Making our world more productive

PLASTINUM® GIM.

Enhanced gas injection moulding solutions.

Car handle

Car door panel

Plastics expert.

We have many years of experience in the development and delivery of innovative gas-enabled solutions tailored to the needs of the plastics industry. Addressing the process challenges of both injection moulding and foaming applications, our end-to-end offering extends from high-pressure supply and metering systems through cooling technologies to total gas supply solutions and supporting services.

Over the years, we have evolved standard gas injection moulding processes, also developing the PLASTINUM® GIM package to boost your productivity, enhance your product quality and strengthen your profitability.

Car handle

Fridge handle

The evolution of GIM.

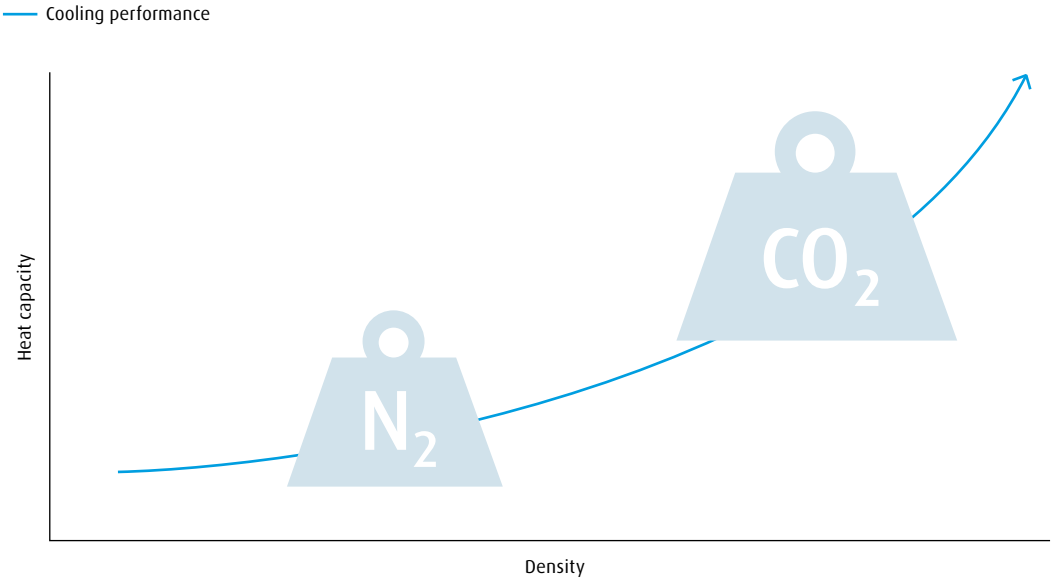
Demand for injection-moulded plastic parts is rising, as are expectations surrounding the surface quality of moulded parts. Many manufacturers already rely on state-of-the-art gas injection moulding (GIM) processes to solve today's product design challenges. GIM is typically used to manufacture handles for cars and white goods, automotive panels and similar parts with thicker cross-sections.

Over the past decade, water injection moulding (WIM) has grown in popularity as an alternative to GIM, especially for fluid pipes. Despite its high heat removal capacity and good pressurising performance, water has various handling drawbacks, including the need for drying and the risk of water leakage resulting in surface damage.

Over time, we have been systematically innovating standard GIM methods. These include the short-shot process, the process with overflow cavities and the push-back process. All of these basic processes rely on one single nitrogen injector operating at pressures between 50 and 340 bar.

We refined these basic GIM variations by adding a patented inner cooling process. Here we mounted a second injector opposite the primary injector to push high-pressure nitrogen through the product more effectively and remove heat from the surface of the gas channel. The benefits of nitrogen flushing are shorter cycle times and improved dimensional stability.

Density at actual pressure and temperature



The next level.

To further increase the competitive and technical gains offered by GIM, we went on to develop the PLASTINUM GIM package.

