International Temperature Control, Inc.

The Value Leader In Hot Runner Temperature Control Systems

Newsletter

TROUBLESHOOTING INJECTION MOLDING PROBLEMS

There is no simple cure-all for molding problems, but there are a number steps which can be taken to troubleshoot various molding problems. There is no guarantee that the solutions provided will successfully resolved a particular problem, but the guideline should be appropriate for most situations.

The most important single thing in trouble shooting is detailed DOCUMENTATION of both the machine and mold

Every tool and machine has its own unique characteristics even if they duplicates so don't assume anything

Compare all tool & machine settings with prior settings

Make only reasonable adjustments (one at a time) — observe and record results

Prior to commencing troubleshooting a molding process, the mold, press and all accessory devices should be thoroughly evaluated

Check Mold	Check the actual tool temperature across its face of both halves and compare it against the last time it was used. Temperature should be very close to uniform across the entire face. Check vents for obstructions and that there size has not been distorted due to wear, Check pins, etc. for wear, alignment and function, Check tool face for square and flatness Check tool for damage such as scratches, bent, wore or broken parts Check for obstructions and leaks in the runner system Check cooling system for proper connections, leaks, etc. Check hot runner for broken or frayed wires, loose connections, defective heaters and thermocouples etc.
Check Press	Check & compare actual setting for the various functions such as: Injection, back & holding pressure Injection speed & time Screw speed & return time Barrel temperature settings Etc. Cooling system settings Hot Runner settings Settings should be the same as the last time the tool was run. If settings are different, determine the reason before starting

Potential problem areas (which are not so obvious) which must be kept in mind

Melt Temperature: Variations in the Screw RPM and/or Injection Rate can drastically affect the melt temperature. These settings will vary for different types of resin as well as molds. It is important that once the proper settings for these functions are achieved, that they be documented for future reference.

- For a quality molding process, a functioning tachometer must be present on the machine.
- If burning occurs in the sprue, runner or gate areas, the injection rate must be reduced or flow passages enlarged.

Proper sizing of mold to machine: One cause of material degradation which is often overlooked is the placing of a small mold in a large press. In these instances resin can reside in the barrel at process temperature for a period of time sufficient to initiate degradation. In most cases, the first tendency is to reduce melt temperature to reduce burning. This action results in weak weld lines, poor appearance, etc. but had not resolved the problem.

Condition of screw: During normal operation and over time the screw's chrome surface will wear or may peel away thus exposing the resin to bare metal. This contact can cause sticking or a chemical reaction with the resin which can result in burn spots within the melt. The first tendency is to reduce melt temperature to reduce what is thought to be burning of the melt, which results in weak weld lines, poor appearance, etc., but has not resolved the root problem

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Steps to be taken prior to commencing production

Pre-Production Procedures: Prior to setting up a new job, It is imperative that a complete & thorough review of all historical documentation associated with the job be preformed.

NOTE: It must be remembered that even if two machines, molds or accessories are identical, they will have there own individual idiosyncrasies, which then must be taken into account.

Verify that the mold is clean, free of dirt, moisture, resin residue, etc. and in proper working order.

Verify that the machine & all accessories (hot runner controls, water cooler, loader, etc.) are of the proper size and type for the job.

Verify the press been properly maintained and lubricated, is in good working order and all instrumentation is working properly

Verify that all accessory items are in good working order, fully tested and have been calibrated.

Ensure the resin is the proper type and grade & recycle content is correct. That any pigment to be used meet specifications and is compatible with the resin.

Verify that all job parameter settings are correct, Temperature, Pressures, Injection Speed, Coolant, Hot Runner Controls, Auxiliary Dryer, Etc.

