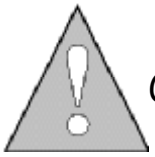
SECTION G: INJECTED METAL ASSEMBLY SYSTEM MAINTENANCE

SECTION G1: MACHINE MAINTENANCE



CAUTION!

Regular inspection of all guards, protective devices, point of operation safeguarding systems and mechanically loaded components is recommended. Component devices or guarding which show signs of wear, fatigue (cracks, distortion), or damage of any type should be replaced immediately.

The system must be electrically and pneumatically isolated when performing maintenance procedures. Suitable lockout/tagout procedures must be followed when maintaining the equipment.

The machine should be electrically isolated by turning off the "Main Disconnect Switch" and locking the switch in the OFF position.

Although the soft start/quick dump valve in the machine will drop the air supply to the manifolds when the main power is removed, the machine should also be pneumatically isolated by turning OFF the ball valve supplied on the back of the machine and locking the valve in the OFF position.

Always make sure the setup/run switch is in the SETUP position for maintenance operations that must be done with the power on. Never attempt any maintenance, setup, adjustment or cleaning operation with the switch in the RUN position.

Control Pendant

The pendant station houses the Operator Interface Terminal (OIT), the Setup/Run key selector switch, the Emergency Stop push button, the Cycle Start push button and the Control On illuminated push button.

Position the pendant station such that during operation, it can be reached comfortably. There are two swivel elbows which can be held in position by locking bolts. Tighten both bolts when the pendant station is positioned correctly.

Emergency Stop (E-Stop) push button

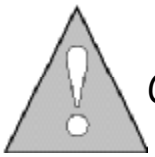
The E-Stop push button can be pressed at any time during the cycle. When it is activated, the Master Control Relay (MCR) drops out. This turns off all of the outputs from the programmable controller. The system will stop immediately.

The E-Stop push button also activates the Soft Start/Quick Dump air supply valve. This quickly empties the pressurized air from the pneumatic system and closes the machine air supply. The E-Stop push button can be reset by pulling out on the actuator.

Master Control Relay (MCR)

Virtually all of the system's functions are controlled through the MCR. It feeds the programmable controller outputs, the melt pot circuit and the Soft Start/Quick Dump air supply valve. The MCR is on when the Control On illuminated push button is illuminated.

To turn the MCR on, simply press the Control On illuminated push button. The E-Stop button must be pulled out for the MCR to be turned on. If the E-Stop is activated, the MCR is off. Therefore, the system cannot be operated and the melt pot will be turned off. However, if you have activated the E-Stop, resetting the E-Stop and turning the Control Power back on will automatically turn the melt pot back on (if in fact it was on prior to activating the E-Stop).



CAUTION!

The key for the Setup/Run the key selector switch should not be left in the switch. Only authorized personnel should have access to the key.

Setup/Run key selector switch

The Setup/Run key selector switch is used to select the system mode of operation.

In Setup mode, the system functions, (with the exception of the injection cylinder), can be operated manually. For example, the Cable Processor Module can be opened and closed, or the transfer unit can be moved left and right. The Setup mode is selected when performing maintenance procedures on the system. Turning the Setup/Run key selector switch from Run to Setup will automatically display the Setup Oph1 screen.

The Run mode must be selected to run production. Turning the Setup/Run key selector switch from Setup to Run will automatically display the Run Mode Option Menu screen.

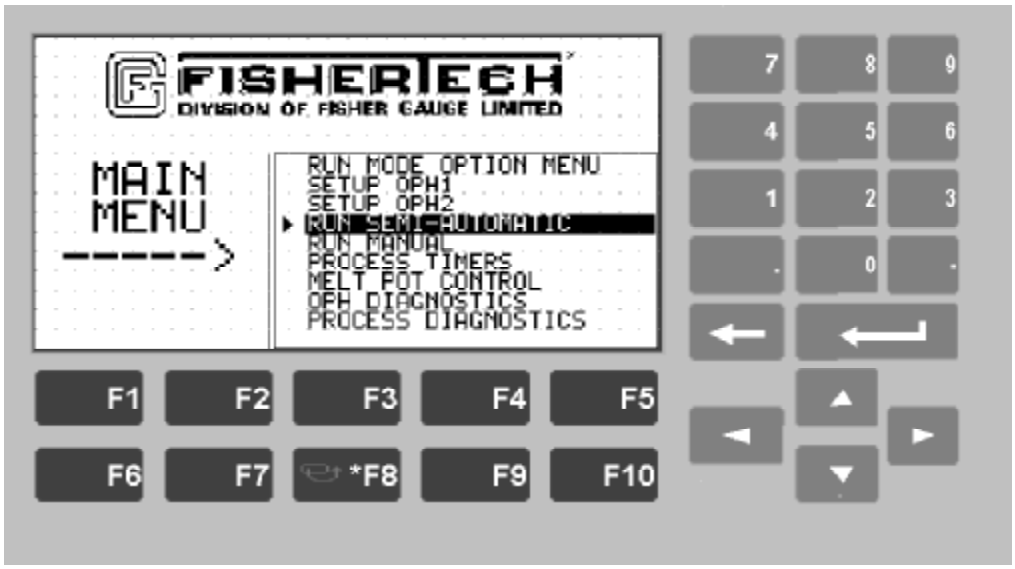
Operator Interface Terminal (OIT)

The Operator Interface Terminal (OIT) is a touch screen unit. Virtual push buttons, or icons, on the screen are used to actuate system functions, (in the Setup mode) or to convey messages to the operator, (in the Setup or Run modes). The Up/Down arrow keys and the Enter key are used to select screens.

Note: In the event that the screen "locks up" and displays a message that the "PLC has screen control", press the F8 button several times to clear the screen.

Refer to the Allen-Bradley Manual for a detailed description of the Operator Interface Terminal.

Main Menu screen



The Main Menu screen is displayed automatically when the main breaker is turned on. The Main Menu screen can also be selected from any of the other OIT screens.

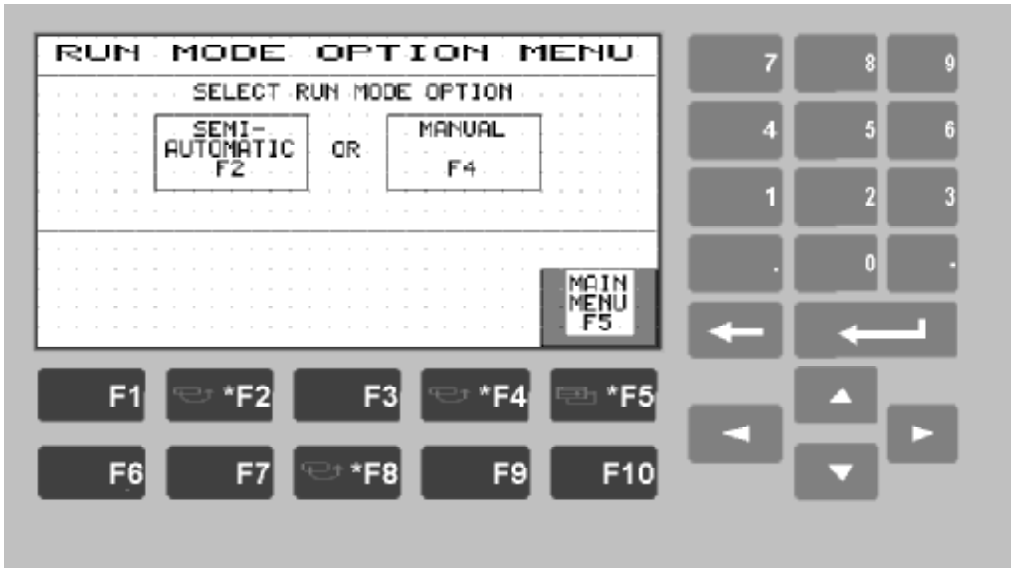
The Main Menu screen lists all of the control and feedback screens. Any screen can be selected from the Main Menu screen. The OIT configuration menu (Config Menu) and the machine information menu (Machine Info) can also be accessed from the Main Menu screen.

Use the Up/Down arrow keys and the Enter key to select a screen from the Main Menu screen.

Run Mode Option Menu screen

The Run Mode Option Menu screen is automatically displayed if the Setup/Run key selector switch is turned from Setup to Run. The Run Mode Option Menu screen can also be selected from the Main Menu screen.

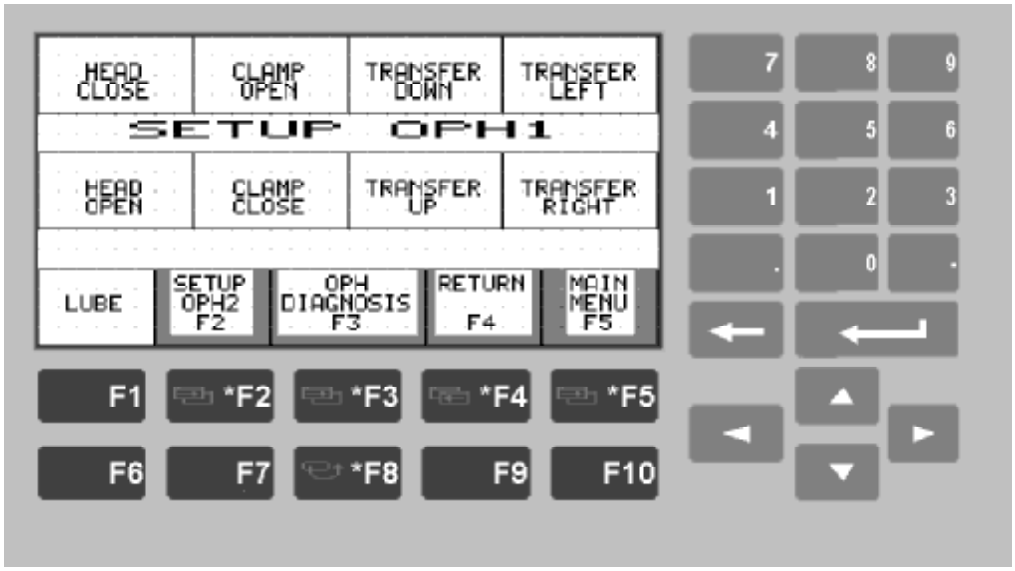
The Run Mode Option Menu offers two possible operating modes, Manual and Semi-automatic. To select, simply touch the icon for the desired mode. The OIT will automatically display the screen for the chosen mode.



Setup Oph1 screen

The Setup Oph1 screen is displayed automatically whenever the Setup/Run key selector switch is turned from Run to Setup. The Setup Oph1 screen can also be selected from the Main Menu screen, the Setup Oph2 screen or the Oph Diagnostics screen.

The Setup Oph1 screen is used when setting the stops on the transfer unit or the Cable Processor Module Closed proximity switch.



