Designing with SMC

Practical Pointers for
Composite Part Manufacturability

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Molding Ribs Into Your Part

Compression molding with sheet molding compound (SMC) delivers an inherently strong part, along with the ability to further enhance the attributes with special features.

Designed-in ribs are a way you can add enhanced stiffness to an SMC part. Incorporating them into the design allows you to optimize the nominal thickness, cycle time and throughput. This can directly and positively impact the bottom line.

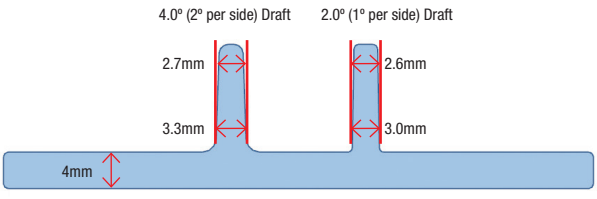
Ribs can be structural or aesthetic. Structural ribs should use larger lead-in radii to improve their functionality. Class A panels need to balance the radii and the rib thickness with the overall panel thickness. This will maximize glass flow into the rib without risk of sink marks.

Design Guidance for Incorporating Ribs

The positives of incorporating ribs come with a potential downside – sink marks on the surface. Sink marks are a common symptom of a poorly designed rib and the archenemy of class A panels.

To avoid sink marks on the surface, make sure the base of the rib is thinner than the nominal part thickness (3/4 of the wall stock).

For example, a panel with a nominal thickness of 4mm will have ribs 3.0mm thick at the root, tapering toward the tip. This tapering is required to add draft to the rib. Ideally, minimum draft should be one degree per side to allow the compression molds to open and close without difficulty and completely "fill-in" the cross-section.

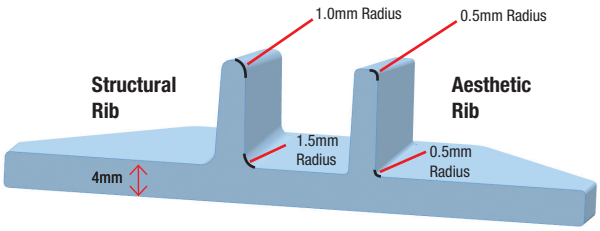


SMC ribs can vary in thickness, depth and draft. Thin ribs make the mold fabrication difficult and can result in a mold with limited service time.

Overly deep ribs also create problems and are unlikely to properly fill with glass. A remedy to this is adding radius to the entrance, allowing for better flow of material into the rib. This adds thickness to the root of the rib, which would result in more shrink/show, but allows the glass fibers to fill in the depth, improving the strength. The deeper the rib, the less glass at the bottom – the more fiber orientation occurs – which can create problems.

As with any material, glass-filled or not, adding radii to part geometry can improve flow - it's simply easier for resin to move through curved radii and fillets than a sharp angle.

Glass fibers in SMC can be visualized as logs in a river. They can be multi-directional at first, but will flow (and straighten) the longer the course. When the river changes directions (in our case a rib structure), the logs will flow better if there is a curved ascent as opposed to a sharp angle. A sharp angle could create a "logjam", impacting the flow of fibers in this direction. Alternatively, fillets built into a rib act as a guide – leading the glass fibers down into the rib.



Example: An ideal design approach for a 4mm thick panel would be a smoothly transitioned fillet into a 3mm wide rib with a one degree draft (per side) down to 2mm that is about 28mm deep.

Cautionary Note

The analysis of rib depth and strength can be misleading.

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