TABLE OF CONTENTS

1 CUSTOMER DATA ____ 1-1

1.1 ENTEK EXTRUDERS CUSTOMER SERVICE ____ 1-1

1.2 EXTRUDER DATA ____ 1-1

1.3 CUSTOMER DATA ____ 1-1

1.3.1 Screw Specifications ____ 1-2

1.3.2 Barrel Specifications ____ 1-2

2 E27MM SERIES EXTRUDER ____ 2-1

2.1 CONSTRUCTION ____ 2-2

2.2 PROCESS SECTION ____ 2-3

2.2.1 Seal Assembly ____ 2-4

2.2.2 Barrel Section ____ 2-4

2.2.3 Screw Section ____ 2-4

2.2.4 Gear Box ____ 2-5

2.2.5 Drive Motor and Control ____ 2-5

2.3 VENTILATION ____ 2-5

2.4 ENCLOSURES ____ 2-6

3 DELIVERY AND INSTALLATION ____ 3-1

3.1 CUSTOMER RESPONSIBILITIES ____ 3-1

3.1.1 Shipping and Storage ____ 3-1

3.2 TOOLS AND EQUIPMENT REQUIRED ____ 3-1

3.3 USER-SUPPLIED PERIPHERAL EQUIPMENT ____ 3-2

3.4 MACHINE PLACEMENT ____ 3-2

3.5 INSTALLATION ____ 3-3

3.5.1 Provide Power to the Machine. ____ 3-3

3.5.2 Plumbing ____ 3-4

3.5.3 Cooling Water System ____ 3-4

3.6 EXTRUDER FRAME LEVELING ____ 3-5

3.7 FOUNDATION PREPARATION ____ 3-6

3.8 EXTRUDER INSPECTION ____ 3-6

3.9 PRE-OPERATIONAL EXTRUDER CHECKLIST ____ 3-7

4 SAFETY ____ 4-1

4.1 POSSIBLE DANGERS 4-1

4.2 SAFETY CONCERNS FOR INSTALLATION 4-2

4.3 SAFETY CONCERNS FOR STARTUP AND OPERATION 4-2

4.3.1 Startup 4-2

4.3.2 Operational 4-3

4.4 SAFETY CONCERNS FOR MAINTENANCE 4-4

4.5 SAFETY CONCERNS FOR RESTART 4-4

4.6 LOCKOUT PROCEDURE 4-5

4.7 EMERGENCY PROCEDURE 4-6

4.8 PORTABLE EXTINGUISHERS 4-6

5 CONTROLLER 5-1

5.1 SCREEN LAYOUT 5-1

5.1.1 PAGE NUMBER 5-2

5.1.2 SCREEN NAME 5-2

5.1.3 SPECIFIC COMMANDS 5-2

5.1.4 GOTO NAMED SCREEN 5-2

5.1.5 COMMAND GROUPS 5-3

5.1.6 PROCESS STATUS 5-6

5.1.7 CLEARED ALARMS 5-6

5.1.8 ACTIVE ALARMS 5-6

5.1.9 PARAMETER BUTTONS 5-6

5.1.10 CONFIGURATION 5-7

5.1.11 FORMULAS 5-8

5.2 HEATERS 5-12

5.2.1 HEATER SETUP 5-12

5.2.2 MONITORING 5-18

5.3 NAVAGATION 5-18

5.3.1 SELECTION 5-18

5.3.2 PASSWORDS 5-19

5.3.3 OTHER FUNCTIONS IN THE SETUP PAGE 5-19

6 STARTUP AND OPERATION 6-21

6.1 PRE-STARTUP CHECKS 6-21

6.2 STARTUP PROCEDURE 6-21

6.3 SHUTDOWN PROCEDURE 6-22

7 MAINTENANCE AND LUBRICATION 7-1

7.1 SPECIFIC MAINTENANCE TASKS/CLEANING 7-1

7.1.1 Screw Removal 7-1

7.1.2 Screw Disassembly and Assembly 7-2

7.1.3 Barrel Disassembly and Assembly 7-4

7.1.4 Coupling Alignment 7-5
7.1.5 Screw Installation 7-6

7.2 MAINTENANCE SCHEDULE 7-6
7.2.1 Gearbox Inspection 7-6
7.2.2 Motor 7-6
7.2.3 pH Sampling 7-7

7.3 LUBRICATION REQUIREMENTS 7-8
7.3.1 Gearbox 7-8
7.3.2 Motor 7-9

7.4 ALARMS/TROUBLESHOOTING 7-10

8 PRINTS 8-1

9 VENDOR OPERATING AND MAINTENANCE INSTRUCTIONS 9-1

1 CUSTOMER DATA

1.1 ENTEK EXTRUDERS CUSTOMER SERVICE

P O Box 39
Lebanon OR 97355
541-259-1068 Phone
541-259-8018 Fax

1.2 EXTRUDER DATA

Serial Number: 15846-0270111

Gearbox Number: 666336

Customer Purchase Order Number: 1138
Ship Date: 5-15-02

1.3 CUSTOMER DATA

24hr Remote Support contracts are available

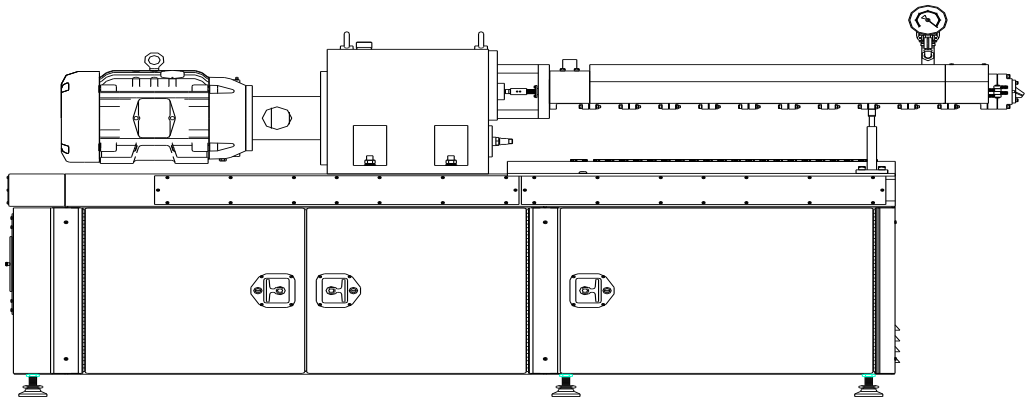
1.3.1 Screw Specifications

See ENTEK Screws and Shafts Assembly drawings in Section 8 of this manual for screw assemblies and part numbers.

1.3.2 Barrel Specifications

See ENTEK Barrel Assembly drawings in Section 8 of this manual for barrel assemblies and part numbers.

2 E27MM SERIES EXTRUDER



The E27MM Series extruder is the new era of twin screw, co-rotating machines. Today, we have the capabilities of compounding at much higher rates than in the past. These advances in technology are allowing companies to cut costs by saving plant space per machine and lower cost in replacement barrels and screws. Our twin screw extruders have several advantages over the competition, such as excellent mixing capabilities, proficient thermal transfer, large melting capacities, superior devolatilization capacities, and accurate control over temperatures. With segmented screw and barrel elements, an unlimited number of screw configurations can be assembled. This design, therefore, creates tremendous flexibility and allows for careful optimization of screw and barrel geometry to tailor each particular application.

The E27MM Series extruders are equipped with three types of elements.

Conveying elements-primary purpose is to transport and pump the material. This area of the screw would consist of flighted elements with different pitches. The lower the pitch of the flight, the higher the pumping pressure produced and visa versa. A typical scenario would be to use high pitch elements in the feed section to forward your bulky, unmelted material and adversely, use a lower pitch element to pump through a mixing element.

Distributive element-for combining two different materials. This area of the screw would consist of narrow kneading disks or blocks and gear type mixers, and combing mixers.

Dispersive element-for compounding melted material into a homogenous melt. This area the screw would consist of kneading disks or blocks and reversing elements. These elements take melted distributed polymer and continues to shear and break it, until the material is a single homogenous melt.

The E27MM Series extruders are designed for high-speed extrusion applications, however the standard motor and gearbox are capable of running at speeds as low as 50 RPM.

By combining the high screw speed capabilities of the E27MM Series extruder and the variety of element designs available today, there is an unlimited number of materials that can be compounded.

The E27MM Series extruder is uniquely designed with a self-contained enclosure system. This includes the low voltage electrical system, all heating and cooling systems, the vacuum system, gearbox lubrication and the entire PLC controller system. The only enclosure not mounted on the machine's frame is the Main Motor Controller. This self-contained design enables the customer a faster hook-up time and ease for transportation.

The E27MM Series extruder demonstrates flexible capabilities with our unique Modular Design. This design allows the same extruder frame to be used with a 7 to 12 barrel section configuration.

2.1 CONSTRUCTION

ENTEK Extruder Division, E27MM Series extruders are constructed using a plate steel frame This design allows for fabrication flexibility and efficient customization. (see Figure 2.2)

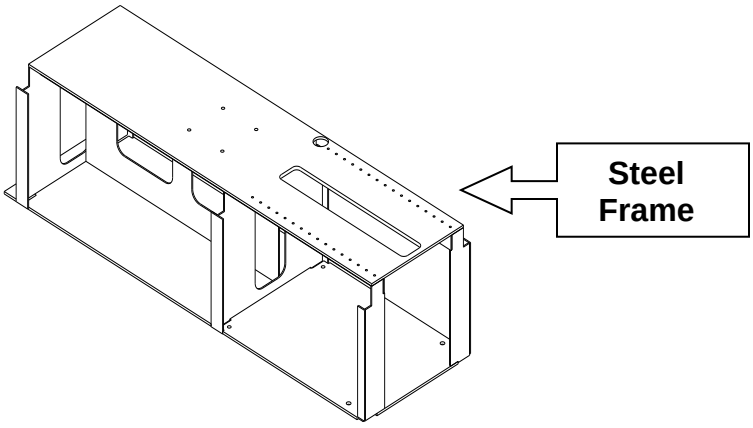


Figure 2.2

2.2 PROCESS SECTION

The E27MM Series process section is configured to match the overall process goal of the machine. This section includes the screws, and barrels.

The process section receives mechanical power from a pair of splined couplings located between the gearbox and screw shaft. The couplings are housed by the adapter (Figure 2.3), which connects the screws to the gearbox.

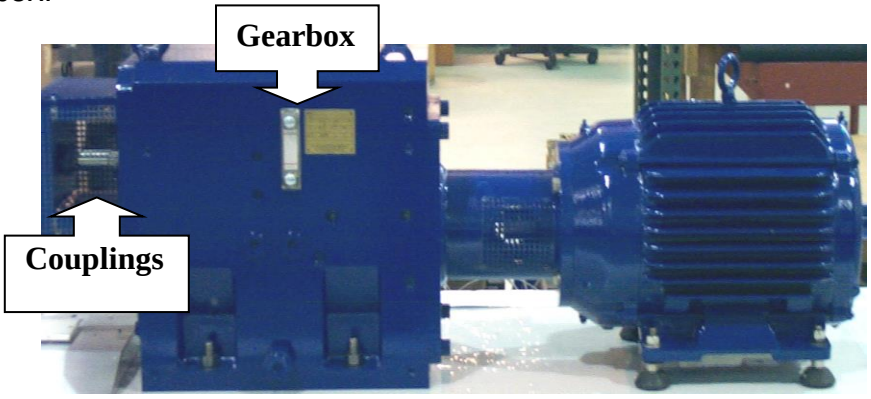


Figure 2.3

2.2.1 Seal Assembly

At the gearbox end of the barrel section there is a sealed housing, eliminating dust and fines from escaping out the rear of the screw. ENTEK uses a standard packing.

