

General Machining Guidelines for Phenolic Materials

In most cases, the same machining operations employed in the fabrication of metals and wood may be adapted to industrial laminates. However, certain slight changes in tools and the use of proper speeds are necessary. For most machining operations, ordinary high-speed steel tooling is satisfactory. However, where production quantity, production speed, or finishes are important factors, carbide-tipped tools often prove more economical to use for paper and cotton fabric based grades. Diamond or tungsten-carbide tools will give more satisfactory work with longer, more economical life than high-speed steel tools when machining glass based grades. Cutting tools must be kept extremely sharp to achieve accuracy and final desired finish.

Typically, laminates are machined dry and cutting compounds and lubricants are not necessary. Cooling by compress air or vacuum at the cutter is preferable to the use of liquid coolants which are difficult to remove from the finished parts. Machine operators should be cautioned to keep the temperature of the work below 300°F, since temperatures above 300° can distort the material and may cause a char on the machined surfaces.

Turning

Paper and Cotton Fabric Based Grades

About 0.010" stock should be left for finishing. Laminated phenolic can be turned at 400 sfpm with high-speed steel tools, and about twice that fast with carbide tooling. Tools should be kept sharp, ground with an included angle of 80° to 100°, and with a 10° to 16° side clearance. Cutting should be done dry.

Glass Base Grades

Carbide-tipped tools and cutters should be used with surface speeds below those used for paper-base laminates. Tools should be ground with a zero rake and machining can be done dry with an exhaust system to remove dust.

Milling

Paper and Cotton Fabric Based Grades

Standard tools may be used at speeds and feeds similar to those for bronze and soft steel. It may be more economical, in spite of higher material cost, to use carbide tools. The cutting angle of the mill will give better results if ground with a slight rake.

Glass Based Grades

Glass based laminates can be milled very satisfactorily on any conventional metal-working milling machine. Carbide tipped tools should be used. Only climb or down milling should be practiced, as up milling will tend to delaminate the material.

Contact your local AIN Plastics branch for more information on machining phenolic or any of the other engineering plastic shapes we offer:

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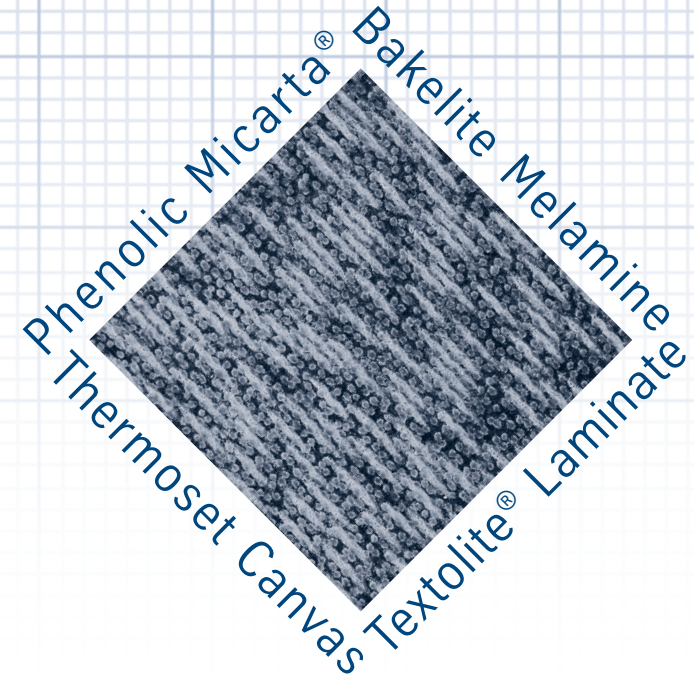
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XXX, XX — Paper Phenolic This paper based phenolic is easy to machine and suitable for many electronic applications.

G-10/FR4 — Glass Epoxy These popular grades are noted for their excellent mechanical and electrical values, especially in high humidity applications.

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