

Airmould

Internal gas pressure technology

world of innovation



FLUID-ASSISTED INJECTION MOLDING

For “thick” parts with an attractive surface

Fluid-assisted injection molding is a process in which a gas (usually nitrogen) or a liquid is injected into a mold cavity partly or completely filled with melt. The pressurized gas forms a bubble at the center of the melt, which counteracts shrinkage and thus removes sink marks. By reducing the quantity of plastic material and enlarging the cavity, targeted production of light-weight parts with excellent surface quality can be achieved with short cycle times. Due to its high heat conductivity and high degree of incompressibility, water is used primarily as a flexible piston to produce complex hollow structures, such as three-dimensional media duct systems. Both processes open up extensive scope for parts designers to realize complex molded components in one piece and with smooth surfaces. For the sake of completeness it should be mentioned that in both processes most of the “fluids” can be restored to the environment after the parts have been formed.

The advantages

- » Quality improvement
- » Elimination of sink marks
- » Elimination of warpage due to shrinkage
- » Reduction of the required clamping force
- » Reduction of cycle time
- » Weight reduction
- » Additional scope for design

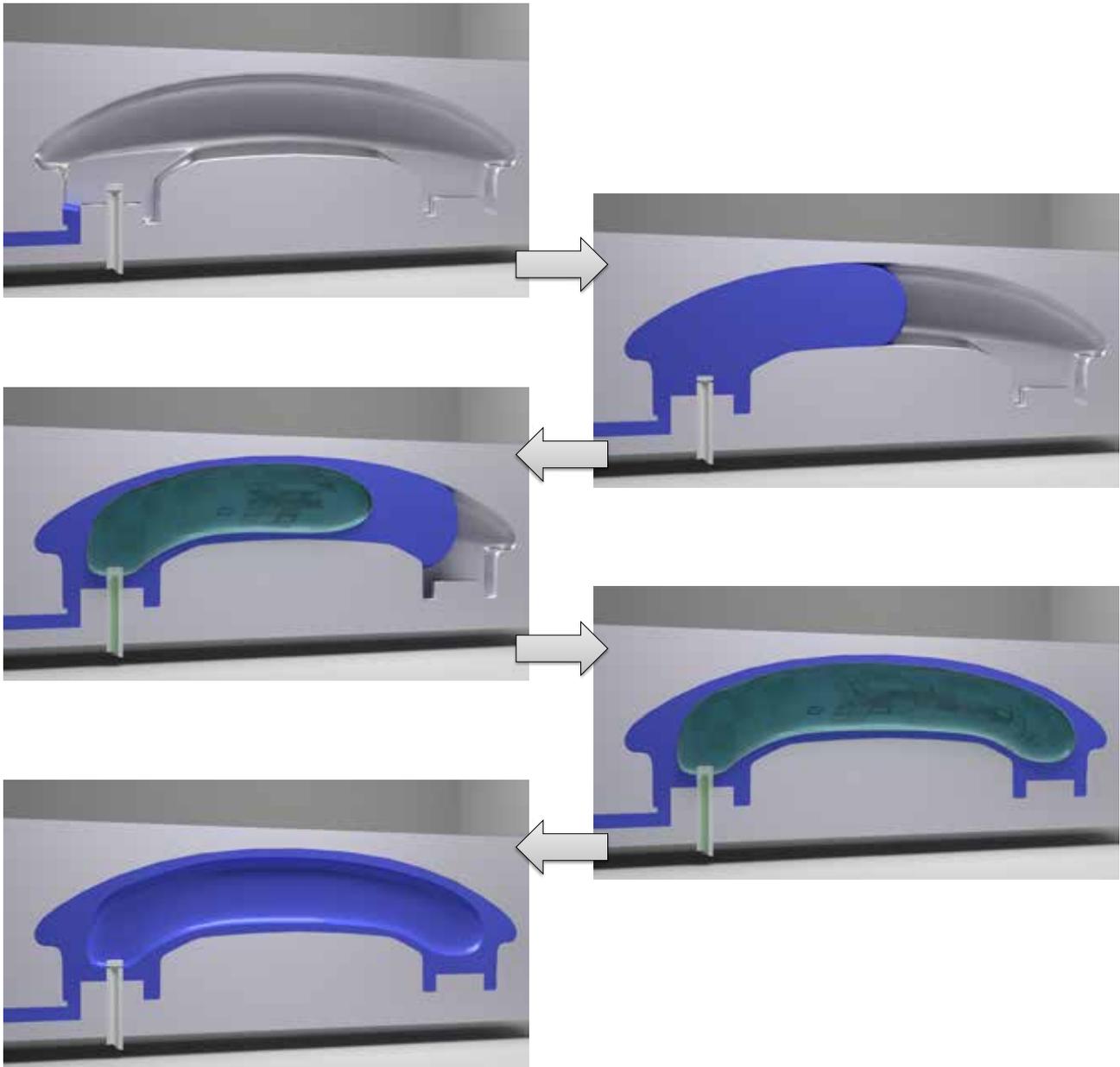


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Internal gas pressure process