2.2.2 Barrel Section

ENTEK's standard barrel materials are Nitralloy 135M ASM 6472C. Special applications may require the use of stainless steels, tool steels, special alloys, and a variety of bimetallic materials. Barrel sections are available as a Vent Port, Top Feed, Side Feed, Combi, Liquid Injection, or as a Solid Section.

All ENTEK barrel sections are CNC machined and secured with 2 hardened dowel pins. Severe damage may occur to the barrel and screw without the proper installation of *both* pins.

Each section is required to pass a strict regimen of QA Testing, before any section is installed (Surface Roughness Testing, Rockwell Hardness Testing, Perpendicular Surface to Face of barrel, & Bore to Bore).

Heat is applied to the barrel with cartridge heaters. Barrel temperatures are measured using a Type J thermocouple mounted in the center of each barrel section.

Barrel sections are constructed with internal cooling passages. A closed-loop liquid cooling system removes excess heat from the barrel sections.

2.2.3 Screw Section

The E27MM Extruder uses two alloy steel screws, broached with a 12 tooth involute spline. The screw shafts have a modified shaft spline design, which allows for larger screw free volume and higher torque.

During maintenance, always clean any polymer found on the screw shafts, keys, tips and elements before attempting to reassemble. High temp anti-seize compound should be applied to components during assembly to aid in disassembly later.

2.2.4 Gear Box

The E27MM Series machines use a 4.5:1 gearbox as standard, other speeds are available. This gearbox produces a screw speed at 400 RPM at a motor speed of 1800 RPM.

All shafts have rolling bearings on both sides, which have a service life of 20,000 hours under normal usage.

2.2.5 Drive Motor and Control

A 15 HP AC Motor compliant to NEMA standards drives the E27MM extruders. The variable speed drive produces a maximum speed of 400 RPM. If application requires, ENTEK offers optional 1200 RPM by replacing the standard gearbox or the change-out gears and can increase the size of the motor to 45 HP.

2.3 VENTILATION

Proper ventilation is required when operating an extruder. Ventilation is required to cool the main extruder motor and main motor drive. The EMAX Series extruder comes standard with an AC motor and drive. The AC motor is a totally enclosed fan-cooled (TEFC) unit. The drive is air cooled.

If an optional DC motor and drive are supplied, the main extruder motor will require a source of clean cooling air because dust adversely affects the operation of a DC motor. A duct to a location external to the processing facility and/or filtered air may be required. If contamination is noted when inspecting the motor, the source of contamination should be identified and eliminated. ENTEK recommends the installation of an airflow sensor to verify adequate motor ventilation.

Enclosures containing AC and DC motor drives must be maintained at a reasonable temperature (refer to the OEM drive manuals for specific requirements).

Vapors discharged from the extruder should be collected and vented away from personnel. Air monitoring required by local, state, and federal regulations is the responsibility of the owner/operator.

2.4 ENCLOSURES

The E27MM Series extruder enclosures are, self-contained systems integrated into each machine's support frame construction. Each enclosure contains a local disconnect for ease of shutdown and maintenance. This excludes the Relay Enclosure on the standard model, or the PLC Enclosure on those machines with PLC Control. Refer to Section 3.5 for interconnection instructions.

Motor/Heater Enclosure: (This enclosure comes standard on every machine). This enclosure contains all of the heater relays, and any motor starters to run auxiliary systems such as cooling systems, vacuum systems, and side feeders. It also houses the 24VDC power supply that provides power to the Relay Enclosure or PLC Enclosure. Depending on the options ordered with the machine. On most machines, this enclosure also contains the main drive's power supplying equipment and the machine's main disconnect.

PLC Enclosure or Relay Enclosure: Every E27MM comes with one of these enclosures depending on the options ordered with the machine. The PLC Enclosure contains all of the PLC hardware and associated equipment. It also contains the main emergency stop relay. The Relay Enclosure also contains the main emergency stop relay, but instead of having PLC hardware for controlling the machine, it uses all relays.

***Warning**: Be sure all enclosures are sealed and locked before the machinery is energized.*

3 DELIVERY AND INSTALLATION

ENTEK recommends the assistance of a Field Technician for the installation of the E27MM Series machine. The Customer Service Department at ENTEK can assist on scheduling this service. Refer to Section 1.0 Customer Data for phone number and address.

Double-check: *The Extruder Inspection & Pre-Operational Machine Checklist has been completed before the machine is turned on. Refer to Section 3.9 & 3.10.*

3.1 CUSTOMER RESPONSIBILITIES

It is the responsibility of the customer to insure transportation and safe delivery of the E27MM Series machine. Immediately upon receiving the machine, it is recommended that a thorough inspection be conducted to insure no damage has occurred during transportation.

3.1.1 Shipping and Storage

ENTEK provides a custom-built wooden pallet, along with protective guarding, for normal transportation of the E27MM extruder. The Extruder, Motor Controller Enclosure, and Control Panel Interface will be in a closed container. All extruder shipments requiring special arrangements must be addressed prior to shipment.

3.2 TOOLS AND EQUIPMENT REQUIRED

The customer is required to supply the following rigging equipment to prepare for the delivery of the E27MM Series machine:

- Forklift with lifting capacity of 4,000 lbs.
- Laser leveling device or leveling device acceptable to the customer

3.3 USER-SUPPLIED PERIPHERAL EQUIPMENT

The customer is required to supply the following peripheral equipment to complete the installation of the E27MM Series machine:

- Piping for supply and return of cooling water
- Ventilation duct work
- Vacuum drain(if applicable)
- Electrical interconnecting wiring and cabling
- Cooling water at a recommended flow of 30 GPM at 60°F. (114 l/min at 16°C)

3.4 MACHINE PLACEMENT

Section 8.0, Footprint Drawing, will provide the needed dimensions for the proper placement of your E27MM Series machine.

Verify the E27MM Series machine position:

- Benefits the manufacturing flow of the facility
- Allows for sufficient space around and above the machine for easy accessibility during service and maintenance, refer to Section 8.0, Footprint Drawing. Consult local and national electrical codes.
- Allows for easy accessibility to all enclosures refer to Section 8.0, Footprint Drawing and Motor Controller Enclosure Layout, for all enclosure clearances.
- Allows for sufficient lighting
- Verify the Motor Controller Enclosure is grounded to the machine's frame and the ground is compliant to all local and federal electrical standards.

3.5 INSTALLATION

It is the responsibility of the customer to have the machine installed. It is recommended that an ENTEK Field Technician inspect the work completed prior to startup. It is crucial the instructions below are followed to provide an efficient and safe startup. The ENTEK Field Technician will provide suggestions or recommendations as needed.

Warning: *Be sure Section 4.0, Safety has been reviewed and understood before the Extruder Startup.*

3.5.1 Provide Power to the Machine.

Use cable tray or conduit to connect 480V / 3 phase power to the extruder and the electrical enclosures. The main power supply gets connected to the Motor/Heater Enclosure on the 15HP model, and the Motor Controller Enclosure on machines with 20HP – 40HP drives. *When installing wiring; be sure to follow all local and national electrical codes.*

Helpful Hint: *ROTATION VERIFICATION-verify rotation of the motors using the rotation labels on the extruder. If rotation is incorrect, wiring must be corrected before continuing with the installation. See Section 8.0, Interconnect, Electrical.*

3.5.2 Plumbing

The front of the machine has 2 connections, an inlet and an outlet for the barrel cooling system. The recommended operating specification for the water system is 30 GPM at 60°F (114 l/min at 16°C). Refer to Section 8.0, Interconnect, Plumbing for interconnect information on the water system.

Warning: *Be sure all exposed hot piping is insulated to avoid personal harm.*

Materials: The customer is responsible for connecting electrical wiring and water piping to the extruder and foundation construction and materials if the preference is to secure the extruder to the floor.

Warning: *ENTEK Extrusion Division recommends all electrical installation to be performed by a licensed electrician.*

3.5.3 Cooling Water System

To insure long term performance of the Barrel Cooling System, it is very important to maintain the highest quality of water. As water processes through the cooling cycle, it will leave a residue or a scale deposit if pure water is not used. Over time, this deposit could become loose contamination within the system, resulting in a possible malfunction in the valve seats, loss of temperature control or eventually plug up the barrel cooling bores.

The E27MM Series machines will be delivered with one gallon of concentrated Oxishield Corrosion Inhibitor. ENTEK recommends using a distilled water and Oxishield Corrosion Inhibitor at a 10:1 ratio. The solution should be monitored on a weekly basis for the first month of use.

ENTEK recommends the system should be completely drained and replaced with the same distilled water and Oxishield solution every 6 months or if the solutions falls below a 9 pH.

Warning: *Do Not Rinse Cooling System, when draining and replacing solution.*

Helpful Hint: *Store and maintain a 10:1 solution of distilled water and Oxishield solution in an easily accessible area to use as needed.*

Oxishield Corrosion Inhibitor may be purchased through Plastic Process Equipment, Inc. at 1-800-362-0706 or contact ENTEK Extruder Division Customer Service.

3.6 EXTRUDER FRAME LEVELING

As a standard feature, ENTEK uses adjustable pads, to support the machine. These pads aid in the extruder leveling process. It is important to install the extruder on a flat surface.

Using a laser alignment device or a leveling device acceptable to the customer and the adjustable pads, level the back portion of the extruder. Verify the level accuracy at the four corners of the motor and gearbox mounting plate. Once the back portion of the extruder is level, in both directions, lower the adjustable pads that support the front section of the extruder. Adjust the front pads until the extruder is level. Verify the level accuracy of the front portion, using the inside compartment floor of the extruder's frame. Throughout the leveling process, it is key to remember that even weight distribution across all mounting pads is more important than actual levelness. A solid even distribution of the weight across all the mounting pads will ensure proper machine support for operation.

Using the adjustable Barrel Support Stud located under the barrel, adjust the height alignment of the barrel to be parallel (//) with the centerline axis of the gearbox output shafts.

All barrels are laser aligned prior to shipment. For optimal barrel-life, ENTEK recommends an ENTEK Field Technician oversee the installation and alignment of the barrel.

3.7 FOUNDATION PREPARATION

The E27MM Series machine does not require mounting to the manufacturing floor. However if the customer elects to bolt the machine to the floor, ENTEK recommends using ¾" studs, on a minimum of a 4" (100mm) thick reinforced concrete floor. The customer is responsible for procuring and installing the studs. Refer to Section 8.0 Footprint Drawing for mounting hole locations.

3.8 EXTRUDER INSPECTION

Verify all areas listed below have been performed before installation is complete.

It is recommended, for a safe and efficient startup, to have an Entek Field Technician present at the time of Startup Inspection.

- Verify all instructions in this section have been followed upon installation of the machine. Refer to Section 3.1-3.7.
- Verify the appropriate oil is used in the gearbox. Refer to Section 7.3, Maintenance and Lubrication.
- Verify the electrical power and electrical grounds have been connected according to the local and federal electrical standards.
- Verify the electrical power is properly phased. See Warning Labels on the machine. Refer to Section 3.6 Installation.
- Verify incoming line voltage is correct. Refer to Section 3.6 Installation.
- Verify the positions of all thermocouples. Refer to Figure 2.4.
- Verify the functionality of all heaters. Refer to 5.6 Heater Controller.
- Verify the Emergency Stop Button is working properly. Refer to Section 4.7 Emergency Procedure.
- Verify the screws are free from any foreign material or debris. Test by turning screws manually. Refer to Section 3.10, Pre-Operational Checklist.
- Check to insure fasteners are secure and did not loosen during transportation.
- Verify Drive Alignment. Refer to Section 7.3.3.

