Compression Molding

TENCATE ADVANCED COMPOSITES

Geometric and Feature Guidelines

PRODUCT HIGHLIGHTS

CUSTOMER SERVICE IS THE KEY TO OUR SUCCESS

TenCate Advanced Composites (through CCS Composites) is a valued supply chain partner offering compression molding parts, tailored to the demands of your application. Utilizing bulk molding compound (BMC) based on either thermoset or thermoplastic matrices, we can offer part designers the flexibility to efficiently fabricate both highly specialized low-volume parts and high-volume commercial parts. With more than 20 years of compression molding experience, TenCate Advanced Composites' achievements include supplying over 100,000 parts to the Boeing 737NG program alone.

Not every application is the same; the solutions that our expertise provide are equally varied, effective, and cost-efficient. The key to our success is customer support. With our resin chemistry and BMC material expertise, we help our customers understand the vast engineering benefits and uses for compression molding in their operations to help ensure success.

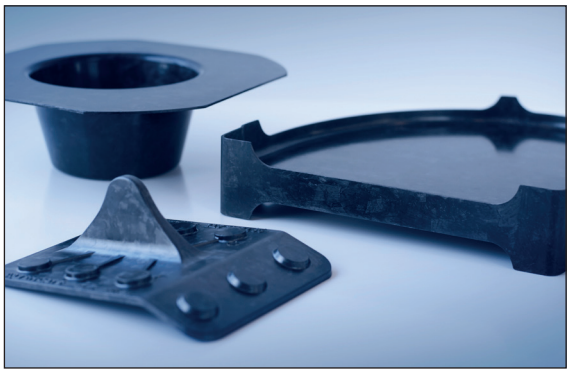
Additionally, TenCate's capabilities include co-molding or hybridizing composite parts. Numerous parts are also co-molded with copper-mesh materials for lightning strike protection or with glass fabric materials for galvanic corrosion protection. With co-molding, no special adhesives or secondary operations are required, which integrates numerous processing steps, saving both time and cost. Below is a guide, created from our Expert Service's years of experience helping first-time users understand where compression molding adds the most value in their business.

GENERAL FEATURE LIMITS AND TOLERANCE

The table below specifies the general limits and tolerances for compression molded parts. In some cases, these limits can be exceeded depending on part geometry.

Feature	Limit/Tolerance
Dimensional Tolerance (General)	±0.18 mm (0.007 in.)
Feature Tolerance (General)	±0.13 mm (0.005 in.)
Thickness (Minimum)	1.3 mm (0.050 in.)
Transition Radii (Minimum)	0.6–1.2 mm (0.025–0.05 in.)
Draft on Vertical Walls	1°–3°
Profile/Flatness (Best, as Molded)	0.5 mm (0.020 in.)
Positional Tolerance (True, as Molded)	0.5 mm (0.020 in.)
Positional Tolerance (True, Post-Machined)	0.2 mm (0.008 in.)
Edge Thickness (Minimum)	0.8 mm (0.030 in.)
Shear Edge Thickness (Minimum)	0.8 mm (0.030 in.)
Length (Maximum)*	1676 mm (66 in.)
Width (Maximum)	1067 mm (42 in.)
Height (Maximum)	1016 mm (40 in.)
Weight (Minimum-Maximum)	10 g–5+ kg (0.25–12+ lb)

** If part is narrow, length >1670 mm (66 in.) is possible if molded on the diagonal.*



Since compression molding requires pressures of up to 138 bar (2000 psi), the size of a part that can be compression molded is sometimes limited by the press tonnage versus just the press area.

TenCate's presses range in tonnage from 65 to 940 tons, with a maximum platen size of 1880 x 1420 mm (74 x 56 inches).

More information:
info@tcac-usa.com (North America/Asia/Pacific)
tcacsales@tencate.com (Europe/Middle East/Africa)

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FEATURE DESIGN RECOMMENDATIONS: WHAT WORKS BEST?

Figure 1 illustrates several design features that are well suited for compression molding: gussets, ribs, pockets/hollows, multiple planes of intersection, molded-in inserts, and vertical walls.