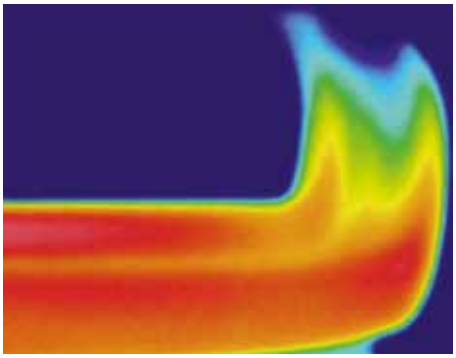
Regular GIM uses high-pressure nitrogen (50 to 340 bar) to shape a hollow or channel in a plastic part with a thicker cross-section. Our PLASTINUM GIM technology takes efficiency to the next level by replacing nitrogen with carbon dioxide (CO_2). At a pressure higher than 150 bar, carbon dioxide is much more dense than nitrogen and almost as dense as water. Thus while CO_2 matches the heat removal and pressurising performance of GIM and WIM, it has the added advantage of eliminating an additional drying step in the fluid injection cycle.

Bundled innovation

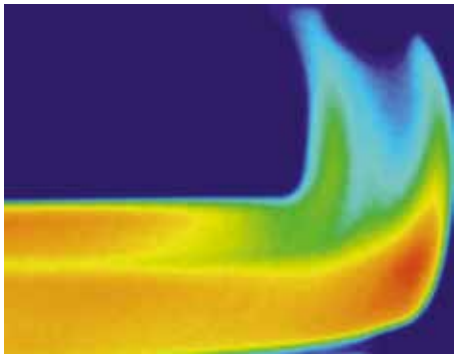
PLASTINUM GIM shortens cycle times and enhances productivity by bundling a range of innovations. Highlights include:

- PLASTINUM GIM I
  Optimised inner cooling process with improved injector technology
- PLASTINUM GIM C
  Use of a higher density gas (carbon dioxide) for enhanced cooling power
- Enhanced cooling for hotspots in the gas channel
  A secondary CO_2 shot is injected into the gas channel after the initial CO_2 or N_2 GIM shot, either through the main injector or a second injector on the opposite side

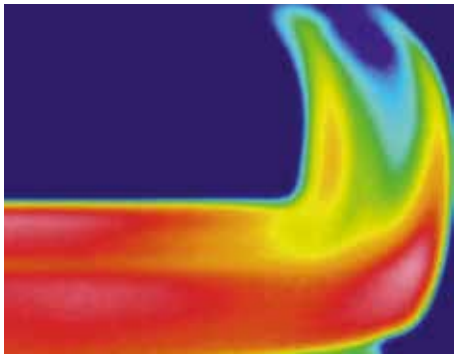
Cycle time reduction using carbon dioxide



Temperature distribution for GIM using nitrogen (state-of-the-art process)



Temperature distribution for GIM using CO_2 (same cycle time as nitrogen)



Temperature distribution for GIM using CO_2 with 28% reduction in cooling time

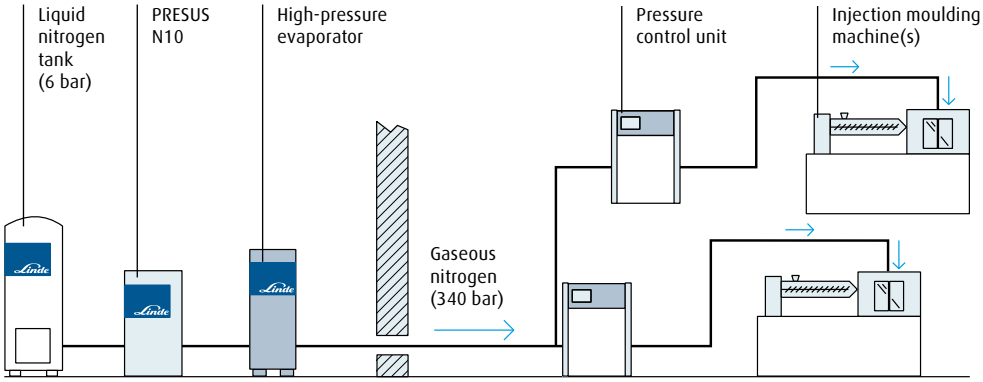
Increasing efficiency further through inerting

In addition to the above innovations, PLASTINUM GIM P uses an inerting step to further enhance productivity and quality. It does so by reducing downtime and scrap rates caused by dirt. Clogging can occur in the gas injectors and the supply system as a result of oxidised residue from polymers and additives. An inert gas can be injected into the cavity or the hopper to avoid this oxidation and the build-up of dirt.

