# EXTRUSION TROUBLESHOOTING GUIDE

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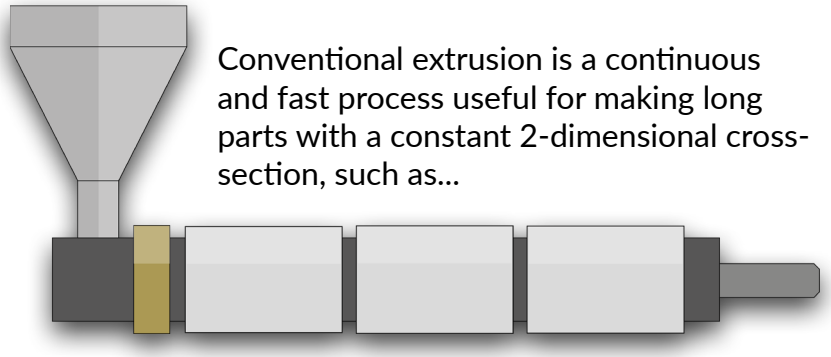

Conventional extrusion is a continuous and fast process useful for making long parts with a constant 2-dimensional cross-section, such as...

PIPES

PROFILES & WEATHER STRIPPING

SHEET

No other process can manufacture these types of parts more affordably. Multiple materials can be co-extruded together creating a rigid material with softer feel. This troubleshooting guide is specifically tailored to profile and tube extrusion, but certain aspects can be applied to other continuous process methods including sheet, cast film, and blown film extrusion.

| PROBLEM | PROBABLE CAUSE | ACTION |
|---|---|---|
| Dull / Rough Surface | Extrudate dragging on surface | Increase die temperature |
| | Die and adapter surfaces too rough | Polish die and adapter surfaces |
| | Die temperature too low | Raise die temperature to approximate melt temperature |
| | Melt temperature too low/poor plasticization | Increase process temperature |
| | | Increase back pressure with additional screens or finer mesh |
| | Resistance to flow / resin viscosity too high | Increase melt temperature |
| | | Add processing aid to formulation |
| | | Select higher melt flow material |
| | Moisture in material | Dry material if necessary, check dryer function, moisture level of material |
| | | Use a vented extruder |
| | Incompatibility; mix of 2 materials with widely varying melt viscosities | Review material specification and/or match melt flow of blend |
| | Short die gap | Increase die gap |

| PROBLEM | PROBABLE CAUSE | ACTION |
|---|---|---|
| Glossy Surface | Die temperature too hot | Decrease die temperature |
| | Melt temperature too hot | Decrease the melt temperature |

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| PROBLEM | PROBABLE CAUSE | ACTION |
|---|---|---|
| Lumpy Extrudate | Melt temperature too low | Increase process temperature |
| | Material not mixed, inconsistent or poorly mixed regrind | Increase back pressure with additional screens or finer mesh |

| PROBLEM | PROBABLE CAUSE | ACTION |
|---|---|---|
| Dimples / Bubbles / Pits | Moisture in material | Dry material if necessary, check dryer function, moisture level of material |
| | | Vent extruder |
| | Entrapped air or gases | Lower rear barrel temperature of zone 1 & 2, add finer screens to increase back pressure |
| | | Reduce screw speed |
| | | Increase back pressure by additional screens or finer mesh |
| | | Reduce die temperature |
| | Melt temperature too high, hot feed section | Decrease process temperature |
| | | Lower rear barrel temperature of zone 1 & 2 |
| | Contamination, dust | Eliminate contamination source (i.e. strings from bags, paper, regrind) |
| | | Keep extrusion room clean, install ventilation hood or fan |
| | Insufficient back pressure | Increase back pressure with additional screens or finer mesh |
| | Check for air bubbles in cooling bath | Eliminate air bubbles in cooling bath |
| | Incorrect screw geometry | Increase compression ratio of screw |

| PROBLEM | PROBABLE CAUSE | ACTION |
|---|---|---|
| Surface Streaks | Moisture in material | Dry material if necessary, check dryer function, moisture level of material |
| | | Vent extruder |
| | Output too high | Reduce screw speed |
| | Contamination in die | Clean die or purge |
| | Entrapped air or gases | Lower rear barrel temperature of zone 1 & 2, add finer screens to increase back pressure |
| | | Reduce screw speed |
| | | Increase back pressure by additional screens or finer mesh |
| | | Reduce die temperature |

| PROBLEM | PROBABLE CAUSE | ACTION |
|---|---|---|
| Swirls on Surface/ Flow Marks | Flow hesitation/interruption | Increase temperature in transition zone |
| | | Reduce output rate |
| | | Add/switch screen packs |
| | | Change breaker plate |
| | | Adjust die flow |

| PROBLEM | PROBABLE CAUSE | ACTION |
|---|---|---|
| Dark Specks, Dark Streaks, Discoloration | Contamination in raw material | Check/change lot or box of material, hoppers, dryers |
| | | Increase melt temperature |
| | Machine contamination | Use appropriate purge material to clean extruder |
| | | Clean die, adapter, screw and/or barrel; check for dead spots/hang-ups on die head, replace screen pack |
| | Thermal degradation of resin | Reduce melt temperature |

| PROBLEM | PROBABLE CAUSE | ACTION |
|---|---|---|
| Orange Peel / Shark Skin | Melt fracture, exceeding critical shear stress of material | Slow down screw speed |
| | | Increase die/adapter temperature |
| | | Increase melt temperature |
| | | Add processing aid to formulation |
| | | Polish/coat die |
| | | Reduce land length |
| | | Use larger extruder |
| | Insufficient back pressure | Increase back pressure with additional screens or finer mesh |
| | Resistance to flow / resin viscosity too high | Increase melt temperature |
| | | Move to higher melt flow material |
| | Surging / excessive head pressure | See actions for Surging |

