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TROUBLESHOOTING MOLDING PROBLEMS

Molding Guide for BMC & SMC

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Blisters

A blister is a delamination that produces a bulge on the surface of the part. This bulge is usually regular in shape and can range in size from 1/8 to 10 inches. A blister is caused by the presence of gases under pressure within the substrate, forcing the skin away from the glass. Can be seen on painted or unpainted parts.	
Probable Cause	
Material	• Insufficient glass wet out with resin (dry glass) • Foreign objects/contamination (film, flash, etc.) in or on the charge • Wrinkles/pockets in discontinuous surface of SMC charge pattern
Process	• Adding small SMC pieces to charge pattern which trap air • Insufficient pressure on SMC during cure cycle • Oven temperature heat-up rate too fast, especially in combination with a high moisture content part • Improper charge patter (too large, rolled or folded) • Mold temperature out of spec • Vacuum too low; improper vacuum cycle • Low cure time (under cure) • Press closure speed to fast (air trapped in laminate)
Tooling	• Mold shear edge is too tight (not allowing air to bleed out) • Tool Deflection
Corrective Action	
Material	• Check for fiberglass wet out • Check material for contaminants and check for moisture contamination • Evaluate viscosity levels affect on blisters, look at high, medium and low • Use less reactive catalyst • Select different shrink additives • Verify material is not dried out
Process	• Increase material flow distance • Increase molding pressure • Pyramid charge in center of the tool • Load pattern, location, size, thickness • Appropriate vacuum amount and timing (position) • Appropriate press closure speeds • Appropriate mold temperatures • Appropriate cure time • Do not use makeup pieces in the charge • Be certain mold shears are clean with at least 0.004" of flash
Tooling	• Check for mold deflection • Check for Platen parallelism

Bond Failure

Failure of a bonded assembly, usually at the interface of the adhesive and the substrate	
Probable Cause	
Material	• Out of spec SMC
Process	• Gel time of adhesive too short to permit proper bonding • Bond not fully cured before clamps are removed • Improperly prepared bond surfaces • Mix ratio of the two-component adhesive is off • Moisture contamination of adhesive or surface to be bonded • Out of spec adhesive • Excessive internal or external mold release in/on the SMC • Shift between inner and outer panels during curing of the adhesive • Incompatible substrate and bond material • Introduction of air into dispense system causing gaps, ratio variations • Improper cure cycle • Improper heating during bond cycle
Tooling	
Corrective Action	
Material	
Process	• Improve QC of adhesive material • Fully cure adhesive before pressure or clamping is removed • Properly prepare surfaces to be bonded • Ensure that periodic check of the mix ratio is performed • Control temperature of adhesive • Do no use external mold release on bond areas
Tooling	

Bond Readout

Bond readout is a surface distortion similar to a hump or sink that occurs over a bond line	
Probable Cause	
Material	
Process	• Mismatch of compliance between outer panel, inner panel and adhesive • Incompatible thermal expansion coefficients between the SMC and the adhesive • Excessive shrinkage of the adhesive during the fixturing and curing cycles • Excessive fixturing pressure induced due to part mismatch of the outer/inner panels and the bond line standoffs • Excessive fixturing temperature due to non-uniform heating • Hot spots from adhesive exothermic reaction due to non-uniform adhesive thickness • Bond gap thick above 1.5 mm • Bond gap thin below 0.5 mm • Outer panel thin, less than 2.0 mm • Inner thickness above maximum
Tooling	
Corrective Action	
Material	
Process	• Increase the thickness of the bonding area of the appearance panel or select a more flexible adhesive • Match the thermal expansion coefficients between the substrate and the adhesive as much as possible • Select an adhesive with minimum polymerization shrinkage • Obtain matched outer/inner panels through better tooling • Eliminate bond line standoffs • Use closed-loop feedback temperature control system for tighter temperature variation tolerance of the fixture • Minimize and control clamp pressure • Mold warp-free parts; do not use adhesive bond fixture to straighten parts • Check adhesive thickness to specification • Check outer thickness to specification • Check inner thickness to specification
Tooling	

