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SAFETY PRECAUTIONS — AVOID INJURY

Safeguards are designed into this application equipment to protect operators and maintenance personnel from most hazards during equipment operation. However, certain safety precautions must be taken by the operator and repair personnel to avoid personal injury, as well as damage to the equipment. For best results, application equipment must be operated in a dry, dust-free environment. Do not operate equipment in a gaseous or hazardous environment.

Carefully observe the following safety precautions before and during operation of the equipment:



Always wear approved eye protection while operating equipment.



Always wear appropriate ear protection while using equipment.



Moving parts can crush and cut. Always keep guard(s) in place during normal operation.



Always insert power plug into a properly grounded receptacle to avoid electrical shock.



Always turn off the main power switch and disconnect the electrical cord from the power source when performing repair or maintenance on the equipment.



Do not operate the equipment without guards in place.



Lift point for equipment.



Never alter, modify, or misuse the equipment



Use caution when working with this equipment.



Never insert hands into installed equipment. Never wear loose clothing or jewelry that may catch in moving parts of the equipment.



Never place liquid containers on any surfaces of the machine. The containers may tip and result in machine damage.



Never enter the electrical enclosure immediately after turning off the machine power switch and disconnecting the electrical cord from the power source. High residual voltages may be present in the electrical enclosure. Read the warning label on the electrical enclosure before entering the enclosure.



Never stare at the bright light used for machine lighting. Bright light can damage the eye.



Never use the machine for other than what it is designed, which is crimping terminals to wire. Do not use the machine for crushing any items.

TOOLING ASSISTANCE CENTER

CALL TOLL FREE 1-800-722-1111 (CONTINENTAL UNITED STATES AND PUERTO RICO ONLY)

The **Tooling Assistance Center** offers a means of providing technical assistance when required. In addition, Field Service Specialists are available to provide assistance in the adjustment or repair of the application equipment when problems arise which your maintenance personnel are unable to correct.

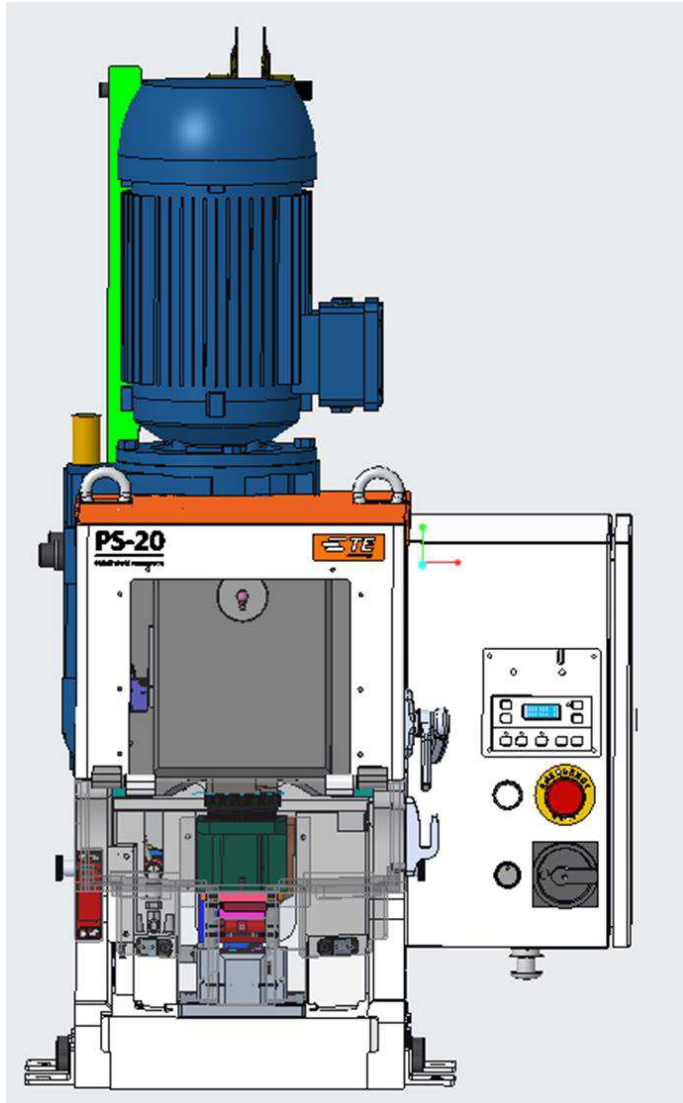
INFORMATION REQUIRED WHEN CONTACTING THE TOOLING ASSISTANCE CENTER

When calling the Tooling Assistance Center regarding service to equipment, it is suggested that a person familiar with the device be present with a copy of the manual (and drawings) to receive instructions. Many difficulties can be avoided in this manner.

When calling the Tooling Assistance Center, be ready with the following information:

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. Customer name 2. Customer address 3. Person to contact (name, title, telephone number, and extension) 4. Person calling 5. Equipment number (and serial number if applicable) | <ol style="list-style-type: none"> 6. Product part number (and serial number if applicable) 7. Urgency of request 8. Nature of problem 9. Description of inoperative component(s) 10. Additional information/comments that may be helpful |
|--|--|

Power Splice 20 (PS-20)



Terminator Part Number	Description
2378104-1	Power Splice 20 Terminator (400v)
2378104-2	Power Splice 20 Terminator (200v)

Figure 1

1. INTRODUCTION



Read and understand the entire manual before using the equipment.

When reading this manual, pay special attention to DANGER, CAUTION, and NOTE statements.



DANGER
Denotes an imminent hazard that may result in moderate or severe injury.



CAUTION
Denotes a condition that may result in product or equipment damage.



NOTE
Highlights special or important information.

This manual contains information on the operation, preventive maintenance, and adjustments of the Power Splice 20 Terminator Machines (reference Figure 1).

Descriptions in this manual pertain to the controls and adjustments on the Power Splice 20 Terminator machines only.

The various applicators that can be used in the machines are covered in applicator instruction sheets packaged with each applicator. Applicator instruction sheets provide information on applicator installation, care, and adjustment.

The specifications and requirements for the Power Splice 20 and Power Splice 20 with CQM Terminator Machines are as listed below:

Max Crimp Force		178 kN (40,000 lb)
Nominal Frame Deflection		0.006 mm per 1000 Newtons [.001 in. per 1,000 lb] Crimp Force
Noise		The emission sound pressure levels at the operator position are at the infeed < 69.3 dB(A), uncertainty K is 6.3 dB (A). The sound power level is 74.0 dB (A), uncertainty K, 7.4 dB (A). Operating conditions and procedures during noise testing are in accordance with EN 1218-4:2004 + A2:2009. Sound pressure level at the operator position have been measured in accordance with EN ISO 11202:2010. The sound power level has been determined in accordance with EN ISO 3746:2010. Uncertainty has been determined in accordance with EN ISO 4871:2009
Weight		390 Kilograms [860 lbm]
Height		965 mm [38 in.] without reel supports
Electrical	-1 Machine	380-420 VAC, 50/60 Hz, Three Phase Current. Operating current is 5 amps
	-2 Machine	208-240 VAC, 50/60 Hz, Three Phase Current. Operating current is 10 amps
Air		620-760 kPa [90-100 psi], 2.83 liters/sec (6 scfm) when req'd for use w/air-feed applicators
Physical Environment	Temperature	4 to 40 °C [40 to 104 °F]
	Relative Humidity	Less than 95% (non-condensing)
	Transportation and Storage	Store in clean, dry environment after coating all surfaces lightly with rust preventing oil

Figure 2

2. DESCRIPTION

2.1. By Model

The Power Splice 20 Terminator Machines were designed to be used as stand-alone semi-automatic bench units. They are assembled with metric hardware.



NOTE

Measurements are in metric units [followed by U.S. customary units in brackets] unless otherwise indicated. Some commercial items may contain non-metric hardware.

2.2. Functional

These machines provide the force required to crimp terminals in the applicator. A terminal is attached to the wire by placing the wire in the crimp area and pressing the foot switch. The machine consists of three functional areas:

1. The **Motor Group** includes an AC motor which drives a crankshaft (see Figure 3). The motor is activated each cycle and rotates the crankshaft one full revolution.

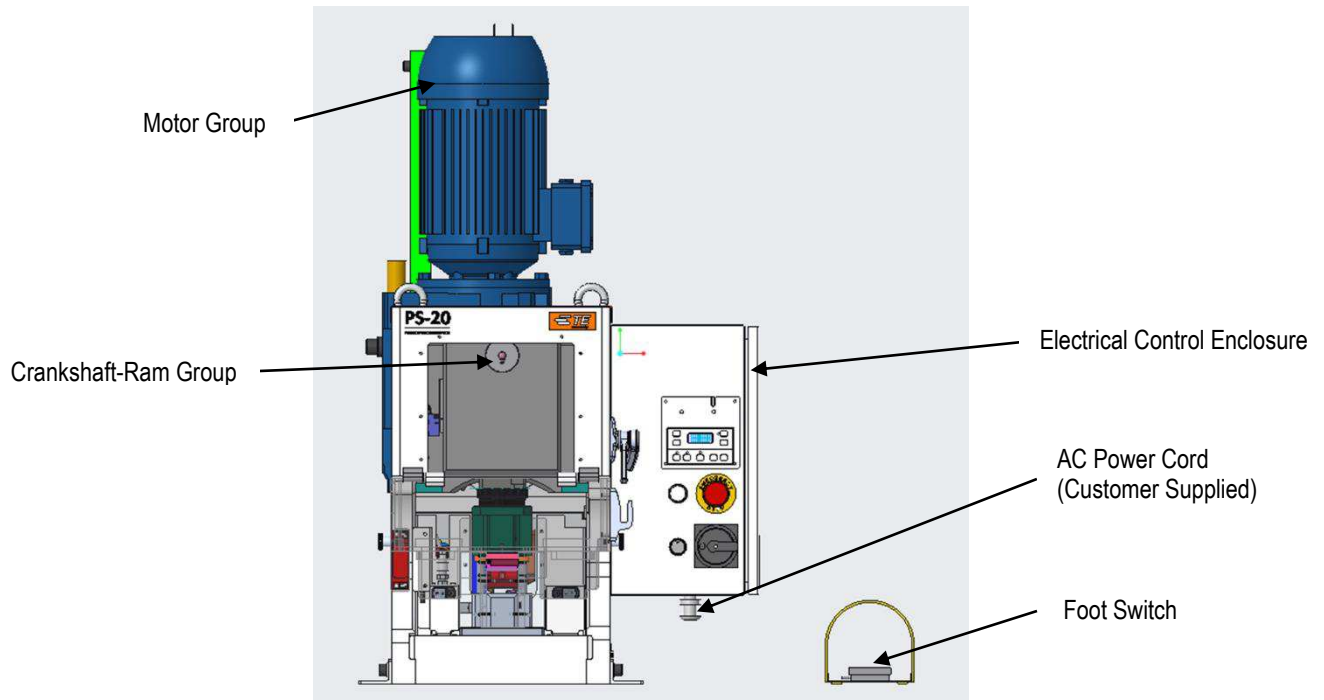


Figure 3

2. The **Crankshaft-Ram Group** converts the rotational output of the motor to the linear motion of the ram that cycles the applicator during the crimping operation.

