



Start-up of the Hot Runner System

5 Start-up of the Hot Runner System

! DANGER

	<p>Danger to Life by Disfunction of Safety Devices</p> <p>Serious personal injury or death can result from disfunctions of safety devices. Before machine operation, properly set all safety devices and use them at all times. For first aid contact your medical / safety representing.</p>	
	<p>Danger to Life by Electric Shock</p> <p>Serious personal injury or death can result from electrical contact. Electrical work must be carried out by qualified persons. Verify that all power source connections are properly grounded. When working on electric parts of the machine, switch off:</p> <ul style="list-style-type: none"> • Temperature control of the Hot Runner System • Injection molding machine • Electric connections to the Hot Runner System or machine have to be disconnected. <p>For first aid contact your medical / safety representing.</p>	
 Hydraulic	<p>Danger to Life by Hydraulic</p> <p>Serious personal injury or death can result from connecting or disconnecting hydraulic hoses under pressure. Hydraulic works must be carried out by qualified persons. Before you start any hose related work:</p> <ul style="list-style-type: none"> • The hoses have to be depressurized. • The electrical disconnect properly locked out. <p>For first aid contact your medical / safety representing.</p>	

! WARNING

 	<p>Heavy Weight Hazard</p> <p>Transport and lifting equipment should be operated only by trained personnel. Operate lifting and transport equipment slowly and carefully to avoid uncontrolled swinging of the manifold. Use personal protective equipment, such as head gear, safety shoes and work gloves. Lifting and transport equipment for lifting Hot Runner Systems shall be approved and properly rated taking into account the weight and size of the manifold. When unpacking the Hot Runner System, there is a risk of injury due to falling parts and sharp edges. Maintain a minimum distance of 1 m from the Hot Runner System. For first aid contact your medical / safety representing.</p>	
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Start-up of the Hot Runner System

! WARNING

Mandatory
Safety
instructions

Oil sprayed from leakages in the oil distribution systems

may result in injury, e.g. to the eyes.

Use personal protective equipment, in this case specifically a face shield or protective goggles.

**Leaking oil may result in severe injuries due to slipping**

Eliminate contamination from lubricants.

When you are working in the vicinity of the machine, pay close attention to the safety of your workplace.

For first aid contact your medical / safety representing

NOTICE**DO NOT heat the Hot Runner System if cooling is not available**

Severe damage to actuators will result.

Cooling shall be switched on together with the heating system.

Average temperature: min. 30 °C (86 °F), max. 60 °C (140 °F), max. pressure 8 bar (116 psi); max. temperature difference between inlet and outlet 5 °C (9 °F).

Parts of the system obstruct movable parts of the machine

Make sure the hoses of the hydraulic, pneumatic and cooling systems as well as all electric cables do not obstruct movable parts of the machine, do not interfere with the machine's area of movement and the area of automatic handling, if applicable.

Rheologic calculation from the customer's point

To provide to the mold function, to determine operating data and to verify the eligibility and functional reliability of the Synventive Hot Runner System as specified and approved by the customer, it is necessary to carry out a rheologic calculation from the customer's point of view based on our knowledge.

Upon request at the time of the purchase order, we can submit free of charge the dimensions of the melt flow channels, necessary for the calculation, converted into the form of three-dimensional data.

Air intake in the hydraulic hoses

may result in incomplete valve pin closing, which may lead to a large gate vestige on the molded part.

Make sure that the connected hydraulic hoses are fully bled of all air prior to molding parts.



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5.1 Preparation for Start up

NOTICE

If you are restoring the operation of the injection mold use the list of adjustment values that state the operating conditions under which the injection mold was initially tested.

- 1) Check if the molding machine nozzle flow channel diameter = $\varnothing A$ matches the inlet bushing flow channel diameter = $\varnothing E$, or if it is smaller by not more than 1.0 mm (0.04").
$$\varnothing_E = \varnothing_A + 0/-1.0 \text{ mm (+0/-0.04")}$$
- 2) Attach the complete injection mold using the applicable screws and, if necessary, fix to the injection molding machine using retaining or clamping elements.
- 3) Connect the hoses of the coolant distribution systems to the connection points of the Hot Runner System and check for leakage.
- 4) Connect the hoses of the hydraulic and / or pneumatic distribution systems to the connection points of the Hot Runner System and check for leakage.
- 5) If you are restoring the operation of the injection mold, make sure that the fittings on the tool in the molding machine are tight.

5.2 Power Supply Connection

! DANGER**Danger to Life by Electric Shock**

Incorrectly installed power supply lines may result in severe burns and even cardiac arrest and possible risk of death.

