Innovative spot cooling with liquid carbon dioxide (CO₂) efficiently supports the conventional water cooling of injection molds. In particular, CO₂ temperature control improves the cooling of hot spots in the mold, such as very thin parts, small cores, or areas with material accumulations. Here, the use of CO₂ can significantly reduce cooling and cycle times (by 50% or more). And because CO₂ spot cooling results in a more even temperature distribution, it decisively increases quality.

Uniform temperature distribution on the cavity surface is a crucial factor for high quality and short cooling times in injection molding. Generally, the temperature in molds for thermoplastic processing is controlled with water which is led through respective runners. Such a conventional water cooling proves to be inefficient where the space for cooling channels is limited.

Especially the conventional cooling of long, thin cores or other difficult-to-access areas faces severe problems. For example, temperatures often remain too high due to runners clogged by deposits. Moreover, small runner diameters as well as long distances between cooling channels and molding surfaces lead to high pressure losses. All this leads to removal problems, surface defects, warpage, and long cooling times. The only viable solution, then, is CO₂ spot cooling.

The CO₂ temperature control of hot spots is only used in areas of the mold where no other cooling method proves effective. Based on long-time expertise in cooling technologies, Linde has developed and refined the CO₂ spot cooling process for conventional steel molds.

Liquid CO₂ flows under high pressure (approx. 60 bar) through small, flexible capillary tubes (outer diameter ≤ 1.6 mm) to the point of use where the cooling is required. The CO₂ expansion creates a snow and gas mixture with a temperature of -79 °C and a high cooling capacity. After removing heat from the hot steel of the mold, the now gaseous CO₂ leaves the cavity through open exhaust channels. To use its high cooling potential, however, a controlled injection of CO₂ is absolutely essential.
Advantages

The high efficiency of CO₂ temperature control – low investment costs, easy installation, convincing results – make it very attractive for injection molding. CO₂ spot cooling is suitable for new molds as well as for retrofitting existing molds. In detail, it offers the following advantages:

- Significant reduction of cooling times
- Uniform temperature in mold and molding
- Higher quality and efficiency
- Intensive heat removal in problem areas (small cores, material accumulations)
- Thin, flexible pipes (d ≤ 1.6 mm)
- Easy installation in conventional tool steel

CO₂ supply concept

Only a reliable CO₂ supply concept ensures stable, repeatable cooling in injection molding. Depending on customers’ requirements and conditions, Linde offers such a concept. A suitable CO₂ tank with pressure boosting equipment – and, if required, a heater – supplies liquid and bubblefree CO₂. In terms of quantity, pressure and temperature, this system is flexible enough to meet the individual needs of different customers.

Service range

Linde offers full service:

- Analysis of the existing injection molding process.
- Feasibility study of the CO₂ temperature control for each product
- Economic calculation of the CO₂ temperature control
- Detailed modification layout
- Implementing the necessary equipment, including the CO₂ control device
- Installation of a suitable CO₂ supply system
- Start-up