3.9 PRE-OPERATIONAL EXTRUDER CHECKLIST

Before actual startup, perform the following to insure machine is functioning properly. Screws will be shipped inside the extruder.

- Pull Screws. Refer to the procedure in Section 7.1.1.
- Verify no foreign material is in barrel or on screws.
- Run extruder drive at 10 to 15 RPMs to verify rotation. Rotation of the screws should be counter-clockwise, when standing at the gearbox and looking toward the output end of the extruder.
- Reinstall screws. Refer to Section in Section 7.1.4.
- Verify heating and cooling systems are working properly. Increase and decrease temperatures on each barrel and auxiliary heat zone, monitor the results.
- Start the extruder motor. Heavy mineral oil may be used at initial start up. Begin screw turnover at 10 to 15 RPMs for approximately 10 minutes. Monitor the motor and drive bearings for unusual noises and temperature fluctuation. Gradually increase speed and begin feeding material into the Feed Port.

Warning: *When running Mineral Oil through screw and barrel, be aware of high temperatures and the Flash Point of the particular Mineral oil being used.*

Warning: *Never operate E27MM Series Extruder over 20 RPMs without material in the screws. The potential for screw/barrel damage is high when running the screws empty.*

4 SAFETY

Accidents result from human error more frequently than from mechanical failures therefore, it is necessary to be safety conscious at all times. ENTEK strongly recommends all personnel operating or maintaining the E27MM Series Extruder have read the Operations Manual to ensure personal safety.

Warning: *ENTEK recommends all personnel operating or maintaining the machine to wear eye and ear protection at all times.*

Warning: *When equipment is in operation, safety regulations from local and federal agencies must followed at all times.*

4.1 POSSIBLE DANGERS

Within the plastics industry one of the most common hazard is a chemical reaction when two materials are mixed. Dangerous fumes, fire, or explosion are potential dangers when mixing materials. It is extremely important to be aware of the potential chemical reactions when any material is being introduced to a machine.

Warning: *Refer to 4.7.* ***EMERGENCY PROCEDURE*** *when a situation becomes dangerous or harmful to human health.*

Helpful Hint: *It is a good idea to have a remotely accessible ventilation system installed to reduce health risks if a dangerous fume situation develops.*

4.2 SAFETY CONCERNS FOR INSTALLATION

- Verify Installation procedure was followed properly. Refer to Section 3.6.
- Verify water and electricity was properly installed according to all local and federal standards.
- Verify lighting is complete, according to in-house standards.
- Verify ventilation within the Motor Controller Enclosure is acceptable. Refer to Section 2.3.
- Verify clearance is available to service and maintain the machine. Refer Section 8.0, Footprint & Motor Controller Enclosure Layout.
- Verify operator work area is cleaned up from any debris left from installation.
- Verify an efficient Emergency escape route is available, according to local fire codes.
- Verify portable extinguishers are easily accessible. Refer to 4.8.

4.3 SAFETY CONCERNS FOR STARTUP AND OPERATION

4.3.1 Startup

- Verify all safety guards are in place and are maintained in good working order.
- Verify written procedures are easily accessible and follow Section 6.2, Start up procedure.

SAFETY CONCERNS FOR STARTUP AND OPERATION CONTINUED

- Verify written Emergency procedures are easily accessible and follow Section 4.7.
- Verify all personnel have reviewed the Safety Section 4 of this manual.
- Verify all warning signs are visible. If any signs become worn or damaged, notify ENTEK immediately for a replacement.

Warning: *BARREL AND SCREW SECTIONS ARE EXTREMELY HOT.*

Warning*: Never stand in front of the die area of the machine. Hot material may spatter through the die.*

4.3.2 Operational

- Verify all on-site safety rules are being obeyed.
- Verify a clean working environment is maintained throughout operation according to the on-site standards.
- Verify all personnel and debris is cleared from the area before the machine is started.
- Verify all personnel are provided with appropriate hand and arm protection to avoid accidental burns according to the customer safety requirements.
- Verify ventilation within the production area is sufficient, according to the state and local standards.
- Verify the appropriate eye and ear protection is being worn at all times. Insure no loose clothing, long hair, dangly jewelry, etc. is being worn.

Helpful Hint: *Perform periodic safety inspections to ensure a safe working environment is being maintained. Document all findings.*

4.4 SAFETY CONCERNS FOR MAINTENANCE

- Verify Shutdown Procedure is followed appropriately. Refer to Section 6.3.
- Verify power and Cooling System has been turned off.
- Verify all appropriate danger tags or warning signs are in place.
- Verify the Lockout Procedure is followed appropriately whenever maintenance is performed. Refer to Section 4.6.
- Verify a clean working environment is maintained.

4.5 SAFETY CONCERNS FOR RESTART

- Verify all guards or safety devices have been properly replaced.
- Verify all personnel and debris is cleared from the area before the machine is started.
- Verify no other Lockout tags have been placed on the machine.
- Verify Startup procedure has been followed properly. Refer to Section 6.2.

4.6 LOCKOUT PROCEDURE

ENTEK recommends the following Lockout Procedure, where an On-site Lockout Procedure does not exist.

1. Shut the machine down appropriately. Refer to Shutdown Procedure, Section 6.3.

2. Disconnect the Motor Control Enclosure and install Lockout on Enclosure.

3. Where applicable, place a lockout on Startup switch in the “Off” position.

4. Upon completion of Service or Maintenance, authorized personnel may remove all locks.

5. Follow Startup procedure. Refer to 6.2.

ENTEK recommends the appropriate level of safety for installation or maintenance can best be determined by a safety professional most familiar with the particular application. It is therefore the responsibility of the owner, employer, or user, to take appropriate steps as may be necessary to ensure the safety of all personnel in the workplace.

***Warning**: Never remove Lockouts that were not personally installed.*

4.7 EMERGENCY PROCEDURE

In Emergency situations such as fire, hazardous gas, elevated or uncontrollable temperatures, or explosions it may be necessary to take drastic measures. ENTEK has the following features in place:

1. Emergency Stop (E-Stop)-this button will stop all rotation and heating of the machine.
2. Motor Controller Disconnect-this will shut off all power to the machine.

It is recommended that the above features be incorporated into the On-Site Emergency Procedure.

4.8 PORTABLE EXTINGUISHERS

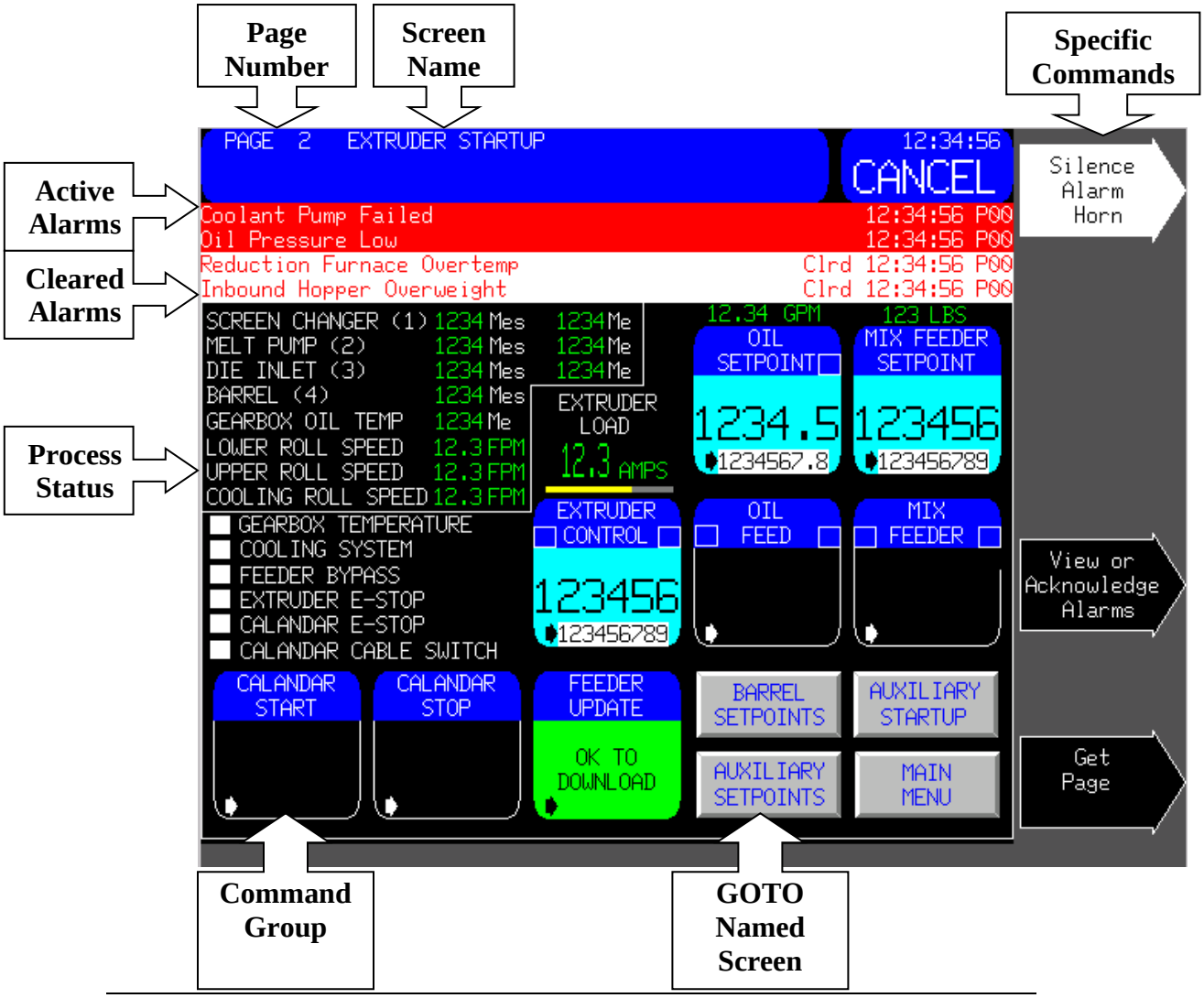
Per local fire codes, all plants are to be equipped with portable fire extinguishers. All portable extinguishers must be UL Approved, comply with all local and federal standards, and approved for the specific class of fire that my result. ENTEK recommends an ABC portable extinguisher. All extinguishers must be visible and readily accessible.

5 CONTROLLER

Each Touch Panel will differ slightly from machine to machine, however the basic operation of each of the buttons is identical. Each button's operation is described in this section. Your particular extruder may not have all of these buttons because of the options that have been ordered.

5.1 SCREEN LAYOUT

Shown below is a standard layout of each of the screens. Each screen may not fit this layout exactly, but the components described are used in all of them. Also the relationship between each of the button categories is identical.



5.1.1 PAGE NUMBER

The page number of each screen is found in the upper left-hand corner of the screen. If you press the “Get Page” specific command and enter a screen’s number, that screen will come up. If you are not sure what screen number you need, you can access a screen directory by selecting the “Get Page” specific command, and then selecting the following “Directory” option.

5.1.2 SCREEN NAME

Each Screen has a name to distinguish it from others. This name is used on the “GOTO Named Screen” buttons described in section 5.1.5. For a directory of the screen names, see the previous section for directions on accessing the directory.

5.1.3 SPECIFIC COMMANDS

Each “Command Group” has “Specific Commands” that actually control each selected device. When these commands are selected, the labeled operation is activated. The only exception is the “Get Page” command. In order for a “Get Page” to be completed, the following “Execute” command must be pressed after entering the desired page number.