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Internal gas pressure technology is used in several different process variants, depending on the parts geometry, the plastic material used and the specific requirements for the product. Basically, a distinction is made between the "partial filling process", the "spill-over cavity process" and the "shrinkage compensation process". The three processes differ from each other by their specific mold technologies and the equipment and control system variants of the injection molding machine. All three process variants can be realized with the modular Airmould gas supply systems.

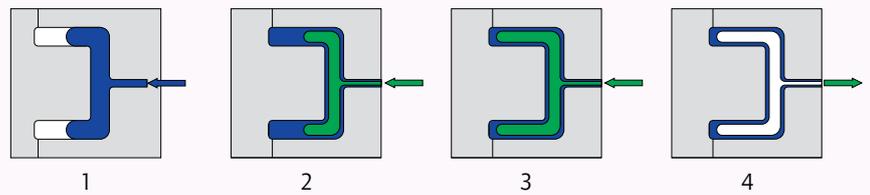


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The process variants in detail

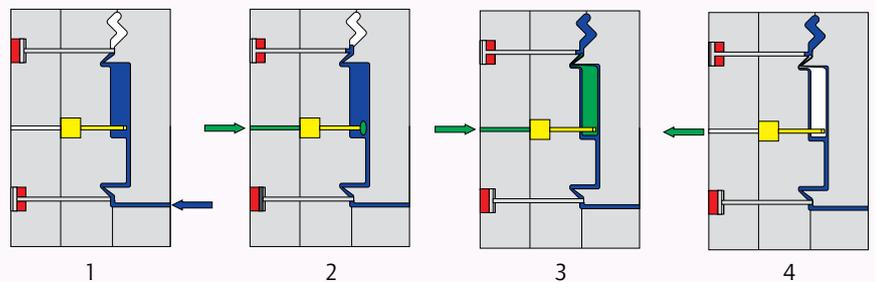
» Partial filling process

Partial filling is the standard process. The cavity is partially filled with melt [1]. Next, gas is injected. It forms a gas bubble inside the hotter core area with lower viscosity and displaces this part of the melt until the cavity is completely filled [2]. The gas pressure is maintained as holding pressure for shrinkage compensation [3] and finally removed prior to mold opening [4]. Gas injection through the Airmould nozzle of the machine serves to seal the sprue.



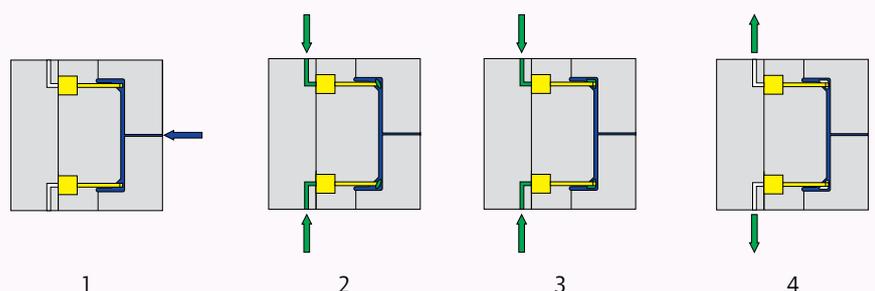
» Spill-over cavity process

As process step No. 1, the cavity is completely filled with melt [1]. If necessary, holding pressure is applied to the melt. Then the spill-over cavity (overflow) is opened and nitrogen injected [2]. The gas displaces melt from the core area of the plastic material into the overflow. Subsequently, the gas pressure is maintained as holding pressure throughout the entire cooling period [3] and thus counteracts shrinkage. The gas pressure is removed prior to opening the mold [4].



