

# EcoPaXX® Extrusion

## PA410

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### GRADE CODING

EcoPaXX® PA410 extrusion grades.

### MATERIAL HANDLING

EcoPaXX® grades are supplied dry and ready-to-process. Material taken from original bags will have a moisture content <0.10%.

This should also be the value once the material has been re-dried. During processing, the inner liner of (large) containers has to be closed tightly to avoid moisture pickup. If the material is transported using pneumatic suction conveyors, the liner should be secured tightly around the suction pipe to limit moisture absorption from ambient air.

Material from opened or damaged containers, as well as recycled waste such as edge trim, must be dried in a dehumidified (dehumidifying) hopper dryer at approximately 75°C / 167°F before processing. The dryer should be a regenerative, desiccant bed type with an exit air dew point monitor. Recommended dewpoint is -25°C / -13°F to -40°C / -40°F. Experience has shown that a drying time of 8 to 10 hours will usually be enough to give an acceptable moisture level. Avoid drying temperatures above 80°C / 176°F, because of possible oxidative damage (for example, yellowing). Compacted edge trim should be dried before reprocessing. Possible defects from material containing too much moisture include holes, bubbles, fluctuations in film thickness (pressure variations), foaming and hydrolytic degradation.

Table 1 shows standard temperature settings. However, in many cases, a reversed temperature profile may be favorable. For instance, from hopper to die starting at 285 - 280 - 270 - 265 - 260°C / 545 – 536 – 518 – 509 – 500°F. Screen, adapter and die can be set at 260°C / 500°F.

This profile puts the energy exactly where it is needed: in the feeding zone where the polymer has to melt; the remaining part of the machine is needed to homogenize the melt and feed it into the die. In blown film, this (reversed) setting contributes to bubble stability.

Table 1. Temperature settings extrusion

Grade	Feed section	Compression	Metering	Adapter	Die
EcoPaXX Q130MS	260°C / 500°F	265°C / 509°F	265°C / 509°F	260°C / 500°F	265°C / 509°F
EcoPaXX Q150MS	260°C / 500°F	265°C / 509°F	265°C / 509°F	260°C / 500°F	265°C / 509°F
EcoPaXX Q170MS	260°C / 500°F	270°C / 518°F	270°C / 518°F	265°C / 509°F	270°C / 518°F

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## CAST FILM EXTRUSION

Flat (chill-roll or cast) film is primarily extruded from EcoPaXX® Q170. In practice, the gauge varies from 18 to 150 µm and the film die may be as wide as 3 m. The die gap should be 0.5 to 1.2 mm; the rate of haul off 25 to 150 m/min. Film quality is determined by sticking to tolerances, dimensional stability, clarity, and thermoformability.

These properties depend on the EcoPaXX® resin selected, and the thermal and rheological history of the material in the extruder and downstream equipment including the chill-roll. If the melt is cooled too abruptly (i.e. if the chill-roll temperature is too low) the film may post-crystallize, and therefore shrink and corrugate. The chill-roll temperature depends on the film gauge, and lies between 90°C / 194°F and 130°C / 266°F for mono layer film. The best setting is determined by the layout of the equipment, and the properties desired.

Temperatures below 80°C / 176°F will cause films to post-crystallize. Post-crystallization causes the film to shrink, and sometimes to wrinkle.

## BLOWN FILM EXTRUSION

Although bottom-fed die designs have been used to extrude Polyamide blown film, spiral mandrel designs are preferable. Conventional equipment such as that used for PE film extrusion can also be used, but avoid sharply grooved feed zones as these may lead to unacceptable high temperature or blocking of the screw.

For monolayer blown film extrusion, the distance between the die and the nip rolls should not be too long (the actual length depends on the bubble diameter). "Lay-flat" should start at a point as close as possible to the die, so in the vicinity of the frost line, to ensure the film remains warm. This will prevent stiffening of the film causing wrinkling in the "lay-flat" section.

The distance between the die and the nip rolls should be adjustable to ensure that the length of the lay-flat section can be easily varied to suit other process variables (haul-off speed, film thickness, cooling conditions);

- the die gap should be 0.5 to 1.2 mm - the bubble may be inflated upwards or downwards. It should be cooled with air or with cold water for the production of thermoform films.
- the blow-up ratio can be between 1 up to and bigger than 3.

Since the blown film process requires a high melt-strength, it is important, and often necessary, to apply a "reversed" temperature profile, to get the polymer temperature as low as possible.

## SCREW DESIGN

Both single-flight, three-section screws and barrier screws can be used for EcoPaXX® extrusion grades. For best results use high-performance screws equipped with shearing and mixing sections. The screw length should be at least 24 D, and preferably 28 to 33 D.

This guarantees best plasticizing and conveying with the high through-put rates of extrusion. (D-screw diameter). A three-section screw should have a flight depth ratio of 2.9 : 4 (feed section to metering section). See Table 2 for some general recommendations.