5.1.4 GOTO NAMED SCREEN

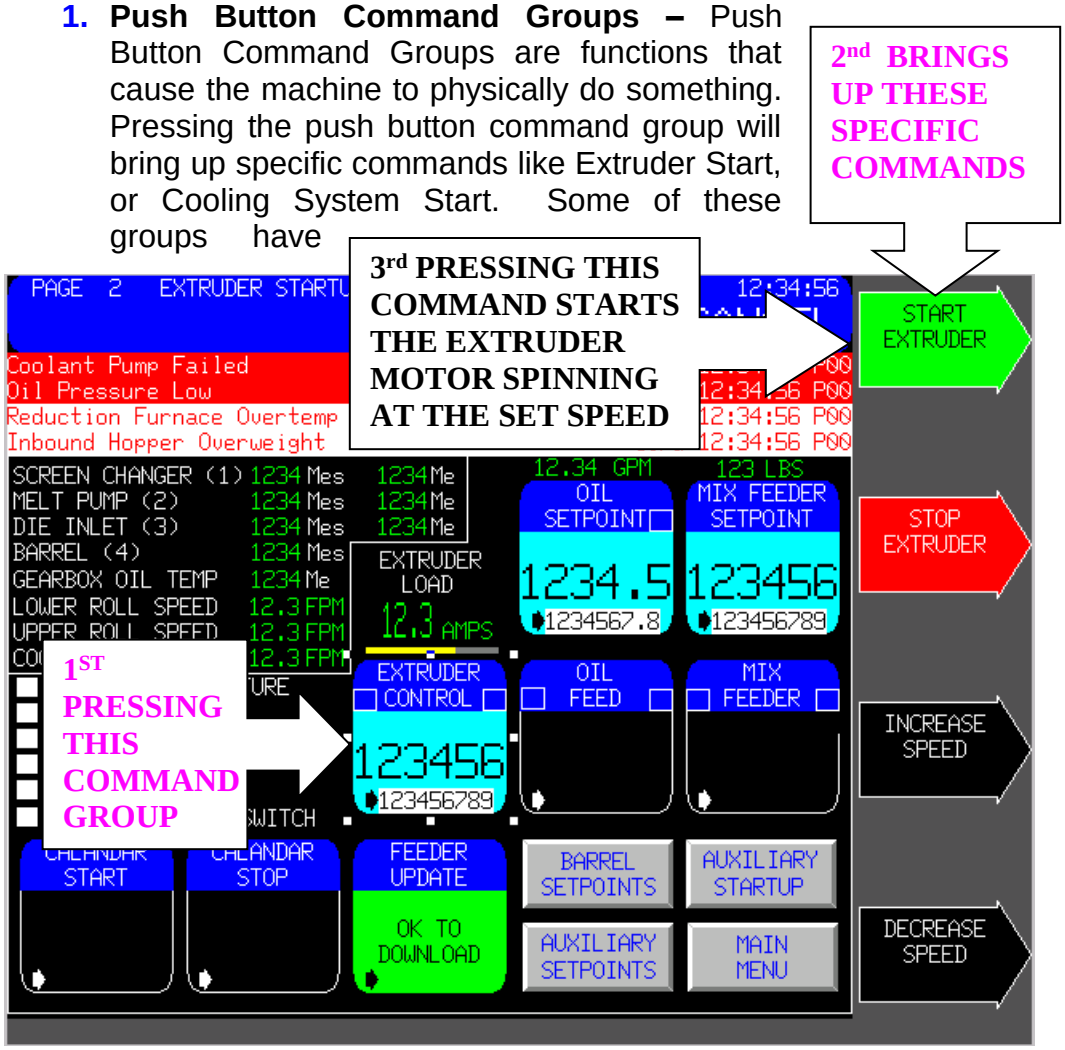
The rectangular buttons that appear all the time will take the operator to the named screen. A password is not required for these buttons. Rectangular buttons with cyan backgrounds, and blue letters require a password. Buttons with red backgrounds and yellow letters are special screens. Note that if no password has been entered, some of these buttons may not even appear on the screen. For more information on passwords see the Navigation section.

5.1.5 COMMAND GROUPS

A command group is a category of operations or adjustment. Pressing it accesses certain commands associated with its particular part of the process. A command group's screen location may vary depending on your machine's needs, and as mentioned earlier, your particular machine may not be equipped with some of these functions as options can vary. There are three (3) general categories of command groups.

- Push Button Command Groups
- Analog Command Groups
- Feeder Command Groups

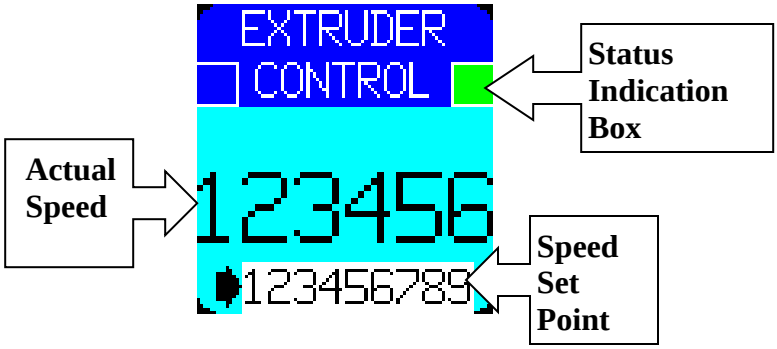
1. **Push Button Command Groups –** Push Button Command Groups are functions that cause the machine to physically do something. Pressing the push button command group will bring up specific commands like Extruder Start, or Cooling System Start. Some of these groups have



other options like Increase Speed and Decrease Speed. When any of the specific commands are activated the named function immediately activates as long as all of the safeties are ok.

The operating status of each extruder system is indicated in the command group's button by various means. In some of the push button command groups, and all of the analog command groups, the process variable is communicated by two numbers displayed on the button. The smaller number at the bottom is the setpoint that is specified by the operator. The larger number in the middle of the button is the actual value. Another way that status is indicated is by a small box to the left and right of the button's name. This button changes color based on what the device is doing. Below is a list of the box colors, and their meaning.

- Green – Running, no problems
- Yellow – Warning
- Red – Alarm
- Transparent - Off



2. **Analog Command Groups –** Analog Command Groups are a way to set the limits and operating parameters for various processes on the machine. Pressing one of these buttons brings up the Change Value specific command, and allows the operator to change the named value. An example of an Analog Command Group is Barrel Temperature Setpoint.

3. **Feeder Command Groups -** Feeder Command Groups only come with extruders that are ordered with a feeder integration package. Many of the buttons that are associated with feeders fall under the category of Push Button Command Groups, and Analog Command Groups, however there are a few items that need to be explained more fully. Listed below is each command group and its specific commands with an explanation of how each function works.

   - **Feeder Bypass**

     Commands

     Enable Bypass-Allows the feeder to run without the extruder running. (When this mode is on, and a metal detector is supplied with the system, the metal detector reject/reset becomes a manual operation.)

     Disable Bypass-Deactivates bypass mode (When Bypass is disabled, if the metal detector has been set to reject, it will automatically reset.)

   - **Mode Status**

     Display Possibilities

     Discharge-Feeder's motor turns at a constant speed

     Loss in Weight-Feeder is feeding at a constant pounds per hour rate.

     (Note: For more information on Mode Status, consult the OEM Feeder Manual)

   - **Total Feed Rate**

     Commands

     Change Value-Confirms updated feedrate and prepares it to go into effect after feeder update is pressed and the feedrate is downloaded

   - **Feeder Update**

     Commands

     Feedrate Download-Sets downloaded feedrate value to current feedrate, but doesn't start anything.

     (Note: If you add up the percentages of all the feeders, and it doesn't equal %100, then this command will not be available.)

5.1.6 PROCESS STATUS

Some screens have a process status section of the screen that displays various process indicators, and their values.

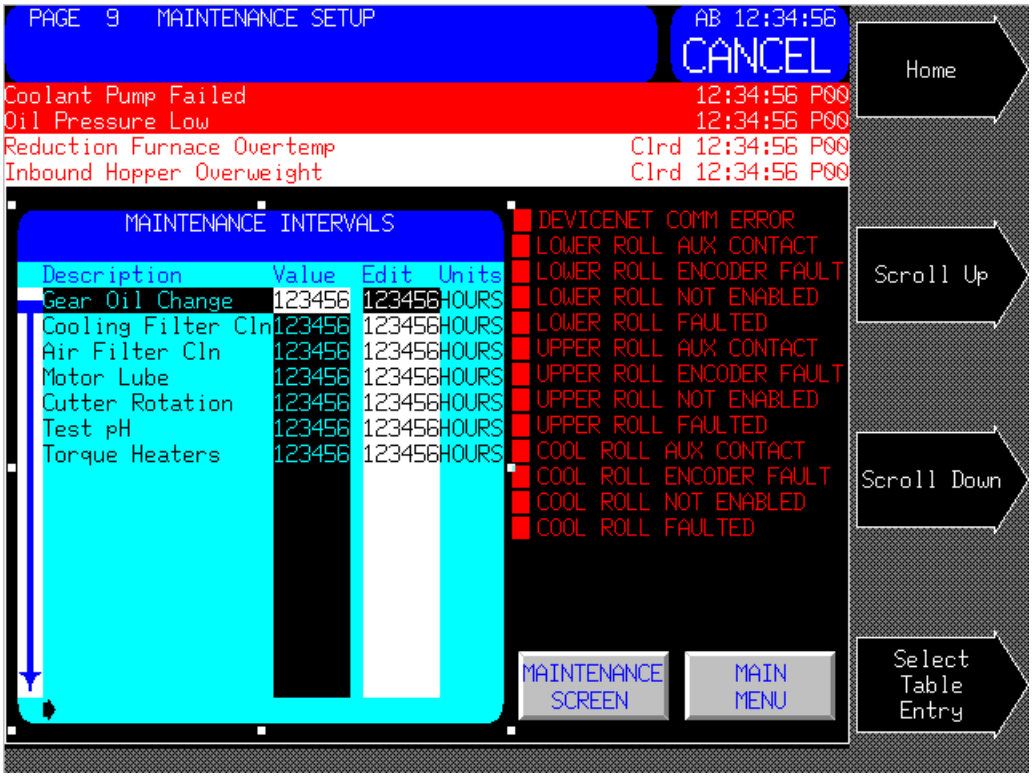
5.1.7 CLEARED ALARMS

This area of the screen shows the last two alarms that were displayed, and when they were cleared.

5.1.8 ACTIVE ALARMS

This area of the screen shows the last two active alarms that have not been cleared, and the time they were issued.

5.1.9 PARAMETER BUTTONS



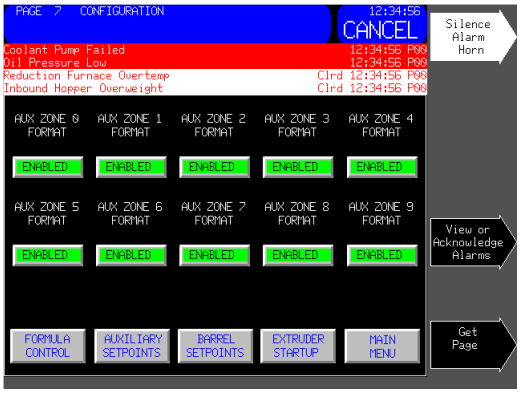
Another type of button that you will see is a parameter button. These buttons allow the operator to adjust various operating parameters. To edit a parameter, select the parameter button, and then select the proper parameter by using the Scroll Up and Scroll Down specific commands.