» Shrinkage compensation process

First, the cavity is completely filled with melt [1]. Then nitrogen is injected [2] and supplies the holding pressure to counteract shrinkage [3]. The gas forms channels inside the molded part, in which gas pressure is maintained throughout the cooling period and thus counteracts shrinkage. Depending on the molded part, the gas is injected either through aggregates inside the mold or the Airmould nozzle of the machine. The gas pressure is removed prior to mold opening [4].



Module system

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Different molded parts, machine sizes and fields of application require different internal gas pressure equipment. For optimal adjustment to all types of requirements and conditions, WITTMANN BATTENFELD has developed the Airmould module system.

Airmould internal gas pressure technology is independent of machine models and can also be used on machines of other brands.

» **Pressure generator**

Nitrogen is used as pressure medium, since it does not form any chemical bond with the plastic material. In the pressure generator, the nitrogen is compressed to an appropriate pressure level. For low gas consumption, the use of nitrogen bottles or gas cylinder manifolds is recommended. For equipment with a high nitrogen consumption, the pressure generator can be combined with a nitrogen generator from the Airmould module system and extract the nitrogen from the ambient air directly next to the machine.

» **Process control**

The Airmould process can be monitored and controlled via the machine's control system, or alternatively via the touch screen of a separate control cabinet or a manual control unit.

» **Gas pressure control**

To control the gas pressure, individual pressure control modules are used which can be mounted close to the mold to ensure an optimal, cost-efficient process by keeping the gas pipes as short as possible.

» **Gas injection**

The gas is injected either through the Airmould machine nozzle or via gas valves located directly inside the mold.



GAS SUPPLY UNITS

Powerful, for one or several machines

Pressure and nitrogen generators

The nitrogen and pressure generation equipment developed and manufactured by WITTMANN BATTENFELD is available in different sizes and with varying capacities, either to supply individual machines or as central systems to supply several machines.



Control system

The control system of the pressure generators is self-explanatory. All important information from the pressure generators and, as an option, from the nitrogen generators are displayed clearly and in a simple way. The equipment's control system can be integrated into the corporate network. In this way, all parameter settings and signals of the equipment can be transmitted to any network-compatible PC.

Advantages

- » Self-explanatory, clear and simple
- » 5.7" color TFT display with touch screen
- » Network-compatible
- » Protection by password against unauthorized operation

PRESSURE AND GAS GENERATION

With two output levels



DE pressure generator

The pressure generators compress the nitrogen to a sufficient pressure for all Airmould applications. Depending on its capacity, one unit can supply either one or several machines. With the help of a modern control system, the pressure generators can be operated by remote control via the corporate network. With its modular design, every pressure generator can be retrofitted with a nitrogen generator at any time.

Advantages

- » Retrofit with a nitrogen generator possible at any time
- » Modern control system with remote control function
- » Small footprint
- » Compact, sound-insulated unit



Type	Output		Drive power ND kW	Max. working pressure bar	Storage capacity ltr	Weight kg	Dimensions (D x W x H) mm
	Nl/min	Nm ³ /h					
DE 250	250	15	5,5	330	50	690	1734 x 789 x 2077
DE 450	450	27	7,5	330	50	710	1734 x 789 x 2077

SE Nitrogen generator

With the nitrogen generator extension modules of the SE series, every pressure generator can be converted into a self-sufficient appliance. Special filter membranes are used to extract the nitrogen from the ambient air. The extension modules are adapted to fit the matching pressure generators of the DE series and can easily be retrofitted at any time.