Chip

A chip is damage to the surface of the part that results in small (less than /2 inch) missing pieces. A chip usually occurs near the edge, and since it is nonstructural, it usually is repairable	
Probable Cause	
Material	• Resin-rich edge
Process	• Rough handling • Rough bypass • Shipping racks lack necessary padding • No use of in-process racks (parts are stacked on each other) • Squared edge on part at mating surface with adjacent parts
Tooling	• Improperly designed secondary fixtures (non padded in all necessary areas) • Mold defects on edges or flash stuck to shear edge
Corrective Action	
Material	• Increase compound viscosity
Process	• Utilize transfer lines and other hands-off processing techniques • Train workers in proper handling techniques • Improve shipping procedures and monitor part quality • Improve shipping rack repair procedures • Add external mold release and clean • Slow ejector speed • Slow press closure rate • Relocate charge • Decrease molding pressure
Tooling	• Design secondary fixtures properly and coat them with soft materials to absorb shocks • Preventative maintenance on molds and fixtures • Periodically clean flash on shear edges and gummy deposits of styrene • Polish tool surface

Contamination

Foreign material in the laminate	
Probable Cause	
Material	• Foreign material in SMC compound or raw materials
Process	• Foreign material from the molding presses
Tooling	
Corrective Action	
Material	• Check for foreign materials in molding compound and cut out if necessary • Check for foreign materials in raw materials
Process	
Tooling	

Crazing (Surface Cracks)

Craze cracks are hairline cracks that do not go through the entire thickness of the part. These cracks usually occur in groups. Craze cracks can appear similar to porosity on painted parts.	
Probable Cause	
Material	
Process	• Mechanical overstressing caused by part sticking in the mold or rough handling • Poor material flow pattern around mash-offs, core pins, mold outs • Thermal stresses induced by mold temperature or by non-uniform part cool down • Charge pattern changed by adding small pieces to make up weight • Ejector pins • Thick-to-thin wall thickness variation
Tooling	• Secondary fixtures improperly designed • Thick-to-thin wall thickness variation • Ribs too thick with respect to wall thickness • Cored holes or slides too low from designated surface position
Corrective Action	
Material	
Process	• Train workers in proper handling techniques • Cool parts at a uniform rate • Design charge pattern to minimize improper flow behavior • Do not use makeup pieces in charge pattern • Minimize mash-offs • Slow ejection system to reduce ejector pin crazing • Increase differential temperature between core and cavity
Tooling	• Design secondary fixtures so they do not induce stress on the part and coat them with soft materials to absorb shock • Polish shear edges of cavity, eliminate back draft or undercuts • Ensure smooth transition from thick to thin sections

Dieseling

Dieseling is a burnt spot on the laminate, often accompanied by non-fills	
Probable Cause	
Material	
Process	• Air entrapped in the tool which burns
Tooling	
Corrective Action	
Material	
Process	• Increase material flow distance • Slow press closure • Vary mold temperature differential • Increase shear opening (assumes dieseling occurs near the shear edge • Add vented ejector pins
Tooling	

Dirt

Dirt is a particulate contaminate under or in any paint film that shows up as a raised bump of the cured paint film.	
Probable Cause	
Material	
Process	• Dirt on parts as received • Dirt created by repairing SMC defects • Dirt on the paint rack that is not washed off • Dirt, hair, fibers, etc. from workers • Improper paint shop cleanliness • De-ionized rinse out of spec
Tooling	
Corrective Action	
Material	
Process	• Installation of appropriate power washer • Automate paint operations • Proper maintenance of paint equipment and paint booth • Remove and clean overspray on the paint racks per agreed-upon schedule • Analyze dirt particles to accurately determine source • Clean overhead conveyor • Improve paint shop cleanliness procedures
Tooling	

Dull Surface

Loss of gloss on overall part surface	
Probable Cause	
Material	• High shrinkage
Process	• Under cure • Loss of pressure
Tooling	• Unacceptable tool surface
Corrective Action	
Material	• Check for catalyst level • Check resin reactivity • Select different shrink additives or levels
Process	• Increase mold temperature • Increase cure cycle • Increase molding pressure • Maintain constant material pressure in press
Tooling	• Polish and buff tool surface • Chrome plate tool surface