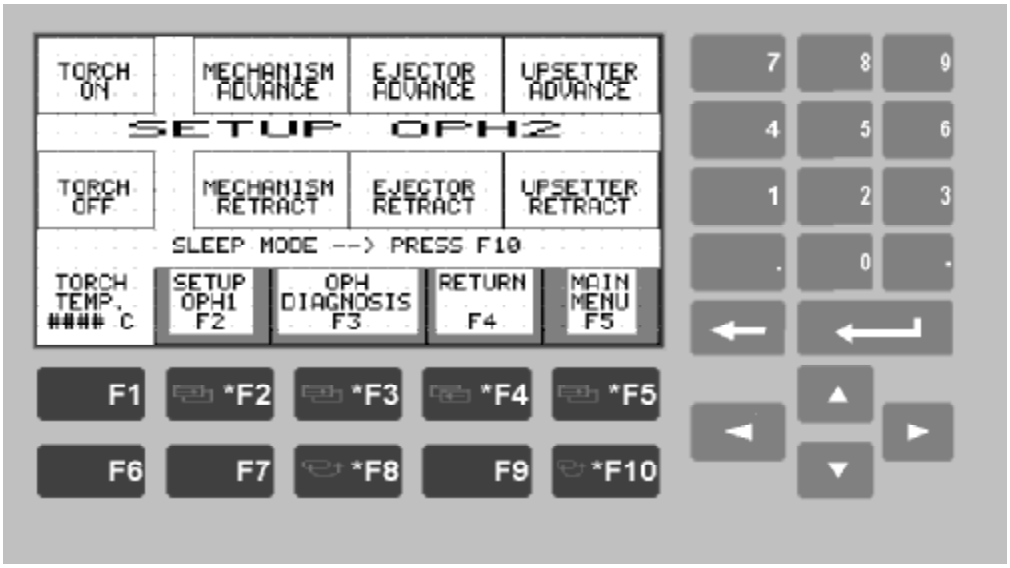
The Setup Oph1 screen has icons for:
Head Close
Head Open
Lube
Clamp Open
Clamp Close
Transfer Down
Transfer Up
Transfer Left
Transfer Right

The icons are active whenever the Setup/Run key selector switch is in the Setup position. The active state is highlighted.

The Up/Down arrow keys and the Enter key can be used to select the Main Menu screen, the Setup Oph2 screen, or the Oph Diagnostics screen from the Setup Oph1 screen.

Setup Oph2 screen

The Setup Oph2 screen can be selected from the Main Menu screen or from the Oph Diagnostics screen.



The Setup Oph2 screen has icons for:
Torch On
Torch Off
Mechanism Advance
Mechanism Retract
Ejector Advance
Ejector Retract
Upsetter Advance
Upsetter Retract.

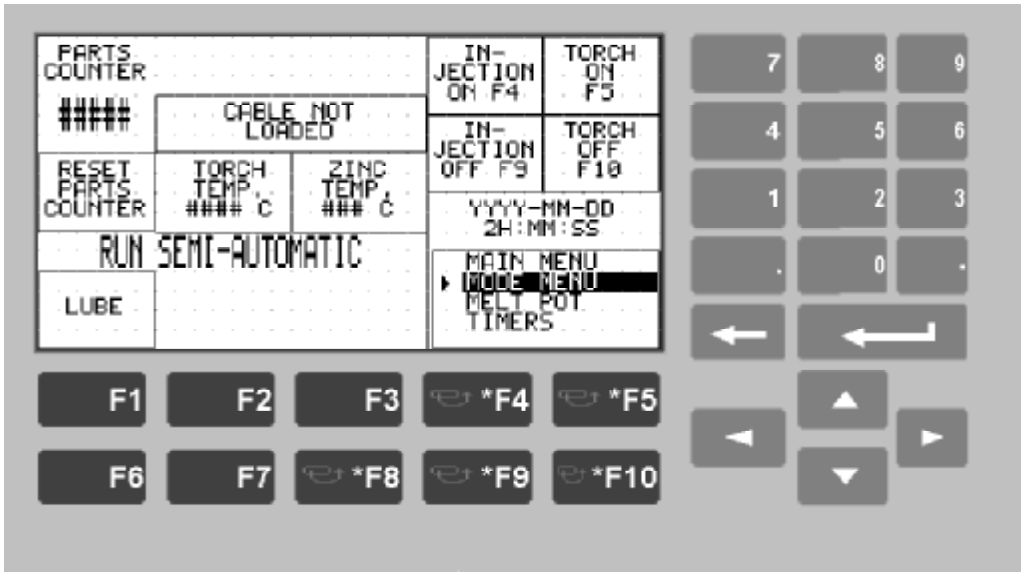
The icons are only operational when the Setup/Run key selector switch is in the Setup position. The active state is highlighted by reverse video.

The Main Menu screen, the Setup Oph1 screen and the Oph Diagnostics screen can be selected from the Setup Oph2 screen by using the Up/Down arrow keys and the Enter key.

Run Semi-automatic screen

The Run Semi-automatic screen is automatically displayed when the Semi-automatic mode is selected from the Mode Menu screen. The Run Semi-automatic screen can also be selected from the Main Menu screen, the Process Timers screen, the Process Diagnostics screen or the Melt Pot Control screen.

Note: Although the Run Semi-automatic screen can be selected from various other screens, displaying the Run Semi-automatic screen does not ensure that the Run Semi-automatic mode of operation has been selected. The run mode - either semi-automatic or manual - must be selected from the Run Mode Option Menu screen.



The Run Semi-automatic screen has icons for:
Torch On
Torch Off
Injection On
Injection Off
Lube.

Icons are also used to display the number of parts made, (including a reset for the counter), the status of the Cable Loaded proximity switch, the melt pot temperature and the status of the Transfer Arm Locked proximity switch.

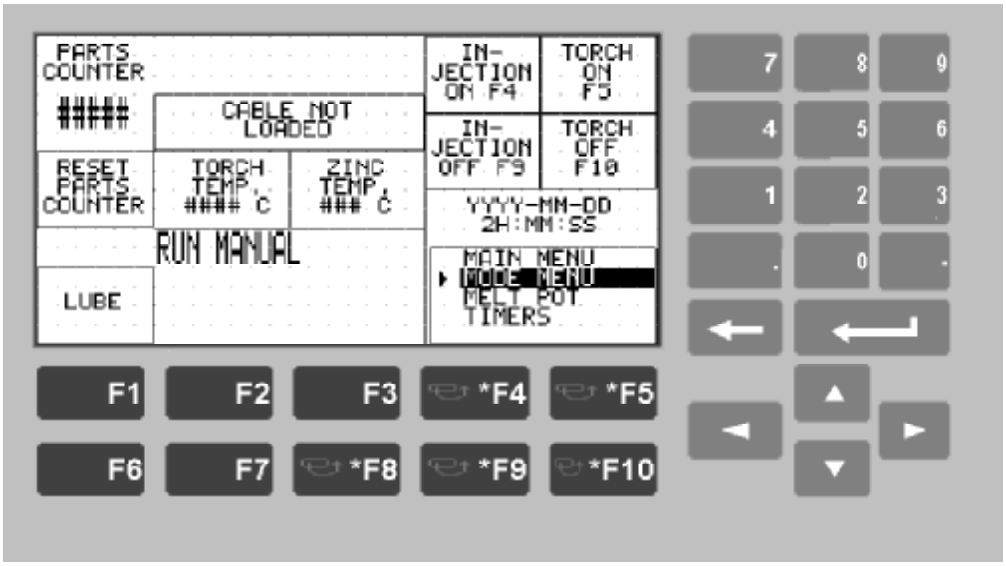
The Main Menu screen, the Mode Menu screen, the Melt Pot screen and the Process Timers screen can all be selected from the Run Semi-automatic screen.

Refer to Section F: Start-up and Operation for details on operating the system in Run Semi-automatic mode.

Run Manual screen

The Run Manual screen is automatically displayed when the Run Manual mode is selected from the Mode Menu screen. The Run Manual screen can also be selected from the Main Menu screen, the Process Timers screen, the Process Diagnostics screen or the Melt Pot Control screen.

Note: Although the Run Manual screen can be selected from various screens, displaying the Run Manual screen does not ensure that the Run Manual mode of operation has been selected. The run mode - either semi-automatic or manual - must be selected from the Run Mode Option Menu screen.



The Run Manual screen has icons for:
Torch On
Torch Off
Injection On
Injection Off
Lube.

Icons are also used to display the number of parts made, (including a reset for the counter), the status of the Cable Loaded proximity switch, the melt pot temperature and the status of the Transfer Arm Locked proximity switch.

The Run Manual mode is used to cast terminations on cable which have already been upset.

Upsetting a cable twice will create a large upset as well as shorten the overall length of the cable assembly. If the cable length tolerance will allow it, and the extra large upset will still

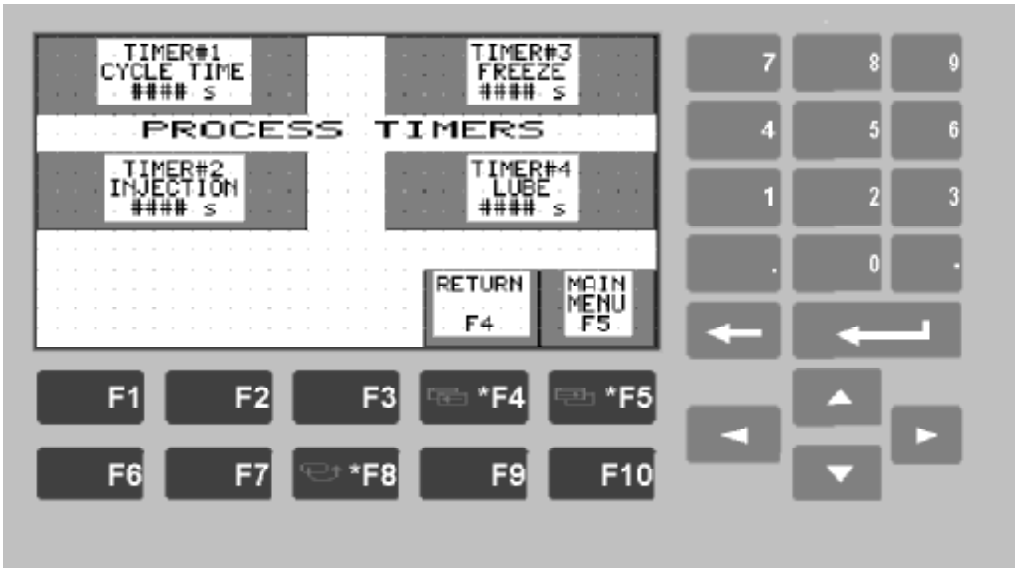
fit in the cavity tooling, previously upset cables can be cast in the Run Semi-automatic mode. However, if the cable length tolerance is tight, or the cable upset will not fit in the cavity tooling after being upset two times, the Run Manual mode must be used.

The Main Menu screen, the Mode Menu screen, the Melt Pot screen and the Process Timers screen can all be selected from the Run Manual screen.

Refer to Section F: Start-up and Operation for details on operating the system in Run Manual mode.

Process Timers screen

The Process Timers screen can be accessed through the Main Menu screen, the Run Semi-automatic screen or the Run Manual screen. Displaying the Process Timers screen will allow adjustment of any of the process timers.



Four process timers are adjustable:
Timer 1 - cycle time
Timer 2 - injection time
Timer 3 - freeze time
Timer 4 - lubrication time.

