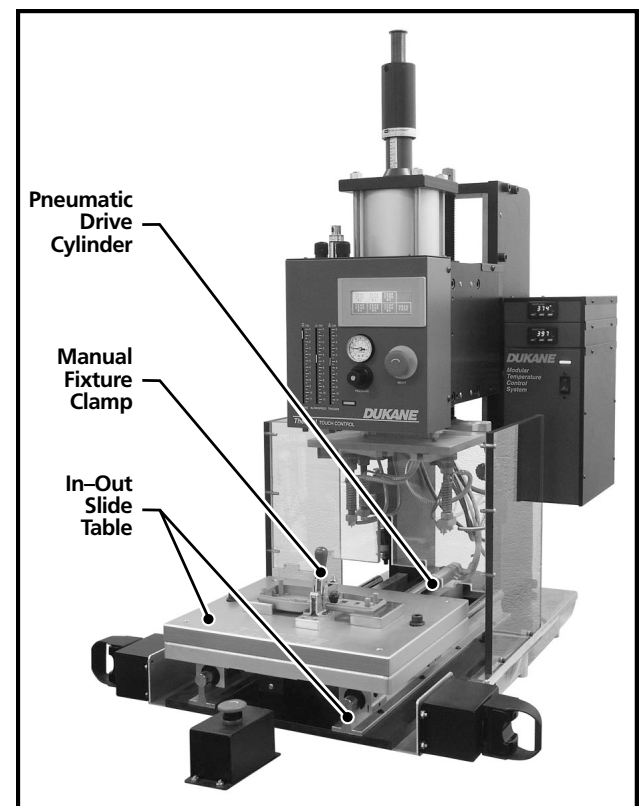


Figure A–2 In–Out Slide Kit

Rotary Slide Kit

(Part No. 438-900)

The Rotary slide kit is a bolt on, plug-in installation. It allows an operator to load a second fixture while the machine is in operation. The rotary table always returns to the exact same load position and it improves operational safety and ergonomics. It is approximately 4-inches (100 mm) in height. It features a rotary pneumatic actuator with cushioned stops, flow control, and position sensing. The pneumatic controller shown in Figure 10-7 is included as part of the rotary slide kit.

Automation Signals Kit

(Part No. 438-904)

This kit installs relays for System Ready and Top Of Stroke signal isolation. Refer to Table 10-IV for a complete description of the signals.

The Top-Of-Stroke (TOS) output signal is a set of contacts that are normally open (N.O.) on pins 4 and 5. The contacts close when the press platen is at the top of its stroke, and open as soon as the platen moves from this position.

The System Ready (SR) output signal requires six conditions for the contacts on pins 12 and 13 to close.

1. Top-Of-Stroke switch must be made.
2. None of the heaters zones have errors.
3. System is not in cycle.
4. Abort (E-stop) is not pushed in.
5. Part-In-Place input is on. If the press is not equipped with a part presence sensor, this signal is jumpered to +24V, and is always on. This signal can also be used to expand the automation logic ladder.
6. If an In-Out slide kit is connected, the slide must be fully extended out to the operator.

The contacts on both relays are rated at 5 Amps/110 Volts. Figure A-3 identifies the automation pins on the multipurpose connector on the back of the electronics and power supply chassis. Figure A-5 shows the connections inside the slide controller chassis.

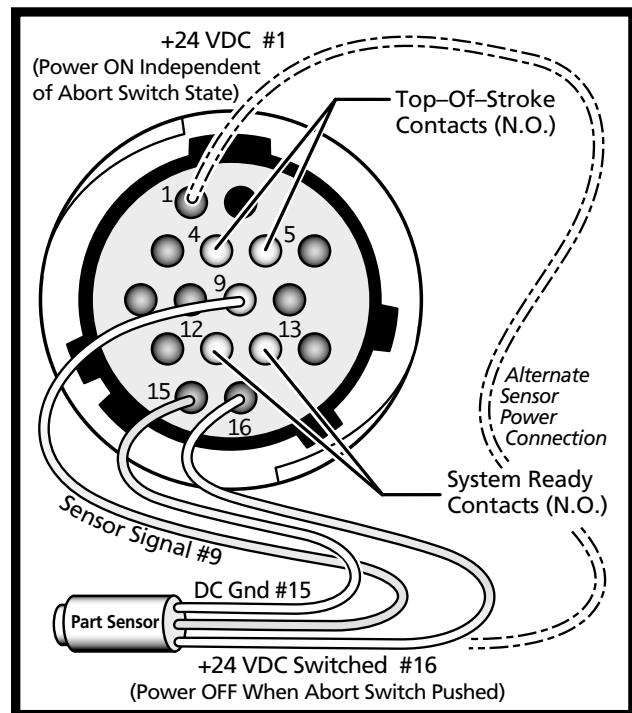


Figure A-3 Automation Signals and Part Sensor Wiring to Multipurpose Connector

NOTE

All specifications are subject to change without notice. Please consult Dukane for any updated information or quotes on custom parts and systems.