Ejector Cracks

Ejector cracks are small, visible surface cracks on the cavity side surface of the molded part. These are often found on the opposite side of the part above an ejector pin. A crack located on the surface of the laminate that does not extend completely through the substrate.	
Probable Cause	
Material	• Resin Reactivity
Process	• The part is sticking to the core • The part is under-cured • Cure time is too low • Mold temperature is too low • Insufficient release agent • The ejector pin is placed in a poor location, too few fins or too small a diameter
Tooling	• Ejection system is too fast • Blocked air to popper passage (partial) • Improperly sized air supply line to air popper • Ejection system leading air popper blow off • Excess flash around ejection pin • Undercuts along shear (acting as “hangers”)
Corrective Action	
Material	• Use less reactive catalyst
Process	• Check temperature and cure times • Place ejector pins in areas least sensitive such as below ribs or bosses, increase diameter or number of pins • Add vented ejector pins • Verify correct load pattern weight • Add external mold release, mold one part, then discard that part • Clean shear edges
Tooling	• Slow ejection system • Check mold for undercuts • Alleviate stresses holding the part too tight to the core (undercuts, etc) • Proper sequencing of air popper system • Inspect mold for biased ejection, install flow control or dividers • If ejectors are on angled surface add skid grooves to top of ejector pin

Fiber Pull

Fiber Pull is a depression left by removing or loosening of fiberglass strands located near the surface of the laminate.	
Probable Cause	
Material	• Sticking
Process	• Flash buildup on the by-pass
Tooling	• Worn by-pass
Corrective Action	
Material	
Process	• Add external mold release and clean by-pass • Vary mold temperature differential (normally narrow the difference) • Decrease by-pass opening • Correct ejector action (are all ejector pins working) • Slow ejector speed
Tooling	

Fiber Tear

Fiber tear is a surface defect caused by fibers tearing away part of the surface resin. These defects always occur near the shear edge of a part.	
Probable Cause	
Material	
Process	• Improper deflashing of the part • Ejector speed too fast • Charge weight too high • Mold temperature differential incorrect • Molding pressure too high • Molding viscosity too low • Shear edge temperature variance too liberal (causing excess flash/leakage) • Molding press strip speed too fast • Flow parallel to shears
Tooling	• Improperly fit or worn shear edges
Corrective Action	
Material	
Process	• Use sandpapers, file or automatic router to deflash instead of a knife • Closer inspection of punched and drilled holes • Use high technology process such as router, water jet, laser or ultrasonics to perform deflash, punch and drill operations • Verify correct load pattern weight • Verify appropriate temperature differential between core and cavity • Verify appropriate molding temperature • Slow ejector speed • Adjust charge to minimize flow parallel to shears
Tooling	• Maintain proper shear edge on molds to minimize flash

Finger Tracks

Finger tracks are shallow groves in the surface that show up after prime or top coat. These grooves are usually the width of a finger.	
Probable Cause	
Material	
Process	• Sanding the surface without a block or backup pad. The pressure directly under the fingers removes more material than between the fingers and leaves tracks that show up on the painted surface • It is generally accepted that the eye can detect surface depressions of 0.0004 inches or greater over a one-inch span
Tooling	
Corrective Action	
Material	
Process	• Always use block or pad when sanding the surface • Develop sanding and feathering techniques that blend surface changes over large areas • Use 400 grit or finer sandpaper
Tooling	

Fish Eye

A fish eye is a circular or elliptical depression in the primer. There is not any penetration into the substrate. Fish eyes are usually caused by some type of surface contamination	
Probable Cause	
Material	
Process	• Oil, grease or silicone contamination in paint system, air feed, paint conveyor line or in the paint itself • Rags containing oil or oil byproducts • Excess mold release at source • Insufficient cleaning of the part • Overspray of primer • Mismatch of solvent with paint or prime system • Ensure parts are not being sprayed or dripped on at press by hydraulic oils (if so, with 50% IPA and 50% DI water)
Tooling	
Corrective Action	
Material	
Process	• Do not use silicone-containing hand creams or lubricants during handling at press-side or bonding • Properly installed power washer for all SMC parts • Proper maintenance of equipment (filters, etc.) • Ensure proper use of oils and lubricants in the paint shop • Proper QC procedures on all paint materials • Fish eye reducing additives to paint are available.
Tooling	

