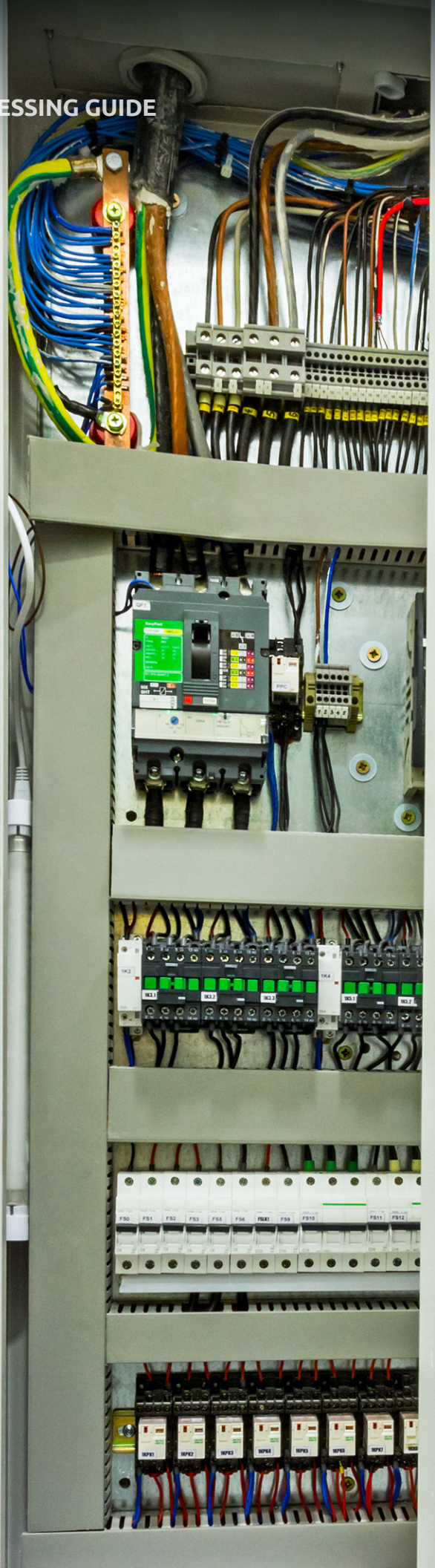
PROCESSING GUIDE



Maxxam™ FR

FLAME RETARDANT POLYOLEFIN FORMULATIONS

AVIENT™

Maxxam™ FR flame retardant polyolefin formulations are engineered to meet stringent flammability performance requirements. Standard grades in the portfolio conform to UL 94 V-2, V-0 and 5VA performance ratings, and many offer elevated Relative Thermal Index (RTI) ratings. Available in both halogen and non-halogen products, including grades with UL Yellow Card rating, Maxxam FR products can be customized for specific performance needs.

Injection Molding Parameters

Barrel Temperatures °F (°C)	**PP**	**Mineral-Filled PP**	**Glass-Filled PP**	**HDPE**	**LDPE**
Rear Zone	360–390 (182–200)	400–420 (204–216)	415–435 (213–224)	400–420 (204–216)	370–390 (188–199)
Center Zone	370–400 (188–204)	410–430 (210–221)	425–445 (218–229)	410–430 (210–221)	380–400 (193–204)
Front Zone	390–410 (200–210)	420–440 (216–227)	435–455 (224–235)	420–440 (216–227)	390–410 (199–210)
Nozzle	400–425 (204–219)	415–435 (213–224)	430–450 (221–232)	430–450 (221–232)	400–425 (204–219)
Melt Temperature	400–425 (204–219)	415–435 (213–224)	430–450 (221–232)	430–450 (221–232)	400 - 425 (204–219)
Mold Temperature °F (°C)	60–120 (16–49)				
Pack & Hold Pressure	50–75% of injection pressure				
Injection Velocity (in/s)	1.0–3.0				
Back Pressure (psi)	50–100				
Screw Speed (rpm)	30–100				
Drying Parameters Hours @ °F (°C)	Not typically required. Drying non-halogenated materials is suggested. 2 hours @ 100 (38)				
Moisture Range (%)	Not required <0.08% for non-halogenated materials				
Cushion (in)	0.125–0.250				
Screw	General purpose				
Screw Compression Ratio	2.5:1–3.0:1				
Nozzle Type	General purpose				
Clamp Pressure (tons/in^2)	2–4				

START UP & SHUT DOWN RECOMMENDATIONS	
Coloring	Contact your Avient representative
Purge Compound	Polypropylene (PP)
Recycling	Contact your Avient representative
Start Up	• If smoking starts to occur, purge barrel completely of Maxxam FR product and reduce barrel temperatures. Follow up by purging machine with general purpose PP • Residence time should not exceed 5 minutes for Maxxam FR products • General ventilation is suggested
Shut Down	• Purge the equipment with a general purpose PP • All tooling and equipment must be free of any residual Maxxam FR upon shut down • Continue generating parts made from the natural PP until clear • Wipe down tool steel with mold cleaner • When using a hot runner system, care must be taken to remove residual product from the manifold

