Recommendations for injection molding

Envalior
Imagine the Future

Arnitel® EL150/U

TPC-ET

Injection Molding, UV Stabilized

Print Date: 2024-03-22

GRADE CODING
Arnitel® E, non reinforced and non flame retardant injection molding grades.

MATERIAL HANDLING

Storage
In order to prevent moisture pick up and contamination, supplied packaging should be kept closed and undamaged. For the same reason, partial bags should be sealed before re-storage.
Allow the material that has been stored elsewhere to adapt to the temperature in the processing room while keeping the bag closed.

Packaging
Arnitel® grades are supplied in airtight, moisture-proof packaging.

Moisture content as delivered
Arnitel® grades are packaged at a moisture level ≤ 0.05 w%.

Conditioning before molding
To prevent moisture condensing on granules, bring cold granules up to ambient temperature in the molding shop while keeping the packaging closed.

Moisture content before molding
Arnitel® is delivered at molding moisture specification (≤ 0.05 w%). We advise to pre-dry to overcome the fluctuation from package to package (see drying section below). Furthermore, pre-drying is required in case the material is exposed to moisture before molding (prolonged storage or open/damaged packaging).
Moisture content can be checked by water evaporation methods or manometric methods (ISO 15512).

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Drying

Arnitel® grades are hygroscopic and absorb moisture from the air relatively quickly. Moisture absorption is fully reversible under the following drying conditions without compromising material quality. Preferred driers are de–humidified driers with dew points maintained between –30 and –40°C / –22 and –40°F. Vacuum driers with N_2 purge can also be used. Hot air ovens or hopper driers are not suitable for pre–drying Arnitel® grades; the use of such driers may result in non–optimum performance.

Moisture content	Time	Temperature	
[%]	[h]	[°C]	*[°F]*
<0.05 and as delivered	3–4	100	*212*
>0.05–0.2	4–6	100	*212*

Regrind

Regrind can be used taking into account that this regrind must be clean/low dust content/not thermally degraded/dry, of same composition and similar particle size as the original material. The acceptable level of regrind depends on the application requirements (e.g. UL Yellow Card). Be aware that regrind can cause some small color deviations.

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MACHINERY

Arnitel® grades can be processed on general injection molding machines.

Screw geometry
Typically 3–zone screw designs with volumetric compression ratios of approximately 2.5 work fine.

Steel type
Abrasive resistant tool steels which are normally used for glass and/or mineral reinforced materials are also to be used for Arnitel® polymers in tools, nozzles and screws.

Nozzle temperature control
The use of an open nozzle with good temperature control and an independently–controlled thermocouple nearby the tip and heater bands with sufficient output is recommended.

Hot runner layout
Try to achieve a close contact with your hot runner supplier and DSM as the material supplier, to be sure that the right hot runner system is chosen.
When processing Arnitel® with hot runners, keep in mind these basic rules:

- Central bushing heated separately
- Only use external heated system
- Manifold heated from both sides
- Tip with thermocouple in front (near gate)
- Very accurate temperature control in the gate area

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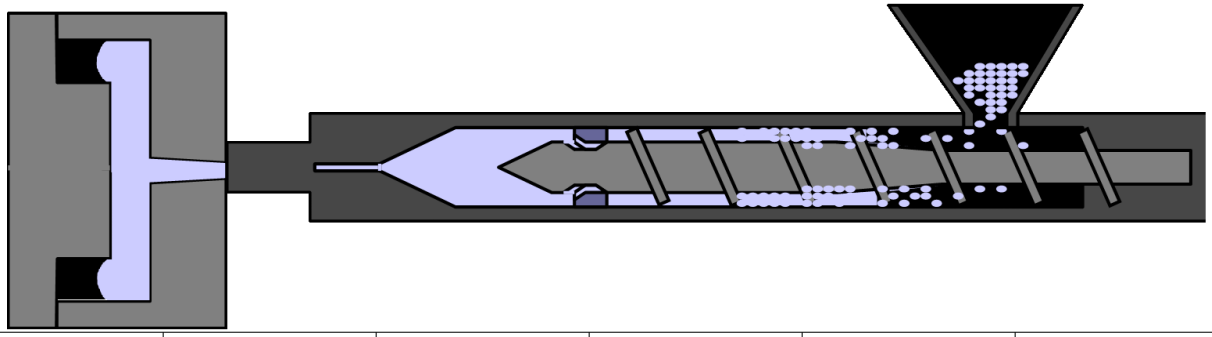
TEMPERATURE SETTINGS

Mold temperature

Arnitel® can be used with a wide range of tool temperatures (20 – 50°C / 68 – 122°F). However, to achieve optimal mechanical properties and stable dimensional parts, it is recommended to apply a tooling temperature at the higher side (50°C / 122°F).
In case the molded part tends to stick to the mold, a lower mold temperature can contribute to a better part release.