Flow Marks

Flow marks is the visual orientation of fiberglass strands on the part surface	
Probable Cause	
Material	
Process	• Flow condition
Tooling	• Tool design
Corrective Action	
Material	• Evaluate molding viscosity effect • Select different shrink additives or levels
Process	• Decrease material flow distance • Relocate charge pattern • Increase press closure rate
Tooling	• Change part wall thickness

Fractures

A Fracture is a structural failure in a part which extends complete through the substrate	
Probable Cause	
Material	• Insufficient glass reinforcement • Sticking or wedging of part in mold
Process	• Mechanical hang-up from flow related knit lines • Rough handling • Poor material flow pattern around mash-offs, etc. • Charge pattern change by adding small pieces to produce proper weight • In process racks not used or poor quality secondary fixtures • Press opens askew • Poor part design (if every part is cracked) • Improper combination of drill speed and feed rate • Shipping damage • Heavier shear on one edge • Dull drill bit or worn out sleeve • Undercut at parting lines or undercut in the mold • Shears too tight • Cure time too short • Parallelism of ejectors
Tooling	• Improperly-designed secondary fixtures or tooling
Corrective Action	
Material	• Control SMC sheet weight to allow use of automatic cutting of charge patterns • Use QC on SMC glass content • Check SMC flow
Process	• Train workers in proper handling techniques • Reduce material flow distance (reduce the flow front) • Design charge pattern to minimize improper flow behavior • Do not use make-up pieces in charge patterns • Properly support part in shipping containers • Evaluate proper paint rack design • Check shears • Change drill bit or sleeve • Eliminate any undercuts in the mold • Increase cure time • Slow ejector speed • Vary mold temperature differential • Add vented ejector pins • Relocate charge
Tooling	• Design secondary fixtures so that they do not induce stress in the part • Draw polish shear edges in the cavity • Use parallelism control on the press • Change part wall thickness

Gouge

A gouge is a long, deep depression in the surface, severe enough to require a repair procedure. Gouges can be several thousands of an inch deep.	
Probable Cause	
Material	
Process	• Rough handling • Improperly designed secondary fixtures (not padded in all necessary areas) • Mold defects on edges or flash stuck to shear edge • Shipping racks lack necessary padding • No use of in-process racks (parts are stacked on each other) • Square edge on part at mating surface with adjacent parts
Tooling	
Corrective Action	
Material	
Process	• Investigate potential source for gouges in process and correct • Train workers in proper handling techniques • Design secondary fixtures properly and coat them with soft materials to absorb shocks • Preventative maintenance on molds and fixtures • Periodically clean flash on shear edges • Improve shipping rack repair procedures • Utilize transfer lines and other hands off processing techniques • Repair using approved repair procedure
Tooling	

Hanging Fibers

Hanging fibers are glass fibers that are left hanging from the part after a deflashing, hold piercing or drilling operation. These fibers cause dirt to be carried into the paint shop.	
Probable Cause	
Material	
Process	• Dull or improperly fit secondary tooling (bits, mash-offs, punches, etc. • Improper sanding to remove fibers
Tooling	• Dull deflashing tool
Corrective Action	
Material	
Process	• Closer inspection of pierced and drilled holes • Use high technology process such as router/drill bit design, water jet, laser or ultrasonics to perform deflash, punch and drill operations.
Tooling	• Proper maintenance program need for molds, pierce dies and secondary tools.

Knit Lines

Knit line is a term for the molding condition which relates to oriented fiber patterns in the molded part. The knit line usually occurs at the edges or corners of the part furthest from the charge placement position. It is an extremely weak area in the molded part resulting from two flow fronts meeting.	
Probable Cause	
Material	
Process	• Flow fronts from different charge pattern pieces • Too far of a distance for the SMC to flow • Charge pattern position • Incorrect rate of tonnage build • Spiral flow of SMC to high/low • Mold temperatures too high
Tooling	• Mold design (deep vertical walls), etc.
Corrective Action	
Material	
Process	• Appropriate load placement • Proper press closure • Proper load pattern dimensions • Consistent tonnage build • Check oil level in press • Place charge directly over critical or knit line area if possible • Decrease closure speed (reduce amount of orientation) • Eliminate separate charges if possible • Verify correct molding temperature
Tooling	• Optimize mold design for best flow conditions

