

**molex<sup>®</sup>**

**“HAWK” FLAT CABLE TERMINATION MACHINE**  
Operation Manual

**62300-2900 "Hawk" F.F.C. Terminator**  
**62300-2950 "Hawk" F.F.C. Terminator**  
**62300-3000 "Hawk" Ribbon Cable Term.**  
**62300-5200 " Hawk" F.F.C. Terminator W/Breakoff**  
**62300-5300 "Hawk" R.C. Terminator W/Breakoff**

For C-Grid<sup>®</sup> SL IDT Connector, 70400 Series

- Description
- Operation
- Maintenance

## Safety Warnings and Information

	<p><b>Read and understand</b> all of the instructions and safety information in this manual before operating or servicing this tool.</p> <p style="text-align: center;"><u>Keep this manual available when using this tool.</u></p> <p style="text-align: center;">Replacement manuals are available for download at no charge at <a href="http://www.molex.com">www.molex.com</a>.</p>
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<b>SAFETY ALERT SYMBOL</b>	
This symbol is used to call your attention to hazards or unsafe practices which could result in an injury or property damage. The signal word, defined below, indicates the severity of the hazard. The message after the signal word provides information for preventing or avoiding the hazard.	
 <b>DANGER</b>	<p><b>DANGER:</b> Indicates an imminently hazardous situation which, if not avoided, could result in death or serious injury.</p>
 <b>WARNING</b>	<p><b>WARNING:</b> Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.</p>
 <b>CAUTION</b>	<p><b>CAUTION:</b> Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. <b>CAUTION</b> may also be used to alert against unsafe practices associated with events that could lead to personal injury.</p>

	<p> <b>WARNING</b></p> <p><b>Always</b> wear proper eye protection when Operating or servicing this machine.</p> <p>Failure to wear eye protection could result in serious eye injury from flying debris.</p>		<p> <b>WARNING</b></p> <p>Excessive noise levels. <b>Always</b> wear proper ear protection when Operating or servicing this machine.</p>
	<p> <b>WARNING</b></p> <p><b>Never</b> wear clothing or jewelry that is loose or That Could potentially hang into the equipment And get caught.</p> <p>Failure to observe this warning could result in Severe Injury or death.</p>		<p> <b>WARNING</b></p> <p><b>Never</b> install or service this machine while connected to any electrical power source. Disconnect power by unplugging the machine from its power source.</p> <p>Failure to observe this warning could result In severe injury or death.</p>
	<p> <b>WARNING</b></p> <p><b>Never</b> operate, service, install, or adjust this Machine without proper instruction and without first reading and understanding the instructions in this manual and all applicable press and/or wire processing machine manuals.</p>		<p> <b>WARNING</b></p> <p><b>Never</b> lift this machine without the aid of mechanical lifting devices.</p> <p>Failure to observe these precautions may result in severe back, other injuries, or property damage.</p>

	 <b>WARNING</b>	 <b>WARNING</b>
	<p><b>Never</b> use this machine without guards or safety devices that are intended to prevent hands from remaining in the termination or feed areas.</p> <p>Failure to observe this warning could result in Severe injury or death.</p>	
 <b>CAUTION</b>		
<p><b>Never</b> perform any service or maintenance other than as described in this manual.</p> <p><b>Never</b> modify, alter or misuse the equipment</p> <p>Molex crimp specifications are valid only when used with Molex terminals and tooling.</p> <p>Failure to observe this precaution may result in injury and property damage.</p>		

## Tooling Technical Assistance

Molex offers tooling technical assistance for customers who may need some guidance for tooling adjustments. This support can be obtained by calling either of the two numbers listed below and asking for the Molex Tooling Group.  
Call Toll Free 1-800-786-6539 (US) 1-630-969-4550 (Global).

This assistance is limited to the operation and set-up of a customer's Molex Terminator Machine. Questions with regard to Molex connector products or how to identify the proper tooling and/ or tooling documentation should be directed to your local Molex personnel or Customer Service Representative.

When calling for service on the machine it is recommended to have the following: a copy of the *Tooling Manual*, the Specific *Specification Sheet* and a person familiar with the machine should be present. The following information is also recommended to supply:

- 1.Customer name
- 2.Customer address
- 3.Person to contact such as (name, title, e-mail, and telephone number)
- 4.Machine order number (Lease number also if applicable)
- 5.Serial number (Lease number also if applicable)
- 6.Molex Connector product order number
- 7.Urgency of request
- 8.Nature of problem

**Molex Application Tooling Group**  
 2200 Wellington Court  
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 Fax:+1 (630) 505-0049

Visit our Web site at <http://www.molex.com>

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## Section 1

### General Description

- 1.1. Description
- 1.2. Features
- 1.3. Technical Specifications
- 1.4. Delivery Check
- 1.5. Tools
- 1.6. Installation
- 1.7. Changing Tooling

### Principal Mechanical Parts of the Flat Cable Termination Machine

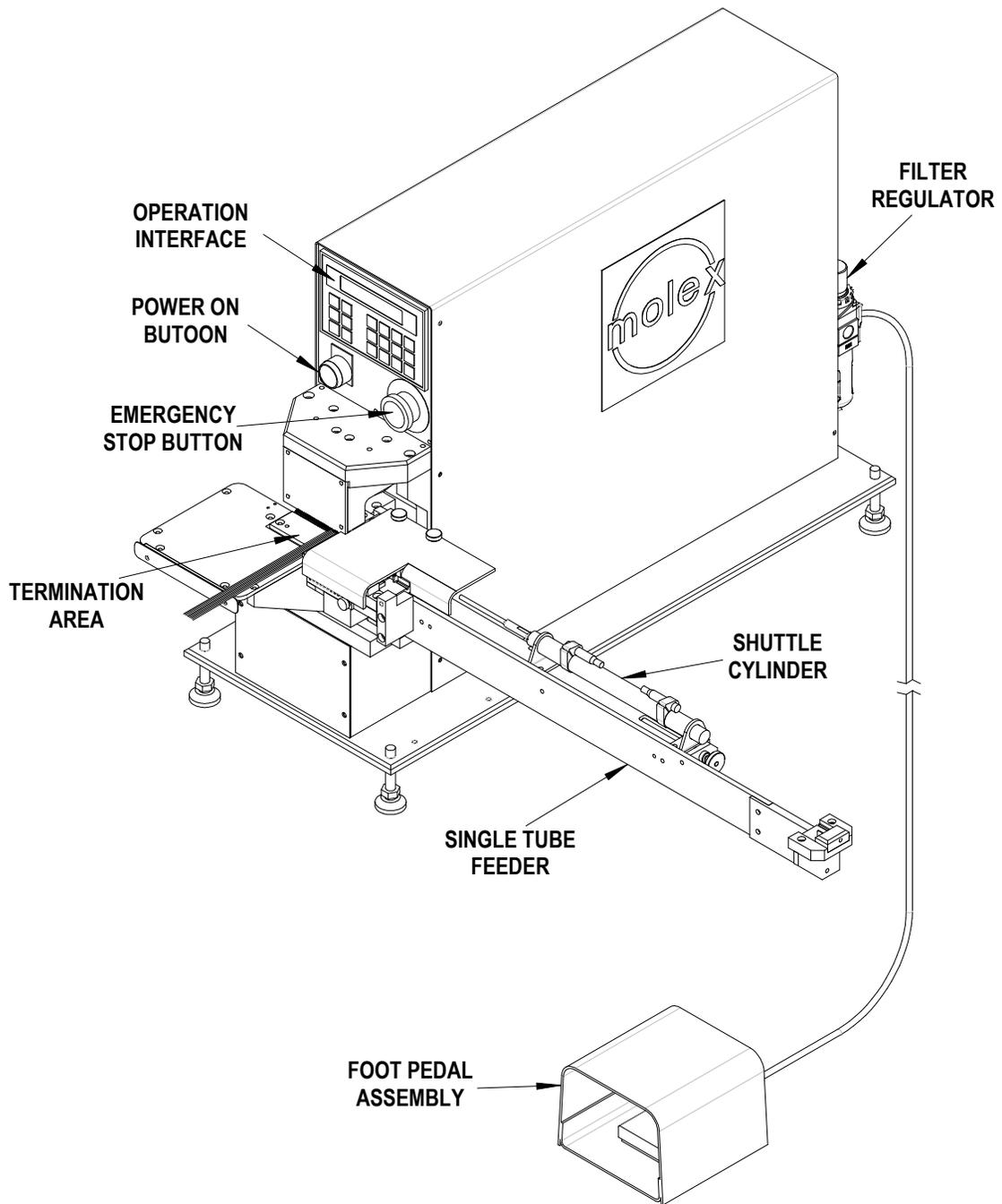


Figure 1-1

## General Description

### 1.1 Description

The 62300-2900 flat flex cable termination machine was developed to assemble .100 S.L. flat flex cable harnesses.

- ◆ The 62300-2950 is the same as the 62300-2900 except no electrical or pneumatic controls are installed.
- ◆ The 62300-3000 ribbon cable termination machine was developed to assemble .100 S.L. IDT ribbon cable assemblies.
- ◆ The 62300-5200 and the 62300-5300 are the same as the 62300-2900 and the 62300-3000 respectively except these have the carrier breakoff option.

An operator loads a tube containing preloaded connectors (70430,70431 or 40556 series for FFC, or 70400 and 70475 for SL) from 2 - 25 circuits (See note below). As each connector assembly is terminated, the terminals are inserted, then the machine automatically loads a new connector into the terminating nest, pushing out the previously loaded connector. The operator then removes the harness from the termination area and inserts the carrier strip into the strip breakoff slot and bends the carrier strip down to break it off. To process another harness, the operator loads a cable, then depresses the foot pedal. The machine then terminates that cable and indexes another connector into position, and so on. This machine is ideally suited for mid- volume, semiautomatic applications.

**NOTE:** 2 circuit connectors may be processed in these machines but only in chains of two (2) or more. It is also recommended that 3 circuit connectors be run in chains of two (2) or more to avoid feed jams.

An option is available that automatically breaks off the carrier strip as it comes out of the termination head. This option is available factory installed or it can be easily installed or removed in the field.

### 1.2 Features

- % Automatic loading of termination nest.
- % Automatic insertion of terminals.

- % A rugged, sealed operator interface with a 24-key tactile feedback keypad for data entry, and a 20-character 2-line display for displaying batch count, fault messages, etc.
- % Operator settable batch counter.
- % Totally enclosed for operator safety.
- % Easily attached option available for automatic carrier strip breakoff.
- % Accepts 25 in. (635 mm) and 564 mm (22.2 in.) tubes.
- % "CE" Certified.

### 1.3 Technical Specification

#### Dimensions

Width: 945 mm (37.25 in.)  
 Depth: 914 mm (36.0 in.)  
 Height: 494 mm (19.5 in.) (without feet)

#### Weight

48.1kg (103lbs) Unpacked

#### Power Requirements

Voltage: 110 VAC or 220 VAC 50/60 Hz  
 Current: 1 A @ 110 V or 220 V

#### Pneumatics

Pressure: 5 BAR (80psig) min.  
 Consumption: 14L/min (.5 SCFM)

#### Rate

Up to 750 connectors per hour depending on operator skill

### 1.4 Delivery Check

Remove the top and sides of the crate. Then remove the screws that mount the machine to the skid. Check to see that following items are included in this package:

	Qty.
62300-XX00 Termination Machine	1
63800-8394 Foot Pedal Assembly	1
11-32-1659 Power Cord	1
11-31-5302 Nest Cleaning Tool	1
63600-0785 Leveling Feet	4
62300-2999 Instruction Manual	1

## 1.5 Tools

The following tools will be needed for setup and adjustment of the Hawk termination machine.

- E Hex Wrench Set (inch)
- E Large and small straight screwdriver
- E Small Crescent Wrench
- E Pliers (Needle nose)
- E Eye Loupe 5X

## 1.6 Installation



**WARNING:** The Molex Hawk terminator weights 48kg (103 lbs.) and is NOT intended to be lifted by an individual. The guarding or connector load assemblies are not attached to provide support for lifting purposes. Mechanical lifting devices should be used from below the unit. A person lifting this machine could sustain severe back or other injuries. Care should be taken at all times. An electrical, hydraulic or mechanical lift should be used to lift this terminator.

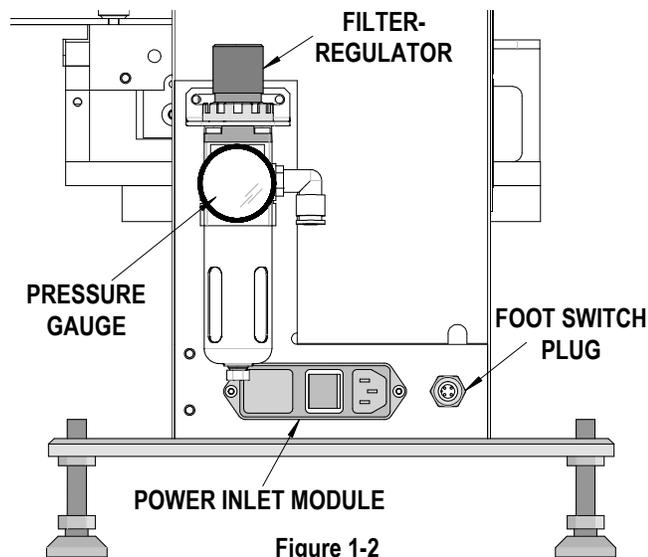


Figure 1-2

### Foot Pedal

Connect the 4-pin Molex plug on the foot pedal to the 4-pin socket in the back right side of the terminator control assembly. Note the locking action of the plug. See Figure 1-2.

## Power Connection

### 110VAC Hookup

This terminator normally comes from the factory set for 110VAC. A power cord is supplied for 110VAC service. To use terminator for 110VAC, plug the power cord into the socket in the power inlet module in the back of the control enclosure (See Figure 1-2), then plug the other end into a grounded outlet.

