Autodesk® Moldflow® Communicator 2012

Process settings

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Process settings

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Process settings are all of the instructions needed beyond modeling, including the machine set-up and material properties, such as melt temperature.

After modeling the part and designing the mold, including the feed and cooling system, you must define the machine parameters. The available process settings will change according to the analysis sequence that you have selected.

Regardless of the analysis sequence, you can set the mold and melt temperatures, and define the velocity/pressure switchover, injection time, and the machine clamp open time.

Profiles

Profiles are used to ensure that the simulation matches the actual molding process as accurately as possible.

Ram speed, velocity or filling profiles are used in the filling phase to control the movement of the screw. Pressure or packing/holding profiles are used in the packing/holding phase to control the packing and holding pressure applied to the mold. The change from velocity to pressure profile control occurs when the velocity/pressure switch-over point is reached. Both types of profiles help reduce mold defects such as flashing, short shots, jetting, burning, sink marks, warpage, flaking, and more.

Temperature profiles are used to simulate the surface temperature of zones of the mold through the injection cycle.

Gas profiles are used to control the injection of gas when simulating gas injection molding.

Changes in the filling profile are typically set to correspond with changes in the mold geometry taking into account the flow restrictions inside the mold. The aim of profiling is to maintain a constant flow front. When the flow front reaches a cross sectional constriction within the mold, the rate of injection (screw velocity) should be reduced. It should be increased when the cross sectional area at the flow front increases. This is important when the flow front reaches the gate. If the melt is injected too fast, it can result in jetting, burning, flaking, melt degradation and surface defects. A common approach is to use a high screw velocity while the melt is moving through the runner system to avoid cooling of the flow front, reduce the velocity when the flow front approaches the gate, and finally increase the velocity once the melt is filling the part.

The velocity should be reduced when the flow front reaches the end of filling to prevent overpacking of the cavity, which may cause stress problems, warpage, and flashing. This facilitates a smooth transition to the packing phase where a pressure profile is used to ensure uniform shrinkage, reduce warpage, and to pack the part well without overpacking.

Linear and constant profiles can be used in the filling phase and the packing phase.

You can also choose to use a relative or absolute velocity profile.

Types of profiles

Profiling operating parameters can give greater control over the final product. Different profiles can be modeled to ensure an accurate analysis.

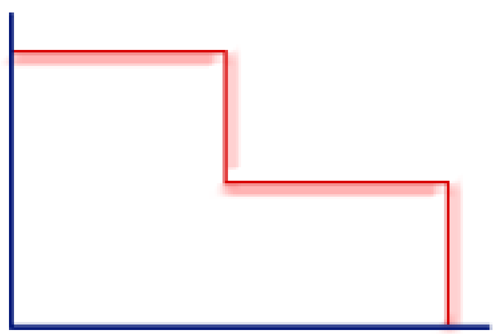
The following profiles can be incorporated:

- Ram speed or filling profiles, which are used to vary the screw movement during the filling phase.
- Pressure or packing profiles, which are used during the packing phase.
- Temperature profiles, which are used where you have the ability to control the temperature of specific zones of the mold surface through the cycle time.
- Gas profiles, which are used to control the rate of gas injection in Gas-injection analyses.

Profiles are specified as a series of steps. You can create a mixed profile, which has sections of both constant and linear adjustment of the parameter profile.

Constant profile

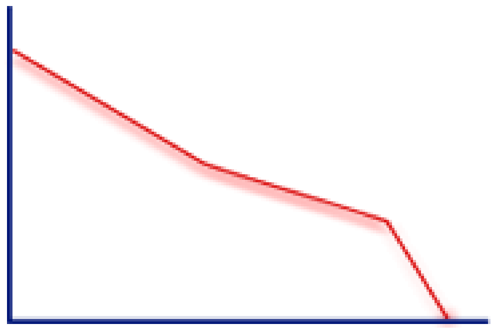
A constant profile specifies steps with a constant value, for example, a constant pressure or screw movement as shown in the following diagram.



NOTE: To create a stepped constant profile, you must enter steps with a duration of **0** seconds.

Linear profile

A linear profile specifies a change in parameter value, which increases or decreases linearly during the step, as shown in the following diagram.



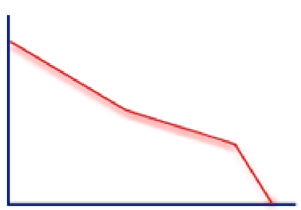
Linear profiles

Linear profiles specify operating parameters, such as pressure or flow rate, which increase or decrease in a linear manner through a step.

Profiling operating parameters can give greater control over the final product. Factors such as warpage can be reduced by profiling the packing pressure over time. Autodesk Moldflow profiles are used to simulate these adjustments.

Profiles are defined in the Process Settings Wizard **(Home tab > Molding Process Setup panel > Process Settings**) by a table outlining how the parameter is to change through the cycle. If a **Packing pressure vs time** profile is specified with the values in the following table, a profile that looks similar to the following diagram will result.

