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# SECTION F: START UP AND OPERATION

## The operating sequence

The sequence of equipment operation is controlled by the Programmable Logic Controller and can be seen on the sequence chart located in the drawing folder in Section K: Machine Reference Drawings. This should be used in conjunction with the machine's electrical connection diagrams to obtain a complete understanding of the operating sequence.



***The programmed operating sequence incorporates features which provide for the safe operation of the system.***

***Under no circumstances should the program be altered or changed in any way. The program has been written to maximize efficiency of the equipment and safety of the operator.***

***Altering the program in even the smallest manner could jeopardize the efficiency and safety of the equipment.***

***Fisher Gauge Limited cannot accept responsibility for damage or injury resulting from changes to the programmed operating sequence.***

## System cycling

In order to cycle the machine, the control power (MCR) must be on, and the Setup/Run key selector switch must be in the run position. The swing out transfer arm must be in and locked.

The “at rest” or “home” state for the Cable Processor Module has the transfer unit in the right and up position. The cable upsetter is retracted, the moving mechanism is retracted, the main slide is up or retracted, and the ejector is retracted.

The cycle is started by loading a cable into the cable upsetter and pushing it back against the anvil. This action moves the anvil approximately 0.5 mm (.020 inch) and actuates the Cable Loaded proximity switch.

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1. When the Cable Loaded proximity switch closes, several actions take place simultaneously. The upsetter advances, gripping and upsetting the cable, the main slide closes, (closing the Cable Processor Module Closed switch) and the transfer arm lowers.
  2. After a factory set time, the transfer unit grippers open and the transfer unit moves to the left. The Cycle Time timer also starts at this point. This is Timer 1 on the Process Timers screen, (see Section G1: Machine Maintenance). When the Cycle Time is complete, the transfer arm grippers advance, gripping the cables in the cable upsetter and in the cavity tooling. At the same time, the Cable Processor Module advances onto the nozzle. The programmable controller is also scanning for the Cable-In-Place switch to be closed and if an upset cable has been sensed.
  3. When the Moving Mechanism Advanced limit switch has closed, the injection plunger starts to advance and the second timer on the Process Timers screen, the Injection Time starts. (The first cycle of a shift will not produce a termination. There will be no cable in the cavity, and therefore, the Cable-In-Place switch will not be closed. Only on the next cycle will a cable be in position to cast a termination. The Upset Sensor proximity switch must close during the cycle, and the Cable-In-Place switch must close and stay closed for an injection to take place.)
  4. When the Injection Time timer has timed out, the plunger retracts and a third timer starts to time. This is the delay before the moving mechanism retracts, or Freeze Time on the Process Timers screen. When this timer times out, the moving mechanism retracts and the main slide opens. Then the ejector advances and the transfer arm lift advances, (moves up). A fourth timer now starts to time, and the transfer unit moves to the right. This is the Lubrication Time on the Process Timers screen. After the Lubrication Time timer has timed out, the ejectors retract and the cycle is complete.

The entire cycle only takes a few seconds, and the above sequence of events is very difficult to follow through one complete cycle.

The machine and operator should be ready to operate at the beginning of each shift. The melt pot should be at operating temperature, and the operator should be wearing all of the protective attire outlined in the Personal protective attire and devices section (See Preface).

The melt pot should be turned on approximately two hours prior to the start of production. The melt pot time switch accomplishes this task. See the Section G1: Machine Maintenance for instructions on how to operate the melt pot time switch. The MCR must be on for the melt pot to be on.

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## Dry cycle

At the beginning of a shift or after any maintenance, it is good practice to cycle the system without injecting any alloy. This is called a “dry cycle”. During the dry cycle, the system will cycle exactly as it does when alloy is being injected, it just leaves the alloy injection part of the cycle out. Proceed as follows to dry cycle the system:

1. Turn the Setup/Run key selector switch to the run position. The Run Mode Option Menu screen will automatically be displayed on the OIT. Select Automatic mode. The Run Semi-automatic screen will be displayed. As this will be a dry cycle, the injection and the nozzle heater do not have to be turned on. Notice that the Run Semi-automatic screen also has icons for lube, a parts counter with reset and the Cable Loaded switch status.
2. Load a cable into the cable upsetter. Once the Cable Loaded proximity switch closes, the system will automatically proceed through a cycle. Cycle the system several times by loading more cable. This will ensure the equipment is cycling correctly.
3. Begin production following the instructions in the Production sections, which follow.