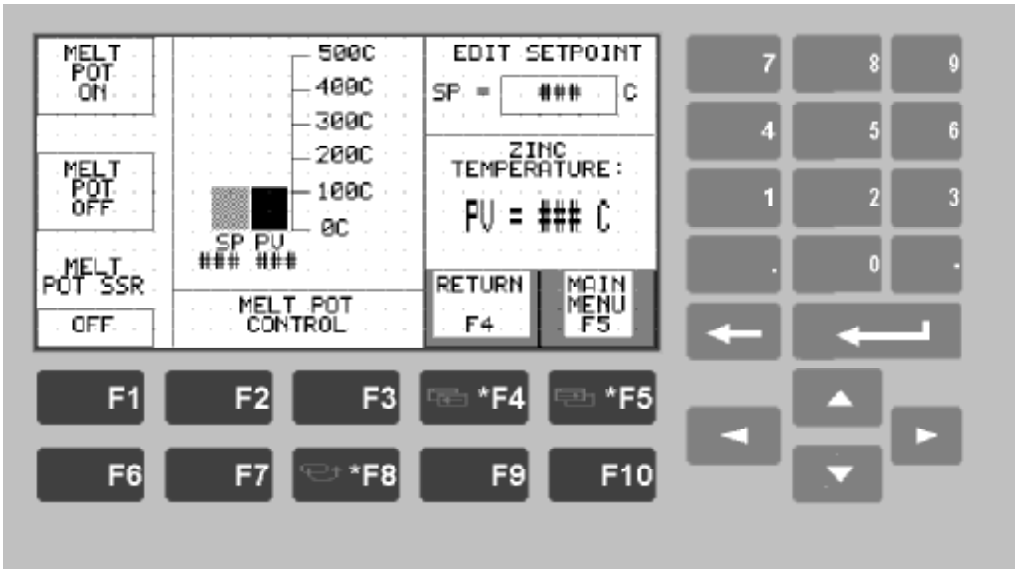
The timers are factory set and stored on the programmable controller EEPROM chip. These times are recorded on the Time and Pressure Setting Chart included with the machine. To adjust a timer, (for example if more lubrication of the tooling is needed, Timer 4 could be increased), simply touch the appropriate timer icon and the OIT will prompt you for the new time, (it will also display a range for which the particular timer can be adjusted). Enter the new value and press the Enter key.

Note: If the system main electrical breaker is turned off and then back on, the PLC automatically loads the program into memory from the EEPROM chip. Any changes made to the process timers will be lost and would have to be re-entered.

The Main Menu screen, the Run Semi-automatic screen and the Run Manual screen can all be selected from the Process Timers screen.

Melt Pot Control screen

The Melt Pot Control screen can be selected from the Main Menu screen, the Run Semi-automatic screen or the Run Manual screen.



The Melt Pot Control screen has icons for:
Melt Pot On
Melt Pot Off
Edit Setpoint.

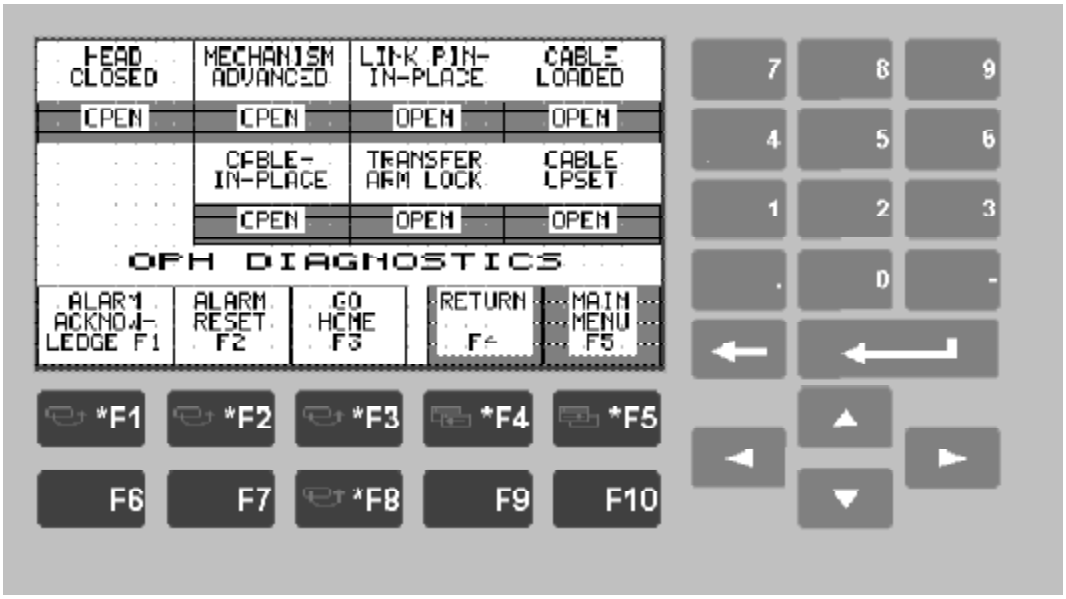
The melt pot temperature and the status of the melt pot solid state relay are also displayed.

To adjust the melt pot temperature set point, touch the Edit Setpoint icon. The screen will prompt you for the new set point. Enter the value and press the Enter key. The high melt pot temperature alarm and the low melt pot temperature alarm are automatically adjusted to changes in the melt pot temperature set point. The high temperature alarm is approximately 10° C (20° F) above the set point. The low temperature alarm is approximately 10° C (20° F) below the set point. In the event that the melt pot temperature goes above or below these alarm values, an alarm will be initiated and the system operation will be inhibited.

The melt pot cannot be turned on if the MCR is not on. The melt pot is turned off when the E-Stop push button is activated. Resetting the E-Stop and turning the Control Power back on will automatically turn the melt pot back on, (if the melt pot was on when the E-Stop was activated).

Oph Diagnostics screen

The Oph Diagnostics screen can be selected from the Main Menu screen, the Setup Oph1 screen or the Setup Oph2 screen. The Oph Diagnostics screen is automatically displayed when there is a problem with any of the seven switches displayed on the Oph Diagnostics screen.



The Oph Diagnostics screen has icons for:
Head Closed proximity switch
Mechanism Advanced limit switch
Cable-In-Place air pressure switch
Link Pin-In-Place proximity switch
Transfer Arm Lock proximity switch
Cable Loaded proximity switch
Cable Upset proximity switch.
These switch status icons can display a number of different status messages.

There are also icons for acknowledging alarms, resetting alarms and a Go Home icon.

When setting switches on the machine or Cable Processor Module, the Oph Diagnostics screen should be used in conjunction with either of the setup screens in order to check the status of a particular switch. For the purpose of setting switches, the icons will display an Open or a Closed status.

The switch icons will display alarms if there is any problem with a particular switch. A switch can fail and put the system into an alarm state in two ways. It can close and stick closed or it can fail to close:

Switches sticking closed

If a switch closes and does not open when it should, the Oph Diagnostics screen will be displayed automatically with a flashing Failure message under the icon for the problem switch, (for example, if the system suddenly stops cycling and the Oph Diagnostics screen displays a flashing Failure message under the Mechanism Advanced icon, the Mechanism Advanced switch did not open when it was supposed to. See Section G5: Troubleshooting for information on how to remedy this type of problem).

Any of the seven switches can fail in this matter and display the flashing Failure message. System cycling is always inhibited when a Failure message occurs. The Failure message must be acknowledged and reset by touching the Alarm Acknowledge icon and the Alarm Reset icon before production can continue. The problem switch would probably need to be looked at in the event that an alarm message occurs regularly. See Section G5: Troubleshooting for a detailed description of remedying problems with switches.

Switches failing to close

A switch can fail to close when it is supposed to. The Head Closed switch, the Mechanism Advanced switch and the Link Pin-In-Place switch will all display a flashing Trouble message if they do not close when they are supposed to.

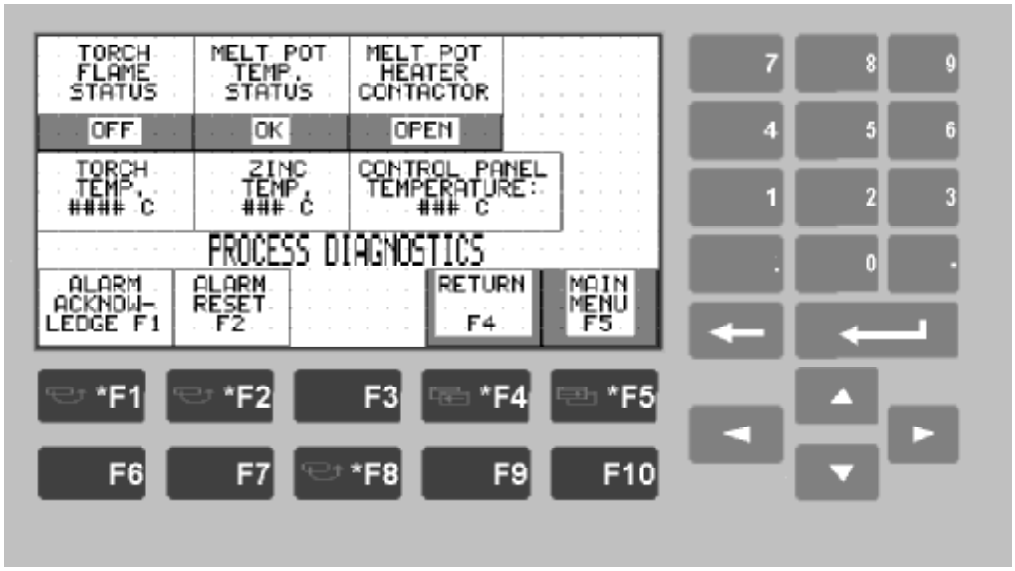
The most common Trouble message will be for the Head Closed switch. If debris or a wire strand prevents the Head Closed switch from closing, the system cycle will stop immediately. The Oph Diagnostics screen will be displayed automatically and there will be a flashing Trouble message under the Head Closed switch icon. In order to reset the system, the Trouble alarm message must be acknowledged, reset and the system put back in the home position. To do this, touch the Alarm Acknowledge icon, the Alarm Reset icon and the Go Home icon.

The Trouble alarm message for the Cable Upset switch and the Cable-In-Place switch works differently. In order to get a Trouble alarm message for either of these switches, the PLC must record four “missed” switch actuations. These four missed switch actuations do not have to occur in consecutive system cycles. As soon as the PLC records four missed actuations, the Oph Diagnostics screen will automatically be displayed and the Trouble message will be flashing under the problem switch, (for example, if the Cable Upset switch is set a little bit too “fine”, a properly upset cable may not close the switch. If this happens, the PLC increments a counter by one each time the switch is missed until it counts to four and then displays the Trouble message for the switch). As with the other alarms, the Trouble message must be acknowledged and reset in order for production to continue.

See Section G5: Troubleshooting for a detailed description of what to look for to prevent a Cable Upset Trouble message or a Cable-In-Place Trouble message. There are no Failure or Trouble alarms for the Cable Loaded or the Transfer Arm Lock switches.

Process Diagnostics screen

The Process Diagnostics screen can only be selected from the Main Menu screen.



The Process Diagnostics screen has icons for:
Torch Flame Status
Torch Temperature
Melt Pot Temperature Status
Alloy Temperature
Melt Pot Heater Contactor
Control Panel Temperature.

The Process Diagnostics screen is automatically displayed if there is a problem with any of these process parameters.

There are also icons to acknowledge and reset alarms messages.

The Melt Pot Heater Contactor icon displays an Open or Closed message.

ATTENTION!

If the system stops cycling during production because of a melt pot alarm, (either High Temp or Low Temp), it is possible to continue production by acknowledging and

resetting the alarm. The melt pot temperature should be monitored after such an alarm to ensure that the melt pot and temperature controller are functioning correctly.

The Melt Pot Status icon will display either an Ok message, a High Temp alarm or a Low Temp alarm. The Process Diagnostics screen will be displayed automatically and the system will stop cycling if either the melt pot High Temp or Low Temp alarms are initiated. The alarm must be acknowledged and reset in order for production to continue. The melt pot will likely need time to return to operating temperature if the Low Temp alarm is initiated.