How ITC Hot Runner Controls can Assist in Diagnosing a Mold Problem

System Type	Areas Within the Mold's Hot Runner System Which Can Be Diagnosed
S20-D3C Control Module	Detects Open Thermocouple, Reversed Thermocouple, Shorted Thermocouple, Open Heater, Reads Actual Amperage drawn by the Heater, High or Low Zone Temperatures
UATC-20 Control Module	Detects Open Thermocouple, Reversed Thermocouple, Shorted Thermocouple, Open Heater, High or Low Zone Temperatures, Shorts to Ground, Reads Actual Amperage draw as well as Senses & Alarms when a Heater exceeds its established Current/ Amperage parameter
VISIONS 3000 Control System	Detects Thermocouple Open, Thermocouple Reversed, Thermocouple Shorted, Open Heater, High/Low Zone Temperatures, Detects a Failure in Water Cooling System, Senses if a Heater Draws Excessive Current, 3 Dimensional Display of the Operating Temperatures of Every Zone on a Single Screen, 3 Dimensional Display of the Current Draw of Every Zone Single Screen, A Full Suite of Diagnostic Functions which can be run before putting the tool in the machine = includes Swapped Heater or Thermocouple with affected zones, Heater Power Monitoring to detect leakage, Heater Resistance Monitoring to predict failure, Measured Resistance of each heater for failure analysis, Additionally a completer report of the molds characteristics can be printed for future reference.

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Black/Brown specks, burn spots or streaks in the part

Possible Cause	Possible Resolution
Machine:	Verify Machine & Tool settings against previous set-up documentation Residence time in barrel may be too long = Shot size may be too small for the machine, put tool in smaller press. Residual contamination = Check barrel/screw, gate system, hot runner system, for contamination, wear & dead spots, alter gate position or size, chrome plating on screw may be worn or peeled away
Thermal Degradation:	Lower melt temperature, lower hot runner temperature, lower back pressure, lower screw speed, lower injection speed, check heaters for malfunction, clean/purge screw & barrel, decrease overall cycle time, check coolant system, check hot runner heaters, material may have too high a content of regrind.
Contamination	Material contamination = Replace with new material Contamination from previous run = Clean/purge screw/barrel & hot runner, check for hang up in areas in nozzle check valve/filter & runner areas, check for misalignment between machine nozzle & mold sprue If temperature is to be reduced for a long period of time (weekend) it is essential to purge the screw/barrel & hot runner system prior to production Color concentrate may be too high a percentage = remove color concentrate and run natural to verify
Mold:	Gate area may have sharp edges, gates may be too small, gate land area may be too long Vents may be plugged, worn or in wrong areas = clean/repair, or additional vents may be needed

Blistering or Bubbles = (hollows on the part caused by entrapped gas, can also appear near walls)

Possible Cause	Possible Resolution
Moisture in material:	Check moisture in material = Dry if needed
Air entrapment:	Check vents & clean if necessary Increase size or number of vents, Reduce clamp pressure to minimum amount needed Increase back pressure Increase injection pressure Increase shot size Increase mold temperature
Degraded material:	Lower melt temperature Lower back pressure Reduce screw RPM (Variations in screw RPM will drastically alter melt temperature) Decrease injection & holding pressure Decrease injection speed Reduce mold temperature Ensure regrind particles are not too large

Brittleness = (cracks or part breaks at too low a stress level)

Possible Cause	Possible Resolution
Moisture in material:	Check moisture in material = Dry if needed
Excessive regrind:	Regrind not a homogenous mixture = use proper mixing techniques Reduce the percentage of regrind used

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Brittleness = (Continued from page # 3)

Possible Cause	Possible Resolution
Melt temperature to high:	Lower melt temperature (NOTE: variations in screw RPM will drastically alter melt temperature) Lower nozzle temperature Lower hot runner temperature Decrease back pressure
Melt temperature to low:	Increase melts temperature Increase nozzle temperature Increase hot runner temperature Increase back pressure
Material Contamination:	Purge machine thoroughly
Improper Gating:	Improve material flow by increasing gate size Relocate gates away from stress areas

Burn Marks, Trapped Gas, Dieseling = (Show up as a porous, dull, discolored and sometimes as a charred or dark area on the surface of the part, often accompanied by a distinctive burnt smell. NOTE: If the root cause of this problem is not fixed, it will very quickly cause damage to the molding surface

Possible Cause	Possible Resolution
Process:	Check for heater malfunction = nozzle, barrel of hot runner Decrease melt temperature (NOTE: variations in screw RPM will drastically alter melt temperature) Decrease mold temperature Decrease hot runner temperature Check cooling system Decrease injection speed Decrease injection pressure Decrease boost time Decrease clamp tonnage
Venting:	Improve mold cavity venting = Vents may become smaller over time due to wear. They will need to be brought back to there original depth. Reduce clamping pressure to improve venting = Vents may be become smaller because of excess clamping pressure crushing them. Reduce clamp force to a point just above that needed to prevent mold flash. This is always a good practice to minimize wear and tear on the mold and machine Improve venting at burn location = Burn marks often occur on deep ribs that have no venting. If possible put an ejector pin or sleeve at the burnt area to allow trapped gas to escape.
Mold:	Polish gate areas to eliminate rough or sharp edges Decrease gate land area Gate size should be approximately 50 – 80% of the normal wall thickness
Material:	Color concentrate may be shear sensitive = Remove color concentrate and run natural to verify
Machine:	The chrome plating on the screw may be worn or peeled away causing material to stick and become degraded