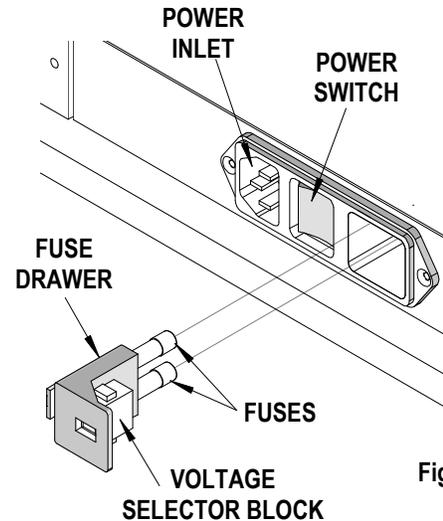


Figure 1-2

### 220VAC Hookup

The Hawk terminator will operate on 110VAC or 220VAC, 50 or 60 Hz. To change from one service to the other, do the following: (Refer to Figure 1-2 and 1-3)

1. Locate the power inlet module on the back of the control enclosure.
2. With a small screwdriver, remove the fuse drawer.
3. Remove the voltage selector block.
4. Rotate the voltage selector block until the correct voltage will show in the window.
5. Reinsert the voltage selector block.
6. 1 Amp fuses are recommended for either 110 or 220VAC so a fuse change is not required.
7. Replace the fuse drawer.
8. Install the proper power cord.

**NOTE:** When servicing this machine, disconnect this power cord and the air to insure complete safety to service person.

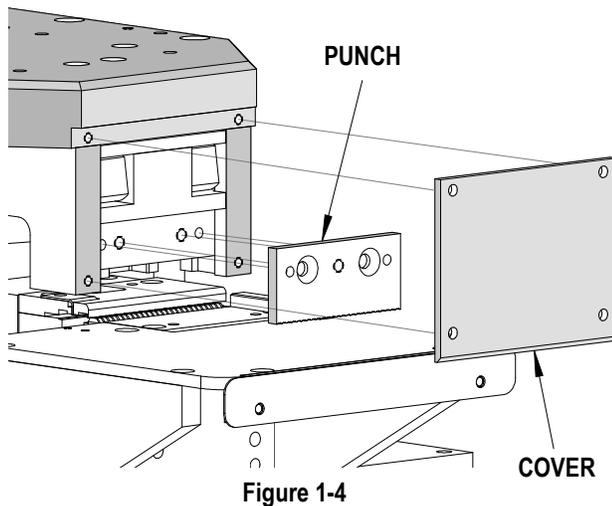
**Air Connection**

Because there are so many variations in air connections, Molex does not supply any type of fitting for air installation. Thus the user must supply a fitting of his choice to attach air of the correct pressure and volume to the 1/4 NPT port on the F-R unit. Use 1/4in. line minimum. Once attached, adjust the regulator on the F-R to 80-85psig (See Section 1.7.1. Air will not flow into the machine proper until power is on and the "POWER ON" button is pressed.

**New Molex Global Packaging Systems Tube versus Molex Current Tube**

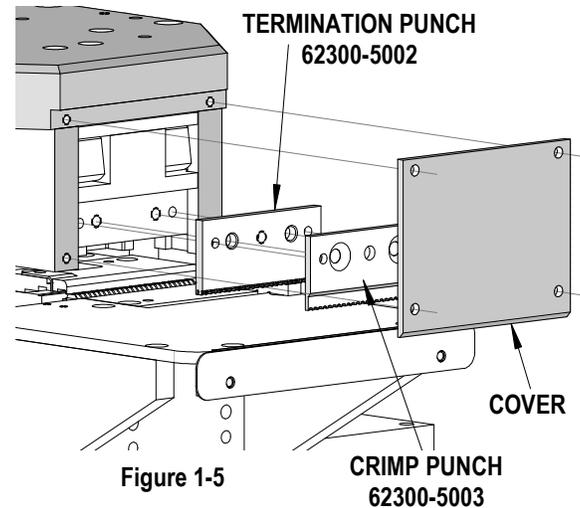
In 2001 Molex changed from a 25 inch tube to our new Global Packaging Standard Tube which is 564 mm long (22.2 in.) These machines are easily adjusted to run either. See Section 2.1 for method.

**1.7 Changing Tooling**



These terminators are easily changed from running FFC to running ribbon cable and visa-versa. To replace a worn punch or to change from one type of tooling to the other, do the following:

1. Remove the four (4) M4 screws holding the tooling cover. See Figure 1-4 and 1-5.
2. Remove the cover.
3. Remove the two (2) M5 flat head screws that hold the punches.



4. Remove the punch(s) that are there. There is a M5 tapped hole in the center of all the punches that a screw can be screwed into to push the punch out, if necessary.
5. Position the new punch(s) on the dowel pins.
6. Replace the holding screws and tighten.
7. Replace the cover.

## Section 2

### Set-Up and Operation

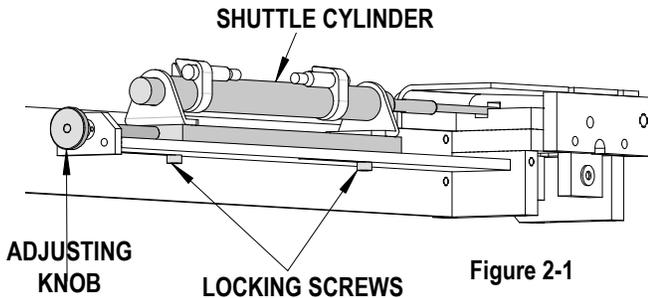
- 2.1 Setup
- 2.2 Setting Batch Size
- 2.3 Setting Break off Strokes
- 2.4 Operation

## 2.1 Setting Up

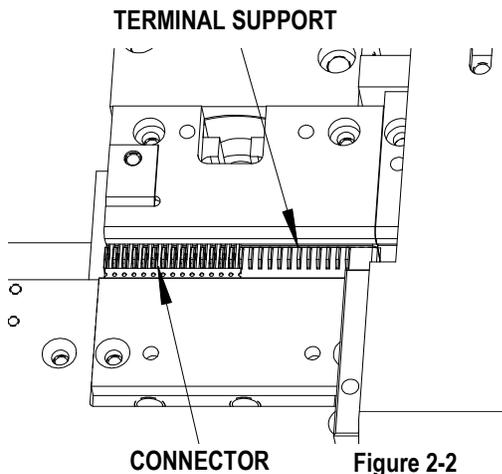
### Air Pressure

Set the air pressure regulator on the F-R (filter-regulator) to 5 - 6 BAR (80 - 90 psi). This is done by pulling out the adjustment knob and setting to the proper pressure, then pushing in the knob.

### Shuttle Adjustment (See Figure 2-1 and 2-2)



The shuttle is adjustable from 3 to 25 circuits. To adjust the stop following the steps below:



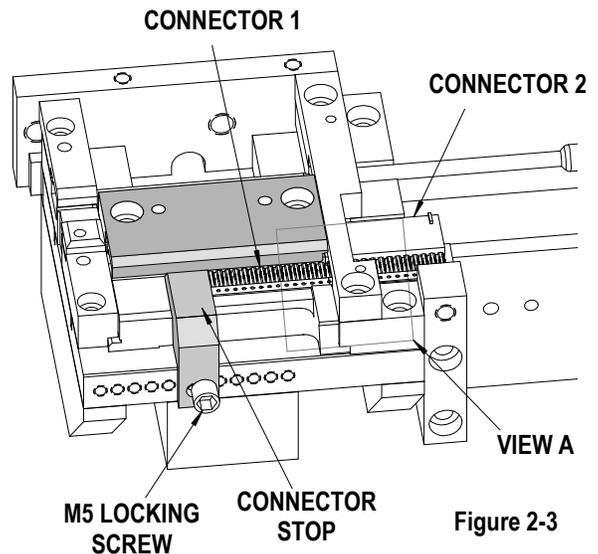
1. Place a connector in the termination nest all the way to the left. See Figure 2-2.
2. Bring the terminal support up. See *Manual Operations* in Section 2.
3. Extend the shuttle cylinder full out.
4. Loosen the two (2) locking screws under the shuttle cylinder.
5. Turn the adjusting knob clockwise to move the cylinder to the right (looking from the front) and counterclockwise to move it to the left.
6. Move the cylinder until the end of the shuttle rod just touches the connector.
7. Tighten the locking screws.

**Note:** 2 circuit connectors are loaded in pairs thus stop is set for 4 circuits

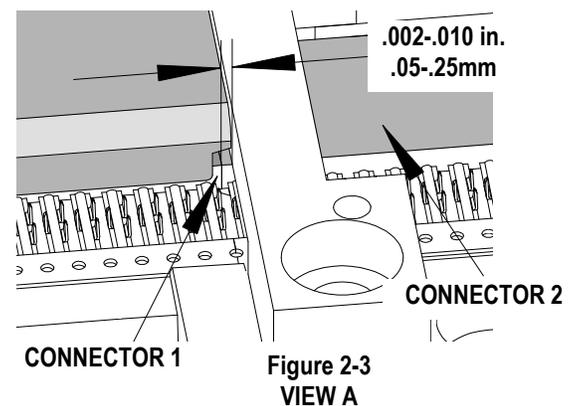
### Connector Feed Stop

This stop is also adjustable from 3 to 25 circuits. To adjust the stop do the following:

1. Remove the nest guard.
2. Loosen the M5 locking screw on the connector feed stop located in front of the shift nest.
3. Starting from "3" circuits to the right, stop locates on every circuit position to 25 circuits. Adjust so that only 1 connector (except a pair of 2 circuits) at a time can enter the shift nest from the cartridge feed. Back edge of connector 1 must be just inside right edge of nest (.002 to .010in./05 to .25mm). See Figure 2-3.



4. When adjustment is set, tighten lock screw.
5. Replace guard.



### Termination Depth Adjustment (See Figure 2-4)

Termination depth is set as follows:



**WARNING:** Make sure power is disconnected before doing steps 1 through 3.

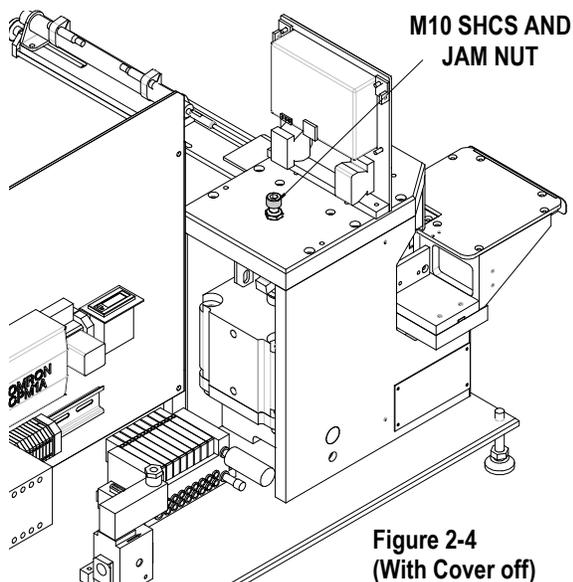


Figure 2-4  
(With Cover off)

1. Remove the control assembly cover.
2. Loosen the jam nut located on top of the termination head.
3. To raise the punch depth, turn the M10 screw clockwise. To lower, turn the M10 screw counterclockwise. The punch depth should be adjusted so that a terminated wire touches the lower surface of the terminal but is not crushed and the crimp tongs are securely gripping the wire without cutting into the insulation. See termination specifications on product drawings.

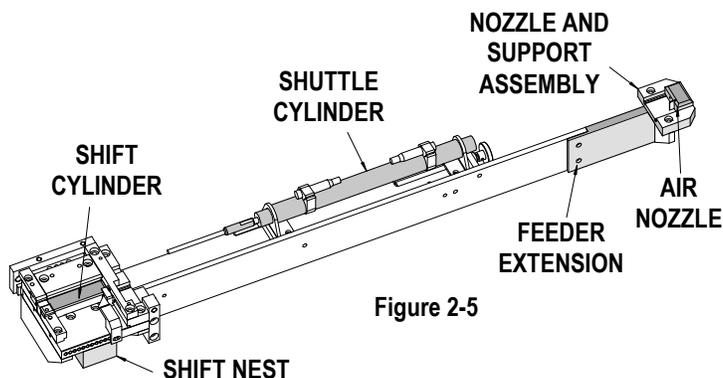


Figure 2-5

4. Terminate a wire and check the setting.

5. Repeat steps 2 and 3 until the termination depth is correct.
6. Tighten the lockout.
7. Replace the cover.

### Changing From Molex 25 inch Tubes To New Global Packaging Systems (564 mm) Tubes and Back (See Figure 2-5)

1. Remove the two (2) M4 screws in the right end of the tube feeder that hold the nozzle and support assembly assembly. See Figure 2-6.

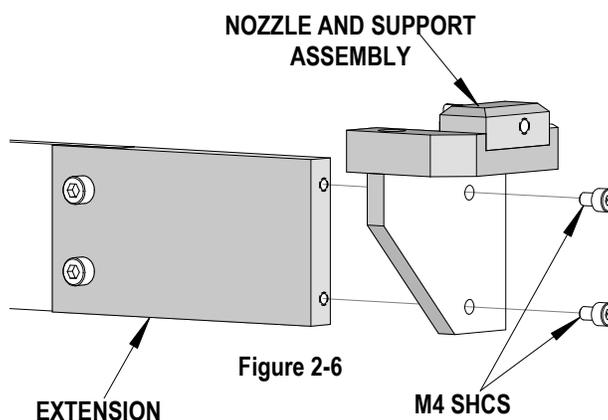


Figure 2-6

2. Set aside the nozzle and support assembly.
3. If GPS tubes will be used, remove the two (2) M5 screws that hold the extension. See Figure 2-7.

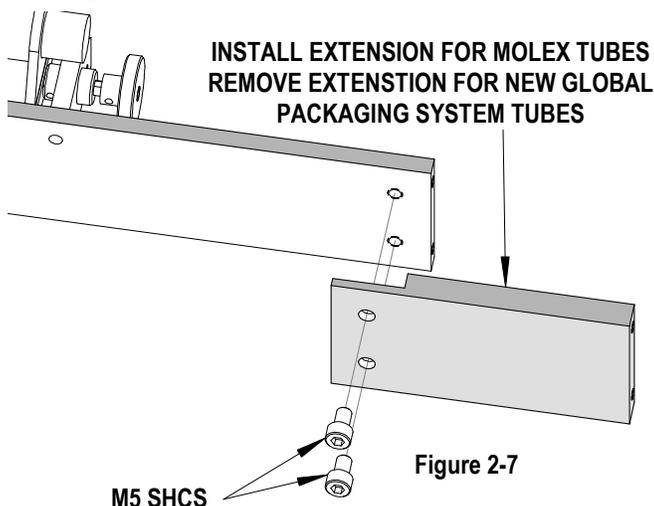


Figure 2-7

4. Store the extension and the two screws for future use.
5. If Molex standard tubes are to be used, install the extension using the (2) M5 SHCS.
6. Reinstall the nozzle and support assembly to the new end. See Figure 2-8B.

