DME®

iControl™ Hot Runner Insulation

BEGIN SAVING TODAY

PROCESSING PRODUCTIVITY, REDUCED ENERGY CONSUMPTION AND BETTER QUALITY PARTS

The molding of a plastic part requires control of the critical plastic variables. Temperature, Flow, Pressure, and Cooling all play an integrated role in the process. Success in these areas can result in reliable, consistent, and improved operations as demonstrated by the 2 case studies presented here.

Minimizing variation is the desired state.

DME iControl™ Hot Runner Insulation

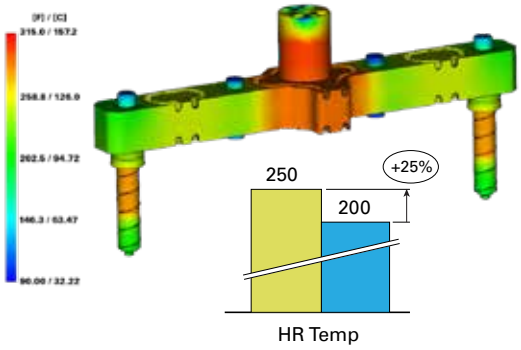
The Industry Challenge:

Ideally, all components in a controlled thermal system will be in a state of thermal equilibrium, or at the same temperature. Because no thermal system is perfect, there will be constant heat loss from the hot runner system to the cooler, surrounding steel plates, primarily through conduction and convection, as shown in case study 1. The conventional hot runner insulator is air, but air's thermal conductivity increases as processing temperatures rise, increasing the heat loss. Most often, the result is operating the hot runner at temperatures higher than desired to overcome the losses, and may result in:

- Longer cycle times
- Higher Energy Use on Heating and Cooling
- Part quality issues
- Changes in the polymer molecular structure
- Polymer degradation

Hot Runner Thermal Analysis Temperature Variance

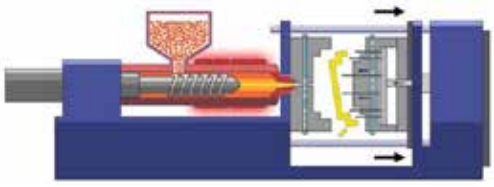
- Blue areas are in direct contact with the mold
- Green areas are the cold section relevant to the process which drives the temperature setting
- Yellow areas are now "hot" relative to ideal for the material
- Creates thermal variation / imbalance in the hot runner system
- Leads to higher melt temperature to compensate for the lowest temperature in the system



The Solution:

iControl Hot Runner Insulation. iControl provides insulating properties to the hot runner system. Capturing the heat may create a more uniform thermal profile across the entire system, allowing processing temperatures to be lower to maintain uniform and lower melt temperatures.

Less Heat In = Less Heat Out = REDUCED CYCLE TIME / REDUCED ENERGY CONSUMPTION



Melt Phase

The lower the heat required to reach the molten phase = the less heat required to be removed during the mold cooling phase

Cooling Phase

The industry accepts that cooling in the mold can represent 50-80% of cycle time - a function of part geometry, mold cooling and polymer temp when injected

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Case Study 1 (automotive tail light housing)

Considering Only Cycle Time Reduction

120,000 Part production run / 1 cavity = 120,000 IMM cycles
120,000 cycles * cycle time saving 6.6 seconds = 220 hours

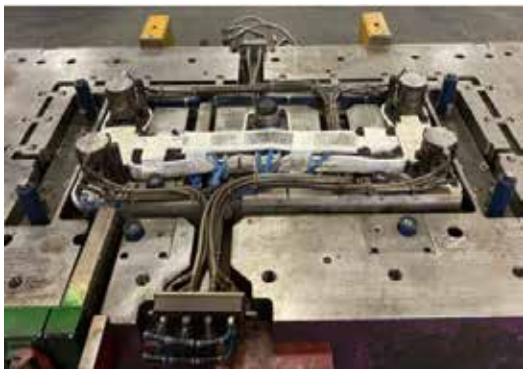
220 IMM hours available for other jobs

Average IMM operation cost = $100
Average IMM operator cost / hour = $40
220 hours saved * $140 / hour = **$30,800 savings**

PROCESS SHEET

			Actual Processing Values	
Polystyrene Processing Guide-lines	Low	High	Without iControl	**With iControl**
Barrel Zone 1	400°F	440°F	470°F	**430°F**
Barrel Zone 2	400°F	440°F	470°F	**430°F**
Barrel Zone 3	420°F	440°F	470°F	**430°F**
Barrel Zone 4	420°F	440°F	470°F	**430°F**
Nozzle	420°F	440°F	450°F	**415°F**
Hot Runner Manifold	430°F	450°F	450°F	**410°F**
Hot Runner Nozzles	430°F	450°F	450°F	**410°F**
Mold (cavity plate)	100°F	140°F	130°F	**110°F**
Hot Runner Start-up Time to 440/450°F			32 mins	**26 mins**
Cycle Time			74.3 sec	**67.7 sec**