The automation kit also includes the Start/Abort cable (Dukane No. 200–1124) and the SR/TOS cable (Dukane No. 200–1374). Wiring information to facilitate integration of the Thermal Press Operate and Abort switches with a PLC or workstation is shown in Figure 10–3 on page 79.

Part-In-Place Sensing

Part-In-Place sensing is built into the press. Part detection requires a sensor in the tooling and is normally quoted as part of the tooling price. If the press is not equipped with a part sensor, this signal is jumpered to +24V on the internal terminal block and is always on. If a part sensor is added later, the jumper wire to +24V, shown in Figure A–4, must first be removed from the electronics chassis.

If a Slide Kit Controller was not purchased, the part sensor can be connected to the multipurpose connector on the rear of the electronic chassis. Power and ground are also available on the connector as indicated in Figure A–3. The part sensor must be a sourcing type (PNP) so that its output is +24V DC when the part is in position.

If a Slide Kit Controller is present, the part sensor is then connected to the terminal strip in the controller chassis as shown in Figure A–5. The cable from the multipurpose connector to the slide controller chassis has dedicated signal lines for both the part sensor and the automation signals. The part sensor must be a sourcing type (PNP) so that its output is +24V DC when the part is in position.

Fixture Clamp Kit

Fixture Clamp operation is built into the press. If a fixture clamp kit is desired, it is normally quoted during the tooling quotation process. It can, however, be added later without modifying the press. All the user needs to install beside the pneumatic fixture clamp(s) is a 24VDC/100mA air valve and control cable. Refer to Figures 10–1 and 10–4 for connector location and pinout.

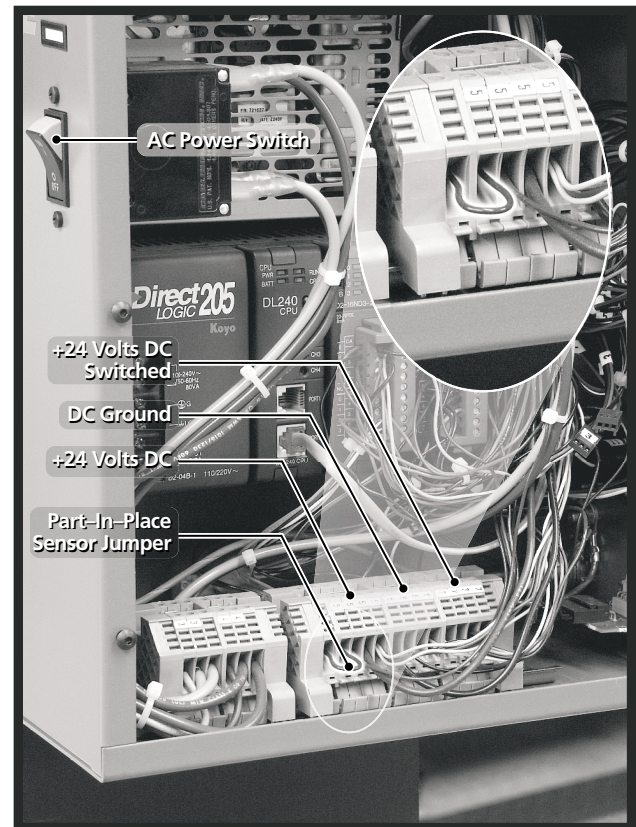


Figure A–4 Part-In-Place Sensor Bypass Jumper

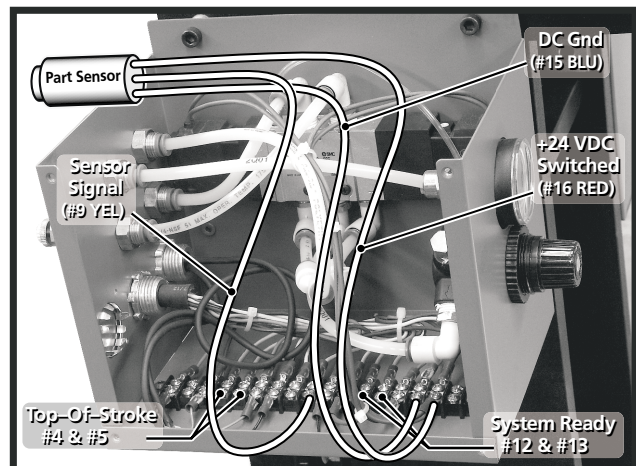


Figure A–5 Part Sensor Wiring Connections and Automation Signals in Slide Controller

Modular Temperature Control Unit

(Model JT-8004-00)

This unit shown in Figure A-6 is designed to be integrated by a third party into a system and not for stand-alone use. It has manual switches to operate up to six temperature controllers. This unit operates on 110 or 220 Volts single-phase AC. The 120 Volt unit can power up to six 350 Watt heaters. The 220 Volt unit is capable of operating twelve 350 Watt heaters. The machine voltage must be matched to the heater voltage. Each master module can power three 350 Watt heaters and also drive up to three slave modules, each of which can support three 350 Watt heaters. You may not however exceed the load rating for the machine (i.e. 2100 Watts or 4200 Watts). Overload may result in damage to the unit's electrical system and may create a hazard.