The Torch Status icon displays an Ok message, an On message or a Failure message. In the event that the flame is extinguished during operation, the torch fails to light, or the flame temperature does not increase fast enough, the Torch Status icon will display a flashing Failure alarm. A Torch Status alarm will have to be acknowledged and reset for production to continue.

See Section G5: Troubleshooting for a detailed description of how to deal with Process Diagnostics alarms.

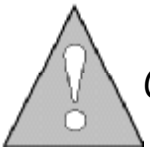
Injection plunger removal and installation

Occasionally, the injection plunger will have to be removed from or installed in the injection unit. For example, during the fill gap adjustment procedure, the plunger cleaning procedure, or if the melt pot is to be left on at operating temperature without injecting parts for more than 1½ to 2 hours.

The recommended procedures for removing and installing the injection plunger is as follows:

ATTENTION!

The plunger is made of stellite, which withstands compressive loads very well but is prone to break under torsional loads. During plunger removal and installation, twisting of the plunger should be avoided.



CAUTION!

The injection unit is hot. Wear protective clothing and gloves, and exercise caution when removing or installing the plunger. Always cover the nozzle with a ladle before working on the injection unit.

Removal of the injection plunger

1. Disconnect the injection lever from the injection cylinder clevis by removing the hitch pin clip and the clevis pin.

2. Swing the injection cylinder out of the way and push down on the end of the lever to partially remove the plunger from the injection unit.

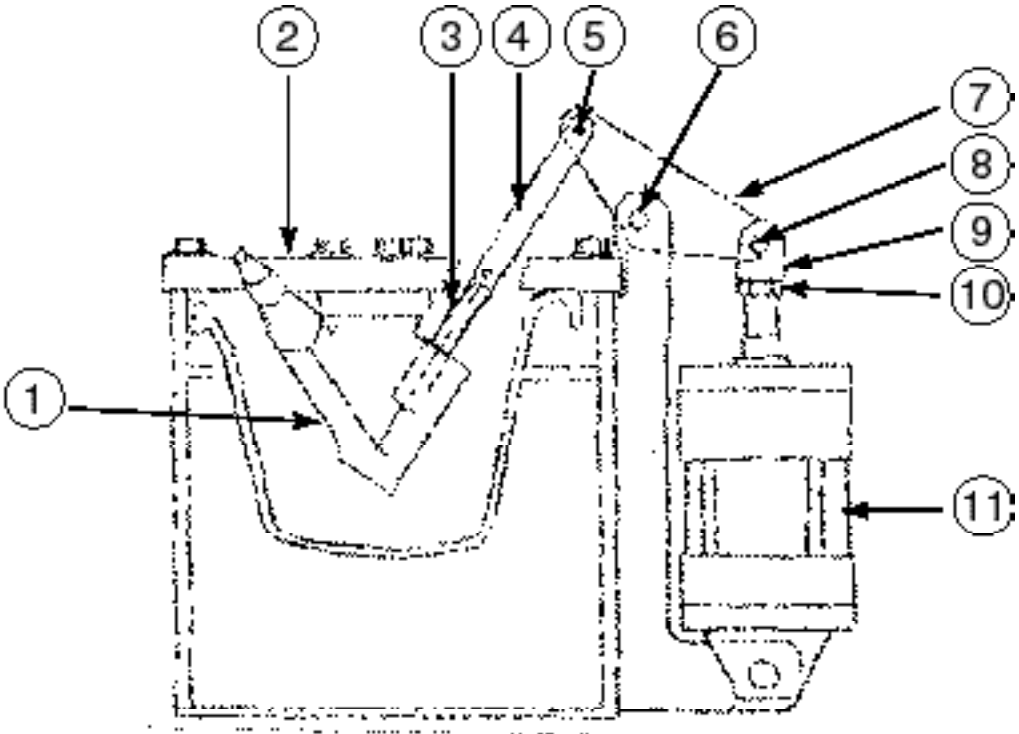
3. Remove the hitch pin clip and the lever pin which connect the lever to the top of the injection cylinder mounting bracket.

4. Remove the plunger from the gooseneck by gently pulling straight up on the lever.

Installation of the injection plunger

Safety precaution/tip

Close the Cable Processor Module and advance the moving mechanism onto the nozzle to prevent zinc from escaping if the plunger is inserted too far into the sleeve. Alternatively, cover the nozzle tip with an inverted ladle.



1. Gooseneck assembly
2. Y-bracket
3. Plunger
4. Link
5. Link pin
6. Lever pin
7. Lever
8. Clevis pin
9. Clevis
10. Locknut
11. Injection cylinder

1. Clean all the dross from the surface of the alloy, especially the area immediately above the gooseneck sleeve. Failure to follow this recommendation may result in dross being pushed into the gooseneck, plugging the gooseneck or causing the plunger to seize.

2. Immerse the plunger in the alloy in an area outside the gooseneck for approximately two minutes. This allows the plunger to heat up before being inserted into the gooseneck sleeve.

3. Insert the plunger in the gooseneck sleeve, using a minimum of twisting. Be careful not to advance the plunger past the fill gap.

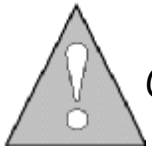
4. Install the lever pin which connects the lever to the top of the injection cylinder mounting bracket. Install the hitch pin clip.

5. Connect the injection lever to the injection cylinder clevis by installing the clevis pin and hitch pin clip.

Note: Applying high temperature lubricant to the lever pins will prevent them from wearing prematurely.

Injection plunger cleaning/injection sleeve reaming

If the injection plunger shows signs of seizing or sluggish operation, there may be a build-up of material on the surface of the plunger or the inside diameter of the gooseneck sleeve. If this is suspected, the plunger should be cleaned and the sleeve reamed using the following procedures:

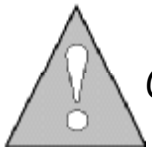


CAUTION!

The injection plunger is hot. Wear protective clothing and gloves, and exercise caution when cleaning the plunger.

To clean the injection plunger

1. Remove the plunger from the injection unit, following the instructions above, and immediately wipe the plunger with a cotton wiper to remove as much molten alloy as possible.



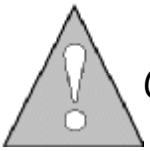
CAUTION!

Do not use a synthetic cloth wiper such as nylon, rayon or polyester. These materials will melt upon contact with the hot plunger.

2. Clamp the plunger in a bench-mounted vise. Wrap a piece of fine grit abrasive paper (200 grit) around a flat file and use this to "clean" the plunger. The flat file will prevent the abrasive paper from rounding off the sharp edges on the plunger. Continue cleaning the plunger until the entire diameter of the plunger is a shiny silver colour.

3. Remove the plunger from the vise and wipe the surface with the cotton wiper before installing the plunger in the injection unit following the instructions described earlier in this Section.

To ream the injection sleeve



CAUTION!

The injection unit is hot. Wear protective clothing and gloves, and exercise caution when reaming the injection sleeve. Always cover the nozzle with a ladle when working on the injection unit.

Safety precaution/tip

Close the Cable Processor Module and advance the moving mechanism onto the nozzle to prevent zinc from escaping if the plunger is inserted too far into the sleeve. Alternatively, cover the nozzle tip with an inverted ladle.

1. Remove the injection plunger following the instructions described earlier in this section.

2. Immerse the injection sleeve reamer, (supplied in the machine's tools and spares), in the alloy in an area outside the gooseneck. Allow the reamer to remain in this area for approximately two minutes so that it heats up before being inserted into the gooseneck sleeve.

3. Insert the reamer into the gooseneck sleeve, rotating the reamer clockwise as it is being inserted. This will scrape the build-up of material from the wall of the sleeve. Continue to insert the reamer while rotating until the reamer bottoms out in the gooseneck assembly.

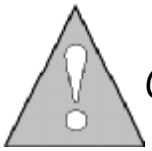
4. Remove the reamer from the sleeve using the same clockwise rotational motion.

5. Install the plunger in the injection unit following the instructions described earlier in this section.

Injection unit removal and installation

Occasionally, the injection unit will have to be removed or installed, such as during the replacement of a worn-out gooseneck assembly, or when the gooseneck assembly contains a broken plunger or nozzle.

The recommended procedures for removing and installing the injection unit are as follows:



CAUTION!

The injection unit is hot. Wear protective clothing and exercise caution when removing or installing the injection unit. Always cover the nozzle with a ladle when working on the injection unit.

Removal of the injection unit

1. Remove the plunger following the instructions described earlier in this section, and remove the nozzle following the instructions described later in this section.

2. Loosen the three ferry cap screws holding the gooseneck assembly to the Y-bracket.

3. Remove the three ferry cap screws holding the Y-bracket to the machine frame.

4. Remove the Y-bracket, with the gooseneck assembly attached, from the melt pot. Invert the gooseneck assembly to pour the molten alloy inside the gooseneck assembly back into the melt pot.

5. Remove the screws holding the gooseneck assembly to the Y-bracket and remove the gooseneck assembly.

Installation of the injection unit

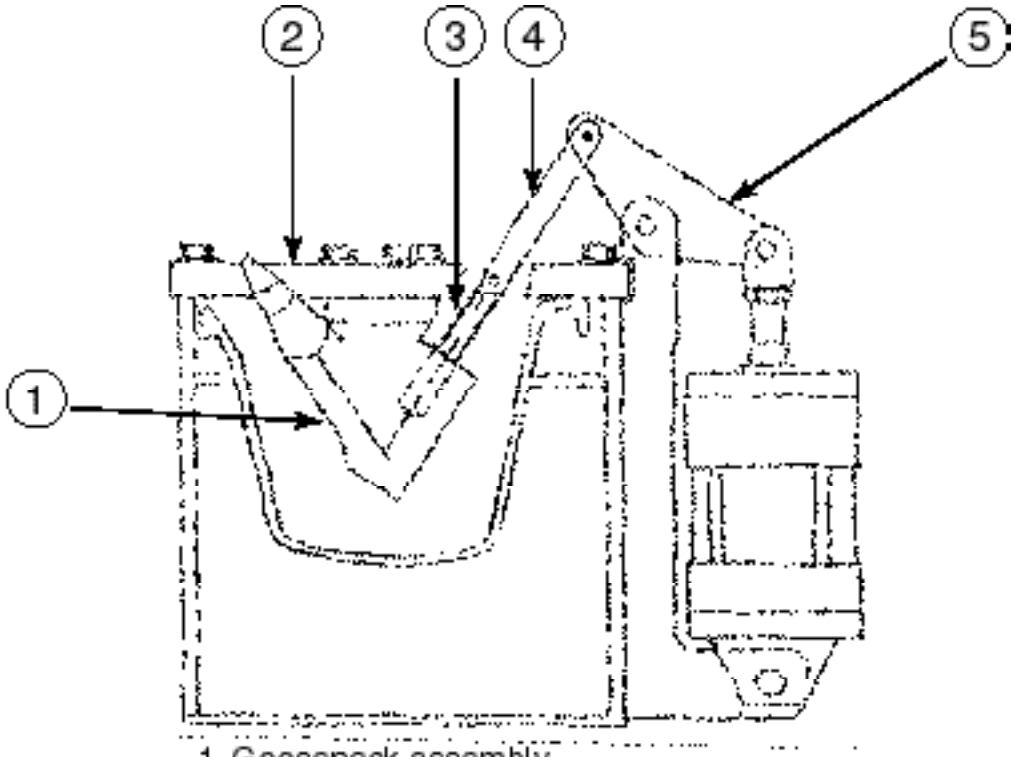
1. Install the gooseneck assembly on the Y-bracket, using the pins in the Y-bracket to orient the gooseneck assembly. Apply high temperature lubricant to the screw threads and fasten the gooseneck assembly to the Y-bracket. Do not tighten the screws at this point.