Laking

Laking is an irregular dull area on the surface of the part. The dull area may be associated with porosity. Laking can also be noticed after prime as “soak-in”	
Probable Cause	
Material	• Differential shrinkage
Process	• Too low a pressure on the part during molding (usually on vertical walls • Molding on stops • Load pattern weight too low • Under-cured part • Cold spots on mold
Tooling	
Corrective Action	
Material	• Select different shrink additives and/or levels
Process	• Maintain pressure on material during molding • Do not mold on stops or flash • Verify load weight is correct and not too low • Verify mold temperatures • Increase pressing speed
Tooling	• Equip press with parallelism control

Mold Marks

A mold mark is a lump, depression or line that occurs in the same location of every part due to a damaged mold	
Probable Cause	
Material	
Process	
Tooling	• Damage to the cavity of the mold due to insufficient protection • Stuck parts that require scraping off the mold • Improper tools used to clean the mold • Thickness variation flowing thin to thick causing tool wear • Hard metal object molded into part causing mold damage
Corrective Action	
Material	• Proper QC of SMC materials will reduce the sticking of parts
Process	
Tooling	• Repair molds as required • Regular maintenance program for molds • Make sure all cutting utensils are made from soft materials that will not damage the mold surface • Make sure all employees use only copper, brass, wood or plastic tools to scrape the mold surface • Wire down all loose items on the cutting table and loading/unloading equipment • Protect mold surface in transport and storage • Automation should be constructed from aluminum or other soft materials

Molded Poly

Irregular shaped, small depressions on the surface of a part shaped like carrier film chips, but recessed into the substrate. These depressions are normally the colour of the film.	
Probable Cause	
Material	
Process	• Pieces of carrier film that are molded into the SMC part
Tooling	
Corrective Action	
Material	
Process	• Make sure that all carrier film is removed from the charge, especially when automatic film stripping is not used. • Proper repair procedure required • Frequent changing of blades to ensure clean cuts • Check for proper slitter cutter alignment to shear guide. Improper alignment will cause a small strip to adhere to the edge of the SMC unnoticed.
Tooling	

Non-Fill

A non-fill is a severe void in the laminate. It is an incomplete part that must be scrapped	
Probable Cause	
Material	
Process	• Tonnage too low • Mold temperatures too high • Not enough SMC charge weight • Molding on stops • Press closure too slow (tonnage build rate too slow) • Mold temperatures of cavity and core are too close (no flash) • Flash/debris on the mold shears/stops • SMC charge sits on mold too long before closure • SMC charge has to flow too far
Tooling	• Tool or platen deflects
Corrective Action	
Material	• Decrease molding viscosity • Use less reactive catalyst
Process	• Verify parameters to control plan/process sheet (tonnage, load pattern, load placement, temperature, closure speeds) • Check SMC spiral flow • Verify molding off stops • Clean mold shears/stops • Check for deflection • Monitor SMC viscosity build • Verify weight scales are correct • Increase molding pressure • Increase closure speed • Ensure charge weights are balanced • Decrease material flow distance • Check oil level in press • Vent ejector pins and/or add vented ejector pins • Shorten tool load time
Tooling	• Blend core half to reduce thin to thick flow restrictions in area of non-fill

Paint Sags

A sag is excess paint on a part that shows itself as a hump or ripple that distorts the surface.	
Probable Cause	
Material	
Process	• Oven temperature too low • Viscosity of paint too low, too much solvent • Film build too thick • Spray gun too close to part being painted • Inconsistent sanding of parts to be reworked (causing sags when painting with electrostatics)
Tooling	
Corrective Action	
Material	
Process	• QC paint viscosity on each shift • Monitor and control ultimate over temperature and heat up rate • Do not allow painters to get ahead or behind job sequence • Instruct painters on proper spray techniques • Preventative maintenance of spray equipment • Implement automatic paint spraying equipment • Verify appropriate air pressure • Verify appropriate paint pressure • Increase distance between part and gun • Use more coats of paint to get desired film build • Thoroughly scuff sand reworks prior to paint.
Tooling	