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Cracking/Crazing = (Caused by high internal molded stress or by an external force. Cracks often do not show up until days or even weeks after the part have been molded)

Possible Cause	Possible Resolution
Over packing mold:	Decrease shot size Decrease injection pressure Decrease injection time
Part Removal:	Knockout system may not be balanced (knocking out parts on an angle) Draft angles may not be adequate for smooth ejection of parts, requiring excessive force
Mold temperature not uniform or to cold:	Increase mold temperature Increase nozzle temperature Increase hot runner temperature Check for unbalance cooling Decrease mold cooling temperature
Material problem:	Contamination Dry material Eliminate regrind Eliminate colorant Eliminate mold release agent Clean mold for residual oils, etc. If the material is partially crystalline, it may help to reduce the mold and or melt temperature If the material is amorphous, it may help to increase the mold and or melt temperature

Delaminating = (when single surface layers start flaking off the part)

Possible Cause	Possible Resolution
Material problem:	Contamination = check material feed system Incompatible resins or colorants may have been mixed together Dry material to remove moisture Insufficient blending = check meld homogeneity and plasticizing performance Try pure virgin material to verify and change color to a compatible concentrate if needed
Injection speed to low:	Increase injection speed
Air entrapment:	Air may become entrapped with in mold causing inconsistent cooling Check, clean & repair venting as necessary or add additional venting

Discoloration = (similar to burn marks or brown streaks but generally not as dark or severe. May cause the part to be a darker shade than the virgin pellets and is often found nearest the gate area,

Possible Cause	Possible Resolution
Material Problem:	Contamination = check hopper and feed zone Material may have oxidized by drying at to high a temperature = check manufactures recommendation Purge screw/barrel

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Discoloration = (Continued from Page # 5)	
Possible Cause	**Possible Resolution**
Material Overheating:	Decrease melt temperature Check coolant operation Decrease hot runner temperature Decrease back pressure Decrease nozzle temperature Shorten overall molding cycle Move mold to smaller shot-size press
Venting:	Check, clean & repair venting as necessary or add additional venting

Flash, Excessive = (A thin section of plastic normally along the parting line, out vent grooves, or down ejector pins) Flash can very quickly damage the parting line surface with in a few cycles	
Possible Cause	**Possible Resolution**
Excessive melt/mold temperature:	Lower melt/mold temperature
Excessive injection pressure:	Decrease back pressure Decrease injection hold time Decrease injection pressure Decrease injection speed Increase clamp pressure
Mechanical problems:	Check Press platens for parallelism Check parting line for obstruction Check tool venting = Vents may be too deep for the type of material being used Check sealing surfaces = Use “bluing and apply applicable clamp tonnage to check Check ejector pin bores diameter to pin diameter tolerance too see if it is satisfactory for the type of plastic being used Projected area may be to large for available tonnage = Switch to larger tonnage press
Un-balanced filling of mold::	Relocate/increase runner and gate size to obtain a uniformed filling Properly balance cavity layout to maintain uniform cavity pressure Check hot runner ensuring all zones are at the proper temperature Check cooling, ensuring proper operation

Flashed Hot Runner Manifold = (Plastic leak in the manifold runner system)	
Possible Cause	**Possible Resolution**
Possible Causes:	Manifolds left on at full temperature for an extended period of time such as a weekend Cold Starts = Not permitting the manifold system to slowly come up to temperature allowing proper seating of components Worn, Fatigued or Cracked components = Valve pins, bushings, compression seal washers, hobbed manifolds, spacers, loose or stretched screws, etc.
Symptoms:	Most obvious = Smoke coming from the stationary platen or plastic residue in places where it should not be More subtle = Periodic short shots Shorted heaters & Thermocouples in a particular area of the mold

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Flashed Hot Runner Manifold = (Continued from Page # 6)	
Possible Cause	**Possible Resolution**
Tool Diagnosis:	VISIONS 3000 = Thermal Electrical Analysis = Power/Wattage monitoring/analysis to identify potential leakage Thermocouple/Heater fault & wiring analysis Comparative analysis checks all zones for deviations from the norm

