Section #4
Polycarbonate

With lubricant, only a light feather-edge was obtained which was easily removed when the part was wiped with a cloth.

Shaping

Standard shaper operating at 138 strokes per minute and using a steel working cutting tool with a 5° rake, produces excellent surface cuts on Polycarbonate molded blocks. Feeds of 2, 10 and 70 mils, with a bite up to 50 mils, can be used without gumming or edge-chipping. Shaping speeds up to 315 feet per minute may be used without lubrication or coolant.

Punching, Shearing, Blanking

Thin sections of Polycarbonate can be punched or sheared very easily. For example an ordinary paper-cutter will perform satisfactorily on 20-mil thicknesses. In thicker sections (60 mils or greater) the material tends to draw as it shears.

Smooth cuts can be obtained with shear blades with a 45-degree angle or less, and by lowering the clearance between the blade and the shear bed to .0005″ to .001″.

Hollow ground punches can be used successfully with Polycarbonate but provision may be necessary for shrinkage of holes. For example, a 3/32″ hole punched in .125″ sheet may shrink .007″, a ¼″ hole .004″.

The tendency toward shrinkage decreases as thickness is reduced. There is no tendency toward cracking or crazing around a sheared edge or punched hole.

Cleanly trimmed Polycarbonate parts are obtained with conventional steel rule and clicker dies. The polymer's shear strength of 9200 psi, relatively low in comparison to metals, makes processing easy. Again, sharp tools produce the best results.

Use of Lubricant

Normally no lubricant is required for the machining of Polycarbonate. In cases where lubrication may be required, for example, in drilling, tapping and threading, a light pure hydrocarbon machine oil is recommended. Cutting oils or emulsions contain additives which may cause stress cracking, particularly when the parts are subsequently heat treated to relieve machining strains. When cooling is indicated, the use of oil free air is suggested.

Degreasing

Popular degreasing agents such as the chlorinated hydrocarbons trichloroethylene, perchloroethylene, and carbon tetrachloride, marketed under a large number of trade names, may crack, craze or otherwise attack Polycarbonate parts. They must not be used for cleaning and degreasing Polycarbonate. Nor should aromatic compounds such as benzene, xylene, or toluene be used. Recommended for cleaning Polycarbonate are soap and water; No. 1 and No. 3 denatured alcohol; white kerosene; Warsol No. 2; V, M, and P naphtha; heptane; hexane; isobutyl and isopropyl alcohol; petroleum ether with 65° C. (149° F.) boiling point.

Sanding

Sandpaper or silicon carbide (emery) abrasive coated belts may be used to remove sprue projections, tool marks, or for flat surfacing sheet stock. Coarse abrasives will produce scratches difficult to remove, while too fine grades will cause the belts to fill readily. Where a scratch-free, highly polished surface is desired, a grit size not over No. 180 is suggested. Hence, it may be desirable to use a coarse grit sand first and follow with the finer one. Belt speeds of approximately 3000 surface feet per minute (sfm) appear adequate but somewhat faster speeds (4000 sfm) can be used so long as the pressure applied is not excessive because of resistance of Polycarbonate to burning.

Because of this resistance, little effort has been made to study wet sanding. While there appears to be no reason why this technique cannot be used, no significant benefit in keeping the belt from clogging has been demonstrated.

Hand sanding must be done with light pressure in order to avoid clogging the paper, especially with the extremely fine grades. For example, 100-grit carborundum paper works well with light pressure but clogs with heavy pressure. A 240-grit paper works well only with very light pressure, while 320-grit paper exhibits slight clogging even with very light pressure but continues to produce a fine satin finish. Crocus cloth also shows a tendency to clog when used on Polycarbonate but the use of kerosene lubricant prevents this and produces a fine satin finish.