Barrel temperature

The given temperature settings are general for Arnitel®. Optimal settings are governed by barrel size and residence time.
Additionally, a higher hardness and higher melting point of the Arnitel®, requires a barrel temperature at the higher side.



Mold/Tool	Measured melt	Nozzle	Front	Center	Rear	
20 – 50°C *68 – 122°F*	190–210°C *374–410°F*	190–210°C *374–410°F*	180–200°C *356–392°F*	170–190°C *338–374°F*	160–180°C *320–356°F*	

Melt temperature

To generate a good and homogeneous melt, the melt temperature should always be above 190°C / 374°F. Optimal mechanical properties will be achieved at melt temperatures between 190–210°C / 374–410°F.
We advise to frequently measure the melt temperature by pouring the melt in a Teflon cup and inserting a thermo probe into the melt.

Hot runner temperature

A hot runner temperature set to the same level as the nozzle temperature should work fine and not lead to excessive overheat of the Arnitel® grade. When starting up, an increased tip temperature may be necessary to overcome a frozen nozzle.

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GENERAL PROCESSING SETTINGS

Screw rotation speed
To realize a good and homogeneous melt, it is advised to set a screw rotation speed resulting in a plasticizing time that is just within the cooling time.
The rotational speed of the screw should not exceed 6500 / D RPM (where D is the screw diameter in mm).

Back pressure
Back pressure should be between 30–100 bars effective. Keep it low in order to prevent nozzle–drooling, excessive shear heating and long plasticizing times.

Decompression:
In order to prevent nozzle drool after plasticizing and retracting the nozzle from the mold, a short decompression stroke can be used. However, to prevent oxidation of the melt, which may result in surface defects on the parts, it is recommended to keep this as short as possible.

Injection speed
Moderate to high injection speeds are required in order to prevent premature crystallization in the mold during injection phase and to obtain a better surface finish. Adequate mold venting is required to avoid burning at the end of the flow path (due to diesel effect).

Injection pressure
The real injection pressure is the result of the flowability of the material (crystallization rate, flow length, wall thickness, filling speed). The set injection pressure should be high enough to maintain the set injection speed (use set injection pressure higher than the peak pressure if possible). Tooling air vents must be effective to allow optimum filling pressure and prevent burn marks.

Holding time
Effective holding time is determined by part thickness and gate size. Holding time should be maintained until a constant product weight is achieved.

Holding pressure
The most adequate holding pressure is the level whereby no sinkmarks or flash are visible. A too high holding pressure can lead to stresses in the part.

Cooling Time
Actual cooling time will depend on part geometry and dimensional quality requirements as well as the tool design (gate size).

Ejection of the part
In view of Arnitel®'s flexibility (particularly the softer types) specific attention has to be given to the mold release. Furthermore the surface of the ejection pins should be large enough to prevent damage or deformation of the part.

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MELT RESIDENCE TIME

The optimal Melt Residence Time (MRT) for Arnitel® EL150/U is ≤ 5 minutes with preferably at least 50% of the maximal shot volume used. The MRT should not exceed 6 minutes.
A formula to estimate the MRT is described below:

$$MRT = \frac{\pi D^3 \rho}{m} * \frac{t}{60}$$

Whereas:

MRT	= Melt Residence Time	[minutes]
D	= Screw Diameter	[cm]
ρ	= Melt Density	[g/cm³]
m	= Shot Weight	[g]
t	= Cycle Time	[s]

Please note: In the calculation above, the hotrunner volume has not been taken into account. When a hotrunner is part of the setup, please add the hotrunner volume to the calculation. A full self–service MRT calculation can be done using the following link.

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.

STARTUP/SHUT DOWN/CLEANING

Production has to be started and stopped with a clean machine. Cleaning can be done with Arnitel® EL150/U, applicable cleaning agents or HDPE. Hot runners can also be cleaned and put out of production cleaning them with Arnitel® EL150/U.

PRODUCTION BREAKS

During production breaks longer than a few minutes, we advise emptying the barrel. The temperature of the barrel and the hot runner [if applicable] should be reduced to a level far enough below the melting point of the compound in order to stop decomposition of the compound.
When the hot runner, nozzle, or even the screw is blocked, be aware that under these conditions a sudden outburst of molten material can take place. Always wear personal safety protections for hand/eye/body.

TROUBLESHOOTING

See our trouble shooting guidelines on the internet.

Contact Envalior in case more information is required from the aspect of material or processing.

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