Material Influences

The properties of the resin being used have a great influence over the selection of the Hot Runner System and the nozzles. The material viscosity, fillers, part weight, wall thickness, flow length, fill time and the gate geometry all combine to determine the correct nozzle.

The first classification that determines the resin properties is whether it is Amorphous or Semi Crystalline.

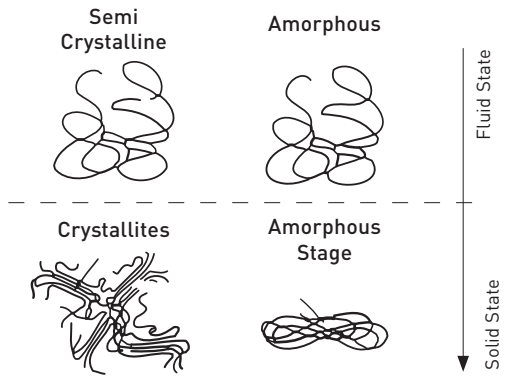
Amorphous versus Semi Crystalline

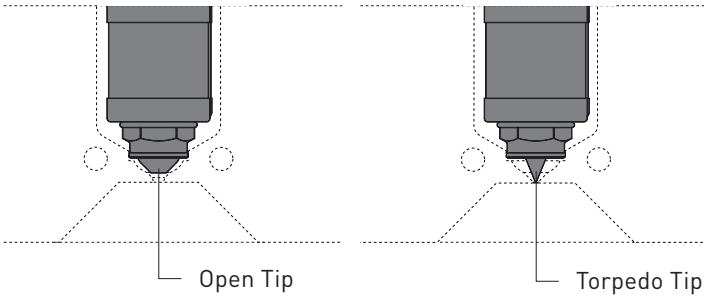
When in the liquid state, Amorphous and Semi Crystalline materials have the same random polymer chain pattern when viewed under a microscope. However, when in the solid state, a Semi Crystalline material has organised polymer chains as shown in the thermoplastics diagram. During the cooling process, the action of these polymer chains trying to organise themselves gives these materials their superior strength.
Semi Crystalline materials have a sharp melting point – this means that they transition from solid to liquid very quickly over a short temperature range. It is this property that results in careful selection of the correct nozzle in a Hot Runner System.
The pictures below show the difference between an open tip and a torpedo tip when viewed in a standard gate detail. You can see how the open tip sits further from the moulding surface. This is why the open tip is not suited to Semi-Crystalline materials – due to the sharp melting point; the material can become solid at the gate and lead to freezing off.

Amorphous
PS, PMMA, ABS
Soften over a broad temperature range
Typically transparent
Mainly for structural use

Semi Crystalline
PA, PPS, PPA, PBT, PET
Sharp melting point
Generally opaque
Good strength
Bearing, wear or structural use

Thermoplastics





Melt Flow Rate

The viscosity of the material is measured by the melt flow rate. Viscosity is defined as the 'resistance to flow'. Therefore a high viscosity means a 'thick' material and a low viscosity means a 'runny' material.
The melt flow rate (MFR) value is a measurement of how much material will flow through a small orifice at given temperatures in a set period of time. A high MFR value means a 'runny' material and a low MFR value means a 'thick' material which is the opposite of viscosity.
When selecting the correct size of nozzle it is necessary to consider the MFR of the material. If the material has a very low MFR number then a larger nozzle may be required than if the same part was to be made from a high MFR material.

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Material Fillers

The properties of any material can be changed by the addition of fillers in the form of glass fibres, talc, sand, minerals and many others. These fillers are normally added at a percentage and will affect the flow characteristics of the material and some properties such as abrasiveness.
It is important to consider these changes when selecting your Hot Runner System. It is often necessary to select a larger nozzle and a relevant tip grade to resist the abrasive nature of fillers. If the material properties have become corrosive as a result of the additive then a stainless manifold may be required.

Tip Grade	Recommend Use	Manufactured Material	Tip Style Options	System Suitability
G1	Default grade Suitable for easy materials	Beryllium copper with nickel coating	TT, IT, OT, TV, OV	Low volume shots
G2	Long life tip Suitable for easy materials	Beryllium copper, steel tipped and nickel coated	TT, IT	MJTG09 formulated tip
G4	Long life tip Suitable for easy materials	Beryllium copper tipped with carbide	TT, IT	High volume shots Cosmetic gate
G5	Long life tip Suitable for difficult & abrasive materials	Carbide D2 hard liner	TT, IT, OT, OV	Filled resin High temp

Part Influences

The volume and geometry of your moulded part will also influence the nozzle selection.

Wall Section

Parts with thin wall sections (less than 1mm) will need to be filled quicker so the nozzle will be required to deliver a higher grams/second throughput to the cavity. A larger nozzle may also be required.

Takeaway containers are an example of a part with thin wall sections.

Long Flow Lengths

It may be necessary to check that the part will fill completely given the flow lengths and exact material grade. If the part does not fill then more injection points may be required.

Automotive bumpers are an example of a part requiring a long flow length.

In both of the above part features, the important processing parameter that influences your nozzle size is the required fill time for your part. Your Mastip applications team is capable of considering all of these key influences for your project. Provided we are made aware of these key features and properties for both part and material then we can ensure the correct nozzle is selected and review the customer nozzle choice.
In most cases Mastip is not made fully aware of these key features and properties. In simple applications this may not be an issue. If you are unsure about the correct nozzle and require Mastip assistance then a fully completed RFQ form found at **www.mastip.com** will need to be supplied.

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