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## **Design Guide and Machining Instructions**

### **HYTAC-W, WF, WFT & C (Cured)**

#### **General**

*HYTAC-W, WF, WFT* and cured *HYTAC-C* are syntactic foam materials consisting of epoxy resin base matrix with hollow glass spheres and other filler materials.

The material is a very good electrical and thermal insulator. The glass and plastic composite material requires very special machining and working rules.

Failure to follow these instructions will result in poor surface quality, shorter product life, higher tool wear, and even fracture of the part while machining.

#### **Machining**

As with most dust and chips resulting from machining, ignition may occur if dust or chips are in prolonged contact with the hot cutting surface. Non-supervised machining should be performed only when using proper fail-safe chip removal methods. Vacuum transport lines should be grounded. Coolant system should be designed for floating chips and dust.

#### **Cutting**

Band saw blades should be a Hook or Raker, 14 tpi tooth design or segmented Abrasive Grit. Circular saw blades should be carbide tipped, triple chip teeth, with high teeth count (80-100). Speeds should be about 2000 to 5000 rpm.

CMT offers sheet and rod cut to rough size for a nominal fee.

#### **Milling**

Cutting materials	Cemented carbide or solid carbide
Cutting speeds	325 ft/min [100 m/min]
Feed rate	Rough 50 in/min [120 mm/min] Finish 0.75 in/min [15-20 mm/min]
Cut depth	Rough 0.50 in. [12 mm] Finish 0.16 in [4 mm] max.
Coolant	None or Non-aromatic, water soluble
Protection	Enclose chip space, dust extraction, safety goggles, dust mask, protective gloves

Dust extraction equipment should draw from as close as possible to the cutter.

Cutter must be very sharp - Slightly dull cutters will chip out the material, resulting in micro-cracks. Two flute cutters work best on this hard, brittle plastic material. HSS cutters will cause micro-cracks. Use cemented carbide radius milling cutters.

It is essential to pre-machine larger radii so as not to exceed the prescribed cutting depth.

The use of climb milling cutters substantially improves chip removal.

When using CNC, use approach and return circles.

Thin sheets should be held firmly in a clamping fixture.

### Turning and Drilling

Cutting materials	Cemented carbide or solid carbide (C2) (CNMG432-MR3 or similar)
Cutting speeds	400 ft/min [120 m/min]
Feed rate	0.005 in/rev [0.1 mm/rev]
Cut Depth	0.030 in [0.8 mm]
Coolant	None or Non-aromatic, water soluble
Protection	Enclose chip space, dust extraction, safety goggles, dust mask, protective gloves

The transition of the acute angle from the 118° to the helix should be rounded with R0.06 in. Drilling cycles with unclamping should be used if available. The ends of drilled holes should normally be provided with a 0.06 in. x 45° phase. Cutting fluids or cooling lubricant should not be used for either tapping or drilling. Taps and drills must be sharpened or replaced when severely worn. Do not CNC tap.

It is essential to monitor cutting tool wear.

## **DESIGN**

### **Bases**

An aluminum base is generally required when plugs are changed out often to avoid base wear. *HYTAC-WF* will perform much better than *HYTAC-W* without a base. If using a base, adhere with a structural epoxy adhesive such as the ones listed at the end of this document.

### **Bonding**

Surface preparation is crucial for a strong bond. Prepare surface by sanding off any gloss on the faces to be bonded. Blow off with air and wipe with Isopropyl Alcohol. Wait 5 minutes for the surface to dry. Apply the structural epoxy adhesive to both surfaces with a v grooved trowel (the grooves allow any air to flow out between the two surfaces as they are mated). Slowly mate the two surfaces, starting at one corner. Clamp or place weight on the assembly. Follow the adhesive manufacturers recommended cure schedule.

### **Insert Installation**

*HYTAC-W*, *-WF* *-WFT* are somewhat brittle syntactic foams. Only adhesive locking inserts should 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.

### **Polishing**

High Gloss and High Clarity forming requires a highly polished plug assist. Wet or dry polish using a lathe or vibrating (random motion) sander with finer and finer grades of sandpaper. Start with 320 grit, then finish with 600 grit if required.

### **Teflon Coating**

Sometimes Teflon coating is required to prevent sticking or improve clarity. A suitable coating is Xylan Fluoropolymer Coating 1010 from Whitford Corp. (tel. 610-296-3200). They have a list of approved application experts in the US. Note that you must specify that the cure temperature not exceed 350°F [175°C] for *HYTAC-W* and or 450°F [232°C] for *HYTAC-WF* and or 425°F [218°C] for *-WFT*.

### **Repairing**

If *HYTAC-W*, *-WF* *-WFT* becomes damaged through abuse, repairs can be made using *HYTAC-C* or other high temperature epoxy materials. If the area to be repaired is not in contact with the plastic to be formed, use a structural epoxy for the repair.

**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:

\*Araldite 2014 50 ml & 200 ml dual syringe or 2 Quart kits  
Devcon High-Performance Epoxy, 1.7 oz, p/n 66215A33  
Loctite Hysol E-120HP, 1.7 oz., p/n 6430A24  
3M Scotchweld 1838 Green, 2.0 oz. p/n 75065A69

\*Independent studies at CMT Materials have found the Araldite 2014 to be the most effective adhesive on the HYTAC epoxy syntactic products. Araldite 2014 is available directly from CMT or through local Huntsman distributors.