2.3. Electrical

The terminator has an electrical enclosure which contains the control system components for the machine. The enclosure also includes mounting of the operator interface controls.

The terminator is designed to operate on three-phase, AC power. A customer supplied power cable and plug must be connected to the machine (refer to Section 3.4. for details of the AC power connection). The machine is factory configured to operate on three-phase power at 208-240 VAC or 380-420 VAC, 50/60 Hz.

The operator control panel is mounted on the electrical enclosure. On Power Splice 20 Terminators, the control panel includes a membrane keypad and LCD display. On Power Splice 20 with CQM Terminators, an LCD & touchscreen user interface are provided. Both machines include an AC power disconnect switch, a guard control button, an emergency stop pushbutton and a safety reset pushbutton (see Figure 4).

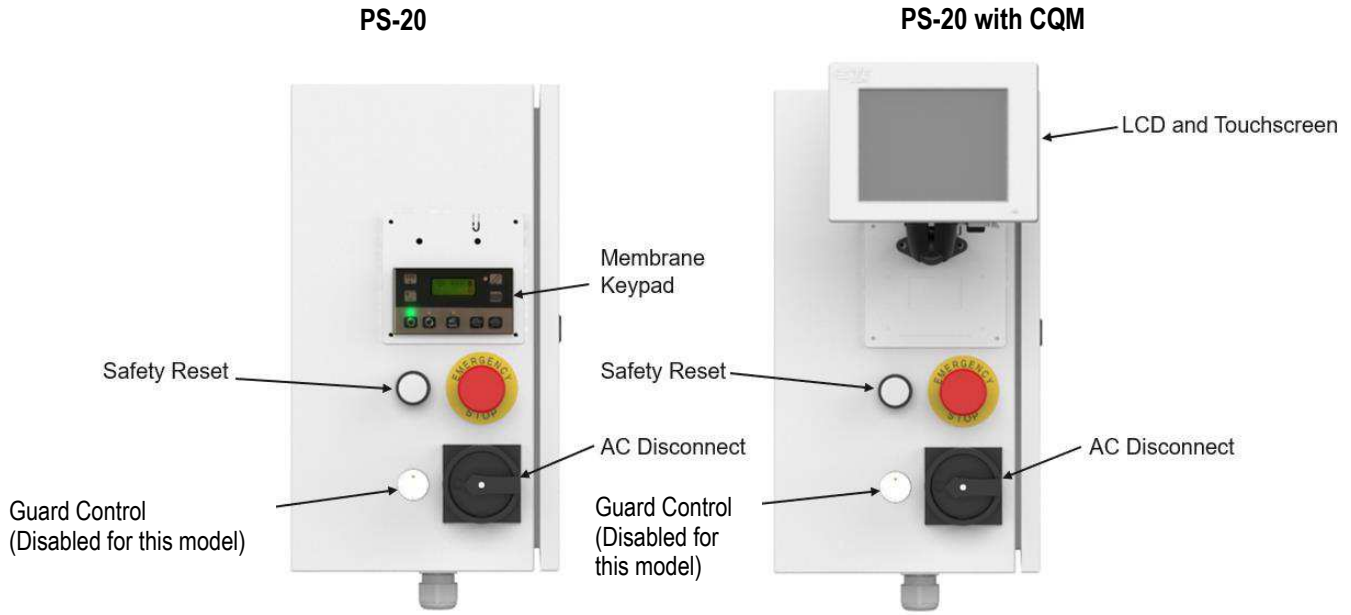


Figure 4

2.4. Machine Guard

A guard system is installed to provide protection for the operator while maintaining proper visibility of the work area. The guard swings open horizontally to allow easy access for applicator adjustments. A safety interlock switch on the lower guard and a safety interlock actuator on the upper guard prevents machine operation if the guard door is open (see Figure 5).

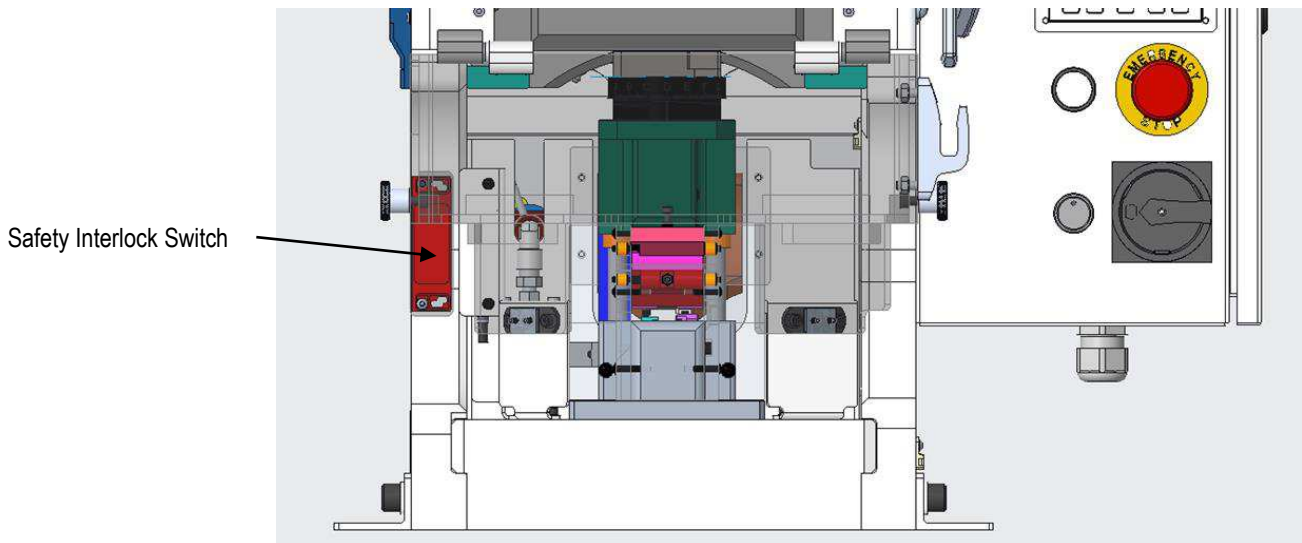


Figure 5

3. RECEIVING INSPECTION AND INSTALLATION

3.1. Receiving Inspection

These machines are thoroughly inspected during and after assembly. A final series of inspections are made to insure the proper machine functioning before packaging and shipping.

Despite careful packaging, damage may occur during shipping. Upon receipt, remove the machine from the crate and carefully inspect for damage. If evident, file a claim against the carrier and notify TE immediately.

3.2. Installation

Remove all mounting bolts securing the machine to the shipping pallet. The Lift Points are located on the top of the machine (reference Figure 6).



NOTE

Bow shackles are installed in the machine for use as lift points; reference TE PN 2337840-1 for replacement.



Lift points for equipment.



CAUTION

Both lift points must be used when lifting the machine.



CAUTION

The machine weighs 390 Kg [860 lbm]. The lift equipment selected needs to have a safety factor of at least 1.5 - 2 times the weight of the machine.

Attach a suitable hoist to the lift points, lift the machine, and place it in the selected operating location.

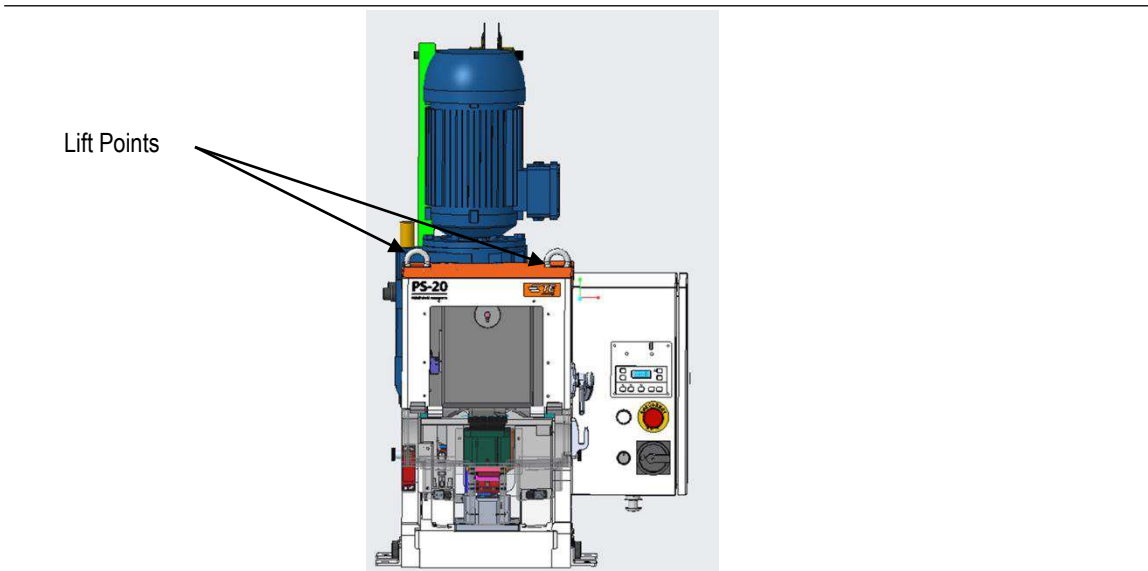


Figure 6

3.3. Considerations Affecting Placement of Bench Machines

The location of the machine in relation to the operator's position is extremely important in terms of both safety and maximum efficiency. Studies have repeatedly shown that operator fatigue will be reduced, and greater efficiency achieved, if:

- The bench is of appropriate height, preferably with sound-deadening rubber mounts;
- The machine is properly located on the bench with ample work areas on both sides to facilitate work flow;
- The operator uses a swivel chair with padded seat and back rest which are independently adjustable; and,
- The foot switch, on machines so equipped, is placed on a rubber mat to maintain its movability, while preventing it from sliding unintentionally.

