STANDARD OPERATING PROCEDURE

Extruder, Twin-screw, Large

Model: Mic 27/GI-40D
Manufacturer: Leistritz Extrusions Technik GmbH
Location: Dry Processing Pilot Plant, 1851 Food Sciences Building
Publication Date: 05/16/2014
Description and Uses

Extrusion is a method of making plastics where the raw materials (granular or pellets) are fed to the hopper and drop into the rotating screw. Extruders can also be used as dry reactors (i.e. starch and food materials) for producing puffed expanded textures. As the screw rotates, the material is conveyed forward through the heated barrel. The combination of shear heat and barrel heat causes the materials to melt. As the plastic reaches the end of the screw, it is now well mixed and is called a melt. Each barrel-heating zone of the extruder can be set to different temperatures to ensure that a good melt is produced. The plasticized material is then pushed out unto the die and out of the extruder. This twin-screw extruder is typically used in small-scale compounding and extrusion processes.

Power Specifications

<table>
<thead>
<tr>
<th>Extruder</th>
<th>Motor: Mic 27/GI-40D</th>
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<tbody>
<tr>
<td></td>
<td>Power (Wattage): 0.1-10.5 kW</td>
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<tr>
<td></td>
<td>Voltage/Amperage: 34-310V/0.45-1.15A</td>
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<td>Speed/Frequency: 500 rpm (Screw)</td>
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<tr>
<th>Drive</th>
<th>Motor: Siemens</th>
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<tr>
<td></td>
<td>Power (Wattage): 14.9 kW</td>
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<tr>
<td></td>
<td>Voltage/Amperage: 440-470V/34.8-37A</td>
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<tr>
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<td>Speed/Frequency: 3400 rpm @ 60 Hz.</td>
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Potential Hazards and Safety Precautions

**Electric Shock/High Voltage (440-470V)**
- Make certain to use the correct outlet that is specifically designed to fit the electrical cord plug.
- Make sure the area around the outlet, floor and your hands are completely dry when plugging or unplugging the electrical cord to/from the outlet.

**Rotating Pinch Points/Possible Entanglement of Extremities, Hair, Jewelry or Clothing**
- The extruder operates with high-speed moving parts. Keep hands, body parts, hair, jewelry and clothing clear of all moving parts while the extruder is in operation.
- Make sure to secure long hair and any loose clothing or jewelry before operating the machine.
Hot Surfaces/Possible Burns to Hands and/or Extremities

- The extruder operates at very high temperatures. Never place any body parts near the extruder while it is in operation.
- Ensure that the vent fans are turned on while the machine is in operation.

Flying Debris/Potential Eye Damage

- Always use proper personal protective equipment at all times while operating the extruder.

High Pressure/Possible Explosion

- Extruders operate under high pressure. If too much material is fed into the hopper at once, high pressure can build and cause the screw to stop turning and damage the motor. Also, hot material can splash on the operator due to excessive pressure release.

Required Personal Protective Equipment

- Safety Goggles
- Protective Footwear (no open-toed shoes)
- Lab Coat
- Hair Net
- Heat-resistant Gloves
- Tie Back Long Hair
- Long Pants and Long Sleeves
- No Loose Fitting Clothing

Training

Required Training

*Denotes courses offered online

- Machine & Site-Specific Training
- Fire Safety & Extinguisher Training*
- Laboratory Safety: Core Concepts*

Recommended Training for Frequent Users

- Electrical Safety & Lockout/Tagout
- Laboratory Safety: Spill Procedures
Operation

Operation: Start-up

1. Before you begin, be sure that you receive the proper training (as listed above). Use of this extruder requires machine and site-specific training by the pilot plant manager or another trained professional.

2. Be sure to familiarize yourself with the extruder by reading the Instruction Manual (Guidelines for installation, operation, and maintenance of Leistritz twin-screw extruders), located in the file cabinet in the Pilot Plant Office, 1955 Food Sciences Building.

3. Be sure to wear all required personal protective equipment before operating this machine (refer to listing on previous page).

