Recommendations for injection molding

Stanyl® HFX31S

PA46-GF20 FR(40)

20% Glass Reinforced, High Flow, Halogen free and free of red phosphorous

Print Date: 2024-03-22

IMR application information
There are specific injection molding technologies and applications for which these Injection Molding Recommendations (IMR) are too broad (e.g. USB-C molding, micro molding, or sensitive colors). For these technologies, the IMR are preferably narrowed down as described in our separate processing leaflet and/or information from our Technical Service Engineers.

GRADE CODING
Stanyl® HFX glass fiber reinforced and halogen-free 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.
Advisable is storage at room temperature.

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

Moisture content as delivered
Stanyl® HFX31S is packaged at a moisture level ≤ 0.1 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
Stanyl® HFX31S is delivered at molding moisture specification (≤ 0.1 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

Stanyl® 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 Stanyl® grades; the use of such driers may result in non–optimum performance.

Moisture content	Time	Temperature	
[%]	[h]	[°C]	*[°F]*
0.1 – 0.2 and as delivered	2	80	*176*
0.2 – 0.5	4 – 8	80	*176*
>0.5	<100 or 24	80 105	*176* *221*

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

Stanyl® 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
Corrosive- and abrasive-resistant steel types which are generally used for glass fibre reinforced, halogen-free FR, high temperature, polyamide materials are also to be used for the Stanyl® grades in tools, nozzles and screws. Failing to do so may result in wear and/or corrosion, especially of the screw/barrel (due to the high temperatures involved there), which can lead to decreasing processing performance.

Suitable corrosive- and abrasive-resistant steel types are generally powder metallurgical steels containing typically more than 13% of chrome and a HRC value of 55 or higher. Furthermore, a carbide or other type of protective coating is often applied. Examples of suitable steel types for Stanyl® grades are Böhler M390 or CPM 420V/590V. More detailed information on this topic is available in Envalior's leaflet "Steel recommendations for molds, screws & barrels".
Injection molding equipment suppliers will also have their own codings for suitable steel types. It is recommended in all cases to contact the technical service department of your injection molding equipment supplier for their specific steel type coding, using the steel requirements mentioned above.

Nozzle temperature control
Due to the combination of the typical high melting temperature of Stanyl® and consequently its high processing temperature, it is necessary to have a good temperature control for the nozzle. The use of an open nozzle or, even better, a reversed tapered nozzle with good temperature control and an independently-controlled thermocouple nearby the tip and heater bands with sufficient output is recommended.
The nozzle temperature should be set as high as possible to prevent a cold slug, yet low enough to prevent excessive drool.

Venting design
A good venting design is crucial for good molding behavior (easy filling) and low outgassing/mold deposit. Blocked vents can lead to incomplete parts and/or burning at the end of the flow path (diesel effect).
It is recommended to use venting on all inserts (explosive venting) and also on the runner system. Use decreased injection speeds during filling in order to make the venting as effective as possible.

Hot runner layout
The fast crystallization of Stanyl® asks for specific hot runner design rules. For more details, there is also a special hot runner flyer available for all Stanyl® grades. Please contact your Envalior sales or check our websites.

Try to achieve a close contact with your hot runner supplier and Envalior as the material supplier, to ensure that the right hot runner system is chosen.
When processing Stanyl® 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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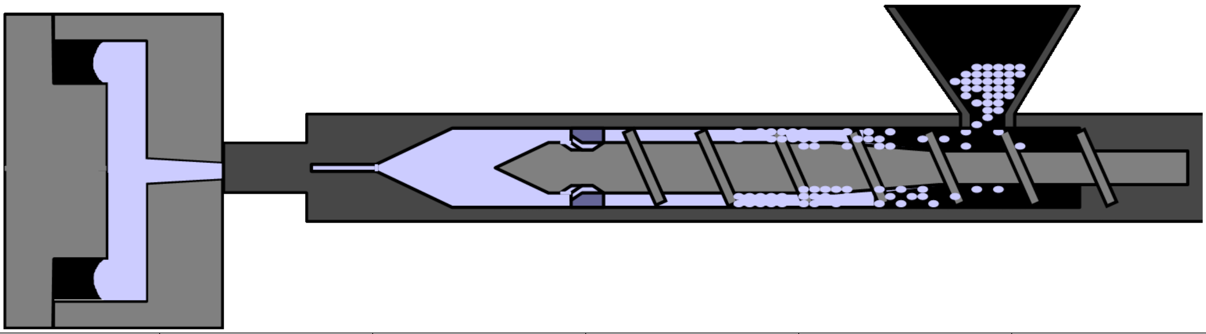
TEMPERATURE SETTINGS

Mold temperature
Stanyl® can be used with a wide range of tool temperatures (80 – 120°C / 176 – 248°F). However, to achieve optimal mechanical properties and stable dimensional parts, it is recommended to apply a tooling temperature at the higher side (120°C / 248°F).
Due to the fast crystallization speed of Stanyl®, the mold temperature has less influence on the cycle–time.

Barrel temperature
Optimal settings are governed by barrel size and residence time. Due to the high melting point of Stanyl® this temperature should be set high enough to provide a homogeneous melt without getting too near to the degradation temperature of 340°C / 644°F. A flat or rising temperature profile is recommended.



Mold/Tool	Measured melt	Nozzle	Front	Center	Rear	
80 – 120°C *176 – 248°F*	305–320°C *581–608°F*	300–320°C *572–608°F*	300–320°C *572–608°F*	300–320°C *572–608°F*	280–320°C *536–608°F*	

Melt temperature
To generate a good and homogeneous melt, the melt temperature should always be above 305°C / 581°F. Optimal mechanical properties will be achieved at melt temperatures between 305–320°C / 581–608°F. Melt temperatures on the low side of this window are recommended to minimize the risk of mold deposit and corrosion.
We advise to frequently measure the melt temperature by pouring the melt in a Teflon cup and inserting a thermo probe into the melt.

Residence time
Melt residence time for Stanyl® in general should not exceed 4 minutes; preferably, melt residence time for Stanyl® is <2 minutes. See also the separate section on residence time below.

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 Stanyl® 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 5-30 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. The recommended injection speed profile goes from fast (for sprue and runner filling) to medium (for part filling) to avoid excessive shear heating and allow air to escape from the mold. 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. Due to its fast solidification, holding time for Stanyl® is short compared to other engineering plastics.

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). Due to the fast crystallization of Stanyl®, a short cooling time is possible.

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MELT RESIDENCE TIME

The optimal Melt Residence Time (MRT) for Stanyl® HFX31S is ≤ 2 minutes with preferably at least 50% of the maximal shot volume used. The MRT should not exceed 4 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 PA6-GF or PA66-GF, applicable cleaning agents or HDPE. Hot runners can also be cleaned and put out of production cleaning them with PA6-GF or PA66-GF.

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

Overall assessment of good molding practice

An effective assessment for good molding practice (that shows limited degradation of the polymer) is to measure the reduction in Viscosity Number (VN) from granules to molded part according to ISO 307. Good molding practice is characterized by a VN reduction up to 5% of the mid spec VN of the material. A reduction of 5% - 10% is very commonly achieved in the industry. Anywhere between 10% and 15% reduction is an indication that the molding process could be improved from the combination of moisture content, melt temperature and residence time perspective. Beyond 15% VN reduction is a very strong indication that optimization of processing parameters is needed. With excessive thermal degradation one should anticipate the possibility of loss of functional robustness of the molded parts.
See our trouble shooting guidelines on the internet.

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