Quick Guide to POKETONE Injection Molding

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Drying

POKETONE does not readily absorb moisture and can normally be fed to molding machine without drying. However, if the material has absorbed moisture due to improper handling or storage, drying may be necessary to prevent gas issues. For oven drying, the POKETONE pellets should be placed in the oven for three to four hours at 80°C(176°F).

Barrel Temperature

POKETONE polymer process well using melt temperature at injection between 240°C(465°F) and 250°C(482°F). A typical barrel temperature profile would range from 230°C(446°F) to 245°C(491°F) given the shear heating during processing.

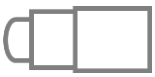
Screw Design

POKETONE polymer can be processed with common types of screw. For optimum result, however, the following screw configuration is recommended.
L/D: 18~22:1
Compression ratio: 2~3:1

Hopper

To avoid premature melting of granules in the feed throat of barrel, the temperature at the hopper should not be set too high, typically 40°C(104°F).

Nozzle



A long nozzle should be avoided as it may lead to overheating and degradation. If a long nozzle is necessary, the heater should cover the entire nozzle to ensure uniform heating. Replaceable nozzle tips can help prevent contamination from forming by enabling frequent cleaning or replacement of the tip. Well-controlled heated nozzles as using enough capacity heater and separated thermocouple are strongly recommended to prevent freeze-off issue at nozzle due to small sized nozzle orifice or rapid solidification of POKETONE.
Recommended nozzle orifice size
>Small sized m/c (200T less): min. Ø3.5mm >Mid sized m/c (200~450T): min. Ø4.0mm
>Mid~Large sized m/c (500T over): min. Ø5.0mm >Reinforced grades: +0.5mm

Starting up

In all cases, once POKETONE is introduced into the barrel it should be kept moving to prevent overheating. If a delay of over 15 minutes is anticipated, the machine should be purged every few minutes. Do not allow the cylinder temperature to exceed 260°C(465°F) until drooling is observed.

Shrinkage

The typical mold shrinkage of POKETONE unreinforced resins is between 1.8 and 2.0%, except for the supertough and fiber-containing grades which have a lower shrinkage. In many cases you can switch from POM to PK with few or no adjustments at all to the tool. Mold temperature can help fine-tune part dimensions. Tools designed for PA, PBT or POM are often suitable for PK.

Cooling

Field trials have indicated that significant reductions in overall cycle time can be achieved with POKETONE polymers when compared with other engineering thermoplastics under similar conditions due to their rapid set-up.

Purging

After processing, clean the barrel by low melt-flow resin immediately. High density polyethylene or polypropylene is suitable for purging. The new material should be introduced to the machine only after proper cleaning and adjustment to the appropriate processing conditions.

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POKETONE Injection Molding Troubleshooting

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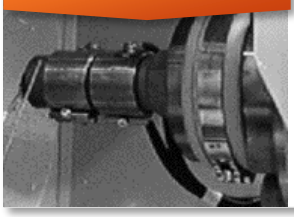
POKETONE Polymers can be successfully processed on conventional injection molding units. As with all polymers, however, some processes will require modification to achieve fully optimized products. Below are some typical troubles during POKETONE processing without proper equipment and procedures.

Nozzle Freeze Off



Due to the rapid solidification of POKETONE resins, material in the nozzle can freeze off if the nozzle internal diameter is too small, or a nozzle heater band is not long enough to completely cover overall nozzle to the tip.

[Possible Corrective Action]
Thermocouple sensor near the nozzle tip may be more effective in preventing potential freeze-off problems. Nozzle diameters should not be too small in order to prevent premature freezing. Generally, the nozzle diameter should be larger than Ø3.5mm.

Mold Adhesion

Unbalanced filling or deep core pin can cause overpacking and subsequent part sticking. With it low modulus, it could be harder to release POKETONE part than the other hard polymer part. Low mold temperature results in the mold opening before complete cooling. This causes the sticking.

