

PVDF from Solvay

General recommendations for injection moulding

Equipment

- Conventional Polyolefin screw type (geometry)
- Screw characteristics

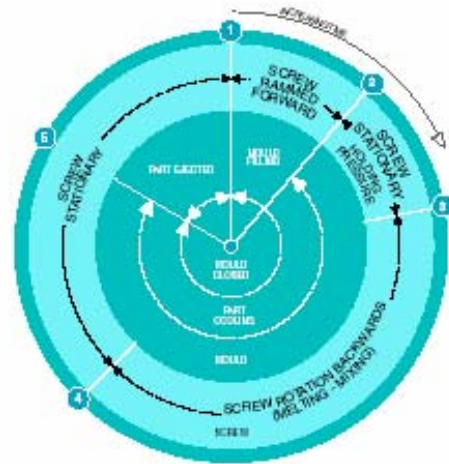
- Compression ratio	2.5 to 3
- Feeding	> 10 D
- Compression	> 3 to 1 D
- Total	20 D

Temperature

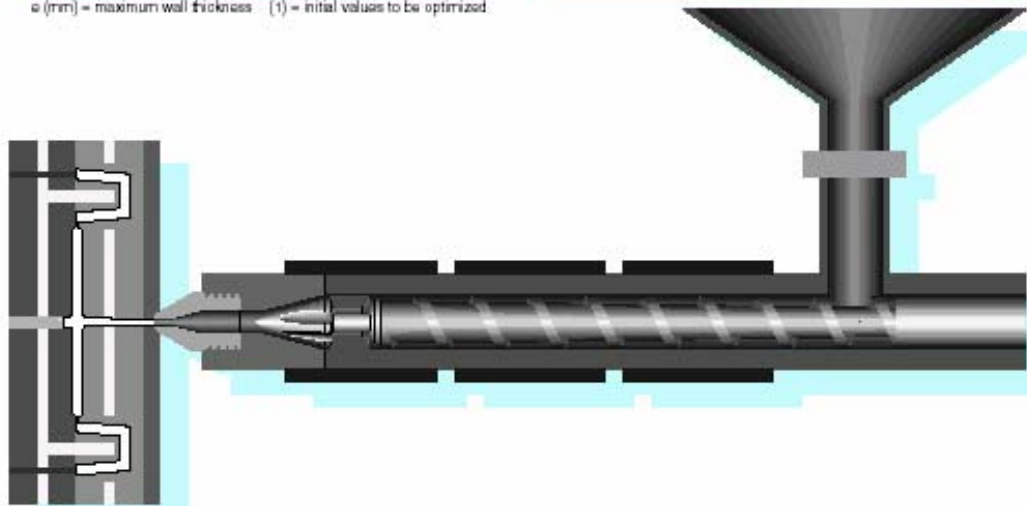
- Material temperature 200 °C to 240 °C
- Cylinder temperatures

- Feed zone	190 °C
- Compression zone	200 to 220 °C
- Metering zone	200 to 240 °C
- Nozzle zone	200 to 240 °C
- Mould temperature 60 °C to 90 °C
- Cooling time (t) including holding time $2.5 \times e^2 \text{ s}$

e (mm) = maximum wall thickness (t) = initial values to be optimized



Drying is not necessary



Moulding conditions

- Injection pressure 600 to 1500 bars
- Hold-on pressure 600 to 1500 bars
- Back pressure (plastification) 5 to 20 bars
- Injection speed low (to avoid shear), but quick enough to fill the mould before crystallization occurs
- Screw rotation speed 3 to 10 m/min (V: tangent speed, $V = n \cdot \pi \cdot D$)

PVDF from Solvay

General recommendations for injection moulding

General recommendations

- **Temperature**
 - Verify the temperature of the mould cavities using a temperature probe
 - Confirm the melt temperature using a temperature probe moved about in a volume of melt, shot onto an insulator (a glove, cardboard, etc.)
- **Shot volume**
 - Set the initial cooling time
 - Set a zero holding time and/or pressure
 - Inject incomplete parts by gradually increasing the shot volume using an average to high injection speed
 - When the mould is almost filled (90 to 95%), set the initial holding pressure and gradually increase the holding time
 - In this way, the end of the filling is done under constant pressure and part over-packing is avoided
- **Holding**
 - Adjust the holding phase parameters to obtain a constant part weight and the required dimensional stability
- **Cooling**
 - The cooling time depends on the part geometry
 - Gradually adjust the cooling time until the optimal cycle time is obtained

Safety

- **Stopping - restarting**
 - When stopping injection during
 - 0-0.5 hours: maintain the temperature settings
 - 0.5 - 2 hours: decrease the temperature settings to 180°C
 - > 2 hours: stop the heating
- **Cleaning**
 - At the end of an injection program (or if problems of degradation would occur), purge with a thermostable, highly viscous, pure polymer, whose processing conditions are compatible with PVDF: e.g. HDPE (e.g. ELTEX® HDPE B 5920), PMMA or PP. Never burn PVDF wastes.
 - Do not clean pieces in a salt bath.
 - Physical cleaning of screw and barrel has to be done (use brass tooling and "chromglanz").
- **Thermal stability**
 - In thermogravimetric analysis (TGA), progressive degradation of PVDF is noted from 380°C onwards.
 - The degradation reaction is autocatalytic. HF will be formed.
 - The decomposition temperature can be lowered by light metals, such as Ti, B, Al, ..., therefore care should be taken to avoid all contamination's coming from
 - additives (TiO₂, B₂O₃, Al₂O₃, etc.)
 - contact with light metals such as Ti, Al, B, etc.
 - impurities (of previous processing for example), greases and silicones.
- **Screw**
 - Screw can be cleaned in an ultrasonic bath under sufficient ventilation, filled with dimethylacetamide and heated up to 60°C (immersion time: 1 hour)

Shrinkage

- **Shrinkage governs a large range of final properties or defects:** tolerances, stresses, voids, sinks marks, etc.
- **A typical value of linear shrink is around 3 %.** But the real correct value is the volumetric shrinkage which is depending on the moulding conditions.
- **How the volumetric shrinkage will be respectively distributed among the three space directions is depending on mould geometry, the filling characteristics and the rheological properties.** All this is never isotropic and three shrinkage coefficients should be taken into account.

The data and numerical results contained in this document are provided for the sake of general information and are given in good faith. They reflect the state of our knowledge at the time of publication. Because the possibilities and application conditions of our product are many and varied, and lie beyond our control, we can in no event be held responsible if all the necessary information on planned applications have not been formally brought to our attention. The information presented here cannot be considered as a suggestion to use our products without taking into account existing patents, or legal provisions or regulations, whether national or local. The purchaser is obliged to verify whether the possession, use or marketing of our products is subject within his territory to particular rules, especially with respect to public health, hygiene and worker and/or consumer safety. The purchaser alone assumes the duties of information and advice for the ultimate user. Solvay can in no event be held responsible for a possible failure on the part of the purchaser to respect these regulations, provisions and duties.