## Production cycle, Run Semi-automatic mode

After completing a number of dry cycles to ensure that the system is functioning properly, it will now be ready to run production. Do not throw out the cables used during the “dry cycles”. They can be used for production even though they have been upset already. The Run Manual mode can be used for these upset cables. To begin production in Run Semi-automatic mode, proceed as follows:

1. Display the Run Mode Option Menu screen and select Run Semi-automatic.

Note: The Setup/Run key selector switch must be in the Run position. If you have been running dry cycles, the Run Semi-automatic screen is already displayed. Turn the nozzle heater on. Allow the heater approximately one minute to warm the nozzle.

Note: The nozzle heater flame should be adjusted so that a soft, blue flame envelopes the nozzle. Adjust the gas and air needle valves, (on the left side of the machine frame - the gas valve is yellow and the air valve is black), if necessary, so the flame is correct.

2. Ensure that coolant flow valves are adjusted to allow coolant to flow through the tool.
3. Load a cable into the cable upsetter. The system will proceed through a cycle.

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Note: If the system will not start cycling, check the Run Semi-automatic screen for a message that the transfer arm is not in and locked. If there is no such message, check the status of the Cable Loaded switch to see if it is closing.

4. After the first cycle is complete, turn the injection on by pressing the Injection On icon. Load another cable into the cable upsetter. If the system is set up correctly, an injection will have taken place. If there was no injection, see the Section G5: Troubleshooting.
5. Continue production. Inspect the first few parts to ensure they are sound and meet specifications.



***Although the zinc alloy cools very quickly, the completed termination or assembly will initially be hot. The operator should exercise caution when handling.***

### Production cycle, Run Manual mode

At the end of a production run or shift, there could be a number of cables which were upset correctly, but did not have a termination cast on them. Likewise, cables used to dry cycle the system will be upset, but will have no terminations cast on them. It is not always possible to run these cables through the system again. There may be restrictions on the upset diameter. If an upset cable is cycled through the cable upsetter twice, the upset diameter increases, and the cable assembly length becomes shorter. In order to terminate cables which are already upset, (assuming that the above restrictions are applicable), the Run Manual mode must be used.

Select Run Manual from the Run Mode Option Menu. The Run Manual screen will now be displayed on the OIT.

Note: The Setup/Run key selector switch must be in the run position. To operate the system in Run Manual mode, proceed as follows:

1. Turn the nozzle heater on. Allow the heater approximately one minute to warm the nozzle.

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Note: The nozzle heater flame should be adjusted so that a soft, blue flame envelopes the nozzle. Adjust the gas and air needle valves (on the left side of the machine frame - the gas valve is yellow and the air valve is black) if necessary, so the flame is correct.

2. Arm the injection by turning the injection on.
3. Load an upset cable into the cable upsetter. Nothing will happen. Push the cable against the anvil and then pull it back so that the upset rests against the back of the lower jaw of the cable upsetter tooling.
4. Push the Cycle Start push button. The system will cycle as it does in Run Semi-automatic mode. The Cable Loaded switch must not be closed when the Cycle Start push button is pressed. This prevents the cable from being upset twice. A False Start warning will show up on the OIT if the Cable Loaded switch is closed and the Cycle Start push button is depressed. If this happens, pull the upset cable back against the lower jaw of the cable upsetter tooling and try again.



***Although the zinc alloy cools very quickly, the completed termination or assembly will initially be hot. The operator should exercise caution when handling.***

## Operator's duties at the beginning of production

### 1. Turn the coolant on

Using the regulating valves, turn the tool coolant supply and drain on.

### 2. Turn the machine air supply on

Turn the machine air supply valve on at the back of the machine. The Quick Dump/Soft Start air valve will bleed air to exhaust. The valve can be reset by activating and resetting the E-Stop and then turning the control power on.

### 3. Replace the ingot feeder float (if used)

Carefully replace the ingot float on the surface of the molten alloy.



**ATTENTION!**

***Failure to replace the ingot feeder float will prevent the ingot feeder from actuating when the melt pot level drops.***

#### **4. Turn on the touch screen backlighting**

Whenever the system will be idle for an extended period of time, the OIT screen backlighting should be turned off to avoid “burning” a screen image on the screen.

If the OIT backlighting was shut off at the end of the last shift, simply touch the F2 button to turn the backlighting back on. Exit the Screen Setup screen by touching the Exit icon. Select Run Mode from the Config Menu to return to the Main Menu.



**ATTENTION!**

***If pressing the F2 button does not turn on the OIT backlighting, it is probably because the Config Menu is no longer displayed on the “dim” screen. It is very difficult to read the screen when there is no backlighting. Press the left and right arrows at the same time to automatically display the Config Menu. Press the Enter key and then F2 to turn the OIT backlighting on.***

## **Operator’s duties during production**

### **1. Replenish the melt pot**

The level of the alloy in the melt pot will decrease as the production of terminations or assemblies continues. The rate at which the level decreases depends upon the cycle rate of the system and the amount of alloy injected during each cycle.