Time	Packing pressure
0	150
5	130
10	120
12	100



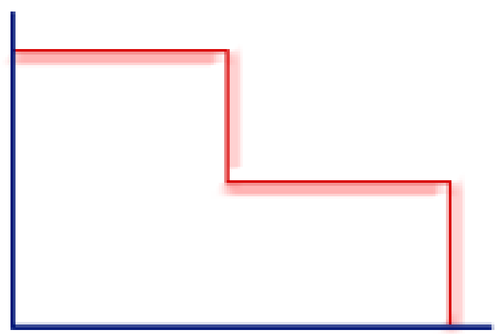
Constant profiles

Constant profiles specify operating parameters, such as pressure or flow rate, which have a constant value through a step.

Profiling operating parameters can give greater control over the final product. Factors such as warpage can be reduced by profiling the packing pressure over time. Profiles within the Autodesk Moldflow product are used to simulate these adjustments.

Constant profiles can have a stepped value incorporated. Profiles are defined in the Process Setting Wizard (**Home tab > Molding Process Setup panel > Process Settings**) by a table outlining how the parameter is to change through the cycle. If a **Packing pressure vs time** profile is specified with the values in the following table, a profile that looks like the following diagram will result.

Time	Packing pressure
0	150
5	150
5	125
10	125
10	100



In this example, the time value is duplicated to achieve the vertical step, and the packing pressure value is duplicated to achieve the horizontal step.

NOTE: A profile can have both constant and linear sections.

Absolute and relative filling profiles

There are two fundamentally different ram speed or filling profiles.

If you have not selected an injection molding machine, you can use a relative ram speed profile. If you know key machine parameters, such as screw diameter and maximum injection rate, you can use an absolute ram speed profile.

A cushion warning limit can be entered, but it does not affect the profile. The cushion is the distance between the forward screw position and the zero screw position, which contains polymer left in the barrel after the cavity is filled. Most of the melt in the cushion is then used for compensation flow during the packing stage. If the screw moves past the cushion warning limit during an analysis, a warning is produced.

Unless you have configured specific molding machine limits, the default settings in the following table are used.

5000 cm^3/s	Maximum machine injection rate
180MPa	Maximum machine injection pressure
7000 ton	Maximum machine clamp force

NOTE:

- The pressure profile is begun when the velocity/pressure switchover point has been reached.
- If you enter a profile that injects less material than the cavity contains, the end of the filling profile is reached before the specified velocity/pressure switchover point occurs. When this happens, the velocity/pressure switchover occurs early, and the pressure profile is begun.The velocity/pressure switchover may also occur early due to material compression when a high pressure is required to fill a part.

Relative profiles

Relative profiles apply ram speed as a function of the total shot size or stroke, which are determined from the geometry of the part, the runner system and the gate. Relative profiles are usually used when the actual injection molding machine has not yet been selected.

The following relative ram speed profiles are available.

- Flow rate vs % Shot volume
- % Ram speed vs % Stroke

In a relative ram speed profile, 100 percent stroke indicates the position of the screw after plastication when it is ready to start the shot, and zero percent stroke indicates the position of the screw at the end of injection. A shot volume of 100 percent corresponds to when the part is completely filled, and zero percent shot volume indicates the injection has not yet started.

NOTE: If you have input a maximum percentage stroke value that is less than 100, or a minimum percentage stroke value that is more than zero, the profile will be extended by using the percentage ram speed values of the closest data entries. For example, the profile in the following Table 1 will be extended to the profile in Table 2.

Table 1: Original profile

% stroke	% ram speed
80	75
60	100
40	50
20	10

Table 2: Profile extension

% stroke	% ram speed
100	75
80	75
60	100
40	50
20	10
0	10

Absolute profiles

Absolute profiles are used when key machine parameters are known, such as screw diameter and maximum injection rate. By running an analysis with an absolute ram speed profile, you can compare simulation results with actual results obtained using the molding machine.

Absolute ram speed profiles use the following machine settings in the injection molding machine properties. You can get to this dialog by selecting **Home tab > Molding Process Setup panel > Process Settings** , select **Advanced options**, edit the **Injection Molding Machine**, select the **Injection Unit** tab, then enter the **Screw diameter**.

The stroke or ram position is measured as a positive value, offset from the point where the ram cannot move any futher forward because it has hit the barrel end. The starting ram position defines the shot size. If this ram position in the profile does not match the shot size, the profile will be extended to or cut off at the starting ram position value.

Zero or negative velocities in absolute profile steps are ignored.

The following absolute ram speed profiles are available:

- Ram speed vs ram position
- Flow rate vs ram position
- % Maximum ram speed vs ram position
- Ram speed vs time

- Flow rate vs time
- % Maximum ram speed vs time

Packing profiles

The efficacy of thermoplastic packing has important effects on warpage, shrinkage, and the incidence of defects, such as sink marks. The main output of a Pack analysis is volumetric shrinkage, and the distribution and magnitude of volumetric shrinkage play a key role in part quality.

