

# FOAM-IN-PLACE MOLDING, SEALING AND POTTING OF CABLE GROMMETS, CONNECTORS AND ELECTRONICS





## Highly reliable system solutions for foam-in-place molding, sealing and potting of cables, connectors and electronics

The modern and soon to be self-driving car is increasingly becoming a computer on wheels with more than 100 control devices and up to six kilometers of cable. The reasons for this are increased safety and comfort aspects as well as the electrification of the drive train for electric mobility. Cables also supply power to every consumer – from the oil pump to the vehicle lighting and from the radio to the sensor-controlled accelerator pedal. This is why the number of control devices, sensors, actuators as well as electrical consumers and advanced driver-assistance systems is growing, and with it the amount of cabling. The cable harness distributes the energy for the consumers and the signals from the sensors and control devices in the car via multiple branching cable bundles.

This is where Henkel's products come in. We offer a range of suitable material systems for polyurethane foam-in-place molding, e.g. for connectors, cable grommets and battery fingers for the alternator, for potting the pins of connector plugs and for sealing electronics with polyurethane potting.

When it comes to foaming molded parts, sealing cable grommets, and sealing your electronics, are you looking for a complete solution consisting of a material system, dosing system and process automation from a single source?

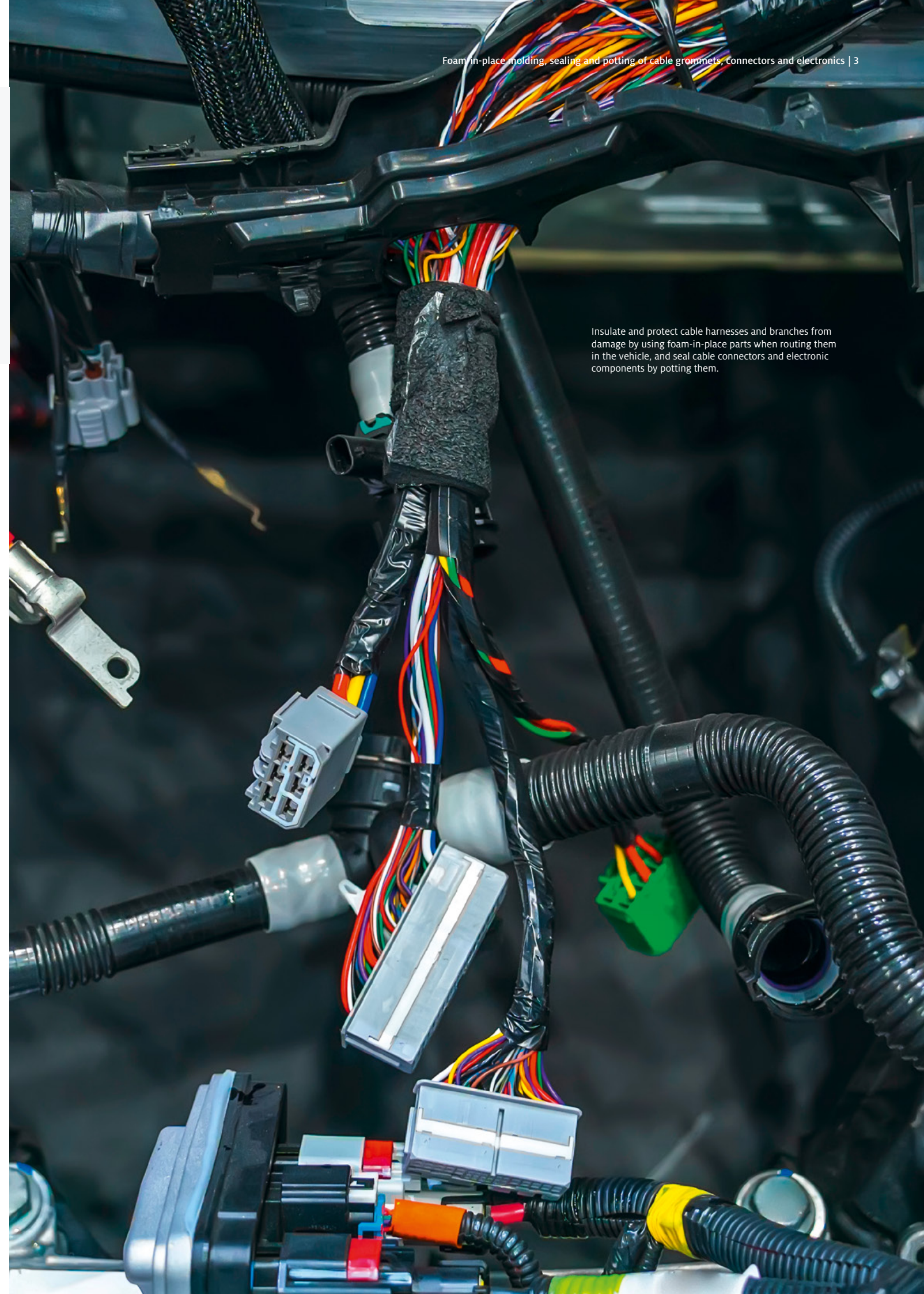
Our perfectly coordinated system solutions allow you to reliably seal your cable grommets, connectors, battery fingers and electronics for robust use in road traffic so that they are waterproof and resistant to vibrations. The connectors or their cable connections and electronic components must be resistant to heat, vibration and other environmental influences and therefore receive special protection from our material systems to ensure a high level of reliability.

Do you need an automation system that adapts to your production requirements?

Our CNC-controlled mixing and dosing systems offer a high level of repeatable dosing accuracy and, thanks in part to systematic, sensor-based process monitoring, are also highly efficient. Thanks to their modular design, they can be flexibly integrated into existing production concepts.