When the desired item is highlighted press the Select Table Entry command, and then enter the new parameter value. Some parameters require passwords before you can change them.

5.1.10 CONFIGURATION

The configuration screen is an option that not all machines have

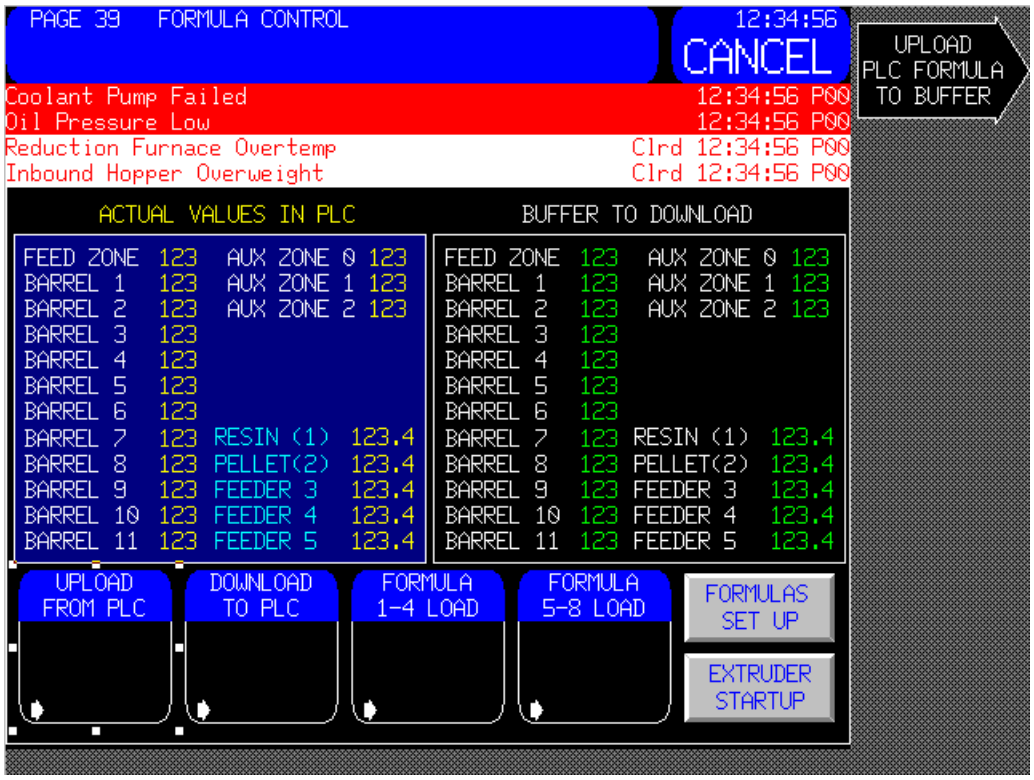
1. **Configuration –** The Configuration screen allows the operator to enable and disable various pieces of equipment as required. This can include but is not limited to heaters, feeders, and down stream equipment such as pelletizers and melt pumps.



5.1.11 FORMULAS

Formula screens allow the user to store predefined operating parameters for later use, and also activate them. In these screens the user can pre-set heat zone temperatures and feeder percentages.

1. **Formula Control –** This screen is used to move data to the desired locations. There are three locations that a formula can be in.



1. **In the PLC –** Values in the PLC are active values. This is what the machine is currently set to run at. If a barrel setpoint is changed, or the feeder percentages are adjusted during operation, the new values will be reflected in the Actual Values In PLC box. If the values are working well for your process and you want to save them. Make sure you move them into the buffer, and then into a formula before making any other process changes. If they are not moved to a formula and other changes are made, the original values will be lost.

2. **In the Buffer –** The buffer is a staging area where unsaved formulas are stored. Current buffer values are displayed in the Buffer to Download box. Formulas in the buffer can be moved to the Actual Values In PLC box, or saved to a specific formula. Once information is overwritten in the buffer, it is lost forever.

Note 1: Values in the buffer can only be downloaded into the Actual Values In PLC box when the Extruder Motor is completely stopped.
Note 2: Values in the buffer can be downloaded into the Actual Values in PLC box when all of the feeder percentages add up to 100% (if applicable)
Note 3: Values in the Actual Values In PLC box can be uploaded into the buffer at any time

3. **In a Formula –** There are eight (8) different formulas that can be saved. Each formula is a group of preset operating parameters that can be loaded into the Actual Values In PLC box in order to be used.

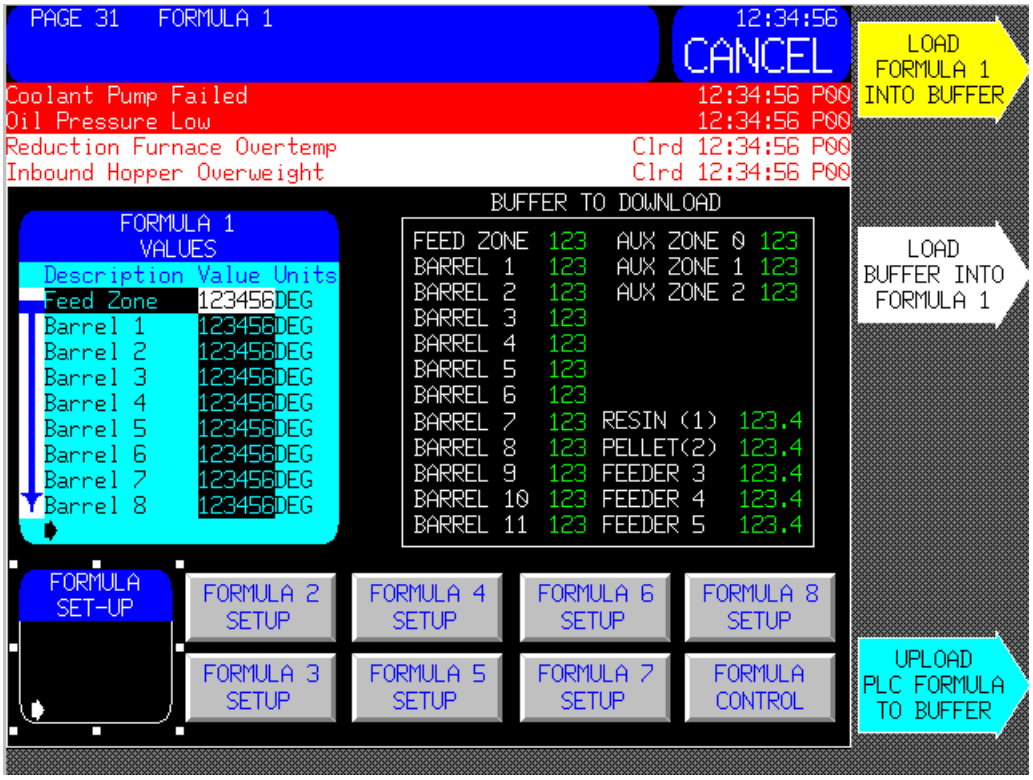
- **Upload From PLC –** This command copies the values in the Actual Values in PLC box to the buffer.

- **Download To PLC –** This command copies the values in the buffer to the Actual Values in PLC box.

- **Formula 1-4 Load –** This command copies the selected formula (1-4) into the buffer.

- **Formula 5-8 Load –** This command copies the selected formula (5-8) into the buffer.

2. **Formula (1-8) –** There are 8 of these screens, and each screen is used to setup or modify existing formulas.



- **Formula 1 Values –** This is a parameter button, and functions like all other parameter buttons as described earlier in this manual. Make sure that all the feeder percentages equal 100%.

- **Formula Set-up**
  Commands
  Load Formula Into Buffer – This command takes the selected formula, and moves it to the buffer so that it can be transferred to the PLC or another formula number.
  Load Buffer Into Formula – This command takes the values in the buffer and assigns it to the selected formula.

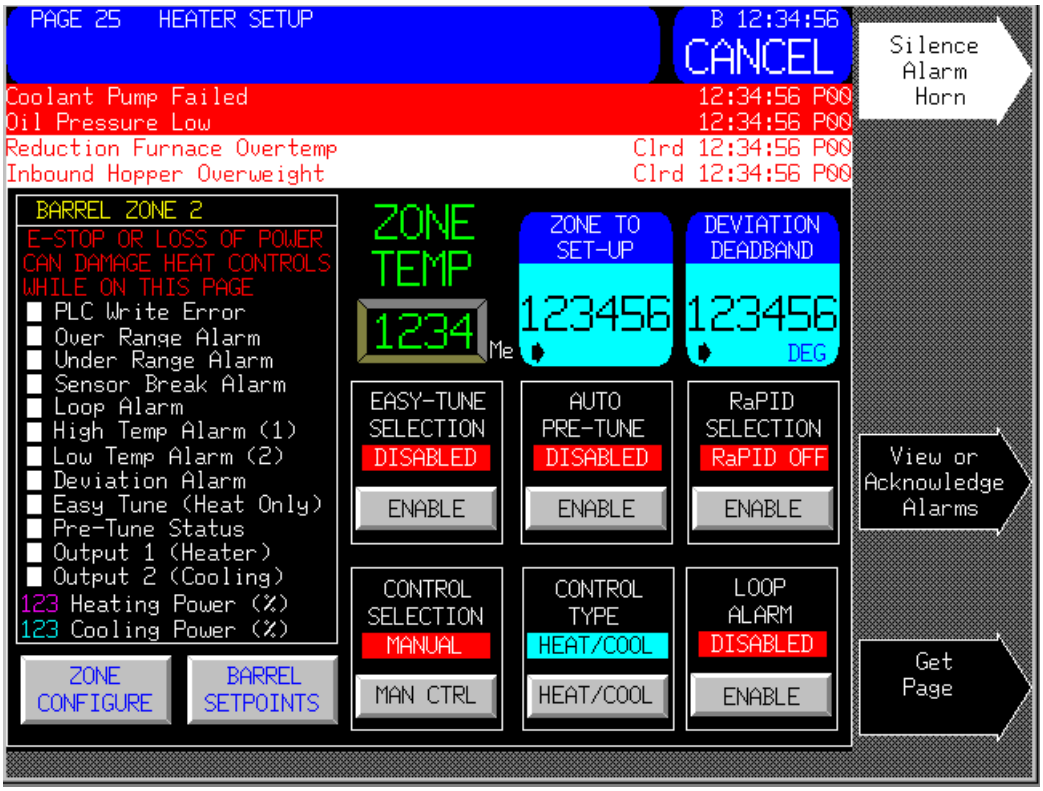
***Warning**: This command will overwrite the existing formula, erasing its old values. Make sure that proper steps have been taken to archive the old formula if required.*

Upload PLC Formula into Buffer – This command takes the values running the extruder, and moves them to the buffer.

5.2 HEATERS

5.2.1 HEATER SETUP

Heater setup can be preformed in a couple of screens depending on what is going to be setup. Below are some examples of the main heater setup screens with explanations on the various functions. Your extruder may or may not have all of these options.



1. **Heater Setup –** The heater setup screen is used to modify each individual zone's various operating characteristics. Once a zone is selected to be setup all of the information on the screen applies to the zone selected.

Warning: *ENTEK recommends modifications to these heater set-up parameters be performed by an ENTEK Support Engineer or Technician at time of initial Start-up.*

***Warning**: Do not use this screen unless you are actively editing the heater operating parameters. Having this screen up during an e-stop condition, or a power loss can **cause damage to the heater control logic**, and lock up the controller.*

- **Zone To Setup –** This function is used to define which zone is being modified. To define a zone to setup, select the Zone To Setup button, and enter the zone number you wish to modify. Typically zones are numbered 0-12 for barrel zones, and 13 and up for auxiliary zones.