A Pack analysis should be performed after the part has been optimized for filling, the runners have been sized and balanced and, preferably, a Cool analysis has been run. In addition to the inputs for a Fill analysis, the following three inputs are required to run a Pack analysis:

- Packing time
- Packing pressure
- Cooling time

Determining a suitable packing pressure

The packing pressure is used to pack out a part and is often related to the fill pressure. As a rough guide, the packing pressure should be about 80 percent of the fill pressure; however, the packing pressure can vary significantly. Packing pressures are commonly between 20-100 percent of the fill pressure, and can be higher or lower. An important aspect of the packing pressure is that it cannot be so high that it exceeds the clamp limit of the machine.

The following formula is used to estimate the maximum pressure that should be used. This formula will determine a pressure, assuming a constant gradient across the part so that 80 percent of the machine capacity will be used. This is a conservative approach, but this can be used as a starting point.

$$P_{max} = \frac{\text{Clamp force (tonnes)}}{\text{Total projected area of model (cm}^2\text{)}} \times 100 \times 0.8 \ \text{MPa}$$

Determining a suitable packing time

You can repeatedly check the part weight and increase the packing time to identify the time at which the gate freezes. Gate freeze occurs when the part weight no longer increases. For example, set a two-second packing time followed by a second analysis with a four-second packing time. If the part weight increases, gate freeze occurred after two seconds. Repeat the analysis, increasing the packing time until the part weight remains stable.

Optimizing a packing profile

Warpage is caused by a variation in shrinkage, so when shrinkage is reduced, warpage also is reduced.

The filling and cooling of the part should be optimized to create a packing profile. Because the way in which part is cooled influences the packing, the packing profile should be based on a Cool+Fill+Pack analysis sequence, which accounts for the effects of mold cooling in the Fill+Pack results.

The size of the part and the type of material used will determine the range of shrinkage. Larger parts will normally have a larger acceptable range of shrinkage. Because warpage is caused by a variation in shrinkage, the volumetric shrinkage of a part influences both the potential warpage and dimensional stability of a part. If a part shrinks uniformly, it changes in size, but injection molded plastics do not shrink uniformly. The amount of warpage is reduced when the volumetric shrinkage is minimized. The range of volumetric shrinkage across the part has an effect on warpage that is beyond the effect of the magnitude of shrinkage.

With a typical part, dimensions are smaller and incidences of sink marks and voids near the end of fill are higher. Alternatively, the opposite is true near the gate where you can expect larger dimensions, and fewer and smaller sink marks and voids, which is due to the amount of packing. Typically, the area around the gate is packed much better than the end of fill. This variation in shrinkage between the end of fill and the gate area can cause warpage. A small distribution in shrinkage across the part causes the properties across the part to become more uniform.

Uniform volumetric shrinkage requires the pressure in the cavity to be controlled. Volumetric shrinkage is a function of the pressure on the plastic when it freezes off; the higher the pressure, the lower the shrinkage. Normally there is a wide variation in shrinkage across the part because of the high pressure gradient. The viscosity of plastic is high, so the resulting pressure gradient prevents the area near the end of fill from having a pressure equal to the pressure around the gate; therefore, the shrinkage at the end of fill is normally higher than around the gate. The amount of shrinkage can be controlled if the pressure is lowered over time during the packing phase of the cycle. This can be done after areas at the end of fill have frozen off, and while areas closer to the gate are still cooling. The freeze front is moving from the end of fill towards the gate, so the lower pressure near the gate results in shrinkage similar to the shrinkage near the end of fill.

The extent to which this technique is useful depends on the size of the part and gate, the type of material, the molding conditions used to fill the parts, and the wall thickness variation in the parts. The two basic methods of packing are using a constant pressure and using a linear pressure profile to vary packing pressure. With constant packing pressure, the machine is applying a uniform amount of pressure for a specified time. Some machines change the magnitude of pressure once but the new pressure is held constant at the new level.

Profiled packing is a linear decay in the packing pressure over time after a period of constant pressure, as shown in the following graph. When properly applied, packing profiles produce a more uniform volumetric shrinkage in the part. Profiles improve the shrinkage distribution by evening out the pressure distribution in the part. This is because the less pressure applied to the part the higher the shrinkage. In effect, a packing profile is designed to achieve an acceptable amount of volumetric shrinkage at the end of fill, and achieve that same level of shrinkage throughout the part.

(a) Pressure [MPa], **(b)** Time [Sec], ——— Constant Pressure, ——— Pressure Profile.

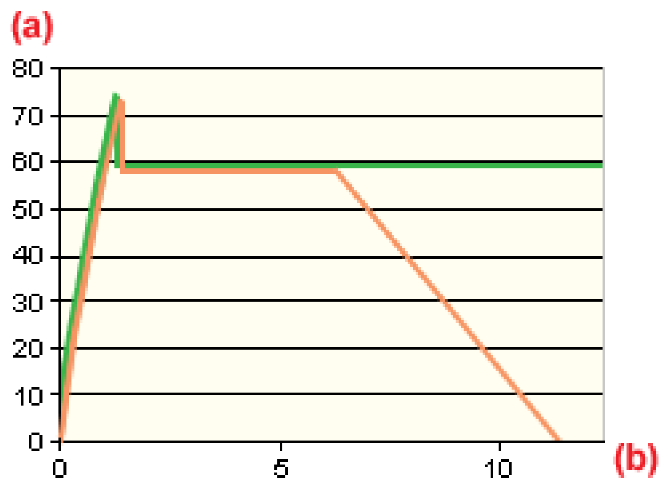


Figure 1: Packing Methods

Packing profiles are used when the injection molding machine is capable of producing profiles. If the part wall thickness changes significantly, a packing profile may not be beneficial. The thicker the wall, the higher the pressure required to have the same volumetric shrinkage as a thinner wall. The main reason for using packing profiles is that they reduce part warpage when the warpage is caused by area shrinkage variation.