Note: Case study results of iControl Hot Runner Insulation installed on a 2 drop hot runner system processing glass reinforced polypropylene (PP) part (automotive tail lamp housing)



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Case Study 2 (automotive air box)

Considering Only Cycle Time Reduction

106,000 part production run / 1 cavity = 106,000 IMM cycles
106,000 * cycle time saving 5 seconds = 147 hours
147 IMM hours available for other jobs

Average IMM operation cost = $100
Average IMM operator cost / hour = $40
147 hours saved * $140 / hour = **$20,580 savings**

PROCESS SHEET

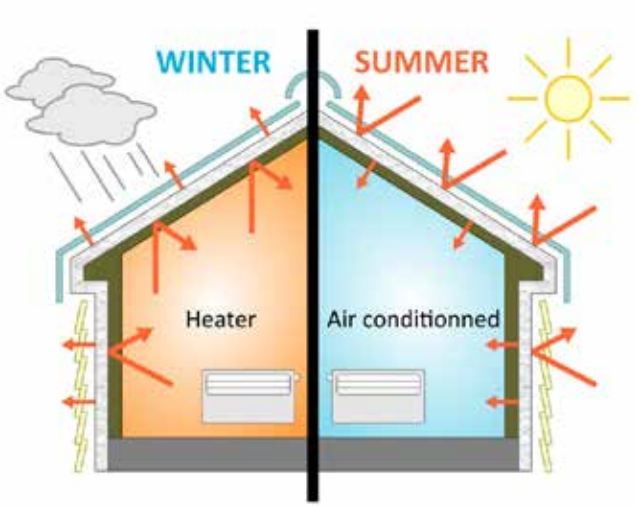
			Actual Processing Values	
Polystyrene Processing Guide-lines	Low	High	Without iControl	**With iControl**
Barrel Zone 1	410°F	440°F	428°F	**428°F**
Barrel Zone 2	410°F	440°F	464°F	**419°F**
Barrel Zone 3	410°F	440°F	464°F	**419°F**
Barrel Zone 4	410°F	440°F	446°F	**410°F**
Nozzle	420°F	450°F	518°F	**410°F**
Hot Runner Manifold	360°F	530°F	473°F	**410°F**
Hot Runner Nozzles	420°F	450°F	473°F	**410°F**
Mold (cavity plate)	100°F	140°F	266°F	**230°F**
Hot Runner Start-up Time to 440/450°F			18 mins	**10 mins**
Cycle Time			46 sec	**41 sec**

Note: Case study results of iControl Hot Runner Insulation installed on a 2 drop hot runner system processing talc filled polypropylene (PP) part (automotive air box)

DME iControl™ Hot Runner Insulation

Reducing Heat Loss & Minimizing Thermal Variation

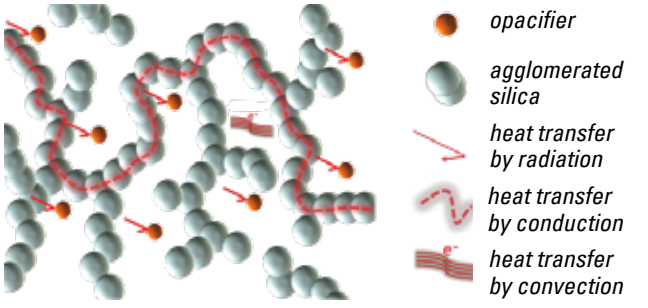
Today's hot runner systems rely on the use of an air gap to minimize the thermal transfer between the plates. However, air is a less effective insulator at elevated temperatures due to the property of diffusivity (rate of thermal transfer). In many hot runner systems the result is heat loss from the heated hot runner system to the adjacent cooled mold plates. Heat loss leads to increased hot runner power consumption to "replace" the lost heat and can also negatively impact the mold cooling process, as most often processing temperatures are increased more than necessary to overcome the losses. iControl insulation can mitigate this problem due to its superior insulation properties, especially at elevated processing temperatures.

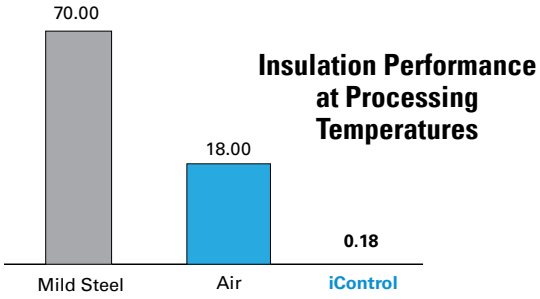


Just like a home, where it is desired for its temperature to be maintained, a thermal barrier is used to isolate the space from the surrounding environment. The thermal barrier is an insulator, and whether keeping the space hot or cool, the insulator reduces the required work of the heating or cooling system and creates a more balanced, uniform temperature in the space.

