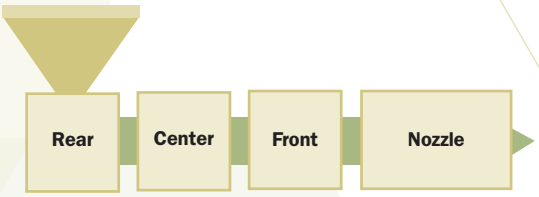
PolyOne

Processing Guide

Global Engineered Materials

Maxxam™ FR
Flame Retardant Polyolefin Compounds

PolyOne Maxxam™ FR flame-retardant polyolefin compounds and masterbatches meet stringent flammability performance requirements defined by industry agencies, including Underwriters Laboratories® UL 94 V-2, V-0 and 5VA performance ratings. In addition, many compounds in the Maxxam FR portfolio offer elevated Relative Thermal Index (RTI) ratings.



Injection Molding Parameters

	Maxxam FR
Barrel Temperatures* °C (°F)	
Rear Zone	182 - 200 (360 - 390)
Center Zone	188 - 204 (370 - 400)
Front Zone	200 - 210 (390 - 410)
Nozzle	204 - 219 (400 - 425)
Melt Temperature	204 - 219 (400 - 425)
Mold Temperature °C (°F)	16 - 49 (60 - 120)
Pack Pressure	50% - 75% of Injection Pressure
Hold Pressure	50% of Injection Pressure
Injection Velocity in/s	1.0 - 4.0
Back Pressure psi	50 - 100
Screw Speed rpm	30 - 100
Drying Parameters °C (°F)	Not Required
Cushion in	0.125 - 0.250
Screw Compression Ratio	2.5:1 – 3:0:1
Nozzle Type	General Purpose
Clamp Pressure	2 - 4 Tons/in^2
Cooling Time Seconds	10 - 40
Screw Type	General-Purpose Polyolefin L/D Ratio = 16:1 – 20:1

STARTUP & SHUTDOWN	RECOMMENDATIONS
Drying	Drying Maxxam FR is not required.
Purge Compound	Polypropylene
Shutdown	The recommended startup and shutdown procedures for Maxxam FR products begin and end by purging the equipment with a general-purpose polypropylene resin. All tooling and equipment must be free from any residual Maxxam FR upon shutdown. Continue generating parts made from the natural polypropylene until clear. When using a hot runner system, care must be taken to remove residual product from the manifold.
Coloring	Contact your PolyOne representative.
Recycling	Maxxam FR is fully recyclable. Conventional granulators with sharp blades should be used. Consistent regrind usage of up to 20% is permissible. Excessive fines or dust-like particles should be avoided.

MOLD DESIGN	RECOMMENDATIONS
Tool Steel	1. When using Maxxam FR compounds, P20 tool steel is acceptable when proper processing and shutdown procedures are followed. However, chrome plating or PH stainless steel is preferred for all halogen-based systems. The use of stainless steel in hot runner manifolds is highly recommended. Avoid the use of aluminum when designing production tools.
Gates	1. All types of gates can be used such as pin, fan, tunnel, tab and edge gates. Gate type should be selected based on location and part geometry. 2. Gate diameters should be equivalent to 50%-75% of the average wall thickness of the part to be injected. 3. A land length of 0.040” (1.0mm) is recommended. 4. Valve gates can be a source of extreme shear for halogen-based systems. This can result in excessive burning on the cosmetic surface of the finished part. Please consult PolyOne for specific recommended grades of Maxxam FR.
Runners	1. Full-round or modified trapezoid runners are the best design and provide the least surface to cross-section ratio. Half-round or standard trapezoid runners are not recommended. 2. Only naturally balanced runner systems (“H” pattern) are recommended. 3. Each 90° bend in the system should step down in size. 4. Vents should be placed at the intersection of each 90° bend off of the cold slug well and vented to atmosphere. 5. Hot runner molds are acceptable and should be sized by the manufacturer. Externally heated manifolds are recommended.
Cold Slug Wells	1. Place cold slug wells at the base of the sprue to capture the cold material first emerging from the nozzle. 2. Place cold slug wells at every 90° bend in the runner system. 3. Well depths approximately 2-3 times the diameter of the runner provide best results.
Venting	1. Place vents at the end of fill and anywhere potential knit/weld lines will occur. 2. All vents need to be vented to atmosphere. 3. Cut vents depths to 0.0010”-0.0015” with a minimum 0.040” land length. Increase the vent depth to 0.010” at 0.100” away from the cavity and vent to atmosphere. 4. Vents should be placed at the intersection of each 90° bend in the runner system off of the cold slug well and vented to atmosphere.
Draft Angle	1. Draft angle should be 1/2°-1° per side. Additional draft may be required for grained/textured surfaces.