NOTE: To summarize the process of optimizing a packing profile, obtain an acceptable amount of volumetric shrinkage at the end of fill, then achieve that same level of shrinkage throughout the part by reducing the pressure over time.

Temperature profiles

Temperature profiles enable you to specify the surface temperature of a specific zone of the mold during the molding cycle.

Temperature profiling has the following uses:

- Enables the input of measured temperatures into an analysis.
- Enables the temperature variation of different zones within a mold to be more closely represented.
- The Cool solver only represents the average temperature of the mold surface throughout the injection cycle. The mold surface temperature variation through the injection cycle can be represented by a temperature profile, but at the expense of additional computational time.

- Rapid heating and cooling techniques can be simulated.

You can select a zone on the mold surface where you want to apply a profile. It is possible to define up to 2500 different zones, each with its own profile.

NOTE:

- A profile can have temperatures that increase and decrease, but if the temperature drops below the transition temperature (Ttrans) of the material it must remain below this value for the rest of the profile.
- If the cycle time is longer than the specified profile, the last temperature specified will apply for the balance of the cycle.

The following three mold temperatures can be used:

- Cool analysis temperature result
- Local temperature profile
- Global Mold surface temperature as set in the **Process Settings Wizard**

If you have run a Cool analysis, the resultant mold temperature will override any temperature profiles you have set, and it also will override the global Mold surface temperature.

A temperature profile will override the global Mold surface temperature in the zone to which the profile applies. Outside that zone, the global Mold surface temperature applies.

NOTE: Mold temperature profiles do not support hot runners.

Gas injection profiles

Gas injection profiles are used in gas injection molding to control the velocity of the gas, which in turn controls the velocity of the polymer flow front.

A filling profile is used to control the polymer injection. There is often a delay between the end of the polymer injection and the start of the gas injection to allow time for the material in the mold to cool a little. Gas is injected to complete the filling stage and to maintain pressure during the packing stage.

As the gas displaces the polymer, there is less polymer between the gas front and the polymer flow front; therefore the gas pressure required to push the polymer through the mold to finish filling reduces over time. The image below illustrates how the distance between the gas front and polymer flow front becomes less over time.

Using a constant gas pressure during the gas injection will increase the shear heating of the polymer as it is pushed by the gas to fill the mold. As the polymer injection is typically very fast, this is difficult to profile. Using profiles to taper the gas injection pressure in the remaining filling phase and in the packing phase helps prevent the following problems:

- Surface defects
- Inconsistent wall thickness
- Gas fingering into the walls
- Structural defects
- Flashing

You can specify gas injection profiles to start after a short delay by using a pressure that is less than the polymer injection pressure. The gas pressure is then reduced over the remaining filling and packing phases.

The following graph and table show a relative gas profile where the gas injection is specified by the gas volume controller. The graph shows the change from filling profile to gas injection profile. There is a 0.2 s delay between the end of the polymer injection and the start of the gas injection. The percentage duration of the gas injection is shown above the graph.

NOTE: Gas injection profiles do **not** include the polymer injection profile or the delay between polymer injection and gas injection.

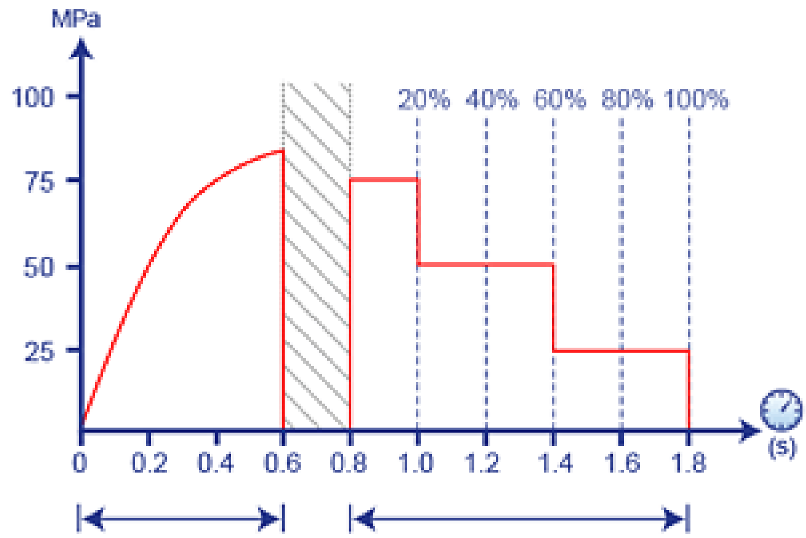


Figure 2: (0–0.6 s) Polymer injection profile, (0.8–1.8 s) Gas injection profile by gas volume control

The relative gas injection profile in the following table is shown in the above graph starting at 0.8 s and ending at 1.8 s.