2. Immerse the gooseneck assembly in the molten alloy. The alloy in the melt pot will probably solidify before the Y-bracket is properly seated in the melt pot frame. Allow sufficient time for the melt pot to reach operating temperature prior to attempting to seat the Y-bracket on the melt pot frame. This can sometimes take up to 1/2 hour or more.

3. Seat the Y-bracket in the machine frame. Apply high temperature lubricant to the screw threads. Install and tighten the screws to securely fasten the Y-bracket to the machine frame.

4. Securely tighten the screws holding the gooseneck assembly to the Y-bracket.

5. Install the nozzle and the plunger in the injection unit following the instructions described in this section.

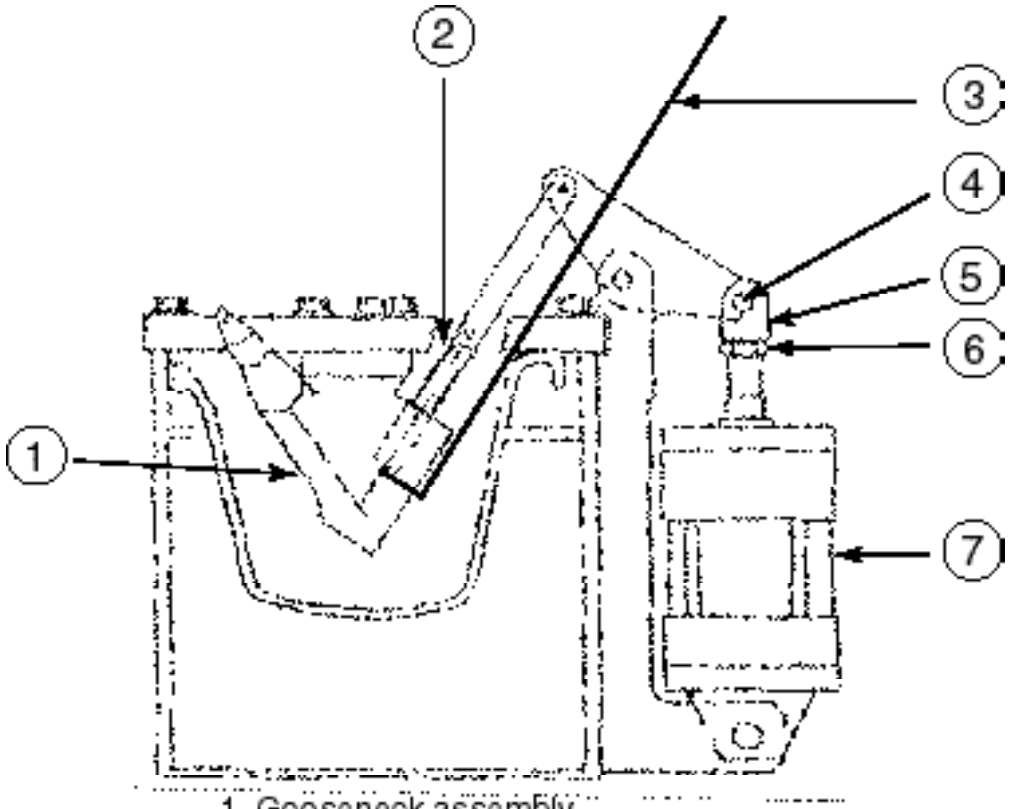


1. Gooseneck assembly
2. Y-bracket
3. Plunger
4. Link
5. Lever

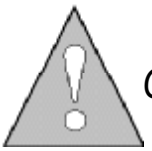
Fill gap adjustment

The fill gap should be reset whenever any part of the injection unit is changed or moved. If the injection unit fill gap is not set properly, the quality of the termination or the cast hub may be affected. A fill gap setting of 0.8 - 1.2 mm (.032 - .047 inch) is desirable. The alloy must be at operating temperature when the fill gap is being checked or reset.

The following steps outline the procedure recommended for resetting the fill gap.



1. Gooseneck assembly
2. Plunger
3. 0.8 mm-1.2 mm (.032 - .047 inch) wire
4. Clevis pin
5. Clevis
6. Locknut
7. Injection cylinder



CAUTION!

Whenever service is being done on the injection unit, cover the nozzle to prevent alloy from escaping from the injection unit during plunger removal and installation.

1. Remove the plunger from the injection unit and clean the plunger.

2. Remove all dross from the molten alloy surface.

3. Take a 25 cm (10 inch) length of 0.8 mm - 1.2 mm (.032 - .047 inches) diameter wire and bend it at a right angle approximately 25 mm (1 inch) from the end. Immerse the bent end of the wire into the molten alloy, running the front end of the wire down the outside of the gooseneck assembly until the wire enters the fill slot in the gooseneck.

4. Carefully install the injection plunger in the gooseneck assembly until the end of the plunger contacts the wire inserted through the fill slot. This establishes a fill gap setting equal to the diameter of the wire.

5. Loosen the locknut on the injection cylinder rod and adjust the clevis so that the hole in the clevis is aligned with the hole in the injection unit lever. Tighten the locknut to lock the clevis in position on the injection cylinder rod.

6. Raise the plunger slightly and remove the wire from the fill slot.

Note: The injection cylinder must be pressurized in the retracted position while adjusting the clevis. The MCR must be On and the Setup/Run key selector switch must be in the Run position for the cylinder to be retracted under pressure. Do not select a run mode from the Run Mode Option Menu. This will prevent the machine from cycling accidentally.

7. Carefully lower the plunger so that the hole in the clevis is aligned with the hole in the injection unit lever. Install the clevis pin in the holes to couple the lever to the clevis and install the hitch pin clip.

Note: Be sure to compensate for any wear in the linkage pins in the injection lever and clevis. The pins can wear sufficiently to allow the plunger to drop below the fill gap once the wire has been removed, thus closing off the fill gap. Replace severely worn pins and bushings. High temperature lubricant periodically applied to the pins will help to reduce wear.

Fitting the injection plunger to the sleeve

Systems are supplied with a clearance between the injection plunger and sleeve of:

- 0.013 – 0.020 mm, (.0005 - .0008 inch) for 3/4 inch diameter injection units.
- 0.018 - 0.028 mm, (.0007 - .0011 inch) for 1 inch diameter units.

This clearance is necessary for proper operation, but will increase during operation because of mechanical wear. Erosion caused by molten alloy leaking between the plunger and sleeve will also increase the clearance over time.

The following symptoms will occur when clearance has become excessive:

1. excessive plunger stroke during injection

2. partially filled or porous terminations

3. turbulence of the molten alloy in the area immediately over the plunger and sleeve.

When any of above symptoms occur, it is necessary to refurbish the injection unit to re-establish the correct clearance between the plunger and sleeve.

An injection unit requiring refurbishing should be shipped to Fishertech following the instructions for the Equipment Return Procedure described in Section A.

The injection drop-out timer

As soon as the injection is turned on from either the Run Manual screen or the Run Semi-automatic screen, an internal timer begins timing. The timer is reset to zero each time an injection takes place. If the timer reaches 90 seconds before an injection takes place, the injection will automatically turn off.

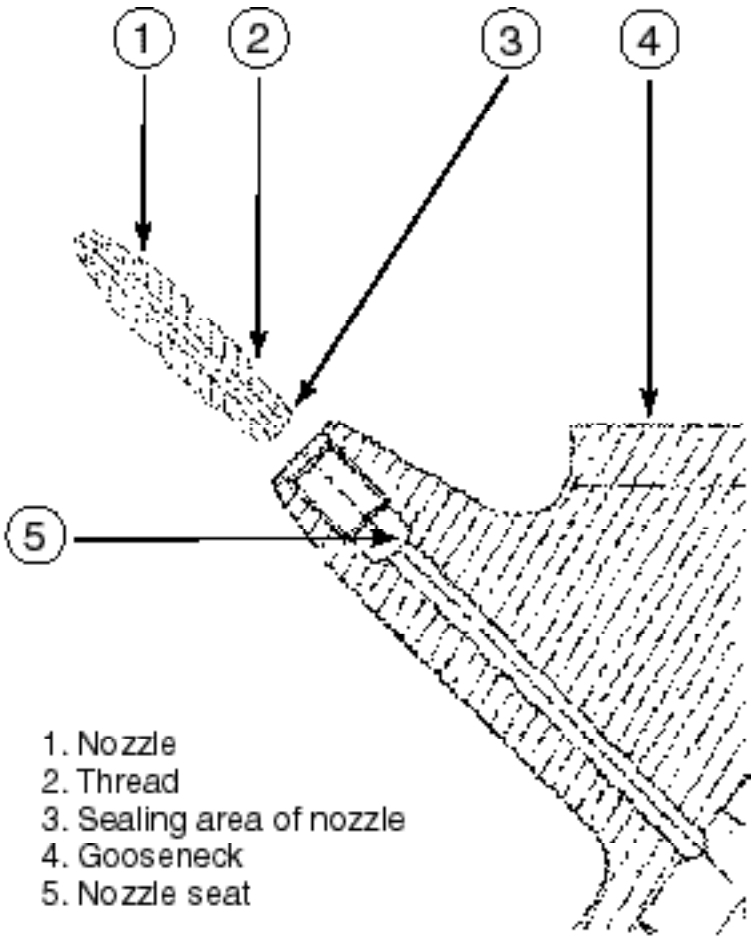
The injection accumulator

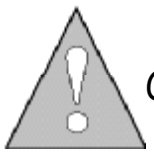
A pneumatic accumulator tank is piped into the injection pneumatic circuit. During the injection stroke, the tank supplements the pneumatic supply in delivering the required volume of pressurized air to the injection cylinder. A drain cock for the tank is located on the back of the pneumatic cabinet. The drain cock should be opened weekly, (or as required), to remove any accumulation of moisture from the tank.

Nozzle removal and replacement

Hint: Follow this procedure monthly whether the nozzle needs replacing or not, and when it does need to be replaced, it will be easier to remove.

To replace a worn or damaged nozzle, the alloy in the melt pot must be at operating temperature, and the machine control power must be turned off.





CAUTION!

The nozzle and surrounding area are hot. Wear appropriate

protective clothing and gloves, and exercise caution when replacing a nozzle.

1. Remove the existing nozzle using a 7/16 inch, (11 mm), box-end wrench. If the nozzle will not come out using the wrench, do not strike the wrench with a hammer or put an extension bar on the wrench. See below for instructions on how to remove a seized nozzle.

2. If the nozzle can be removed using the wrench, but was tight coming out, the threads in the gooseneck should be cleaned prior to installing a new nozzle.

3. After successfully removing the existing nozzle, clean the threaded hole using a 1/2-13 bottoming tap. Take care not to damage the nozzle seat in the gooseneck.

4. Place a small ladle over the end of the gooseneck and manually purge the injection unit. This will remove any debris left by the tap which could otherwise plug the new nozzle. Clean the 1/2-13 tap and clean the threaded hole again.

5. Apply high temperature lubricant to the threads and the nozzle seat end of the replacement nozzle.

6. Insert the replacement nozzle in the gooseneck and turn it in approximately 2-3 turns. Let the nozzle warm up for approximately 2-3 minutes.

