CHAPTER 3

Pultrusion Die Design

Introduction

The same good design features that apply to other FRP molds generally are applicable to pultrusion dies. Generally, pultrusion dies are considerably simpler in construction than most matched metal molds.

A new pultruder should standardize, as soon as possible, on die design, type of steel, hold down hole size and location, die size, etc., so that dies are interchangeable on production equipment.

On large volume items it is sometimes necessary to procure several dies. The question generally arises whether to purchase one multicavity tool for the sake of economy or to purchase several single-cavity dies. It generally is considered preferable to have several single cavity tools to one multiple cavity one. Should one cavity of a multicavity tool be damaged and require rechrome plating or repair, the entire tool is out of production. On the other hand, if one single die of a set requires work the balance can remain in production. The actual savings in initial purchase price of a multicavity tool most often will be offset on the first die repair required.

There also is a general disagreement over mold length and production line speed. In the early days of pultrusion production the pultruder had to use whatever resins were available. Generally these were highly inhibited, and slow line speeds resulted. Today special resins are being designed for pultrusion
use that cure faster and permit higher line speeds. There is no question that line speeds have increased from inches per minute a decade ago to feet per minute today. By using longer dies it is possible to make use of several different heating zones in which to better control the gel and cure of the pultruded products.

**Pultrusion Die Design Suggestions**

1. Provide adequate steel around the pultruded part so the die can be heated evenly without hot or cold spots. The steel cross-sectional area should be at least 10 times the cross-sectional area of the pultruded part.
2. Design dies so that they are simple to load. Most parts will run with either die half up in the machine. Angles seem to form best when the V is upside down so that the reinforcement can be drawn over a shaping or forming tool before entering the die (see Figure 3.1 as an example). Channels seem to run best with the web horizontal in the die as shown in Figure 3.2.
3. The die should be approximately 6 inches longer than the heated platens so that it extends outside the platens on the downstream side. A cold junction can then be easily installed by clamping an aluminum block to each mold half. The block is cored to permit fluid flow.

**Specific Pultrusion Die Design Criteria**

**Die Steel**

Any good tool steel can be used to make a pultrusion die. A reasonably hard mold is required to offset the abrasive action of the glass reinforcement being drawn through the die. Dies have been heat treated after machining to a high hardness. Economics usually dictates that an AISI-4140 forged steel pre-hardened to Rockwell C of 28-30 be used since this can then...