The modular control unit has the same AC power switch and indicator as the thermal press. This switch is also the main circuit breaker. If the circuit breaker trips, it may be reset by flipping the switch fully OFF (marked by the O) and then back ON (marked by the I). The touch control screen is replaced by six zone switches which activate or deactivate the temperature control zones.

The master and/or slave modules are installed on top of the modular control unit in the same way as they are in the thermal press. The heaters are then connected to the master/slave controller modules. Each temperature control zone is capable of sending a status signal to the parent machine. To utilize these signals, a status cable must be connected to the terminal block inside the control unit chassis. This terminal block is shown in Figure A-7. It is located at the bottom of the electronics chassis at the same position as the terminal block shown in Figure A-4. The connections labeled A1 through A6 are prewired alarm circuits from the six master module control cables (see Figure 9-13 for the lo-

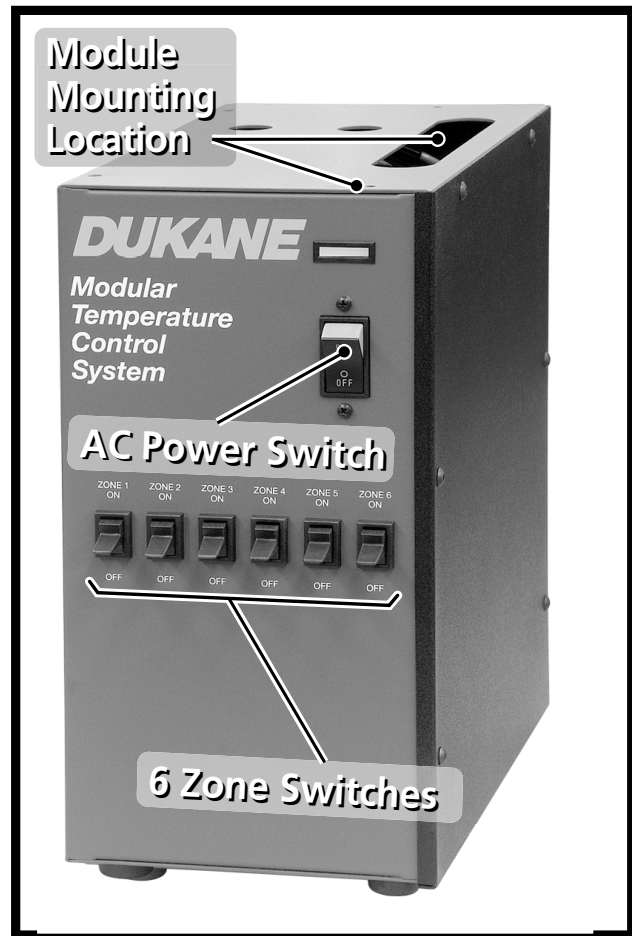


Figure A-6 Modular Temperature Control Unit

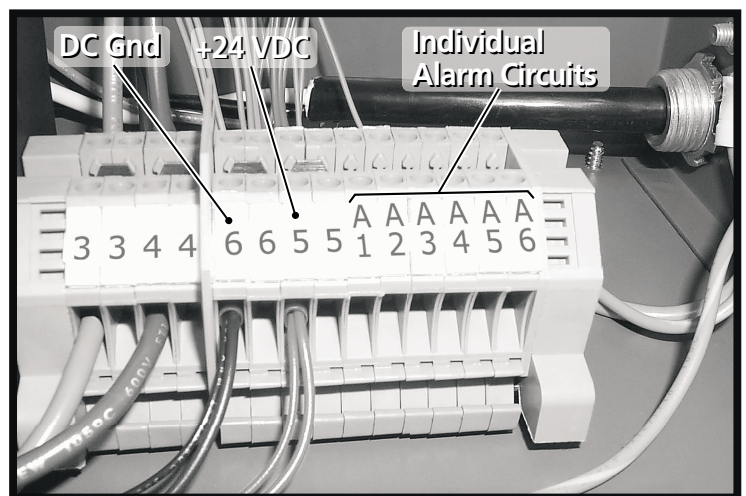


Figure A-7 Alarm Status Signal Terminal Block

cation of the P101 connector). These circuits can be connected directly to the inputs of a PLC or to opto-couplers for driving external devices. The connections labeled 5 and 6 are +24V DC and Ground respectively. The total current draw from all six terminals A1 through A6 plus any extra circuitry powered from terminal 5 cannot exceed 500mA.

If the status from the zone controller is NO ALARM or NORMAL, the output is +24V. If the status is ALARM or ZONE DISABLED, the output is 0V. This feature allows the machine controller to verify that each zone that should be operating is operating in a normal state and that no alarm condition exists.

It is intended that this control unit be used only to heat thermal tooling for plastics joining applications. Any other use is attempted completely at the user's own risk. Because this equipment is part of a larger assembly installed by a system integrator, Dukane does not assume any responsibility for performance, safe operating practices or safety of the heated equipment.

