From The Desk Of

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SHORTENING THE COOLING TIME
IN
EXTRUSION BLOW MOULDING BY CHILLING THE BLOW AIR

In 1972 Hunkar Labs. Patented the Internal Surface Cooling (ISC) system.

This worked by using an unusually high blow air pressure and allowing it to expand through a small nozzle in the blow pin. The air was humidified so that the resultant cooling caused by the adiabatic expansion actually caused ice to form on the inside of the container.

The system worked very well and was quickly adopted my companies producing thick walled parts such as 25 lt jerry cans and 200 lt drums.

One by one these systems were abandoned because the multi stage compressors available at that time requited excessive maintenance.

This was before the era of PET bottle technology that has driven the development of high pressure compressors.

Produces of liquid gasses such as Distillers Co. and Linde both actively promoted systems that gave a squirt of liquefied gas (Nitrogen or CO2) into the container as it was being blown. Some of these systems are still in use.

Another approach is to cool the blow air in a recirculation loop. To prevent the system blocking up with ice some form of air drier is required.

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Firstly, A *little bit* of Polymer Rheology …

Polyolefin's (P.E. P.P.) do not have a specific melting point (the so-called glass transition point 'Tg')

When you see a big blob of purging on the floor and it changes from looking like a clear gel to milky white it is going through the "Glass Transition" point.

Amorphous materials such as PET, PVC have a 'sharp Tg',

Materials that don't have a sharp melting point just get softer and softer as they are heated, and somewhere over a range of temperatures you could say it has 'melted'

As a container cools in the mould the reverse happens, and at some point you decide to open the mould because the container is substantially stiff enough to do so.

The idea is that by removing heat from the internal surface the moment of mould opening can be sooner, so the production output is increased.

Pros and Cons of cooling the blow air…

Pros…

In any environment where continuous improvement is being encouraged it is inevitable that there will be interest in shortening the cycle time.

As the 'blow time' is often the longest part of the moulding cycle it is obvious that this is a good place to start the optimization process.

Obviously any investment that yields a payback in a period acceptable to a company should be investigated.

Cons..

Because the point at which the mould can be opened is not an exact moment in time it is often possible to improve the cycle time just by careful adjustment.

This should be done **before** any cooling system is installed otherwise the cooling system could get the credit for an improvement you could have had anyway.

When 'over enthusiastic' process improvements are made it is common that the machine will be run nearer to the edge of the comfortable 'processing window'

This can mean that you will either have to spend more time 'tweaking' to keep the containers in tolerance, or as so often happens the machine will be adjusted back towards its old 'slow' settings.

It is a known fact that the faster a moulding is cooled the more stresses with be 'built in' (This also goes for glass, metal, etc) If these 'stressed' containers are tested it is common that some factor such as drop test or environmental stress cracking (ESCR) will be adversely affected.

And Finally,

Fast cooling systems are not without their own problems and the extra maintenance requirements will add to the workload of personnel.

It is also a bit disconcerting that many blow air cooling systems have been removed. This comment applies mainly to the liquefied gas methods.

Just because “We tried this once and it didn't work” IS NOT a good reason to not investigate the subject again.

This is a typical mantra of older “know it all” curmudgeons!

Technology moves on.

Control systems are infinitely smarter than 20 years ago.

Beware of salesman's claims. Typically they quote some of the best results that have been achieved giving the impression that dramatic savings are typical.