HU22091901

Checklist for variothermal control

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Company details** | | | | | | | | | | | | |
| Company |  | |  | |  | | Phone | |  | |  | |
| Name |  | |  | |  | | E-Mail | |  | |  | |
| Fct./Dept. |  | |  | |  | | Web | |  | |  | |
| Street |  | |  | |  | |  | |  | |  | |
| ZIP/City |  | |  | |  | | Project | |  | |  | |
| Country |  | |  | |  | | Date | |  | |  | |
|  | |  | |  | |  | |  | |  | |  | |
| **Purpose of the checklist** | | | | | | | | | | | | | |

The checklist helps clarify whether the planned application is suitable for the variothermal system. To determine the relevant data, it includes a list of questions about the planned application. It also gives an indication of the technical description and details that require special attention (such as temperature and pressure resistance, expansion, etc.).

Conditions for the use of variothermal fluid-fluid control

**Temperature control unit**

Thermo-5

TH (hot)

**Switching Unit**

Vario-5

VS

**Mould**

**Temperature control unit**

Thermo-5

TH (cold)

**Temperature control unit**

Thermo-5

TH (optional)

variothermal zone

(cavity)

isothermal zone

(e.g. frame)

*Fig. 1 Mould temperature control concept with a fluid-fluid system*

The main conditions necessary for the use of a variothermal control system in injection moulding are:

* The temperature of the variothermal zone in the mould can be influenced within the cycle time.
* The desired effect can be achieved in the process with the generated temperature curve.
* Moulds and installation are suitable for the planned temperature process.
* Suitable control options exist.

In order to better understand the interdependencies, it helps to be aware of the principles of variothermal control. Detailed information on variothermal control can be found in “Technical documentation for variothermal control”.

Checkpoints (list of questions)

The main data for the variothermal control process can be calculated using the information collected from the list of questions:

* Achievable temperature curve on the critical surface of the mould cavity
* Required power of the units
* Characteristic delays of the system
* External circuit volumes

Also included are questions to clarify whether the application is suitable for the variothermal process.

# Process

| **No.** | | **Checkpoint** | |  | | **Answer** |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Reason for variothermal control**  Helps choose the optimum variothermal process and identifies possible limits. | |  | | Weld line  Thin wall (injection pressure)  Reproduction accuracy  Other (what?)  Comments: | |
|  | **Result with isothermal control**  Were parts with isothermal control already produced or sampled, and if so, how? | |  | | No  Yes  Main line temp.       °C  Cycle time      s  Quality  Comments: | |
|  | **Material**  Processed plastic | |  | | Comments: | |
|  | **Upper temperature**  Cavity surface temperature at the end of the heating phase, typically at the start of injection | |  | | °C  Comments: | |
|  | **Lower temperature**  Cavity surface temperature at the end of the cooling phase, typically at part ejection | |  | | °C  Comments: | |
|  | **Cycle time**  Planned cycle time | |  | | s  Comments: | |
|  | **Heating time**  Planned heating time (normally from ‘mould open’ to ‘start injection’) | |  | | s  Comments: | |
|  | **Frame temperature control**  Temperature control in the non-variothermal mould zones? | |  | | None  Exists       °C  Comments: | |
|  | **Cooling water temperature**  Maximum cooling water temperature | |  | | °C  Comments: | |

# Mould

| **No.** | | **Checkpoint** | |  | | **Answer** |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Material**  Mould material (variothermal zone) | |  | | Comments: | |
|  | **Weight**  Total weight of the mould | |  | | kg  Comments: | |
|  | **Number of cavities**  How many identical/similar cavities to have variothermal control? | |  | | Comments: | |
|  | **Variothermal zone**  On which side of the mould is the variothermal zone located? | |  | | Fixed side (nozzle)  Movable side (ejector)  Both sides  Comments: | |
|  | **Layout of temperature control channels**  Temperature control channel of the variothermal circuit (all cavities) | |  | | Sketch  Comments:  *1).* | |
|  | **Diameter of temperature control channel**  Main diameter of the channel used for variothermal control | |  | | Drilled d:      mm  Milled (wxd) w:      mm, d:      mm  Comments:  *1).* | |
|  | **Length of variothermal tempering circuit**  Complete length of the channel which is subjected to the variothermal temperature changes (without the feed channels according to Pos. 2.12) | |  | | mm  Comments:  *1).* | |
|  | **Distance from temperature control channel to mould cavity**  Centre of temperature control channel to surface of the mould cavity | |  | | mm  Comments:  *1).* | |
|  | **Distance between the temperature control channels**  Centre to centre | |  | | mm  Comments:  *1).* | |
|  | **Connection of the temperature control channels**  Are the circuits used for variothermal control all connected in series? | |  | | Yes  No, sketch required  Comments:  *1).* Attach temperature control diagram if necessary. | |
|  | **Variothermal zone as insert**  Is the variothermal zone designed as an insert? | |  | | Non  Yes, not insulated  Yes, insulated (how?)  Comments:  *1).* | |

