



1. Disclaimer

Following injection moulding suggestions apply to ZX-610 ETFE. Please note that these parameters may change depending on the component to be injected, the machine used etc.

2. Moulding of ZX-610 ETFE

Unlike PTFE, ZX-610 ETFE can be processed by conventional melt processes.

Specifically, its melt viscosity at moulding temperature is 103~105 poise, which is about the same as that of conventional thermoplastics, and as a result, methods such as injection can be used. See also Figure 1 - Effect of share rate on melt viscosity.

3. Delivery form

ZX-610 ETFE granules are available in valve sacks (up to 25 kg) and BigBags (up to 1500 kg). Bulk density: approx. 0.9 kg/dm³.

4. Storage

During storage, it is preferable to have the container sealed tightly, so that no moisture is absorbed and the resin is not contaminated by dust due to static charge.

5. Machines and Materials

5.1 Injection Machine and Moulding Material

Any of the plunger-type and screw-in-line-type injection machines may be used for moulding, as long as the heater holds a heat capacity of up to 340°C.

Corrosion resistant materials such as Hastelloy-C, X-alloy 306, Duranickel, etc., are recommended for those parts coming into contact with the polymer (inner surface of cylinder, screw, torpedo, nozzle, etc.).

If not used as a machine exclusively for ZX-610 ETFE, nitrided and hard-chromium-plated materials may also be used.

5.2 Mould

The mould used, although it depends on the number of shots, should be hard-chromium-plated, and must be designed to withstand temperatures up to 120°C.

The gate structure may be side gate, pinpoint gate, film gate, etc., depending on the product desired. The runner should be designed to have a round cross section, and as short a length as possible.

The usage of hot oil is preferred over the electrical system. The mould should be isolated from the press and the mould frame.

6. Processing

6.1 Parameters

Table 1 outlines the typical parameters for moulding ZX-610 ETFE.

6.2 Pre-drying

Although ZX-610 ETFE is not hygroscopic and we do suggest a preliminary drying of the resin at 100°C (212°F) 5 hours.

The drying should preferably take place in a dry air dryer with an air flow of about 5,1 m³/kg/h and a maximum dew point of -30°C.

6.3 Temperature

The temperature settings (see table 1) must lead to a melt temperature of 280°C to 300°C. ZX-610 ETFE is a thermally stable resin, but if subjected to temperatures above 350°C thermal decomposition is induced.

Thus, the resin cannot be kept at high temperatures for a long time. The residence time of the material in the barrel should be less than 25 minutes. When interrupting the operation, it is suggested that the temperature of the moulding machine is lowered.

6.4 Injection conditions

For light-gauge moulding (thinner than 0.5 mm), the speed should be increased, while for heavy-gauge moulding (thicker than 5 mm), the cooling time should be increased.

Futhermore, to obtain a smooth surface, the injection speed should be reduced. In fact moulding temperature and injection speed do not affect the fluidity much, but have the greatest effect on the surface smoothness.

6.5 Moulding contraction

As ZX-610 ETFE is a crystalline polymer, the shrinkage is relatively large. The shrinkage was measured in the flow direction, and in the direction perpendicular to the flow, by using the mould shown in figure 2.

In the diagrams shown in figures 3,4,5 and 6 can be seen can read detailed values for what concerns the shrinkage of ZX-610 ETFE. The general values, that can be used for a first analysis, are summarized in Table 1.