Gas injection time (%)	Gas volume (%)
0	75
20	75
20	50
60	50
60	25
100	25
100	0

Examples of filling profiles

Ram movement during filling either can be automatically calculated, or you can define the movement profile. The variables you can select to define ram movement differ between different models and makes of injection molding machines, so a varied selection of input methods is available.

In absolute filling profiles, a ram position of 0mm corresponds to the position of the screw at the end of injection. Profiles that use ram position should be entered from the position of the screw after plastication when it is ready to start the shot. The screw must not move backwards, so ram position should not increase from one step to the next.

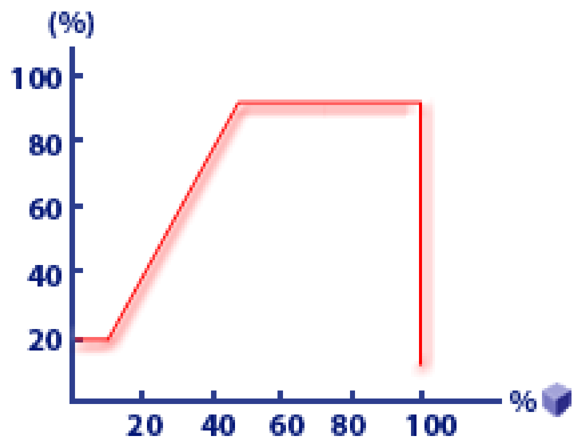
NOTE: Zero and negative velocity values in absolute profile steps are ignored.

The following tables and associated graphs are examples of the values that are required to achieve various filling profiles. These examples use both constant and linear profile steps. To enter a constant profile, you must enter steps with a duration of 0 seconds.

Relative filling profile: percentage flow rate vs percentage shot volume

A shot volume of 100 percent indicates the part is completely filled, and a zero percent shot volume indicates the injection has not started.

% Shot volume	% Flow rate
0	20
10	20
50	90
100	90
100	10

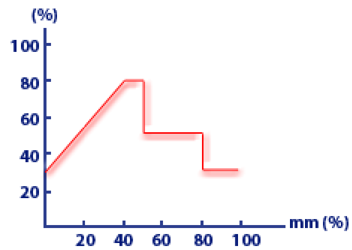


Relative filling profile: percentage ram speed vs percentage stroke

A stroke of 100 percent indicates the position of the screw after plastication when it is ready to start the shot, and zero percent stroke indicates the position of the screw at the end of injection. Percentage stroke values should be entered in descending order because backwards movement of the screw is not allowed.

% Stroke	% Ram speed
100	30
80	30
80	50
50	50
50	80
40	80

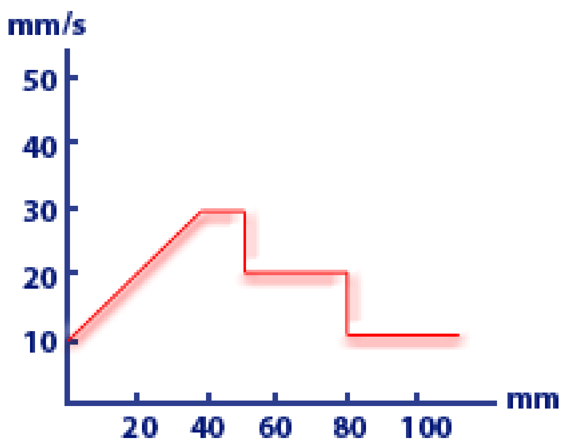
% Stroke	% Ram speed
0	30



Absolute filling profile: ram speed vs ram position

An arbitrary ram starting position of 110 mm was used in the following example.

Ram position (mm)	Ram speed (mm/s)
110	10
80	10
80	20
50	20
50	30
40	30
0	10

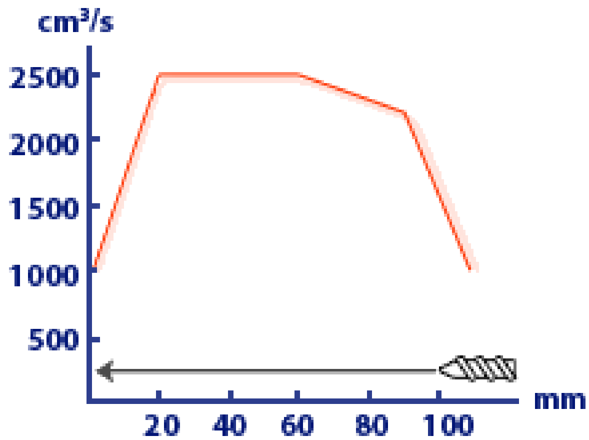


Absolute filling profile: flow rate vs ram position

An arbitrary ram starting position of 110 mm was used in the following example.