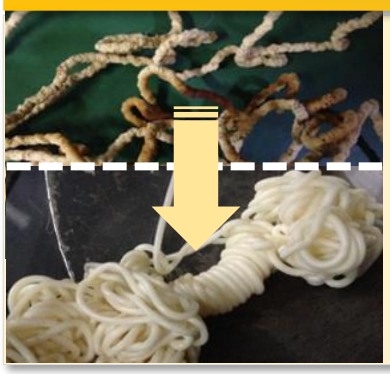
[Possible Corrective Action]
If it is hard to release the molded parts from the cavity, you can appropriately lower mold temperature and increase cooling time. In addition, too high temperature of the fixed mold will also cause sticking sprues or parts. For deep core parts, ensure the mold surface is well polished and the cooling line has no defect.

Black Specks

When you see black or brown specks on POKETONE molded part, most often, they are signs that the material has been degraded to a charred state, which usually means the POKETONE polymer has been at temperature for too long.

[Possible Corrective Action]
Clean the barrel by low melt-flow resin immediately. High density polyethylene or polypropylene is suitable for purging.
Set the barrel temperature between 240°C(465°F) and 255°C(491°F) given the shear heating during processing.

Shutdown: Thoroughly and Immediately



One unusual aspect of the rheological behavior of POKETONE is its tendency to exhibit a gradual increase in melt viscosity with increasing residence time in the melt as aldol condensation proceeds slowly at melt temperatures leading to molecular weight advancement, long-chain branching, and eventually to crosslinking. The machine should be purged thoroughly and immediately after POKETONE injection molding which cuts the time required for subsequent start-up and reduces risk of contamination. There is a risk of crosslinking caused by excessive barrel temperature as well as long residence time. Crosslinking is visible through black specks. In this case, purge immediately with polyolefins.

Unstable Metering

Due to the excessive temperatures, POKETONE pellets travelling down feed throat could melt and clump up. This can partially block the flow of resin into the screw and barrel and essentially run the machine out of material, while also blocking much of the flow of gas out of the machine.

[Possible Corrective Action]
Sufficient feed throat cooling must be provided to prevent bridging. Otherwise, a low temperature set point should be used at the feed throat. Colder is not always better. Too low feed throat set point can result in additional cycling of the rear barrel zones as well as the possibility of condensation introducing water into the material as it feeds into the screw.

Minimizing Black Specks during POKETONE Injection Molding

POKETONE is subjected to high temperatures and long residence times as it flows through the machine's barrel and nozzle. To minimize POKETONE degradation and the resulting black specks, it is important to control both the heat and residence time during injection molding.
We recommend 6 guidelines to Minimizing Black Specks.

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6 Guidelines to minimizing Black Specks

Guideline 1

: Don't use undesired colorants or additives.

To minimize the risk of black specks, it is important to avoid using undesired colorants and additives that are incompatible with POKETONE. Pigment dry blending should be avoided, and instead, it is recommended to use a colorant master batch with a POKETONE carrier. The manufacturer's instructions for use should be followed carefully. Colorants or additives that are known to cause black specks or other issues should be avoided. The best option is PK carrier color masterbatch.

Guideline 2

: Optimize the barrel temperature profile.

Maintaining an optimal temperature profile in the barrel is imperative for achieving a homogeneous melt and reducing the likelihood of degradation, which could result in unsightly black specks. It is recommended to monitor the temperature profile throughout the process and make necessary adjustments as required. POKETONE polymer is best processed at an injection melt temperature between 240°C(465°F) and 250°C(482°F). Considering shear heating during processing, a typical temperature profile for the barrel would fall between 230°C(446°F) to 245°C(491°F). In any case, it is important to ensure that the barrel and nozzle temperature does not exceed 260°C.

Guideline 3

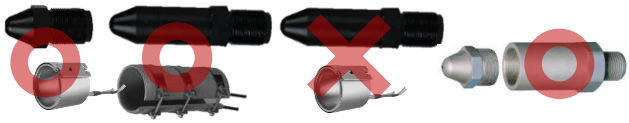
: Clean the machine thoroughly.

A clean machine is critical to minimizing the risk of black specks. Before starting the injection molding process, the machine should be thoroughly cleaned. The screw should be cleaned regularly to remove any buildup of charred material or other contaminants. After POKETONE injection molding, the machine should be shut down thoroughly and immediately. If there is a risk of crosslinking caused by excessive barrel temperature or long residence time, the machine should be purged immediately with low flow polyolefins to minimize the risk of black specks.