8-Module Custom Press

The thermal press can be modified at the factory with a custom control cable harness to support eight master control modules (8 temperature zones). The maximum power available is still limited to 4200 Watts (220 VAC). A photo of an eight-module custom press is shown in Figure A-8.

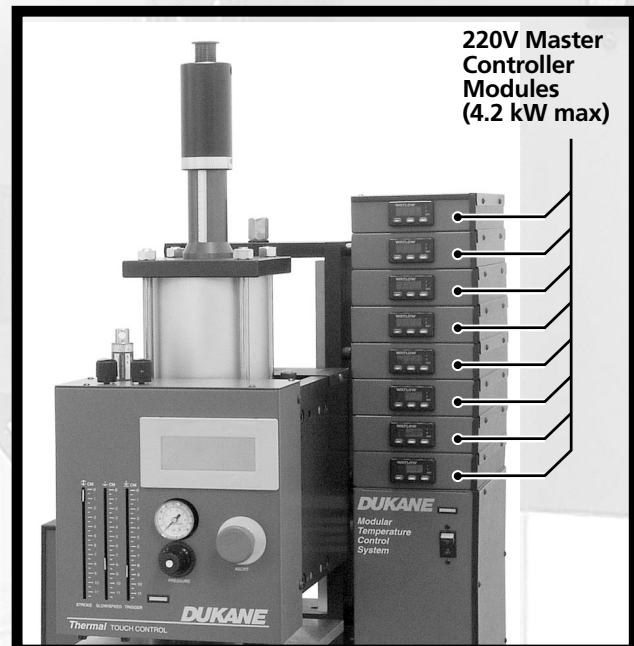
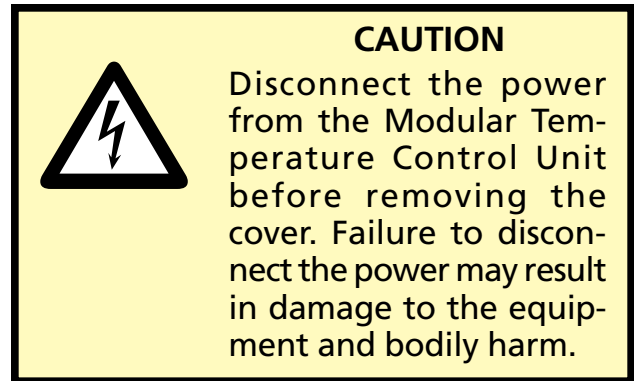


Figure A-8 Eight Module Custom Thermal Press

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List of Figures

Figure 2-1	20–Amp 110V and 220V Power Cords	10
Figure 2-2	20–Amp 110V and 220V Power Receptacles	10
Figure 2-3	Grounding Lug	11
Figure 2-4	Compressed Air Safety Isolation Device	11
Figure 3-1	Lifting Rings Installed	15
Figure 3-2	Heater Cable Connectors	16
Figure 3-3	Optical Activation Switches	17
Figure 3-4	Thermal Press Cable Connections	19
Figure 3-5	Compressed Air Fittings and Pneumatic Isolation Device in Lockout Position	20
Figure 4-1	Thermal Press in Starting Position	23
Figure 4-2	Slide Table Retracting	23
Figure 4-3	Main Air Valve Energized and Platen Descending	24
Figure 4-4	Trigger Switch Setting and Trigger Light	24
Figure 4-5	Post Cool Cycle with Cooling Air	25
Figure 4-6	Platen Returning to Start Position	25
Figure 4-7	Single Heater Zone	26
Figure 4-8	Dual Heater Zone – Mixed Probe Sizes	26
Figure 4-9	Dual Heater Zone – Different Work	26
Figure 4-10	Abort & Operate Switches, AC Power and Polycarbonate Guarding	27
Figure 5-1	Major Controls Identified	31
Figure 5-2	Temperature Controller Display, Control Keys and Indicator Lights	32
Figure 5-3	Main Control Panel and Touch Screen Display	32
Figure 5-4	Resetting the Abort Switch	33
Figure 5-5	Air Regulator and Pressure Gauge	33
Figure 5-6	Graph of Applied Force As a Function of Pressure	34
Figure 5-7	Bottom Stop Adjustment Mechanism	35
Figure 5-8	Thermal Press in Setup Mode	35
Figure 5-9	Indicator Flags and Trigger Light	36
Figure 5-10	Trigger and Speed Adjustments	36
Figure 6-1	Main Screen Menu	41
Figure 6-2	Main Menu With POST COOL Turned Off	41
Figure 6-3	INSERT PREHEAT Turned ON	41
Figure 6-4	SETUP Mode Enabled	42
Figure 6-5	CYCLE COUNTER Display Screen	43
Figure 6-6	DWELL TIMER Display Screen	43