Ram position (mm)	Flow rate (cm^3/s)
110	1000

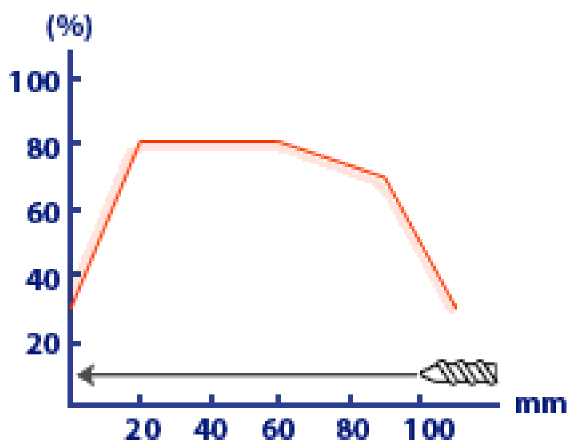
Ram position (mm)	Flow rate (cm^3/s)
90	2200
60	2500
20	2500
0	1000



Absolute filling profile: percentage maximum ram speed vs ram position

An arbitrary ram starting position of 110 mm was used in the following example.

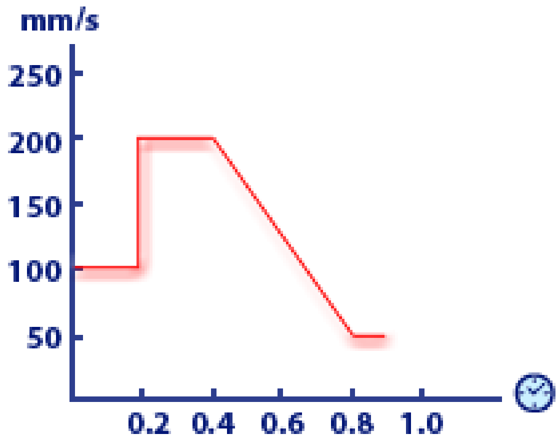
Ram position (mm)	% Max ram speed
110	30
90	70
60	80
20	80
0	30



Absolute filling profile: ram speed vs time

Enter times as absolute times from the start of injection.

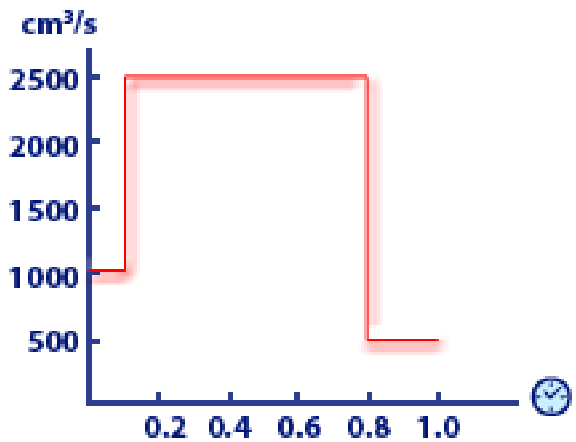
Elapsed time (s)	Ram speed (mm/s)
0	100
0.2	100
0.2	200
0.4	200
0.8	50



Absolute filling profile: flow rate vs time

Enter times as absolute times from the start of injection.

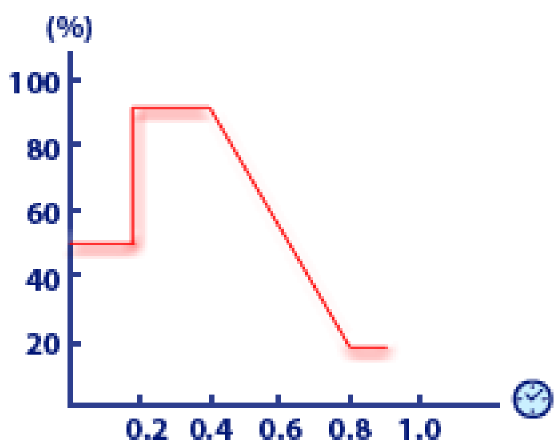
Elapsed time (s)	Flow rate (cm^3/s)
0	1000
0.1	1000
0.1	2500
0.8	2500
0.8	500



Absolute filling profile: percentage maximum ram speed vs time

Enter times as absolute times from the start of injection.

Elapsed time (s)	% Max. ram speed
0	50
0.2	50
0.2	90
0.4	90
0.8	20



Examples of packing/holding profiles

Packing/holding profiles are used during the packing and holding phases to reduce defects in the part due to uneven shrinkage, warpage, and overpacking.

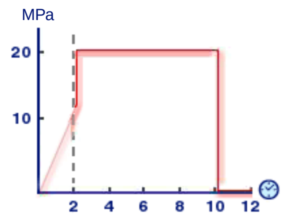
Filling profiles are used during the molding cycle until the velocity/pressure switchover point has been reached. Pressure profiles then begin.

You can use a constant profile or a linear profile.

Following are three examples packing profiles, the tables below each profile provides the values used to achieve them.