Advantages

- » Independent operation, no logistic expense to replace nitrogen bottles
- » Nitrogen purity of at least 98 %
- » One control system for the entire equipment
- » Compact, sound-insulated unit



Type	Output		Drive power ND kW	Max. working pressure bar	Storage capacity ltr	Weight kg	Dimensions (D x W x H) mm
	Nl/min	Nm ³ /h					
SE 250	250	15	11	6	20	800	1580 x 900 x 1980
SE 450	450	27	18,5	6	40	950	1737 x 1010 x 2050

The compact system for all injection molding machines with a EUROMAP 62 interface

Thanks to the modular design of Airmould 4.0, all components can be easily integrated into all machines, and without taking up much space either. The system consists of three components: the manual operating terminal for simple, graphically supported process control, the central processing unit to coordinate all components with each other, and the pressure control module, to be mounted close to the consumer to minimize gas consumption.

- » Extendable to up to 8 modules at any time
- » Space-saving and easy to integrate in all machines
- » Easy data interchange via USB
- » Access control via user group administration
- » Pressure monitoring program to detect leakages on the molded part
- » Impulse programs for automatic purging of the injection components



Manual operating terminal

The small, compact manual operating terminal can be easily attached to all machines by means of a wall bracket.

- » Small control unit, measuring no more than 200 x 165 mm, easy to integrate in all machines
- » 5.7" touch screen
- » 8 pressure and time profile points are available for each pressure control module.
- » Impulse program for purging of gas injectors at regular intervals
- » Pressure profile monitoring for a safe process
- » Graphically supported data input and process control
- » USB connection for easy data transfer
- » Easy controlling of 1 to 8 modules
- » Supports Wittmann 4.0



Central processing unit

The central processing unit can be mounted freely anywhere on the machine. The unit is available in two different versions: one with its own 24V power connection to operate up to 8 modules, the other a small version without power plug to operate up to 2 modules

- » Modest space requirements of no more than 330 x 300 x 330 mm
- » Easy connection of all components



Control modules

Regulation of the gas pressure is carried out via at least one pressure control module. The gas present inside the pipe between the gas injection point and the pressure control module is lost in every cycle. Short connection distances are desirable to minimize this loss of gas. The compact design of the gas pressure control modules enables their positioning close to the gas injection point either on the machine or on the mold. This ensures accurate pressure regulation and minimizes nitrogen consumption as well. The connection is made with short, small-volume, high-pressure hoses. The gas pressure is regulated via high-precision valves. The valves are electrically actuated directly without requiring any additional compressed air or hydraulics. Thanks to the special structure of the control module, precise regulation and monitoring of the gas pressure is ensured for both small and large volumes of gas. The pressure control modules are equipped with inlet and outlet filters. For easy power connection, several modules can be integrated into in a serial circuit.



PROCESS CONTROL

Integrated in the machine's control system

The Unilog B8 machine control system is the WITTMANN BATTENFELD solution to simplify the operation of complex processes. For this purpose, the integrated industrial PC has been fitted with an enlarged intuitive touch screen operating panel. The visualization is the interface to the new Windows® 10 IoT operating system, which offers extensive process control capacities. In addition to the swivel-mounted display screen unit, the machine's central console is equipped with an integrated manual operation panel / terminal.



Advantages

- » The selected pressure profiles are shown as curves.
- » The actual value pressure curves for all pressure control modules can be displayed simultaneously.
- » Simultaneous display of gas pressure curves and machine-relevant process curves in one chart
- » The data are saved together with the machine data.
- » Data output is effected via a USB flash drive.

GAS INJECTION

Nozzles and injection elements

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» Nozzles

Special Air mould nozzles have been designed to inject the nitrogen through the nozzle of the machine. The Air mould nozzles prevent the nitrogen from entering the barrel during gas injection. The nozzle's connection dimension is identical with that of a standard nozzle, so that it can easily be retrofitted to any machine.

» Injection elements

Via an injection element, the nitrogen is injected into the mold. The elements are available in different lengths and diameters, so that a suitable element can be chosen for every application.

Advantages

- » The injection element is inserted and sealed from the rear of the mold.
- » Easy cleaning: where necessary, cleaning can be effected within a very short time by unscrewing the element head from the open mold.
- » Small apertures in the mold: the aperture in the mold corresponds to the diameter of the injection element.