Figure 7 illustrates proper machine location, operator position, and recommended foot switch position.

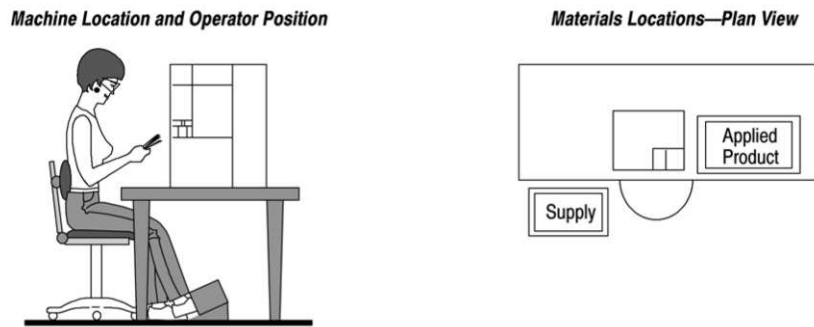


Figure 7

A. Bench

The bench to be used should be of sturdy construction and preferably with rubber mounts to minimize noise. A height of 762 to 812 mm [30 to 32 in.] is the most suitable for operator comfort and convenience. This height allows the operator to rest both feet on the floor, thereby providing for the shifting of weight and leg position.

B. Machine Mounting and Location on Bench

The machine should be located near the front of the bench with the “target area” (tooling area where the product is applied) not more than 152 to 203 mm [6 to 8 in.] - minimum 50 mm [2 in.] from the front edge. This location will eliminate unnecessary operator motion and help to avoid back strain and fatigue.

Orientation of the machine should be such that the “target area” is facing the front of the bench and is parallel to the front edge (access to the back of the machine MUST also be provided).



DANGER

Machines shall be securely bolted (4 places) to the bench using the machine mounting holes shown in Figure 8. Hardware is customer supplied. Use M12 bolts of grade 12.9. Choose bolt length based on bench or platform thickness. Bolts shall be installed using a flat washer under the head and a flat and lock washer with the nut. Care must be taken not to deform the bolt during installation. At least one thread must protrude beyond the nut after tightening. Periodically inspect bolts for tightness. Machines shall not extend beyond the footprint of bench.

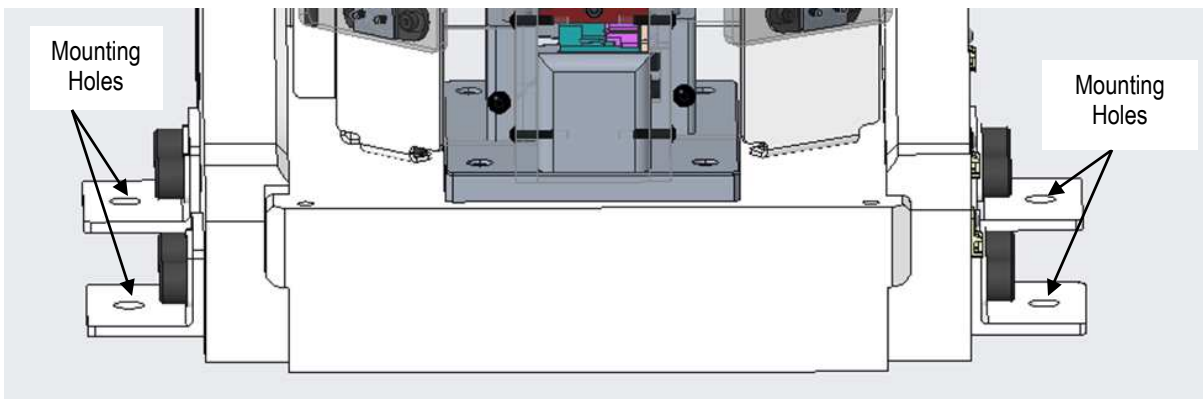


Figure 8

C. Operator's Chair

The operator's chair should swivel, and have independent seat height and back rest adjustments. The seat and back rest should be padded, and the back rest should be large enough to provide support both above and below the waist line.

In use, the chair should be far enough under the bench so the operator's back is straight and supported by the back rest.

D. Foot Switch

When the operator is correctly positioned in front of a machine equipped with a foot switch, the foot should rest on the switch comfortably. The foot switch should be movable, so that its location can be readily changed when the operator shifts position to minimize fatigue. Placing the switch on a rubber mat keeps it movable while preventing unintentional sliding.

The preferred foot switch location varies to some extent among operators. Some operators prefer the switch located so that their foot rests on the switch when their feet are in the natural sitting position (calf of leg perpendicular to the foot). Others prefer the leg to be slightly in front of the natural position. The important thing to remember is that the foot should be at approximately 90° (right angle) to the calf when resting on the switch. Those operators who prefer the foot switch slightly in front of the natural position may require a wedge-shaped block placed under it.

3.4. Electrical Connection



DANGER

Electrical wiring to AC mains must be done by a qualified electrician. The electrical enclosure maintains high voltage for a short period of time after power has been removed. Disconnect the power source and wait 5 minutes before opening the electrical enclosure.



DANGER

Follow all appropriate electrical safety precautions and employ lockout/tagout techniques.

A customer supplied power cable and plug must be connected to the machine. The cable must include three, 2.08 mm² (14 AWG) phase wires and a ground wire. The machine does not require a neutral connection for operation.

The terminator must be connected to the proper 3-phase AC supply voltage, as indicated on the label attached to the electrical enclosure door. The machine is factory configured to operate on three-phase power at 208 - 240 VAC or 380 - 420 VAC, 50/60 Hz. **Do not connect the machine to any power source other than the source configured for your machine.** Connect the power cable to the power disconnect switch as shown in Figure 9.



Figure 9

4. OPERATION

4.1. Control Panel

A. PS-20 Terminator

The PS-20 Terminator includes a membrane keypad and LCD for operator control of the terminator. Operation of the machine using the membrane keypad, will be as described below. On PS-20 terminators equipped with an optional CQM kit, terminator operation will still be controlled using the membrane keypad.

B. PS-20 with CQM Terminator (reference Figure 10)

1. If the PS-20 is intended to be used with the CQM (Crimp Quality Process Monitoring) select the “Use CQM” radio button on the “Options Screen” Use CQM

If CQM is not desired to be used, ensure the “Use CQM” radio button on the “Options Screen” is not selected Use CQM

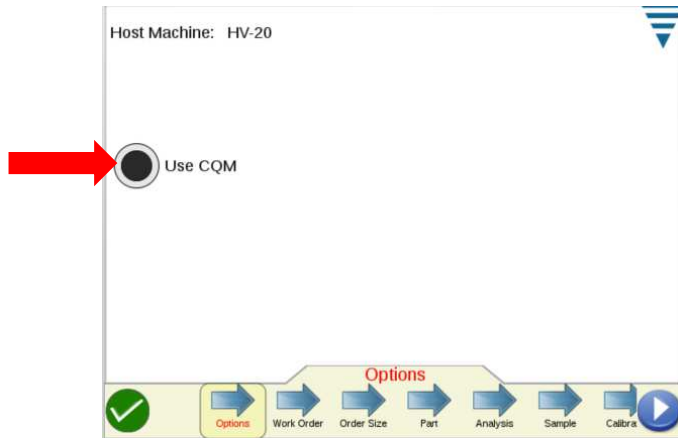


Figure 10

2. The PS-20 Terminator provides a virtual keypad in lieu of the membrane keypad for operator control of the terminator. The virtual keypad is accessible on the “Sample” screen if “Use CQM” is selected or on the “Production” screen if “Use CQM” is NOT selected.
 - a. To view the “virtual keypad”, click the “virtual keypad” button on the appropriate screen corresponding to whether you have selected to use or not use CQM (see Figure 11).

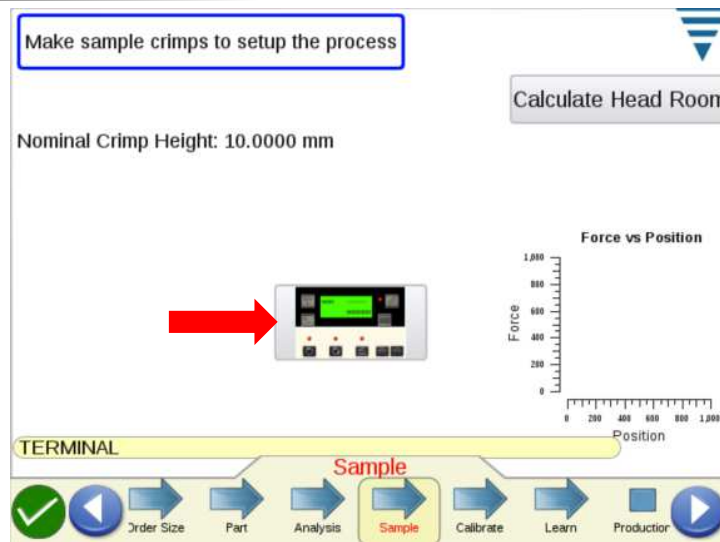


Figure 11

i **NOTE** Operation of the machine with the virtual keypad is identical to that of the membrane keypad, except where noted.

i **NOTE** Changes made with the virtual keypad will be saved with the selected part if CQM is Used.

b. Remove the virtual keypad by pressing the “X” button (see Figure 12).

