

Drying and extrusion processing guide

for Eastman Tritan™ copolyester

Eastman Tritan™ copolyester provides customers excellent toughness as well as clarity, chemical resistance, dimensional stability, low and stable shrinkage rates, and other enhanced physical properties. Versions of Tritan are also available with various additive packages, such as UV and color. To optimize these physical properties and widen the processing window, some drying and processing guidelines are listed.

Drying

- Dry Tritan at 180°F for 6–8 hours using a desiccant dryer. The moisture content should ideally be ≤ 100 ppm, but parts of acceptable quality might be possible up to 200+ ppm of moisture. Do not dry over 20 hours (resin and color concentrate). Insufficient drying will cause excessive molecular weight loss during extrusion with resultant decrease in physical properties. Additionally, excess moisture will often cause bubbles to form in the sheet.

- Desiccant dryer guidelines
 - Dryer capacity should be a minimum of 8,000 lb for 1,000 lb/hr production.
 - Minimum airflow of 1 CFM per lb/hr extrusion rate.
 - Maintain drying equipment properly. It is critical to check regeneration temperatures, filters, and airflow.
 - Use a dryer that will deliver air with a minimal dew point temperature of -20°F (pref. -40°F).
 - Locate the air temperature probe close to the hopper inlet to assure that the incoming air is at target temperature. Also, monitor the dew point at the hopper inlet.
 - Utilize a properly designed dryer hopper that promotes good airflow throughout the pellet bed.
 - Do not use multiple drying hoppers that share one drying system unless there is a means of measuring airflow and dew point to each hopper.
- Target pellet moisture is 0.01% to 0.02% (100–200 ppm) using a moisture analyzer.¹
- Typical cycle example
 - Sample weight 20–60 g
 - Heat to 150°C for 10 min
 - Moisture $< 0.02\%$

¹Examples of moisture analyzers—Computrac Max 4000SL from Arizona Instruments LLC, www.azic.com/computrac, 800.528.7411; and Mark 3 from Sartorius, www.sartorius-omnimark.com, 800.835.3211



Extrusion

Main extruder

- Screw: 32:1 L/D; barrier first stage; blister ring ahead of vent; double flights at vent
- Vacuum to vent should be turned on if equipped to minimize bubbles in the sheet.
- Optional twisted Maddock mixing section (i.e., for better dispersion of color concentrates) on end of screw
- Optional screw cooling (cooling bore stops before entering first heater zone)
- Feed throat should be water cooled.

Die

- Cloeren die with no restrictor bar and ~0.400 in. maximum die gap opening
- Set die gap opening to $1.25 \times$ target sheet thickness.
- A/B/A coextrusion block with two plugs—A/B, A/B/A

- UV cap minimum of 3 mils and maximum of 6 mils
- Clean extremities of die lips thoroughly and apply silicone spray release agent to these areas before starting the extrusion line. Otherwise, the polymer may stick to the die lips, causing drag or flow lines in the sheet.
- Use a prethreaded leader of clean, soft cotton cloth void of any sizing or other materials that may transfer or stick to the hot roll surfaces in the takeoff unit to facilitate an easy, rapid, and clean start-up.

Extrusion conditions

- Start with a completely clean hopper, extruder, and die before processing Tritan.
- For Tritan sheet and film, proper extruding conditions are shown in Figure 1 and Table 1.

Figure 1 Rheology

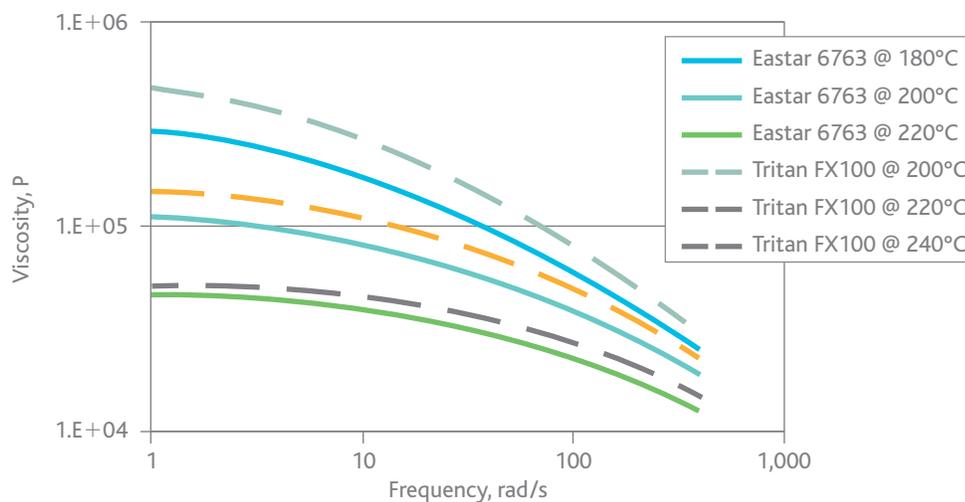


Table 1 Extrusion conditions for Tritan film

Zones	Temperatures	Comments
1 Barrel	515°F (270°C)	Feed section needs to be at 350°F (177°C) w/ screw cooling on if equipped.
2	510°F (265°C)	
3	500°F (260°C)	
4		Vacuum zone (vent)
5		
6		
7 Barrel		
8		Start of transition section
9		Screen changer
10		Screen changer
11		
12		Melt pump
13		
14		
15		
16		
Die zones	520°F (270°C)	
Coex	350°–520°F (175°–270°C)	Feed zone is 350°F; 520°F on the rest.