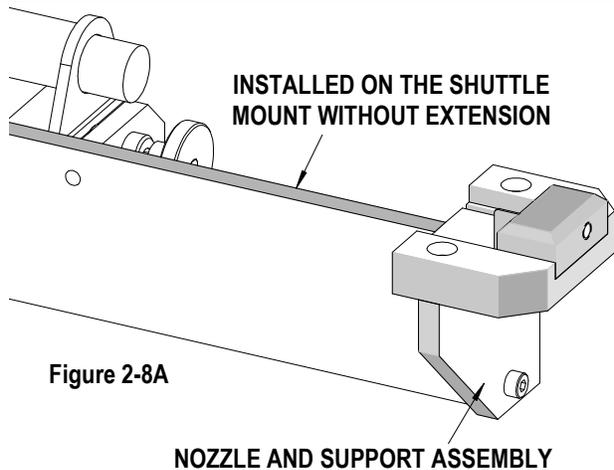


Figure 2-8A

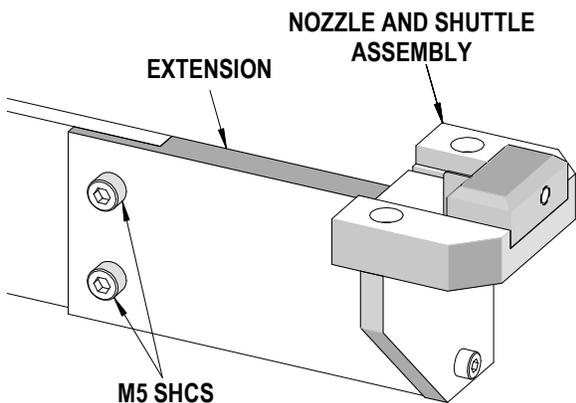


Figure 2-8B

### 2.2 Setting Batch Size

1. Press the blue **"BATCH"** button on the operator interface. The following display will appear:

**BATCH COUNT = 0000**  
**PRESS UP OR DOWN**

2. Use the up and down arrows to set the desired value in the display.  
**NOTE:** Holding the arrow button down causes the incrementing to go faster.
3. Press the **"MAN"** or the **"RUN"** button to exit Batch mode.

### 2.3 Setting Breakoff Strokes

If the carrier breakoff option is not installed, it is necessary to enter a "0" in the breakoff stroke counter. If the carrier breakoff option is installed there must be a positive value (from 1 to 9) entered into the counter.

The same procedure is used if the operator wants to increase or decrease the number of breakoff strokes.

1. Press the blue **"BK OFF"** button on the operator interface. The following display will appear:

**BRKOFF STROKES = 0000**  
**PRESS UP OR DOWN**

2. Use the up and down arrows to set the desired value in the display (0 - 9).
3. Press the **"MAN"** or the **"RUN"** button to exit Batch mode.

### 2.4 Operation

This machine operates in two (2) modes; Manual and Run. Manual mode is used during setup and trouble shooting. It allows most machine functions to be operated independently, allowing adjustment, testing and repair of that function. here are built in interlocks to prevent collisions of machine parts and possible damage to same.

Run mode sets the control to run a complete termination cycle when the foot pedal is pressed. This includes terminating the cable and connector, inserting terminals, and loading another connector automatically.

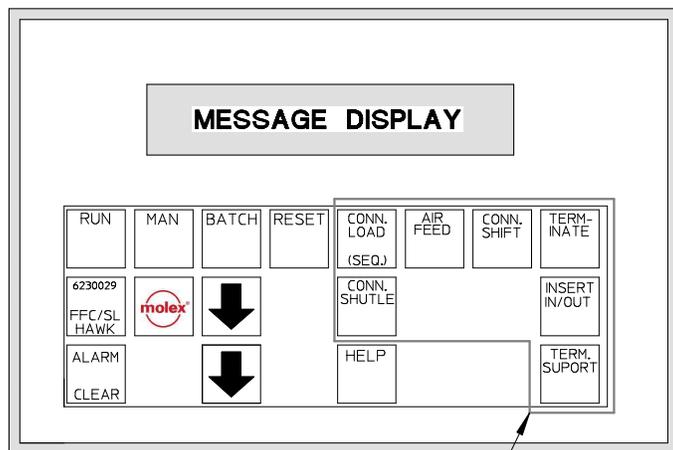


Figure 2-9

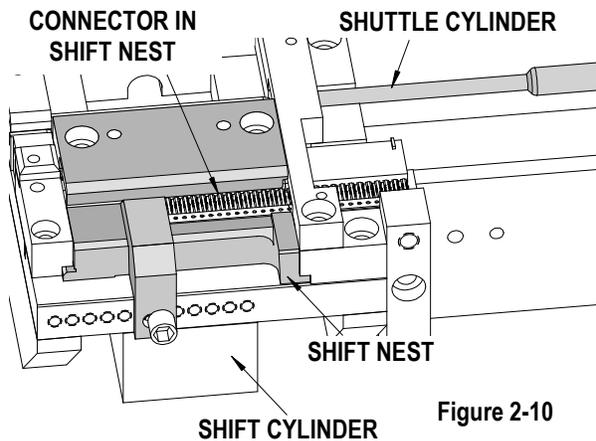
MANUAL BUTTONS

**Manual Mode** (See Figure 2-9)

1. **"MAN"** (yellow) Pressing this button puts the controller into "Manual Mode", and the display will show:

**MANUAL MODE  
PRESS MANUAL BUTTON**

2. **"CONN. LOAD (SEQ)"** This button, when pressed, starts the sequence that loads another connector into the shuttle nest, then shuttles it forward, where the shuttle pushes the connector out of the slide nest into the termination nest. (Interlock: The terminal support must be down.)
3. **"CONN. SHUTL"** (See Figure 2-5 and 2-10) This button operates the shuttle cylinder. Pressing it once extends the cylinder rod forward pushing the connectors into the termination nest. Pressing it the second time, retracts the cylinder rod to the rest position. (Interlocks: Terminal support must be down and insert cylinder must be retracted.)
4. **"BREAK OFF"** If the carrier breakoff option is installed, pressing this button causes the carrier breakoff mechanism to go up and down. (No Interlocks.)
5. **"AIR FEED"** Pressing this button once turns on the air that blows the parts out of the tube into the shift nest. Pressing it a second time turns off the air.



6. **"CONN. SHIFT"** (See Figure 2-10) Pressing this button causes the connector in the shift nest to move to the rear position. Pressing it a second time returns the nest to the forward or rest position. (Interlock: Shuttle must be retracted.)

7. **"TERM-INATE"** Pressing this button extends the termination cylinder which in turn brings down the termination die. Pressing it a second time retracts the cylinder, raising the termination die. (Interlock: Insert must be retracted.)
8. **"INSERT IN/OUT"** Pressing this button extends the insertion cylinder which pushes connector housing onto the terminals and cable. Pressing it a second time returns the guide to the rest position. (Interlocks: Termination die must be up and terminal support must be down.)
9. **"TERM. SUPRT"** (See Figure 2-2) In the termination nest there is a series of blades mounted on a block that locate and support the terminals when a connector is in the nest. This button raises and lowers the support. (No Interlocks.)
10. **"ALARM CLEAR"** (Red Button) As noted with each button above, there are interlocks to prevent damage to various parts of the machine. If one of these interlocks is violated, a warning message comes up on the display indicating which interlock is violated the action does not occur and the alarm goes off. The alarm cause must be corrected. Then the operator must press the **"ALARM CLEAR"** button to clear this message before proceeding. See Section 3.4 for more information.

**NOTE:** By pressing E-STOP, the air can be dumped for clearing jams.

**Run Mode**

1. The first connector must be manually loaded into the termination nest. Press the **"MAN"** button.
2. Press the **"CONN. LOAD"** button. This will put the terminator through all operations necessary to load the connector.
3. Press the **"RUN"** button. The operator is now ready to begin a run. The following display will appear.

**RUN MODE BATCH XXXX  
PRESS FOOT SWITCH**

4. Place a length of flat cable against the cable guide and slide it forward until the leading edge of the cable touches the connector housing. See Figure 2-11.

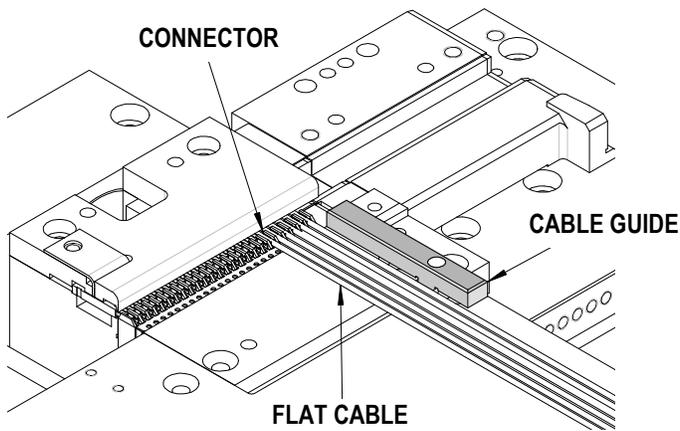


Figure 2-11

5. Press and release the foot pedal.
6. When the terminator has completed its cycle, the terminated cable and connector will be pushed out the left side of the termination nest and a new connector is loaded.
7. Break off the carrier strips by inserting them in the slot in the front of the cable support (See Figure 2-12) and bending back and forth once or twice.

**NOTE:** If the optional carrier breakoff assembly is installed the above step is not necessary.

8. Repeat steps 4 through 7 as often as required to reach the desired batch size. When the batch is completed, the following display will appear and the bottom line will flash:

**BATCH COMPLETED 0000  
PRESS ALARM CLEAR**

9. Press the "ALARM CLEAR" button.
10. The operator can now go to Manual mode and set up for a new job or he can press the "RESET" button (which will reset the batch count to "0") and run another batch.

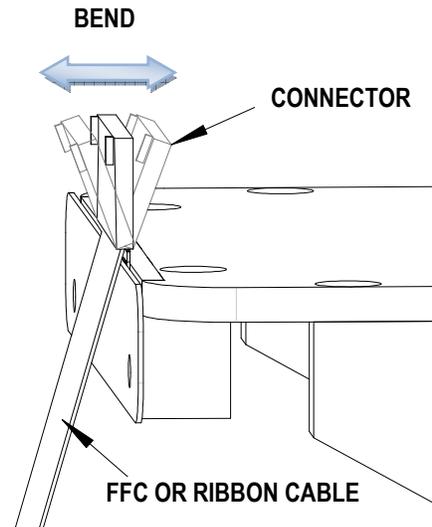


Figure 2-12

## Section 3

- 3.1. Maintenance
- 3.2. Perishable Parts
- 3.3. Spare Parts
- 3.4. Troubleshooting
- 3.5. Fault Message Diagnostics

### 3.1 Maintenance



**WARNING:** Disconnect the compressed air line and the power cord from the power source during all maintenance operations.

#### Cleaning



1. Using a small soft brush, clean all the debris and dust out of both nests and the tooling at least once a day, **NOTE:** The use of compressed air to clean the tooling is not recommended as it can cause debris to wedge into the tooling and/or come flying out at the operator.
2. When it is necessary to replace tooling, care should be taken to remove any debris from tapped holes or mounting surfaces. Debris can prevent tooling from being properly locked into position.
3. Keep the air filter clean. A visible coating of dirt in the bowl indicates that the unit needs cleaning. To clean, Remove the bowl and filter element and clean with denatured alcohol.

#### Lubrication

Springly lubricate the sliding parts approximately every month with S.A.E. 10W motor oil or equivalent.

#### Preventive Maintenance Chart

**Daily:** Clean. See Section 3.1.

**Monthly:** Check air filters and clean as necessary. See Section 3.1.  
Lubricate sliding parts. See Section 3.2.

CHECK SHEET MONTH \_\_\_\_\_ YEAR \_\_\_\_\_

Week	Daily Use	Days of the Week							Solution
		MON	TUE	WED	THU	FRI	SAT	SUN	
1									
2									
3									
4									
<b>Monthly</b>									
Air Filters									
Lubricate									

Schedule should be adjusted up or down depending on usage. Molex recommends that a log of preventive maintenance be kept with the tool.

### 3.2 Perishable Parts

These parts make contact with the connector and can wear over time. The customer is responsible for maintaining a set of these parts and Molex recommends the customer keep at least one spare set on hand at all times.

**NOTE:** Perishable Parts are identified in the Parts Lists in Section 6.

### 3.3 Spare Parts

These are parts that are available to support the Hawk terminators in service. They are moving or otherwise functioning parts that could be damaged or malfunction. It is suggested that the customer may want to keep some or all of these parts on hand to reduce down time.

**NOTE:** Recommended Spare Parts are identified in the Parts List in Section 6.

### 3.4 Troubleshooting

Symptom	Cause	Solution
No Power	▪ No power at source	Make sure there is power at the power outlet.
	▪ Loose connection or damaged power cord.	Check both ends of the power cord to be sure they are firmly plugged in. Check the power cord and repair or replace as required
	▪ Terminator fuses blown.	See Section 1.6 for locating and removing fuses. Check and replace as required.
Connector over feeding or short feeding in termination nest.	▪ Shuttle feed improperly set.	See Section 2.2 and check the shuttle feed. Reset if required.
Cable not terminating correctly in connector.	▪ Cable guide not set correctly.	See Section 2.2 and check the cable guide Position and reset if necessary.
	▪ Termination punch height set too high or too low.	See Section 2.1 and readjust the termination Depth.
	▪ Air pressure too low.	Check and correct. See Section 2.1.
Machine stops and a fault message appears in the display.	▪ A machine function has failed to perform as expected.	See "Fault Message Procedure" on following page.

### 3.5 Fault Message Procedure

This terminator has built in fault diagnostics. When an action fails to occur properly, a fault message will appear in the display. This messages indicates what did not happen and what sensor the controller is expecting to see.

For Example: The following display appears:

<b>S5 HSG. SHUTTLE NOT FORWARD</b>
--

This message tells us the following:

The controller is looking to see sensor S5 on and either the shuttle did not move at all, it moved and jammed part way, or it went all the way but the sensor is not made.

The following example, while it uses the above message to explain the procedure, it is typical of the method for handling most fault messages.

