

## GET RID OF ISSUES DURING MOLDING PROCESS BY USING NEW DIMENSION OF MOLD TEMPERATURE MANAGEMENT

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### **EXTRACT**

*Injection moulding sector has a lot of restriction about productivity, quality, secondary process necessity etc. for plastic parts. The main point of the all are mould temperature management. Perfect mould temperature management gives permission to produce perfect condition parts. To having perfect mould temperature management way is using conformal cooling technology which means contour following cooling/heating channels equipped mould. Conformal cooling technology give a lot of benefits as well as reducing cycle time, better dimensional stability, better mechanical property and longer life time of final product. On the other hand, Conformal cooling technology gives to chance to use Rapid Heat & Cool technology on injection moulds. Nowadays painted parts are becoming more popular in the market which are automotive, white goods and electronical sectors. With the application of Rapid Heat & Cool process, paint elimination, better dimensional stability has been made very successfully until now.*

### **1 INTRODUCTION**

Basically, every mould is a heat exchanger. Efficiency or capability of heat exchangers mostly depend on engineering design on injection mould. Quality and cost efficiency in the plastic injection process depend significantly on the heat transfer quality between the mould surface and the molten material. Therefore, an optimum temperature profile on the mould surface is needed to achieve low cycle time and high part quality.

Cooling time is inefficient / lost time in the plastic injection process, so a small improvement in cooling time will directly increase efficiency. Conventionally designed cooling channels prevent using this potential, resulting in long cycle times and low part quality. But CONTURA® MTC technology overcomes all these limitations of conventional cooling. With CONTURA® MTC technology, the cycle time decreases by an average of 30%, and the following properties are also improved thanks to the optimum temperature profile provided on the mould surface.

### **2 THE IMPORTANCE OF MOULD TEMPERATURE MANAGEMENT**

Mould temperature management is quite important for injection moulds. Because driven factor is mould surface temperature for the:

- Cooling time
- Surface quality
- Dimensional stability
- Mechanical property
- Production sustainability
- Life time of production
- Maintenance performance

All of these factors show, mould temperature should be taken care by the producer carefully. First decision might be what will be necessary for best temperature management.

#### **2.1 Conformal Cooling**

Conformal Cooling means contour following cooling/heating channels using for injection moulds. That doesn't means that the cooling channel distance should be everywhere the same

but the distance should be calculated according to part thickness and plastic material.

As CONTURA®-MTC which is a solution company offers you the best possible service related to temperature control optimisation of the injection mould. Even highly complex components can be realised with CONTURA® MTC as a leading company in the development of contoured temperature control concepts.

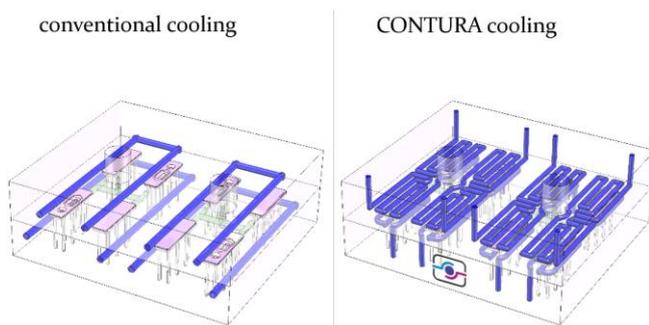


Fig. 1: Comparison of Conventional Cooling and Conformal Cooling

With CONTURA®-MTC Conformal Cooling Inserts are crucial for a lot of advantages.

These are:

- Cycle Time Reduction
- Better Dimensional Stability
- Better Mechanical Properties
- Reduction of mould correction loops
- Improvement of the process stability

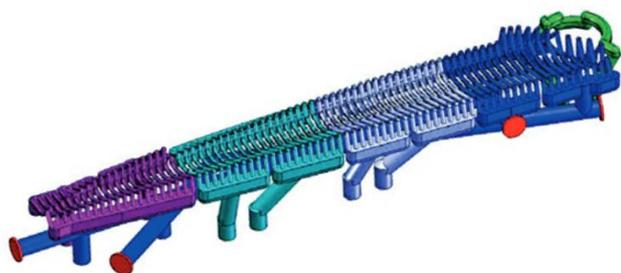


Fig. 2: Conformal Cooling Channels Design

As well as CONTURA®-MTC provide Conformal Cooling Solution for Rapid Heat &

Cool (Variotherm) Process including mould inserts and Variotherm device.

## 2.2 Rapid Heat & Cool

Rapid Heat & Cool means before injection phase heating up of the cavity or visual side of the mould after volumetric filling of the cavity, switch to cooling water through water channels until end of the cooling phase that needs for ejection of the plastic part.

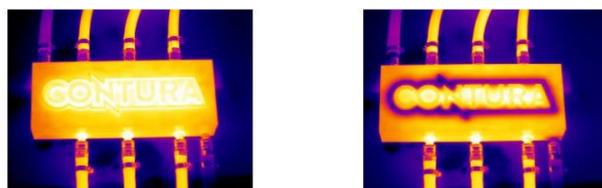


Fig. 3: Thermal Photo of Heating and Cooling Phase of the mould insert

The reason of using warmer cavity during injection phase is for:

- Less flow lines and silver streaks will appear
- More homogeneity in glass fiber distribution will be achieved
- Less weld or knit-lines will appear;
- Lower the risk for warpage caused by uneven shrinkage
- Better mechanical properties of the product
- Less sink marks will appear far from the gate



Fig. 4: Comparison of Rapid Heat & Cool and Conventional Molding

To have a better Rapid Heat & Cool Process, Injection moulds need to have conformal cooling.

The formula shows the reaction of the mould by switching the temperature of the coolant. According to this equation the most critical factor is the vertical distance between mould surface and cooling channels which means cooling channel design will be more critical that compares with conventional injection moulding process.

$$\tau_m = \frac{\rho_m c_m l_m^2}{K_m} \left( 1 + \frac{2WK_m}{h\pi D l_m} \right)$$

$\rho_m$  is the mold density  $c_m$  is the mold specific heat  
 $l_m$  is the vertical distance from conformal channels to mold wall  
 $K_m$  is the mold thermal conductivity

### 3 CONCLUSIONS

Most of injection moulding process using inefficient cooling system. Obviously, it shows us part producer under estimate the hidden potential of cooling system. 20 years experienced tells us, averagely %30 saving from the cycle time which means %50 of cooling time in total.

Furthermore, there is huge improvement on part quality with using Rapid Heat & Cool into the process. With this technology part producer can get rid of secondary process like painting.

In conclusion, using conformal cooling will dramatically increase productivity and decrease scrap rate and inefficient production time which helps to be able to have higher benefits and a big positive impact for environment. Saving the environment is already biggest discussion on the plastic industry and it will be the driven factor for plastic sector in future.

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