

# Mould design: Combined blow mould cooling

In the third of a series of four articles, Dominique Vassaux explains the importance of mould cooling, its influence on the performance of the IS process and on container quality.

Standard blow side VertiFlow equipment introduces cooling air at the base of the blow mould (via the bottom plate) and directs it upward to the top of the blow mould. The superiority of the BEG standard VertiFlow cooling is the total freedom on the cooling holes patterns. Depending on the body diameter of the container, the number and the diameter of the cooling holes must be correctly defined, as well as the correct distance between the mould cavity and the cooling holes. Patterns made of two rows of cooling holes with a distance of 12mm-17mm between the mould cavity and the cooling holes give the best cooling results.

A typical blow mould temperature distribution is illustrated. When using standard VertiFlow cooling, the bottom part of the blow mould is much colder than the body/shoulder part. This can be a drawback in production, as the mould extracts more heat from the glass in the bottom part and less heat in the body/shoulder part. This results in stiff glass in the heel/bottom part and soft glass in the body/shoulder part of the newly formed container.

The use of configured holes (or isolation grooves) along the length of the holes helps to make the vertical temperature more uniform but the

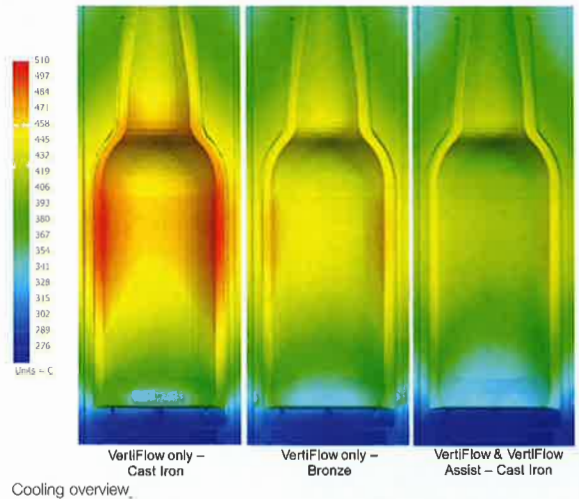
tendency still shows that the bottom part will be colder than the body/shoulder area. In addition, it is important to note that standard VertiFlow cooling can only be used when the blow mould is closed, just after the final blow event. This limitation in total cooling duration sometimes leads to blow mould cooling restrictions (mainly in NNPB).

## Additional cooling

In order to improve cooling at the blow side, BEG introduced 'VertiFlow Assist', which is an 'add on' cooling system to be used together with the standard VertiFlow cooling.

VertiFlow Assist is available on both AIS and NIS machines. On the AIS machine, the cooling air is supplied radially to the blow mould via the mould holder insert, whereas it is supplied vertically to the second row of cooling holes on the NIS machine.

Since standard VertiFlow and VertiFlow Assist can be timed independently, not only is it possible to significantly reduce the overall blow mould temperatures (up to 80°C in the shoulder area of a TG 4 ¼in blow mould) but the capability is provided to influence this 'combined cooling' system, in order to balance the temperatures vertically. This feature



Cooling overview

makes it possible for the production operator to achieve a homogenous temperature distribution within 20°C along the vertical and horizontal axes of the blow mould. This decrease in temperature amplitude (minimum, maximum) generates less stress in the mould material, leading to an increase in mould lifetime (up to 20%). It also results in potential speed increases of up to 5%, depending on the type of container produced.

## Temperature control

Looking into the near future, closed loop systems will enable the operator to control blow mould temperatures automatically, not only in amplitude but also in vertical temperature gradient distribution. If the temperature measuring system detects too high temperatures in the shoulder region, only the VertiFlow Assist duration will increase, lowering the temperatures in the shoulder of the mould.

In the same logic, in case the bottom part will be too cold, the closed loop system will only reduce the standard VertiFlow duration, warming up the heel region of the mould. In addition, having this first closed loop system to ensure homogenous blow mould temperatures, a second closed loop system between the BEG FlexRadar system and the thermal parison conditioning (total blank mould closed duration and/or blank mould cooling duration) can be used, in order to have direct control on the vertical glass thickness distribution of the container.

The fourth in this series of articles will be published in the January/February 2020 issue of Glass Worldwide. ●

## Best machine performance with the right cooling process

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<p><b>Blank mold cooling:</b> glass parison thermal conditioning ...</p> <p>InVertiFlow Preferred for: NNP&amp;B ... to ensure homogenous glass thickness distribution: a must for light weight containers</p>	<p><b>Blow mold cooling:</b> container stability ...</p> <p>VertiFlow ... to avoid "out of shape" containers: a must for high speed cavity rate productions</p>	<p><b>Mold design services:</b> simulations, calculations ...</p> <p>... virtual prototyping solutions to reduce time from mold design/development to efficient production</p>
<p><b>Blow side cooling:</b></p> <p>VertiFlow &amp; VertiFlow Assist</p>		

Blow side cooling.

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