- **Deviation Deadband –** This button is an Analog Command Group. The value here defines how far the barrel zone can drift off of the defined set point before the PLC alarms the operator.

- **Easy Tune Selection –** This variable affects how the machine's heaters perform on startup. Having this enabled automatically tunes the heaters for more efficient power-ups. For more information on this mode, refer to the MLC 9000 OEM manual that has been supplied. Easy Tune is not applicable when Control Type is set to Heat/Cool.

- **Auto Pre-Tune –** This command overrides Easy Tune. It calculates the optimum ramp time values for the heaters. For more information on this variable, refer to the MLC 9000 OEM manual that has been supplied.

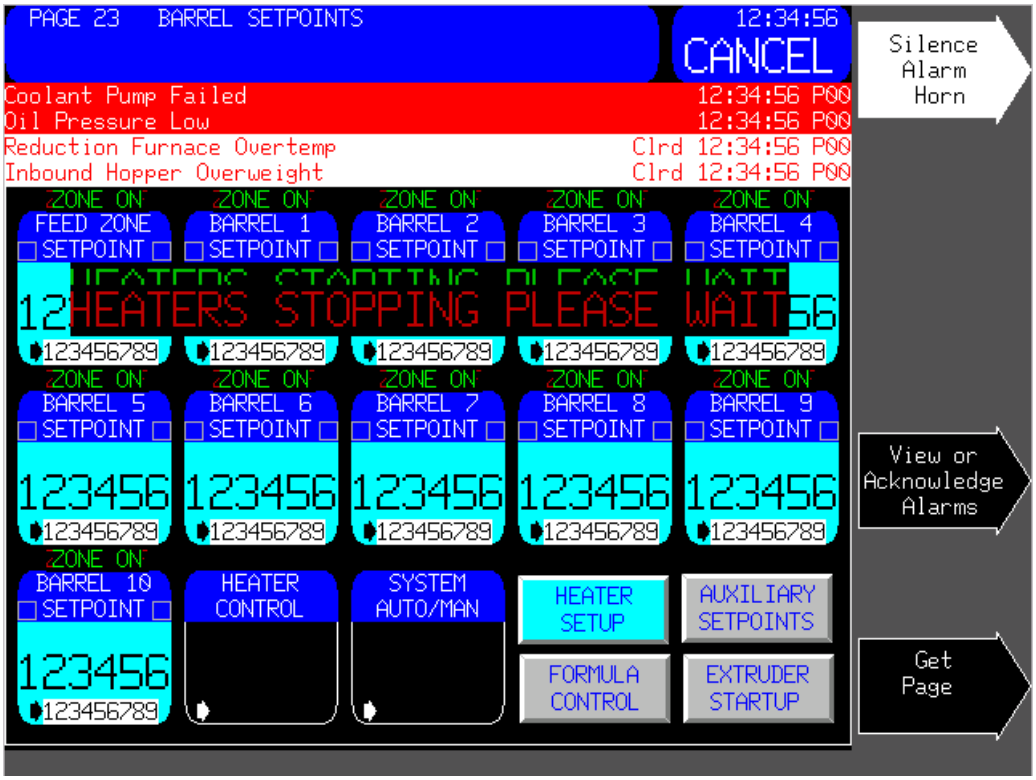
- **RaPID Selection –** This parameter selects/de-selects the RaPID control function. It optimizes the PID control.

- **Control Selection –** Allows the user to turn manual control on and off. When manual control is selected, an active Loop Alarm is turned off and Loop Alarm is disabled.

- **Control Type –** Allows the user to select the control type. Heat control can be selected, or Heat/Cool can be selected.

- **Loop Alarm –** Loop alarm is a special alarm that detects problems in the control loop. See the OEM manual for more information

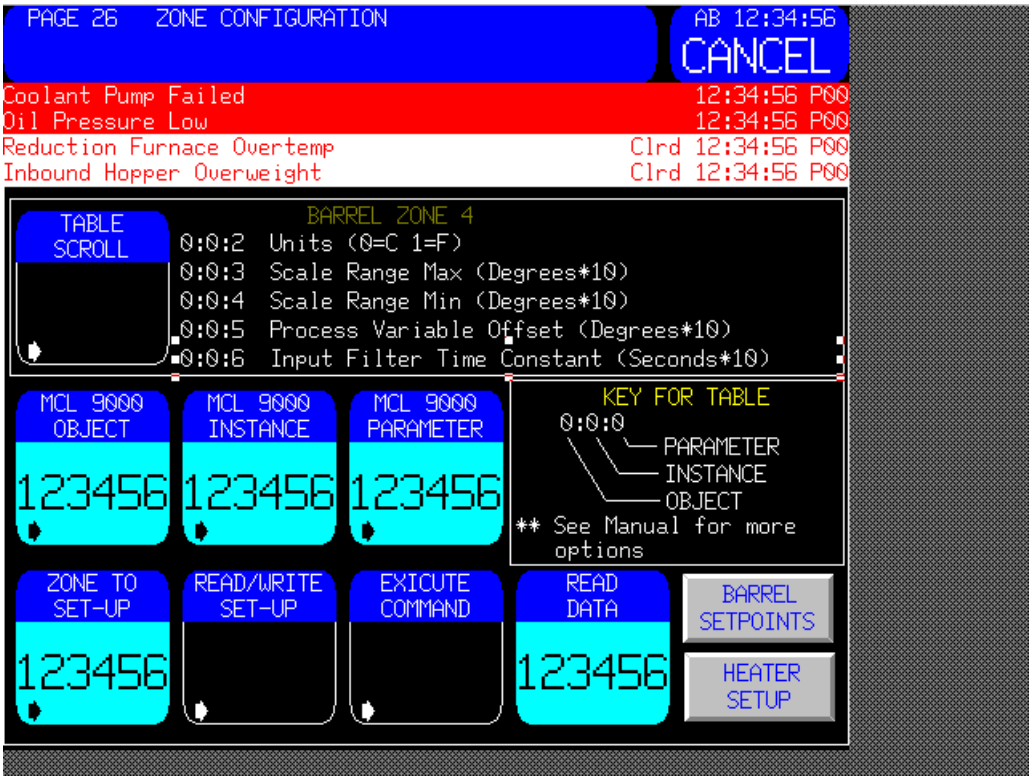
2. **Barrel Setpoints –** The Barrel Setpoints screen sets the operating temperature of each barrel zone. Each of the setpoint buttons are an Analog Control Group.



- **Heater Control –** This command group allows the operator to start and stop all of the heaters that have been enabled on the Configuration page

- **System Auto/Man –** Allows the operator to toggle between Auto Mode and Manual Mode on the cooling system.

3. **Zone Configuration –** This screen allows the user to modify various individual parameters associated with the heaters.



- **Table Scroll –** This button allows the user to view which parameters can be edited. Use the Scroll Up and Scroll Down commands to navigate through the list.

  Each parameter has a series of numbers listed to the left of it. This is its address. The first number is selected by the MLC 9000 Object button. The second is selected by the MLC 9000 Instance button, and the last one is selected by the MLC 9000 Parameter button.

***Warning**: ENTEK recommends modifications to these heater set-up parameters be performed by an ENTEK Support Engineer at time of initial Start-up.*

***Warning**: Do not use this screen unless you are actively editing the heater operating parameters. Having this screen up during an e-stop condition, or a power loss can **cause damage to the heater control logic**, and lock up the controller.*

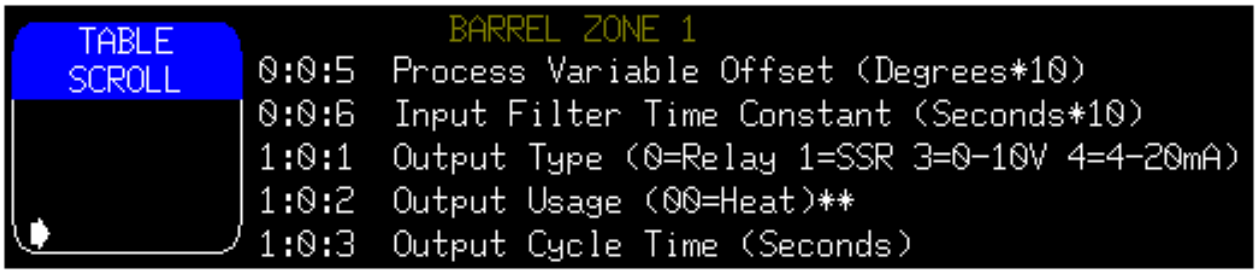
- **MLC 9000 Object –** This button defines the first digit of the address you're trying to reach
- **MLC 9000 Instance –** This button defines the second digit of the address you're trying to reach.
- **MLC 9000 Parameter –** This button defines the last digit of the address you're trying to reach.
- **Zone to Set-up –** This function is used to define which zone is being modified. To define a zone to setup, select the Zone To Setup button, and enter the zone number you wish to modify. Typically zones are numbered 0-12 for barrel zones, and 13-and up for auxiliary zones.
- **Read/Write Set-up –** This button allows the user to switch between read and write modes. The read mode displays the selected parameter's value. The write mode allows the user to write a new value to the parameter.

***Warning**: Before writing new values to any of the parameters on this screen, ENTEK Extruders recommends that the person editing the parameters read what the existing parameter's data is and record it so that if the new values don't work, the old ones can be re-entered.*

- **Read Data and Write Data –** This button's name changes depending on the mode you're in. If you are in the read mode, its name will be Read Data, and it will display the data that is currently active for the parameter that is defined in the MLC 9000 address buttons as described above. If you are in the write mode, the button's name will be Write Data, and it will become an Analog Command Group. Changing this value, and pressing the Execute command will write a new value to the specified parameter. Make sure it's correct.

- **Execute Command –** The execute button activates the read or write function depending on which mode is selected. Before pressing this button, make sure that the proper parameter address is defined in the MLC 9000 buttons. Also make sure that the correct zone is listed in the Zone to Set-Up button. Lastly, if you are performing a write command, make sure that the value entered is the one that is desired.

The following is an example of how to edit the Output Type variable on Barrel Zone 1. This example is intended to show the steps involved in editing all similar variables. Refer to the picture below.

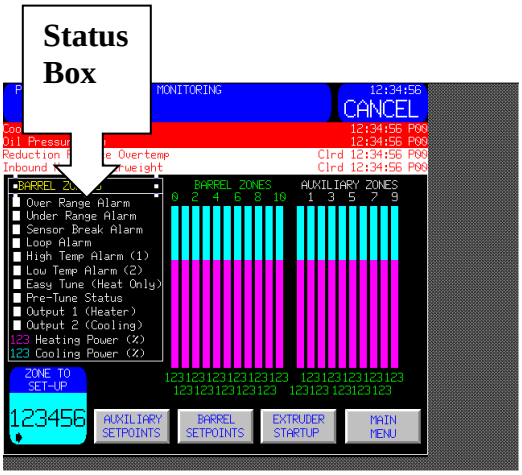


1. Press Zone to Setup, and enter 1
2. Press the MLC 9000 Object and change the value to 1
3. Press the MLC 9000 Instance and change the value to 0
4. Press the MLC 9000 Parameter and change the value to 1
5. Press the Read/Write Set-up button and put the screen in read mode.
6. Press the Execute command and record the value that comes up in the Read Data button
7. Now Press the Read/Write Set-up button and put the screen in write mode
8. If you wanted to change the output type to relay, press the Write Data button and enter 0.
9. Double check that the correct parameter is selected for the correct zone, and press the Execute command.

