Blow mould cooling

T BEWER DESCRIBES THE OUTCOME OF FIELD TESTS ON EQUIPMENT TO INCREASE THE BLOW SIDE COOLING CAPACITY

In order to guarantee high production speeds, flexibility and quality, predictable and efficient cooling systems for forming moulds are a necessity. On the blank side the cooling needs to be adjustable to achieve a desired temperature profile. On the blow side, however, the cooling needs to stabilise the container as quickly as possible. The cooling capacity has to be high, but still be able to influence the temperature profile.

Emhart Glass addresses these needs. Blank side demands are met by the new InVertiFlow cooling system. Emhart Glass developed a 360° auxiliary blow mould cooling which works in addition to the existing blow side VertiFlow cooling system.

AUXILIARY COOLING

The new auxiliary cooling system supplies air from the sides to the outer cooling bore row. Air is supplied via telescopic tubes which allow air supply from 360°, including mould travelling and in the open position. A pocket guarantees the even distribution of air on the bores. The air supply is timed by one on/off control per side. The system set-up is illustrated in Figure 1.

In order to supply the air from the pocket, supply bores have to be drilled to meet the cooling bores of the outer VertiFlow bore row. These bores should have about the same diameter as the cooling bores. If the 360° auxiliary cooling is not used and not mounted, the moulds can be used on standard VertiFlow systems without any restrictions or reduction in performance.

FIELD TEST RESULTS

Extensive laboratory and field tests were performed to identify the benefits of the auxiliary cooling system. These trials were aided by the use of Computational Fluid Dynamics (CFD) calculations.

In one example the temperature distribution on the cavity surface was determined in the field using a thermal imaging camera. The results (Figure 2) show a drastic improvement of the cooling capacity: mould temperature could be reduced by 100°C when the auxiliary cooling was turned on for 360° cooling time.

Further studies showed that one timing degree of auxiliary cooling corresponds to about 0.5 timing degrees of VertiFlow cooling. The results also indicate that the vertical temperature profile can be influenced by changing the auxiliary cooling timing relative to the VertiFlow timing. Furthermore the vertical temperature profile can be designed by varying the pocket position between the mould holder and by angling the supply bores.

THE HORIZONTAL PROFILE

As well as being able to influence the vertical temperature profile, the horizontal profile can be controlled by choosing which outer bores will be supplied. This will prove beneficial when producing non-round bottles, enabling an increase in cooling of the panel areas. This will also be an advantage for bottles with special engravings.

A transient CFD analysis of the temperature distribution on the moulds during the cycle showed that in addition to the cooling capacity improvements, auxiliary cooling equalises the mould temperatures during the forming cycle. At the inner cooling bores the cyclic temperature change is reduced by about 25% and on the outer bores by 75%. This reduces the likelihood of mould breakages in these regions.

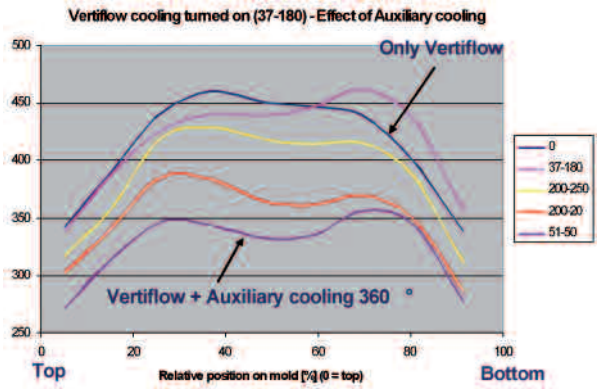

FIGURE 2: TEMPERATURE MEASUREMENTS WITH A THERMAL IMAGING CAMERA

CONCLUSION

These prototype tests demonstrated that combining the new 360° auxiliary cooling with VertiFlow offers the following benefits for container production:

- A potential to increase speed due to higher cooling capacity
- A potential to increase speed and optimise cooling conditions by influencing the horizontal and vertical temperature profile
- Longer mould life due to less cyclic temperature variation.

The mould modification required is easy and can be done on existing moulds. If the 360° auxiliary cooling is not used and not mounted, the modified moulds can be used on standard VertiFlow systems without compromising their efficiency.

Further field tests with the auxiliary cooling system are ongoing. ■

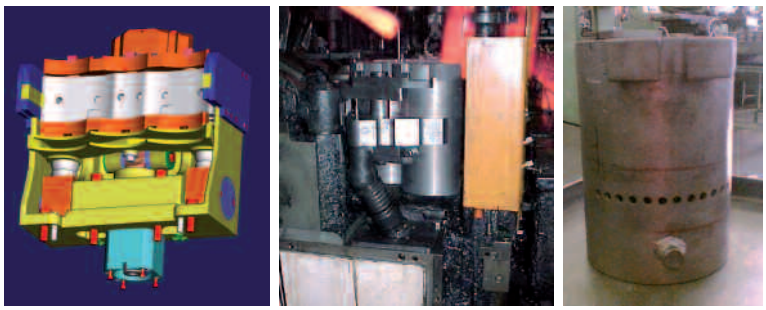

FIGURE 1: PRINCIPLE OF AUXILIARY COOLING ON THE NIS (LEFT), THE DG 5 $^{1}/_{2}$-INCH IN OPERATION (MIDDLE) AND NECESSARY MOULD MODIFICATION (RIGHT)

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