4. Under the supervision of the pilot plant manager, flip ON the circuit in circuit-breaker panel (arrow in Figure 1) that pertains to the outlet where the large Leistritz extruder (circle in Figure 1) is plugged into. **Note:** Make absolutely sure that the area around the outlet, circuit panel, floor and your hands are completely dry before flipping the circuit to the ON position.

5. Attach the hose (see Figure 2) to the faucet (see Figure 3). Once the hose is firmly attached, open the faucet all the way.

6. Turn on the water line by opening the water-line valve (see Figure 4). Open to only 25-50% fully open. **Note:** Do not open this valve to 100% fully open because the water pressure will be too high.

7. Turn on the cooler by flipping the switch to ON (circle in Figure 5).

8. Turn ON the extruder’s Power Supply Switch located on the bottom right side of the machine (see Figure 6).

Operation: Main

1. In the control panel (see Figure 7), ensure that the red Ease Stop button is disengaged (pulled out). Ensure that the Motor Speed Controller Knob is turned fully counterclockwise to OFF.
2. Set the desired temperature profiles by pressing the UP and DOWN buttons in the control panel. The number on top of the temperature panel is the actual temperature while the number at the bottom is the set temperature.

3. Turn ON the drive motor by pressing the green button of the Motor Speed ON/OFF Switch in the control panel (see Figure 7).

4. Slowly increase the motor speed up by turning the Motor Speed Controller Knob clockwise until desired speed is achieved. **Note: Ensure that the Torque remains below 100% (see Figure 7).**

5. Once the desired temperatures are obtained, slowly start feeding the material into the hopper. **Note: Do not place any metallic materials into the hopper, as this may cause serious damage to the machine.**

6. Place appropriate containers below the die at the end of the barrel to collect the extruded samples. **Note: Never stand in front of the die where the samples come out nor try to peek inside the die or barrel while it is in operation, as this may cause serious injury.**

**Operation: Shut Down**

1. When the experiment is complete, fill the extruder with purge materials through the hopper.

2. Wait for all the purge materials to come out of the barrel. **Note: Before continuing with shut down procedures, ensure that all the materials inside the barrel are purged out.**

3. Once purging is complete, slowly decrease the motor speed by turning the Motor Speed Controller Knob completely counter clockwise to OFF (refer to Figure 7).

4. Turn OFF the drive motor by pressing the red button of the Motor Speed ON/OFF Switch in the control panel (refer to Figure 7).

5. Turn OFF the extruder’s Power Supply Switch (refer to Figure 6).

6. Turn OFF the cooler by flipping the switch to OFF (refer to Figure 5).

7. Turn OFF the water line (refer to Figures 3 and 4).

8. Disconnect the hose from the faucet (refer to Figures 2 and 3).

9. Under the supervision of the pilot plant manager, flip OFF the main electrical line in circuit breaker panel (refer to arrow in Figure 1). **Note: Make absolutely sure that the area around the circuit panel, floor and your hands are completely dry before flipping the circuit to the OFF position.**

10. Log your name and hours of equipment usage in the log sheet.
**Clean-up Procedures**

After purging and shut down procedures are complete, please refer to the Instruction Manual (Guidelines for installation, operation, and maintenance of Leistritz twin-screw extruders), located in the file cabinet in the Pilot Plant Office, 1955 Food Sciences Building, for disassembly and clean-up procedures.

**Machine Care and Maintenance**

- Inspect the machine after every use for any leakage or broken parts.
- Report any operational difficulties, leaks or broken parts to the pilot plant manager.
- All final inspections are performed by the pilot plant manager.
- For detailed maintenance procedures, please refer to the Instruction Manual (Guidelines for installation, operation, and maintenance of Leistritz twin-screw extruders), located in the file cabinet in the Pilot Plant Office, 1955 Food Sciences Building.

**Accessories**

Trough. For further accessory details, please refer to the Instruction Manual (Guidelines for installation, operation, and maintenance of Leistritz twin-screw extruders), located in the file cabinet in the Pilot Plant Office, 1955 Food Sciences Building.