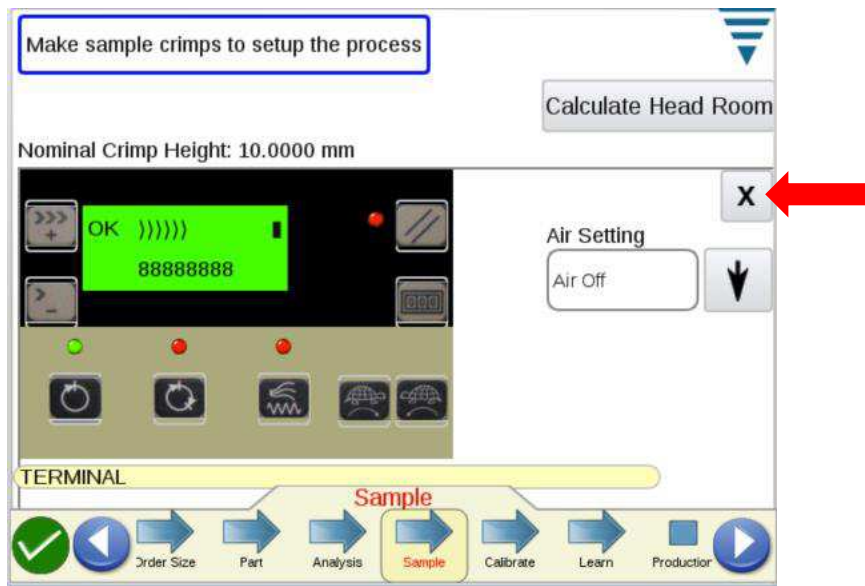


Figure 12

4.2. Membrane Keypad and LCD Display

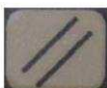
A. The basic control panel operation is as described in Figure 13. The membrane keypad will be used to set up and operate the machine.



Decrease Speed - Decrease the motor speed for normal cycle operation and for jogging.



Increase Speed - Increase the motor speed for normal cycle operation and for jogging.



Error Reset - Clears the displayed error code.

Figure 13 (Cont'd)



Count Reset - Clears the batch count to 0.



Jog Forward - Causes the motor to rotate in the forward direction at the jog speed set by the Increase/Decrease speed buttons.



Jog Reverse - Causes the motor to rotate in the reverse direction at the jog speed set by the Increase/Decrease speed buttons.



Air Feed - Toggles the Air Feed Output on and off. The LED indicates the current condition.



Full Cycle - Places the terminator in full cycle mode so that the terminator rotates one full cycle when the footswitch is pressed. The LED indicates that this mode of operation is selected.



Split Cycle - Places the terminator in split cycle mode so that the terminator rotates to the down position on the first press of the footswitch, and then completes the cycle on the second press of the footswitch. The LED indicates that this mode of operation is selected.

Speed Indication – Each “>” represents a portion of the full operation or jog speed setting. Minimum speed is denoted by a single arrow “>”. Maximum speed is denoted by six arrows “>>>>>>”.

Figure 13 (End)

B. Machine Status / Error Code Display

OK	Machine is ready to cycle
**	Emergency Stop system is not ready. Twist and pull out the Emergency Stop button, then press the white safety reset pushbutton.
--	Machine guards are open, or cycling is inhibited by the Crimp Quality Monitor (if attached).
ERRxxx	Machine error occurred. Error is defined by number “xxx” as shown in the error code table Figure 28.

C. Guard Status Indication

- When the input identifier shows a solid icon the guard and side feed guard (if attached) are closed. When the input identifier shows an open icon one of the interlocks is open (the motor will not run when the guard interlocks are open).
- On the HV-20 machine, in addition to the guard status indicators on the virtual keypad, the HV-20 also will show a ready icon in the taskbar when the guard and side feed guard (if attached) are closed.
A icon in the taskbar indicates one of the interlocks is open (the motor will not run when the guard interlocks are open).

D. Air Setting

All PS-20 terminators allow the following air settings to be defined:

- Air Off
- Single (DEFAULT)
- Single Delayed
- Double
- Long

E. Additional Controls (reference Figure 14)

1. AC Disconnect
Main AC power switch for the machine
2. Emergency Stop
Control for inhibiting motor operation in the event of an emergency condition. Twist and pull to release for normal operation.
3. Safety Reset
Pushbutton/Indicator. Press to cause safety circuit to turn on, permitting motor operation. The indicator shows that the safety circuit is active; motor operation can occur.

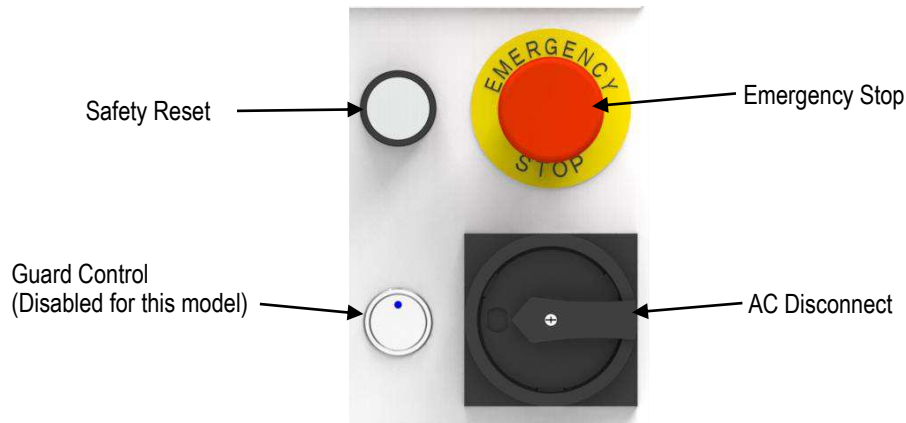


Figure 14

4.3. Mode Selection

The three basic modes of operation for this machine are: Full-Cycle, Split Cycle, and Jog (reference Figure 14).

1. Full-Cycle Mode
Depressing the footswitch (with the guard closed) causes the crankshaft to be rotated (at a speed defined by the speed control buttons), through a complete revolution. This completes one full machine cycle.
2. Split Cycle Mode
Depressing the footswitch once (with the guard closed) causes the crankshaft to be rotated (at a speed defined by the speed control buttons), to the split cycle position. Depressing the footswitch a second time causes the crankshaft to be rotated through the bottom position and back to the top position to complete the machine cycle.
3. Jog Mode, Forward/Reverse
Pressing either Jog button causes the crankshaft to be rotated at a reduced speed in the forward or reverse direction until the Jog button is released or the crankshaft completes the cycle. If the Jog button is released in mid-cycle and pressed again, the crankshaft will continue to rotate in the forward or reverse direction at the reduced speed. If the machine does not complete the cycle, either adjust the speed control buttons (as described below), or complete the cycle using the footswitch (at a speed determined by the speed control buttons) after the Jog button has been pressed and released.

Holding the Jog button down for an extended period without completing the cycle will cause an error. To clear the error, clear the problem area, and then press the Error Reset button. If the motor is stalled, it may be necessary to manually cycle the machine to the home position. Refer to the CAUTION and DANGER statements below for the proper manual cycling procedure.

**CAUTION**

While in the jog mode, attempting to complete a crimp cycle with terminals and wire in the applicator may cause the motor to stall and create a jammed condition. DO NOT ATTEMPT. Remove terminals and wire prior to jogging. If a jam does occur, contact TE Field Engineering personnel for assistance.

4.4. Adjusting Motor Speed

The speed of the motor is adjusted using the Decrease Speed and Increase Speed buttons on the membrane keypad (reference Figure 14). The Decrease and Increase buttons are used to adjust the motor speed for Full-Cycle, Split Cycle, and Jog modes. The speed setting in Full and Split Cycle modes is independent from the speed setting used in the Jog mode. Both speed settings are retained in memory by the CPU / motor controller. During Full and Split Cycle modes the last set motor speed is on the display. When the Jog button is pressed, the display will change to show the last set Jog mode speed. The Jog mode speed will continue to be displayed until the footswitch is pressed to change to Full or Split Cycle modes.

In Full and Split Cycle modes, a single ">" shown on the display indicates the motor speed is set for 16% of the maximum operating speed value. Each additional ">" on the display increases the motor speed. Available speeds are 16%, 28%, 42%, 58%, 77% and 100%.

In Jog mode, a single ">," shown on the display indicates the motor speed is set for 5% of the maximum operating speed value: each additional ">" shown increases the motor speed incrementally to a maximum jog speed of 25% of the maximum operating speed.

4.5. Applicator

The Power Splice Applicator applies reeled side-feed strip terminals (Part Number 1601953-1) to pre-stripped lead wire and unstripped magnet wire. This applicator is part of the Power Splice 20 system. These instructions, product Application Specification 114-13093, the parts lists and exploded view drawings packaged with the machine, and this manual for the Power Splice 20, provide all the information required to operate and maintain the Power Splice Crimping system.

A. Description

This applicator has been designed specifically for the Power Splice Terminal, Part Number 1601953-1. The applicator directs the lead wire and magnet wire into the designed terminal saddles. The crimp height may be easily adjusted for many different CMA (circular mil area) wire ranges. The applicator features a unique guard assembly that also acts as a wire management device. The guard features two moveable wire guides that funnel magnet wire into the Power Splice Terminal. The main components of the applicator are identified on the print of the applicator. In the air feed system, the feed action is started after the foot switch is depressed to begin the machine cycle. The ram begins its downward motion. The ram continues downward, completes the crimping action, and starts back up. When it reaches the fully raised position, the solenoid valve shifts. This supplies air to extend the feed finger and moves the next terminal over the anvil. The flow control valves control the speed of the feed finger stroke. After full extension, the solenoid valve shifts to retract the feed finger to its "rest" state.

B. Applicator Loading and Unloading

1. Terminal Strip Loading

Before loading the terminal strip in applicator, be SURE the installed applicator is the correct one for terminal to be applied. Compare terminal number on reel with numbers listed on applicator parts list.

- a. Turn the machine "off" and disconnect power cord. Disconnect air supply.
- b. Check the ram assembly to be sure it is at the "top dead center" position.

**NOTE**

Refer to the appropriate customer manual for instructions for hand-cycling the machine to the "top dead center" position.

- c. Manually disengage the feed finger from the terminal strip and release the drag.

