

## WHAT IS BLOWN FILM EXTRUSION?

Argotec's blown film extrusion process begins with computerized mixing of virgin resin and any additives needed to control the film production process and properties, along with carefully controlled rates of regrind, if necessary, to reduce customer cost.

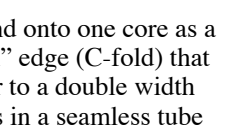
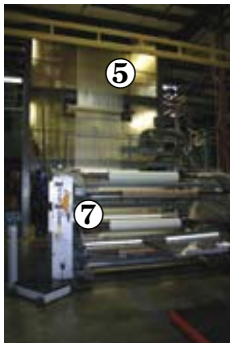
The mixture is heated and conveyed through the extruder. The melted material is then pumped, under continuous pressure, through a circular, rotating die ① that creates a tube of thin polyurethane (TPU) or other polymer. As the warm, extruded material is drawn up several stories by nip rollers ②, the tube is expanded by filling it with air, creating a "bubble" ③ that performs three basic functions:

1. The volume and pressure of air "blown" into the tube causes the material to stretch, thereby determining the overall size of the bubble and the width of the finished sheet.
2. This same action, in conjunction with the rate at which the bubble is being pulled upward away from the die, determines the thickness of the finished film.
3. The bubble begins the air-cooling process while traveling up to the nip rollers.

As the bubble enters the nip rollers it is collapsed into a flat tube ④ and then cools further while it travels back down the outside of the tower ⑤ to an additional set of rollers ⑥.

The film next enters the slitter station where one or both sides of the flat tubular film can be slit. Slitting both edges allows the flat tube to be separated into two layers that can each be wound onto their own core. Slitting only one edge allows the flat tube to be wound onto one core as a double wound layer with one "open" edge (C-fold) that can later be opened by the customer to a double width film. Not slitting either edge results in a seamless tube that is wound on a core.

Finally, the finished product is wound onto corrugated or plastic cores ⑦ and packaged for shipment to the customer.



## WHEN TO USE BLOWN FILM

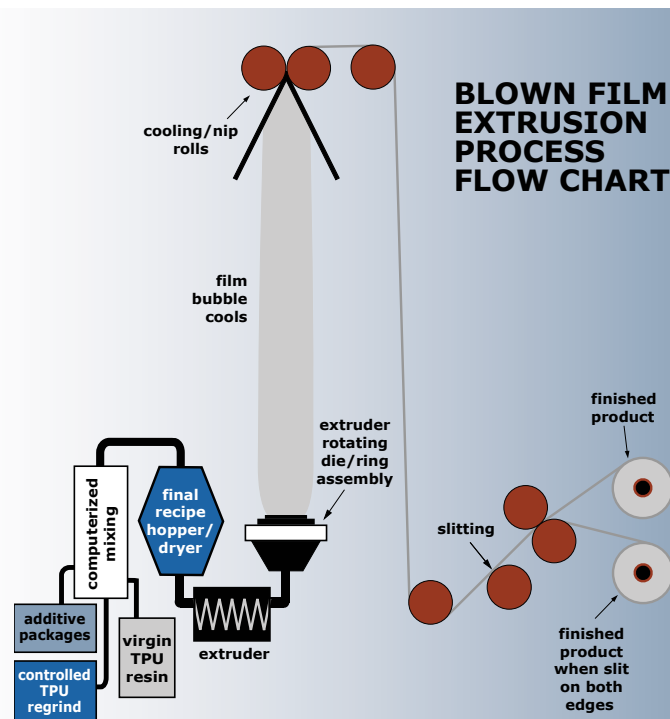
Blown film extrusion has several advantages over flat-die or cast-on-carrier extrusion, the other methods typically used to manufacture polyurethane film and sheet. These include:

- When cost is a factor. Blown film can be the most economical method for producing films from 1-10+ mils thick.
- When a carrier or interleaf is not required.
- When consistently flat roll put-up is critical. The rotating die on a blown film extruder distributes any gauge variations evenly across the width of the roll.
- When the high-slip attribute of the processing aid is acceptable or desired.