Power supply have to be connected by qualified persons.

For any work on the Hot Runner System, check that the system is properly grounded.

For first aid contact your medical / safety representing.

- 1) Close the injection mold.
- 2) Switch off temperature control of the Hot Runner System and the control system of the injection molding machine.
- 3) Disconnect all power supply lines to the Hot Runner System, temperature controller and the injection molding machine.
- 4) Check if the connector arrangement of your temperature control system matches the connection diagram and wiring schematics supplied by Synventive.



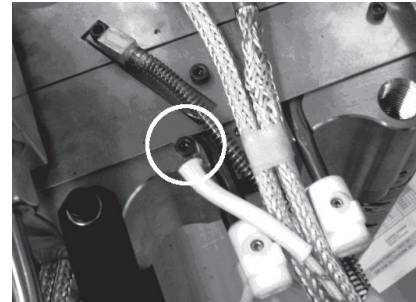
Start-up of the Hot Runner System

5.2.1 Grounding Check

- 1) To check if the Hot Runner System is grounded, hold a multimeter between temperature control grounding and manifold grounding.

! DANGER

The measured resistance value should be zero Ω .



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5.2.2 Verification of Heater Grounding

! DANGER

**Danger to Life by Electric Shock**

Electrical work must be carried out by qualified persons.

For any work on the Hot Runner System, check that the system is properly grounded.

For first aid contact your medical / safety representing.

! DANGER

Never operate the heaters at full capacity if resistance is below 230 k Ω .

NOTICE

Heaters may accumulate ambient humidity, which could reduce resistance to a value between 100 k Ω and 10 M Ω .

- 1) In case resistance is below 230 k Ω , heat the system to 50 °C (122 °F) for the first 10 to 15 minutes. (Slow start).
- 2) If resistance is lower than 1 M Ω , heating can be set to the processing temperature.



Start-up of the Hot Runner System

5.2.3 Information on Heater Connection

5.2.3.1 Color coding of Thermocouples

NOTICE

Take notice of the production and color identification of thermocouple cables.

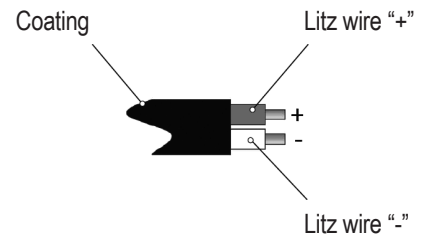
Synventive uses J and K type thermocouples. Their color coding is given in the following table.

Table 1: International color coding for temperature sensors

Type	International standard IEC 584-3	
J	Black	+ Black
		- White
K	Green	+ Green
		- White

Table 2: Color coding of temperature sensors by customer request

Type	ANSI/MC 96.1		JIS C-1610-1981	
J	Black	+ White	Yellow	+ Red
		- Red		- White
K	Green	+ Yellow	Blue	+ Red
		- Red		- White





Start-up of the Hot Runner System

5.3 Hot Runner System Start-up

! WARNING**Danger of Unexpected Discharge**

If the inlet bushing does not heat up as quickly as the manifold, pressure inside the manifold may increase due to the thermal expansion properties of plastics.

Move injection unit towards the injection mold to engage the heated machine nozzle is pressed against the inlet bushing.

NOTICE

This ensures additional heat supply for the inlet bushing, to be transmitted to the cold plastic.

Use personal protective equipment.

For first aid contact your medical / safety representing.



1) Switch on machine control, temperature control of the injection molding machine and the mold cooling.

2) Move the injection unit slowly to the injection mold until the heated molding machine nozzle is pressed against the inlet bushing.

3) Set the temperature control of the Hot Runner System and the plastification unit (screw and barrel) to the operating temperature given in the plastic's material safety data sheet.

NOTICE

Ideally, all hot runner heating zones and the plastification unit should reach the given temperature at the same time.

It is advisable to wait at least 15 minutes after operating temperature is reached to allow for full thermal soak prior to attempting to mold parts.



Start-up of the Hot Runner System

! WARNING**Danger of Unexpected Discharge**

Uneven heating of the Hot Runner System and the material may result in damage to the Hot Runner System.

When the machine reaches the required temperature (based on the temperature control indicator), let it heat soak for another fifteen minutes prior to beginning molding operations.

If the injection mold is opened, the material injected into the Hot Runner System under high pressure could be ejected causing severe injury.

Never inject the melt under high pressure into an open injection mold.

If production operation stops while Hot Runner heating is on, the melt can overheat easily. Overheated plastic may emit dangerous vapors that could eject explosively if the mold gate is opened.