Note: Consult the OEM Manual for a list of addresses and settings.

5.2.2 MONITORING

Heater monitoring is typically done in one screen. Its functions are describes as follows.

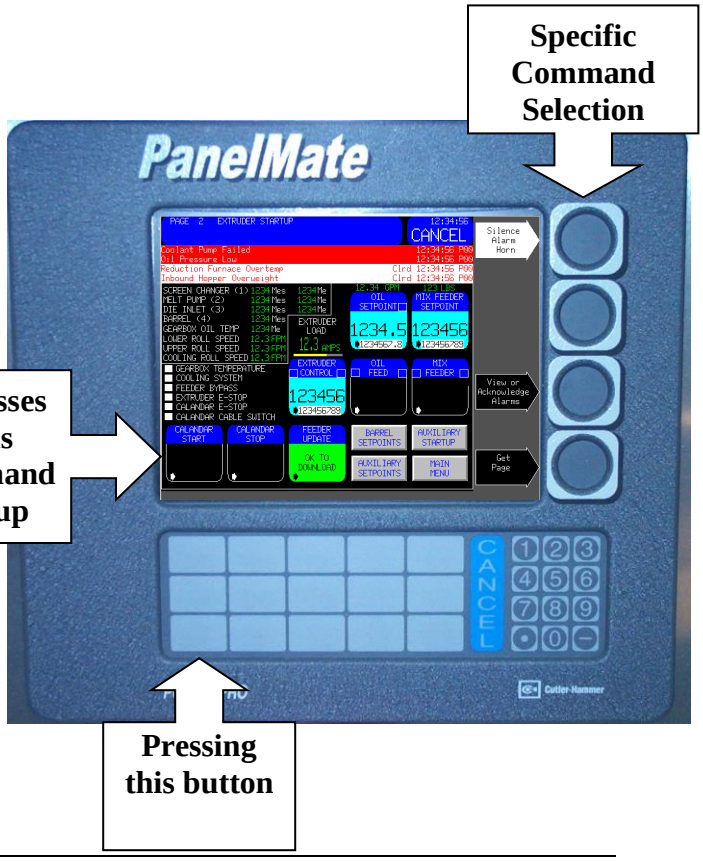


1. **Temperature Monitoring –** This screen shows in graphical form the temperature of each zone. If information on a specific zone is required, use the zone to Set-up button, and enter the zone in question. The status box will show the current status of the heater, and if any alarms are active for that zone.

5.3 NAVAGATION

5.3.1 SELECTION

Accessing commands in the PanelMate is easy. The screen is divided into 15 sections, and the division is duplicated in the button area. Each button selects the corresponding section on the screen. In the case of "GOTO Named Screen" buttons, pressing the button once selects the upper button, and pressing it again selects the lower one.



Also, this operator interface is not a touch screen because of the nature of plastics work. The screen would quickly get too dirty to operate.

5.3.2 PASSWORDS

Some screens and buttons require passwords. This is because the information contained and edited in these areas is of a nature where wrong values can severely hamper machine performance, or even cause damage. The following describes how to navigate with and change passwords. These commands are found in the Setup Page.

- **Log-In Password A**-Maintenance Personnel-Logging in with this password allows access to all screens, excluding the individual Barrel Zone screens.

- **Log-in Password B**-Engineering/Plant Supervisor-Logging in with this password allows access to all screens.

- **To Change Password A or B**
  1. Goto Main Menu
  2. Press Get Page
  3. Select “More Buttons”
  4. Select “Setup Page”
  5. Select “Change Password A:”
  6. Enter Old Password A:
  7. Enter New Password A:
  8. Reenter New Password A:
  9. Press Cancel (Esc)
  10. Press Get Page
  11. Enter “00” to return to Main Menu

5.3.3 OTHER FUNCTIONS IN THE SETUP PAGE

- **How to get to the setup page**
  1. Goto Main Menu
  2. Press Get Page
  3. Select “More Buttons”
  4. Select “Setup Page”

- **How to Set Date & Time**
  a) Select Set Date & Time
  b) Select Date-Enter New Value
  c) Select Time-Enter New Value
  d) Cancel (Esc)

- **Display System/Config. Information**-ENTEK recommends not entering this command.

- **Enter Offline Mode**-ENTEK recommends not entering this command.

6 STARTUP AND OPERATION

6.1 PRE-STARTUP CHECKS

- Verify the water supply has been turned on.
- Verify all electrical switches are engaged.
- Verify the gearbox has the proper amount of oil. (Oil must be a minimum of ½ way up the sight glass)
- Verify the cooling tank has the proper amount of liquid.
- No material in screws before startup

6.2 STARTUP PROCEDURE

Before starting the machine, be sure the Pre-startup Checks have been completed.

Using the Operator Controller Interface, engage the following systems:

1. Start Gearbox Oil Pump (If so equipped). Let run at least 5 minutes, before proceeding.
2. Start Cooling System
3. Start all of the heaters, and allow their temperatures to come up to setpoint.
4. Extruder System Start (This will cause the Extruder, Gearbox Lubrication Pump and Extruder Blower (if applicable) to start if not already started)-Remember to start at low RPMs
5. If required, start vacuum after machine has been started.

6.3 SHUTDOWN PROCEDURE

Using the Operator Controller Interface, disengage the following systems:

1. Extruder System Stop (This will stop the Extruder Motor and Gearbox Lubrication Pump)
2. Stop Vacuum Pump, if running.
3. Cooling System Stop and stop heaters if shutting down for an extended amount of time.

***Warning**: If machine is going to be shutdown for maintenance, be sure to follow the Lockout Procedure, Refer Section 4.6.*

7 MAINTENANCE AND LUBRICATION

To insure the service life and operation security of the extruder, ENTEK strongly recommends following a regular maintenance schedule and perform a periodic evaluation.

ENTEK has developed a Preventative Maintenance Schedule directly into the PLC. Refer to 5.13. ENTEK strongly recommends the plant Maintenance Department incorporate this schedule into the On-site Maintenance Schedule.

7.1 SPECIFIC MAINTENANCE TASKS/CLEANING

7.1.1 Screw Removal

1. Run machine at a low RPM and to allow purging compound to run through the entire barrel and screw assembly. This will remove any unwanted material from the barrel sections. Mineral oil may also be used in this process to aid in screw removal.

Warning: *When running Mineral Oil through screw and barrel, be aware of high temperatures and the Flash Point of Mineral oil.*

2. Verify the Shutdown Procedure, Section 6.3 and the Lockout Procedure, Section 4.6 have been followed appropriately and all Lockouts are in place before Screw Removal begins.

3. Open or remove die heads.

4. Refer to the specific coupling work instruction that applies to your machine. Contact ENTEK Extruders for more information.

5. Begin pulling on screws until they are completely out of the barrel. Be sure to place an adjustable height, aluminum or hard wood surface tabletop under screws as they are being removed. Be sure cart is on casters to allow for each transportation.

Warning: *Temperatures may be 200°C (400°F) or more, be sure appropriate cautions are in place.*

7.1.2 Screw Disassembly and Assembly

1. Clean all sections of the screw, using wire brushes, wire wheel, solvents, brass, aluminum, etc.

2. Once entire screw is clean from all foreign plastic, check for any wear or damage to the screw sections.

3. Map entire screw assembly for accurate re-assembly. See Section 1.3.1, Screw Layout Spreadsheet.

4. To aid in screw segment removal, heat screw and shaft using propane torch or comparable non-focused flame apparatus.. Begin pulling each section individually. Save screw sections in 2 separate bins to aid in accurate re-assembly. Sections may require tapping(Aluminum or Brass punch or square stock) to aid in the removal, due to material buildup or shaft wear/damage.

5. Clean shaft and inside screw sections using the same tools in Step 1.

Warning: Do not use a marring tool on seal area or gearbox shaft splines.

6. Inspect screw shafts, gearbox end of spline and seal area for damage or wear.

7. Inspect for damage or wear on all components. If wear or burrs are evident, be sure to stone before assembly. If major damage or wear is evident, component replacement may be required.

Assembly

1. Before assembly of the screws, verify all parts are clean and stone/lap faces of screw segments.

2. Place both shafts, milled spline up, in a Timing fixture or as they would fit into the extruder.

3. According to assembly map or part number order of assembly, place the feed screw section on one shaft first, with the screw lobe facing up. Be sure timing identification is facing gearbox. Next place the feed screw section on the other shaft, rotated 90 degrees. This will compensate for the offset and allow proper timing inter-mesh.

4. Continue to follow print or pre-drawn map of assembly. Each part in progression will match (in profile).

5. Where Reverse elements are required, be sure to install as per Section 1.3.1, Screw Layout Spreadsheet.

6. Complete each shaft as per Section 1.3.1, Screw Layout Spreadsheet.

7. Hand tighten screw tips back on the end of the shafts.

8. Upon completion of the shafts, remove timing fixture and roll shafts together. They must roll smoothly, if not, double check assembly and timing of both shafts to determine the discrepancy.

9. Verify Screw Timing is correct.
   a) Place screws back into the Timing Fixture or as they would fit into the extruder.
   b) Visually inspect clearances between all flights. All clearances should be equally spaced between flights.
   c) Verify screw configuration with print configuration.
   d) Remove Timing fixture and slowly rotate (clockwise or counter-clockwise) the screws together. The screws should roll smoothly, without any interference. Any interference must be resolved before accepting screws.
   e) Perform an overall visual inspection of screws.

10. Upon final inspection approval of the screw assembly, tighten screw tips.

Warning: Only buffing pads or wire brushes be used on shafts.

Helpful Hint: *Use High Temperature Anti-Seize compound on screw sections during assembly to secure all sections.*

Warning*: Always verify screw assembly and timing before placing screws back into machine.*

Helpful Hint: *Insure all parts are clean from any foreign material, this will allow correct face-to-face contact and timing gap clearance of kneading discs or mixing elements.*

7.1.3 Barrel Disassembly and Assembly

Following Screw Removal, the barrel section will need to be removed.

1. Remove all bolts holding barrel assembly to the barrel supports and the machine.

2. Lift barrel using safe lifting practices and place on an aluminum or hard wood surface tabletop cart. Be sure cart is on casters to allow for easy transportation.

3. Remove all nuts and bolts or dowel pins, pull sections apart. Use caution not to damage dowels or dowel holes.

4. Clean each section using a wire wheel on all bores. Remove all other foreign material using a wire wheel, Scotch-Brite®, etc. or Sections may be sent out for a chemical or heat cleaning process.

5. Inspect for wear or damage on all barrel components. Verify bore condition to in-house specification requirements. If burrs are evident, be sure to remove before assembly. If major damage or wear is evident, component replacement may be required.

Assembly

1. Organize all barrel segments in the proper sequence and orientation. Insure all mating surfaces are clean.

2. Using the dowel pins and flange bolts, begin adding downstream barrels to the feed barrel. It is critical that both dowel pins are used. Incrementally tighten the flange bolts in a criss-cross pattern. Torque M8 fasteners to 25 ft./lb. [34N-m].

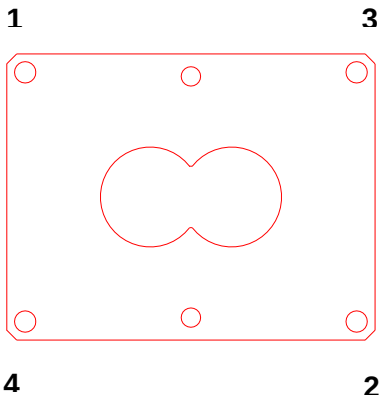


Figure 7.1

3. Once the barrel has been fully assembled, verify that the bore alignment is within .004 inch. Used, worn, or dirty barrels may be difficult to check.