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| PROBLEM | PROBABLE CAUSE | ACTION |
|---|---|---|
| Surging | Output too high | Reduce screw speed |
| | Die temperature too cold | Increase die temperature |
| | Feed section too hot | Drop feed zone temperature |
| | Insufficient back pressure | Increase back pressure with additional screens or finer mesh |
| | Starving screw/inconsistent feed | Lower rear barrel zone temperature |
| | | Check for material blockage/bridging at hopper |
| | | Maintain consistent hopper level and material blend |
| | | Lower dryer temperature to reduce feed temperature of material |
| | Incompatibility; mix of 2 materials with widely varying melt viscosities | Review material specification and/or match melt flow of blend |
| | Moisture in material | Dry material if necessary, check dryer function, moisture level of material |
| | | Vent extruder |
| | Die gap too big | Reduce die gap |
| | Extruder drive variation | Check drive performance |
| | Too fast extruder throughput vs. specification | Run extruder within specifications |

| PROBLEM | PROBABLE CAUSE | ACTION |
|---|---|---|
| Gels | Unmelts, usually clear caused by low heat/shear | Increase melt temperature |
| | | Increase back pressure with additional screens or finer mesh |
| | | Lower rear barrel zone temperature |
| | | Make sure screw is designed to melt specific resin |
| | | Slow down extruder to increase residence time |
| | Degraded gels, black caused by high heat/shear | Reduce melt temperature |
| | Contamination in raw materials | Clean out hopper and feed lines |
| | | Check/change lot or box of material, hoppers, dryers |
| | | Increase melt temperature |
| | Resin contains gels | Check resin gel spec with material supplier |

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| PROBLEM | PROBABLE CAUSE | ACTION |
|---|---|---|
| Lines in Extrusion Direction | Damage to the exit edges of the tip or die | Polish die to remove nicks |
| | Die drool or build-up on the tip or die faces | Clean, remove die build up |
| | Melt temperature too low | Increase melt temperature |
| | Die temperature too low | Increase die temperature |
| | Die land too short | Use die with longer land length |
| | Moisture in material (discontinuous/random lines) | Dry material if necessary, check dryer function, moisture level of material |
| | | Vent extruder |

| PROBLEM | PROBABLE CAUSE | ACTION |
|---|---|---|
| Lines in Transverse Direction | Surging / excessive head pressure | See actions for Surging |
| | Profile sticking to sizer | Reduce sizer vacuum |
| | | Roughen up sizer surface area to reduce contact area with material |
| | Die gap too big | Reduce die gap |

| PROBLEM | PROBABLE CAUSE | ACTION |
|---|---|---|
| Die Bleed / Plate Out | Additive migrating to the surface under heat or shear | Reduce melt temperature |
| | | Increase die temperature |
| | | Reduce screw speed |
| | | Run virgin to isolate additive (i.e. color) |

| PROBLEM | PROBABLE CAUSE | ACTION |
|---|---|---|
| Warpage | Uneven flow | Balance die |
| | Uneven cooling | Adjust air flow to cool on the side of the warpage, check water bath for circulation |

| PROBLEM | PROBABLE CAUSE | ACTION |
|---|---|---|
| Die Swell | Excessive shear through die causes orientation and recoil | Decrease extrusion rate |
| | | Increase melt temperature |
| | | Introduce polymeric processing aid |
| | | Increase die land length |
| | | Reduce die entry angle |

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| PROBLEM | PROBABLE CAUSE | ACTION |
|---|---|---|
| Lines in Extrusion Direction | Extrusion rate too high | Reduce screw speed |
| | Surging / excessive head pressure | See actions for Surging |
| | Contamination | Check for cross contamination by another material |
| | Non-uniform cooling | Check water temperature and cooling lines in tank |
| | Process temperatures not correct | Be sure temperature controllers are functioning properly & temperature set for resin |
| | Moisture in material | Dry material if necessary, check dryer function, moisture level of material |
| | | Vent extruder |
| | Incompatibility; mix of 2 materials with widely varying melt viscosities | Review material specification and/or match melt flow of blend |
| | Vacuum level fluctuation | Check operation of vacuum pump |
| | Puller / haul off slippage | Change broken belts, adjust caterpillar pressure |
| | Uneven speed of take-off equipment | Synchronize take-off equipment |
| | Improper alignment of die to take-off unit | Check for proper alignment |
| | Die and pin not centered evenly | Check for proper alignment |
| | Screw or barrel worn | Repair worn screw or barrel |

| PROBLEM | PROBABLE CAUSE | ACTION |
|---|---|---|
| Profile Slipping in Puller | Inadequate pressure on profile | Adjust caterpillar pressure |
| | Worn equipment | Inspect puller belt for wear |
| | Material contains additive (i.e. slip agent) | Check additive package in base resin and move to neat material, if possible |