- d. Remove the length of terminal strip (still in applicator) by grasping terminal strip with needle nose pliers and pulling the strip straight out the back of the applicator.
- e. With a reel of terminals installed on the reel support, feed the terminal strip into applicator between strip guides.

**NOTE**

Be SURE the terminal strip enters strip guides with the open side UP.

- f. Lift the stock drag and feed the terminals toward the feed finger.
 - g. Lift the feed finger and advance strip until the feed finger engages the feed area behind the second terminal.
 - h. Be sure the applicator feed is properly adjusted by making several test cycles.
2. Terminal Strip Unloading
 - a. Turn the machine "off" and disconnect power cord. Disconnect air supply.
 - b. Cut terminal strip one or two terminals from end of applicator.

**NOTE**

The applicator should never be unloaded unnecessarily. A section of terminal strip should always be left in the unit. Since it is not necessary to remove strip section for cleaning, lubrication, or repair, it should only be removed as a part of the loading procedure.

C. Adjustments

1. Testing Terminations
 - a. Make several test cycles and inspect terminations closely.
 - (1) Look for rough or sharp edges around crimped barrels (flash), deformed crimps, bent terminals, or other defects caused by worn or broken tooling. If necessary, replace tooling.
 - (2) If terminations appear normal, measure the crimp height of each termination as described in 114-13093, packaged with the applicator. The crimp height must agree with the measurement specified by the crimp height formula for the wire size combination being used.
 - (3) Record crimp height dimensions for reference.
 - b. During extensive operation, periodically repeat the inspection to make sure that the applicator is producing correct terminations.
2. Crimp Height (Fine Adjust) Adjustment
 - a. Adjust the crimp height of the Die Holder using the crimp height adjustment feature located on top of the Die Holder. Each increment on the Height Position Head corresponds to 0.044 mm.
 - Turning the Crimp Height Disc clockwise decreases the crimp height.
 - Turning the Crimp Height Disc counterclockwise increases the crimp height.

**NOTE**

Every tenth (10 count) increment is denoted by a letter - A to G (reference Figure 15).

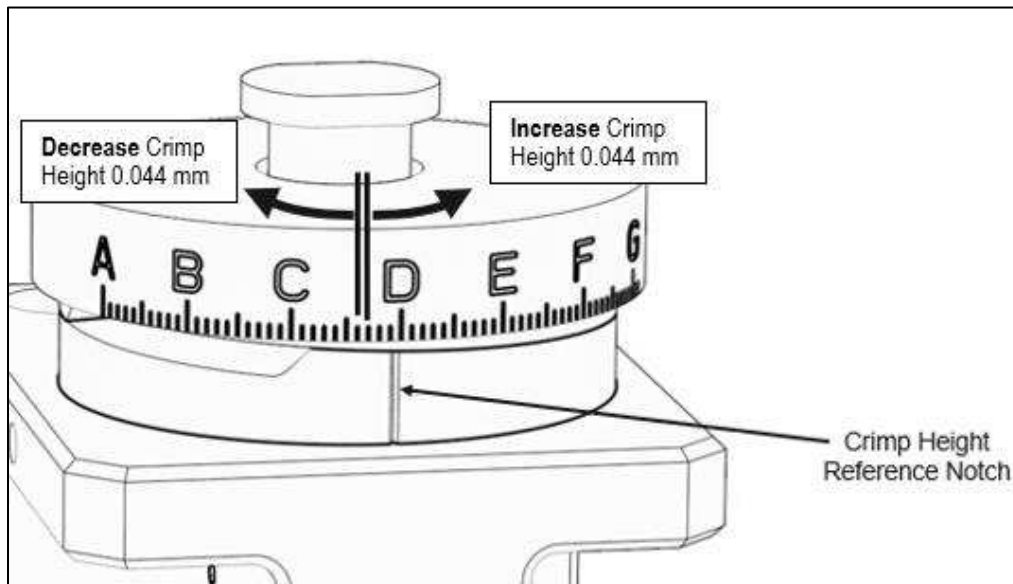


Figure 15

- b. Run the Die Holder through several cycles and inspect terminals **closely**, looking for the following:
 - **Rough or sharp edges** around the crimp barrels (flash), deformed crimps, bent terminals, or other defects could indicate worn or broken tooling. If necessary, replace tooling.
 - **Incorrect crimp height.** Make further adjustments to the Height Position Head.
 - **Terminations that appear normal.** Measure the crimp height of each termination, and record dimensions for reference.



NOTE

Crimp height must agree with measurement specified on the Application Specification for the terminal.

- c. During continuous operation, check crimp height routinely. Adjust as-needed to ensure that the Die Holder is producing correct terminations.
3. Terminal Strip Feed Adjustment (Figure 16)
 - a. With the terminal strip loaded in the applicator as described in Paragraph 4.5.B.1, check the position of the lead terminal in relation to the center of the terminal anvil and cutoff punch by running several test crimps and inspecting the terminals. The cutoff punch and trim pad must remove the “ladder carrier” between lead and second terminals - without deforming either terminal.
 - b. If the carrier is correctly slugged out, and the terminals are centered, and not damaged, proceed to next adjustment, Terminal Drag Actuation.
 - c. If adjustment is required (terminal is not centered), continue with Step d.
 - d. Adjust forward limit of feed finger stroke as follows:
 - (1) Loosen the screw on top of pivot block.
 - (2) Turn the air feed adjusting screw counterclockwise to move the forward limit toward anvil, or clockwise to move the forward limit away from the anvil.
 - (3) Tighten screw on top of pivot block.
 - (4) Repeat Step (1) through Step (3) as necessary until the terminal is centered.

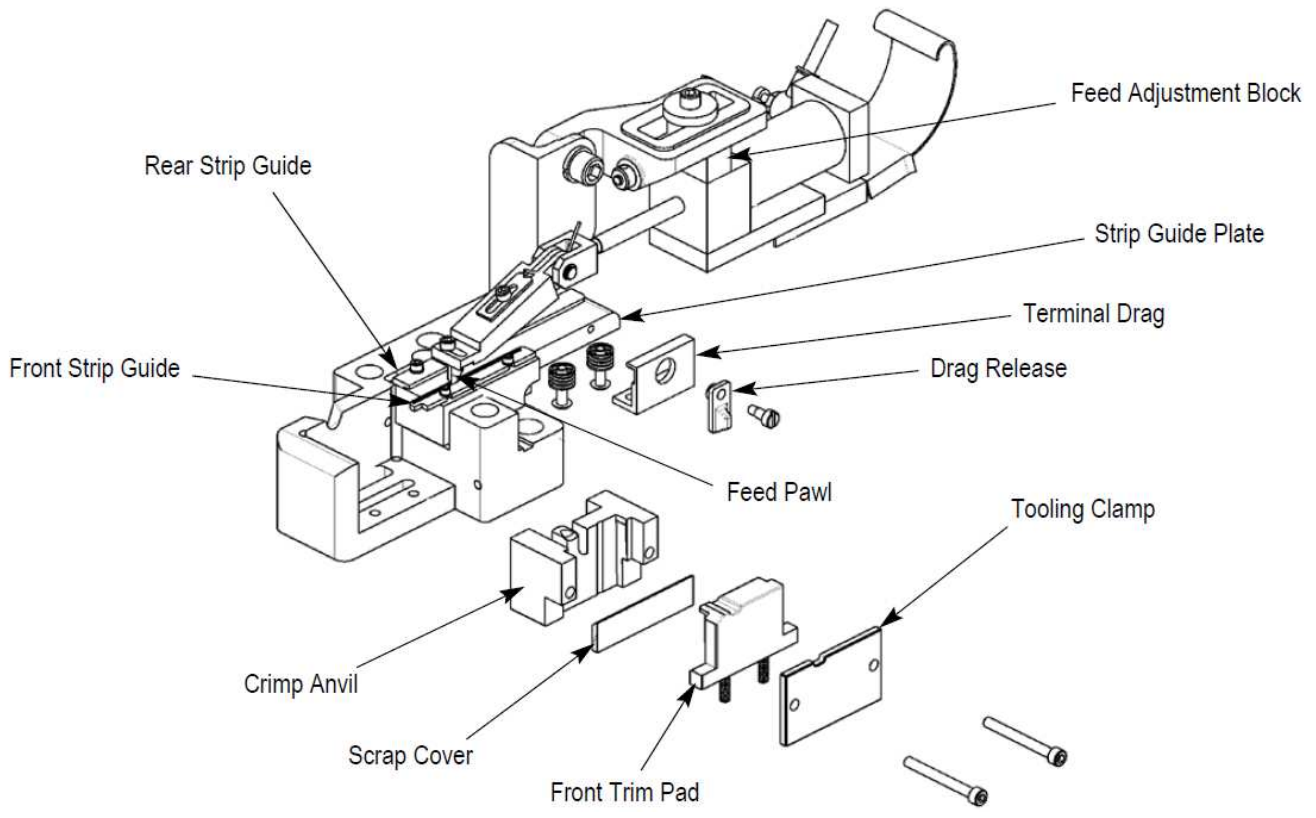


Figure 16

4. Terminal Drag Actuation

- a. The terminal drag must be lowered to provide pressure to the terminal strip so that it will maintain the correct position during the stroke of the feed finger.
- b. Rotate the drag release to point down for drag “on,” and rotate the drag release to point up to release the drag.

D. Applicator Operation

1. The Power Splice Terminal contains two crimp barrels that separate and cradle magnet wire and stripped lead wires prior to crimping. The lower saddle accepts up to six magnet wires that can total up to 30,000 CMA (circular mil area).
2. The upper saddle accepts up to two pre-stripped lead wires that can total up to 11,000 CMA (circular mil area).



CAUTION

Total CMA for both the magnet wire and the lead wire CANNOT exceed 38,000 CMA.

3. In one step automatic operation, the magnet wire film insulation is pierced as it is forced into the terminal serrations while the lead wire is terminated during the crimping process.

E. Repair and Replacement of Parts

These procedures cover the applicator parts which most often need repair or replacement because of wear. Remove the applicator from the machine before doing any maintenance work. Refer to the exploded view drawing and parts list packaged with the applicator for identification of parts. Be sure to order replacements for parts used from spare parts stock, so that they will be available when needed.



