

# PLASTINUM® Temp S.

Advanced temperature control of injection moulds with carbon dioxide.



# Hotspot cooling challenge.

Manufacturers of injection-moulded plastic parts face two key challenges. On the one hand, expectations surrounding surface quality and performance of moulded parts are rising. And, on the other, productivity pressures are growing as operators look for ways to further reduce cycle times through accelerated cooling. Both of these challenges can be met by ensuring uniform temperature distribution on the mould cavity surface.

Many thermoplastics processors rely on water to cool moulds. However, flowing water through cooling channels quickly reaches its limits if space for the channels in the mould is restricted. This is typically the case when cooling long, thin cores or other tiny or difficult-to-access areas (known as hotspots). In addition, the water channels required to reach these areas are exceptionally thin and prone to clogging as a result of deposit build-up. In addition, small coolant duct diameters and long distances between cooling channels and moulding surfaces lead to high pressure losses in the cooling system. All of this results in insufficient cooling performance with long cycle times, caused, for example, by difficulty in removing the part from the mould, surface defects and warpage.

With PLASTINUM® Temp S, Linde has developed an innovative technology to reach these hotspots and ensure rapid, even cooling efficiency.

## Up to 50% reduction in cycle times with PLASTINUM Temp S

PLASTINUM Temp S uses liquid carbon dioxide (LIC) to cool hotspots in plastic moulds. This innovative, patented solution is ideal for areas of injection-moulded products that are difficult to access or prone to material accumulation. In other words, areas where water or other cooling methods are ineffective. It is usually combined with conventional water cooling for maximum flexibility. By ensuring cooling of hotspots, PLASTINUM Temp S can thus accelerate cycle times by up to 50% depending on part geometry and material. In addition, carbon dioxide (CO<sub>2</sub>) results in more even temperature distribution along the mould surface. This greatly enhances the quality of the moulded part by eliminating surface defects, sink marks and warpage.



*“With PLASTINUM Temp S from Linde we are able to significantly reduce cycle times and at the same time ensure our high quality standards in the production of plastic parts for high-performance pressure washers.”*

**Steffen Ammon**, Head of Plastic Injection Moulding at Adolf Föhl GmbH + Co KG. Föhl has 25 hydraulic and two all-electric injection moulding machines with locking forces between 35 and 300 tonnes.



The CO<sub>2</sub> control device for PLASTINUM Temp S enables easy adaptation of the CO<sub>2</sub> cooling parameters to the process.

## Precision-engineered for optimum outcomes.

Drawing on our many years of expertise in cooling technologies, we teamed up with plastics consulting, research and testing expert Kunststoffinstitut Lüdenscheid (K.I.M.W.) to ensure optimum cooling outcomes with our PLASTINUM Temp S process. With PLASTINUM Temp S, liquid CO<sub>2</sub> flows at high pressure (approx. 60 bar) through thin, flexible stainless steel capillary tubes to the hotspot in the mould. For maximum accessibility, these tiny tubes have outer diameters of 1.6 mm or even less depending on individual requirements.

The CO<sub>2</sub> expands as it reaches the hotspot to form snow and a gas mixture at a temperature of -79°C. The CO<sub>2</sub> sublimates, efficiently withdrawing the heat from the hot steel of the mould in the process. The gaseous CO<sub>2</sub> then leaves the mould through the annular gap between the hole and capillary tube. To capitalise on the high, local cooling potential of CO<sub>2</sub>, it must be precisely controlled and injected under stable conditions.

### Benefits at a glance

PLASTINUM Temp S can be installed quickly and easily both in new and existing moulds. It offers a host of advantages:

- Up to 50% reduction in cycle times
- Uniform temperature in mould and moulding
- Higher efficiency and part quality by eliminating surface defects, sink marks and warpage
- Intensive heat removal in problematic hotspot areas
- Thin, flexible capillary tubes with standard outer diameter of 1.6 mm
- Special, even smaller outer diameters down to 0.8 mm available on request
- Easy installation in conventional tool steels with low investment costs
- No sealing of the mould inserts required

# All-in-one technology package.

PLASTINUM Temp S builds on our PRESUS® family of cost-effective, high-pressure gas supply solutions. PRESUS C is an energy-efficient, pressure boosting unit for CO<sub>2</sub>-based moulding processes. It is one of the core building blocks within our end-to-end carbon dioxide supply concept, rounded off with a liquid storage tank and CO<sub>2</sub> control device. The entire package has been specially engineered to maximise the physical properties of CO<sub>2</sub> as a cooling agent for stable, predictable outcomes in injection moulding.