Figure 6-7	DWELL TIMER Data Entry Screen	43
Figure 6-8	DWELL TIMER Set To 2.5 Seconds	43
Figure 6-9	POST COOL TIMER Display Screen	44
Figure 6-10	PREHEAT INSERT TIMER Display Screen	44
Figure 6-11	TEMP ZONES Display Screen	44
Figure 6-12	TEMP ZONE #1 Activated	44
Figure 6-13	Temperature Controller Activated	45
Figure 6-14	Zone Fault Display	45
Figure 6-15	Abort Mode Fault Display	45
Figure 6-16	Startup Fault Display	46
Figure 7-1	Displaying and Changing Set Point	49
Figure 7-2	Temperature Controller Menu Structure	50
Figure 7-3	Thermal Model of Heater and Probe	52
Figure 7-4	Probe Temperature With On-Off Control	53
Figure 7-5	Temperature With Proportional Control	53
Figure 7-6	Proportional + Derivative Control	54
Figure 7-7	Proportional + Derivative + Integral Control	54
Figure 7-8	PID Block Diagram – Parallel or Noninteractive Form	55
Figure 7-9	PID Block Diagram – Series or Interactive Form	56
Figure 8-1	12mm 350 Watt Heater Coil	61
Figure 8-2	110V Connector – Cable End (438–886)	61
Figure 8-3	220V Connector – Cable End (438–887)	61
Figure 8-4	Complete Heater and Cable Assembly	62
Figure 8-5	Thermocouple Principle of Operation	62
Figure 8-6	MATP™ (Multi-Adjustable Thermal Probe)	63
Figure 8-7	Standard Probe and Heater	64
Figure 9-1	Master Modules	67
Figure 9-2	Master Module AC Voltage Rating and Part Number Labels	67
Figure 9-3	110V and 220V Master Module Heater Pin Assignments	68
Figure 9-4	Loosen Cover and Remove Screws	68
Figure 9-5	Remove Cover Assembly	69
Figure 9-6	Install Ground Jumper Cable in Existing Module	69
Figure 9-7	Locate Heater Control Cables	70
Figure 9-8	Position New Module	70
Figure 9-9	Securing New Module to Stack	71
Figure 9-10	Attach Grounding Jumper to New Module	71
Figure 9-11	Connect Heater Power Cable	72
Figure 9-12	Connect The Controller Cable to P101	72
Figure 9-13	Master Module Power and Control Connector Detail	73
Figure 9-14	Attach New Panel to Assembly Cover	73
Figure 9-15	Install Cover Assembly	74
Figure 9-16	Securing The Cover Assembly	74
Figure 9-17	Slave Module	75
Figure 9-18	110V and 220V Slave Module Heater Pin Assignments	75
Figure 9-19	Slave Module Power Connector Detail	76

Figure 10-1	Thermal Press Rear Connectors	79
Figure 10-2	Operate Connector Pin Numbers	79
Figure 10-3	Operate Switches Schematic	79
Figure 10-4	Pneumatic Fixture Clamp Connector	80
Figure 10-5	Post Cool Panel Connector	80
Figure 10-6	Multipurpose Panel Connector	81
Figure 10-7	Optional Slide Kit Controller	82
Figure 11-1	Head Height Adjustment Mechanism	85
Figure 11-2	Head Radial Position Adjustment Mechanism	85
Figure 12-1	Inserting Operation	89
Figure 12-2	Staking Operation	91
Figure 12-3	Swaging Operation	92
Figure 12-4	Degating Operation	93
Figure 13-1	Temperature Controller Error Message	99
Figure 13-2	Finger Placement To Activate System Menu	99
Figure 13-3	Internal System Menu Display	99
Figure 13-4	Zone Fault Display	100
Figure 13-5	Abort Mode Fault Display	100
Figure 13-6	Startup Fault Display	100
Figure 13-7	Distorted Heating Coil and Damaged Armor-Flex Cable	101
Figure 14-1	Air Filter Replacement	108
Figure 16-1	Series 48H Thermal Press Dimensions	118
Figure 16-2	1-1/2 ton Thermal Press	119
Figure 16-3	MATP™ Probe Drawing and Dimensions	120
Figure 16-4	Standard Probe and Dimensions	120
Figure 16-5	Interpreting the Thermal Press Model Number	121
Figure A-1	Post-Cool Kit	125
Figure A-2	In-Out Slide Kit	125
Figure A-3	Automation Signals and Part Sensor Wiring to Multipurpose Connector	126
Figure A-4	Part-In-Place Sensor Bypass Jumper	127
Figure A-5	Part Sensor Wiring Connections and Automation Signals in Slide Controller	127
Figure A-6	Modular Temperature Control Unit	128
Figure A-7	Alarm Status Signal Terminal Block	128
Figure A-8	Eight Module Custom Thermal Press	129