DANGER

To avoid personal injury, be sure the power and air supply are disconnected before repair or replacement of parts. The machine ram should be in the raised position. Wipe parts with a clean, dry cloth as they are removed from applicator. Then, when putting them back into applicator, wipe mating surfaces with your fingers to make sure that all lint and other foreign matter has been removed.



DANGER

Remove the front guard assembly to perform any of the listed repairs or replacements. To avoid personal injury, be sure to exercise extreme caution when working around the applicator when the front guard is not in place.

1. Crimp Anvil Replacement
 - a. From the side of the applicator, remove the two screws from the lower applicator die set which hold the tooling clamp, front trim pad, scrap cover, and crimp anvil in place.
 - b. Replace the crimp anvil, if required.
 - c. Install tooling using reverse procedure.
2. Front Trim Pad Replacement
 - a. From the side of the applicator, remove the two screws from the lower applicator die set assembly which hold the tooling clamp, front trim pad, scrap cover, and crimp anvil in place.
 - b. Replace the front trim pad, if required.
 - c. Install tooling using reverse procedure.
3. Crimp Punch Replacement
 - a. Remove the upper die set assembly from the applicator by pulling upward.
 - b. Remove the bolt, which holds the pad actuator, crimp punch, and cutoff punch to the applicator die set assembly.
 - c. Replace the crimp punch, as required.
 - d. Re-install parts using reverse procedure.
 - e. Tighten bolt that was removed.
4. Cutoff Punch Replacement
 - a. Remove the upper die set assembly from the applicator by pulling upward.
 - b. Remove the bolt, which holds the pad actuator, crimp punch, and cutoff punch to the applicator die set assembly.
 - c. Replace cutoff punch as required.
 - d. Install parts using reverse procedure.
 - e. Tighten the bolt that was removed.

F. Preventive Maintenance

For best performance and minimum downtime, the Power Splice Applicator should be cleaned, inspected, and lubricated after each 200 hours of operation, and each time it is removed from the machine to be placed in storage (Section G.).

1. Cleaning
 - a. Remove the applicator from the machine.
 - b. Remove the upper die set assembly from applicator by pulling upward.

- c. Using a clean, dry cloth, remove dirt, chips, etc., from applicator. The entire applicator may be immersed in a suitable commercial solvent (one that won't affect paint or plastic) once a month to flush out chips.

**NOTE**

It is not necessary to remove the section of terminal strip to clean the applicator.

- d. Lubricate applicator as described in Paragraph F.2.
- e. Re-assemble the applicator.

2. Lubrication

Lubricate the applicator each 200 hours of operation at the following points with SAE 20 motor oil (non-detergent), or where specified, light grease. Do NOT use too much oil or grease on applicator.

**CAUTION**

Any excess lubricant must be wiped off before placing applicator back in service.

- a. Take the upper die set assembly out of the applicator, clean the shafts, and apply a thin coat of grease to each shaft.
- b. Carefully lay applicator on its side and put one drop of oil on the feed finger pin. Wipe the feed finger pin to remove excess oil.
- c. Set the applicator upright.
- d. Wipe off excess oil.
- e. Put the upper die set back into the applicator and wipe off excess oil or grease.

G. Applicator Storage

When storing the applicator, or taking it out of machine for any reason, use the following procedure to keep tooling from being damaged by the bottoming of the ram assembly.

1. Cut terminal strip one or two terminals from end of applicator.
2. Take applicator out of machine.
3. Take applicator out of machine as described in Paragraph F.2.
4. Lower the ram assembly to hold the lead terminal between crimper and anvil. This will also identify the type of terminal to be used when the applicator is put back in service.

4.6. Setup

1. Turn on the main power using the switch located on the front of the control panel.
2. Be sure the guard is closed.
3. Jog the machine (reference paragraph 4.3.3.) through a complete crimp cycle.

**NOTE**

Wire should not be used during this step of the setup process.

**NOTE**

The machine should be able to jog through the terminal at maximum jog speed.

4. Inspect the crimped terminal to verify that the terminal is being positioned properly within the applicator.
5. Correct for any positioning errors in accordance with the applicator instruction sheet and repeat Steps 2 and 3 until a terminal is properly positioned.
6. Place a prepared wire in the crimp area and press the foot switch.
7. Inspect the completed crimp and make adjustments, as necessary.

4.7. Crimp Height Adjustment

Refer to the 408 Series Instruction Sheet provided with the applicator to perform this adjustment. Refer to Paragraph 6.1.B. for procedures to adjust the crimp height using the machine precision adjustment feature.

5. PREVENTIVE MAINTENANCE

Preventive maintenance will keep the machine in good working order and ensure maximum reliability and service from all components.

**DANGER**

To avoid personal injury, electrical and pneumatic power must be DISCONNECTED at the source prior to maintenance.

**DANGER**

The AC motor drive maintains high voltage for a period of time after power has been removed. Disconnect the power source and wait several minutes before opening the electrical enclosure.

5.1. Cleaning

Clean any debris from the applicator area daily.

**DANGER**

Compressed air used for cleaning must be reduced to less than 207 kPa [30 psi] and effective chip guarding and personal protective equipment (including eye protection) must be used.

If an air-feed assembly is installed, check and replace the air filter element, if necessary.

Wipe off the guards with a clean soft cloth.

**CAUTION**

DO NOT use any solvent to clean the guards. Solvent could cause irreparable damage.

5.2. Lubrication

The moving parts of the machine require regular lubrication to ensure reliable service and long life. Preferred greases are Chevron Delo ESI EP NLGI 2, and Chevron Ulti-Plex EP NLGI 2.

**NOTE**

Contact TE Engineering for 2nd choice alternates.

**NOTE**

For operation in temperatures below 10 °C [50 °F], it may be necessary to use a NLGI 1 grease.

**CAUTION**

It is important to only use Lithium-based grease with extreme pressure (EP) additives.

Chevron, Delo, ESI, and Ulti-Plex are trademarks of their respective owners.

Every 250,000 cycles apply the recommended grease (using a grease gun) to the fittings identified with red arrows in Figure 17, as follows:



NOTE

For proper distribution of grease, the ram should be located at the top of the stroke.

- a) The left side of the ram assembly - Pump grease until grease is forced out the top of the ram-way.
- b) The ram assembly pin - Pump grease until grease is forced out between link and ram.
- c) The right side of the ram assembly - Pump grease until grease is forced out the top of the ram-way.
- d) The front bearing (behind the bottom left side of the ram assembly).
- e) The rear bearing (along the left side).

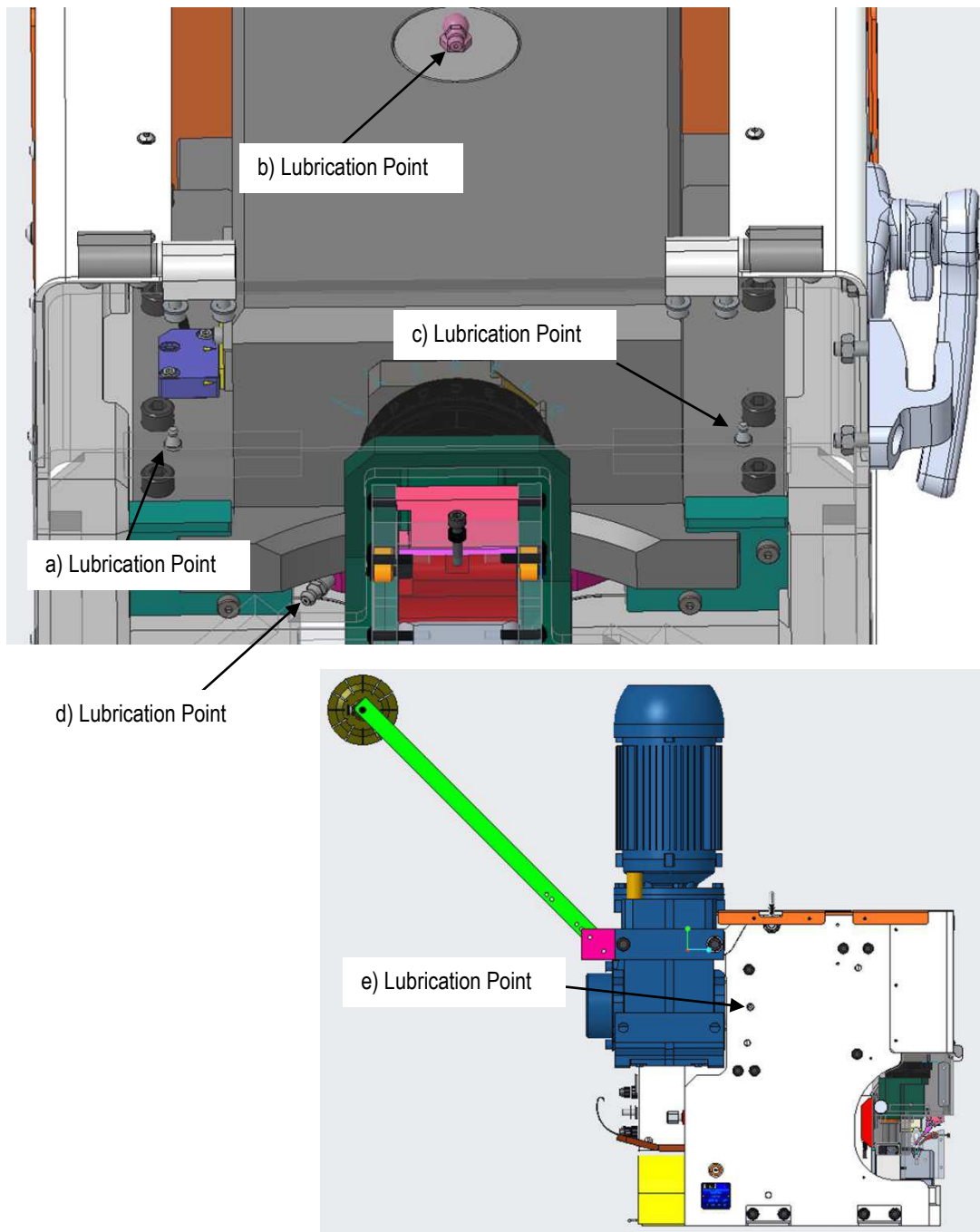



Figure 17

5.3. Safety System Check

A check of the safety system should be performed once per shift or, no less than once per day during routine production. Perform the following during the check:

A. PS-20 Terminators

1. Power ON the system by turning on the AC Disconnect switch.
2. Place the system in Diagnostics Mode (reference paragraph 8.2; *Diagnostics*).
3. Close all the guards - Front Guard and Side Guard (if equipped).
4. On the control panel display, verify that the input identifier is ON  (see Figure 18).