1. Determine where the shuttle rod is: Is it all the way home, part way forward, or all the way forward (to the Left)?
2. If the shuttle rod is all the way forward jump to step 6.
3. If the rod did not move, check to see if the valve (SV5 in this case), is functioning correctly. See Pneumatic Diagram in Section 5. Replace if necessary.
4. If the rod did not move or moved part way, check for bent cylinder rod, loose mechanical joints or debris in the path of the rod. Also check the air pressure.
5. Repair, replace, clean or adjust as required.
6. Locate the appropriate sensor and determine if it is functioning properly by placing a piece of steel in front of sensor. If the LED on the back of the sensor goes on, the sensor is OK. If LED does not go on, check the plug. If this is OK, replace the sensor.
7. Make sure the sensor flag (if there is one) is positioned so that it activates the sensor when the shuttle is all the way forward.
8. From the electrical schematic (See Section 6) it is determined that Sensor 5 is wired to input 008. Find input 008 LED on the controller in the control cabinet. Check to see if this LED goes on when the sensor LED goes on. If not, check the wiring between the sensor and the controller.

## Section 4

### Optional Carrier Breakoff Station Order No. 62300-4700

- 4.1 Description
- 4.2 Technical Specifications
- 4.3 Installation
- 4.4 Operation

### 4.1 Description

(See Figure 4-1)

The optional 62300-4700 Carrier Breakoff Station is designed to mount on the left side of the basic terminator. It automatically breaks the carrier strip off the finished connector and cable assembly. The carrier strip then slides down the chute into a customer provided container.

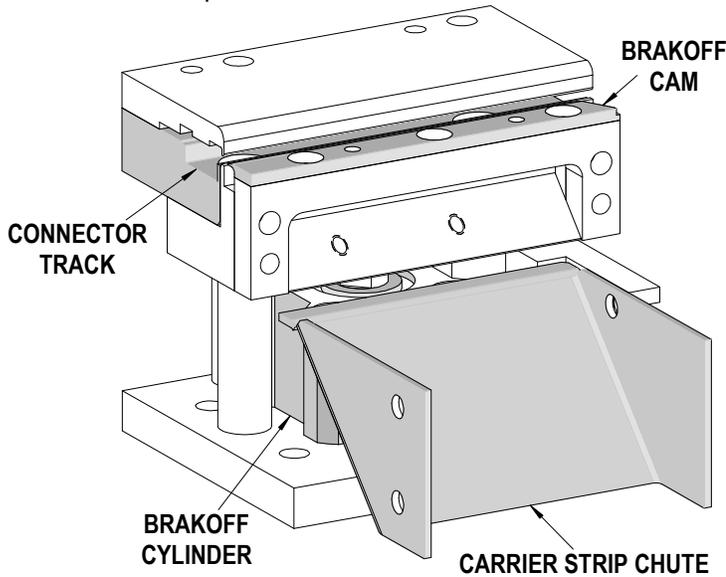


Figure 4-1

### 4.2 Technical Specifications

- Width:78.8 mm (3.1 in.)
- Depth:65.1 mm (2.56 in.)
- Height:70.5 mm (2.78 in.)
- Weight:0.9 kg (2 lbs.)

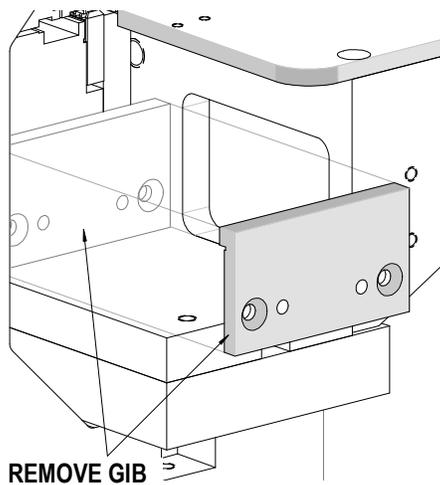


Figure 4-2

### 4.3 Installation and Removal

#### Installation

To install the optional Carrier Breakoff Assembly, do the following steps.

1. Remove the gib from the left side of the termination nest as shown in Figure 4-2.
2. Install the breakoff assembly (without the strip chute) into the area where the gib was removed. The rear bolt hole and the two dowels will line up with the holes in the mating block. See Figure 4.3.

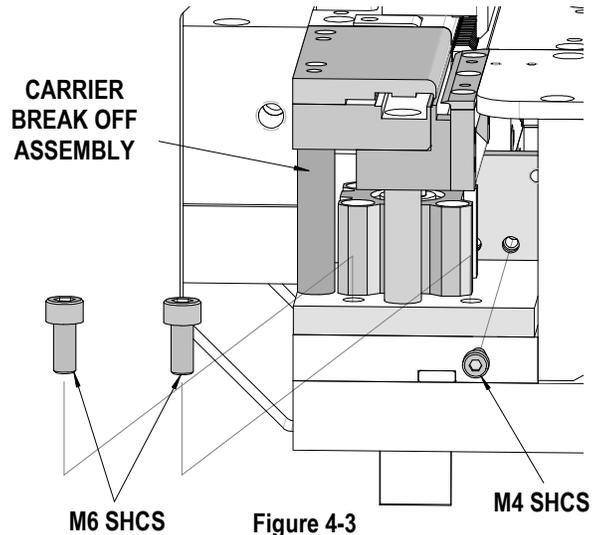


Figure 4-3

3. Install the two (2) M6 screws that hold the breakoff assembly down.
4. Remove the two (2) plugs from the A and B ports of the spare valve in the valve bank.
5. Connect two lengths of 4mm tubing from the valve assembly to the cylinder. Connect the "B" port to the top fitting on the cylinder and the "A" port to the bottom fitting. Reference the Pneumatic Schematic in Section 6.
6. Looking at Figure 4-4, locate the carrier strip chute and mount with two (2) M4 screws.

#### Removal

If for some reason you want to un-install the carrier breakoff assembly, simply reverse the installation procedure described above.



**CAUTION:** It is important to make sure the gib, removed in step 1 above, is reinstalled.

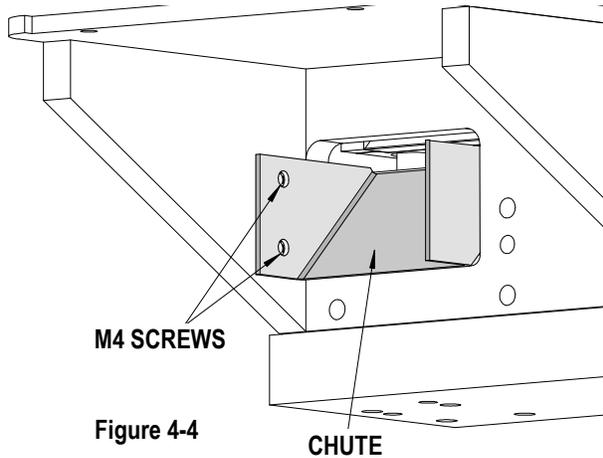


Figure 4-4

**Tubing Hookup**

**No Breakoff**

If the breakoff station is removed do the following:

1. Remove the two (2) tubes (that went to the breakoff station) from the valve bank.
2. Install two (2) plugs in the right hand ports as shown in Figure 4-5 (where the tubes were just removed).

**With Breakoff**

If the breakoff station is being installed, do the following:

1. Remove the two (2) plugs from the spare valve (#8).
2. Install two 6mm to 4mm reducers in these ports.
3. Cut the piece of tubing supplied with the breakoff kit into two suitable lengths to run as shown in Figure 4-6.
4. Insert the tubes into the reducers.
5. Connect the other ends of the tubes to the breakoff cylinder as shown in Figure 4-6. Tube "A" connects from the "A" (bottom) port on the valve manifold to the top port of the breakoff cylinder, and the "B" tube connects from the "B" (upper) valve manifold port to the bottom port of the breakoff cylinder. See also the Pneumatic Schematic at the end of Section 6.

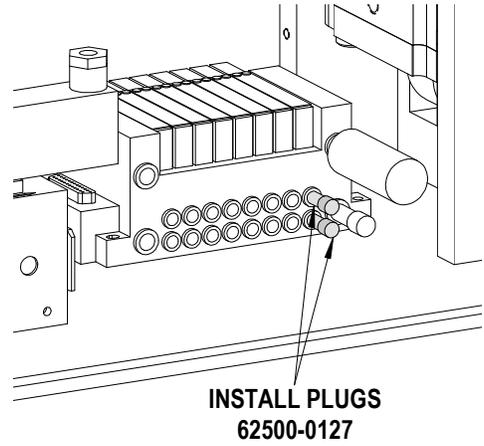


Figure 4-5 (With Cover removed)

**4.4 Operation**

Once the tubing is connected, the carrier breakoff assembly is ready to go. The control is preprogrammed to operate the breakoff cycle automatically.

**NOTE:** A value greater than "0" must be programmed into the breakoff stroke counter for the breakoff to function. See Section 2.3 for programming procedure.

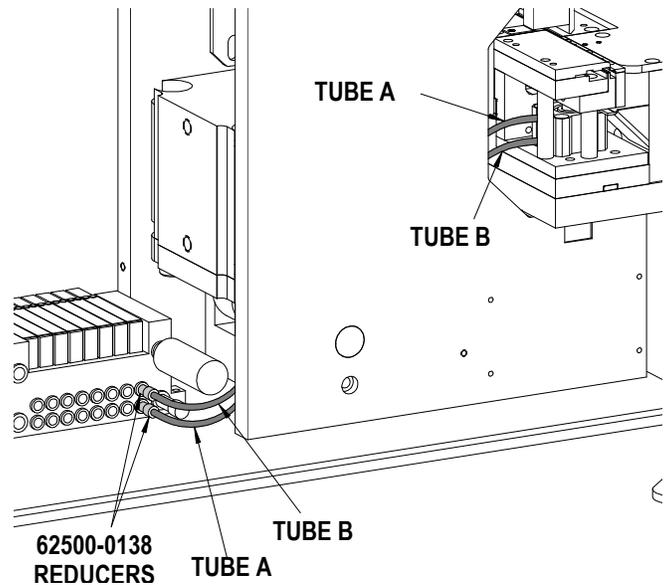


Figure 4-6 (With Cover removed)

## Section 5

- 5.1. Parts Lists and Assembly Drawings
- 5.2. Electrical Controls and Schematics
- 5.3. Pneumatic Schematics

The following pages contain the parts lists and assembly drawings for the 62300-2900 and 62300-3000 Hawk Terminators.

Here is some information that will help you better understand and use the information contained in these documents.

1. The "**Item No**" in the left column of the parts lists matches the number in the bubble on the assembly drawings.
2. The "**Order No.**" in the next column is the number that should be used when ordering that particular part.
3. An "**RSP**" appearing at the end of the Description column designates this part as a Molex **Recommended Spare Part**.
4. A "**PP**" appearing at the end of the Description column designates this part as a **Perishable Part**.
5. The "**Req'd**" quantity is the number of pieces of that part required per assembly. It is also the quantity Molex recommends be kept on hand if that part is a Perishable Part or a Recommended Spare Part.

### 5.1 62300-2900 Parts List and Assembly Drawings

62300-2900 – FFC/SL Hawk Assembly Figure 5-1				
Item	Order No.	Engineering No.	Description	Qty
1	11-31-5302	AM60510-122	Tool, Nest Cleaning	1
2	11-41-0265	KM242	Logo, 6" Molex	1
3	62300-2600	62300-2600	Assembly, Tube Feeder	1
4	62300-2700	62300-2700	Assembly, Hawk Controls	1
5	62300-3400	62300-3400	Assembly, Press	1
6	62300-3500	62300-3500	Assembly, SL Insert and Termination Nest	1
7	62300-5100	62300-5100	Tooling, FFC/SL Termination	1
8	62800-7317	62800-7317	Tag, "CE" Serial Number	1
9	63800-8394	63800-8394	Foot Switch	1

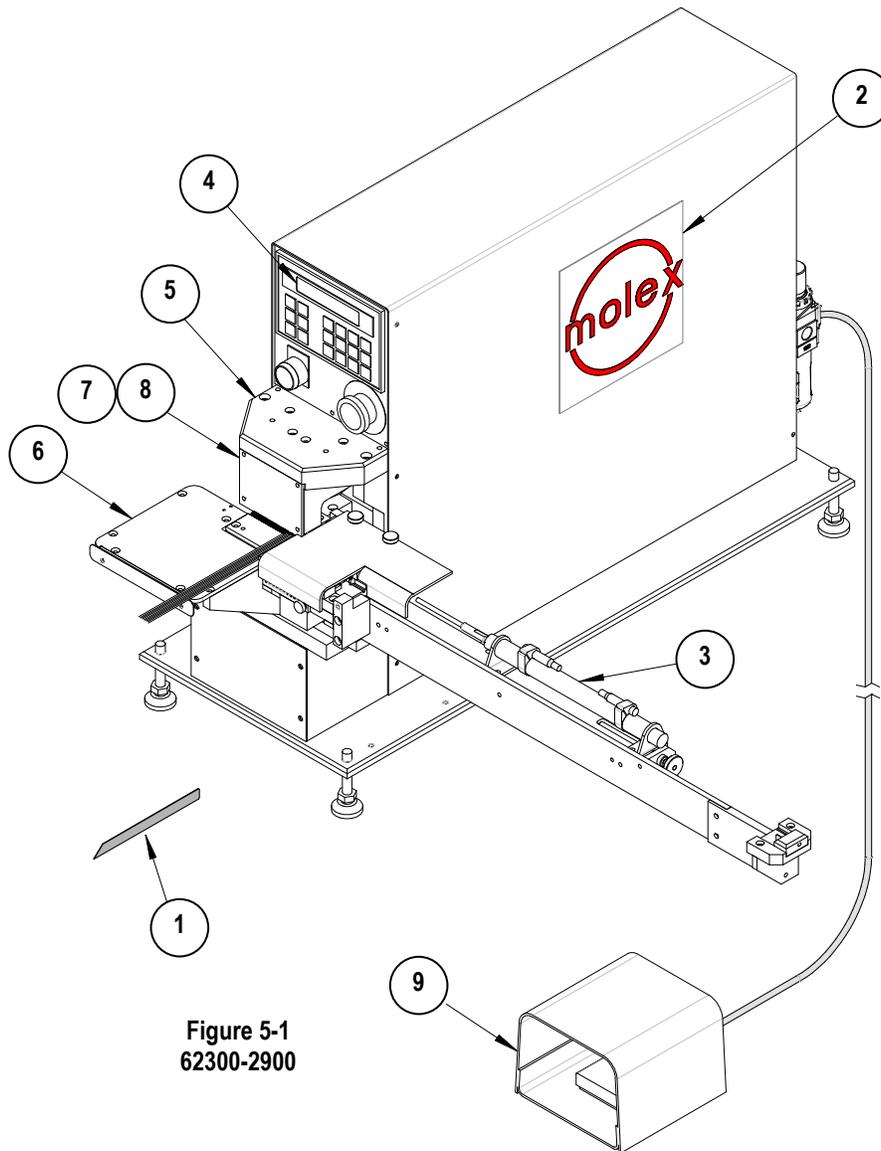


Figure 5-1  
62300-2900

### 62300-2950 Parts List and Assembly Drawings

62300-2950 – Ribbon Cable SL Hawk Assembly Figure 5-2				
Item	Order No.	Engineering No.	Description	Qty
1	62300-2600	62300-2600	Tube Feeder Assembly	1
2	62300-3400	62300-3400	Press Assembly, 99 Hawk	1
3	62300-3500	62300-3500	SL Insert and Termination Nest Assembly	1
4	62300-5100	62300-5100	FFC/SL Termination Tooling	1