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Feed channels inside mould**  Is the variothermal zone connected directly by tube sections (no long inflow channels running through mould)? |  | Yes  No, inflow channels  Diameter      mm  Total length      mm  Comments:  *1).* |
|  | **Connecting lines**  Only the dimensions of the connecting lines between the switching unit and mould, as well as the circuit bridges on the mould (variothermal control circuits, all cavities) |  | Internal diameter      mm  Length      mm  Comments:  *1).* |

1) Drawings or CAD data are required for geometries or channel layouts that are difficult to describe. The work required for the assessment can increase considerably. In this case the work will be billed after prior consultation (optional service).

# Control

| **No.** | | **Checkpoint** | |  | | **Answer** |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Machine signals**  Can heating and cooling both be controlled directly from the machine or is only a clock signal available? | |  | | Heating and cooling  Only clock signal  None (limit switch necessary)  Comments: | |
|  | **Temperature sensor**  Is there a temperature sensor in the variothermal zone of the mould? | |  | | Non-existent  Exists (describe position, sketch)  Comments: | |
|  | **Control**  Is switching purely time-controlled or temperature-controlled through mould sensors? | |  | | Time-controlled  Temperature-controlled  Comment:  Temperature control is only possible through a machine, which must be equipped for this. | |

# General

| **No.** | | **Checkpoint** | |  | | **Answer** |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Water quality**  Is the available water quality suitable for the intended variothermal control system (working temperatures)? | |  | | Yes  No (clarification necessary)  Comments: | |
|  | **Additional heaters**  Are there any additional heating elements available to support variothermal control processes? | |  | | No  Yes (clarification necessary)  Comments: | |
|  | **Material durability**  Are all the materials which the variothermal circuit is comprised of suitably temperature- and pressure-resistant (typically 180 °C, 25 bar)? | |  | | Yes  No (modification necessary)  Comments: | |
|  | **Temperature gradients**  In the variothermal control process temperatures in the mould locally change heavily. Is it certain that the mould will not be damaged from this (slides getting stuck, adverse effects on cavity ventilation, etc.)? | |  | | Yes  No (modification necessary)  Comments: | |
|  | **Special**  Are there any scenarios in the application which could be adversely affected by the variothermal operation? | |  | | No  Yes (clarification necessary)  Comments: | |

*Note: The questions 4.3 to 4.5 are questions that concern safety which, if not properly clarified, can lead to damage to moulds or the installation!*

# Results

The results are based on the information given and complementary assumptions; they are normally determined and entered by HB-Therm.

| **No.** | | **Checkpoint** | |  | | **Answer** |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Suitability for variothermal control**  Is the intended application suitable for variothermal fluid-fluid control? | |  | | Yes  No  Comments: | |
|  | **Hot unit (TH)**  Minimum values | |  | | Temperature       °C  Heating capacity      kW  Comments: | |
|  | **Cold unit (TC)**  Minimum values | |  | | Temperature       °C  Cooling capacity      kW @     K  Comments: | |
|  | **Pumping capacity** (both units identical)  Minimum values | |  | | Flow rate       L/min  @ pressure      bar  Comments: | |
|  | **External circuit volume**  Temperature control channels with hoses from switching unit to mould and mould connections | |  | | L  Comments: | |
|  | **Characteristic delay time**  After switching, time until the temperature change arrives at the cavity surface | |  | | s  Comments: | |
|  | **Recommended unit type, hot (TH)**  Minimum requirement | |  | | HB-  Comments: | |
|  | **Recommended unit type, cold (TC)**  Minimum requirement | |  | | HB-  Comments:  *2).* | |
|  | **Recommended switching unit (VS)**  Minimum requirement | |  | | HB-  Comments:  *2).* | |
|  | **Recommended accessories**  (without hoses, fittings, cables) | |  | | Proximity switch  IR temperature sensor  Comments: | |

2) The type of unit (single or modular unit) and the required interfaces and remote control depend on the needs of the application.