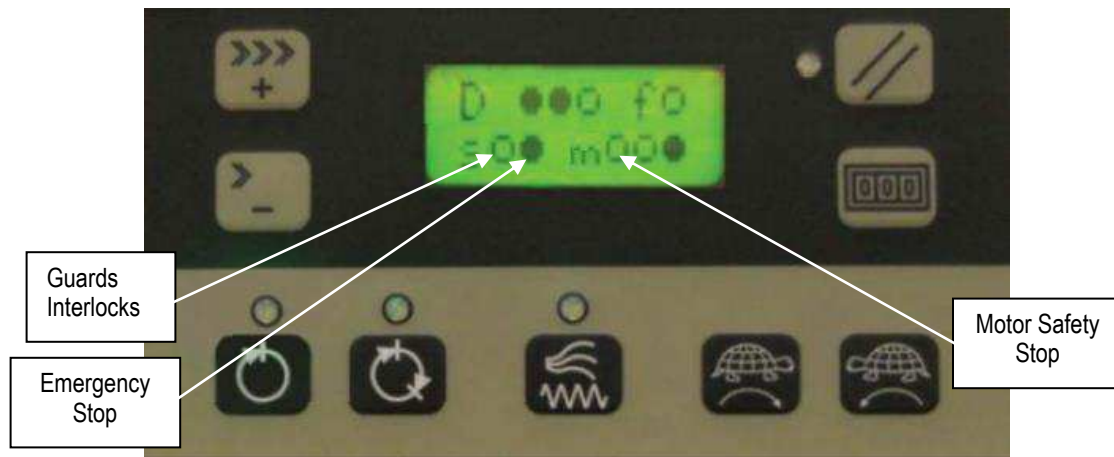








Figure 18

5. Open the Front Guard. Verify that the input identifier "Guard Interlocks" is OFF  (see Figure 18).
6. Close all the guards - Front Guard and Side Feed Guard (if equipped).
7. On the control panel display, verify that the input identifier "Guard Interlocks" is ON  (reference Figure 18).
8. Twist and pull out (to release) the Emergency Stop Button.
9. Press the Safety Reset Pushbutton.
10. Verify that the Safety Reset indicator in the Safety Reset pushbutton turns ON when the button is pressed.
11. Verify that the input identifier "Emergency Stop" is ON  and the input identifier "Motor Safety Stop" is OFF  (see Figure 18).
12. Press the Emergency Stop pushbutton.
13. Verify that the Safety Reset indicator in the Safety Reset pushbutton turns OFF when the Emergency Stop pushbutton is pressed.
14. Verify that the input identifier "Emergency Stop" is OFF  and the input identifier "Motor Safety Stop" is ON .



DANGER

If the preceding checks cannot be verified, DO NOT operate the machine. Failure to verify these systems checks indicates a potential problem with the safety system. Contact TE Field Engineering personnel for assistance.

B. PS-20 Terminators

1. Power ON the system by turning on the AC Disconnect switch.
2. Navigate to the Diagnostics Screen (reference paragraph 8.2; *Diagnostics*).
3. On the Diagnostics Screen, verify that the input identifier “Guards Sw.” is ON (see Figure 19).

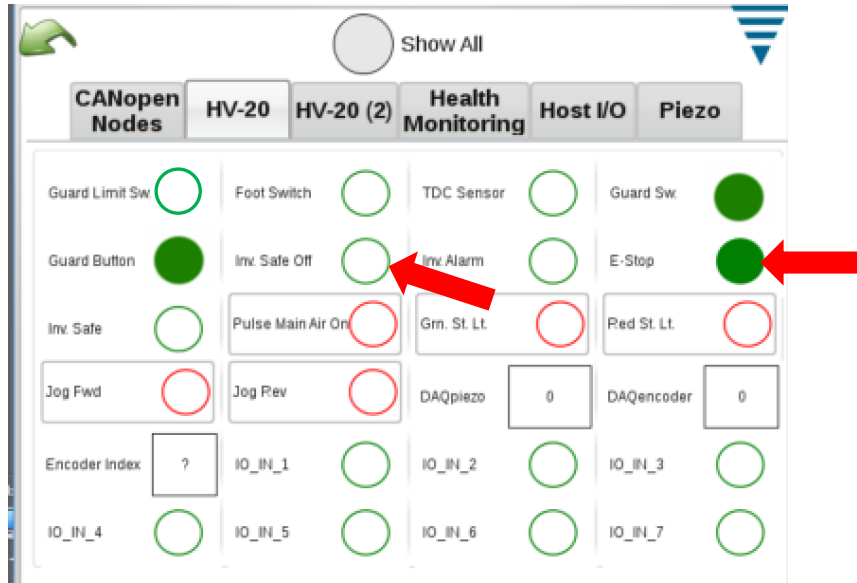


Figure 19

4. Close the guard.
5. On the virtual keypad display, verify that the input identifier “Guards Sw.” is ON ●.
6. Twist and pull out (to release) the Emergency Stop Button.
7. Press the Safety Reset Pushbutton.
8. Verify that the Safety Reset indicator in the Safety Reset pushbutton turns ON when the button is pressed.
9. Verify that the input identifier “E-Stop” is ON ● and that the input identifier “Inv. Safe Off” is OFF ○ (see Figure 19).
10. Press the Emergency Stop pushbutton.
11. Verify that the Safety Reset indicator in the Safety Reset pushbutton turns OFF when the Emergency Stop pushbutton is pressed.
12. Verify that the input identifier “E-Stop” is OFF ○ and that the input identifier “Inv. Safe Off” is ON ●.



DANGER

If the preceding checks cannot be verified, DO NOT operate the machine. Failure to verify these systems checks indicates a potential problem with the safety system. Contact TE Field Engineering personnel for assistance.

6. ADJUSTMENTS

The following adjustments are necessary to maintain the machine in operating condition, and to set up the machine after replacing parts.



DANGER

To avoid personal injury, ALWAYS disconnect electrical and air supplies before performing adjustments.

6.1. Shut Height

A. Measuring

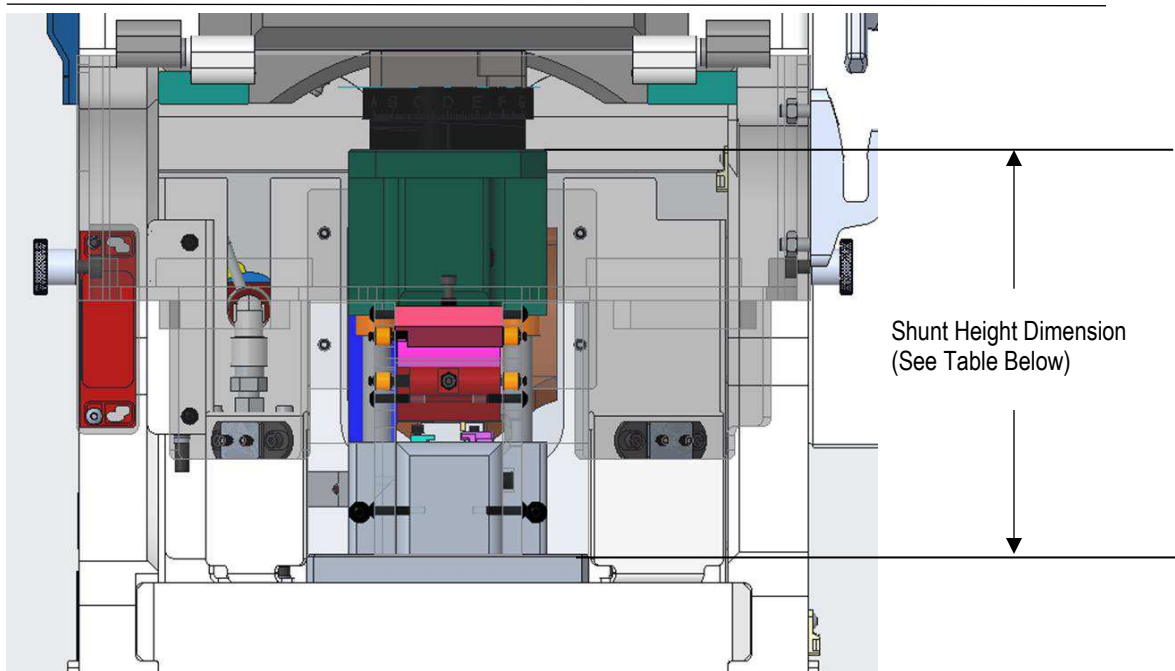
The shut height is the distance between the bottom surface of the ram post adaptor and the top surface of the machine base plate as illustrated in Figure 20.



NOTE

Shut Height Gage PN 679655-2 (reference Figure 19) is recommended for measuring shut height (refer to 408-8535 for instructions on use of the gage along with Base Plate Adapter PN 2326031-1).

1. Follow the procedure for measuring the shut height as described in 408-8535.



Shut Height Gage	Shut Height Dimension (with Plate Adapter Installed) mm [inch]	Applicator Type
679655-2	182.019 ±0.025 [5.346 ± .001]	TE-Type

Figure 20

B. Adjustment

The shut height is pre-set at the factory and should not require further adjustment unless it is necessary to replace parts. Before you make any changes to the machine, contact your local Field Service Representative, or call the Tooling Assistance Center at 1-800-722-1111.



CAUTION

NEVER attempt to adjust the shut height without FIRST trying an applicator that is known to produce terminations of the correct crimp height. If this applicator produces correct terminations, the trouble is in the original applicator and the shut height MUST NOT BE CHANGED.