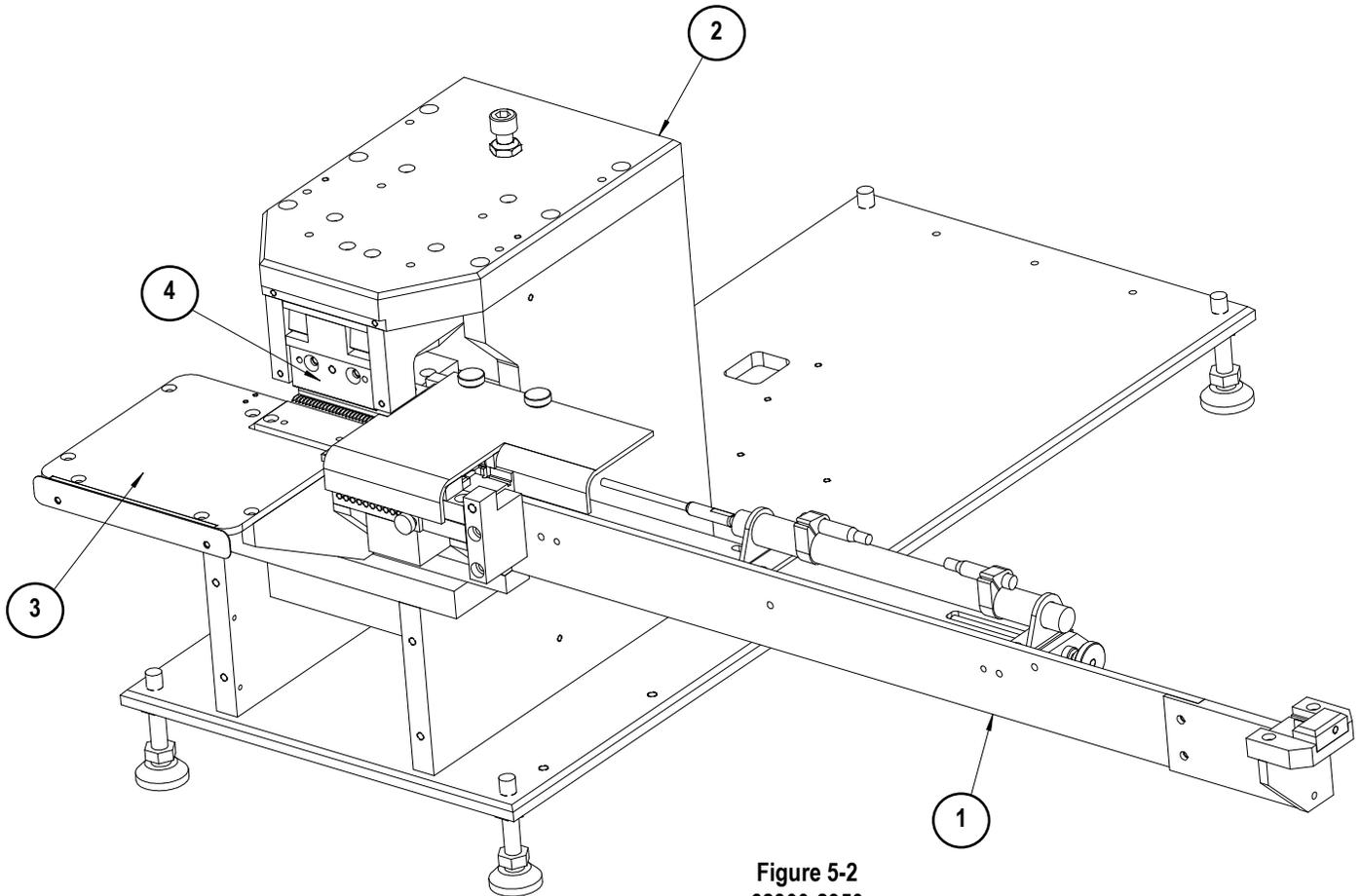


Figure 5-2  
62300-2950

### 62300-3000 Parts List and Assembly Drawings

62300-3000 – Ribbon Cable SL Hawk Assembly Figure 5-3				
Item	Order No.	Engineering No.	Description	Qty
1	11-31-5302	11-31-5302	Tool, Nest Cleaning	1
2	11-41-0265	KM242	Logo, 6" Molex	1
3	62300-2600	62300-2600	Assembly, Tube Feeder	1
4	62300-2700	62300-2700	Assembly, Hawk Controls	1
5	62300-3400	62300-3400	Assembly, Press	1
6	62300-3500	62300-3500	Assembly, SL Insert and Termination Nest	1
7	62300-5000	62300-5000	Tooling, FFC/SL Termination	1
8	62800-7317	62800-7317	Tag, "CE" Serial Number	1
9	63800-8394	63800-8394	Foot Switch	1

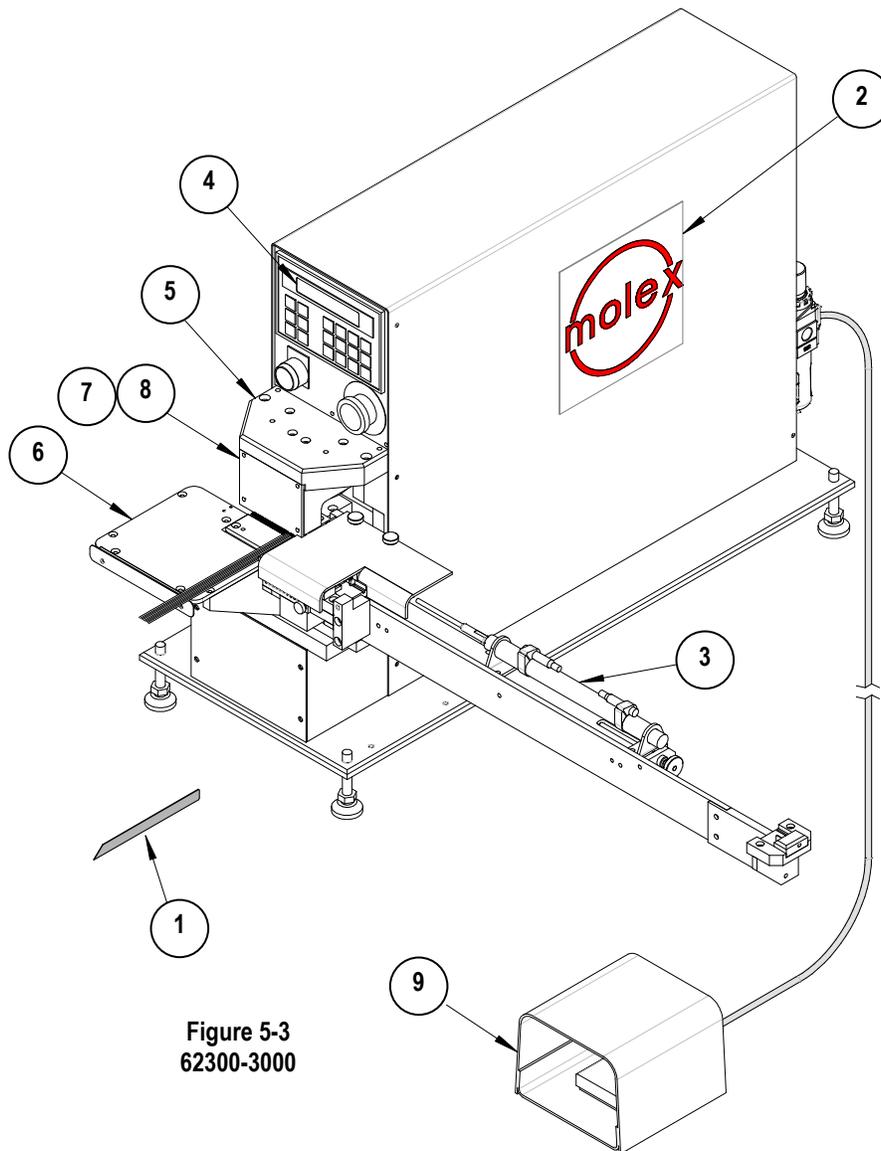


Figure 5-3  
62300-3000

### 62300-5200 and 62300-5300 Parts List and Assembly Drawings

62300-5200 – A 62300-2900 with Carrier Break off Figure 5-4			
Item No.	Order No.	Description	Qty
1	62300-2900	Assembly, FFC/SL Hawk	1
2	62300-4700	Assembly, Carrier Break off	1

62300-5300 – A 62300-3000 with Carrier Break off Figure 5-4			
Item No.	Order No.	Description	Qty
1	62300-3000	Assembly, FFC/SL Hawk	1
2	62300-4700	Assembly, Carrier Break off	1

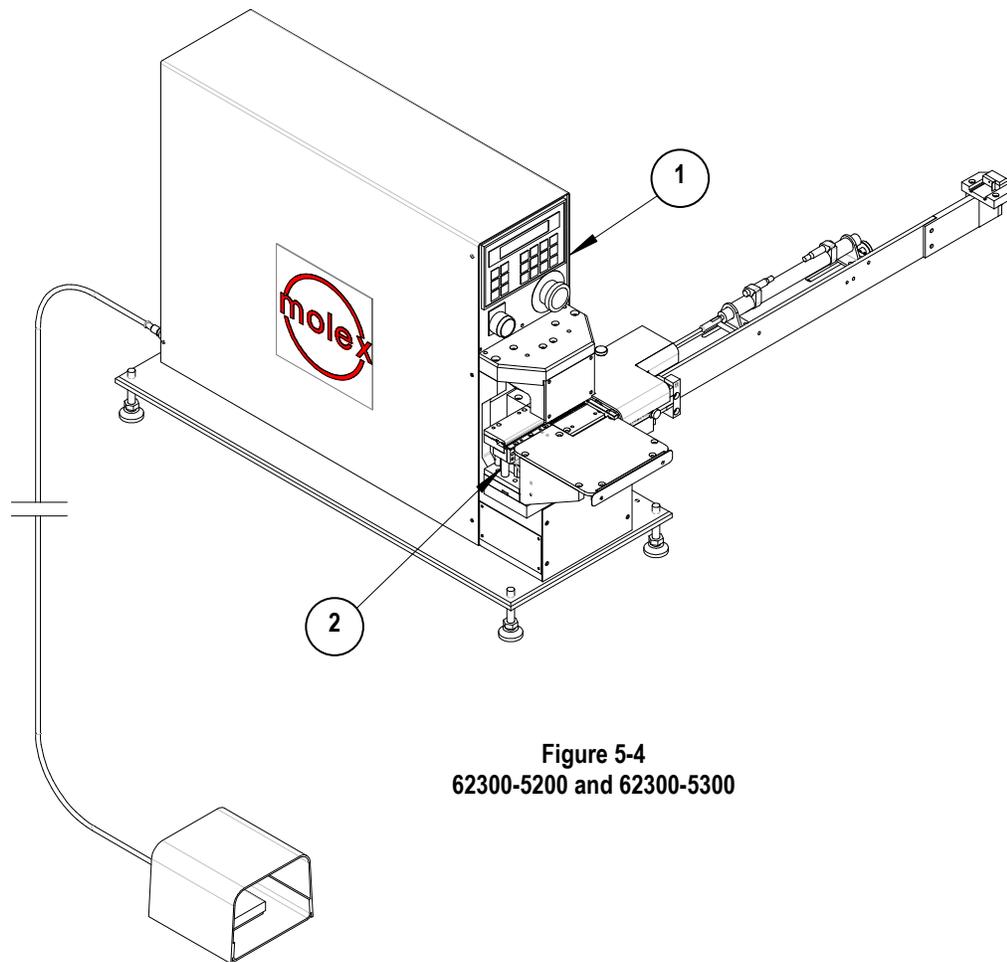


Figure 5-4  
62300-5200 and 62300-5300

## 62300-2600 Parts List and Assembly Drawings

62300-2600 – Tube Loader Assembly Figure 5-5				
Item	Order No.	Engineering No.	Description	Qty
1	11-32-5624	63163Z316	Switch, Shuttle Cylinder Proximity	2
2	62300-2601	62300-2601	Base, Shuttle	1
3	62300-2602	62300-2602	Mount, Shuttle	1
4	62300-2603	62300-2603	Bracket, Tube Rest	1
5	62300-2604	62300-2604	Rest, Tube	1
6	62300-2606	62300-2606	Base, Shift	1
7	62300-2607	62300-2607	Spacer, Left	1
8	62300-2608	62300-2608	Spacer, Right	1
9	62300-2609	62300-2609	Nest, Shift	1
10	62300-2610	62300-2610	Guide, Left Shift	1
11	62300-2611	62300-2611	Guide, Right Shift	1
12	62300-2612	62300-2612	Cover, Shift Nest	1
13	62300-2613	62300-2613	Stop, Tube Stop	1
14	62300-2614	62300-2614	Bracket, Shift Nest	1
15	62300-2615	62300-2615	Nozzle, Tube Feed Air	1
16	62300-2616	62300-2616	Block, Cylinder Adjusting	1
17	62300-2617	62300-2617	Screw, Adjusting	1
18	62300-2618	62300-2618	Cover	1
19	62300-2619	62300-2619	Holder, Tube	1
20	62300-2620	62300-2620	Mount, Cylinder	1
21	62300-2621	62300-2621	Preload, Tube	1
22	62300-2628	62300-2628	Guide, Terminal Feed	1
23	62300-2630	62300-2630	Stop, Shift	1
24	62300-2631	62300-2631	Extension, Shuttle Mount	1
25	62300-2634	62300-2634	Guard, Shift	1
26	62300-3702	62300-3702	Pusher, Shuttle	1
27	63600-0055	63600-0055	Bracket, Prox Mount	2
28	63600-0283	63600-0283	Washer, Thrust	2
29	63600-0350	63600-0350	Plunger, Ball	1
30	63600-0575	63600-0575	Collar, Set Screw	2
31	63600-0709	63600-0709	Cylinder, Shift <b>RSP</b>	1
32	63600-0710	63600-0710	Cylinder, Shuttle <b>RSP</b>	1
33	63600-0770	63600-0770	Bearing	1
34	63600-0789	63600-0789	Knob	1
35	63600-0826	63600-0826	Bracket, Cylinder	2
36	63600-1179	63600-1179	Thumb Knob with M5 by 10 Long SHCS	2
37	63600-1583	63600-1583	Thumb Knob with M4 by 10 Long SHCS	1