Through our combination of individual material systems, customer-specific mixing and dosing machines and skilled process expertise, we offer solutions to address your technical and economic challenges.

Insulate and protect cable harnesses and branches from damage by using foam-in-place parts when routing them in the vehicle, and seal cable connectors and electronic components by potting them.





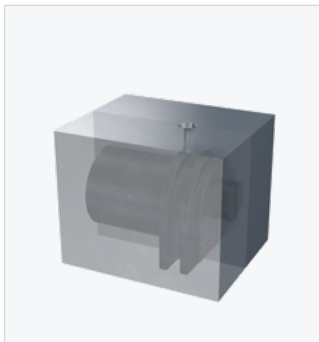
# Tailored potting systems for maximum product safety

When it comes to the production of foam molded parts, we develop tailor-made solutions according to your requirements

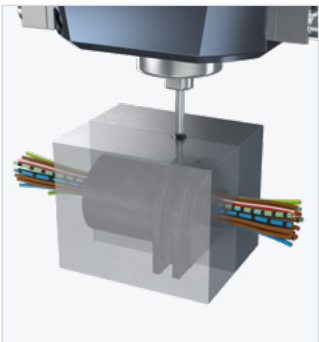
For the production of molded foam parts such as connector plugs, cable grommets and battery fingers for electrical connections to the control devices, sensors, electrical consumers and advanced driver-assistance system, low foaming polyurethane potting is used. To achieve this, a two-part or multi-part mold is automatically, precisely and reliably filled by our DM 502 mixing and dosing machine.

The 2-component reference material FERMADUR A-173-3-VP1 and B-81 (B component) is available for this purpose as a low-foaming polyurethane potting compound.

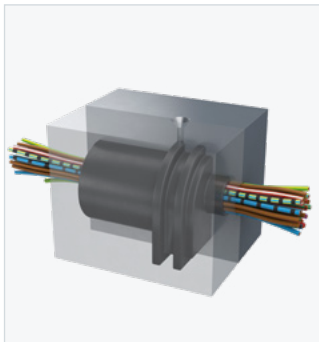
This system consisting of material, machine and process automation provides you with versatile and technically safe solutions for protecting electrical connections in vehicles against moisture, vibrations and mechanical damage.



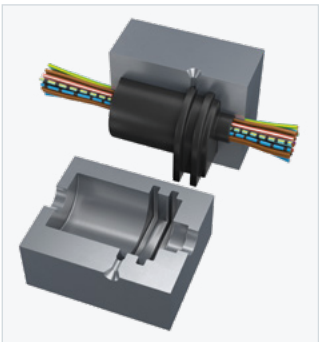
Two-part mold for the production of a cable grommet



The mixing head doses PU potting material into the molding tool



The mold filled with PU potting material cures at room temperature or additionally through the temperature-controlled molding tool to form the cable grommet.



Removal of the fully cured cable grommet

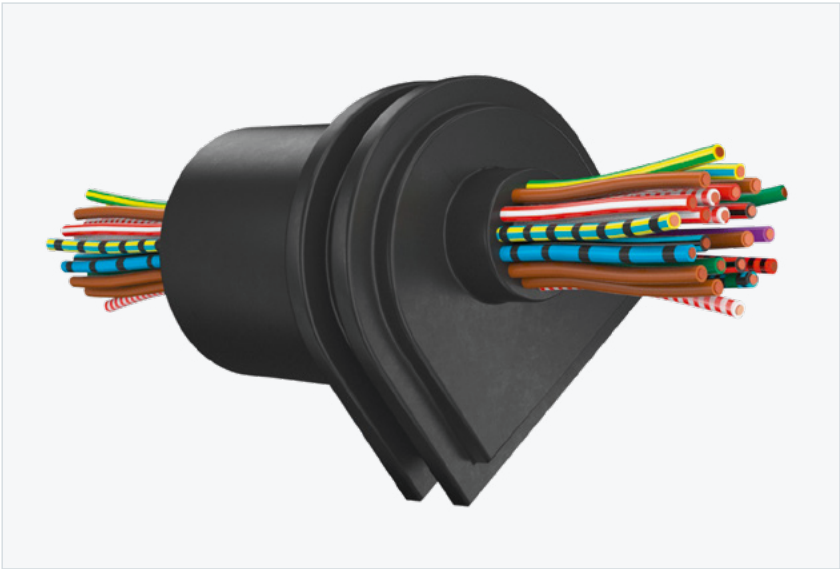
Potting system for the production of molded parts	
FERMADUR	A-173-3-VP1
	B-81
Mixing ratio	2.5 : 1
Pot life time	45 sec.
Tack-free time	3 min.
Viscosity of the A component	1,800 mPas
Density of the foam	0.75 g/cm³
Hardness (Shore A)	60
Temperature resistance	from -40 to +80 °C



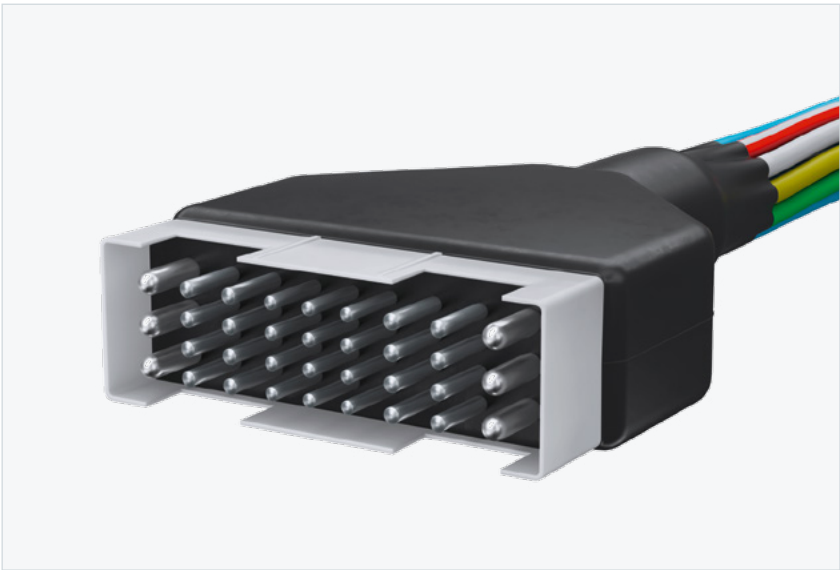
Foam-in-place battery finger

During the molding of a foam-in-place cable grommet, the material is also distributed into the spaces between the cable strands. This achieves excellent longitudinal watertightness, which prevents moisture from entering the interior from the engine compartment along the cable strands.