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List of Tables

Table 3—I	Contents of Thermal Press Shipping Container	15
Table 5—I	Table of Scale Factors for Applied Force (pounds)	34
Table 5—II	Table of Applied Force for Air Pressure in Increments of 10 psi	34
Table 7—I	Sensor Types and Temperature Ranges	51
Table 10—I	Pin Assignment and Signal Description for Operate Switches Connector	79
Table 10—II	Pin Assignment and Signal Description for Fixture Clamp Connector	80
Table 10—III	Pin Assignment and Signal Description for Post Cool Connector	80
Table 10—IV	Pin Assignment and Signal Description for Multipurpose Connector	81
Table 10—V	Slide Table Positions for Limit Switch Inputs	81
Table 10—VI	Slide Kit Description for ID Combinations	81
Table 12—I	Processing Temperature of Common Thermoplastics	95
Table 16—I	Thermal Press Model and Power Requirements	121

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A

ABORT Mode Fault Screen	45, 100
Abort Switch	31, 33
Abort Switch, Auxiliary	17, 31, 33
AC Outlet, Rating	10, 121
AC Power Cord	10, 18
AC Power Indicator	27, 31
AC Power Requirements	10, 18, 121
AC Power Switch/Breaker	27, 31, 128
Accessories (see Option Kits)	
Activation Switches (Operate Switches)	17, 23
Adjustment of Head	85
Air Filter	20, 108
Air Lockout Device	17, 20, 27
Air Pressure Regulator	33
Air Pressure Gauge	33-34
Alarm Status Signals	128-129
Aluminum Base, Cast	31
Applied Force Graph	34
Auto Tune, Temperature Controller	50, 52
Automation Signals Kit	126

B

Base, Thermal Press	31, 118
Bench Capacity for Placing Thermal Press	15
Block Diagram, PID Controller	55-56
Bottom Mechanical Stop	24, 27, 31, 35

C

Cable Connections	18-19, 67, 75, 79, 82
Cable Harness, Temperature Controllers	69-73
Cable, Heater	16, 61-62
Cable Part Numbers	61, 126-127
Cable Pinout (also see Connector Pinouts)	61
Cable Schematics, System	19
Calibration, Heater	100
Cautions and Warnings	3
CE Compliance	117
Chassis, Power Supply and Electronics	31
Circuit Breaker	31, 128
Compressed Air Lockout Device	17, 20, 27
Compressed Air Safety	11, 20
Configuration Menu	50
Connector Pinouts	16, 61, 68, 79-81, 126
Connectors, Identified	16, 67, 79, 82

Contents, Shipping Container	15
Control Keys, Temperature Controller	32
Control Panel, Main	31
Controller, Temperature	32
Conversion, Temperature – °F to °C	89
Custom 8-Module Thermal Press	129
Cycle, Normal	23-25
CYCLE COUNT Menu Key	43

D

Damping Adjustment on Hydraulic Speed Control	36
Data Entry Screens	43
Date Stamping Process (<i>also see</i> Embossing Process)	93
Decrement Key, Temperature Controller	32, 49
Degating Process	93
Degree Units, °C or °F	49, 89
Derivative Action Differences in PID	56
Derivative Controller Fundamentals	55
Derivative Gain	54
Derivative Time	57
Digital Timer	6
Dimensions	118-120
Display, Temperature Controller	32, 45, 49, 99-100, 107
Display, Touch Screen	32, 107
Downspeed (<i>also see</i> Slow Speed)	31, 36
Downspeed Setting, Insertion	90
Downspeed Setting, Swaging	93
Drain, Water for Air Filter	108
Drawings, Dimensioned	118, 120
Dukane Website	111
Dwell Time	27, 90
DWELL TIMER Menu Key	43

E

Electrical Safety & Grounding	10-11, 18
Electronics Chassis and Power Supply	31
Email Addresses, Dukane	111
Embossing Process	93
Error Messages, Temperature Controller	45, 99-100
Error Messages, Thermal Press (<i>see</i> FAULT Screens)	
Excess Flash During Inserting	101

F

FAULT Screens, Thermal Press	45-46, 100
Features of Thermal Press	6
Feedback Control	53
Filter Element Replacement	108

Fixture Clamp Activation	23
Fixture Clamp Cable	18-19
Fixture Clamp Released	25
Fixture Clamp Option Kit	127
Flowchart, Temperature Controller Software	50
Force Applied vs Air Pressure, Graph	34
Force, Insertion	90
Force, Staking	91
Force, Swaging	92
Front Panel Controls	33
Front Panel Displays	32
Front Panel Layout	31
G	
Gain, PID Controller	54
Graph of Applied Force vs Air Pressure	34
Ground Lug, Thermal Press	11, 18-19
Grounding Jumper	69, 71
Guarding, Polycarbonate	11, 27
H	
H-Frame	6, 31
Head, Adjusting Height and Radial Position	85
Head Height Adjustment	31, 85
Heading (see Staking Process)	
Health and Safety Tips	9
Health Notice, Plastics	10, 94
Heater, 12mm	61
Heater Cables	19
Heater Temperature Calibration	100
Heater, Cartridge	61
Heater Connectors	16, 61
Heater Damage, Prevention	100
Heater Power Limits	26
Heater, Replacement	107
Heater Runaway Condition	100
Heater Voltage Ratings	61
Heater Zone Selection	27, 44
Hydraulic Speed Control	31, 36
I	
Idle Set Point	50
Increment Key, Temperature Controller	32, 49
Indicator, Air Filter	108
Indicator Flags, Position	36-37
Indicator Lights, Temperature Controller	32
Indicator, Power	27, 31