**RSP** - Part is a Molex Recommended Spare Part.

62300-2600 Assembly Drawing

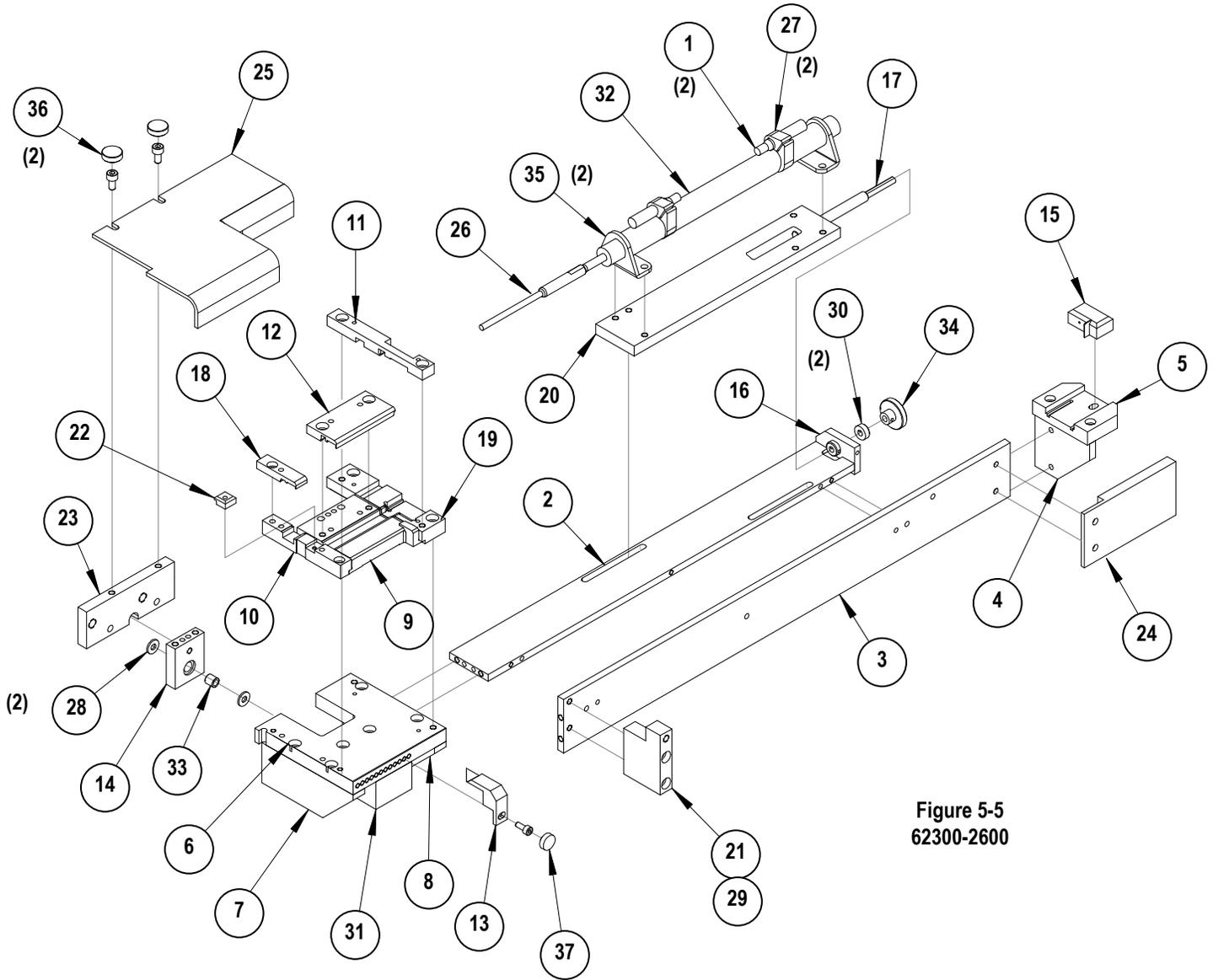


Figure 5-5  
62300-2600

## 62300-3400 Parts List and Assembly Drawings

62300-3400 – Hawk Press Assembly Figure 5-6				
Item	Order No.	Engineering No.	Description	Qty
1	62300-3401	62300-3401	Base, Nest	1
2	62300-3402	62300-3402	Upright, Left Frame	1
3	62300-3403	62300-3403	Upright, Right Frame	1
4	62300-3404	62300-3404	Pin, Pivot	1
5	62300-3405	62300-3405	Support, Nest	1
6	62300-3406	62300-3406	Plate, Press Top	1
7	62300-3407	62300-3407	Mount, Termination Cylinder Pivot	1
8	62300-3408	62300-3408	Guard, Punch	1
9	62300-3409	62300-3409	Lever, Press	1
10	62300-3410	62300-3410	Base, Machine	1
11	62300-3411	62300-3411	Pivot, Cylinder	1
12	62300-3412	62300-3412	Guide, Left Termination	1
13	62300-3413	62300-3413	Guide, Right Termination	1
14	62300-3414	62300-3414	Slide, Termination	1
15	62300-3415	62300-3415	Slide, Upper Termination	1
16	62300-3416	62300-3416	Fulcrum, Lever	1
17	62300-3417	62300-3417	Bracket, Sensor	1
18	63600-0725	63600-0725	Cylinder <b>RSP</b>	1
19	63600-0726	63600-0726	Clevis	1
20	63600-0727	63600-0727	Mount, Swivel	1
21	63600-0785	63600-0785	Foot, Leveling	4
22	N/A	N/A	M10 by 40 long SHCS	1**
23	N/A	N/A	M10 Hex Nut	1**
<b>RSP</b> - Part is a Molex Recommended Spare Part.				
** Available from an industrial supply company such as MSC (1-800-645-7270).				

62300-3400 Assembly Drawing

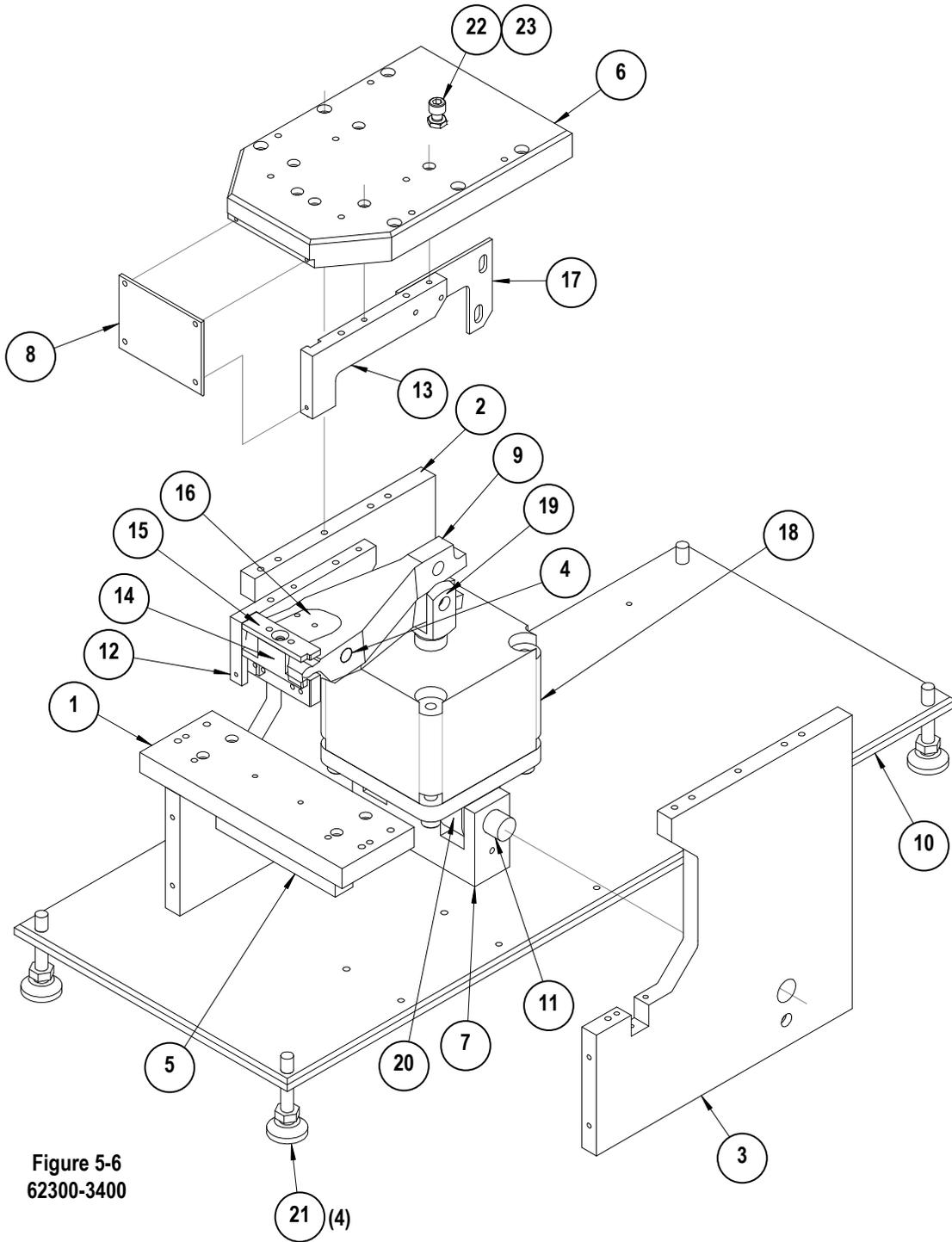


Figure 5-6  
62300-3400

## 62300-3500 Parts List and Assembly Drawings

62300-3500 – SL Insert and Termination Nest Figure 5-7				
Item	Order No.	Engineering No.	Description	Qty
1	11-32-3059	63222E18	Sensor, Proximity <b>RSP</b>	1
2	11-40-5203	63303T112	Spring, Compression <b>RSP</b>	4
3	62300-3501	62300-3501	Support, Terminal	1
4	62300-3502	62300-3502	Anvil <b>PP</b>	1
5	62300-3504	62300-3504	Bar, Insertion	1
6	62300-3505	62300-3505	Base, Nest	1
7	62300-3506	62300-3506	Cover, Nest	1
8	62300-3507	62300-3507	End, Rod	1
9	62300-3508	62300-3508	Slide, Nest	1
10	62300-3509	62300-3509	Base, Slide	1
11	62300-3510	62300-3510	Gib, Slide	2
12	62300-3511	62300-3511	Mount, Table	1
13	62300-3512	62300-3512	Table, Feed	1
14	62300-3513	62300-3513	Spring, Drag <b>RSP</b>	1
15	62300-3514	62300-3514	Base, Tooling	1
16	62300-3516	62300-3516	Bar, Locating	1
17	62300-3517	62300-3517	Bar, Break off	1
18	62300-3518	62300-3518	Bar, Inner Break off	1
19	62300-3519	62300-3519	Guide, Cable	1
20	62300-3520	62300-3520	Clamp, Cable Guide	1
21	63600-0724	63600-0724	Cylinder <b>RSP</b>	1
22	63600-0730	63600-0730	Cylinder <b>RSP</b>	1
23	63600-0761	63600-0761	Screw, Shoulder	1
24	N/A	N/A	M8 by 30 long SHCS	1**
25	N/A	N/A	M8 Hex Nut	1**
<b>PP</b> - Part is a Molex Recommended Perishable Part.				
<b>RSP</b> - Part is a Molex Recommended Spare Part.				
** Available from an industrial supply company such as MSC (1-800-645-7270).				

