PROFILE EXTRUSION

Typical thermoplastic extruder

The selection of extruder barrel diameter depends on the dimension of the profile being produced. As throughput needing increases, diameter must be increased. A length to diameter ratio (L/D) of 24:1 are recommended. If higher capacity needed, L/D ratios of 30:1 preferred as they deliver a higher output capability, more uniform output rate and better melt quality with the proper screw design.

Extrusion of Elastraon TPE product requires medium to high shear to properly plasticize (high shear for Elastraon V products) and ensure properly processing at recommended temperatures. General purpose three zone screw design (feed, transition/compression, metering), having a compression ratio of 2.5 to 3.5 with an L/D of 18:1 to 24:1 is recommended. Barrier screws especially for Elastraon V products are used successfully and are recommended.

In order to be changed the melt flow from rotational to uniform laminar flow, there are some relaxation zone after the extruder barrel. During extrusion, melt being inside the barrel are compressed and stressed and it needs uniform flow before profiling.
Also breaker plate must be used for screening. Special screens must be installed on the breaker plate to catch the foreign or burned particles coming from the screw or barrel inside. Depending on the extruder size and capacity breaker plates having holes from 2mm to 4mm can be used, and 20 or 40 mesh screens are recommended.

The advantages of using screens:

- Homogenize melting due to pressure,
- Catching the burned particles coming from the screw,
- Catching the unmelted particles due to ununiform screw design,
- Increasing the shear,
- Increasing the surface quality,
- Increasing back pressure to better melt quality.

**MELTING IN THE SCREW**

From left to right, during processing, melting takes places. The material being melted remains behind the solid material. That’s why if we don’t use enough compression ratio and the length of compression zone, there would be some unmelted material in the metering zone and we could see the rough surface on the profile. We have to ensure that the material coming to the metering zone have to be melted completely.

**MELTING IN THE CONVENTIONAL SCREW**

Melt Pool in the conventional screw

Non melted particles being breaked up
HOW TO GUARANTEE MELTING (BARRIER SCREW)

Extra barrier flights let us extra compression during melt transition from filling to metering zone. This compression provides extra melting due to shear increasing.

TROUBLESHOOTING GUIDE FOR EXTRUSION

1. **Interrupted melt output: Unbalanced barrel temperatures.**
   - Reduce the feed zone temperature to feed the material to transition zone properly.
   - Checked the temperature resistance and cooling system.
   - Checked the screen to catch the degraded, burned particles.

2. **Surging: Due to contaminated material or wrong temperature settings unbalanced die exit.**
   - Increase the barrel temperatures gradually for each zone equally.
   - Check the screen, clean if it is blocked.
   - Check for the blockage in the hooper.
   - Check the screw configuration.
   - Clean the screw before production.

3. **No Output: Die blocked due to solidification.**
   - Check the material entrance from hooper to barrel inside.
   - There might be blockage in the hooper inside.
   - Increase the die temperature to dissolve the blockage.
   - Change the screen.

4. **Rough Surface due to unmelted particles:**
   - Check the screen if there is any tears.
   - Increase the temperatures especially in the compression zone.
   - Check the zone temperature resistance.
   - If there are any crosslinked particles on the surface, reduce the screw rpm and the zone temperatures in order to prevent the degradation.
5. Burned and discolored extrudate:
   - Reduce the screw rpm.
   - Reduce barrel temperatures gradually until getting the right colour.
   - Select the extruder having lower L/D ratio for production.

6. Die lines:
   - Select the material having lower viscosity.
   - Increase the die temperatures.

7. Melt Fracture:
   - Reduce the barrel temperatures.
   - Change the material with in accordance with the die design.

8. Shark Skin:
   - Reduce rpm.
   - Change the screen.
   - Increase the melt temperature.

9. Fish eyes:
   - Check the material and screen for contamination.
   - Material must be dried properly before using.
   - Reduce the temperatures to prevent material degredation.

10. Bubbles on the profile surface:
   - Be sure to dry the material properly.
   - Reduce the melt temperature.
   - Reduce screw rpm.

11. Warpage: Insufficient cooling
   - Increase the cooling bath lenght, reduce the water temperature.
   - Balance the die according the part wall thickness.

12. Orange Peel surface:
   - Die temperature is too low, increase the die temperature.
   - Increase the temperature of the zones which is close to die.