7. Using the 7/16 inch, (11mm), box-end wrench, turn the nozzle into the gooseneck until it contacts the seat. Work the replacement nozzle back and forth a few times to seat the nozzle in the gooseneck. Use a torque wrench to torque the nozzle to 70 N-m (50 ft-lbs). Back off 1/2 turn and re-torque the nozzle to 35 N-m (25 ft-lbs).

ATTENTION!

Do not overtighten the nozzle as this will make it difficult to remove, possibly resulting in nozzle breakage.

If the nozzle cannot be removed with a standard 7/16 inch (11 mm) wrench, proceed as follows:

ATTENTION!

Never use an extension bar or a hammer on the wrench during nozzle removal or installation.

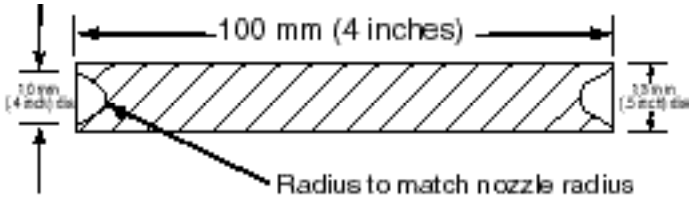
1. Using the ladle supplied with the equipment, remove sufficient alloy from the melt pot so that approximately 50 mm (2 inches) of the gooseneck is exposed. Scrape all foreign material from the exposed portion of the gooseneck.

2. Using an oxy-acetylene torch, heat the gooseneck near the nozzle to a dull red colour. Remove the nozzle using a 7/16 inch (11 mm) box end wrench.

3. Following installation of a replacement nozzle, purge the injection unit to remove the overheated alloy from the interior of the gooseneck. Discard this alloy once it has cooled.

Lapping the nozzle

If the nozzle is damaged during operation or set-up, it can often be lapped to repair the damage. A Fishertech nozzle lap is included with the machine. Diamond lapping compound should be used.



Nozzle lap

Heat the nozzle with the torch and wipe away any alloy from the end of the nozzle before lapping the nozzle. Put a small amount of diamond lapping compound in one end of the lap and work the lap back and forth on the nozzle. Check the nozzle periodically by wiping it clean of diamond compound. When the entire surface is clean, the lapping is complete.

One end of the lap should be kept new, to be used to “blue-out” the freshly lapped nozzle. Use toolmaker’s bluing compound applied on the unused end of the nozzle lap. Press this end onto the end of the nozzle. The nozzle should “blue-out” completely. If it does not, the lap, (lapping compound end) is worn and should not be used.

In this case, use the “bluing” end of the lap for lapping the nozzle and use a new lap for checking the nozzle radius.

Nozzle seat/nozzle tip alignment

The proper functioning of the system requires that the tool nozzle seat fits properly onto the nozzle tip. There must be no escape of molten alloy between the nozzle tip and the nozzle seat.

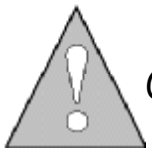
The system will function for long periods without adjustment if the nozzle tip and the nozzle seat are clean, in good condition and are correctly aligned with each other.

Alignment of the tool and nozzle is normally only required when:

1. The position of the nozzle tip is changed. This can happen for a number of reasons, such as changing the nozzle, changing the gooseneck, or removing and installing the injection unit.

2. The position of the nozzle seat is changed. This can happen when the fixed tool is changed.

The nozzle alignment procedure is simple, but must be properly understood and executed.



CAUTION!

Before commencing the nozzle alignment procedure, the following safety precautions should be taken:

1. ***Ensure that the MCR is turned off.***
2. ***Disconnect both pneumatic lines from the moving mechanism.***
3. ***Disconnect the electrical connector from the Moving Mechanism Advanced limit switch.***

Note:

- The melt pot should contain molten alloy not lower than 10 mm (.40 inches) from the top of the melt pot.

- The alloy should be at the correct operating temperature to create the proper conditions for a nozzle alignment.

- The fixed tool seat should be inspected to ensure it is clean and free from damage. The seat should be lapped if the seat appears to be worn or otherwise damaged.

- The nozzle should also be inspected to ensure it is clean and damage free. It should be replaced or lapped if it is damaged.

Nozzle alignment procedure

Note: The Cable Processor Module should be correctly installed on the moving mechanism.

1. Rotate the hand-wheel to the extreme counter-clockwise position to ensure the tool is retracted from the nozzle.

2. Loosen the two lower ferry cap screws and rotate the knurled knob clockwise as far as it will turn.

3. Look through the runner hole while rotating the hand-wheel gently clockwise to advance the Cable Processor Module/tool combination onto the nozzle. The tip of the nozzle will become visible through the runner hole.

Normally, the tool will rest on the nozzle and be very close to being correctly aligned. Such is the case if a nozzle alignment is being performed because a new nozzle was installed or the tooling was changed. A nozzle alignment is usually not required when changing tooling if inserted style tooling is being used.

4. Use a flashlight, if necessary, to see the tip of the nozzle through the runner passage.

5. The two jacking bolts should be touching the blocks on the moving mechanism. If not, adjust so they are supporting the operating head.

6. Loosen the two upper ferry cap screws (those hold the moving mechanism onto the machine ways).

7. Hold the tooling against the nozzle gently, but firmly, by maintaining clockwise pressure on the hand-wheel. At the same time, adjust the jacking bolts so that the tool seats itself on the nozzle. This will take some practice.

8. Once the nozzle appears to be seated correctly on the tool (use a flashlight in order to get a better view of the tip of the nozzle through the fixed tool), turn each jacking bolt so they no longer support the operating head - maintain constant clockwise pressure on the hand-wheel. The tool should rest right on the tip of the nozzle.

9. Now turn the jacking bolts up until they just touch and start to support the operating head. After the bolts just start to support operating head, turn both approximately 1/4 turn. Tighten the two upper ferry cap screws.

10. Maintain constant clockwise pressure on the hand wheel to hold the tool on the nozzle, and at the same time, turn the knurled knob counter-clockwise. Continue to rotate the knurled

knob until the red dot on the hand-wheel lines up with the green dot on the moving mechanism housing.

11. Tighten the lower ferry cap screws.

12. Check the locking pressure by rotating the hand-wheel clockwise to its extremity. Slight pressure should be felt as the hand-wheel "cams over".

13. Spray mold release on the nozzle and tool seat.

Checking nozzle alignment

1. Place a piece of tissue (doubling the tissue by folding it works best) between the nozzle and the tool, then rotate the hand-wheel to advance the tool onto the nozzle. Retract the Cable Processor Module and carefully remove the tissue.

2. Check the tissue for an even, circular impression.

If the tissue is torn or the impression appears "heavy" on one side (usually the impression will be heavier on the top - between the top of the nozzle and the top of the tool seat because of the weight of the Cable Processor Module), the alignment is not correct.

If the impression is good - a perfect circular impression - the nozzle alignment is complete. Reconnect the air lines and the Moving Mechanism Advanced limit switch electrical connector. The machine should be dry cycled several times to ensure proper system operation.

To correct a poor nozzle alignment, follow these steps

1. With the MCR off, turn the hand-wheel clockwise to advance the Cable Processor Module/tool combination onto the nozzle.

2. Loosen the two upper ferry cap screws, (the two that hold the moving mechanism onto the machine ways). Only loosen the screws enough for the moving mechanism to be able to move on the machine ways.

3. Adjust the jacking bolts to move the Cable Processor Module in the desired direction. If the tissue impression was heavy on the top, the Cable Processor Module would need to be adjusted up. Turning each jacking bolt clockwise slightly will lift the Cable Processor Module. The jacking bolts can also be used to move the Cable Processor Module left or right by adjusting one more than the other. Once the adjustment has been made, tighten the ferry cap screws and repeat the tissue test. Continue the adjustment until the impression left on the tissue is correct.

4. Reset the locking pressure as required after a good alignment has been achieved.

The nozzle heater

The nozzle heater keeps the nozzle at operating temperature during production, and must be on for the system to inject alloy. The nozzle heater flame can be adjusted by adjusting the gas and air needle valves attached to the nozzle heater mixing block which is mounted on the left side of the melt pot frame.

The black knob is the air. The yellow knob is the gas. The nozzle heater flame should be set so that a soft, blue flame envelops the nozzle. The flame should not separate from the end of the stainless steel tubes.

Spark Igniter and Flame Detector

The machine is equipped with an automatic igniter to light the nozzle heater. When the nozzle heater is turned on, the igniter is turned on. It remains on for 10 seconds and then shuts off. If a flame is detected by the flame detector thermocouple, the nozzle heater stays on. If the igniter did not light the nozzle heater, an alarm will be displayed on the OIT.

The igniter is fragile. If the igniter becomes covered in zinc, remove it and gently place the tip in to the melt pot. Gently tap the igniter against the side of the melt pot to remove the zinc from the igniter.

The nozzle heater can be lit manually if the igniter is damaged and there is no replacement available.

The flame detector ensures that the nozzle heater is on and remains on during production. When the nozzle heater is turned on, the flame detector must sense a preset temperature within 10 seconds or the nozzle heater gas and air are turned off and an alarm is initiated. If the preset temperature is reached within 10 seconds, the igniter shuts off and the flame detector senses a second preset flame temperature to be reached in another 10 seconds.

Again, if this second temperature is not reached, the nozzle heater gas and air are turned off and an alarm is initiated. Finally, if the second preset temperature is reached, the flame detector senses a preset operating temperature. During production, if the flame temperature drops below this operating temperature, production will be stopped and an alarm will be displayed. Such is the case if the flame is extinguished during operation.

The flame detector should be positioned such that it is touching the nozzle and directly in the flame when the nozzle heater is lit.

There is a built in timer which times how long the nozzle heater has been on. This timer is reset each time the injection is activated. If more than 90 seconds elapses before an injection takes place, (for example if the operator leaves the system to get more cable), the nozzle heater will shut off.

The Electric Nozzle Heater (if used)

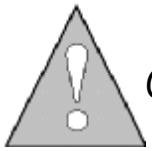
Turn the nozzle heater ON/OFF selector switch to ON. Allow the nozzle heater to reach the setpoint operating temperature [factory set at 930°F (500°C)] – recommended operating temperature range: 930°F to 1070°F (500°C to 575°C). The temperature controller for the electric nozzle heater is already set up and tuned. Refer to Section "J" for excerpts from the temperature controller manual showng how to view or change the factory setpoint.

N.B. While it is not **as** critical to turn off the electric nozzle heater during breaks and lunchtime, **it is still recommended practice.** 500° C is hot enough to cause accelerated corrosion of parts exposed to Zinc.

During production, **always** remove zinc flash from the nozzle and heater area immediately after it occurs in order to avoid corrosion of the components.

Melt pot removal and installation

Occasionally, the melt pot will have to be removed or installed, such as during the replacement of a heating element. The melt pot should be removed or installed only when the alloy is in a solid state. The recommended procedures for removing and installing the melt pot are as follows.



CAUTION!

The melt pot may be hot. Wear protective clothing and gloves, and exercise caution when removing/installing the melt pot.

WARNING!

To prevent personal injury or damage to the equipment, the system must be electrically isolated from the electrical supply. Only qualified personnel should perform these procedures.

Removal of the melt pot

1. Disconnect the injection unit lever from the injection cylinder clevis by removing the hitch pin clip and wrist pin. Swing the injection cylinder out of the way.

2. Disconnect the injection unit lever from the injection cylinder mounting bracket by removing the hitch clip and wrist pin.