Upon each interruption of production operations, retract the machine's injection unit to make sure the pressure in the Hot Runner System can normalize through the inlet bushing.

Use personal protective equipment.

For first aid contact your medical / safety representing.



4) Start-up of a new and empty Hot Runner System (initial start-up):

Extrude or gently purge plastic material through the Hot Runner System and the injection mold under a low pressure of 10 bar (145 psi) to 14 bar (200 psi).

Doc003125: Mold flush

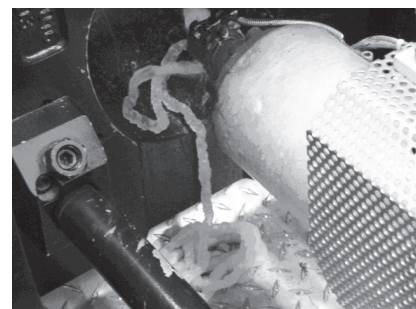


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5) Start-up if there is plastic in the Hot Runner System (repeated start-up):

Retract the plastification unit from the inlet bushing and purge the unit until fresh, clean plastic material is exiting the machine nozzle, then return it back to the hot runner inlet bushing.

Doc003126: Injection unit flush



Doc003126.png



Start-up of the Hot Runner System

- 6) Set the molding parameters of shot size, time and pressure depending on the size of the molded part, runner size and material.
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- 7) Set the valve pin open time to 0.2 to 0.5 s before injection starts.

NOTICE

At least one valve gate must be opened before start of injection.

- 8) In manual mode do a visual check (using a mirror if possible) that each valve pin opens and closes.
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- 9) Make sure the valve pins are closed before starting the injection cycle.
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- 10) Start the injection cycle in semi-automatic mode and verify that all machine functions are operating correctly.
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- 11) Switch the machine to automatic mode.
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NOTICE

The production process may require some additional fine-tuning. Record the optimum set-point values for operating cycle or on the molded part's quality.



Start-up of the Hot Runner System

5.4 Color Change

If a Hot Runner System is to be used for color-change applications, it is advisable to use a clear or natural material at first shots to ease future color changes.

NOTICE

If possible, colors should be changed from light to dark to prevent any unnecessary waste.

5.4.1 Color Change of direct contact Nozzles (plunged through-Nozzles)

- 1) Remove all residues of the previously processed material from the hopper.
- 2) Retract the plastification unit from the inlet bushing and flush the plastification unit with the new material until no signs of the previous material are visible.

NOTICE

Do not change the barrel temperature in the process.

Set the temperature of the injection mold as follows:

- 3) While cleaning the plastification unit, increase the temperature of the hot runner manifold and the nozzles by 38°C (68 °F).

NOTICE

The condition is that the plastic intended for processing withstands this temperature increase.

- 4) Increase the mold temperature on the nozzle side by 15°C (27 °F).

! WARNING**Danger of Unexpected Discharge**

There is a risk of material degradation or unexpected discharge.

Once the new required temperature is achieved, leave the hot runner at least 4 minutes at the increased temperature.

Purge or extrude through the manifold.

Use personal protective equipment.

For first aid contact your medical / safety representing.





Start-up of the Hot Runner System

- 5) If possible, purge or extrude the new material through the open injection mold until no residues of the old material are visible.

NOTICE

If this is not possible, go to the next step.

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- 6) Perform 20-30 shots at a reduced injection speed (approx. by 30%) and reduced part cooling time (approx. by 20%) to make sure that the color in the injection mold can change.

NOTICE

If the material cannot be purged or extruded through the open mold, you may be required to run more than 30 shots.

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- 7) Reduce the temperature of the hot runner and the injection mold back down to normal operating temperature.

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- 8) Run 10-20 shots to completely remove all scattered material residues from the whole injection mold.
9) Resume normal production once all evidence of the previous color has disappeared from the parts.

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- 10) If the color is still not fully changed, repeat steps (1-7) once more or use a granulated cleaner instead of natural or clear plastic.



Start-up of the Hot Runner System

5.4.2 Color change of Nozzles with pre-chamber isolation without removable cavity plate

In case of difficult color change and material (e.g. from black to white) the isolation cap should be removed from the nozzle.

For such cases the injection mold is equipped with a replaceable cavity plate, so it is possible to remove the isolation caps directly on the mold.

If your injection mold is not fitted with a removable cavity plate, please contact our Customer Services.

5.4.3 Color change of Nozzles with pre-chamber isolation and replaceable cavity plate

(not plunged through-Nozzles)

- 1) Remove residues of the previously processed material from the hopper.