## BLOWN FILM PRODUCT OPTIONS

The product designer, converter or fabricator who determines that blown film extrusion can provide the economies and product characteristics required for their specific application has a variety of product options to specify.



- **Thickness:** typical film gauge from blown film extrusion ranges from 1 to 10 mils, although Argotec can extrude from 0.8 to 20 mils.
- **Width:** maximum sheet widths up to 85 inches.
- **Length:** is a function of the size of the bubble and resulting gauge, up to a maximum roll diameter of 20 inches.
- **TPU Polymer:** aromatic or aliphatic polyester; aromatic or aliphatic polyether; aromatic or aliphatic polycaprolactone.
- **Surface finish:** smooth or rough.
- **Additive packages:** flame resistance; UV resistance; anti-bacterial; antifungal; lubricant and antiblock packages.



Virgin TPU resin (left) and regrind

## THE ARGOTEC LABORATORY TEST LINE

The Argotec lab line can produce thermoplastic film in thicknesses from 0.8 to 20 mils, widths of 6 to 15 inches, and lengths of up to 100 feet. It is used for a variety of key functions:

- Generating short-run film concept samples for customers.
- Testing the processability and physical characteristics of new film formulations.
- Performing preliminary tests of new product offerings from resin suppliers.

In addition to demonstrating Argotec's commitment to R&D, its blown film lab line also enhances the company's ability to engineer polyurethane or other TPE film compounds to a customer's specific application requirements and then test the feasibility of the formulation in advance of a full production run, thus saving the customer significant development costs.



## ELEMENTS OF A SUCCESSFUL BLOWN FILM EXTRUSION PROGRAM

A successful blown film extrusion program involves much more than just having the right equipment. Up to five additional key factors must also be included:

1. **Recipe Control** – the fixed ratio of ingredients that go into the film. Argotec uses up-front engineering and the lab test line to eliminate mid-run recipe changes to fix problems or increase yield. Three basic components are custom designed to meet the specific needs of the application:
  - Virgin TPU resin, straight out of the box from the resin supplier.
  - Chemical additives which can impart flame resistance, UV resistance, antibacterial (odor) control, infection control, antifungal, antistatic, lubricant or antiblock properties.
  - Regrind, the recycling of edge trim or other films of

the same chemistry previously produced by Argotec. Use of regrind is carefully controlled and limited to the same resin type, color and additives when needed to reduce costs. Cleanness of the regrind is strictly monitored. Argotec does not buy regrind on the open market unless instructed by the customer.

2. **Process Control** – standardized operating conditions and procedures are used to ensure consistent film quality, lot-to-lot, roll-to-roll:
    - **Temperature and pressure** used to pump the melted recipe through the die.
    - **Running speed** effects product quality. Running film at low temperatures and high speeds can result in poor dimensional stability in the end use as the film becomes directionally oriented. When it is exposed to ambient or secondary processing heat, the polymer will attempt to relax, causing the film to change dimension. Argotec maintains the optimum temperature and through-put rate for consistent dimensional stability.
    - **Measurement** of critical film properties and comparison to standard to ensure consistently high product standards.
  3. **Packaging** – Argotec will package blown film in a variety of configurations to meet customer requirements:
    - Individually boxed rolls, horizontally suspended with end plates.
    - Vertical bulk pack, rolls stacked on end.
    - Horizontal bulk pack, rolls suspended in cradles.
  4. **Labeling** – Argotec will package, label and ship in a manner that will support customer objectives:
    - Standard Argotec labels.
    - Private labeling tailored to customer requirements.
  5. **Secondary Processing** – Argotec can refer you to industry partners who meet rigorous quality standards and can provide a variety of secondary processing operations:
 

■ Slitting	■ Textile lamination
■ Die cutting	■ Glass lamination
■ Sealing	■ Perforation
■ Adhesive coating	
- Strict control of carefully engineered recipes, tight process control and measurement of film properties, flexible packaging and labeling options, along with proven industry partners for secondary processing operations all combine to provide Argotec customers with the industry's premier blown film program.



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