3. Disconnect the Y-bracket from the melt pot frame by removing the three screws.

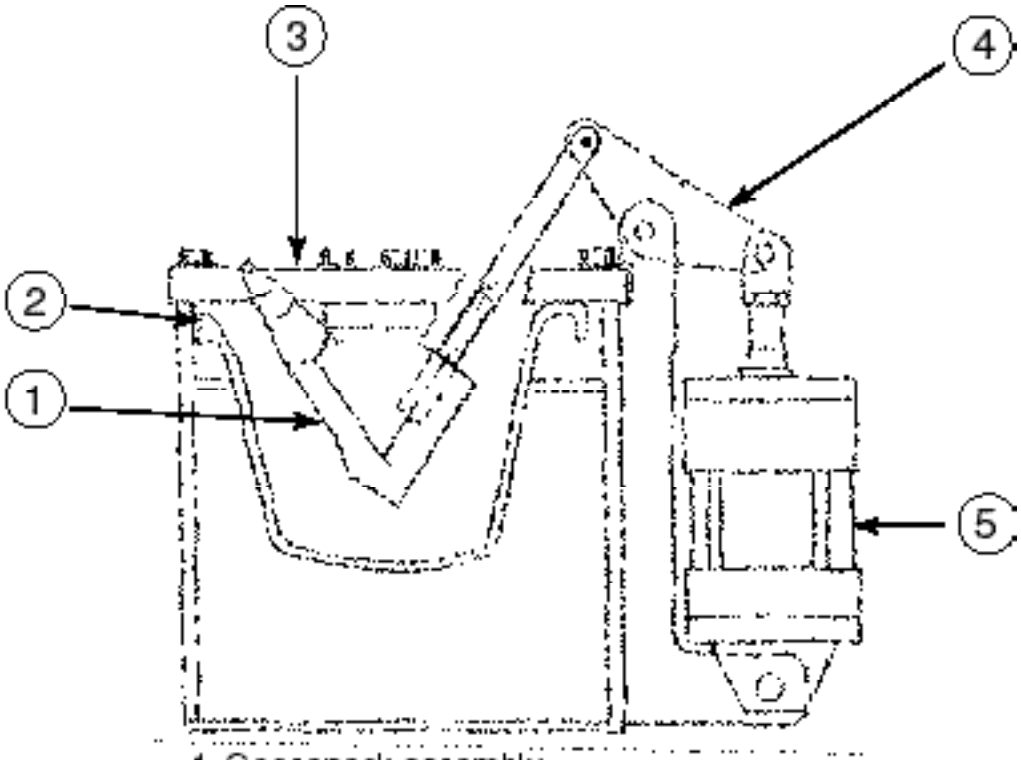
4. Remove the bottom cover from the melt pot frame exposing the electrical connections to the heating element.

5. Remove the electrical connections to the heating element and the ground connection to the clamp block.

6. With a suitable device, lift the melt pot assembly, (complete with solidified alloy, gooseneck assembly and Y-bracket), out of the melt pot frame.

Installation of the melt pot

1. With a suitable device, lower the melt pot assembly into the melt pot frame. If the gooseneck assembly and Y-bracket are solidified in the melt pot assembly, guide the Y-bracket into position while lowering the melt pot assembly. If the gooseneck assembly and Y-bracket are not solidified to the melt pot, install them after the alloy is once again molten, following the instructions for installation of the injection unit.



1. Gooseneck assembly
2. Melt pot
3. Y-bracket
4. Lever
5. Injection cylinder

2. Install the electrical connections to the heating element and the ground connection to the clamp block. Install the melt pot frame bottom cover to isolate these connections.

3. Apply high temperature lubricant to the screws and install the screws to secure the Y-bracket to the melt pot frame.

4. Reconnect the injection unit lever to the injection cylinder mounting bracket and the injection cylinder clevis. Install the hitch pin clips on both wrist pins.

5. When the alloy has reached operating temperature, tighten the screws securing the Y-bracket to the melt pot frame, the screws securing the gooseneck assembly to the Y-bracket and install the nozzle.

Note: Check the fill gap before proceeding.

Replacing the melt pot thermocouple

If the OIT displays a High Temp alarm on the Process Diagnostics screen and the melt pot is not over temperature, the thermocouple has probably failed.

To replace the thermocouple, slide the old unit out of the protector tube and remove the two pin connector from the end. Install the two-pin connector to the new thermocouple: on a J-type thermocouple, the red wire is negative, the white wire is positive. Push the new thermocouple into the protector tube, making sure it is pushed all the way into the protector tube. Plug in the connector.

Heating element replacement

If the alloy does not reach operating temperature, a likely cause is a failed melt pot heating element.

Voltage, current and resistance checks can be easily performed to confirm the failure of the heating element. The alloy in the melt pot should usually reach operating temperature within approximately 1½ hours of turning on the system. If it takes much longer than this, there are a number of things which should be checked.

1. Voltage input – Is the machine actually receiving the correct voltage (240 volts in North America, 230 volts elsewhere)? Depending on other usage in the plant or the distance of the system from the transformer, power could be less than 200 volts. Under these conditions, it could take 2½ hours or more for the alloy to reach operating temperature.

2. Electrical Current – When the melt pot is turned on, have qualified maintenance personnel check to verify that electrical current is flowing through the heating element.

3. Resistance – With the wires unhooked from the element, check for continuity between the core and the jacket of the melt pot heating element. If the element is functioning properly, there should be infinite resistance.

4. Thermocouple – A faulty thermocouple in the melt pot will give a false reading to the Temperature Controller.

5. Temperature Controller – If, after checking the settings, the Temperature Controller could be faulty.

The following steps outline the procedure recommended by Fishertech for replacing heating elements.

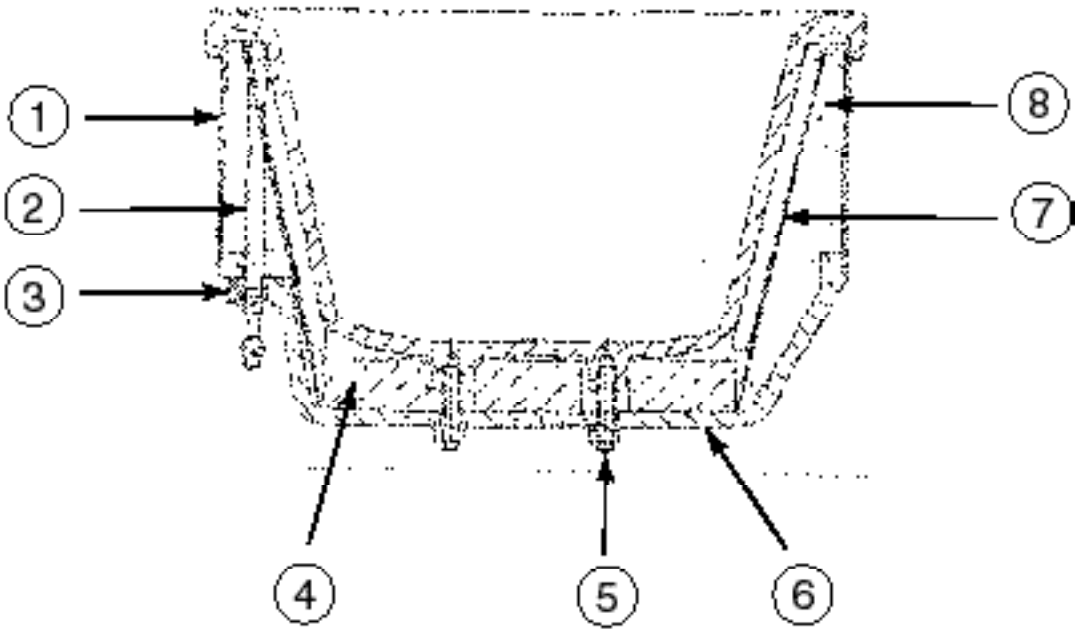
WARNING!

To prevent personal injury or damage to the equipment, the system must be electrically isolated from the electrical supply. Only qualified personnel should perform these procedures.

1. After removing the melt pot assembly from the melt pot frame, place it on a bench with the bottom plate facing up.

2. Remove the nuts and washers from the studs.

3. Remove the clamp block securing the element to the bottom plate.



1. Wrapper plate
2. Element
3. Clamp block
4. Retaining plate
5. Stud
6. Bottom plate
7. Clamping cone
8. Insulation

4. Invert the melt pot assembly and remove the melt pot. The studs may have to be tapped on the bench to loosen the melt pot from the wrapper plate.

5. Remove the heating element.

6. To eliminate moisture that may have accumulated in the insulation between the core and the jacket of the heating element, dry it out in a 120°C (250°F) oven for 3 hours.

7. Install the new element.

8. Check to ensure that all insulation is contained between the wrapper plate and reflector cone. Remove any insulation that is evident in the space near the element.

9. Replace the melt pot, guiding the studs into the holes in the bottom plate. Press the melt pot firmly into the wrapper plate.

10. Invert the melt pot assembly. Replace the washers and nuts on the studs and tighten the nuts.

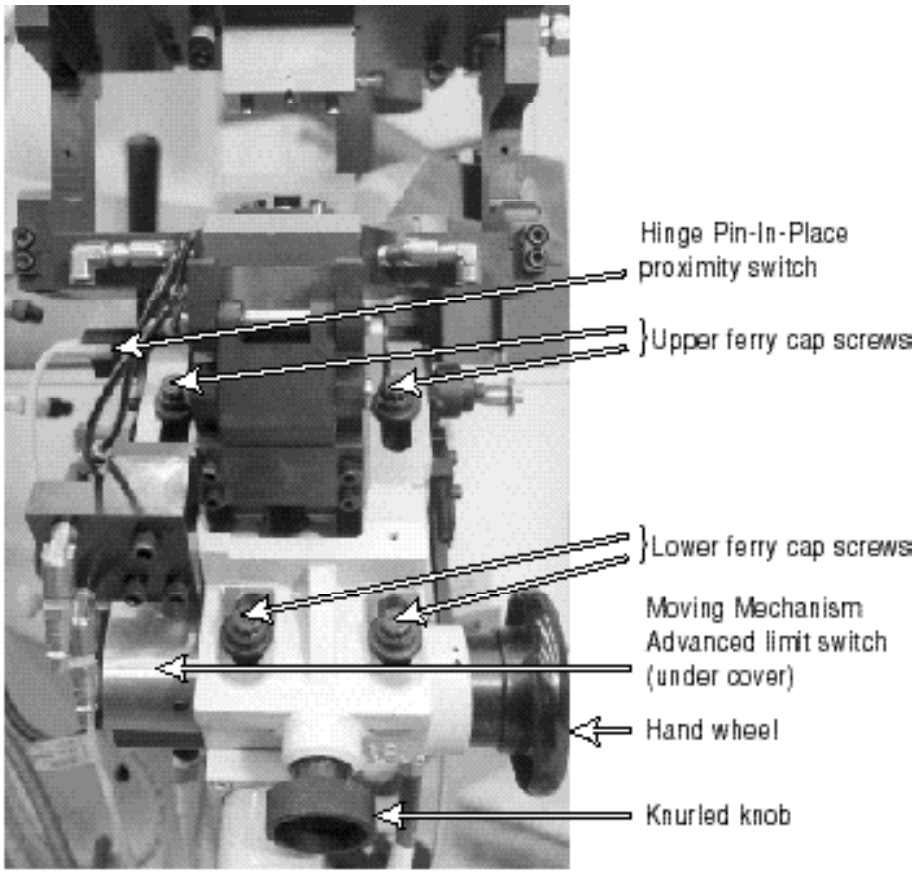
11. Replace the clamp block, securely fastening it to the bottom plate.