Flow Lines, Halo, Blush Marks = (seen on the part due to flow of molten plastic across molding surface)	
Possible Cause	**Possible Resolution**
Melt temperature low:	Increase melt temperature Increase mold temperature Increase nozzle Increase hot runner temperature Decrease injection speed
Mechanical:	Increase size of sprue/runner/gate Redesign part for a more uniform wall thickness to provide optimum filling

Gate / Nozzle Stringing, Drooling = (the part does not break cleanly from the gate area)	
Possible Cause	**Possible Resolution**
Nozzle temperature to hot:	Decrease melt temperature Decrease nozzle temperature Decrease temperature of hot runner manifold Increase cycle cooling time Reduce back pressure Increase screw decompression Check mating between nozzle tip and mold Check isolation cap thickness Check temperature sensor position = sensor too far from heating area, move sensor closer Irregular injection cycle
Material:	Material may have too much moisture = Dry material according to manufactures recommendations Regrind may not be a homogenous mixture = Mix thoroughly

Gate / Nozzle Freezing = (resin that solidifies in the gate nozzle area)	
Possible Cause	**Possible Resolution**
Process:	Nozzle/gate temperature to low = Increase temperature Defective heater/sensor Irregular injection cycle
Process:	Gate/nozzle may be too small Check for a foreign body in the nozzle/gate Check for the presence of cold/non-plasticized material

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Hard Spots (Precure) = (Slight bumps on the surface of part that are usually uneven, pointed, rough, and have a definite outline)

Possible Cause	Possible Resolution
Process:	Decrease melt temperature Decrease injection speed Decrease Injection pressure Decrease injection holding pressure Decrease mold temperature Check sprue tip for “soft bulb” and adjust conditions as necessary Regrind = Check for proper mixing Material degradation = Check screw, chrome plating may be worn or peeled causing plastic to stick & burn

Heating (Low Temperature) = (Actual temperature does not reach the required value)

Possible Cause	Possible Resolution
System:	Heating power is not sufficient to cover the heat loss = Heating element may be too small. Verify the correct heating element has been installed. Defective heating element Cooling system may be set for too low a temperature. Nozzle heating may be in contact with mold Cross wired heating elements = check other heated areas for excessive heating Low input voltage condition = check that the heater is receiving the proper voltage Controller may need calibrating Check for proper grounding

Heating (Unstable) = (Actual temperature does not remain constant)

Possible Cause	Possible Resolution
System:	Inaccurate temperature controller = Check controller for proper operation or calibration Unstable sensor position = Sensor may be located too far from heat source causing the sensor to read a temperature considerably different than the temperature of the heater Inconsistent input power condition = Check input power to verify it is within the controllers operating Range Check for frayed wires Check for proper ground Are there large variations in the molding process = Verify by comparing the molding process with the temperature variations, check for variations in screw RPM’s

Heating (Power to Low) = (Maximum heating power cannot be reached)

Possible Cause	Possible Resolution
System:	Low input voltage condition = Check input power source to verify it is within the controllers operating range Controller may be set to limit the current output to the heater

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Hot Runner Manifolds Thermal Problem = (Basic troubleshooting of a manifold heat problem)

Possible Cause	Possible Resolution
Symptoms of and steps to take to determine if there is a problem in the hot runner manifold:	Thermal problems: • Parts which vary in weight from shot to shot or from various locations on the mold may be an indication of an imbalanced system • Check the mold face for flatness or a bow. If the face is not flat there may be a thermal expansion problem • Broken screws are often a sign of thermal expansion problems • Check mold vents for any signs of deformation • Seal leakage in the outer most areas of the mold • The cooling system may not be maintaining uniform temperature • Check for heater malfunction (use ITC's UATC-20, S20-D3C or VISIONS 3000 control system to perform this check) • Check for Thermocouple malfunction (use ITC's UATC-20, S20-D3C or VISIONS 3000 control system to perform this check)

Injection too slow = (During the injection portion of the molding cycle, the material does not fill the mold in the recommended time)

Possible Cause	Possible Resolution
Process:	Increase injection pressure Check injection throttle position and if possible, increase its setting Increase barrel temperature & Back pressure to increase melt temperature Increase mold/nozzle/hot runner temperature
Machine:	Check hydraulic pressure setting Check hydraulic valves for proper function

Jetting = (Caused by an undeveloped frontal flow of melt in the cavity. The uninterrupted plastic flows or "snakes" into the cavity and cools enough so that it does not fuse homogenously with the material that follows)

Possible Cause	Possible Resolution
Excessive temperature:	Decrease nozzle temperature Decrease melt temperature Decrease hot runner temperature Reduce back pressure Increase screw decompression

Material Leakage = (Usually caused by material forces overcoming the structural strength of the mold) NOTE: One sign that material has leaked is that the manifold reaches processing temperature very slowly.