Our polyurethane potting for molding is characterized by excellent thermal insulation as well as high dielectric strength and heat resistance. There is also an optimal stiffness-to-weight ratio. In addition, the molded parts are characterized by their excellent elasticity and abrasion resistance, even under continuous stress.



Foam-in-place cable grommet



Foam-in-place connector housing

# Flexible and fully automatic – fully in line with your requirements

DM 502 mixing and dosing system with 3-axis linear robot  
and shuttle table for precise filling of the molds

Through our combination of individual material systems, customer-specific mixing and dosing machines and skilled process expertise, you receive solutions from us to address your technical and economic challenges. As process experts, we offer you individual consultation for the optimal integration of fully automatic material application processes into your production. Here, you can select different configuration and equipment options for semi-automatic or fully automatic production systems.

The reference configuration shown here consists of the DM 502 mixing and dosing system with LR-HE plus 3-axis linear robot and WT 1-LEVEL shuttle table. The production of molded foam parts is carried out by filling the mold with PU potting material with the two pick-up plates in continuous shuttle mode in one plane.

The CNC-controlled MK 800 PRO precision mixing head of the DM 502 mixing and dosing machine automatically, precisely and reliably fills the mold with the dynamically mixed 2-component polyurethane potting compound. The filled material expands slightly and the foam-in-place part is produced in the shape specified by the mold.

After the material has cured at room temperature, the foam-in-place components can be removed from the mold for further processing in the manufacturing process. The mold is tempered to accelerate this curing process.



Optionally available: **CONTROL 2 touchscreen operating panel** (21.5") for operating the dosing system



**WT 1-LEVEL shuttle/sliding table**  
Two pick-up plates operating in shuttle mode in one plane

Highly efficient **LR-HE plus 3-axis linear robot** for precise guidance of mixing heads for the application of polymer reaction materials. The Omega toothed belt drive enables high application speeds for components with medium and large radii.



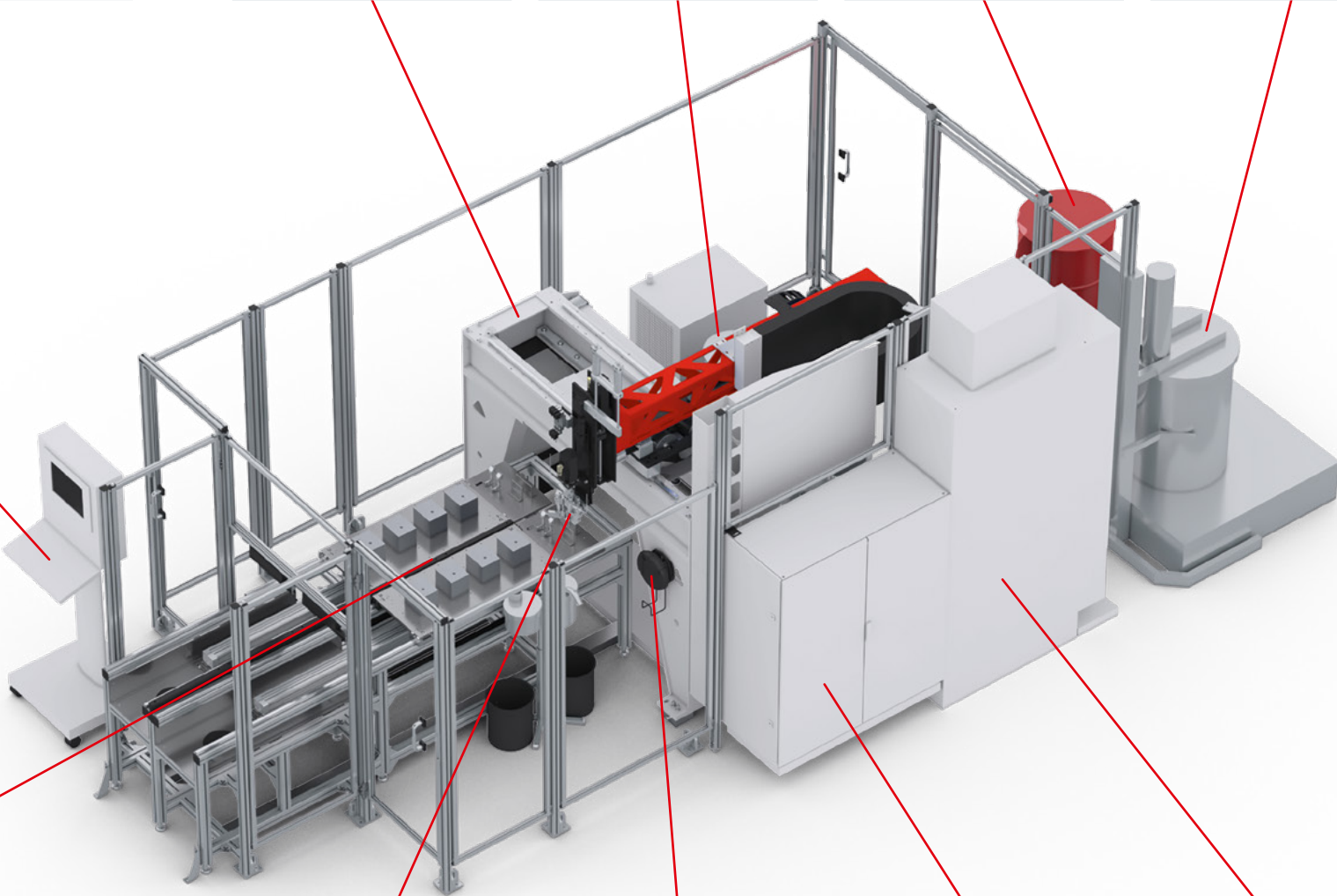
Separately installed **material pressure tanks** (24 l or 44 l, single-walled or double-walled) with minimum level sensors, on a grating platform with adjustable leveling feet and drip tray