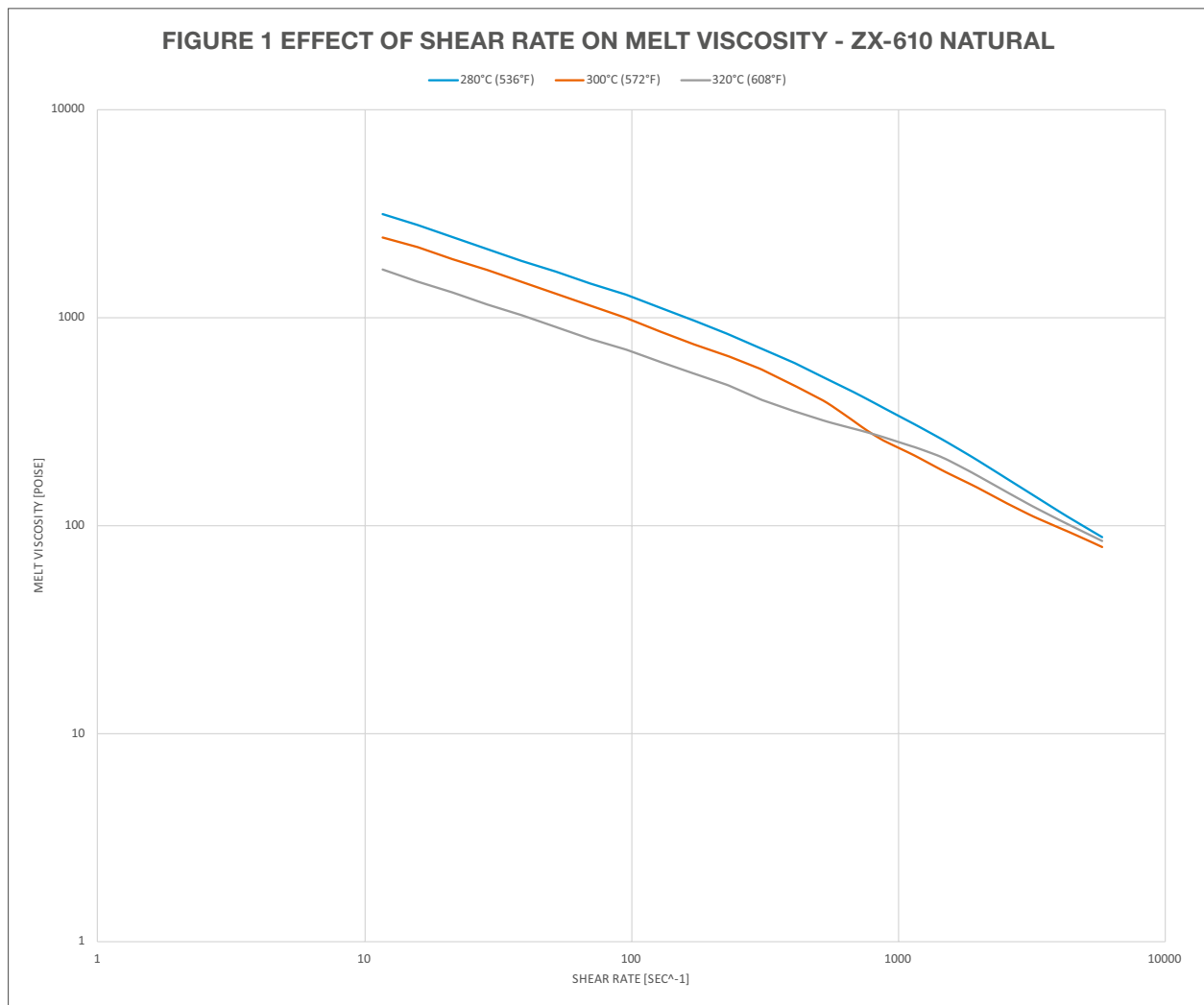
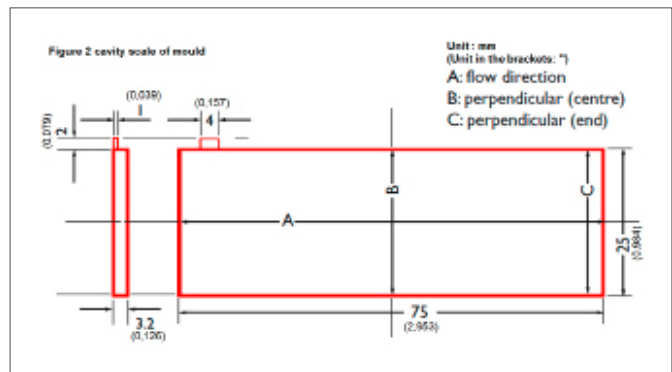