PLASTINUM GIM at a glance

- Ideal process for precision-engineered plastic parts
- Design advantage with enhanced part quality
- Greater productivity and profitability with up to 50% reduction in cycle times
- Reduced maintenance effort with almost zero downtime thanks to inerting properties of nitrogen
- Elimination of water handling issues associated with water injection moulding
- Innovation lead thanks to various patent-protected technologies from Linde

Schematic of high-pressure nitrogen supply concept with PRESUS N10



All-in-one package.

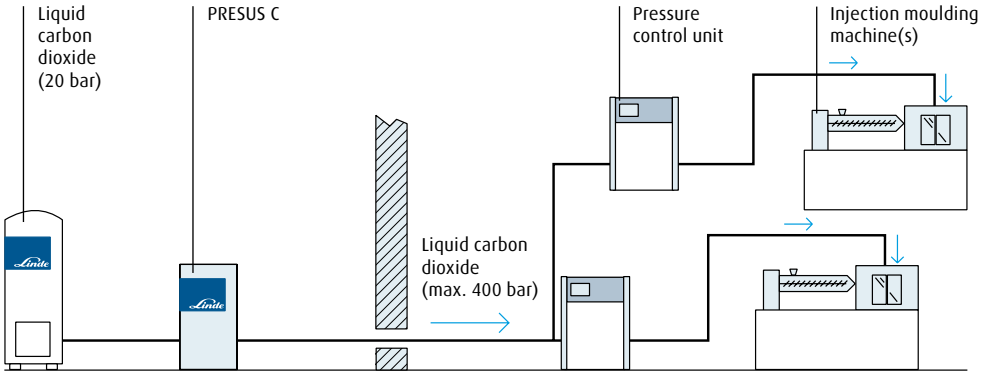
Our PLASTINUM GIM technology package is generally built on our PRESUS® family of cost-effective, high-pressure gas supply solutions for both nitrogen and carbon dioxide. Both PRESUS N10 (for nitrogen) and PRESUS C (for carbon dioxide) are energy-efficient, single-stage pressurising units. Other components typically include gas tanks and evaporators, backed by supporting consultation, integration and commissioning services.

The PRESUS N10 is simply integrated into the customer's nitrogen storage and supply setup along with the liquid nitrogen storage tank. Unlike conventional high-pressure compressors, our compression solution ensures a gaseous nitrogen stream that is as pure as the liquid nitrogen in the tank. The gas is supplied at a pressure of up to 340 bar at a minimum flow rate of 130 m^3/h.

Benefits of PRESUS

- Simple and inexpensive installation
- No additional pressurising devices required
- High degree of reliability – proven by numerous customer installations
- Low energy consumption, up to 95% lower than state-of-the-art gas compression units
- Absolute oil-free operation compared with gas compressors

Schematic of high-pressure carbon dioxide supply concept with PRESUS C



Global network of experts. At your service.

Building on many decades of experience in the delivery of industrial gases to support plastics manufacturing processes, we have developed many pioneering 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 value tools 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 or send an email to plastics.rubber.team@linde.com

The environmentally friendly option

Carbon dioxide (CO_2) 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_2 instead of generating new streams of this gas. Consequently, around 80% of the CO_2 that we supply comes from chemical processes where the CO_2 occurs as a by-product – such as ammonia synthesis or ethylene oxide production. And the remaining 20% of the CO_2 we deliver originates from natural sources.

Linde GmbH
Gases Division, Dr.-Carl-von-Linde-Strasse 6–14, 82049 Pullach, Germany
Phone: +49 89 7446 0, plastics.rubber.team@linde.com, www.linde-gas.com/plastinum

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