Optional:  
Automatic **SUPPLY TAB drum refilling station** for low-viscosity products, e.g. isocyanate (**B component**)



Optional:  
Automatic **ELEVATOR drum refilling station** for the **A component** with pneumatic lift and agitator



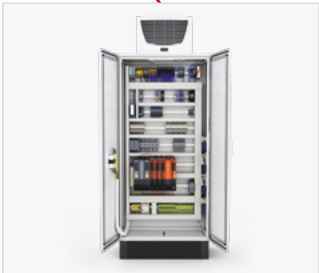
**MK 800 PRO precision mixing head**  
with high-pressure water rinsing



The multifunctional **MP 2 mobile panel** (10.1" WXGA TFT) enables convenient operation of the dosing system.



The **dosing machine cabinet** contains the components of the dosing periphery, e.g. the dosing pumps.



The control electronics, safety engineering and industrial PC are installed in the **control cabinet**.



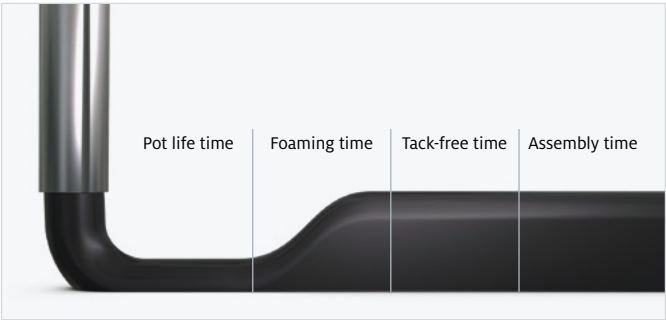
# Tailored sealing solutions for maximum product safety

We develop custom sealing foams for sealing cable grommets according to your requirements

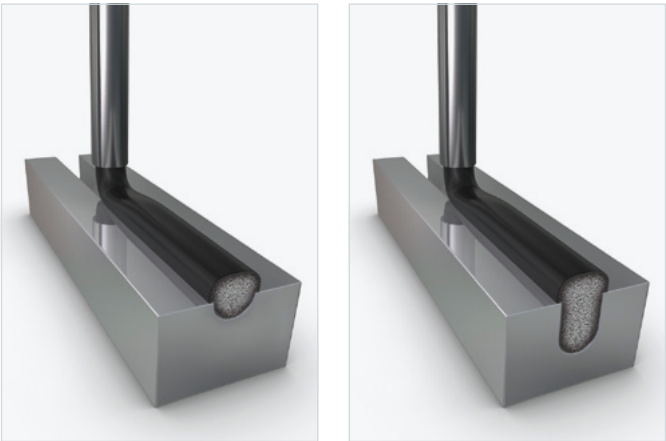
Loose parts in the wiring of vehicles are not permitted, as they can cause operational malfunctions and damage. This is because the cables in cars are exposed to a wide range of influences such as vibration and also environmental influences. Therefore, they must be particularly solid and well protected.

The wiring from the engine compartment through the firewall of the engine compartment partition into the interior, e.g. to the control devices, is made via plastic cable grommets with vulcanized cable passages. The contour of the underside of the cable grommet is sealed to the installation side of the engine partition with sealing foam. Possible component tolerances are fully compensated.

The reference material presented for this purpose, FERMAPOR K31-A-9308-5-VP5 and B-81 (B component), is a room-temperature curing 2-component polyurethane foam. It is temperature-resistant from -40 to +80 °C and is applied to the component contour very precisely, reliably and efficiently using the FIPFG (Formed-In-Place-Foam-Gasket) technology of our fully automated dosing machines.



The different reaction phases of the sealing foam in the chronological sequence



	Polyurethane sealing foam for sealing cable grommets
FERMAPOR K31-	A-9308-5-VP5
	B-81
Mixing ratio	4 : 1
Pot life time	24 sec.
Tack-free time	3.5 min.
Viscosity of the A component	130,000 mPas
Density of the foam	0.20 g/cm³
Hardness (Shore 00)	45
Temperature resistance	from -40 to +80 °C
Pretreatment	if necessary plasma for e.g. PP and PE



Cross-section of a polyurethane foam bead in groove uncompressed



Cross-section of a polyurethane foam bead in the groove and compressed to approx. 50%

In addition, we can also customize the polyurethane sealing foams to meet your specific component requirements. Influencing factors include pot life until start of foaming, curing time, and the viscosity, hardness and adhesion properties. Thanks to a mixed-cell foam structure, the closing forces when installing the foam gasket are low.

Due to its very good shape recovery characteristics, the mixed-cell polyurethane foam gasket can be compressed easily even after many years (tested according to DIN EN ISO 1856). It is possible to remove and reinstall the sealed component several times while maintaining the sealing effect of the foam gasket.