If it is determined that the shut height must be adjusted, use the following procedure:



DANGER

To avoid personal injury, ALWAYS turn "off" the machine and disconnect the power supply to the machine before making any adjustments. If applicator is an air-feed type, DISCONNECT air lines to valve located on the right side of the machine.

1. Check shut height as described in paragraph 6.1.A.
2. If the shut height is incorrect, proceed as follows:
 - a. Remove three socket head cap screws which secure the ram post adaptor. Remove the ram post adaptor and shims. Change the shim thickness as required to adjust the shut height. Shims contain .051 mm [.002-in.] peel-type laminations.



NOTE

If additional shims are required, order TE PN 2326019-1.

- b. Re-install the ram post adaptor. Insert screws in the ram post adaptor and place the shims over the screws and onto the adaptor post.
 - c. Re-install the socket head cap screws into the ram assembly to secure the ram post adaptor. Re-tighten the screws.
3. Repeat Steps 1 and 2 as necessary until the proper shut height is attained.



NOTE

The miniature applicator is an integrated assembly consisting of upper tooling, lower tooling, and adjustment mechanisms. The applicator requires a fixed shut height; that is, the distance between the bottom of the ram and the base mount when the ram is FULLY bottomed. The required adjustments for crimp height are made by using the wire and insulation discs within the applicator. Refer to the instruction sheet supplied with the applicator for adjustment procedures.

7. AIR FEED VALVE KIT (PN 2372210-1)

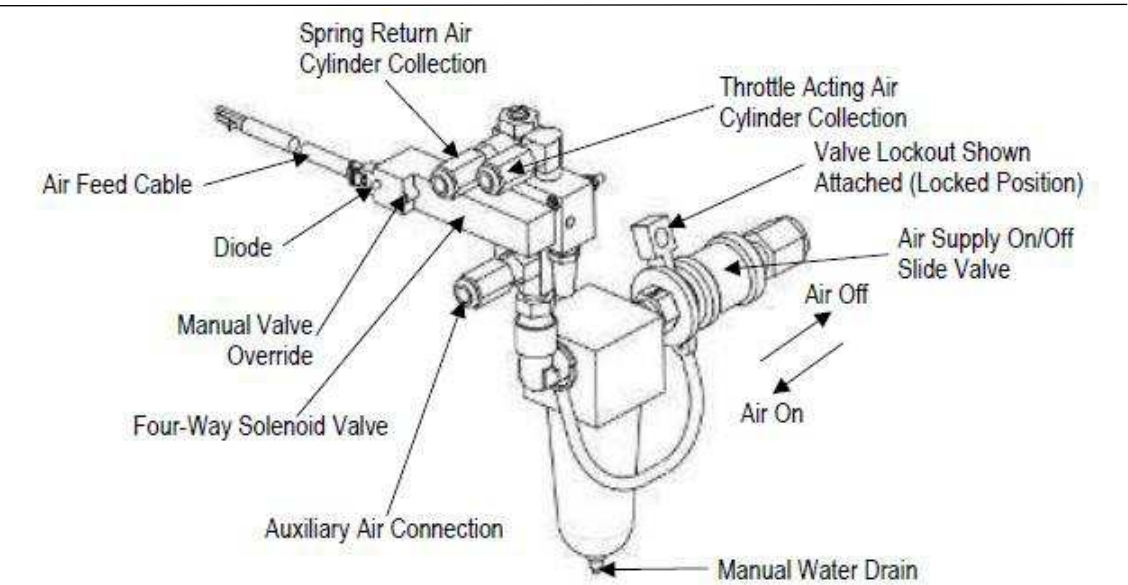


Figure 21



NOTE

TE drawing 2372210 provides additional details for installing the air feed kit.



NOTE

The air can be turned “off” rotating the shut off valve to the “off” position.



NOTE

The return feed stroke for the two fastest machine speeds occurs 220 milliseconds after the start of the crimp cycle, and, for the four slower machine speeds occurs 440 milliseconds after the start of the crimp cycle.

8. TROUBLESHOOTING

Contact the Tooling Assistance Center at 1-800-722-1111.

8.1. Error Codes

See Figure 22 for a listing of error codes.

Error Code	Error Description
E001	The host is inhibiting operation.
E002	The guard interlock is open.
E005	The control panel is not communicating with the CPU board.
E020	Movement of the TDC switch was not detected.
E021	The TDC switch was not made.
E050	No Modbus Communications with motor drive.
E052	The motor drive indicates the safety circuit is open.
E053	The motor drive indicates it has detected an internal safety fault.
Ennn54	The motor drive indicates it has a fault. "nnn" represents the fault number. Contact TE Engineering for details
E057	Crimp position not achieved
E070	Emergency Stop
E071	Guard failed to open
E072	Guard failed to close
E073	Linear encoder not working
E074	Front guard position switch is bad
E099	Host Module not detected
E100	Stuck keypad button
E101	Footswitch input stuck on

Figure 22

8.2. Diagnostics

The control panel can be placed in a *Diagnostics* Mode to check operation of the machine inputs.

A. PS-20 with CQM Only

Navigate to the "Diagnostics" screen and press the "PS-20" tab. Various indicators are shown. An open circle signifies the input is OFF, a solid circle indicates the input is ON.

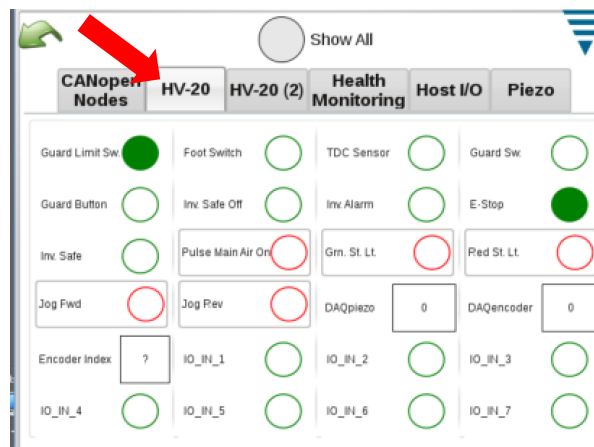




Figure 23

B. To place the control panel in the Diagnostics Mode:

1. Press and release Error Reset to clear any error.
2. Press and hold Error Reset for five seconds, until the control panel software version is displayed.
3. Release the Error Reset.

A screen like the one in Figure 24 will be presented. Each of the inputs is shown with an input identifier, followed by an input status indicator. The input identifiers are shown in Figure 24 along with corresponding input description. A solid icon  indicates the input is ON. An open icon  indicates the input is OFF.

Some identifiers have more than one associated input, and therefore have multiple input status indicators.

Press Error Reset to exit the Diagnostic mode.

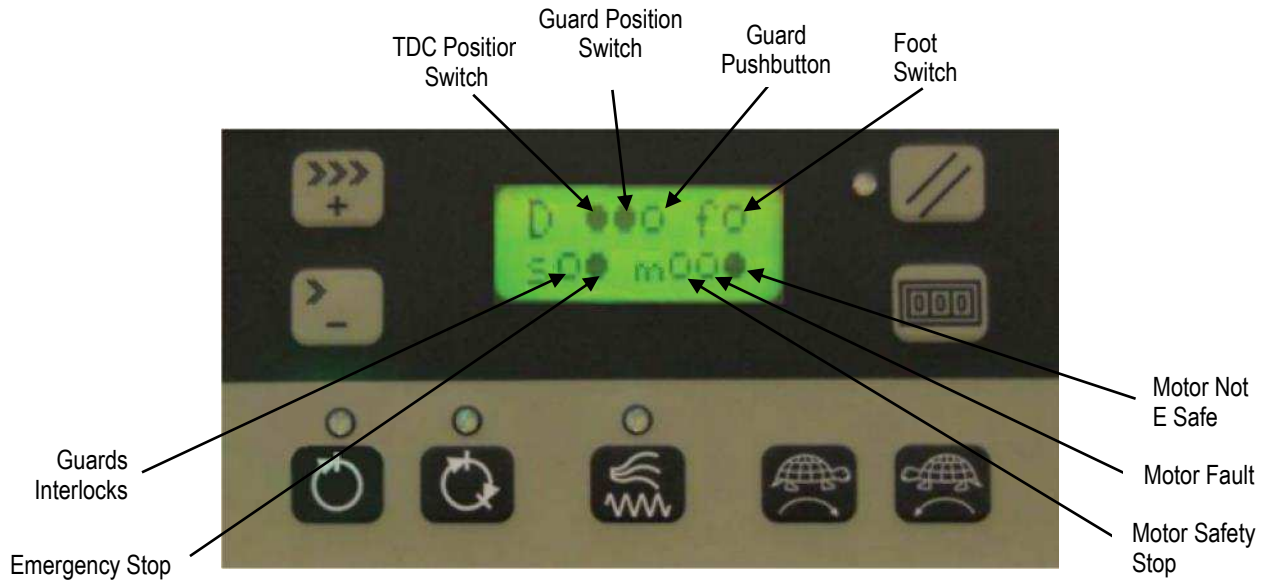


Figure 24

9. SOFTWARE VERSION IDENTIFICATION

1. Be sure machine is OFF.
2. Turn power to the machine ON.

When the display on the control panel appears, the control panel software version will be displayed briefly, followed by the software version.

The format for both is: "X.XX.XX."

10. DISPOSAL

Contact TE for disposal; www.te.com/compliance

11. REPLACEMENT AND REPAIR

See drawing and documentation package to identify parts. To obtain replacement parts, order through your TE representative. You can also order parts by any of the following methods:

- Go to TE.com and click the **Shop TE** link at the top of the page.
- Call 800-522-6752.
- Write to:

CUSTOMER SERVICE (038-035)
 TE CONNECTIVITY CORPORATION
 PO BOX 3608
 HARRISBURG PA 17105-3608

For customer repair services, call 800-522-6752.

12. RESTRICTION ON HAZARDOUS SUBSTANCES (RoHS) INFORMATION

Information on the presence and location of any substances subject to RoHS can be found at the following website:

<http://www.tycoelectronics.com/customersupport/rohssupportcenter/>

Enter the equipment part number and click **Product Compliance**.

13. REVISION SUMMARY

Added steps for adjusting the applicator crimp height to section 4.5.