Autodesk® Moldflow® Insight 2012

AMI Pressure Control Points

Autodesk®

Revision 1, 18 March 2012.

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Contents

Pressure control points 1

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.

Pressure control points

You can specify the model location and pressure at which velocity/pressure switch-over is to occur.

Pressure Control Point Settings dialog

This dialog is used to specify the model location and pressure at which velocity/pressure switch-over is to occur.

To access this dialog, ensure that you have selected an analysis sequence that includes Fill or Fill+Pack, click  (**Home tab > Molding Process Setup panel > Process Settings**), if necessary click **Next** one or more times to navigate to the **Fill Settings** or **Fill+Pack Settings** page of the Wizard, set the **Velocity/pressure switch-over** option to **By pressure control point**, then click **Edit settings**.

Velocity/pressure switch-over by pressure control point	Specify the switch-over point by selecting a pressure control point inside the cavity. Once the specified pressure is reached at the selected node, the program will change from velocity to pressure control, and the pressure profile will be applied.

Suitable pressure control points

2

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

3

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 point

During an analysis, you must specify the method by which the program switches from velocity control to pressure control during the filling phase. Midplane and Dual Domain simulations handle multiple switch-over settings differently. This topic provides instructions for setting switch-over controls.

Specifying the velocity/pressure switch-over point

NOTE: The switch-over control option is only available for a thermoplastic injection molding process. The switch-over control option will appear on the Fill+Pack analysis related page of the Process Settings Wizard.

TIP: Make sure you take into account material compressibility and shot size when setting the velocity/pressure switch-over point.

1 Ensure that you have already selected a material.

Selecting the material will set the default switch-over criterion to 99% volume filled.

2 Click **Home tab > Molding Process Setup panel > Process Settings**, or double-click the Process Settings icon in the **Study Tasks** pane.

The **Velocity/pressure switch-over** control option appears on the Fill+Pack analysis related page of the Process Settings Wizard. By default, this option is set to **Automatic**.

3 Select the switch-over control method of your choice in the **Velocity/pressure switch-over** drop-down list.

4 Enter the required value in the box that appears to the right.

In some cases you may first need to access another dialog by clicking **Edit switch-over settings...**.

5 Continue by clicking **Next** until you reach the final page of the **Process Settings Wizard** and then click **Finish**.

Specifying the velocity/pressure switch-over by pressure control point

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 can specify a pressure, at that node, that the algorithm changes from velocity phase control to pressure phase control.

TIP: First determine the entity number of the node on which you want to specify the pressure control point. This can be done by selecting the node on the model and checking the number that is updated in the **Select Saved Selection List** drop-down list in the **Selection** toolbar.

1 Click **Home tab > Molding Process Setup panel > Process Settings**, or double-click the Process Settings icon in the **Study Tasks** pane.

2 In the **Velocity/pressure switch-over** drop-down list, select **By pressure control point**.

3 Click **Edit settings**.

4 Enter the number of the **Node** where you want the pressure control point specified.

5 Enter the **Pressure** at the selected node at which you want the process to switch from the velocity phase to the packing phase.

6 Click **OK** twice.

Velocity/pressure switch-over point

Use this dialog to specify switchover points from velocity control to pressure control during the filling phase of an analysis.

Velocity/Pressure Switch-Over Settings dialog

This dialog is used to specify a combination of velocity/pressure switch-over criteria whereby the criteria that is encountered first during the filling phase will trigger velocity/pressure switch-over.

To access this dialog, ensure that you have selected an analysis sequence that includes Fill or Fill+Pack (see Note), click  (**Home tab > Molding Process Setup panel > Process Settings**), if necessary click **Next** one or more times to navigate to the **Fill Settings** or **Fill+Pack Settings** page of the Wizard, set the **Velocity/pressure switch-over** option to **By which ever comes first**, then click **Edit switch-over settings**.

NOTE: This dialog is not available for Underfill Encapsulation .

Velocity/pressure switch-over by pressure control point	Specify the switch-over point by selecting a pressure control point inside the cavity. Once the specified pressure is reached at the selected node, the program will change from velocity to pressure control, and the pressure profile will be applied.

Velocity/pressure switch-over options

4

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.