Possible Cause	Possible Resolution
Temperature to low:	Mold or melt temperature may be to low, causing an increased pressure in the manifold hot runner temperature may be low

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Material Leakage = (Continued for Page # 9)

Possible Cause	Possible Resolution
Mechanical:	Manifold locator may be oversize Manifold locator may be hobbed into the mold = Decrease the force applied to the nozzle pad by the machine then repair the damaged area, then check and if necessary replace locator. Insufficient number of mold assembly screws = Ensure that the quantity, type and location of screws correspond to the general assembly drawing. Nozzle may have overheated causing damage to the seal or gate = check/replace the thermocouple in the nozzle, then check and if necessary repair the nozzle well area. Manifold may have overheated = Check and replace if necessary the following components; nozzle well area, thermocouple, heater, valve disks, sprue disks or pressure disks.

Mold Stains = (A build up of volatiles on the molding surface that will cause that surface area of the part to be dull and pit marked. This can eventually lead to part discoloration and parts sticking in

Possible Cause	Possible Resolution
Process:	Increase melt temperature Increase mold temperature Decrease injection pressure Decrease injection holding pressure Decrease injection speed Decrease clamp tonnage
Mold:	Check mold venting = Clean & repair as needed Increase vent size Add venting as needed Polish the mold

Mottled Surface Appearance = (A non-uniform coloring or texture on the surface of the part)

Possible Cause	Possible Resolution
Process:	Increase shot size Decrease melt temperature Decrease back pressure Decrease mold temperature

Orange Peel = (Surface appearance looks like and undersurface craze or numerous small ripples that resembles the skin of an orange)

Possible Cause	Possible Resolution
Mold:	Inspect mold surface for defects. Excessive build up of lubricant on mold surface = Clean mold surface Use mold release agent sparingly

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Orange Peel = (Continued from page # 10)

Possible Cause	Possible Resolution
Process:	Decrease back pressure Decrease nozzle temperature Increase boost time Increase melt temperature (NOTE: screw RPM drastically alters melt temperature) Increase injection pressure Increase injection speed Increase shot size Increase overall cycle time

Parts Oversize = (A part which is too large compared to the drawing specification)

Possible Cause	Possible Resolution
Press:	Decrease boost time Decrease screw/barrel temperature Decrease holding pressure Decrease injection pressure Decrease injection speed Decrease overall cycle time
Mold:	Adjust melt temperature for optimum filling Adjust hot runner temperature Adjust cooling system temperature Adjust gate size and or change gate location
Material:	Decrease level of regrind in process Ensure regrind is thoroughly mixed with virgin material

Parts Undersized = (Part is too small when compared to drawing specifications)

Possible Cause	Possible Resolution
Press:	Increase boost time Increase screw/barrel temperature Increase holding pressure Increase injection pressure Increase injection speed Increase overall cycle time

Parts Sticking = (Parts not being pulled from cavity and in rare circumstances stick on core)

Possible Cause	Possible Resolution
Machine:	Over packing of mold = Decrease first stage of injection process Decrease boost time Decrease injection forward time Decrease packing pressure Decrease Barrel & Nozzle temperature Increase clamp pressure Increase mold close time Decrease melt temperature

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Parts Sticking = (Continued from Page # 11)

Possible Cause	Possible Resolution
Mold:	Part to hot for ejection = Decrease mold temperature Increase cooling time Add addition cooling lines Knockouts not operating properly Insufficient draft angle on cavity/sprue Texturing/Undercuts too deep to allow part to release properly = This is especially true if new texturing or re-texturing has been performed on the cavity Parts sticking to stationary half of mold = Redesign sprue puller Increase nozzle temperature

Screw does not go "Home" = (During the injection portion of the molding cycle, the screw does not inject the complete shot, thereby increasing the amount of cushion)