INSERT PREHEAT Key	41
Insertion Process.....	89-91
Insertion Troubleshooting	101-102
Installing Modules, Master and Slave	68-76
Integral Controller Fundamentals	55
Integral Gain	54
Integral Time	57
Integral Windup.....	56
Internet Site.....	111
ISO 9001 Certification	6, Inside Back Cover
Isolated Signals Option	126
J	
J-Type Thermocouple	51, 62
Jumper Cable, Grounding for Modules.....	69, 71
Jumper Wire, Part-In-Place Sensor.....	127
K	
Key Features of Thermal Press	6
Keys, Temperature Controller	32, 49
Keys, Touch Screen	41-46
L	
Laplace Transform	54
Left-Right Slide Kit	125
Leveling the Thermal Press.....	16
Lifting the Thermal Press.....	15
Line Voltages, Heater and Modules	61, 67, 75
Linear In-Out Slide Kit.....	125
Lockout Device, Pneumatic Safety	17, 20, 27
M	
Main Control Panel	31
Main Menu Screen	41, 107
Main Pneumatic Pressure Cylinder	31
Maintenance, Scheduled	107
Manifold, Distribution for Post Cool Air	25
Marking Process (<i>also see</i> Embossing Process).....	93
Master Module	31, 67
Master Module Installation	68-74
Master/Slave Modules	6
Material Factors (Process Operations)	94-95
MATP™ Thermal Probes	6, 63
MATP™ Probe Drawings	120
Mechanical Safety	11
Mechanical Stop.....	24, 27, 31, 35
Menu Structure, Temperature Controller	50
Model Number Coding	35, 121

Modular Temperature Control Unit	128-129
Module Installation, Master and Slave	68-76
N	
NEMA Outlet Types	10, 19
Normal Welding Cycle	23-25, 27
O	
Operate Connector	19, 79
Operate Switches	17, 23, 27, 31, 33, 79
Operating Environment	119
Operational Setup of Thermal Press	18-20
Operations Menu	50
Option Kits	Appendix A (125-129)
OSHA Compliance	9, 10, 17, 94
Outlet, AC Power	10, 18,
P	
Part-In-Place Sensor	127
Part Sensor Installation Wiring	126-127
Part Numbers	61, 63-64, 67-68
PID Algorithm	54-56
PID Block Diagram	55-56
PID Controller Theory	52-56
PID Definition	52
PID Tuning	56-58
Pinout, Connector	16, 61, 67, 80-81
Placement of Thermal Press	15-16
Plastics Health Notice	10, 94
Platen Extending Cycle	24
Platen Retraction Cycle	25
Platen, Upper	31
Pneumatic Lockout Device	17, 20, 27
Pneumatic Pressure Cylinder, Main	31
Pneumatic Controls	33-34
Pneumatic Safety	11-12, 20, 108
Polycarbonate Guarding	11, 27
Position Indicators	36-37
POST COOL Cycle Activated	24
Post Cool Distribution Manifold	25
Post Cool Kit	125
POST COOL OFF Key	41
Post Cool Time, Insertion	91
Post Cool Time, Staking	91
Post Cool Time, Swaging	93
POST COOL TIMER Key	44
Power Indicator, AC	27, 31
Power Limits, Heater	26, 67

Power Requirements, AC 10, 18, 121
 Power Supply and Electronics Chassis 31
 Power Switch, AC 27, 31, 128
 PREHEAT TIMER Activation 24
 PREHEAT TIMER Key 44
 Pressure, Insertion 90
 Pressure, Staking 91
 Pressure, Swaging 92
 Pressure Gauge 31,33
 Pressure Graph of Applied Force 34
 Pressure Ratings of Press Model No. 34
 Pressure Regulator 31, 34
 Principles of Operation, Proportional Controller 53
 Principles of Operation, Thermocouple 62
 Probes, Thermal – MATP™ and Standard 63–64, 120
 Process Operations 89-92, 94-95
 Proportional Band 50, 54, 57
 Proportional Controller Fundamentals 53

R

Radial Adjustment of Head 85
 Rear Connectors, Temperature Controller 16, 67
 Rear Connectors, Thermal Press 19, 79, 82, 100
 Regional Representatives Back Cover
 Regulator Gauge 33-34
 Regulatory Compliance 117
 Replaceable Tips 64
 Replacement Air Filter 108
 Replacement Heaters 107
 Representatives, Regional Back Cover
 Reset, Circuit Breaker 31, 128
 Reset Level Parameter 54
 Riveting (see Staking Process)
 Rotary Slide Kit 126
 RTD Sensors 51

S

Safety Lockout, Compressed Air 17, 20, 27
 Safety Tips 9-12, 20, 108
 Sales 111-112, Back Cover
 Scale Factor, Applied Force 34
 Screen Saver, Touch Screen 32, 99
 Selecting Heater Zones 27, 44, 128
 Sensor, Part-In-Place Connections 126-127
 Service Centers Back Cover
 Service & Parts 111-112
 SET Key, Temperature Controller 49
 Set Point, Temperature Controller 49