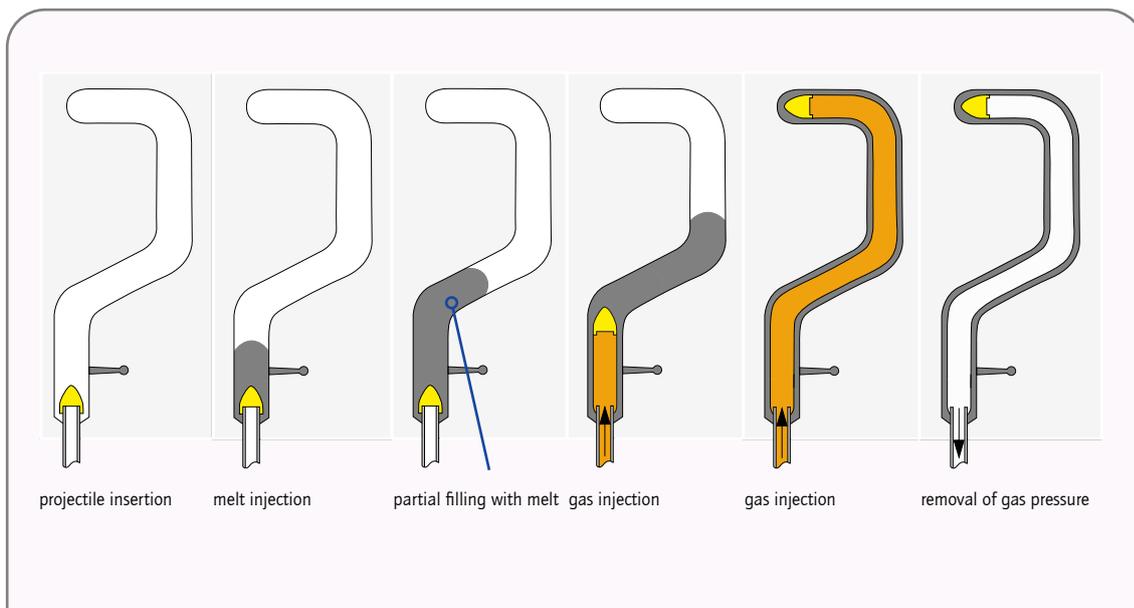


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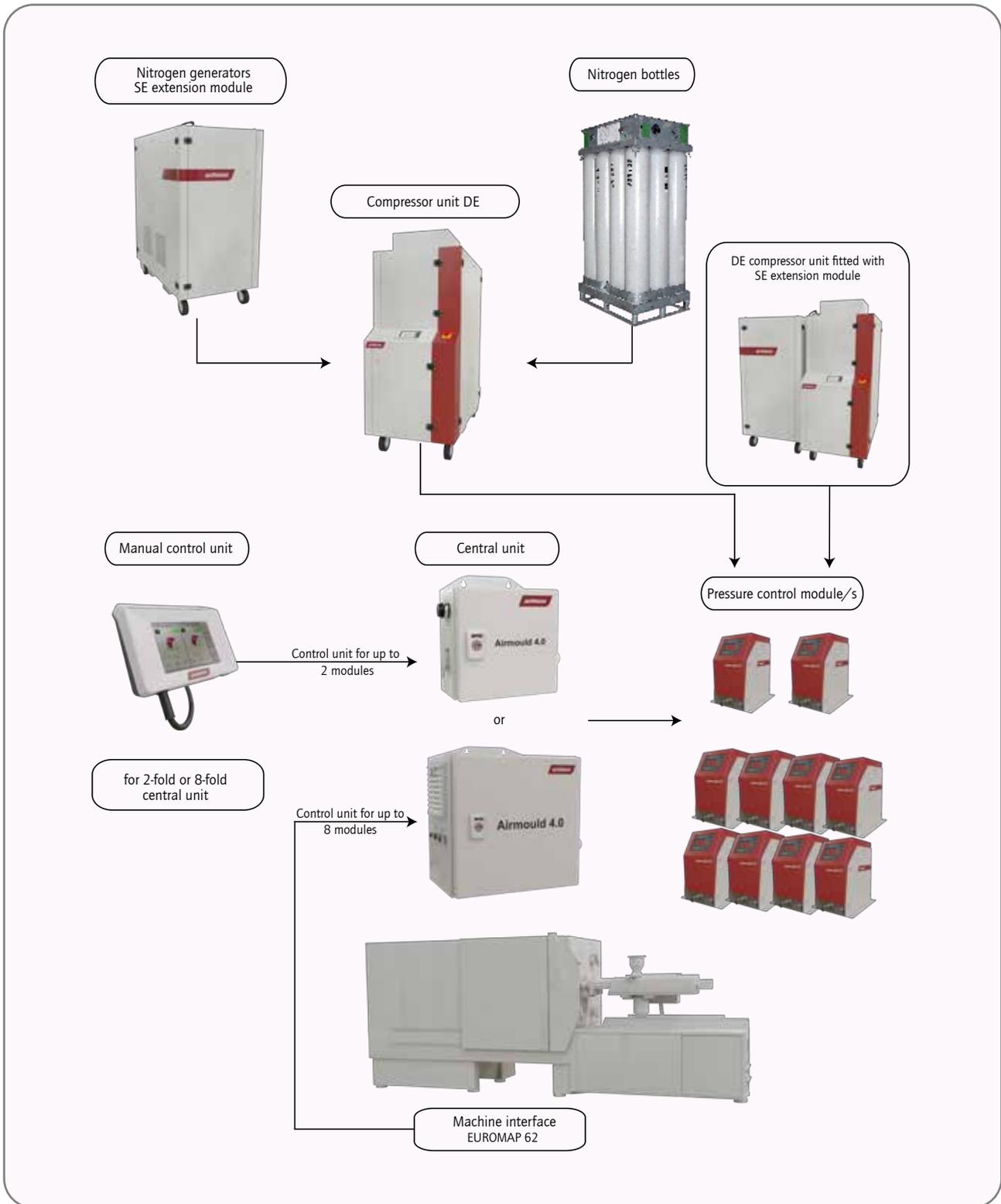
For special applications

» Projectile injection process

With this fluid injection technology, a displacement body (projectile) is driven under gas pressure through the previously injected melt. The projectile displaces plastic melt and thus forms a cavity with a uniform diameter. This process is particularly recommended for pipes and media conduits. Handles and other parts with sizeable hollow spaces of uniform diameter can also be produced with projectile injection technology.



Gas injection system



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Application examples

Automotive

Excellent moldings are achieved with internal gas pressure technology in the production of premium-class door handles, operating levers and handholds for vehicles and the automotive sector, which also meet the industry's requirements for high-quality surfaces. In addition to weight reduction, high productivity is achieved with internal gas pressure technology through short cycle times using the "partial filling process" or the "spill-over cavity process".



Exterior door handle - WITTE Automotive

Packaging

The carrying comfort of beverage crates is improved by a targeted wall thickness increase in the gripping areas. Sink marks in these areas are prevented by the "shrinkage compensation process" using internal gas pressure technology.



Beer crate - Oberland MV

Pipes and media supply lines

For pipes and media supply lines, cavities can be created at pre-defined points by combining the projectile injection process with the "spill-over cavity process".



Media supply line

Building construction

In addition to reductions in part weights and cycle times resulting from the "partial filling process", the internal gas pressure process creates added advantages in using the products. The lighter weight ensures easier handling for products used in building construction, such as rubbing boards.



Rubbing board – Plastica Orth & Wächter

Products for daily use

With the help of internal gas pressure technology, the scope for added criteria can be extended in designing parts like the coat-hanger shown in the picture. The design can be realized with internal gas pressure technology. In addition to reducing both the part weight and the cycle time, warpage is also minimized by using the "partial filling process".



Design-coat hangers

Sports and leisure products

This hockey stick, manufactured with internal gas pressure technology in the "partial filling process" provides sportsmen with a light-weight piece of equipment adapted to their requirements.



Hockey sticks

The Wittmann logo is located in the bottom right corner of the page. It consists of the word "Wittmann" in a white, italicized, sans-serif font, set against a dark red, rounded rectangular background.

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