ATTENTION:
THIS DOCUMENT IS NOT INTENDED TO PROVIDE COMPLETE OPERATING INSTRUCTIONS FOR THE EXTRUSION EQUIPMENT. ALL OPERATORS MUST RECEIVE TRAINING FROM THE LAB MANAGER PRIOR TO OPERATING THIS EXPERIMENT.

DO NOT PRESS RED POWER BUTTON ON THE EXTRUDER UNTIL THE MELT ZONE TEMPERATURE IS AT LEAST 115 degrees C AND THE DIE TEMPERATURE AND ZONES 1-3 ARE > 140 degrees C -THE MELT POINT MUST BE AT LEAST 115 degrees C before operating the motor.

If the torque reading is rapidly increasing when you start the motor, shut the motor off and wait for the melt zone temperature to increase above 120 degrees C. The torque reading should be negligible regardless of the extrusion screw speed, if it is not, contact the lab manager.

A note on pressure readings: The pressure transducer is located in the melt zone, the range of the transducer is 0 – 10,000 psig, the transducer outputs 3.314 d.cc mv per volt of excitation voltage. The excitation voltage is 8 vdc. The pressure reading is calibrated such that the maximum output voltage of 26.5 mv, (3.314 x 8vdc), correlates to 10,000 psig, the transducer output is assumed to be linear.

Never leave this equipment unattended!

The red button applies power to the screw; if you power the screw when the polymer is solid or not viscous enough you will break the shear pin! Extra shear pins are in the storage cabinet below the extruder.

Extruder polymer is VERY HOT!
Use gloves and metal tongs when handling extruder polymer.
Polymer fumes may be toxic when the polymer is overheated. Closely monitor temperatures to avoid burning the polymer.

The melting temperature of HDPE is in the range of 108 – 134 degrees C. Since the extruder temperatures displayed on the Opto software are the internal barrel temperatures and not the actual polymer temperatures the recommended set point /extrusion temperatures for HDPE is higher (140 – 180 deg C) than the actual melt temperature listed for the polymer.

ALWAYS WEAR SAFETY GLASSES WHEN OPERATING THE EXTRUDER.

Startup Procedure:

1. Verify that the main air pressure valve is open.
2. Open the main cooling water valve ½ turn.
3. Verify that the main power button on the extruder is off, the indicator light should be off.
4. Verify that the toggle switch on the extruder, by RPM dial, is set at local.
5. Verify that the motor speed control toggle switch is set to “fine speed control”.
6. Verify that the fine speed control is set to zero.
7. Open water-cooling valves to the feed hopper, flow should be set at 0.5-g.p.m. Cooling water is not required for the take-up rollers.
8. On the main control unit – the old control unit under the newer control cabinet –verify that the main power and heat zone toggle switches are in the off position, they do not affect Opto control.
9. On the right side of the older control unit, verify that the three solenoid toggle switches are in the on position. These switches must be on in order for Opto to control the coolant airflow.
10. The Opto software incorporates PID control for the three heating elements in the extruder barrel and the die heating element. The motor speed is controlled manually using the speed control knob on the extruder.
11. The Opto heating control software can be operated in either manual or auto mode. Normal operation is in AUTO Mode. A description of manual mode operation is given for reference. To operate in manual mode set all control windows to manual mode, the “M” should be displayed in each control window - set the manipulated variable (MV) to the desired value. In
manual mode the PID values have no effect. Use the (MV) to control temperature by setting the 
% power on. A set point of 12% (MV) in manual mode will maintain approximately 150 degrees 
Celsius. Remember that in manual mode the heating elements are constantly being heated at the 
percentage power set whereas in PID mode the heating elements are constantly switching from on 
to off status with power output being constantly adjusted according to the PID parameters.

Extrusion Procedure:

1. Open Opto Control from the shortcut (OPTO EXTRUDER) on the desktop. Close the event log 
   viewer window. Start the extruder program.
2. Select Auto mode for zones 1, 3 and the die heat control.
3. Select manual mode for zone #2, in zone #2 enter zero in the MV numeric window.
4. For operation in Auto mode: Set all control windows except heater #2 control to Auto, Set the 
   set point (SP) to the desired value, 150-170 deg C is recommended as a set point for zones 1, 3 
   and the die heater. Zone two is not actively heated; it will heat from conduction from zones one 
   and three.
5. When the die and zones 1 – 3 reach a minimum of 140 degrees Celsius and the melt zone is at a 
   minimum of 115 degrees C you are ready to attempt to extrude.
6. Verify that the speed control potentiometer is set to zero.
7. Now push the red button on the extruder, this will apply power to the motor. The motor will not 
   rotate until you increase the speed control potentiometer.
8. Very gradually, increase the speed control potentiometer just until the motor begins to rotate. 
   Allow the motor to run at this very low RPM for 1 – 2 minutes in order to stabilize the motor. 
   Observe the torque meter on the extruder, torque should never exceed 600. If the torque meter 
   starts to move rapidly or erratically, immediately shut down the motor by depressing the red motor 
   power button, and then contact the lab manager. Do not shut down the computer; do not close the 
   opto program.
9. Once the extruder motor has stabilized at a low RPM, gradually increase the motor speed to the 
   desired level. Continue to closely observe the torque meter for any erratic reading. If the torque is 
   approaching the 600 mark, reduce the speed.
10. Under optimal conditions the torques should not exceed 100.
11. Supplemental material is available in the extruder manual.
12. Data is stored at C:\DATA extruder. Save your data to a flash drive after each session.

Shutdown procedure:

1. Turn off power to extruder motor – Press red button on extruder, light should be off.
2. Exit Opto, do not log off computer. Cooling air will run until the temperatures are reduced 
   below 100 deg C.
4. Shut off the main water supply valve, the air supply valve remains open.
5. Check out with lab manager.