## Benefits of PRESUS C

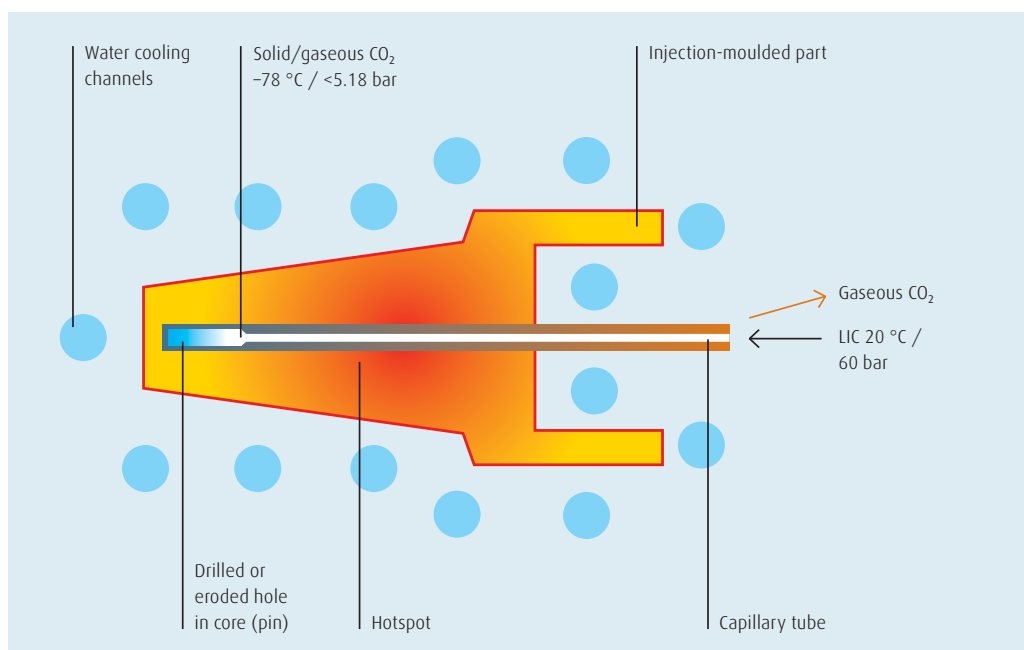
- Simple and inexpensive installation
- No additional pressurising devices required
- High degree of reliability – proven by numerous customer installations
- Up to 95% lower energy consumption
- Oil-free operation compared with gas compressors

## Success through close collaboration

We complement our PLASTINUM Temp S suite of technologies with a rich portfolio of hands-on services to ensure you are investing in the technology that offers your specific process the greatest optimisation potential. Typical lifecycle services include:

- Analysis of your existing injection moulding process, including analysis of temperature distribution with an infrared camera
- Feasibility study evaluating CO<sub>2</sub> temperature control for each moulded part plus cost efficiency analysis (using our cost-benefit calculation)
- Detailed engineering plans outlining where to position capillary tubes in the mould for optimal temperature control; specification of modifications to be executed by the mould maker
- Trials at your site using the modified mould
- Installation of complete PLASTINUM Temp S system, including CO<sub>2</sub> bulk tank, pressure booster (PRESUS C) and CO<sub>2</sub> controller
- Full commissioning service and support
- Aftersales service / maintenance

## Mould with conventional water cooling (channels) and CO<sub>2</sub> (spot) cooling of the core (pin)





Kärcher pressure washer part, created using PLASTINUM Temp S technology.



Föhl uses PLASTINUM Temp S to produce plastic components for Kärcher® pressure washers.

## Global network of plastics experts. At your service.

Building on many decades of experience in the delivery of industrial gases to support plastics manufacturing processes, we have pioneered multiple gas-enabled solutions to increase your productivity and efficiency. We back these up with in-depth consulting and professional support to help you identify the gas injection moulding process best suited to your individual application landscape. Our global network of gas experts uses sophisticated test equipment and our Value Tool to show how our enhanced gas injection moulding technologies and PRESUS high-pressure solutions can translate into energy, maintenance and productivity savings for your individual process flow.

To keep our customers ahead of the curve, we continue to work with our partners in the plastics industry to research and develop new innovations – particularly in the area of enhanced temperature control – and to enhance the functionality of existing solutions. Many leading manufacturers rely on our expertise and technologies today.

For more information, please visit [www.linde-gas.com/plastinum](http://www.linde-gas.com/plastinum) or send an email to [plastics.rubber.team@linde.com](mailto:plastics.rubber.team@linde.com)

### The environmentally friendly option

Carbon dioxide (CO<sub>2</sub>) is used across a broad spectrum of industrial applications, plastics included. Like all gases, it must be stored and used correctly and safely – and this calls for specialist knowledge. We have developed a package of dedicated product stewardship services, which includes education and consulting, to support you in the safe handling and use of this gas. Committed to mitigating the effects of climate change, we seek to minimise our carbon footprint by recycling CO<sub>2</sub> instead of generating new streams of this gas. Consequently, around 80% of the CO<sub>2</sub> that we supply comes from chemical processes where the CO<sub>2</sub> occurs as a by-product – such as ammonia synthesis or ethylene oxide production. And the remaining 20% of the CO<sub>2</sub> we deliver originates from natural sources.

**Linde AG**

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