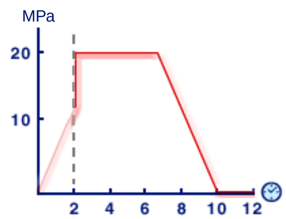
NOTE: The end of fill occurs at 2 sec in the following examples.

Example 1. Constant profile



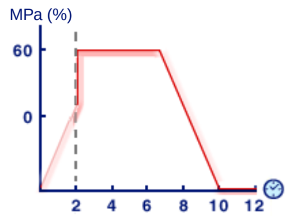
Duration (sec)	Pressure (MPa)
0	20
8	20
0	0

Example 2. Linear profile



Duration (sec)	Pressure (MPa)
0	20
5	20
3	0

Example 3. % Maximum machine pressure vs time (linear profile)



Duration (sec)	Pressure (%)
0	60
5	60
3	0

Examples of temperature profiles

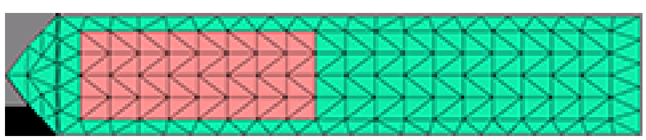
Combinations of temperature profiles can be applied to the mold surface of a part.

NOTE: If the molding cycle time is longer than the temperature profile time, the last specified temperature will be applied to the remaining time.

In these examples it is assumed that the global mold surface temperature is set at 100°C.

A profile can have temperatures that increase and decrease, but if the temperature drops below the transition temperature (Ttrans) of the material it must remain below this value for the rest of the profile.

Single temperature profile zone



The selected pink zone can be assigned the following temperature profile.

Table 3: First temperature profile

Time (s)	Temperature (C)
0	120
2	120
3	80
10	60

Over the cycle time, the mold surface temperature of this zone will vary as shown (*Figure 3: First temperature profile graph* on page 20).

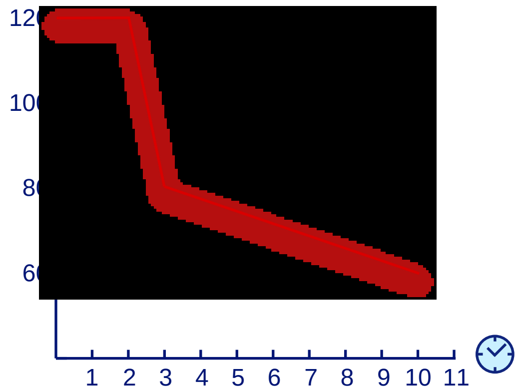
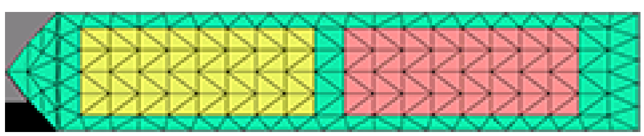


Figure 3: First temperature profile graph

The rest of the part will use the constant global mold temperature of 100°C.

Multiple temperature profile zones



The yellow section of the part has been assigned the same values as specified for the single zone example (*Table 3: First temperature profile* on page 19).

The second pink section of the part has then been selected and has had a different profile applied to it (*Table 4: Second temperature profile* on page 20).

Table 4: Second temperature profile

Time (s)	Temperature (C)
0	110
4	90
9	90
10	70

Over the cycle time, the mold surface temperature of the pink section will vary as illustrated (*Figure 4: Second temperature profile graph* on page 21).

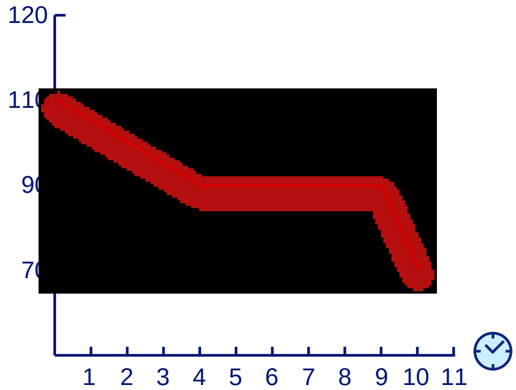


Figure 4: Second temperature profile graph

The yellow section will retain the original temperature profile (*Figure 3: First temperature profile graph* on page 20). The rest of the part will use the constant global mold temperature of 100°C.

It is possible to have up to 2500 different temperature zones on the part, with each zone having its own time/temperature data.

Constant temperature zone

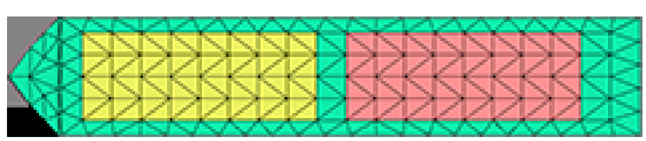
You can assign a constant mold surface temperature to a zone that is different to the global mold surface temperature.

Applying the following profile to the selected zone will result in that part of the mold surface using a constant temperature of 110°C

Time (s)	Temperature (C)
0	110
10000	110

The balance of the part will use the constant global mold surface temperature of 100°C.