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- 2) Purge the plastification unit with the new material until no signs of the old material are visible.

NOTICE

Do not change the barrel temperature in the process.

Set the temperature of the injection mold as follows:

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- 3) While purging the plastification unit, increase the temperature of the hot runner manifold and the nozzles by 20-30 °C (36-54 °F)

NOTICE

The condition is that the plastic intended for processing withstands this temperature increase.

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- 4) Switch off the Hot Runner System (manifold and nozzles).

NOTICE**System with Support Ring Face Fit nozzles:**

Leave the nozzles until they cool down to not more than 50 °C (122 °F), to prevent damage to the nozzle tip. (The manifold temperature may be higher).

System with Threaded Screw Fit nozzles:

Leave the hot runner system (manifold and nozzles) until it cool down to not more than 50 °C (122 °F), to prevent damage to the nozzle tip.



Start-up of the Hot Runner System

! WARNING**Danger of Unexpected Discharge**

There is a risk of material degradation or unexpected discharge.

Once the new required temperature is achieved, leave the hot runner at least 4 minutes at the increased temperature.

Flush through the manifold.

Use personal protective equipment.

For first aid contact your medical / safety representing.



5) Slide away the cavity plate on the guiding elements.

6) Heat the nozzles to a temperature 50°C (90°F) lower than the processing temperature for the specific plastic.

Example:

Processing temperature = 260 °C (500 °F) - 50 °C (90 °F) =
210 °C (410 °F).

In this case the nozzle temperature would be set to 210 °C
(410 °F).

7) Remove all isolation caps using a suitable aluminum or brass tool.

8) Switch off the nozzles once again and wait until they cool down to about 50 °C (122°F).

9) Slide the cavity plate onto the guiding pins until the cavity plate engages the nozzle tips. Fasten the plates.

! WARNING**Hot Surfaces Hazard**

10) Heat the hot runner to normal operating temperature and produce parts using normal cycle.



Start-up of the Hot Runner System

5.5 Hot Runner System Switch-off

NOTICE



Mandatory
Safety
instructions

Hazards Material Damage

Do not switch the machine off, if there is ethylene vinyl alcohol (EVOH) copolymer inside.

Because of its low viscosity, it could be difficult to remove the cleaning material from the hot runner.

Switch off hot runner heating and continue injecting until the melt in the hot runner solidifies and the material stops spreading.

Solidification occurs when the cavity plates do not fill with the material any more. Then finish injecting.

System shutoff without aftercooling could result in damage to the sealing at actuator seals.

To avoid this, the cooling of hydraulic actuators should continue for at least 15 minutes after the system power is disconnected.

The liquid flowing from leaking hoses or connections could result in short circuit or fire in case of contact with electric parts.

Maintain good condition of the hoses and their connections through regular maintenance.

The coolant and the hydraulic fluid should not be located near the electric connections and devices on the machine.

- 1) Close the valve pin after the last molding shot.

- 2) Switch off the temperature control of the Hot Runner System.

- 3) Switch on mold cooling and wait until the material inside the Hot Runner System freezes, i.e. until the temperature in the manifold drops under the melting point of the processed material.

- 4) Retract the injection unit from the inlet bushing.

- 5) Flush the injection unit with a suitable granulated cleaner.

- 6) As soon as the granulated cleaner is completely discharged from the injection unit without any impurity, disconnect the unit.

- 7) Switch off the control system and the temperature control of the machine.



Start-up of the Hot Runner System

5.6 Storage of Hot Runner System during Shutdowns

If you want to shut down the Hot Runner System temporarily, comply with the following instructions after dismantling.

- 1) Treat the Hot Runner System by injecting a protective anti-corrosion agent.

NOTICE

We recommend the multipurpose spray CC80 by Metaflux as an anti-corrosion agent.

- 2) Store the mold in the horizontal position.

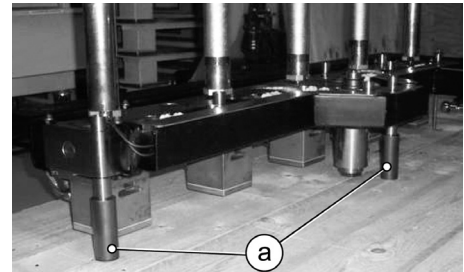
NOTICE

Use the assembly pillars (a) for a secure storing.

This hot runner system has been shipped with assembly pillars installed to prevent damage to the actuators and valve pin bushings while being assembled or in transit. These assembly pillars must be removed prior to installing the top clamp plate.

! WARNING

Do not use the assembly pillars as lifting device.



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- 3) Store the Hot Runner System in a dry location.