Possible Cause	Possible Resolution
Process:	Increase the injection time Increase both the injection and holding pressures decrease Decrease the amount of cushion Decrease back pressure and/or barrel temperature Increase or decrease mold temperature as needed

Screw pickup is "Erratic" = (This occurs during the return portion of the molding cycle, The screw does not return to its full retracted position at a uniform rate)

Possible Cause	Possible Resolution
Process:	Increase barrel temperature Decrease screw speed Check material feed from hopper
Press:	Check Hydraulic pressure for this function Check Hydraulic valve Check screw & barrel for wear

Screw pickup is too "Slow" = (Happens during the return portion of the molding cycle. The screw takes too long to return to its fully retracted position at a uniform rate

Possible Cause	Possible Resolution
Process:	Increase screw speed Decrease barrel temperature and back pressure Increase barrel temperature of the feed zone
Machine:	Check Hydraulic pressure for this function Check Hydraulic valves Check screw & Barrel for wear

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Short Shots = (This occurs when the cavity does not completely fill)

Possible Cause	Possible Resolution
Insufficient material volume into mold:	Increase shot size to maintain a constant cushion Inspect non-return valve for wear/leakage Restricted flow of material to cavity = Increase gate size Increase hot runner size Use larger orifice nozzle Increase the switch over pressure, distance, or time (whichever method is being used) point from fill to hold so the fill stage is used longer
Mold:	Melt temperature to low Mold temperature to low Air entrapment = Make sure mold is vented properly & vent are clear Increase size and number of vents if necessary
Part Design:	Change part design. Thin areas on the mold may not fill completely, especially if there is a thick thin transition, or there is a long rib that cannot be vented properly. If the part design allows, changes in these areas can help.

Sink Marks = (Occur during the cooling process when certain areas of the part are not cooled sufficiently, causing them to contract)

Possible Cause	Possible Resolution
Insufficient material volume into mold:	Increase shot size to maintain a constant cushion Inspect non-return valve for wear/leakage
Machine/Mold:	Decrease back pressure Decrease melt temperature = Do this if sink marks are near the or thick walled areas Decrease mold & hot runner temperature = (same as above) Decrease injection rate = (same as above) Increase injection pressure = Do this if sink marks are away from the gate or thin wall area Increase injection speed = (same as above) Increase mold temperature = (same as above) Increase injection hold Increase size of sprue and or runner and or gates Relocate gates on or near as possible to thick sections Increase cooling time
Material / Part:	Check material for dryness = Dry to manufactures specifications Amount of regrind may be excessive = Run with virgin material to verify Change mold design to maintain an even wall thickness throughout the part

Splay Marks, Silver Streaks = (Usually caused by water vapor blisters at the flow front bursts and Freezes on the wall of the molding surface)

Possible Cause	Possible Resolution
Contamination:	Check for material contamination
Moisture:	Dry material as per manufactures specifications Incorrect storage of material. Moisture on the plastic could be transferred into the melt, especially if the resin is not normally pre-dried Ensure the mold is not leaking water anywhere, especially near the cavity or cores which will cause condensation within the mold area that can be transferred into the melt

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Splay Marks, Silver Streaks = (Continued from page #13)

Possible Cause	Possible Resolution
Temperature/Mold:	Decrease melt temperature Decrease nozzle temperature Raise mold temperature = This will prevent condensation on the mold walls from being carried into the melt Shorten overall cycle time Relocate gates on or as near as possible to thick sections

Sprue Sticking = (Occurs in a cold runner mold when the sprue stays in the mold)

Possible Cause	Possible Resolution
Mold/Machine:	The Nozzle orifice is larger than the sprue orifice = Nozzle orifice should be at least .010" smaller in Diameter than the sprue orifice Increase taper on sprue bushing = minimum taper on the sprue bushing should be 1.5° over the length of the sprue Polish inside of sprue area to eliminate imperfections. Polish in direction of flow
Process:	Over packing of material in sprue area Nozzle temperature to low to provide clean brake Use reverse taper nozzle Decrease injection pressure Decrease injection speed Decrease injection hold Decrease mold closed time Decrease nozzle temperature

Surface Finish (Low Gloss) = (The appearance of the surface of the part when light is reflected off has a low luster. This does not apply to molds which have a textured finish or materials which are filled which have a lower luster level)

