

Reduction of Sink Marks

General information

Injection moulded parts often show sink marks in the areas where material has been accumulated (e.g. ribs etc.). These arise from an inadequate equalisation of the volume contraction due to an irregular cooling effect in the region of the material accumulations.

In many cases these sink marks can be reduced or totally avoided by working with holding pressure and restoring of moulding compound

In difficult cases, these sink marks can be avoided by using a small amount of blowing agent.

Selection of the blowing agent

This selection is depends on the process temperature as well as a post treatment of the injected parts (painting, plating etc.)

Melt temperature

Melt temperature

160°C up to 200 °C

200°C up to 220°C

> 230°C

Blowing agent

PLASTRONFOAM of the type B

PLASTRONFOAM of the type C

PLASTRONFOAM of the type D

Surfaces treatment of the moulded part

The use of the PLASTRONFOAM types B and C can cause a migration of the ingredients, so that as a result the paint or the plating might come off.

In those cases PLASTRONFOAM type D has to be chosen to avoid the migration.

Attention: The use of high concentrated PLASTRONFOAM of type D (> 40%) involves the risk of corrosion of the screw and the mould, especially during a prolonged stop of the system under processing conditions.

Therefore it is strongly recommended to purge the extruder with virgin material before each stop and to use a steel with a chromium content of about 13% for the moulds.

Concentration of the blowing agents

The PLASTRONFOAM blowing agents are produced in a range between 20% until 70% of active ingredients. For an excellent distribution of the generated blowing gas and obtaining a fine cell structure a blowing agent with a maximum content of 40% can be used. The best results are given with a content of not more than 20%.

Dosage level

The dosage level varies between 0.2 and 1% and can be found out best by trial and error.

Surface structure

Injection moulded parts characteristically show a mat surface. Brilliant ones can only be achieved in special cases by using small amounts of blowing agents, as it is the case by the reduction of sink marks.

Theory

Due to the reduction of the melt temperature at the walls of the mould a temperature and pressure gradient is developed between the inner and outer side of the injection moulded part. Through this the blowing gas presses the still workable thermoplastic resin against the walls of the mould and in this way avoids the sink marks.

If the gas pressure is too high, though, it is quite plain, that the bubbles of the blowing gas will try to find a way out of the plasticized until the resin has reached sufficient melt strength. The way of the bubbles can be seen clearly on the moulded part!

Therefore:

- Do not use more blowing agent as absolutely necessary to avoid the sink marks!
- A even cooling of the mould must be guaranteed
- Avoid too narrow cross-sections of the runner

Adding the blowing agent into the process

The blowing agent can either be premixed with the resin, (in this case you have to ensure a absolute, homogenous mixture) or better be dosed by means of a gravimetric (best) or volumetric dosing unit into the hopper.

Extrusion temperatures

Normally the temperatures needn't be changed, but to avoid a decomposition of the blowing agent in the feeding zone of the extruder you should chose the recommended temperature in the data sheets.

This is also valid for the decomposition temperature of the blowing agent, if the temperature is, too low the blowing agent will only be partly decomposed or not at all. The result is no reduction of the sink marks or an unusual high consumption of the blowing agent.

A too high temperature of the melt can cause coarse foam and a mat surface of the injected article.

By missing shut-off nozzle and using a hot runner it is recommended to reduce the temperature of the last heating zone about 10°C.

Equipment

Blowing agents can be used normally with all injection moulding machines, but it is highly recommended to use a shut-off nozzle.

If a shut-off nozzle is not available, **the extrusion die must lay** at the mould at each time during the moulding process.

Process

The generated blowing gas shall act only in the mould itself, which means it may not escape at any other place in the atmosphere like at the hopper or through the extrusion die!

An escape at the hopper can be avoided by adapting the correct temperatures of the heating zone.

More critical is an escape at the extrusion die, especially if no shut-off nozzle is installed. In this case the extrusion die must not be removed from the mould to avoid an escape of the blowing gas.

The minor quantity of resin which comes into the mould during the opening of the mould will be worked in during the next shot without influence on the quality of the injection moulded part.

As with the processing of solid articles the back pressure has to be kept upright.

Injection time

Independent of the shot weight an injection time of ≤ 2 seconds gives the best results, as praxis has proven. To reach this rapid injection time, sufficient venting channels are necessary, sometimes the assistance of a vacuum is helpful.

Application:	Lever for seat adjustment of a passenger car
Process:	Injection moulding
Raw material:	PP
Modification of mould:	none
Cavities:	4
Melt temperature:	250 °C
Blowing agent	PLASTRONFOAM C 7,5
Dosage of BA:	0.8 %
Target:	Sink Mark Reduction



Before



Afterwards



Cross Section