MOLD DESIGN RECOMMENDATIONS	
Cold Slug Wells	• Place cold slug wells at the base of the sprue to capture the cold material first emerging from the nozzle • Place cold slug wells at every 90° bend in the runner system • Well depths approximately 2–3 times the diameter of the runner provide best results
Draft Angle	• Draft angle should be 1/2°–1° per side. Additional draft may be required for grained/textured surfaces
Gates	• 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. • Gate diameters should be equivalent to 50–80% of the average wall thickness • A land length of 0.040" (1.0 mm) is recommended • Valve gates can be a source of extreme shear for halogen-based systems. This may result in excessive burning on the surface of the part.
Runners	• 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. • Only naturally balanced runner systems (“H” pattern) are recommended • Each 90° bend in the system should step down in size • Vents should be placed at the intersection of each 90° bend off of the cold slug well and vented to atmosphere • Hot runner molds are acceptable and should be sized by the manufacturer. Externally heated manifolds are recommended.
Tool Steel	• P20 tool steel is acceptable when proper processing and shut down procedures are followed • Chrome plating or PH stainless steel is preferred for all halogen-based systems • The use of stainless steel in hot runner systems is highly suggested • Avoid the use of aluminum when designing production tools
Vents	• Place vents at the end of fill and anywhere potential knit/weld lines will occur • All vents need to be vented to atmosphere • Cut vent 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. • 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

Troubleshooting Recommendations

PROBLEM	CAUSE	SOLUTION
Black Specks	Contamination	• Purge barrel with general purpose PP • Verify correct nozzle is being used • Pull screw for cleaning
	Degraded/overheated material	• Decrease melt temperature • Decrease back pressure • Decrease injection speed • Use appropriately sized barrel
Brittleness	Degraded/overheated material	• Decrease melt temperature • Decrease back pressure • Decrease injection speed • Use appropriately sized barrel
	Gate location and/or size	• Relocate gate to nonstress area • Increase gate size to allow higher flow rate and lower molded-in stress
Burning	Process related	• Decrease nozzle and barrel temperatures • Decrease mold temperature • Decrease injection rate
	Mold design	• Clean, widen and increase number of vents • Increase gate size to reduce shear
Fibers/Minerals on Surface or Uneven Surface Appearance	Melt temperature too low	• Increase melt temperature • Increase mold temperature • Increase injection speed
	Insufficient packing	• Increase hold pressure and time • Increase shot size
Flash	Injection pressure too high	• Decrease injection pressure • Increase clamp pressure • Decrease injection rate • Increase transfer position
	Excess material volume	• Adjust transfer position • Decrease pack pressure • Decrease shot size • Decrease injection rate
	Melt and/or mold too hot	• Decrease nozzle and barrel temperatures • Decrease mold temperature • Decrease screw speed
	Loose clamp	• Reset mold height • Increase clamp tonnage

Troubleshooting Recommendations (continued)

PROBLEM	CAUSE	SOLUTION
Incomplete Fill	Melt and/or mold too cold	• Increase nozzle and barrel temperatures • Increase mold temperature • Increase injection rate
	Mold design	• Enlarge or widen vents and increase number of vents • Check that vents are unplugged • Check that gates are unplugged • Enlarge gates and/or runners • Perform short shots to determine fill pattern and verify proper vent location • Increase wall thickness to move gas trap to parting line
	Shot size	• Adjust transfer position to 98% full • Increase shot size
Nozzle Drool	Nozzle temperature too hot	• Decrease nozzle temperature • Decrease back pressure • Increase screw decompression
Shrink	Too much shrink	• Increase cooling time • Decrease mold temperature
	Too little shrink	• Decrease cooling time • Increase mold temperature
Sink Marks	Part geometry too thick	• Reduce wall thickness • Reduce rib thickness
	Melt too hot	• Decrease nozzle and barrel temperatures • Decrease mold temperature
	Insufficient material volume	• Adjust transfer position • Increase shot size • Increase injection rate • Increase packing pressure

PROBLEM	CAUSE	SOLUTION
Sticking in Mold	Overfilled cavity	• Decrease injection rate and pressure • Decrease hold pressure • Adjust transfer position • Decrease nozzle and barrel temperatures • Decrease mold temperature • Decrease cooling time
	Mold design	• Increase draft angle • Polish cores in direction of ejection
	Part is too hot	• Decrease nozzle and barrel temperatures • Decrease mold temperature • Increase cooling time
Warp	Process related	• Increase cooling time • Increase melt temperature • Increase pack pressure • Increase pack time • Decrease mold temperature
	Mold design	• Inspect for non-uniform mold cooling
	Part design	• Inspect for non-uniform wall thickness
	Temperature control unit incorrect temperature	• Check settings • Inspect thermocouple
Weld Lines	Melt front temperatures are too low	• Increase pack and hold pressure • Increase melt temperature • Increase injection rate • Increase mold temperature
	Mold design	• Increase gate size • Perform short shots to determine fill pattern and verify proper vent location • Add vents and/or false ejector pin • Move gate location

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