Possible Cause	Possible Resolution
Process:	Increase barrel/screw temperature = This applies to molds with a polished surface Increase injection pressure = (same as above) Increase injection speed = (same as above) Increase mold temperature = (same as above) Decrease Barrel /screw temperature = This applies to molds with a textured surface Decrease injection pressure = (same as above) Decrease injection speed = (same as above) Decrease mold temperature = (same as above) Increase melt temperature Insufficient packing of part Insufficient material in mold Excessive build up of lubricant on mold surface = Clean mold surface Use mold release agent sparingly Moisture in material = Dry material prior to the molding process Check vents to make sure they are adequate
Mold:	Mold surface not clean = Clean only with a soft polishing cloth Water on the mold surface = Excess humidity in the air, Increase mold temperature, Check for leaks and repair

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Surface Finish (Scars, Wrinkles) = (Appear as ripples or wrinkles on the surface of the part)	
Possible Cause	**Possible Resolution**
Mold:	Inspect mold surface for defects. Excessive build up of lubricant on mold surface = Clean mold surface Use mold release agent sparingly
Process:	Decrease back pressure Decrease nozzle temperature Increase boost time Increase melt temperature Increase injection pressure Increase injection speed Increase shot size Increase overall cycle time

Smudges = (Appears as a swirling smudge mark on surface of part)	
Possible Cause	**Possible Resolution**
Process:	Decrease back pressure Decrease nozzle temperature Increase boost time Increase melt temperature Increase injection pressure Increase injection speed Increase shot size Increase overall cycle time Restriction in material flow = Nozzle orifice, gate or sprue too small

Valve pin does not close properly = (This leaves the gate protruding from the part. This may also occur if the valve pin is too hot, the material may stick to the pin)	
Possible Cause	**Possible Resolution**
Mechanical:	Valve pin may be too short = Check and replace Valve pin improper fit = Ensure that the valve pin is lapped to the gate steel when appropriate Damaged gate = Check if valve pin is too long, rework as necessary. Also check to ensure that the valve pin is concentric with the gate, if not replace. Hydraulic/Pneumatic seals may be worn = Replace as necessary Insufficient pin/land area in the gate area. Increase the gate cooling area, or increase the valve pin land contact. Excessive hold time = Decrease hold time

Voids = (Hollows in the part. Normally found in thick sectioned parts caused by material being pulled away from the hot center section toward the cold walls leaving a void in the center of the part	
Possible Cause	**Possible Resolution**
Process:	Decrease injection pressure Decrease melt temperature Increase injection pressure Increase injection – hold Increase mold temperature Increase shot size

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Voids = (Continued from Page # 15)

Mechanical:	Check vents for obstructions = clean and repair as necessary Add or increase vents size to those areas where needed Increase size of sprue and or runner and or gates

Warping = (shows up as parts being bowed, warped bent or twisted)

Possible Cause	Possible Resolution
Process:	Adjust melt temperature = Increase to relieve molded-in-stress Decrease to avoid over packing Equalize / balance mold temperature over the total surface of both halves Increase mold cooling time Try increasing or decreasing mold injection pressure Part ejected while too hot = Increase mold hold time Increase mold cooling time Decrease mold temperature Decrease melt temperature Shrinkage due to non-uniform wall thickness = Increase cooling time Increase back pressure Redesign part with uniform wall thickness Cool parts in warm water after ejection Use secondary fixture to hold part dimensions while they cool Regrind may not be homogenously mixed = Verify by using 100% dried virgin material
Mold:	Non-uniform shrinkage = Increase runner and gate size Relocate gate on or as near as possible to thick sections Balance runners and gates Check for variation in mold cooling system

Weld Lines = (When two or more melt flows meet possibly causing a cosmetically visible or structurally weakened area in the part. This is especially true with filled plastics)

Possible Cause	Possible Resolution
Process:	Increase melt temperature Increase mold temperature Increase first stage injection pressure Increase boost time Increase pack pressure Increase pack time Increase injection speed Reduce amount of mold release lubricant used

Weld Lines = (When two or more melt flows meet possibly causing a cosmetically visible or structurally weakened area in the part. This is especially true with filled plastics)

Possible Cause	Possible Resolution
Mold:	Check vents = May be blocked or damaged Add vents to weld area Decrease clamp pressure to improve venting Decrease injection speed to allow for better air removal Make sure part contains no sharp variations to cross-sections Flow distance from gate to weld line may be excessive = relocate gate or use multiple gates utilize overflow tab in mold to increase strength in weld line area

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