Constant and profiled zones



The yellow section of the part can have a mold variable temperature profile specified while the pink section can have a constant mold temperature applied. The balance of the part will use the constant global mold temperature.

It is possible to have up to 2500 different temperature zones on the part, with each zone having its own time/temperature data.

Pressure control points

During the injection molding process, there is a stage where the velocity control changes to pressure control.
The pressure control point is an optional analysis input that can be set to trigger the program to switch control when a specified pressure at a node is reached.

Extra information about the molding machine settings is required when you want to simulate the workings of an injection molding machine as closely as possible. The time and pressure at which velocity control will switch over to pressure control must be specified. The pressure control point is one option that you can use to specify the switch-over.

The pressure control point is a sensor that is used to detect pressure values during an analysis. If you specify a pressure control point at a node, you also specify a pressure value at that node at which the algorithm will change from velocity control to pressure control. When the pressure at the pressure control point exceeds the specified value, packing will begin.

Suitable pressure control points

A general rule should be observed when selecting a suitable pressure control point.

The switch-over pressure can be higher or lower than the fill pressure, but in general the following rule should be observed:

REMEMBER: If the fill pressure is close to the pressure/clamp ceiling for the machine, then the switch-over (packing) pressure should be less than the fill pressure to prevent the mold from flashing. If the fill pressure is substantially less than the pressure ceiling for the machine, it may be possible to use a packing pressure which is greater than the fill pressure, to ensure a product with a good surface finish while not exceeding clamp force limits.

Selecting a transition point for small, thin-walled parts

If a part is small and thin walled, such as a connector part, the molder can set up the machine to fill the cavity quickly by using the ram displacement control, and then switch over to pressure control either just before or just after the part has filled volumetrically. This can cause a rapid escalation in pressure, but because the machine may have a reserve of clamp force, the molder does not have to worry about the resulting high clamp opening forces.

Selecting a transition point for large, thick-walled parts

By contrast, if the part is a thick-walled, large-area molding, such as a large rubbish container, available clamp force may be the critical factor and so the molder will set an injection time (ram forward velocity) that the molder knows will not fill the part. When the mold is only partially filled, the molder can switch over to pressure control, to prevent the part from flashing. In this case, if the switch-over point is set close to the instant of fill, the pressures and clamp forces calculated in the analysis may appear unreasonable. This is because the software has not been run in the way the molder sets up the machine.

The choice of the transition point can influence the calculated values of pressure at the injection node, and the clamp force prediction. Consequently, if these are of interest, the analysis must be set up in a realistic way to represent what happens in an actual injection molding machine. This is best done by thinking how the molder is likely to set up the machine in practice.

Velocity/pressure switch-over point

The switch-over from ram speed control to packing pressure typically takes place before the cavity is filled. The remainder of filling takes place at the constant pressure achieved at the time of the switch-over from filling to packing/holding, or at the specified packing/holding pressure. In either case, the ram speed typically decreases.

The significance of the switch-over point is best illustrated by considering the consequences of switching too early or too late.

Switching too late can lead to:

- Mold opening and flashing due to build up of excessive cavity pressure towards the end of fill
- Burn marks as the plastic slams into the end walls of the part
- Damage to molding machine and/or mold as ram bottoms out

Switching too early can lead to:

- Short shot due to insufficient ram displacement
- Longer cycle times

NOTE: If the switch-over is occuring earlier than expected, look for a short shot, or check that material compressibility has been taken into account when setting the velocity/pressure switch-over point.

Velocity/pressure switch-over options

There are a variety of options available to control the velocity/pressure switch-over point.

Automatic Select this option if you want the flow simulation to automatically determine the optimum time to switch from velocity to pressure control. The transition point is selected such that if the ram stopped instantaneously there would be enough melt decompression to just fill the cavity.

By %volume filled Specifies that the switch-over from filling to packing will occur when a particular percentage of the cavity volume is filled. By default, this percentage is 99%.

NOTE: For Injection-Compression Molding analysis only, the **by %volume filled** option specifies the percentage of design part weight (not cavity volume, as for other Autodesk Moldflow Insight analyses). Design part weight is defined as the density at room temperature and atmospheric pressure, multiplied by the cavity volume at the design thickness. Volume is not used because the total volume (including the extra space created by the press open distance) is updated at each time interval as the compression press moves. That is, once the press moves, the total volume keeps changing and is different from the original total volume. Further, the **by %volume filled** option controls only the injection unit, not the compression unit.

By injection pressure Specifies that the switch-over from filling to packing will take place when the machine reaches a specified injection pressure.

By hydraulic pressure Specifies that the switch-over from filling to packing will take place when the machine reaches a specified hydraulic pressure.

By clamp force Specifies that the switch-over will occur when the clamp force reaches a specified limit.

By pressure control point Specifies that the switch-over from filling to packing will occur when a specified pressure is reached at a specified location on the mesh.

By injection time Specifies that the switch-over from filling to packing will take place at the specified time from the beginning of the cycle.

By whichever comes first Select this option if you want to specify one or more of the switch-over criteria listed above. In this case velocity/pressure switch-over will occur as soon as one of the set criteria is met.