SETUP Mode Menu Key	35, 42
Setup of the Thermal Press	18
Slave Module	31, 75
Slave Module Installation	75-76
Slide Kit Controller	19, 31, 82
Slide Table Activation	23
Slide Table Option	125
Slide Table Retraction Cycle	23
Slide Table Extension Cycle	25
Slow Speed Adjustment	31, 36
Slow Speed Indicator Flag	36
Slow Speed Setting, Insertion	90
Slow Speed Setting, Swaging	93
Software Flowchart, Temperature Controller	50
Specifications of Thermal Press	118-119
SR/TOS Cable	126
Standard Thermal Probes	6, 64, 120
Staking Process	91
Staking Troubleshooting	102-103
Starting a Weld Cycle	27
STARTUP Mode Fault Screen	46, 100
Status Signals, Alarm	128-129
Stopping The Weld Cycle	27
Storage Conditions	119
Stroke Length Scale on Mechanical Stop	35
Stroke Position Indicator Flag	24, 25, 36
Swaging Process	92-93
Switches, Activation (Operate Switches)	17, 23, 27, 31, 33
T	
Telephone Numbers, Dukane	112
TEMP ZONES FAULT Screen	45, 100
TEMP ZONES PAGE Key	44
Temperature Calibration of Heater	100
Temperature Controller	31-32, 45, 49-58, 99-100, 107
Temperature Conversion, °C to °F	89
Temperature Differential	53, 89
Temperature Display	31-32, 45, 49, 107
Temperature, Inserting Process	89
Temperature, Processing of Common Thermoplastics	95
Temperature Range of Thermocouple Types	51
Temperature, Swaging process	91
Temperature Units, Display	32, 49
Temperature Zone Concept	26
Theory of Operation, PID	53
Theory of Operation, Thermocouple	62
Thermal Press Fault Screens	45-46, 100
Thermal Probes, MATP™ and Standard	63-64, 120

Thermal System Model 52

Thermocouple, Principles of Operation 62

Thermocouple Sensing Pins 68

Thermocouple Types 51

Thermoplastic Selection 94-95

Time, Derivative and Integral 57

Time, Insertion Dwell 90

Time, Insertion Post Cool 91

Time, Swaging Dwell 92

Time, Staking Post Cool 91

Time, Swaging Post Cool 93

Timer, Digital 6

Timer, PREHEAT 24

Tips, Titanium 64

Tooling Platen, Upper 31

Touch Screen Display 31-32, 41-46, 99, 107

Trigger Indicator Light 31, 36-37

Trigger Position Adjustment 31, 37

Trigger Position Indicator Flag 24, 36-37

Trigger Switch Activation 24

Troubleshooting, Thermal Press 99-102

Tuning Procedure, PID 56-58

U

Unpacking Thermal Press 15

Units, Temperature °F or °C 49, 89

Upper Tooling Platen 31

V

Vertical Adjustment of Head 85

Vortex Cooler 91

W

Warranty, Domestic 113

Warranty, International 114

Warranty, Tooling 114

Water Drain on Air Filter 108

Website, Dukane 111

Weld Cycle, Normal 27

Weld Troubleshooting 99-103

Z

Zone, Heater Selection 27, 44

Zone, Switches 128

Zone, Temperature 26

Dukane ISO

ISO CERTIFICATION

Dukane chose to become ISO 9001:2000 certified in order to demonstrate to our customers our continuing commitment to being a quality vendor. By passing its audit, Dukane can assure you that we have in place a well-defined and systematic approach to quality design, manufacturing, delivery and service. This certificate reinforces Dukane's status as a quality vendor of technology and products.

To achieve ISO 9001:2000 certification, you must prove to one of the quality system registrar groups that you meet three requirements:

1. Leadership
2. Involvement
3. Quality in Line Organizations and Quality System Infrastructure.

The ISO 9001:2000 standard establishes a minimum requirement for these requirements and starts transitioning the company from a traditional inspection-oriented quality system to one based on partnership for continuous improvement. This concept is key in that Dukane no longer focuses on inspection, but on individual processes.

Dukane's quality management system is based on the following three objectives:

1. Customer oriented quality. The aim is to improve customer satisfaction.
2. Quality is determined by people. The aim is to improve the internal organization and cooperation between staff members.
3. Quality is a continuous improvement. The aim is to continuously improve the internal organization and the competitive position.

**ISO 9001:2000
CERTIFIED**

Dukane products are manufactured in ISO registered facilities

DUKANE CORPORATION

WHO ARE WE?

We are plastic welding technologists. We are scientists.
We are employees and businessmen. We are instructors.

We are engineers. We are specialists in electronics
and experts in plastic assembly. We are salesmen. We do
basic research and we manufacture machines.

We are problem solvers and we are technical advisors

We Are Your Partners.



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Thermal Press User's Manual

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