Sealed contour of the bottom of the cable grommet with PU foam

# Flexible and fully automatic – fully in line with your requirements

DM 502 mixing and dosing system with 6-axis robot  
for seal foaming of cable grommets

The reference configuration shown here for seal foaming the contour on the underside of cable grommets consists of the DM 502 mixing and dosing system and a 6-axis robot that precisely guides the MK 825 PRO precision mixing head over the component for dosing of the sealing foam.

Parts are picked up and machined with the WT 1-LEVEL shuttle table in continuous shuttle mode of the two pick-up plates in one plane. Parts are placed either by a machine operator, who can also check the parts for quality, or by a Pick & Place Robot. In the latter case, an optionally installed camera system could also perform quality control.

The FERMAPOR K31 polyurethane sealing foam is accurately and fully automatically applied to the groove contour on the underside of the cable grommet via the nozzle of the MK 825 PRO precision mixing head which is mounted on the robot arm. After the dosing cycle, the coupling point of the foam gasket closes seamlessly and as a result is almost invisible. When the cable grommet is installed, e.g. to the engine compartment wall, the uniform compression of the foam gasket achieves a high degree of tightness over the entire groove contour.

Even with short cycle times and high unit numbers, the material application process using the FIPFG method is carried out with high dosing precision and repeat accuracy. As a result, you achieve foam gaskets of uniformly high quality. This allows you to quickly process the sealed cable grommets right through to final assembly. This saves time and money.

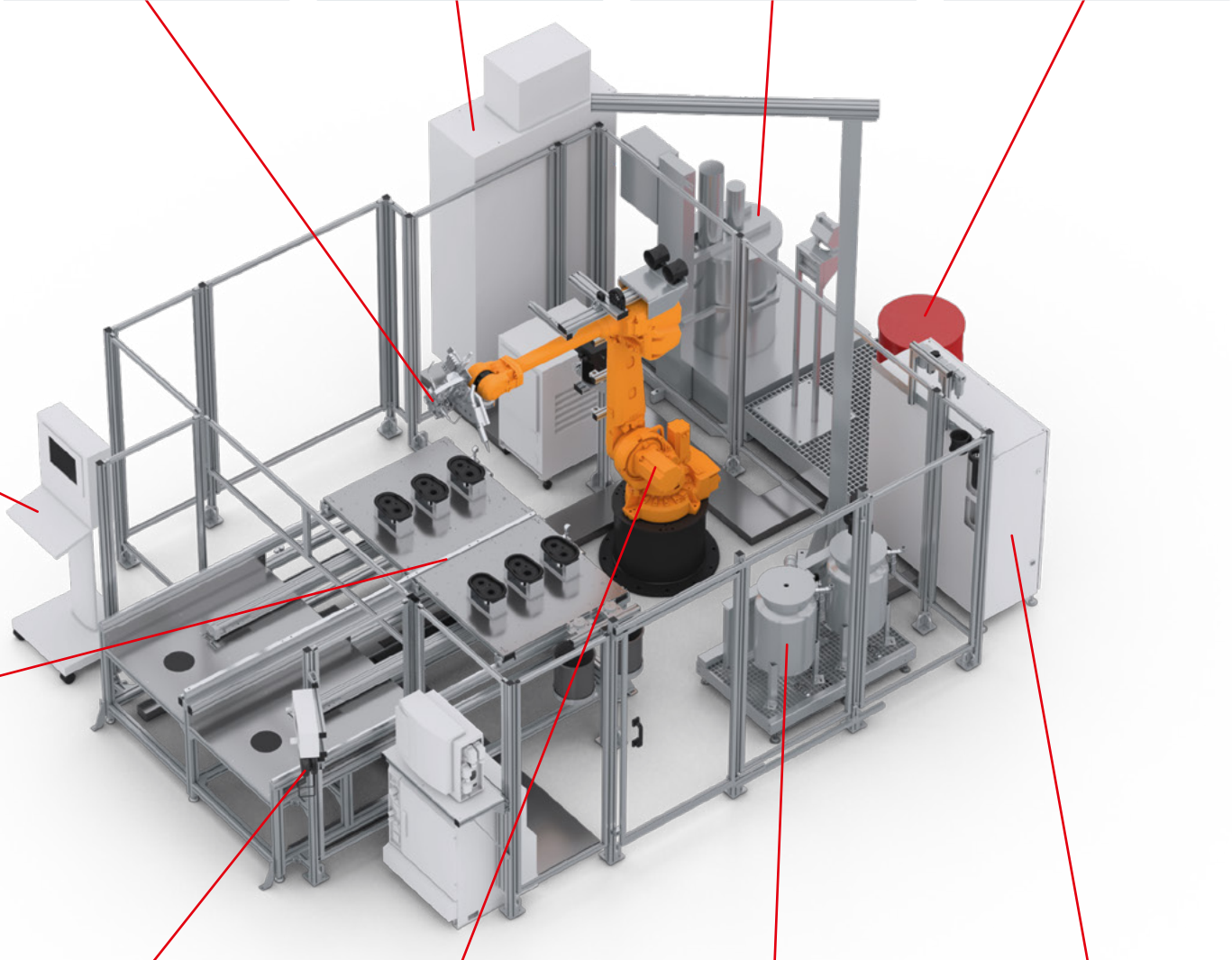
In addition, our fail-safe mixing and dosing system can be operated easily and intuitively without the need for extensive training. Thanks to the automatic logging of dosing program data, all process data can be traced and evaluated by the machine operator via the CONTROL 2 operating panel while production is running.



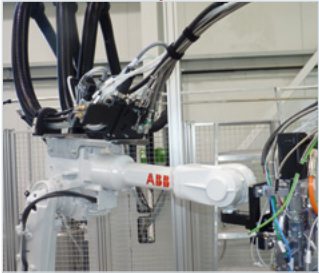
Optionally available: **CONTROL 2 touchscreen operating panel** (21.5") for operating the dosing system



**WT 1-LEVEL shuttle / sliding table**  
Two pick-up plates operating in shuttle mode in one plane



The multifunctional **MP 2 mobile panel** (10.1" WXGA TFT) enables convenient operation of the dosing system.