62300-3500 Assembly Drawing

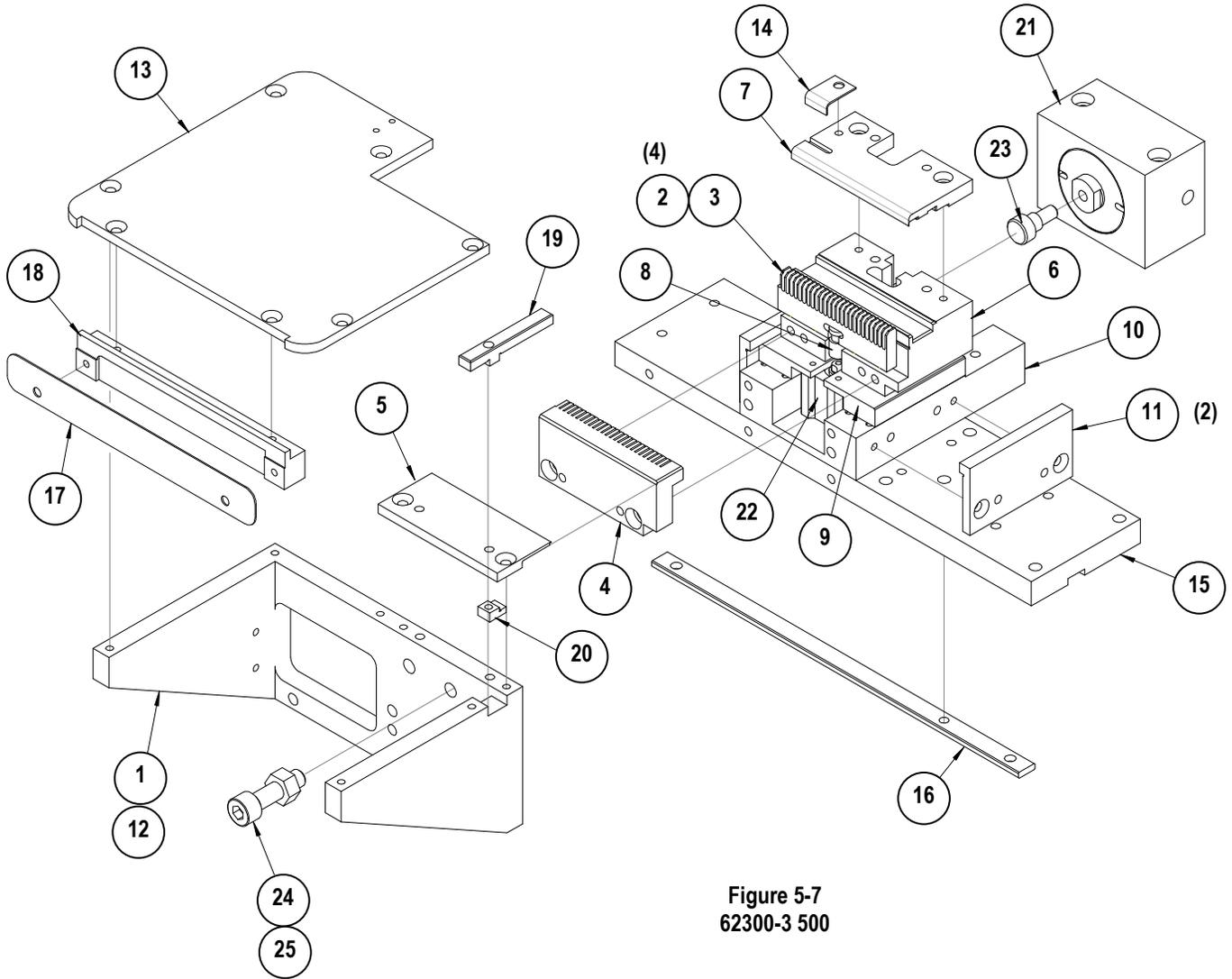


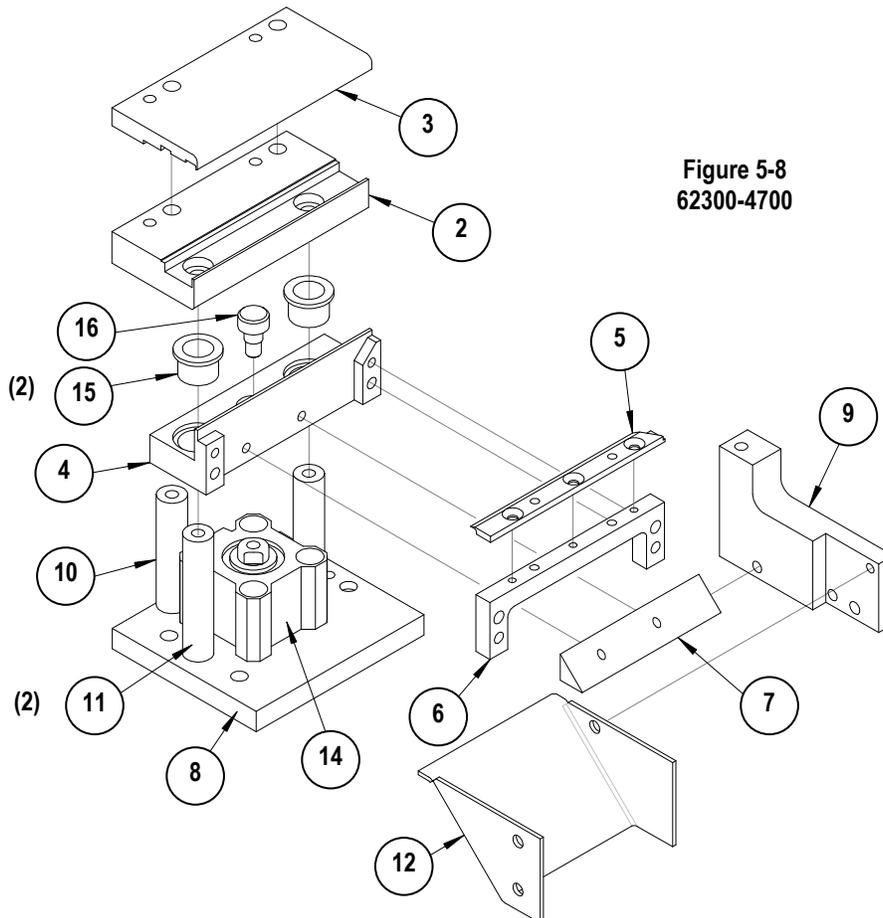
Figure 5-7  
62300-3 500

### 62300-4700 Parts List and Assembly Drawings

62300-4700 – Optional Carrier Break off Station Figure 5-8				
Item	Order No.	Engineering No.	Description	Qty
1	11-31-6809	AM60018-46	Fitting, M5 Thad. to 4mm Tube (Not Shown)	2
2	62300-4701	62300-4701	Nest	1
3	62300-4702	62300-4702	Cover, Nest	1
4	62300-4703	62300-4703	Block, Slide	1
5	62300-4704	62300-4704	Bar, Break off	1
6	62300-4705	62300-4705	Mount, Break off Bar	1
7	62300-4706	62300-4706	Deflector, Carrier	1
8	62300-4707	62300-4707	Base	1
9	62300-4708	62300-4708	Plate, Mount	1
10	62300-4709	62300-4709	Standoff	1
11	62300-4710	62300-4710	Pin	2
12	62300-4711	62300-4711	Chute	1
13	62500-0138	62500-0138	Reducer (Not Shown)	2
14	63600-0723	63600-0723	Cylinder <b>RSP</b>	1
15	63600-0915	63600-0915	Bearing	2
16	63600-0918	63600-0918	Screw, Shoulder	1
17			Tubing, 4mm (Not Shown)	1m

**RSP - Part is a Molex Recommended Spare Part.**

### 62300-4700 Assembly Drawing



## 62300-5000 and 62300-5100 Parts List and Assembly Drawings

62300-5000 – Ribbon Cable SL Tooling Figure 5-9				
Item No.	Order No.	Description		Qty
1	62300-5002	Punch, Termination	PP	1
2	62300-5003	Punch, Crimp	PP	1
PP- Part is a Molex Recommended Perishable Part.				

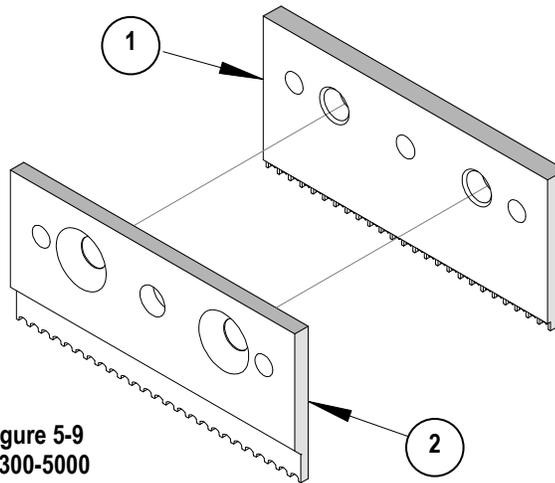


Figure 5-9  
62300-5000

62300-5100 – FFC/SL Tooling Figure 5-10				
Item No.	Order No.	Description		Qty
1	62300-3503	Punch	PP	1
PP- Part is a Molex Recommended Perishable Part.				

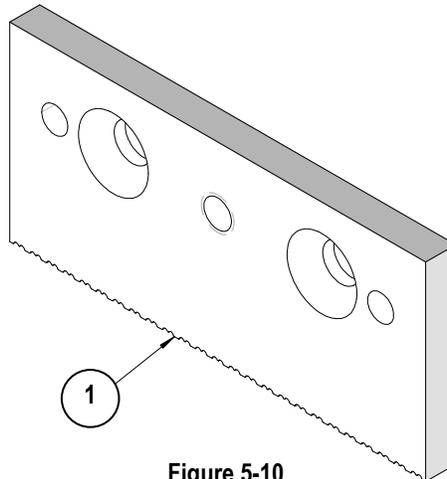


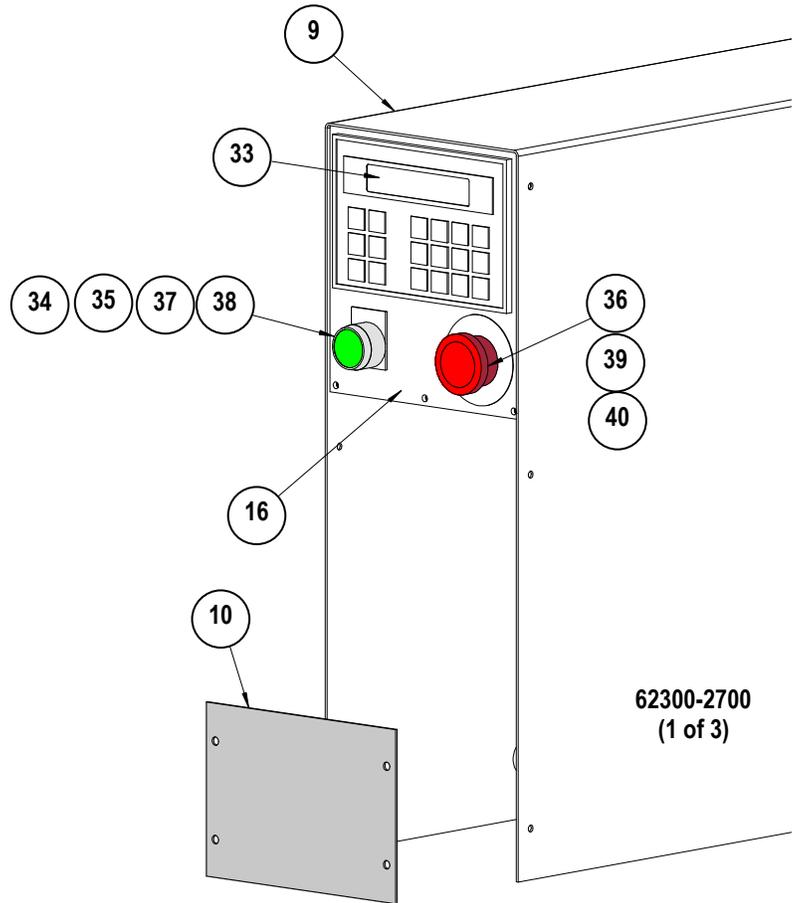
Figure 5-10  
62300-5100

5.2. Electric Controls

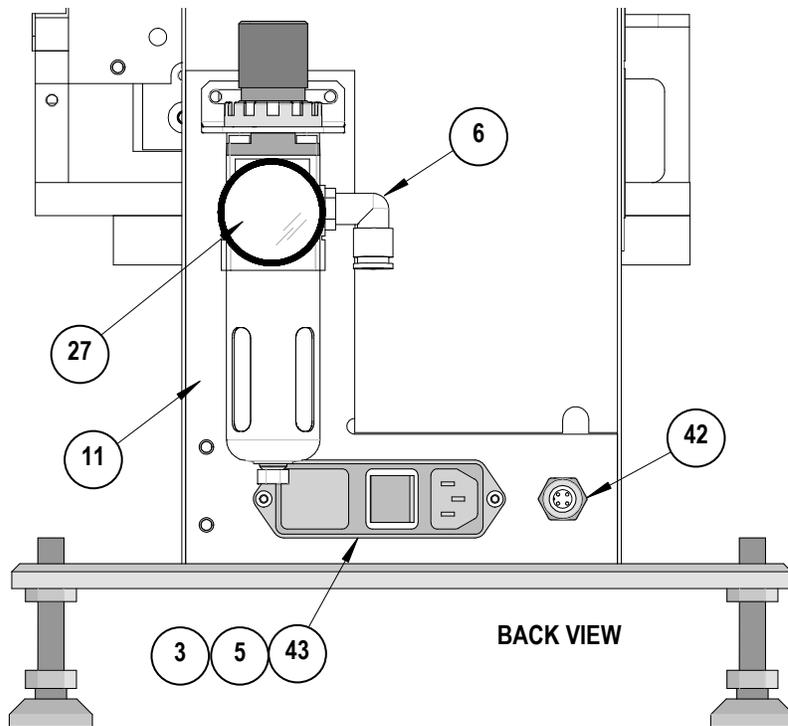
62300-2700 Electric Controls				
Item	Order No.	Engineering No.	Description	Qty
1	11-32-1659	11-32-1659	Cord, 3-Cond. Detachable (NOT SHOWN)	1
2	11-32-1660	11-32-1660	Fuse, 1A. Slow Blow	4
3	11-32-2733	11-32-2733	Drawer, 2-Pole Fuse	1
4	11-32-3059	11-32-3059	Switch, 8mm Proximity (See Mechanical Assemblies)	7
5	11-32-5182	11-32-5182	Receptacle, Casing	1
6	11-32-5376	11-32-5376	Elbow	1
7	11-32-6551	11-32-6551	Relay, 3 Pole	1
8	11-32-6552	11-32-6552	Socket, 3 Pole Relay	1
9	62300-2701	62300-2701	Enclosure	1
10	62300-2703	62300-2703	Cover, Front	1
11	62300-2705	62300-2705	Mount, Rear	1
12	62300-2706	62300-2706	Mount, Rear Control	1
13	62300-2707	62300-2707	Mount, Front Control	1
14	62300-2708	62300-2708	Panel, Control	1
15	62300-2709	62300-2709	Mount, Valve	1
16	62300-2722	62300-2722	Panel, Operator	1
17	62300-2723	62300-2723	Mount, Lower Panel	1
18	62300-2724	62300-2724	Mount, Rear Panel	1
19	62300-2725	62300-2725	Mount, Right Panel	1
20	62500-0050	62500-0050	Terminal, Side Entry	15
21	62500-0051	62500-0051	Clamp, End	4
22	62500-0078	62500-0078	Plug, 8mm Tube	1
23	62500-0122	62500-0122	Manifold, 8-Station	1
24	62500-0123	62500-0123	Valve, Single Solenoid <b>RSP</b>	8
25	62500-0126	62500-0126	Muffler	2
26	62500-0161	62500-0161	Plate, Terminal End	2
27	62500-0189	62500-0189	Filter/Regulator	1
28	62500-0460	62500-0460	Module, Peripheral Port to RS232	1
29	62500-0478	62500-0478	Cable, 8mm Proxy. Right Angle (NOT SHOWN)	9
30	62500-0490	62500-0490	Valve, Slow Start	1
31	62500-0515	62500-0515	CPU	1
32	62500-0534	62500-0534	Supply, Power	1
33	62500-0608	62500-0608	Display	1
34	62500-0609	62500-0609	Block, Lighted N.O. Contact	1
35	62500-0610	62500-0610	Operator, Lighted Push Button	1
36	62500-0611	62500-0611	Plate, 'E-Stop' Legend	1
37	62500-0612	62500-0612	Plate, 'Power On' Legend	1
38	62500-0613	62500-0613	LED, Green	1
39	62500-0614	62500-0614	Switch, Red Mushroom Head	1
40	62500-0615	62500-0615	Block, N.C. Contact	1
41	62500-0689	62500-0689	Cable, CPU to Operator Interface	1
42	62500-1055	62500-1055	Receptacle, Footswitch	1
43	69018-6221	69018-6221	Insert, Voltage Selector	1
44	69018-6228	69018-6228	Counter, 7 Digit Non-Reset able	1
45	69018-6231	69018-6231	Diode	2