Porosity

Porosity is an observable or unobservable condition in any part. It consists of a cluster of holes that usually occurs when trapped air escapes during the molding process. This cluster usually covers an area no larger than a quarter, but can be larger, and can occur as a single hole. Unfilled porosity creates a crater-type condition on a top coated part	
Probable Cause	
Material	• Excess styrene loss
Process	• Insufficient flow of the SMC; too large/small a charge pattern • Pre-gel • Flash on shear edge prevents adequate venting of gasses • Insufficient pressure on material during molding • Improper press closure speed • Mold temperature too high • Vacuum too low; improper vacuum cycle • Undercure • Low charge weight • Adding small SMC pieces to charge pattern • Too many plies • Molding on stops • Moisture contamination
Tooling	
Corrective Action	
Material	• Evaluate viscosity level • Verify material is not dried out
Process	• Verify vacuum amount and timing • Verify load pattern location, size, thickness • Verify appropriate press closure speeds • Verify appropriate temperatures • Verify molding off stops • Make sure mold shears are clean • Increase material flow distance • Minimize number of plies in charge • Check charge weight • Check molding pressure • Clean mold stops
Tooling	• Change part wall thickness

Pre Gel

Pre-gel causes localized areas of dull, rough, porosity, usually with discoloration	
Probable Cause	
Material	• Too reactive resin • Too reactive catalyst
Process	• Slow closure rate
Tooling	
Corrective Action	
Material	• Check resin reactivity • Use less reactive catalyst
Process	• Shorten tool loading time • Increase press closure rates • Decrease mold temperature
Tooling	

Resin Rich

An area in the part where fiberglass strands content is low.	
Probable Cause	
Material	• Resin is not carrying fiberglass strands
Process	
Tooling	
Corrective Action	
Material	• Increase material molding viscosity
Process	• Relocate charge pattern • Decrease material flow distance • Slow pressure closure rate
Tooling	

Rib, Pin and Boss Readout

A surface depression located over ribs, bosses, ejector pins or thick sections of the part that appear as a lighter color resulting in read through.	
Probable Cause	
Material	
Process	• Lack of material flow • Lack of cavity/core temperature differential • Lack of a tonnage "bump" (decrease molding pressure after 30 seconds into cycle)
Tooling	
Corrective Action	
Material	
Process	• Increase material flow distance (do not load over a boss) • Increase mold temperature differential (the hotter appearance side will gel slightly faster and will reduce the amount of sink) • Reduce tonnage after mold fill (high tonnage held through the cure cycle increases sink. Reduce tonnage by 25% to 30% after 30 seconds.
Tooling	

Ripple

Severe short-term waves in the SMC, almost always on the edge of a part or vertical walls.	
Probable Cause	
Material	• Improper viscosity • Material too old and will not flow properly • Higher paste shrinkage • Improperly maturated SMC • Extremely high-flowing SMC
Process	• Inconsistent force on the material during molding • Charge pattern placed or cut improperly • Temperature of mold too high or dropped temperature zone of mold • Improper closure speed • Abrupt thick-to-thin flow condition • Reflow of material due to non-parallel closure (leveling)
Tooling	• Mold not centered to press platen • Flow turbulence resulting from tool design
Corrective Action	
Material	• Investigate viscosity of paste • Verify SMC is within appropriate spiral flow • Investigate past shrinkage
Process	• Increase tonnage • Decrease material flow distance • Verify charge weight • Verify molding off stops • Monitor and control mold temperatures to specs
Tooling	• May need to offset mold • Modify tooling

Sand Through

A sand through is a break through the primer surface resulting from a sanding operation.	
Probable Cause	
Material	
Process	• Localized sanding that is deeper and more severe than is necessary (finger sanding) • Tipping power sander to cut deeper in one area to remove dirt or other localized defects • Sanding with too course a sandpaper
Tooling	
Corrective Action	
Material	
Process	• Always block sand defects • Repair mold when mold marks appear to minimize the amount of sanding • Goal is to avoid using sandpaper • Eliminate use of power sanders • Use only 400-grit or finer sandpaper
Tooling	

Sander Scratches

Scratches in the substrate result from a sanding operation. These scratches usually appear as very fine circular scratches.	
Probable Cause	
Material	
Process	• Sanding curved areas of part with a flat sander • Improper grit size paper • Sanding Class "A" surface to remove die marks • Repair procedures for all defects • Poor flash removal methods which require additional sanding • Excessive loading of sandpaper with sanding debris
Tooling	
Corrective Action	
Material	
Process	• Establish specification describing grit size for specific operations • Hand sand curved areas that require sanding • Repair die marks on mold, not on parts • Automate flash removal to eliminate error • Specify paper grit size for every repair method • Specify sandpaper change interval • Clean debris from unloading fixture or racks
Tooling	