The **6-axis robot** guides the mixing head precisely over the contour of the underside of the cable grommet during the dosing process.



Separately installed **material pressure tanks** (24 l or 44 l, single-walled or double-walled) with minimum level sensors, on a grating platform with adjustable leveling feet and drip tray



The **dosing machine cabinet** contains the components of the dosing periphery, e.g. the dosing pumps.

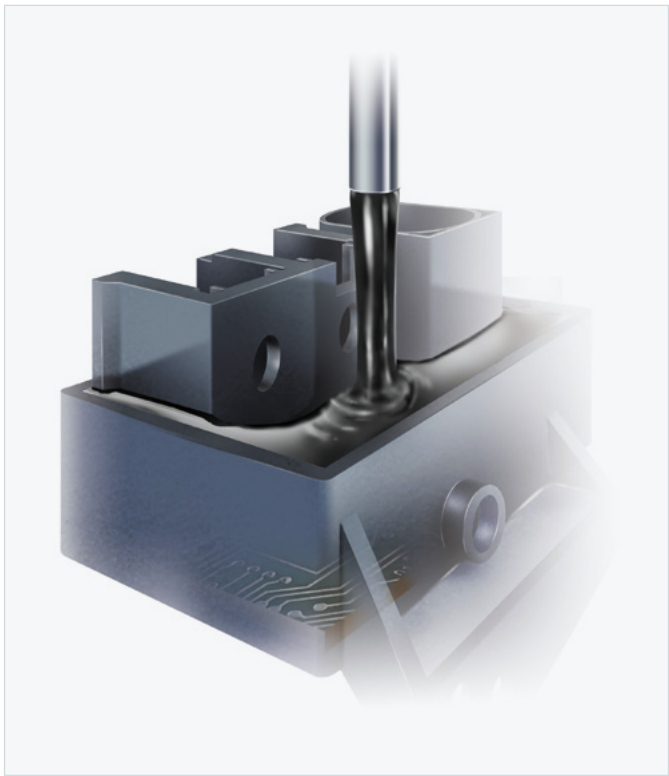


# Tailored potting systems for maximum product safety

## Sealing of electronics or connectors with polyurethane potting compound

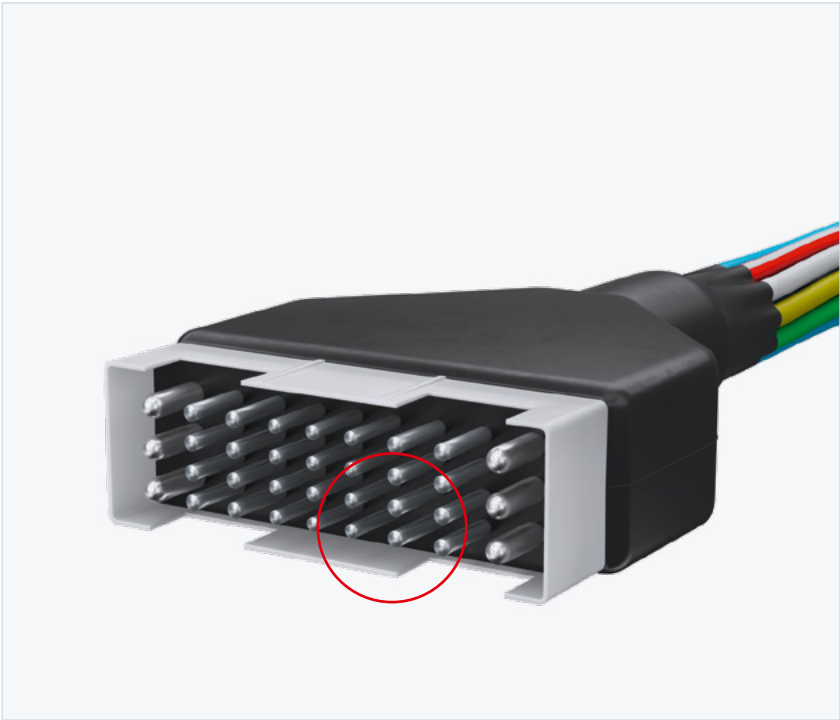
Electronic components such as windshield wiper electronics or the pins of a connector plug are potted with our polyurethane potting systems. The reference material presented for this purpose, FERMADUR-A-83D10-1-FR and B-N (B component), is a room-temperature curing 2-component polyurethane potting compound. This material has a temperature resistance of -40 to +80 °C, is particularly mechanically stable and tear-resistant, and is resistant to shrinkage and stress. This increases dielectric strength and protection against moisture and corrosion. As a rule, polyurethane potting provides good adhesion to plastic surfaces.

The FERMADUR polyurethane potting compound is applied to the electronics and connector housings without bubbles using the FIP (Formed-In-Place) technology of our DM 502 mixing and dosing machine via the CNC-controlled mixing head, which features high dosing and repeat accuracy.



Dimensionally accurate pouring of PU potting compound with the CNC-controlled mixing head of the DM 502 mixing and dosing system

Polyurethane potting for sealing electronics and connectors	
FERMADUR-	
A-83D10-1-FR	
B-N	
Mixing ratio	3.8 : 1
Gel time	5 min.
Tack-free time	6 min.
Viscosity of the A component	11,000 mPas
Density of the foam	1.50 g/cm³
Hardness (Shore D)	85
Temperature resistance	from -40 to +80 °C
Pretreatment	normally not necessary, otherwise primer (for metal) or plasma (for plastic)



Uniform PU potting provides a smooth, flat surface between the connector pins in the housing.