12. Install the melt pot assembly in the machine pot frame following the instructions described earlier in this section.

The moving mechanism and limit switch

The moving mechanism

The moving mechanism moves the Cable Processor Module/tool combination on and off the injection nozzle. Pneumatically operated, it has flow controls for both the advance and retract motion. The flow controls are factory set, but can be adjusted if necessary. Motion is controlled by regulating the flow of air out of the cylinder.



To adjust the advance motion, the flow control on the retract (the air line and fitting with the green markings), should be adjusted.

To adjust the retract motion, adjust the flow control on the advance (white) side of the cylinder.

The advance and retract motion of the moving mechanism, as it moves the Cable Processor Module/tooling combination on and off the nozzle, should be smooth - not fast. Excessive advance speed can lead to tooling damage and broken nozzles.

The limit switch

A limit switch, mounted on the left side of the moving mechanism, closes when the moving mechanism has advanced fully. The switch is factory set and is not adjustable, and the limit switch actuator is guarded.

1. The guard should be removed periodically to inspect the actuating lever and to remove any debris which may have accumulated under the guarding.

Note: The guard should always be replaced after the work has been completed.

2. The limit switch operation can be checked by advancing the moving mechanism in Setup mode from the Setup Oph2 screen and then checking the status of the switch by displaying the Oph Diagnostics screen.

If the Moving Mechanism Advanced limit switch fails to close during a cycle, the cycle will stop. The Oph Diagnostics screen will automatically display a flashing Trouble message under the Mechanism Advanced icon. The alarm must be acknowledged, reset and the Cable Processor Module sent "home" before the system can be cycled again.

A second switch, (proximity style), is mounted on the moving mechanism and senses the toggle arm pin. If the pin is not correctly installed, (left out by mistake), the system cycle will stop. The Oph Diagnostics screen will automatically display a flashing Trouble message under the Link Pin-In-Place icon. The alarm must be acknowledged, reset and the Cable Processor Module sent "home" before the system can be cycled again.

See Section G5: Troubleshooting for information on the alarms which can be caused by the Moving Mechanism Advanced switch or the Hinge Pin-In-Place switch.

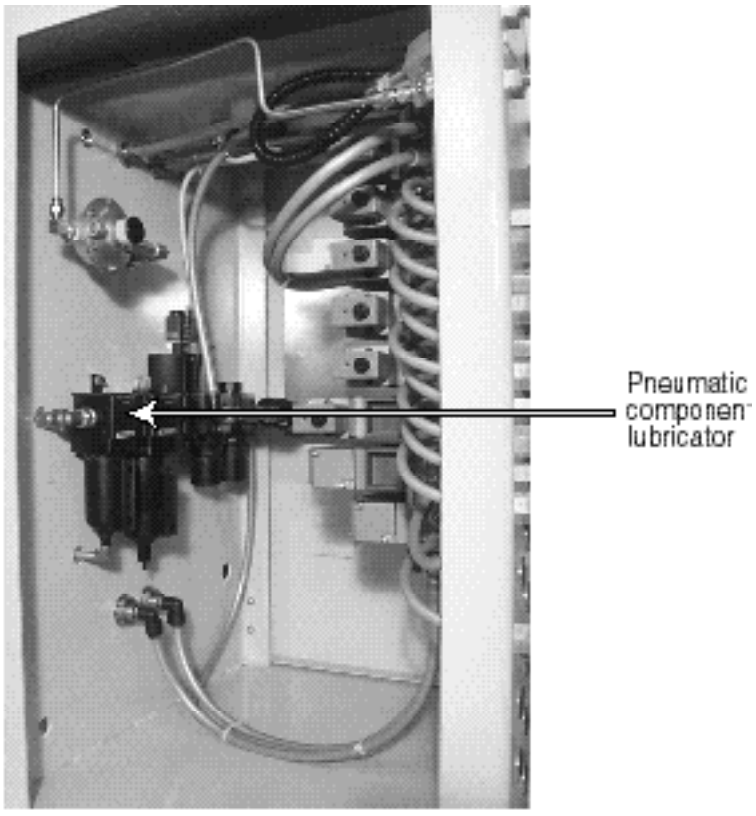
Pneumatic component lubricator adjustment

The pneumatic lubricator should be checked regularly and oil should be added as required.

The oil can be added through the fitting on the top of the oiler or, if the air supply is shut off at the back of the machine, the container can be removed from the lubricator for filling. The volume of oil can be adjusted by turning the adjusting screw on top of the lubricator. See Section J: Vendor Supplied Specifications and Maintenance Bulletins for detailed instructions on the pneumatic lubricator.

The pneumatic components lubricator is set at Fishertech prior to shipment.

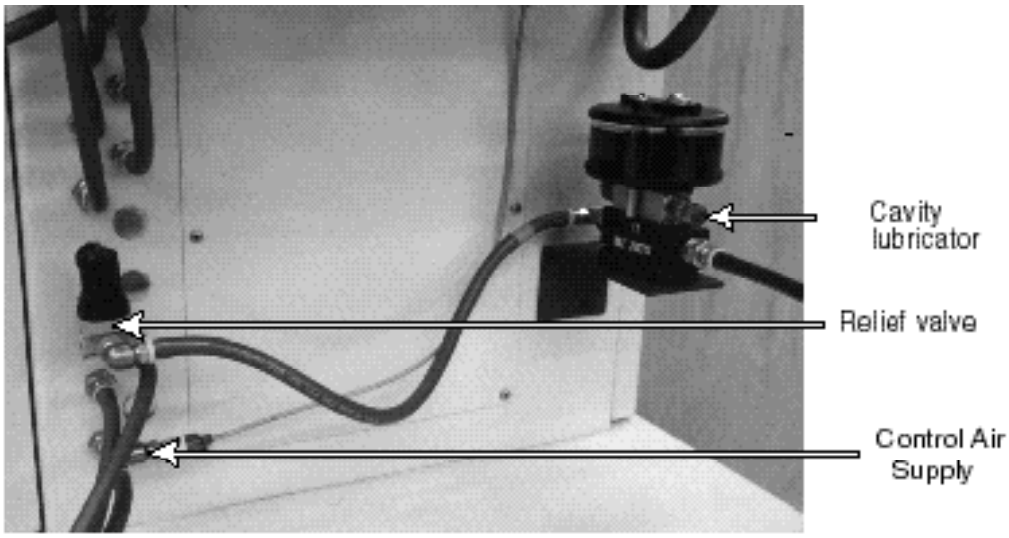
If the lubricator appears to be using an excessive amount of lubricant, the oiler should be adjusted by turning the knob on the top of the lubricator to control the amount of lubricant. Turning the knob clockwise will reduce the amount of oil. Turning the knob counter-clockwise will increase the amount of oil.



Cavity lubricator - setup and adjustment

A positive feed lubricator is used to lubricate the tooling. A detailed instruction sheet can be found in Section J: Vendor Supplied Specifications and Maintenance Bulletins. Refer to this instruction sheet for a detailed description of how the lubricator works and how to overhaul the unit.

The lubricator operates at machine line pressure. Air is supplied to the lubricator via a two position valve.



There are two adjustments that can be made to the lubrication system. The lubricator itself has an adjustment on it, or the lubrication timer can be adjusted.

1. Turn the adjusting knob clockwise for more lubricant and counter-clockwise for less lubricant.

2. The lubrication time can be adjusted from the Process Timers screen. Increasing the lubrication time may improve the distribution of the lubricant on the tooling. Decreasing the lubrication time may also alter the distribution of the lubricant.

Relief valve

The relief valve ensures that the cavity lubricator is not affected by any transient fluctuations in the pneumatic supply.

Air should pass through the cavity lubricator circuit only when the lubricator valve is energized. If air is passing through the cavity lubricator at any other time, the relief valve may need to be adjusted. Turn the adjusting knob clockwise to increase the relief valve setting.

The pneumatic filter

The pneumatic filter should be drained weekly (or more often, if required) and cleaned as necessary. The filter bowl drains automatically when the air supply to the machine is turned off.

See Section J: Vendor Supplied Specifications and Maintenance Bulletins for complete service instructions for the pneumatic filter.

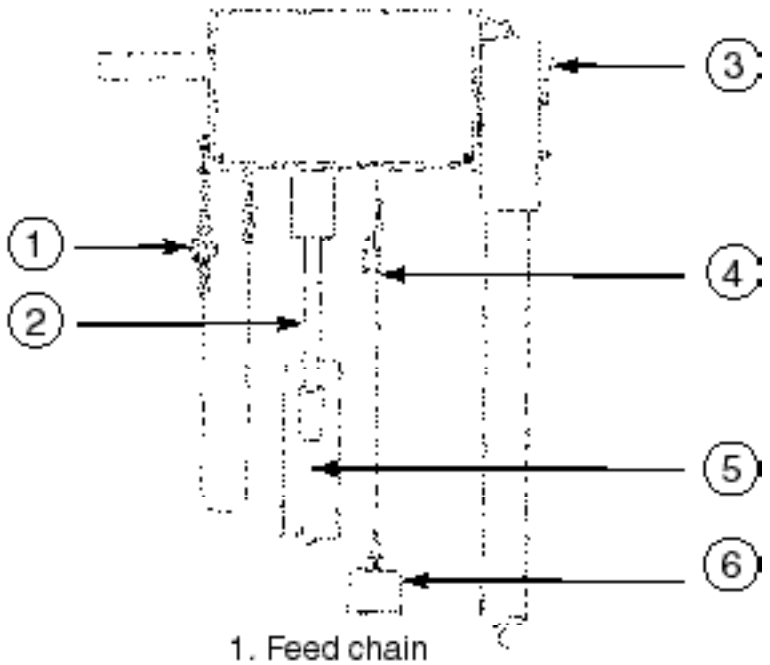
Quick Dump/Soft Start air supply valve

The machine is equipped with a Quick Dump/Soft Start air supply valve. The valve stops air flow to the machine and exhausts air when the E-Stop illuminated push button is depressed. The valve is reset (activated) when the machine control power is turned on. The air supply pressure builds slowly when the valve is reset.

Complete operating and maintenance instructions for the Quick Dump/Soft Start air supply valve can be found in Section J: Vendor Supplied Specifications and Maintenance Bulletins.

Ingot feeder setup and adjustments (if used)

Fishertech's Margash Ingot Feeder automatically controls the melt pot level when installed on Fishertech Injected Metal Assembly equipment. The feeder is a stand-alone unit and requires only an air source for operation. The air source for the ingot feeder is the same supply for the Cable-In-Place switch.



1. Feed chain
2. Hook
3. Upper support
4. Float chain
5. Alloy ingot
6. Float

Melt pot level adjustment

The melt pot level is set by adjusting the length of the float chain. Decreasing the length of the chain will increase the alloy level in the melt pot. Increasing the length of the chain will lower the alloy level in the melt pot.

Maintaining the melt pot level

The ingot feeder requires very little adjustment. The melt pot should be kept free from dross for the float to work properly. The melt pot level can be adjusted by changing the length of the chain attached to the float. To lower the level, make the chain a link or two longer. To raise the pot level, shorten the chain by a link or two.

To Adjust the Flow Control Valves

Periodically check that the two Flow Control Valves are not plugged. Clean and replace the valves, adjusting each one approximately one half-turn counter clockwise. Activate the unit and adjust the Flow Control Valves so that the cylinder makes one complete cycle in about 1-2 seconds.