
Extrusion Post-forming

Design and Processing Information

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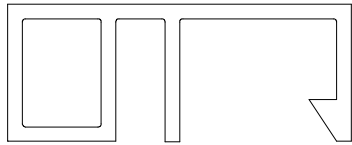
Extrusion Post-forming

Extrusion post-forming is the process of continuously forming a hot, flat, extruded sheet into a shape. This process is usually done at the extrusion process, and is normally done with rigid PVC. Typical products formed by this process are vinyl siding and accessories, vinyl skirting and accessories, rain gutter, some fence products, and some decking products. Some of the advantages of the post-forming process include:

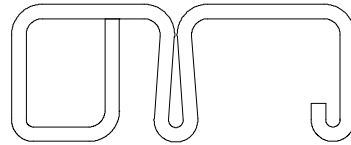
- 1)** Processing speeds are much greater with the post-forming process. Typical line speeds for post-formed vinyl siding range from 90 to 150 feet per minute, with extrusion rates running as high as 3500 pounds per hour.
 - 2)** Because a standard sheet die is used as the extrusion head, very little die tuning is required for new products. Formulations and colors changes can be made often with little or no effect on the extruded sheet. The simple adjustment of the lip bolts can even out the thickness of the sheet if changes are required.
 - 3)** With the advent of co-extrusion and tri-extrusion dies, capping materials can be run at a minimum thickness, creating a more cost-efficient product. Also, different materials can be used as the capping material versus the substrate material. The cost of the extruded material can be greatly lowered if only the cap contains the weatherable materials. Most sheet dies do not have to be re-cut to run the different materials.
 - 4)** Each sheet die can be used to run different products that are similar in undeveloped lengths (undeveloped length is the cross-sectional width of a post-formed product before the product is formed to shape). The hot, extruded sheet can be stretched some at the die by the embosser (nip device) and/or by the haul-off (puller) to adjust the sheet width before the post-forming process.
 - 5)** The extruded sheet can be embossed with many different patterns after the sheet's exit from the die. Laminate materials also can be applied at this time. Neither of these processes greatly affect the ability to form the sheet to the desired shape.
 - 6)** The calibration (sizing) tooling is simple to set-up and run. The amount of calibration tooling required to do the forming greatly depends on the accuracy required for the finished product.
 - 7)** The down-stream equipment required to run a post-formed extruded product is similar to the equipment required to run profile extrusions. Cutting, punching, and notching equipment can also be used in-line with the post-formed parts.
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Design Criteria for Post-formed Extruded Products

- 1) Post-formed products are manufactured from a single thickness flat extruded sheet. Hollow shapes, multiple thickness profiles, and parts with multiple legs or ribs are generally not formed using the post-formed process.

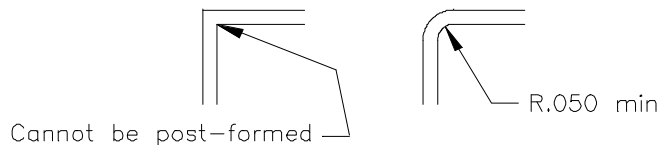


Profile
Extrusion

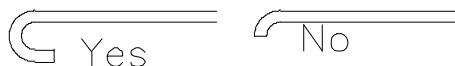


Post-formed
Extrusion

- 2) Rigid PVC is the material of choice in the post-forming process because of its price-to-performance ratio for the construction market, and for the melt strength PVC exhibits. PVC, properly formulated, can be pulled and stretched without pulling apart. Other materials can be used, but most of the technology today surrounds rigid PVC.
- 3) Sharp corners cannot be formed using the post-forming process. The inside radius of a typical post-formed product should be no less than .050" or the product thickness, whichever is greater.



- 4) Tight curls can be formed, but care must be taken to allow for some surge in the extrusion process. Half-curls should be avoided.

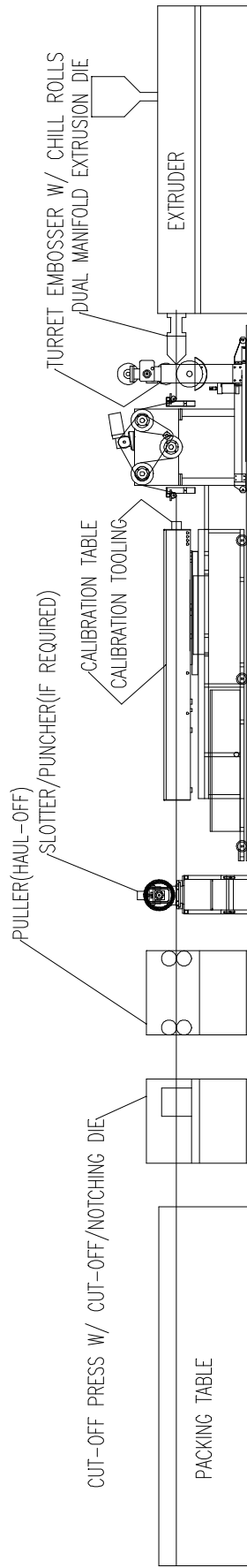


- 5) Profiles extruded using the post-formed process should typically have some type of embossing. This could be anything from a smooth finish pattern (shows as no pattern) to a very aggressive grain pattern.
- 6) Tolerances can generally be held to $\pm .025$ on lengths, and at ± 2 degrees on angles. Some tolerances can be held tighter than others depending on the placement of the critical dimensions. Each part would have to be evaluated for tolerances according to the use of the part, and how the parts fits with other extruded or injection molded parts.

Typical Post-formed Extrusion Line Set-up

- 1)** Extruder- Using a screw and barrel, the extruder mixes and melts the plastic material.
- 2)** Sheet Die- The sheet die is mounted on the end of the extruder barrel. It is used to form the hot plastic into a sheet. A co-extrusion die will combine the material from two different extruders.
- 3)** Nip/Emboss- The nip is used to pull the hot extrudate from the die, and set the skin on the sheet so it can be pulled and formed. An embossing pattern can be introduced at this time.
- 4)** Cooling Rolls- If necessary, the sheet can be run over a series of rolls in order to drop the temperature of the plastic sheet so the sheet can be formed.
- 5)** Calibration/Cooling Table- The extrudate is formed and cooled at the calibration table. Vacuum and water are used to set the shape of the part. A water bath is used to bring the temperature of the extruded part down to room temperature.
- 6)** Punching/Slotting- Punching and slotting are performed after the extruded part has been formed and cooled. Nail slots, weep holes, and screw holes can be punched at this time.
- 7)** Puller(Haul-off)- The puller is probably the most critical piece of equipment in the post-formed extrusion process. The puller must be consistent enough to keep a steady pull on the extruded sheet. An inconsistent puller will cause surge(width variation) in the extruded sheet. The puller must also be strong enough to pull the sheet through the calibration tooling without jamming up. The wheels of the puller must have enough grip so as to not let the extruded part slip.
- 8)** Cut-off Press- The cut-off press is used to shear the extruded part to length, and also to cut any type of notches that may be needed in the part. The press usually is a mechanical or air-operated press that is capable of running at high line speeds.
- 9)** Packing Table- The extruded part, cooled, punched, notched, and cut to length is now packaged. Packaging methods include corrugated boxes, plastic bags, or skids. This process will vary greatly depending on the type product being produced, and the speed at which the product is being extruded.

*** The following page is a layout of a typical post-formed extrusion line.**



TYPICAL POST-FORMING EXTRUSION LINE