Scratch

A scratch is similar to a gouge, but is not deep enough to require fill repair material. A scratch can usually be feather sanded out.	
Probable Cause	
Material	
Process	• Rough handling • Improperly designed secondary fixtures (not padded in all necessary areas) • Mold defects on edges or flash stuck to shear edge • Shipping racks lack necessary padding • No use of in-process racks (parts are stacked on each other) • Square edge of part a mating surface with adjacent parts
Tooling	
Corrective Action	
Material	
Process	• Train workers in proper handling techniques • Design secondary fixtures properly and coat them with soft materials to absorb shocks • Design secondary fixtures properly and coat them with soft materials to absorb shocks • Preventative maintenance on molds and fixtures • Periodically clean flash on shear edge • Improve shipping procedure and monitor part quality • Improve shipping rack repair procedures • Utilize transfer lines and other hands-off processing techniques • Repair using approved repair procedure
Tooling	

Separation (Phasing)

An area of high thermoplastic content resulting in non-uniformity of color	
Probable Cause	
Material	• Separation of the thermoplastic resin from polyester
Process	
Tooling	
Corrective Action	
Material	• Increase molding viscosity • Select different shrink additives and/or levels
Process	• Shorten die loading time • Increase material flow distance • Decrease molding pressure • Decrease molding temperature
Tooling	

Scumming

Dulling or streaks in the part (generally transfers a similar pattern on the tool surface).	
Probable Cause	
Material	• Incompatible resin additives
Process	• Internal mold release not functioning at the mold temperature
Tooling	
Corrective Action	
Material	• Use greater viscosity material • Select different shrink additives and/or levels
Process	• Increase mold temperature • Increase material flow distance • Shorten tool loading time
Tooling	

Sink Marks

A sink is a depression on the part surface that will normally occur over ribs or bosses. It is possible to get a sink on the edge of a flanged part. Sinks can range in depth from 0.0004 to several thousands of an inch anywhere along a rib or boss.	
Probable Cause	
Material	• Poor glass orientation • Excess shrinkage of the SMC over a thick section
Process	• Inadequate molding pressure • Temperature variations due to variable thickness
Tooling	• Improper rib design
Corrective Action	
Material	• Select different shrink additives and/or levels
Process	• Flow material from a thick section to a thin section so as not to create surge flow patterns in localized areas (the surge flow orients glass fibers perpendicular to adjacent areas which shows up as a sink). • Cross sectioning the wall section may be necessary to prove a thin-to-thick flow condition • Control aspect ratio of rib and boss (depth-to-thickness ratio); rib should not be more than 0.075” thickness of attached wall • Place ribs and bosses behind design lines • Mold off stops • If sink is over a “boss”, reduce mass by having a long cored hole
Tooling	• Modify tooling

Sticking

Sticking occurs when the part adheres to the cavity or core and is not easily released or results in a crack upon removal.	
Probable Cause	
Material	• Release problem with the SMC • SMC shrinkage control is incorrect
Process	• Core is too rough • Charge weight is excessive • Undercuts on cavity or core • Part is under-cured • Temperature spread on dies too close • Press strip is too fast • Contaminated mold surface (oils, dirt, etc)
Tooling	• Mold surface is corroded
Corrective Action	
Material	• Check for SMC release • Check SMC shrinkage data
Process	• Slow strip speed • Clean mold surface/run break-in material • Add external mold release • Increase cycle time • Increase mold temperature
Tooling	• Evaluate mold for undercuts and remove where necessary • Check chrome plating wear • Polish tool surface • Pyramid charge in the center of the tool

Streaking (Abrasion)

Dark areas, directional, in line of flow, found in pigmented parts and is generally located over fiberglass strands	
Probable Cause	
Material	
Process	
Tooling	• Tool abrasion or scuffing
Corrective Action	
Material	• Check raw material • Use greater viscosity material • Select different shrink additive or level
Process	• Relocate charge pattern
Tooling	• Polish or buff out tool surface • Chrome plate tool surface