The excellent flow properties of FERMADUR ensure that the gaps between the connector pins in the connector housing are evenly and completely potted without the potting being drawn up on the pins. After dosing, a smooth, even surface is formed which does not show any signs of shrinkage. This produces, at room temperature or by using an annealing oven for accelerated curing, a compact seal with the desired hardness.

Our potting systems and the fully automated application process for potting electronic housings and connector pins are perfectly matched with one another and adapted to your specific component requirements.



Dimensionally accurate PU potting for sealing electronic components

# Flexible and fully automatic – fully in line with your requirements

DM 502 mixing and dosing system with 3-axis linear robot and shuttle table for potting electronic components or connectors

The reference configuration shown here for potting electronic components or connector pins consists of the DM 502 mixing and dosing system with the LR-HE plus 3-axis linear robot and the WT 1-LEVEL shuttle table. Parts are picked up and machined with the two pick-up plates in continuous shuttle mode in one plane. Parts are placed either by a machine operator, who can also check the parts for quality, or by a Pick & Place Robot. In the latter case, an optionally installed camera or sensor system could also carry out quality control.

The installed highly efficient LR-HE plus 3-axis linear robot ensures that the MK 800 PRO precision mixing head is guided over the component with repeatable accuracy. The FERMADUR potting material is applied fully automatically into the electronics housing or into the connectors with high dosing accuracy and dimensional accuracy. The dosing nozzle reaches as deep as possible into the component to ensure that it is filled from bottom to top without bubbles forming and thereby avoiding air pockets.

Our fail-safe mixing and dosing systems can be operated easily and intuitively without the need for extensive training. Thanks to the automatic logging of dosing program data, all process data can be traced and evaluated by the machine operator via the CONTROL 2 operating panel while production is running.

In all solutions, our main focus is on extremely reliable plant engineering, minimized maintenance times and consistent dosing quality. As process experts, we support you with tailored advice for the automation of your manufacturing processes.



Optionally available: **CONTROL 2 touchscreen operating panel** (21.5") for operating the dosing system



**WT 1-LEVEL shuttle/sliding table**  
Two pick-up plates operating in shuttle mode in one plane

Highly efficient **LR-HE plus 3-axis linear robot** for precise guidance of mixing heads for the application of polymer reaction materials. The Omega toothed belt drive enables high application speeds for components with medium and large radii.



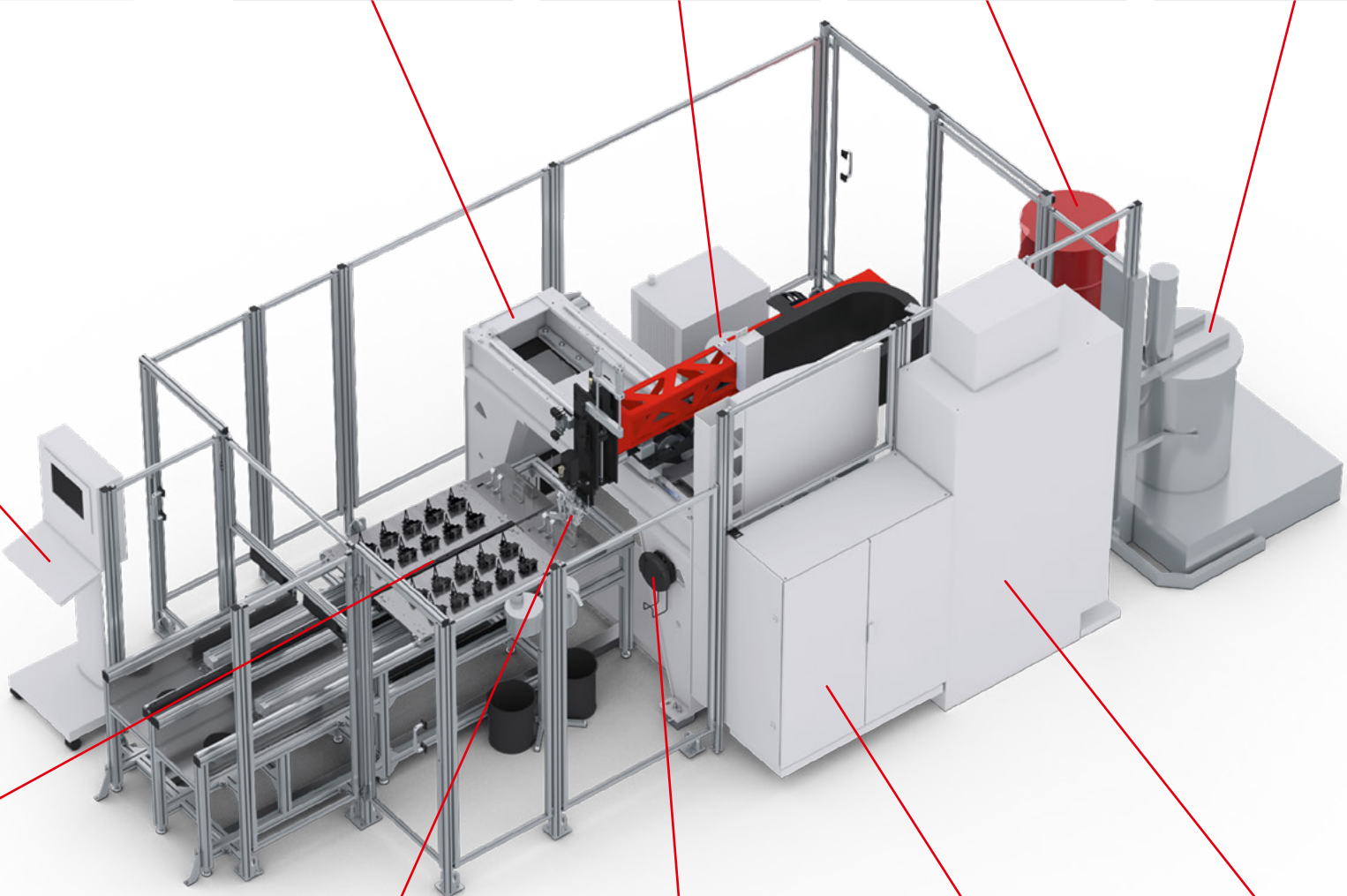
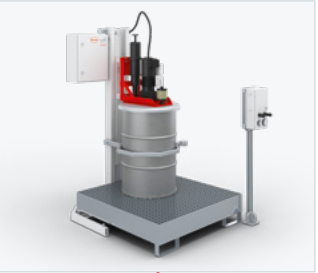
Separately installed **material pressure tanks** (24 l or 44 l, single-walled or double-walled) with minimum level sensors, on a grating platform with adjustable leveling feet and drip tray