The alloy level must be monitored and alloy added as required. The alloy should not be allowed to drop more than 20 mm (0.8 inches) below the full level.

Replenish alloy by removing the rear melt pot cover. Alloy should be added in a small enough quantity so as not to significantly affect the temperature of the alloy in the melt pot.

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Alloy bars should be cut into small pieces. If large pieces are used during production, the melt pot temperature may drop too low.

The optimum time to add alloy is at the beginning of any pauses in production resulting from such things as change of shift, meal time, tool changes, break time, etc.

Ensure that the melt pot is not overfilled.



***When replenishing alloy, ensure the ingot being added to the melt pot is dry. Splattering of molten alloy may result if fluids get below the top surface of the alloy.***

***Use proper protective attire when adding alloy to the melt pot as described in Personal Protective Attire and Devices in Section A of this manual.***

### Systems equipped with an ingot feeder

If the machine is equipped with an ingot feeder, the alloy level will be maintained automatically.

Pay attention to the amount of ingot remaining. When an ingot has been completely used up, the hook must be raised and a replacement bar must be loaded onto the hook.

Once the ingot has been loaded onto the hook, it should be lowered to just touch the molten alloy. The ingot feeder can be manually actuated by pulling the activating chain.

For a detailed description of how the ingot feeder works, turn to Section G1: Machine Maintenance.

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## 2. Clean the tool faces

During production, the system may stop cycling for any number of reasons. The OIT will display the reason(s) for a stoppage. These are displayed as alarms. During production, the most common alarm will be Head Closed Trouble. This alarm is tripped when the Cable Processor Module Closed switch does not close when it should - that is something is holding the tool faces apart. When this happens, the cycle will stop and the Head Closed Trouble alarm will be displayed on the OIT. Acknowledge the alarm by touching the Acknowledge icon. Reset the alarm by touching the Alarm Reset icon. Finally, touch the Go Home icon to return the Cable Processor Module to the home position.

The swing out transfer arm will have to be opened to gain access to the tool. Clean the tool faces in order to fix the problem.

Section G5: Troubleshooting contains a detailed description of each alarm and how to address each problem.

## 3. Skim the dross from the melt pot

Skim the dross from the surface of the melt pot once per shift. Place the dross in a suitable container until cooled, then discard.

## Operator's duties at the end of production

When production is completed, or a shift is complete and a new shift does not immediately follow, the operator should:

### 1. Turn the coolant off

Using the regulating valves, turn the tool coolant supply and drain off.

### 2. Turn the melt pot off

If the timer switch is properly set, it will automatically shut the melt pot off at the end of the production shift. In this case, the melt pot does not need to be turned off from the Melt Pot Control screen.

In the event that production is complete before the end of the shift and the melt pot timer is being used to control the melt pot, the melt pot should be turned off manually using the "hand" button on the melt pot timer.

The timer should be set to turn the melt pot on approximately 2 hours before the start of the next production shift.



**ATTENTION!**

*The alloy should not be left molten for more than two hours without producing terminations or assemblies. Failure to follow this guideline may result in the injection plunger seizing in the injection sleeve.*

### **3. Remove the ingot feeder float (if used)**

If the machine is equipped with an automatic ingot feeder, remove the float from the melt pot and store it in the holder on the ingot feeder stand. Also, pull the ingot up from the pot surface by 15-20 mm to avoid strain on the system caused by the shrinkage of alloy during solidification.



**CAUTION!**

*The chain and float are hot. Use protective gloves when removing the float.*

### **4. Put the system in “sleep” mode**

Prior to shutting the system down, it should be put into “sleep” mode. Sleep mode will neutralize all of the solenoid valves in the pneumatic cabinet, but will not turn the MCR off. This will leave the system “deactivated”, but with the MCR on. This way, the melt pot timer will still turn the melt pot on. If the MCR is deactivated, the melt pot will not come on when the melt pot time switch signals it to do so.

### **5. Turn off the touch screen backlighting**

The Operator Interface Terminal can be “damaged” by leaving any of the various menu screens displayed for long periods of time. If the system will be sitting for a full shift, (or overnight), the screen backlighting should be turned off to avoid “burning” a screen image on the screen. Press the right and left arrow keys simultaneously to display the Configuration Mode screen. Select Screen Setup. When the Screen Setup screen is displayed, press the F7 button to shut off the screen backlighting.

The OIT incorporates a timer which will turn the backlighting off after a preset time. The timer is factory set at five minutes. Changes to the preset time, or enabling/disabling of this feature are accomplished via the Screen Setup screen.