What is iControl Hot Runner Insulation?

The extremely low thermal conductivity of iControl is the result of its microporous structure and the addition of opacifiers. iControl material insulates against all three methods of heat transmission: conduction, convection and radiation. Low conduction is a result of the very small silica particle agglomerates of approximately 10nm which only have a single point to touch each other. Convection heat transfer is minimized by the unique nature of the micro pores which prevent the movement of air and hence the transfer of heat. Finally, the inclusion of opacifiers minimize heat transfer due to infrared radiation.





Insulation Performance at Processing Temperatures

DME iControl™ Hot Runner Insulation

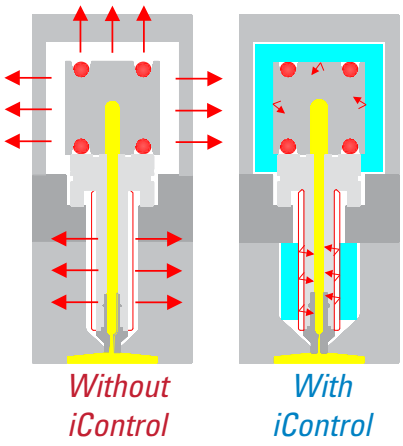
Boost Productivity - Lower Energy Consumption

Breakthrough in improving the performance of hot runner systems

The unique nano microporous material of iControl Insulation helps isolate the heat, reducing the heat loss and thermal variation of the hot runner system.

Easily installed at time of original build or later as a retrofit, iControl will greatly reduce the thermal variation throughout the manifold and nozzles so the temperature of the incoming resin closely matches the temperature at entry to the cavity.

Effectivity insulating the hot runner can mitigate cold spots and opens the possibility to lower both melt and mold temperatures.



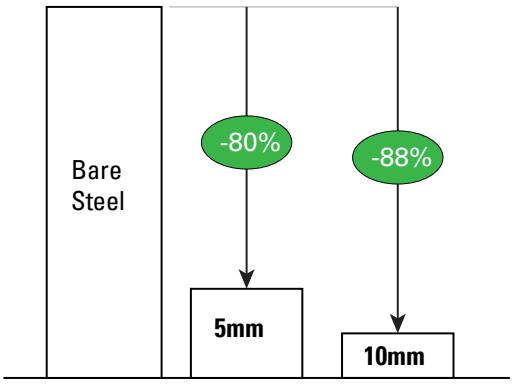
Result: Less heat in means less heat out for accelerated startups and faster cycle time.

Benefits of lower melt temperature:

- Faster start up times
- Reduced part cooling time
- More homogenous melt assuring better part quality
- Reduced energy consumption (lowering processing temperature = less power)
- Optimizing process temperatures protects heat sensitive materials such as optical grade resins, bioplastics and resins with high post-consumer recycled content

Hot Runner Surface Temp at Thermocouple

230°C / 450°F - Thermal Transfer Rate



Heat Loss by Insulation Thickness

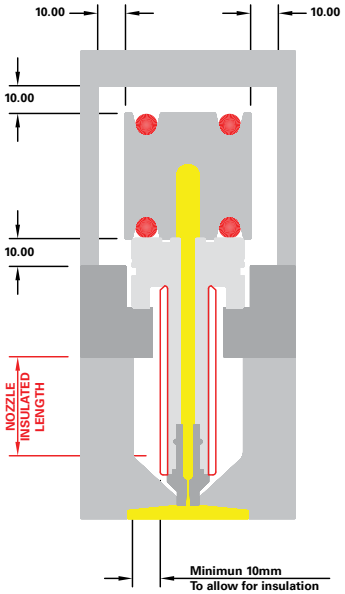
Variable Insulation Thickness	Surface Temp (°C)	Heat Loss (W/m^2)	Efficiency (%)
Bare	231.7	3879.00	
Layer 1 (5.0mm)	91.4	782.60	79.83
Layer 1 (10.0mm)	69.1	448.3	88.44

