



**CMT MATERIALS, INC.**

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Attleboro, MA 02703

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**Design Guide and Machining Instructions**  
**HYTAC—B**

**General**

*HYTAC-B* is an engineering thermoplastic. As such, it is important to use proper cutting procedures in all phases of the machining operation. It is critical that sharp tools are used in the machining process. Heat from machining with dull or improper tooling can cause severe melting resulting in poor surface quality.

**NOTE: Dull or incorrect tool geometry will cause Very Poor Surface Quality.**

Starting speeds and feeds for machining should be similar to 6061 Aluminum. Tools must be very sharp to obtain high quality finish.

**Cutting**

Band saw blades should be Buttress tooth form with pitch of 6 teeth per inch for 1 in. and less thickness and 3 teeth per inch for greater than 1 in. thick material. Use saw speed of 1500 ft.per minute. Circular saw blades should be carbide tipped, combination teeth, with low teeth count (40-60), 0 deg. tooth rake and 3 to 10 deg. tooth set.

**NOTE: CMT offers sheet and rod cut to rough size for a reasonable charge.**

**Milling**

Cutter type	Cemented carbide or solid carbide (C-2 type) Non-coated
Cutting speeds	400 to 1700 ft/min[120 - 520 m/min]
Feed rate	6 to 15 in/min [150 - 380 mm/min]
Cut depth	0.20 in [6 mm] max.
Coolant	None or Air
Protection	Safety goggles



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A two flute carbide mill is recommended to allow sufficient clearance for the large chips. Do not use high speed steel cutters due to surface quality issues resulting from quickly dulled tools. Radius milling cutters for rounding off the edges should also have cemented carbide faces.

It is essential to pre-machine larger radii so as not to exceed the prescribed cutting depth. The use of climb milling will improve surface finish. When using CNC, use of approach and return circles may produce better results.

**Turning**

Cutter type and geometry	Carbide, non-coated positive sharp-edge insert (CPG-422) K313 (Kennametal) (see page 3)
Tool Holder	CCLP(Ror L) (Kennametal) (see page 3)
Clearance angle	5 deg
Chip angle	Neutral to 5 deg
Cutting speeds	500 to 700 ft/min [150 to 210 m/min]
Rough Feed rate	0.007 in/rev [0.18 mm/rev]
Finish Feed rate	0.005 in/rev [0.13 mm/rev] at min nose rad. depth
Coolant	None or Air
Protection	Safety goggles

An air stream, venturi or suction pickup should be used to direct removed material away from the part.

**Drilling and Tapping**

Cutter type	Solid carbide
Clearance angle	9 to 15 deg.
Chip angle	3 deg
Cutting speeds	160 ft/min [40 m/min]
Feed rate	0.007 to 0.020 in/rev [0.18 to 50 mm/rev]
Coolant	Flood coolant suitable for plastics
Protection	Safety goggles



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The ends of drilled holes should normally be finished with a 0.06 in. x 45° countersink. Cutting fluids or cooling lubricant should be used for either tapping or drilling. Taps and drills must be sharpened or replaced when worn. CNC tapping only at slow speeds.

**Bases**

An aluminum base may be used; however, a base is not necessary due to the tough nature of the *HYTAC-B*. If using an aluminum base, use mechanical fastening and adhesive or mechanical fastening only. For mechanical fastening use coarse thread with engagement of more than two times the diameter.

**Insert Installation**

*HYTAC-B* is a tough plastic, allowing for a variety of inserts to be used. Highest insert strength will be obtained using a coarse OD thread, thick walled insert, glued into place 0.000 in. to 0.015 in. below the surface to avoid pullout. Inserts are recommended to prevent stripping on multiple change-out applications.

**Bonding**

When bonding *HYTAC-B* to itself or other materials, it is important to properly prepare the bonding surfaces. Be sure that both mating surfaces are free of grease, cooling fluids, dust, and other materials. Use a clean cloth with alcohol to remove contaminants. After cleaning, abrade both surfaces using medium grit (120-220 grit) sandpaper. Re-clean the surface with alcohol and allow the surface to dry completely. Mix the structural adhesive per the manufacturers recommendations and apply to both surfaces. Mate the two surfaces, being careful not to trap air. A “V” groove adhesive applicator works well. Maintain pressure on the surface during cure to insure proper contact. Allow the adhesive to harden at room temperature (follow manufacturers recommended cure schedule). Use suitable high temperature, room temperature cure, structural adhesives (see “Sourcing Information” section pg. 4). Each plug assist application differs in stress and temperature cycling so call CMT or the adhesive manufacturer to discuss your specific application.

**Polishing**

High Gloss and High Clarity forming requires a highly polished plug assist. Incorrectly machined surfaces resulting in a melted surface cannot be sanded out. Smooth surfaces can be polish to a higher gloss with Nylon Mesh Silicon Carbide Pads (Very Fine, Ultra Fine, then Micro Fine) or Silicon Carbide Sandpaper (400 grit, 600 grit, 1200 grit then 1500 grit). Wash with any standard plastic cleaner (409 or Windex like cleaner).



*Innovative Tooling Materials for Thermoforming*

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**Sourcing information:**

Kennametal, Inc.  
PO Box 800  
Windsor, CT 06095-0800  
Telephone 800-446-7738  
Fax 800-847-0004

Holders

Catalogue #	CCLPR124B
Mat. No.	1096903
Description	Qualified Holders

Inserts

Catalogue #	CPG422 K313
Mat. No.	1183422
Description	Kendex Inserts

McMaster-Carr Supply Co.  
473 Ridge Road  
Dayton, NJ 08810-0317  
Telephone 732-329-3200  
Fax 732-329-6666

Adhesives:

Devcon Plastic Welder II, 1.7 oz, p/n 66215A27  
Devcon High-Performance Epoxy, 1.7 oz, p/n 66215A33  
Loctite Hysol E-120HP, 1.7 oz., p/n 6430A24