Figure 3 Moulding temperature and moulding shrinkage -
ZX-610 ETFE
%-°C

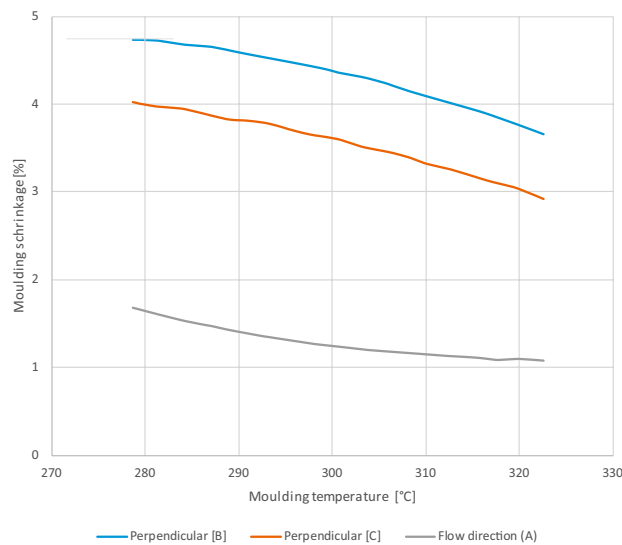


Figure 3 Moulding temperature and moulding shrinkage -
ZX-610 ETFE
%-°F

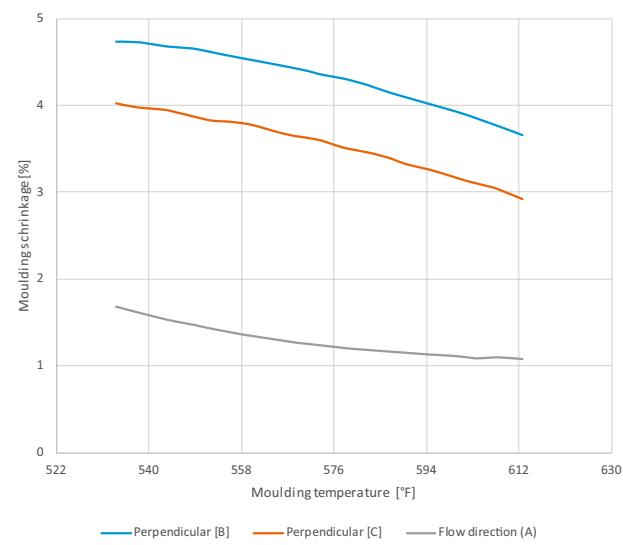


Figure 4 Injection pressure and moulding shrinkage -
ZX-610 ETFE
%-MPa

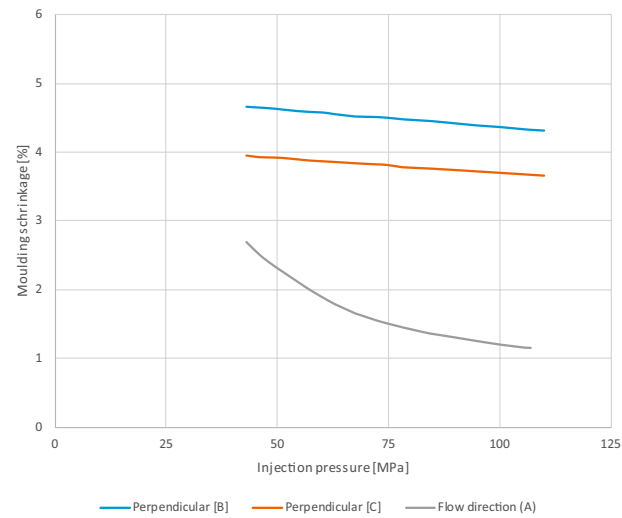


Figure 4 Injection pressure and moulding shrinkage -
ZX-610 ETFE
%-psi

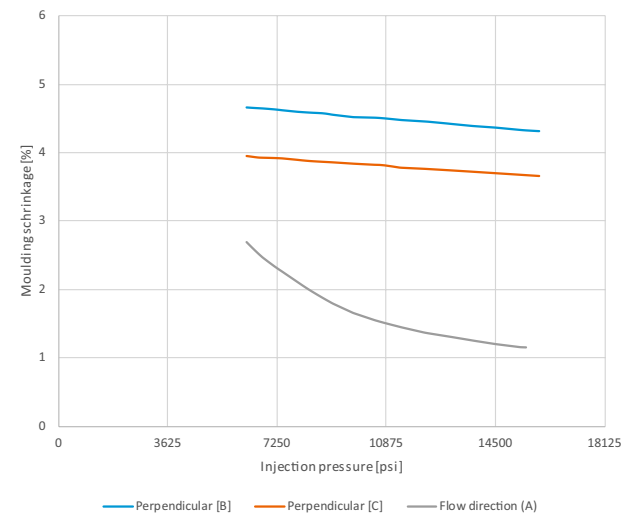




Figure 5 Mould temperature and moulding shrinkage -
ZX-610 ETFE
%-°C

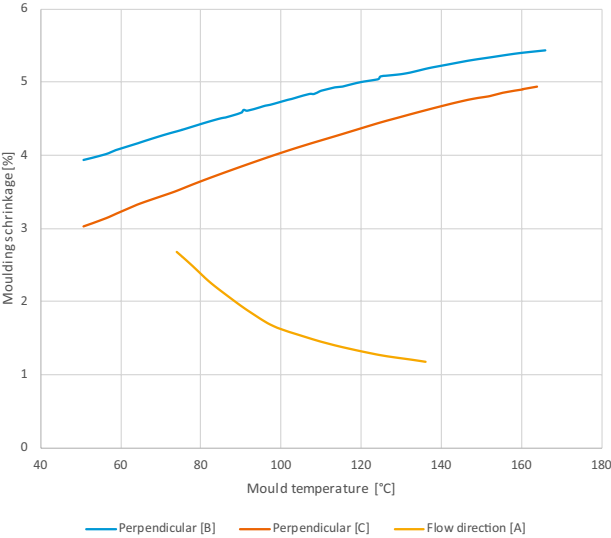


Figure 5 Mould temperature and moulding shrinkage -
ZX-610 ETFE
%-°F

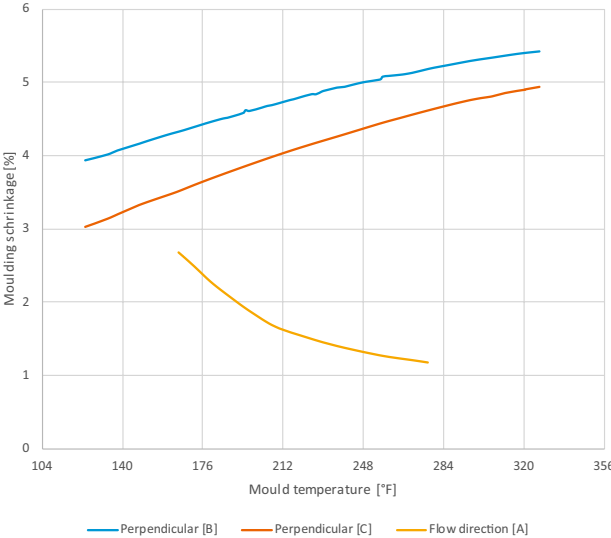


Figure 6 Thickness and moulding shrinkage -