Surface Waviness

Short term waviness has wave lengths for ¼ to one inch long. Long term waviness has wave lengths from one to five inches. Waviness causes distortion of straight lines on the Class "A" surface and is most readily observed on a painted part.	
Probable Cause	
Material	
Process	• Improper spiral flow of SMC sheet when molded • Inconsistent force on the material during molding • Parts molded with improper pressure • Charge pattern cut or placed improperly • Flow interrupters (mash-offs, core pins, part geometry) in mold • Partial charge • Improper bonding temperature (Undercure) which can cause bond readout, causing waviness.
Tooling	
Corrective Action	
Material	
Process	• Monitor spiral flow for appropriate values • Use proper pressure to mold material • Remove flow interrupters from mold • Monitor viscosity of paste • Monitor and control mold temperatures to specs • Refer to design guide for allowable thick-to-thin transition • Verify closure speeds, load pattern (location, size) and leveling • Verify molding off stops • Monitor viscosity of paste
Tooling	

Undercure

Undercure is an incomplete cure or bake cycle of the SMC in the mold. The part is often extremely smoky, very dull and can exhibit blown bosses or ribs. This part is scrapped.	
Probable Cause	
Material	• Unreactive resin • Incorrect cure chemistry
Process	• Low temperatures and/or short cycle time • Loss of tonnage
Tooling	
Corrective Action	
Material	• Check SMC for cure time • Check resin reactivity
Process	• Check mold cold spots or bad stream lines and regulators • Verify cure times • Verify tonnage via parameter sheet
Tooling	

Warpage (Dimensional Error)

Dimensional error is the failure of the part to fit the checking fixture or to meet print tolerances due to Warpage, shrink, expansion or tooling error.	
Probable Cause	
Material	• Out of spec material
Process	• Uneven cure • Excessive stress on the part when unloading or bonding • Not allowing the part to cool on fixture long enough • Variable charge pattern or placement • Improper expansion factor in tool for approved material • Improper thermal expansion material molded in approved mold • Improperly designed paint fixture • Degree of cure – bond line
Tooling	• Tool temperatures not within spec
Corrective Action	
Material	• Verify SMC for proper shrinkage
Process	• Use heat management design of mold to permit consistent curing of part • Proper placement of ejector pins reduces demolding stress • Evaluate process for sufficient cooling time • Control charge pattern by area, not weight. When possible use laser light or automation to permit consistent charge placement • Design paint fixtures to properly support part during baking • If bonded assembly, review bonding process • Verify cure time versus tool temperature capability of maintaining correct temperature through consecutive moldings. • Decrease material flow distance • Increase cure time or temperature • Vary mold temperature differential • Increase charge pattern • Verify mold temperatures
Tooling	• Proper mold design to ensure that the part does not stick to core or cavity • Work with design engineers early in program so that mold is constructed using expansion factors of the newer-technology materials

Water Spots

Circular spots on the painted surface usually in groups. These spots are usually depressions with a raised ring around the edge. Water spots can cause paint failure of top coats/	
Probable Cause	
Material	
Process	• Failure to fully dry the part after a wash operation • Failure to sue a DI water rinse after wash • Failure to clean and filter DI water to meet specifications • Part designs which trap water in pockets • Failure to use a rinse additive which ensures a water break-free surface
Tooling	
Corrective Action	
Material	
Process	• Dry parts thoroughly after all wash operations • Design drain holes into parts when necessary to prevent the accumulation of water during the wash cycle • QC rinse water to specs • Use and maintain a rinse additive after parts washing
Tooling	

White Spots

A general light or whitened area on a pigmented surface that occurs as a result of thermoplastic separation. The problem is associated with pitting occurring in the white spotted area.	
Probable Cause	
Material	• Low viscosity builds of SMC through maturation • Thermoplastic incompatibility with SMC formulations • Flow restrictions
Process	
Tooling	
Corrective Action	
Material	• Verify day 1 viscosity • Record occurrence and roll yardage when problem occurs • Record material rates and lot number when problem occurs • Verify spiral flow of material
Process	• Verify load pattern is correct according to engineering specification • Reduce die coverage to allow for increased flow
Tooling	