4. Place the barrel on the extruder. Engage the gearbox dowel pins and barrel support.

5. Install heaters, cooling hoses, and all other equipment that was removed to get access to barrel.

7.1.4 Coupling Alignment

The coupling alignment is set by the gearbox manufacturer and verified by ENTEK upon assembly.

7.1.5 Screw Installation

1. Place screws in barrel, with drive end, toward gearbox. Push screws the entire length of barrel.
2. Verify the gearbox timing (ground) splines are correctly aligned with the set screws or pins in the couplings. Tighten set screws, pins or lock collars.

3. Refer to the proper Coupling work instruction for you machine. Contact ENTEK Extruders for more information.

4. To insure screw timing, follow the steps below:
   a) Lockout Drive
   b) Remove Motor Drive Guard
   c) Rotate gearbox input shaft by hand
   d) Verify proper rotation. Refer to Section 3.6.
   e) Watch for smooth rotation. There should be no hesitation or resistance when rotating.
   f) If screws rotate freely, replace the Motor Drive Guard and remove Lockout on Drive enclosure.

7.2 MAINTENANCE SCHEDULE

7.2.1 Gearbox Inspection

Follow manufacturers instructions in the PIV 23-B2N13110-EXT OPERATING INSTRUCTIONS manual.

Please notify ENTEK immediately, if any damage or a malfunctions occurs during operation.

7.2.2 Motor

ENTEK recommends visually inspecting the motor on a regular (monthly) schedule. Be sure to keep the motor clean and the vent openings clear of all debris.

7.2.3 pH Sampling

On a monthly basis, ENTEK recommends sampling the extruder coolant water. The sample should be taken at the drain of the Basket strainer. The Extruder must be turned off completely and the coolant water is cooled down.

1. Insert the Test Paper Strip into the water sample and allow the paper strip to fully saturate.
2. Compare the Test Paper Strip to the chart on the test kit to determine the pH reading.
3. If the pH is lower than 9, the system must be flushed completely. Follow procedure in Section 3.5.4 to properly prepare the new coolant water.

7.3 LUBRICATION REQUIREMENTS

7.3.1 Gearbox

The first oil change should be carried out after approx. 600 operating hours. Further oil changes should be carried out every 8000 operating hours or 18 months. See Section 9.0, Vendor Operating and Maintenance Instructions for detailed instructions.

LUBRICANT TABLE FOR GEARBOX

Lubricant	**Mineral Oil**
Identification letter	CLP
Acc. To DIN 51517 Code Number	320
Notation acc. to DIN 51517 III	CLP 320
Notation acc. to DIN ISO 3498	CC 320
ISO-viscosity class acc. to DIN 51519	ISO-VG 320
Kinemat. Viscosity at 40° C (mm^2/s)	320
ARAL	Degol BG 320
BP	Energol GR-XP-320
Esso	Spartan EP320
Mobil	Mobilgear 632
Shell	Omala Öl 320
AGIP	Blasia CLP 320
DEA	Falcon CLP 320
Optimol	Optigear BM 320
Tribol	Tribol 1100/320

7.3.2 Motor

ENTEK is utilizing the 254TC Frame motor (15 hp application), which is furnished with double shielded or open ball or roller bearings, depending on the HP size and/or speed required.

The motor is furnished with grease fittings and in general should be greased per the schedule below. Before greasing, be sure fittings are clean and free from dirt. Remove grease relief plug or plate and using a low pressure grease gun, pump in the required grease. Do not over-grease. After relubrication, allow motor to run for 10 minutes before replacing relief hardware. See Section 9.0, Vendor Operating and Maintenance Instructions for detailed instructions.

LUBRICATION SCHEDULE FOR MOTOR

Sync. RPM Rang	**Frame Range**	**Type of Service**		
		Standard	*Severe*	*Extreme*
1800	210-280	9500 Hrs.	4750 Hrs.	950 Hrs.
1800	280-360	7400 Hrs.	3700 Hrs.	740 Hrs.
1800	360-5800	3500 Hrs.	1750 Hrs.	350 Hrs.

SERVICE CONDITIONS

Severity of Service	**Ambient Temp. Maximum**	**Atmospheric Contamination**
Standard	40 Deg. C	Clean, Little Corrosion
Severe	50 Deg. C	Moderate dirt, Corrosion
Extreme	>50 Deg. C* or Class H Insulation	Severe Dirt, Abrasive Dust, Corrosion
Low Temp.	<-30 Deg. C**	

*Special high temperature grease is recommended.
**Special low temperature grease is recommended.

LUBRICATE TABLE FOR MOTOR

	Texaco Polystar	Rykon Premium #2
	Pennzoil Pen 2 Lube	Chevron SRI
	Polyrex EM (Exxon Mobil)	

7.4 ALARMS/TROUBLESHOOTING

All the alarms listed under this section are for example only. Your particular machine may or may not have all of these alarms available.

Alarm:
EMERGENCY STOP TRIPPED

Solution:
Emergency Stop normally energized circuit is de-energized.

1. E-Stop pushbutton pressed. Reset e-stop condition
2. E-Stop loop power interrupted or off. Check wiring, fuse, etc.
3. E-Stop relay failed. Replace relay.
4. PLC I/O fault - clear fault.
5. PLC input module failure - replace module.
6. PLC backplane failure - replace backplane.

Alarm:
EXTRUDER MOTOR ALARM

Solution:
Extruder motor failed to start when commanded, or stopped unexpectedly.

1. Check the extruder drive status. See OEM manual for detailed troubleshooting.
2. Check power to and from drive - fusing, disconnects, etc.

Alarm:
EXTRUDER DRIVE COMMUNICATION ALARM

Solution:
Extruder drive not communicating to PLC.

1. Check extruder drive status. See OEM manual for detailed troubleshooting.
2. Test PLC to extruder drive cable integrity.
3. Verify proper operation of PLC communication channel.

Alarm:
EXTRUDER DRIVE FAULTED ALARM

Solution:
Extruder drive was running, but stopped due to fault.

1. Check extruder drive status. See OEM manual for detailed troubleshooting.
2. Check power to and from drive - fusing, disconnects, etc.
3. Test motor for internal short.

Alarm:
EXTRUDER HIGH-HIGH MELT PRESSURE ALARM

Solution:
The melt pressure of the plastic melt stream exceeded the high alarm value.

1. Screen in screen changer/die has excessive material build-up. Replace screen.
2. Melt temperature is too low, causing excessive pressure. Raise barrel temperature.
3. Flow is obstructed. Remove obstruction from flow path.

Alarm:
EXTRUDER HIGH-HIGH MELT TEMP ALARM

Solution:
The melt temperature of the plastic melt stream exceeded the high alarm value.

1. Barrel zone temperatures are too high. Reduce temperatures.
2. Barrel cooling is not effective. Check cooling water supply, cooling water pump, etc.
3. Heat gain from motor exceeds ability of barrel cooling to remove heat. Reduce throughput.

Alarm:
EXTRUDER GEARBOX MOTOR ALARM

Solution:
Extruder gearbox lube motor failed to start when commanded, or stopped unexpectedly.

1. Test motor power circuit - fusing, contractor, motor overload, disconnect, etc.
2. Test motor for internal short.
3. Verify voltage on PLC output to motor contractor.

Alarm:
EXTRUDER GEARBOX HIGH TEMPERATURE

Solution:
Gearbox oil temperature is too high (above 80 degrees Centigrade).

1. Check gearbox oil level. If level is not at middle of sight glass, add oil.
2. Increase cooling water flow and/or decrease cooling water temperature to gearbox oil heat exchanger.

Alarm:
EXTRUDER GEARBOX LOW PRESSURE ALARM

Solution:
Gearbox oil pressure is too low (less than 2 bar).

1. Check gearbox oil level. If level is not at middle of sight glass, add oil.
2. Check for oil system leak.
3. Check oil temperature. If temperature is greater than 80 degrees Centigrade, shutdown the extruder. Verify proper operation of oil temperature sensing system.

Alarm:
EXTRUDER GEARBOX OIL HIGH PRESSURE

Solution:
Gearbox oil pressure is too high (greater than 3.5 bar).

1. Gearbox oil filter may be plugged. Check oil filter pressure indicator, replace filter if necessary.
2. Oil flow is obstructed. Remove obstruction.
3. Oil temperature is too low (below 40° C). Verify that oil pressure relief system is allowing oil to flow when the oil temperature is less than 40° C.

Alarm:
EXTRUDER VACUUM PUMP MOTOR ALARM (Optional)

Solution:
Vacuum pump motor failed to start when commanded, or stopped unexpectedly.

1. Test motor power circuit - fusing, contractor, motor overload, disconnect, etc.
2. Test motor for internal short.
3. Verify voltage on PLC output to motor contractor.

Alarm:
COOLING SYSTEM SURGE TANK LOW LEVEL ALARM

Solution:
Barrel coolant level is low.

1. Add barrel coolant to tank.
2. If coolant level is adequate, verify operation of float switch. If switch has failed, fix or replace.

Alarm:
COOLING SYSTEM COOLING PUMP MOTOR ALARM

Solution:
Cooling pump motor failed to start when commanded, or stopped unexpectedly.

1. Test motor power circuit - fusing, contractor, motor overload, disconnect, etc.
2. Test motor for internal short.
3. Verify voltage on PLC output to motor contractor.

Alarm:
EXTRUDER ZONE XX HIGH TEMP ALARM

Solution:
Barrel or auxiliary heating zone temperature is above setpoint.

1. Verify the barrel cooling flow is on.
   Check that manual shutoff valve is open.
   Check solenoid for obstruction, verify voltage to solenoid, replace solenoid if defective.
2. Heat from previous zones and/or motor horsepower is causing excessive heating, greater than the cooling system can remove. Reduce heat in prior zones and/or reduce motor horsepower.

Alarm:
EXTRUDER ZONE XX RUNAWAY ALARM

Solution:
Barrel or auxiliary heating zone temperature is not approaching setpoint.

1. If temperature is below setpoint:

   Check heater amperage to verify heater is operating. Check all heater lead to verify that all elements in the cast heater are operating. If the heater is not functioning, check all heater leads for a short circuit condition. Replace heater if required.

   Verify the barrel cooling flow is off.
   Use manual shutoff valve to insure that cooling water is not flowing through the barrel zone which is not reaching temperature. If the barrel temperature immediately begins to increase, the cooling water solenoid has failed. Check solenoid for obstruction, verify voltage to solenoid, or replace solenoid if defective.

2. If temperature is above setpoint:

   Verify the barrel cooling flow is on.
   Check that manual shutoff valve is open.
   Check solenoid for obstruction, verify voltage to solenoid, replace solenoid if defective.

Alarm:
ERRATIC HEATER PERFORMANCE

Solution:

1. If barrels do not cool to set point:

   Check Basket strainer in cooling system for plugged screen.

   Check any facility filter/screen on facility supply water.

   Check needle valve on problem zone to verify it is open.

2. If barrel will not heat to set point:

   Verify all heater bolts are secure.

   Verify cooling water solenoid is not stuck open by fully closing needle valve.

   If temperature rises with needle valve closed, remove and thoroughly clean solenoid valve

8 PRINTS

E27 E-MAX Series Extruder Prints

9 VENDOR OPERATING AND MAINTENANCE INSTRUCTIONS

9.1 OEM Manuals will be provided with delivery of equipment.