



## EXTRUDING FLEXIBLE GEON® VINYLS INTO PROFILES

### INTRODUCTION

Flexible PVC compounds consist of resins, plasticizers, stabilizers, lubricants, and may contain fillers and color pigments. Therefore, transparent, natural and precolored compounds can be formulated. Other modifiers such as processing aids, flame retardants, fungicides, etc., can also be used.

Resins are basic in determining mechanical and processing properties. Plasticizers have a major influence on the final properties of a compound, including tensile, elongation, low temperature brittleness, insulation resistance, retention of properties on aging, flame resistance, etc. There are many plasticizers available that are used to impart certain properties. Often a mixed plasticizer system is used to obtain a desired combination of properties.

### EXTRUSION EQUIPMENT

A typical extrusion line consists of an extruder, die, sizing and cooling equipment, take off (puller), and a method of cutting the profile.

### EXTRUDER REQUIREMENTS

The extruder barrel should have a length to diameter ratio of 24:1. The barrel should be lined with a chemical and wear resistant material such as Xaloy 101.

The power section is made up of the motor and driving mechanisms. Care should be taken to ensure that the extruder is supplied with enough horsepower and gearing to operate efficiently.

### SCREW DESIGN

The screw should be single flighted, constant pitch, with the pitch equal to the diameter and the length equal to 24 diameters. It should be bored for cooling. Screw flights should be flame hardened or capped with Colmonoy 56. The screw should be AISI-4140 chrome plated.

Since flexible PVC compounds can cover a wide range of hardnesses, the screw design and dimensions are less critical than for rigid PVC. Some starting point recommendations for screws are:

Diameter Inches	Feed	Transition	Metering	Compression Ratio
2 1/2"	0.350"-5 Flights	12	0.117-0.140"-7 Flights	3.0-2.5
3 1/2"	0.450"-5 Flights	12	0.150-0.180"-7 Flights	3.0-2.5
4 1/2"	0.550"-5 Flights	12	0.180-0.220"-7 Flights	3.0-2.5

Mixing pins and other types of mixing sections are often incorporated in a screw design to enhance dispersion, especially when adding color concentrates to a natural based compound. Screws with mixing pins typically have 12-14 flights in the metering section.

Barrier screws, with and without Maddox mixing sections are still another type of design that can be used for extruding flexible PVC.

**BREAKER PLATES AND SCREENS**

Breaker plates are required to prevent the melt from twisting in the die, thus avoiding swirls in the product. Screens packs are recommended. They may be used to increase the pressure and temperature, or improve the surface appearance. Screen packs should be stainless steel.

When multiple screens are used, always put the coarser screen against the breaker plate to back up the finer screens. A 20/40 mesh screen combination is a good starting point; finer mesh screens can then be added as required.

Use a breaker plate made of Armco 17-4PH, 15-PH, or Carpenter Cartech Custom 450, hardened and polished. Avoid carbon steel, aluminum or brass, which can lead to degradation of the PVC. Entrance and exit should be chamfered to avoid stagnation.

**DIES FOR FLEXIBLE PVC**

Profile dies for extruding flexible PVC are designed on similar principles to those for rigid PVC. Refer to Technical Service Report No. 9 "Basic Die Design Concepts for Extruding Rigid Geon Vinyl" for various design parameters.

**COOLING AND SIZING**

Flexible PVC profiles are typically cooled by water immersion. Various types of sizing fixtures, such as sleeves, finger sizers, jigs, etc., are used to maintain the desired shape.

**TROUBLE SHOOTING GUIDE FOR PROFILE  
EXTRUSIONS MADE WITH FLEXIBLE GEON® VINYL**

<u>PROBLEM</u>	<u>POSSIBLE CAUSE</u>
Low Production Rates	<ul style="list-style-type: none"> <li>• Metering depth of screw too shallow.</li> <li>• Worn screw resulting in excessive clearance between screw and barrel.</li> </ul>
Voids just below surface sometimes giving a rough or grainy surface	<ul style="list-style-type: none"> <li>• Moisture in material from improper storage or high humidity.</li> </ul>
Voids generally throughout the entire cross sectional area	<ul style="list-style-type: none"> <li>• Trapped air from rear zone temperatures being too high.</li> <li>• Screw design contributing to low back pressure.</li> </ul>
Melt viscosity too low (soupy)	<ul style="list-style-type: none"> <li>• Screw design too severe.</li> <li>• Barrel zone temperatures too high.</li> <li>• Breaker plate holes too small.</li> </ul>
Stock temperature too low	<ul style="list-style-type: none"> <li>• Metering depth in screw too deep.</li> <li>• Barrel zone temperatures too low.</li> <li>• Screen packs too coarse.</li> <li>• Screw RPM too low.</li> </ul>
Lump extrusion	<ul style="list-style-type: none"> <li>• Stock temperature too low.</li> <li>• Die back pressure too low due heavy wall profile.</li> <li>• Screen packs too coarse.</li> </ul>

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