TROUBLESHOOTING RECOMMENDATIONS

Problem	Cause	Solution
Incomplete Fill	Melt and/or mold too cold	1. Increase nozzle and barrel temperatures 2. Increase mold temperature 3. Increase injection rate 4. Increase pack and hold pressure 5. Increase nozzle tip diameter 6. Check thermocouples and heater bands
	Mold design	1. Enlarge or widen vents and increase number of vents 2. Check that vents are unplugged 3. Check that gates are unplugged 4. Enlarge gates and/or runners 5. Perform short shots to determine fill pattern and verify proper vent location 6. Increase wall thickness to move gas trap to parting line
	Shot size	1. Increase shot size 2. Increase cushion
Brittleness	Low melt temperature	1. Increase melt temperature 2. Increase injection rate 3. Measure melt temperature with pyrometer
	Degraded/Overheated material	1. Decrease melt temperature 2. Decrease back pressure 3. Use smaller barrel/excessive residence time
	Gate location and/or size	1. Relocate gate to nonstress area 2. Increase gate size to allow higher flow rate and lower molded-in stress
Uneven Surface Appearance	Melt temperature too low	1. Increase melt temperature 2. Increase mold temperature 3. Increase injection speed
	Insufficient packing	1. Increase pack and hold pressure, and time 2. Increase shot size
Sink Marks	Part geometry too thick	1. Reduce wall thickness 2. Reduce rib thickness
	Melt too hot	1. Decrease nozzle and barrel temperatures 2. Decrease mold temperature
	Insufficient material volume	1. Increase shot size 2. Increase injection rate 3. Increase packing pressure 4. Increase gate size
Flash	Injection pressure too high	1. Decrease injection pressure 2. Increase clamp pressure 3. Decrease injection rate 4. Increase transfer position
	Excess material volume	1. Decrease pack pressure 2. Decrease shot size 3. Decrease injection rate
	Melt and/or mold too hot	1. Decrease nozzle and barrel temperatures 2. Decrease mold temperature 3. Decrease screw speed
Color Streaks	Incomplete color dispersion	1. Increase back pressure. 2. Verify color concentrate compatibility. 3. Reduce rear zone temperature. 4. Increase injection rate.

TROUBLESHOOTING RECOMMENDATIONS

Problem	Cause	Solution
Excessive Shrink	Too much orientation	1. Increase packing time and pressure 2. Increase hold pressure 3. Decrease melt temperature 4. Decrease mold temperature 5. Decrease injection speed 6. Decrease screw rpm 7. Increase venting 8. Increase cooling time
Not Enough Shrink	Too little orientation	1. Decrease packing pressure and time 2. Decrease hold pressure 3. Increase melt temperature 4. Increase mold temperature 5. Increase injection speed 6. Increase screw rpm 7. Decrease cooling time
Burning	Melt and/or mold too hot	1. Decrease nozzle and barrel temperatures 2. Decrease mold temperature 3. Decrease injection rate
	Mold design	1. Clean, widen and increase number of vents 2. Increase gate size or number of gates.
	Moisture	1. Verify material is dried at proper conditions
Nozzle Drool	Nozzle temperature too hot	1. Decrease nozzle temperature 2. Decrease back pressure 3. Increase screw decompression 4. Verify material has been dried at proper conditions
Weld Lines	Melt front temperatures are too low	1. Increase pack and hold pressure 2. Increase melt temperature 3. Increase vent width and locations 4. Increase injection rate 5. Increase mold temperature
	Mold design	1. Decrease injection rate 2. Increase gate size 3. Perform short shots to determine fill pattern and verify proper vent location 4. Add vents and/or false ejector pin 5. Move gate location
Warp	Excessive orientation	1. Increase cooling time 2. Increase melt temperature 3. Decrease injection pressure and injection rate
	Mold design	1. Increase number of gates
Sticking in Mold	Cavities are overpacked	1. Decrease injection rate and pressure 2. Decrease pack and hold pressure 3. Decrease nozzle and barrel temperatures 4. Decrease mold temperature 5. Increase cooling time
	Mold design	1. Increase draft angle
	Part is too hot	1. Decrease nozzle and barrel temperatures 2. Decrease mold temperature 3. Increase cooling time

For questions or issues, please call Global Engineered Materials Technical Support at: 440.930.1000