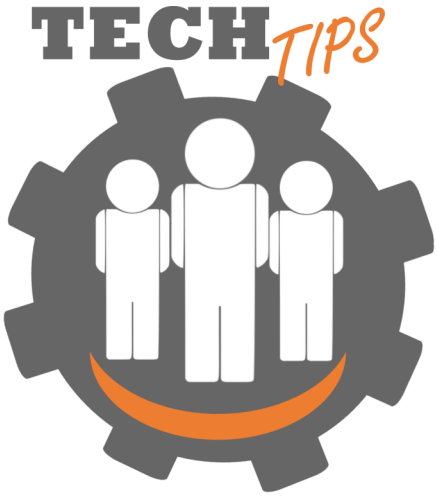
Wax Pattern Defect Troubleshooting



R&R recommends utilizing the following potential causes and corrective actions for troubleshooting wax pattern related defects in your foundry.

Air Entrapment (Bubbles)

Potential Cause	Corrective Action
Air bubbles in wax purge operation	Perform wax conditioning sequence per wax supplier
Acceleration/ramp-up too short (electronic control)	Increase time to reach full flow rate
Excessive mold release	Clean mold and decrease mold release use
Improper mold venting due to excessive clamp force	Reduce clamp force
Injection system fill rate too rapid	Increase time to fill injection system chamber
Injection system seals worn, allows air to be pulled with wax	Inspect injection unit for wax leakage, may require rebuilding
Low wax level in reservoir, air pulled into system	Check wax level in reservoir or wax delivery system
Mold temperature	Increase or decrease temperature
Mold vents blocked due to equipment	Flip mold over (top to bottom), changing vent arrangement if possible
Nozzle temperature	Make adjustments to nozzle temperature
Sprue location or size causing turbulence	Evaluate mold design to reduce turbulence
Turbulence/mold loading into press	Check mold sprue is in line to injection nozzle not to cause flow turbulence
Vents filled with wax/mold release	Clean vent holes
Wax flow too high	Decrease wax flow or longer injection ramp-up time
Wax hot	Decrease wax reservoir temperature
Die improperly vented	Add or enlarge vents at all locations where air may be trapped

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Flash

Potential Cause	Corrective Action
Acceleration/ramp-up too short (electronic control)	Increase time to reach full flow rate
Dirty mold	Clean wax fragments or compressed wax from mold
Flow rate incorrect	Decrease flow rate
High injection pressure	Decrease injection pressure
Hot wax temperature	Lower wax temperature
Low clamp force	Increase clamping force
Mold alignment, unequal clamp force or worn guide pins	Check closing of mold, watch for shifting or reposition for equal clamping force
Mold wear	Check fit up of parting lines and inspect for edge rounding or guide pins/ bushings wear

Flow Lines, Ripples & Knit Lines

Potential Cause	Corrective Action
Acceleration/ramp-up excessive (electronic control)	Shorten time to reach full flow rate
Cold mold	Increase mold or platen temperature
Cold wax	Increase wax temperature
Cold wax in nozzle	Increase nozzle temperature
Excessive mold release	Decrease amount of mold release, excess becomes trapped where knit line forms
Flow rate incorrect	Increase or decrease flow rate
Hot wax (creating turbulence)	Decrease wax reservoir temperature, change flow rate
Improper mold venting	Add or enlarge vents, clean vents
Injection pressure low	Increase injection pressure
Sprue location or size	Evaluate mold design

Non-Fill

Potential Cause	Corrective Action
Acceleration/ramp-up excessive (electronic control)	Shorten time to reach full flow rate
Cold mold	Increase mold or platen temperature
Cold nozzle, wax slugs	Increase nozzle temperature/remove slug
Cold wax	Increase wax reservoir temperature
Excessive mold release	Clean mold and decrease mold release use
Flow rate incorrect	Increase or decrease flow rate
Improper mold venting	Add or enlarge vents, clean vents or core pins
Low injection pressure	Increase injection pressure
Low wax level in reservoir	Check wax level in reservoir or wax delivery system

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Non-Fill *(continued)*

Potential Cause	Corrective Action
Shot size incorrect	Increase shot size or check equipment capacity
Small injection sprue, wax freezes during injection	Enlarge sprue, insulate mold contact with nozzle
Trapped air in mold	Slow flow rate/flip mold over (top to bottom) changing fill arrangement

Pattern Oversize

Potential Cause	Corrective Action
Clamp force low	Adjust clamp force to prevent opening
Cold wax	Increase wax temperature
Dirty mold	Clean mold
Excessive hold time/injection time	Reduce time
High injection pressure	Lower injection pressure
Incorrect shrink factor/mold design	Inspect mold dimensions/design
Mold wear/damage	Inspect mold
Nozzle temperature (small parts)	Adjust nozzle temperature
Platen/mold temperature	Adjust platen temperature

Pattern Undersize

Potential Cause	Corrective Action
Incorrect shrink factor/mold design	Inspect mold dimensions/design
Insufficient hold time/injection time	Increase time
Low injection pressure	Increase injection pressure
Missing chills	Check proper chills were placed in mold
Nozzle temperature (small parts)	Adjust nozzle temperature
Platen/mold temperature	Adjust platen/mold temperature
Small sprue runner	Enlarge sprue
Wax hot	Decrease wax temperature

Pitted, Graining, Orange Peel Finish

Potential Cause	Corrective Action
Cold mold	Increase mold, platen temperature
Cold wax	Increase wax temperature
Excessive mold release	Clean mold and decrease amount of mold release
Flow rate incorrect	Increase or decrease flow rate
Injection pressure low	Increase injection pressure
Issues with mold	Inspect surface finish of mold
Wax separation with filler	Perform wax conditioning sequence per wax supplier

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Shrinkage, Cavitation, Sink

Potential Cause	Corrective Action
Cold mold	Increase mold or platen temperature
Flow rate incorrect	Increase wax flow rate
Hold time too short	Increase hold/clamp time
Injection temperature low	Increase injection system temperature
Insufficient injection time	Increase injection time
Low injection pressure	Increase injection pressure
Small injection sprue, small sprue runner, wax freezes before pattern solidifies	Enlarge sprue, insulate mold contact with nozzle
Sprue location or size	Evaluate mold design
Type of wax used	Consult wax supplier
Wax temperature too high	Decrease wax reservoir temperature
Lack of wax or steel chills	Add chills to large cross-sections

Splash/Splatter

Potential Cause	Corrective Action
Acceleration/ramp-up too short (electronic control)	Increase time to reach full flow rate
Instantaneous wax flow into die	Decrease wax flow acceleration

Wax Pattern Cracking

Potential Cause	Corrective Action
Burr in mold or back lock	Inspect mold
Cold mold	Increase mold or platen temperature
Excessive hold time/injection time	Reduce time
High injection pressure	Lower injection pressure
Improper mold eject timing	Check timing of eject pins as mold opens
Improper mold opening	Check or add guide pins, check opening sequence and core pull operation, use mold release spray
Improper removal of pattern	Check for mold damage, use mold release spray, add ejector pins or compressed air to assist removal, check opening sequence
Pressure in tool	Determine if vacuum exists, inspect or add vents
Type of wax used	Consult wax supplier

Core Breakage

Potential Cause	Corrective Action
Improper core fit in die	Clamp die with core in place, open die and check core for cracks, open up core seats if required
Wax flow too high	Decrease maximum wax flow and/or wax flow acceleration set
Wax viscosity too high	Increase wax temperature
Injection pressure too high	Decrease injection pressure to 50-150 psi (3.5-10.5 kg/cm^2)

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