Guideline 4

: Use the right nozzle

The length of the nozzle should be suitable for the POKETONE being used. A long nozzle should be avoided as it can cause increased dwell time and may lead to overheating and degradation. If a long nozzle is necessary, the heater should cover the entire nozzle to ensure uniform heating. Black specks in injection-molded parts can be caused by contamination such as burnt resin, charred material, or foreign objects. Replaceable nozzle tips can help prevent contamination from forming by enabling frequent cleaning or replacement of the tip.



Guideline 5

: Use the right screw

The L/D ratio of the screw should be suitable for the POKETONE being used. A too short screw (low L/D ratio) should be avoided, as it can cause overheating and degradation of the material, leading to black specks. Conversely, a too long screw (high L/D ratio) can cause increased dwell time and may lead to overheating and degradation. A Maddock mixer is a type of screw design that is not suitable for POKETONE injection molding. It can cause shear stress and lead to degradation of the material, resulting in black specks.

Guideline 6

: Minimize dwell time.

To minimize the risk of black specks, it is important to reduce cushion and optimize cooling time during the injection molding process of POKETONE. Cushion is the amount of plastic left in the barrel at the end of the injection stroke. A smaller cushion can reduce dwell time and optimize cooling time. Additionally, POKETONE cools quickly, so you can minimize the cooling time by optimizing cooling channels, using efficient cooling methods, and reducing the cycle time where possible

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POKETONE Hot Runner Processing Guide

Hot runners have been used successfully around the world for the injection molding of POKETONE. Like other heat-sensitive resins, POKETONE resins in hot runners need more care than basic molds. Here are tips reducing troubles during processing.

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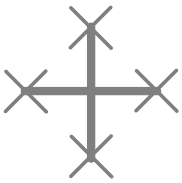
Basics

- Use only a well-balanced hot runner manifold system built specifically for the product design.
- Heated runner paths should provide a streamlined flow path to the cavity and be externally heated.
- Use complete systems from one manufacturer rather than different manufacturers.

Manifold



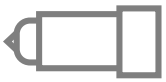
Externally heated systems are best. Internally heated manifolds are not suitable for POKETONE – these systems typically have hot spots and stagnation zones that cause partially solidified material to cling to the cooler manifold walls. All passages should be highly polished circular cross sections with gentle bends to minimize the possibility of stagnation zones.

Temper-ature

A typical hot runner temperature profile would range from 230°C (446°F) to 245°C(473°F) given the shear heating during processing. If the temperature at the gate is too low, melt at the gate will be too cold, which will make valve needle difficult to close and open.

[Mold cooling]
Field trials have indicated that you need to keep the mold temperature around gate over 70°C to minimize hot runner nozzle tip freezing off. Please DO NOT raise up the the hot runner temperature to eliminate blocking the gate. Just raising up the mold temperature can solve the freezing off issues.

Nozzle



Nozzle and gate(for both valve gate and hot tip) elements need to be insulated from the mold plates to maintain proper temperature control. Small gate size is not recommended to prevent freeze-off issue at nozzle due to rapid solidification of POKETONE. All passages within the nozzle should be highly polished and streamlined to minimize stagnation and degradation zones. Each gate should use an individual temperature controller.

[Nozzle tip insulator]
We suggest you install the insulator cap at the nozzle tip. This eliminates blocking your melt passages and prevents freezing off of the POKETONE while awaiting injection inside the hot runner system.

Purging

After processing, clean the hot runners by high density polyethylene or polypropylene immediately. POKETONE resin should be purged thoroughly and immediately to prevent risk of contamination like black specks and degradation.

Typical Trouble Shooting

Black Specks

Cause: When you see black or brown specks on POKETONE molded part, most often, they are signs that the material has been degraded because POKETONE resin has been at high temperature for too long.
Remedy: Clean the barrel and hot runner by low melt-flow resin immediately. Set the hot runner temperature between 230°C(446°F) to 245°C(473°F).

Gate freezing off

Cause: Gate freezing off usually happens due to too cold melt, too small gate for material being used, excessive cooling around gate, too much contact between nozzle and mold, or incorrect gate type.
Remedy: Raise mold temperature around gate over 70°C, check machining of nozzle cavity and make sure contact is at a minimum, check machining of gate profile and change if needed.

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