Table 2 Extrusion guidelines

	Setting	Comment
Operation mode	Screw slave to melt pump.	
Typical screw speed	100 rpm	
Typical melt pump speed	60 rpm	
Melt pump	Start with manual mode.	See where the suction pressure settles at start-up. Set suction pressure set point to match its current value then switch to auto mode.
Melt pump inlet pressure	~450 psi	
Vacuum (vent)	18 in. Hg or better	→
Screen filter pack	20 mesh/100 mesh/60 mesh/ 40 mesh/20 mesh	Flow direction
Output rate	1000+ lb/hr	
Melt temp. max.	450°F (280°C)	

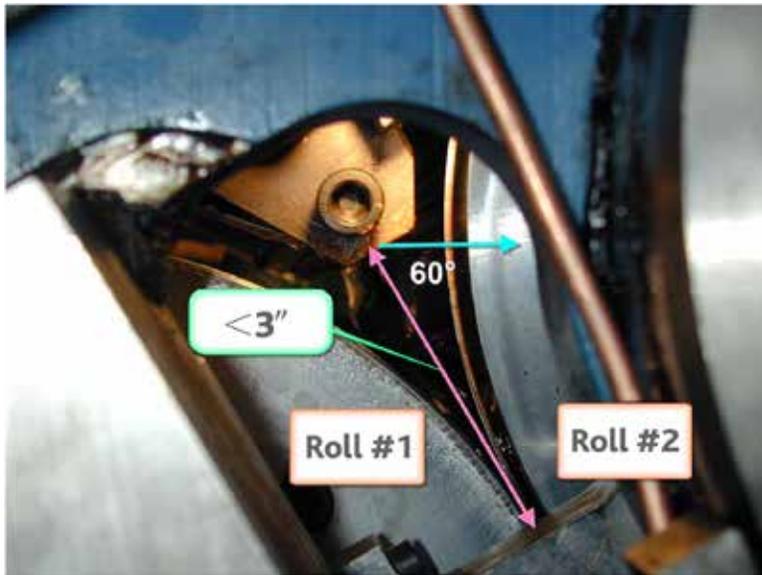
- Recycling of edge trim and defective sheet can be done by regrinding them into particle size close to that of virgin pellet. The maximum level of regrind is 25%.
- Minimize regrind fines by sharpening the blades of the grinder.
- Prevent regrind contamination with other polymers and foreign materials, such as cardboard, dust, etc.

Downstream equipment

Roll stand

- The distance from die gap to the cooling roll nip should be between 1–3 inches. See Figure 2.
- 3-roll up-stack cooling rolls—top roll (#3) can be repositioned for more or less wrap on the middle roll
- Roll diameter 16 in. O.D. with polished surface
- A 60° die-to-nip angle (Figure 2) is preferred to a vertical 90° angle (horizontal die with vertical stack).

Figure 2 **Chill rolls**



Chill roll temperatures

Chill rolls	Temperature
1	85°–110°F (30°–43°C)
2	145°–150°F (63°–66°C)
3	155°–160°F (68°–71°C)

- For repositionable roll #3, the sheet takeoff angle should be 25° from horizontal line, which reduces the wrap and contact time.
- It is critical for the vertical stack to have an adjustable cooling roll #3, since a longer wrap and contact time with roll #3 may create internal stress and roll set in the sheet.

Roll stack operation guidelines

- Use Invisible Glass[®] spray (available from auto stores) on three chill rolls to remove materials from the roll surface. Quickly wipe clean the rolls.
- Use moistened applicator and apply a small amount of AUTOSOL[®] metal polishing wax on the chill rolls—just enough to create haze on the roll surface.
- Remove immediately by polishing with a clean, soft, nontreated, and low-lint cloth. Rolls are ready to be heated up and used.
- After threading up the line, increase roll temperatures until sticking occurs, then reduce temperatures 5°F.
- Run just enough bank/bead to be polished but not more. An oversized bank/bead can trap air and generate bubbles in the sheet. An undersized bank/bead can adversely affect polishing of the sheet surfaces and hence sheet optical quality.

Haul off and cutting

- The edge trim can be cut by a sharp knife when the sheet is still warm in heavy-gauge sheet production.
- Masking unit should have reheat capability.
- An in-line crosscut saw can be used to cut sheet to desired length.

Purging and shutdown

- Purge material composition should be 20% Rapid Purge R5000² + 80% PETG 6763 blend (or 100% PC).
- Run extruder until Tritan material is empty.
- Remove screen pack.
- Run about 50 lb of purge blend through the extruder until it starts coming out of the die.
- Shut down extruder for 15–20 min and plug the vent if possible.
- Push the purge blend out with the next planned material until the melt curtain is clean without contamination.

Do not allow Tritan material to stay in extruder barrel more than 30 minutes, because the material could crystallize.

If the material crystallizes:

- ***DO NOT STAND IN FRONT OF DIE, BECAUSE THE PLASTIC MIGHT SHOOT OUT OF DIE.***
- Cover roll stack to protect the cooling rolls.
- Barrel temperatures may need to be increased to 600°F until all material is purged from the extruder.

²Rapid Purge—www.rapidpurge.com, 800.243.4203 or 860.767.0085



Contact your Eastman representative
to learn more about how to produce
the best sheet from
Eastman Tritan™ copolyester
while enhancing ease of extrusion.

For more information on
Tritan, visit www.eastman.com/tritan.

Conversion of metric/U.S. customary values may have
been rounded off and therefore may not be exact.



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