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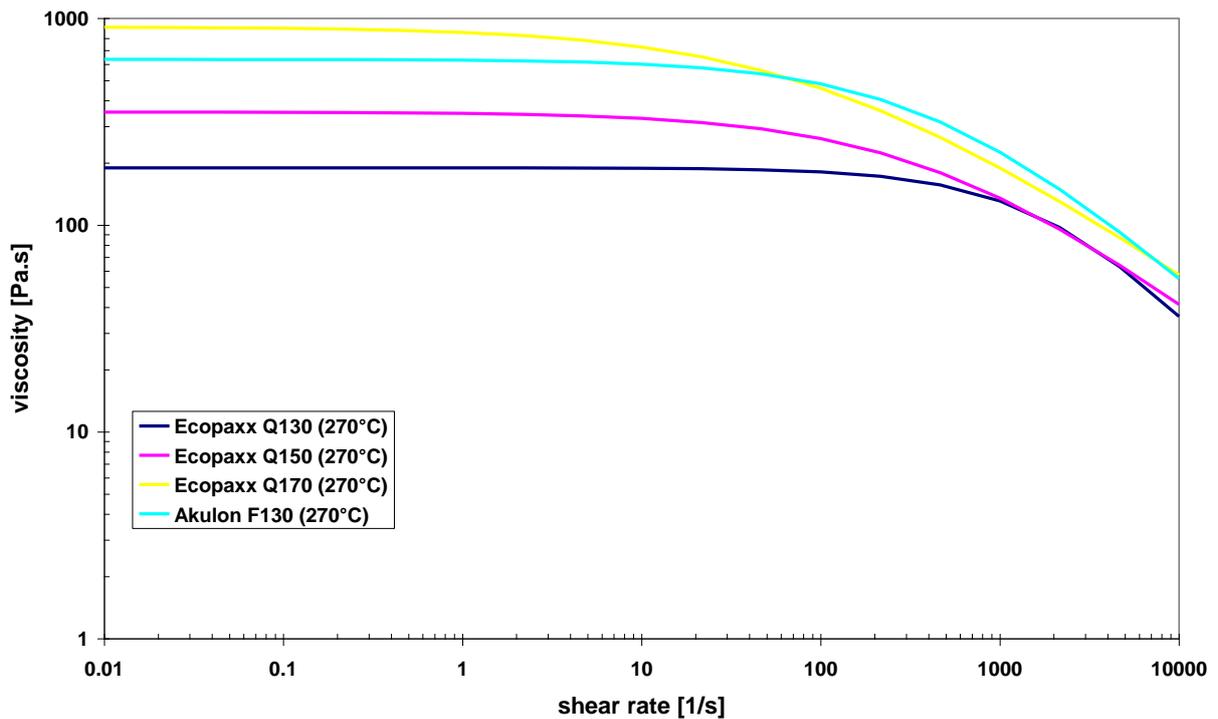
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Table 2. Recommended plasticizing (screw) parameters

L / D Ratio	> 24
Length of the sections:	
Feed section	25 – 30%
Compression section	15 – 25%
Metering section	40 – 55%
Compression rate	2.9:1 / 4.0:1
Screenpack	recommended

## RHEOLOGICAL DATA



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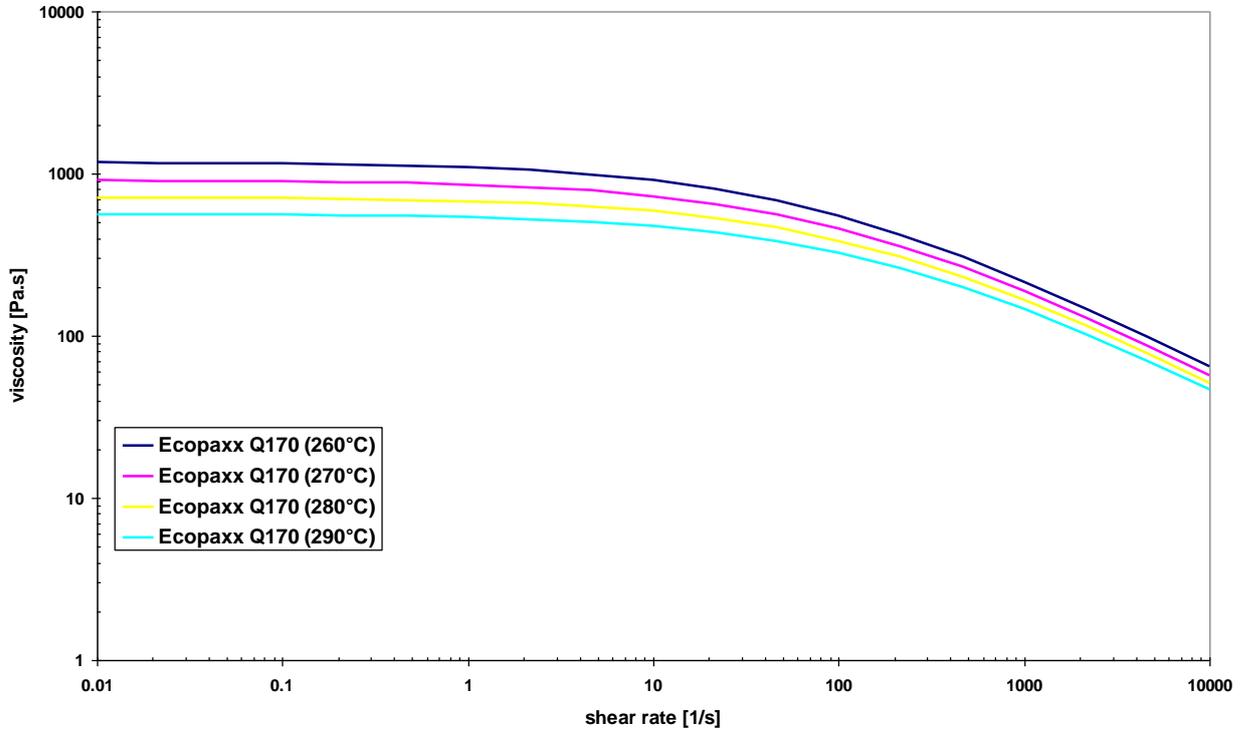
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## SAFETY

For the safety properties of the material, we refer to our SDS which can be ordered at our sales offices. During practical operation we advise to wear personal safety protections for hand/eye/body.

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