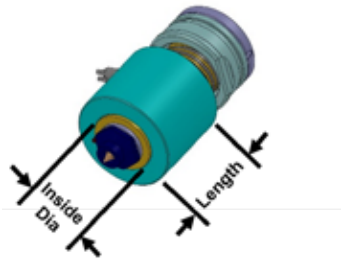
DME iControl™ Hot Runner Insulation

New to iControl Hot Runner Insulation - Standard Panels for Retrofit

Item Number	Description	Size
ICIP452508SS	iControl Insulation Panel	45mm X 25mm X 8mm
ICIP455008SS	iControl Insulation Panel	45mm X 50mm X 8mm
ICIP4510008SS	iControl Insulation Panel	45mm X 100mm X 8mm
ICIP4520008SS	iControl Insulation Panel	45mm X 200mm X 8mm
ICIP752508SS	iControl Insulation Panel	75mm X 25mm X 8mm
ICIP755008SS	iControl Insulation Panel	75mm X 50mm X 8mm
ICIP7510008SS	iControl Insulation Panel	75mm X 100mm X 8mm
ICIP7520008SS	iControl Insulation Panel	75mm X 200mm X 8mm
ICFLX4508915	iControl Flex Insulation	45mm X 8mm X 915mm Long
SSCT10	Stainless Steel Cable Tie	10" Long
SSCT12	Stainless Steel Cable Tie	12" Long
SSCT165	Stainless Steel Cable Tie	16.5" Long
SSTC14	Stainless Steel Cable Tie	14" Long
SSCT225	Stainless Steel Cable Tie	22.5" Long
303S	Heavy Duty Tin Snip - 10"	Multi-Purpose Cutter
303U	Industrial Duty Tin Snip - 10"	Multi-Purpose Cutter

Nozzle sleeves are not stocked due to internal diameter and length combinations. Please contact dmeus-csspecials@dme.net with your nozzle specifications.





iControl Space Requirements

Ideally a 10mm air space is required to accommodate iControl Insulation

iControl Insulation is Easy to Install!

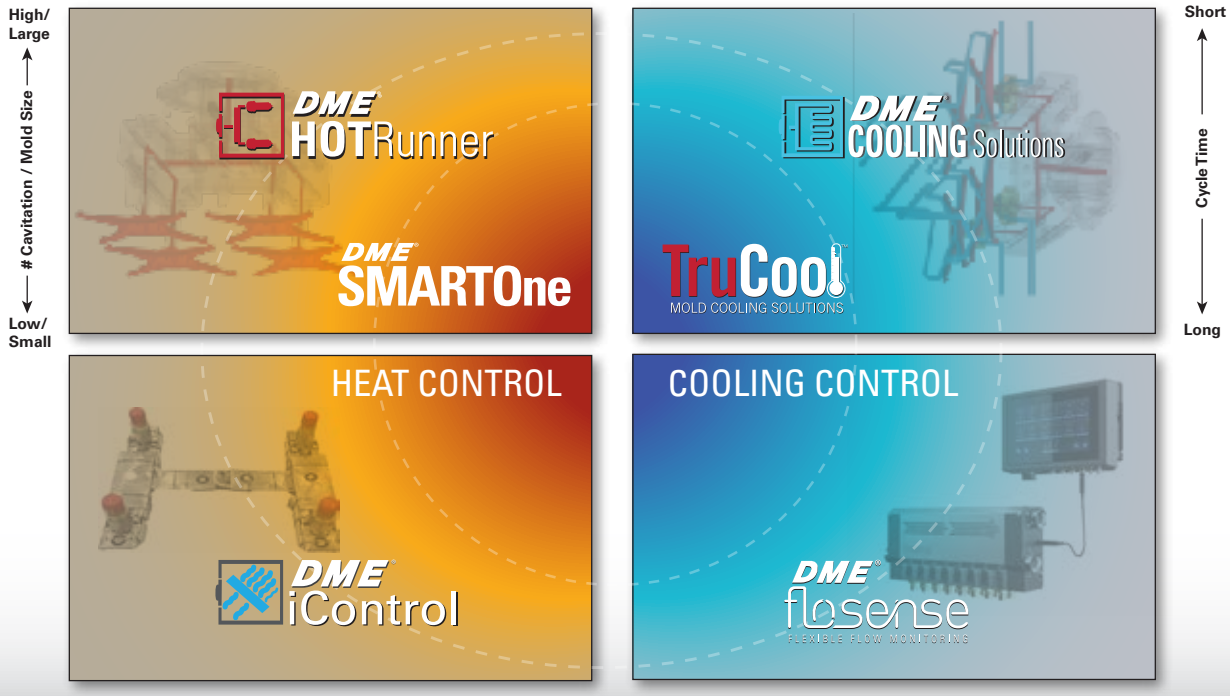
Perimeter flex wrap and rigid top and bottom manifold panels are held in place with stainless steel ties. Nozzle insulation is pre-fabricated tubes that simply slide over the nozzle assemblies.

iControl Hot Runner Insulation is available in stock panels OR can be custom made to your hot runner system's specifications

To request a quote please email 2D CAD of your manifold to DME's Mechanical Engineering Department: dme_mech_eng@dme.net

DME THERMAL MANAGEMENT

Our approach to the molding process is a scientific one. By understanding the type of resin and necessary flow requirements we can help you to optimize and control the thermal management of the manifold and nozzles. When combined with efficient cooling, the production output of high-quality parts can be maximized.



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