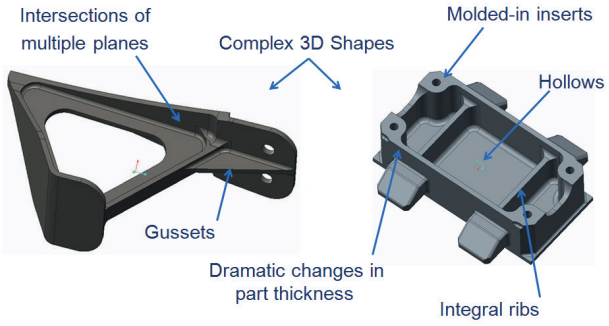


Figure 1. Design features well suited for compression molding

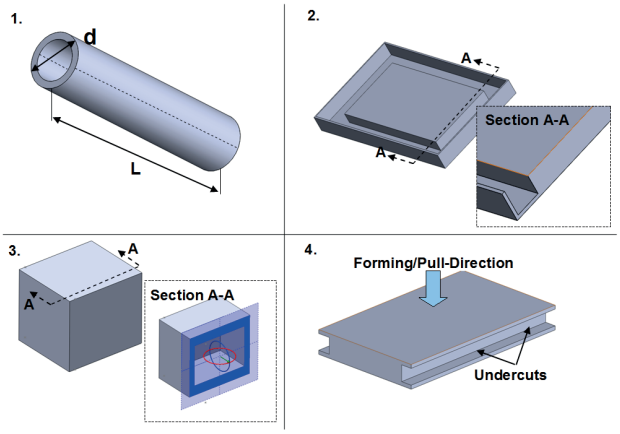


Figure 2. Design features not suited for compression molding

TenCate has several numerically controlled vertical machine centers to provide post-machining of undercuts. In some cases, TenCate can offer slide-action tools as a solution for the customer, if budget permits. This allows for difficult part features to be adopted to a compression molded design.

WHAT DOESN'T WORK WELL?

There are many design features that are difficult to mold and should be avoided. Figure 2 shows four of the most common features that are not directly moldable.

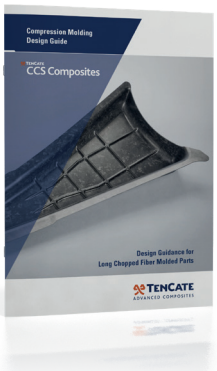
1. Long cylinders and are not generally moldable. If the L/D ratio is less than 4, it is possible to mold a tube, provided the overall length does not exceed the maximum height for molded parts. A viable option for molding tubes would be to mold the tube in two halves, as illustrated by the dotted cut line, and post-assemble to form the enclosed tube.

2. Parts with large regions of thick sections adjacent to smaller regions with thin areas may have warpage issues induced by uneven cooling of the part after molding. We recommend avoiding this, or plan to post-machine these features after molding.

3. Enclosed hollows cannot be molded. However, through holes, normal to the pull direction, are possible. TenCate successfully accomplished this for a particular aerospace application utilized on the Bell/Boeing V-22 Osprey.

4. Undercuts relative to the mold opening or pull direction are the most common issue with parts for compression molding. These undercuts lock the part in the tool after molding. Avoiding undercuts is the most cost-effective method. These features can be post-machined after molding.

TenCate Compression Molding Design Guide, *Design Guidance for Long Chopper Fiber Compression Molding*, provides advice and processing information. To request a copy please refer to our website **www.tencatecomposites.com/guides** For product data sheets and technical papers, please refer to our online resource center and our app.



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TENCATE ADVANCED COMPOSITES

18255 Sutter Blvd.
Morgan Hill, CA 95037 USA
t +1 408 465 8500

2450 Cordelia Road
Fairfield, CA 94534 USA
t +1 707 359 3400

Amber Drive, Langley Mill
Nottingham, NG16 4BE UK
t +44 (0)1773 530899

www.tencatecomposites.com
info@tcac-usa.com (North America/Asia)
tcacsales@tencate.com (Europe)