ZX-610 ETFE
%-mm

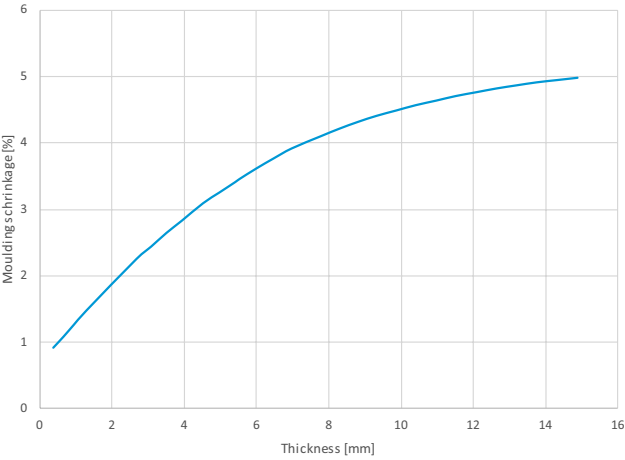


Figure 6 Thickness and moulding shrinkage -
ZX-610 ETFE
%-"

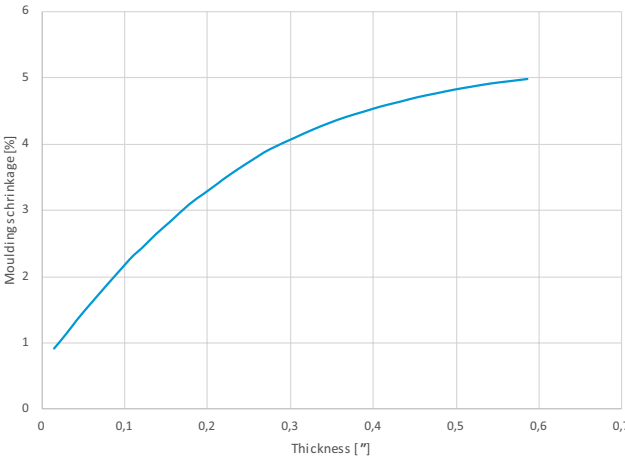


Table 1 - Material-/ machine data **ZX-610 ETFE**

Product characteristics					
Properties	Test method	Unit	Values	Unit	Values
Material Code	-	-	771	-	771
Colour	-	-	natural	-	natural
Density	ISO 1183	kg / dm ³	1,70	lb / ft ³	0,106
Bulk Density	Internal Standard	kg / dm ³	0,90	lb / ft ³	0,056
Melt volume rate MVR 297°C / 5kg	ISO 1133	cm ³ / 10 min	15-25	cm ³ / 10 min	15-25
Shrinkage					
Molding shrinkage (flow direction)	Internal Standard	%	1,75	%	1,75
Molding shrinkage (perpendicular to flow)	Internal Standard	%	3,75	%	3,75
Drying - not required but suggested					
Dryer temperature T (Dry air dryer or vacuum dryer)	-	°C	100	°F	212
Drying time	-	h	5	h	5
Injection moulding					
Melt temperature range	-	°C	280-300	°F	536-572
Melt temperature (optimal)	-	°C	290	°F	554
Mold temperature range F	-	°C	60-120	°F	140-248
Mold temperature F (optimal)	-	°C	80	°F	176
Injection pressure	-	MPa	50-120	psi	8702-17404
Moulding cylce	-	sec	30-120	sec	30-120
Machine settings					
Temperature hopper feed throat	-	°C	100-120	°F	212-248
Barrel Head temperature 1 (feed zone)	-	°C	260-280	°F	500-536
Barrel Head temperature 2 (compression zone)	-	°C	270-290	°F	518-554
Barrel Head temperature 3 (metering zone)	-	°C	280-300	°F	536-572
Nozzle	-	°C	290-320	°F	554-608
Injection speed	-	mm/sec	2-30	ft/min	0,394-5,906