**RSP - Part is a Molex Recommended Spare Part.**

### Electric Controls (Cont.)



62300-2700  
(1 of 3)



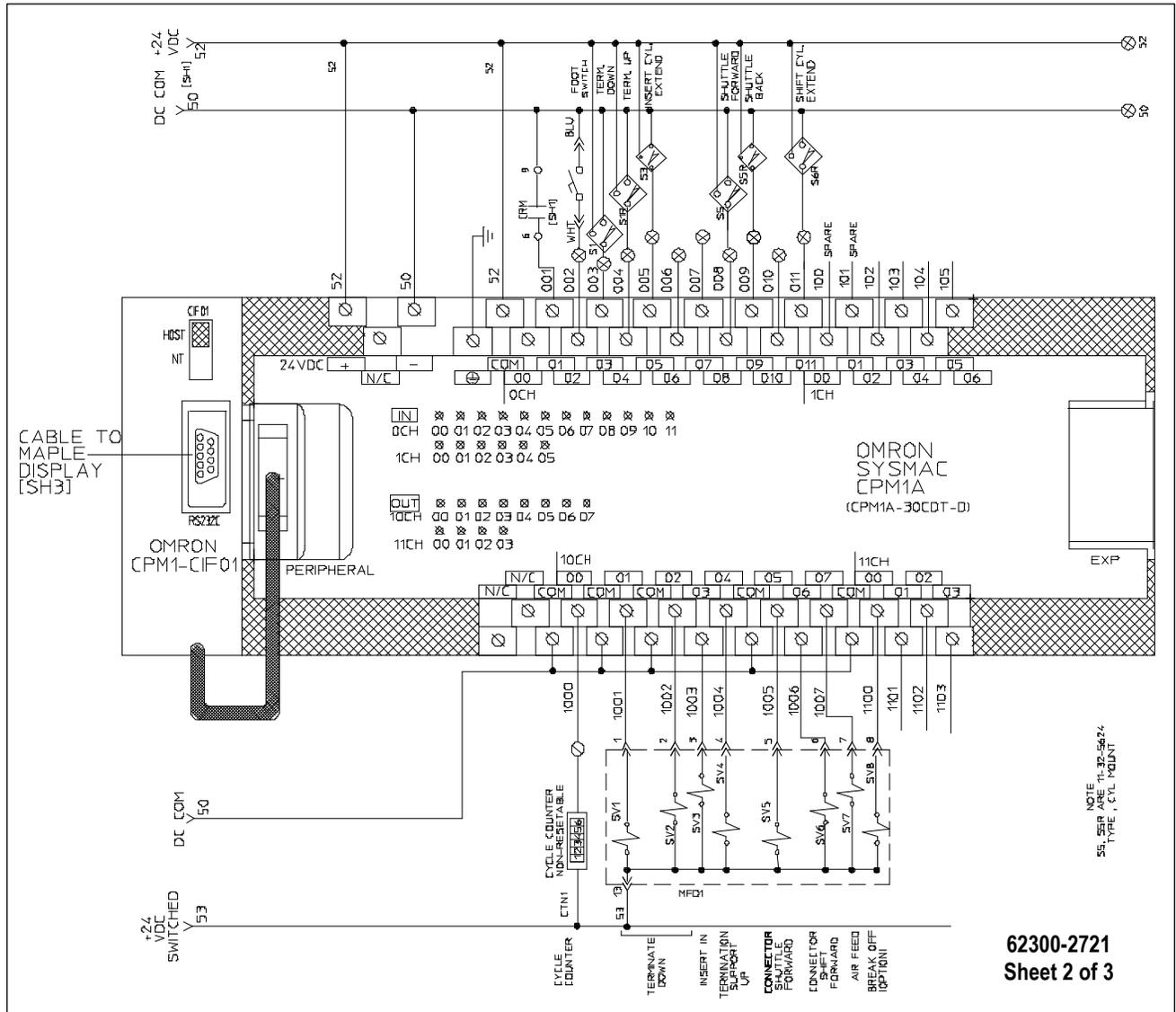
BACK VIEW

62300-2700  
(2 of 3)





### Electric Schematics (Cont.)





## Section 6

### Glossary of Terms

<b>Carrier</b>	Strip that temporarily holds the terminals in position during shipping and termination. Must be removed upon completion of assembly.
<b>Circuit Size</b>	Number of conductors in a connector.
<b>Crimp</b>	To form tabs on a terminal around a wire conductor or insulator.
<b>Connector</b>	An assembly of a housing and a series of terminals.
<b>Discrete Wire</b>	Individual wires terminated to a connector.
<b>FFC</b>	The abbreviation for "Flat Flex Cable", a type of ribbon cable where the conductors are conductive film strips between two layers of insulation making the cable very thin.
<b>Housing</b>	Plastic connector body.
<b>Insertion</b>	Pushing terminals into the housing.
<b>Insulation Displacement</b>	A wire termination technique where the terminal pierces the wire insulation, and makes contact with the conductor without the need for stripping the wire.
<b>Punch</b>	The tooling piece that crimps (or terminates) wires to terminals.
<b>Sensor</b>	Electrical non-contact switch that detects the presence of metal moving into its field and signals the machine control.
<b>SL</b>	Molex trade mark for its modular, single row wire-to-board and wire-to-wire system.
<b>Terminal</b>	The parts (2 or more) of the connector assembly to which the wire is attached and provides the internal conductor.
<b>Termination</b>	The process of attaching the wire to the terminal.
<b>Termination Head</b>	The part of the machine that holds the crimp and termination punches and terminates the wires into the terminals.

## Section 7

### Statistical Process Control (Summary)

- 7.1 I.D.T. Termination Process Control
- 7.2 Process Capability
- 7.3 Production

## 7.1 I.D.T. Termination Process Control

The I.D.T termination process is the interaction of a terminal, wire, tooling, personnel, methods and procedures, and environmental attributes that, when controlled, produce a quality termination. Quality control is an important aspect to quality termination. It should not take excessive setup or inspection time to implement, and can save a harness manufacturer thousands of dollars in potential rework or re-manufacturing.

The key to quality is to target nominal specifications while continuously reducing variability. Variability is the slight changes that occur from wire to wire. There are two types of variability, common and special. Common sources of variation are those causes that affect the process uniformly, and are created from numerous small sources. Common variability are inherent tolerances within a reel of wire, terminals or connector housings. Also, common variability is created by the natural tolerances of the harness assembly machines. Reduction of variability at the common level normally has to come from changes at the wire, terminal, and tooling manufacturer.

The second source of variability is referred to as special cause. Unlike common cause, special sources of variation occur irregularly and unpredictably. Without checks throughout a run, a tool becoming loose after the first hundred cycles, or a damaged tool from a jam, may be undetected until thousands of assemblies are made.

This section assumes that the termination depth is being measured with a resolution of .025 mm (.001 in), and pull force is measured with a resolution of 1 N (.25lbs).

## 7.2 Process Capability

Molex qualifies each I.D.T terminator for termination depth and vertical pull force. (where applicable) This qualification is performed on a specified sample, and is targeted at 2 CpK. Before a new tool is put in production, it is

recommended that a capability study be done by the customer using their specific wire in their process. A capability study is based on the assumption of a normal distribution (bell-type curve). It provides an estimate on the probability of a measurement being outside of specification.

CpK	+/- Sigma	% Yield	PPM
0.67	2	95.45	45,500
1	3	99.73	2,699
1.33	4	99.99	63
1.67	5	99.99+	0.57
2	6	99.99++	0

PPM - Parts per million potential defects.

A minimum of a 25 piece sample should be run. The average and standard deviation should be calculated for each specification.

A capability index defined by the formula below. Cp may range in value from 0 to infinity, with a larger value indicating a more capable process. A value >1.33 is normally considered acceptable.

$$\frac{\text{Tolerance}}{6 * \text{Standard Deviation}}$$

The CpK index indicates whether the process will produce units within the tolerance limits. CpK has a value equal to Cp if the process is centered on the mean of specification; if CpK is negative, the process mean is outside the specification limits; if CpK is between 0 and 1 then some of the 6 sigma spread falls outside the tolerance limits. If CpK is larger than 1, the 6 sigma spread is completely within the tolerance limits. CpK is calculated with the lesser of the following formulas:

$$\frac{(\text{USL} - \text{MEAN})}{3 * \text{Std Deviation}} \quad \frac{(\text{LSL} - \text{MEAN})}{3 * \text{Std Deviation}}$$

USL = Upper Specification Limit, LSL = Lower Specification Limit

Six sigma is a goal of many companies because it represents virtually zero defects. The ability of a company to achieve a six sigma level is dependent on the amount of common variability in their

process. A termination hand tool will produce more variability than a bench mounted terminator. Operator run terminators will produce more variability than a fully automatic machine.

A portion of the variability in harness assembly will come from the instruments used to measure the parts and the ability of an operator to repeat the measurement. A drop gauge will measure more accurately than a dial caliper. An automatic pull force system will measure better than a hook type scale. It is important that the measurement gage has enough resolution. Also, two operators may measure the same part differently, or the same operator may measure the part different when using two types of gages. A gage capability study is recommended to identify what part of the variability is coming from measurement error. The variability from measurement error can keep CpK's low.

The capability of the process should be re-confirmed if the production data is significantly different from the capability study.

### 7.3 Production

Once the level of capability is established, the machine is ready for production.

Many harness manufacturers run only a few hundred or few thousand wires at one time. In this case, it is not practical or economical to run a twenty-five piece capability with every setup.

#### Setup Confirmation

After the setup of the termination process, terminate five terminals with a shallow termination depth. Visually inspect for tooling marks on the terminal and housing, and measure termination depth. Make the appropriate adjustments to the machine. (Refer to product termination specification and problem checklist sections if needed.) After all adjustments have been made, terminate five more samples for termination depth measurement. Then measure and document the average depth, the maximum reading, and the minimum reading. The range is considered the maximum reading minus the minimum reading. With a drop gauge and an experienced operator, the range for termination depth is normally only a

few thousandth of an inch. This data becomes the first point on the control chart.

When the termination depth has been confirmed, the vertical pull force can be measured. This checks the capability of the insulation crimp (strain relief) to hold the wire to within the specification limits.

This is best done with an automatic pull force system.

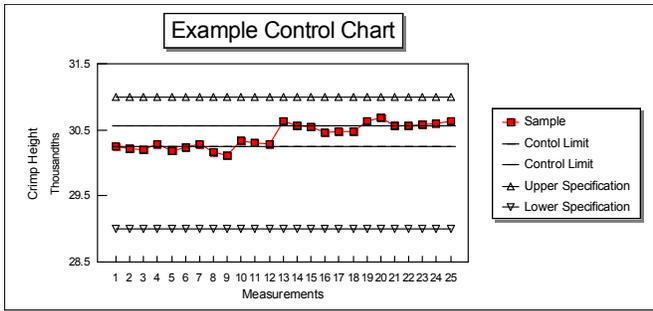
#### Production (Control Charting)

It should be normal procedure for the operator to visually check the terminal area for damage or improper termination. Termination should be checked throughout the run. The frequency of each check is determined by the risk you wish to take for scraping parts. A check every 250 to 500 parts is recommended.

#### Control Charting

Termination depth is normally control charted since it is a quick nondestructive measurement and is critical for the electrical reliability of the termination. There are three primary purposes for control charting. First, the number of setup samples are normally small, and its statistical value is limited. Second, since special-cause effects on a process are irregular and unpredictable, it is necessary to have a means of catching changes in the process as soon as they occur. This prevents thousands of terminations from being scrapped after the run is over. Third, and most important, this data is necessary to assess and improve the process.

Once the tooling process is setup and the wire size is not changing, keep one control chart for wire color changes, wire length changes, or setup adjustments. Record the data point on the chart before an adjustment is made. If data is recorded after each adjustment, the process most likely will assume control and provide little data for improving the process. Write as many notes on the chart as possible. The only truly effective and economically sensible manner of managing a manufacturing process is to understand, monitor, and reduce sources of variability inherent to the process itself. Every minute the process is down for setup or adjustment is unproductive.



Refer to the Example Control Chart above. What does this sample chart tell us? A process shift occurred between measurement 12 and 13. This type of shift could occur due to a change in wire, a change in connector lots, a jam in the machine that damaged the tooling, a change in operators, or an adjustment to the machine. Since the measurements are still within specification, would you stop production to make adjustments?

A shift in the process due to a change in wire insulation may warrant a termination depth adjustment. A shift after a jam would not indicate an

adjustment, but a close evaluation of the tooling. A shift in the process between operators would not indicate an adjustment, but an evaluation of measurement capability. The idea of the control chart is to identify what caused the shift to justify if an adjustment to the process is warranted.

I.D.T.termination processes have been producing product within specification for many years. Today with statistical process control, the philosophy of quality is being within specification, is being replaced by being on target with continuous reduction in variability. Control charting is a tool that truly allows a company to understand their process.

**ATTENTION**

**Reference must always be made to product application / termination specification to determine harness assembly parameters.**

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