Optional: Automatic **SUPPLY TAB drum refilling station** for low-viscosity products, e.g. isocyanate (**B component**)



Optional: Automatic **ELEVATOR drum refilling station** for the **A component** with pneumatic lift and agitator



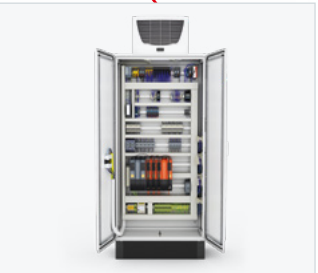
**MK 800 PRO precision mixing head** with high-pressure water rinsing



The multi-function **MP 2 mobile panel** (10.1" WXGA TFT) enables convenient operation of the dosing system.

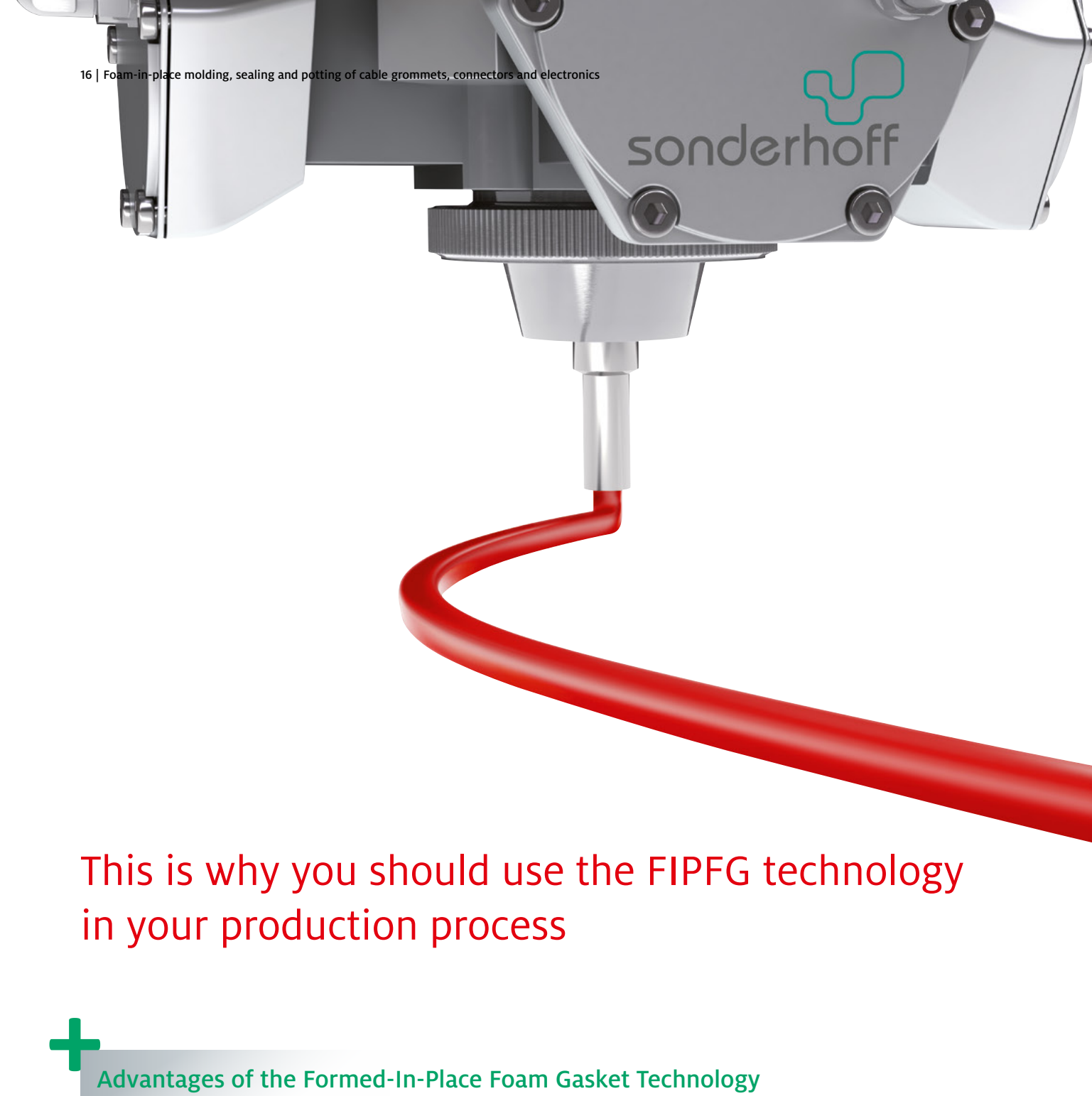


The **dosing machine cabinet** contains the components of the dosing periphery, e.g. the dosing pumps.



The control electronics, safety engineering and industrial PC are installed in the **control cabinet**.





This is why you should use the FIPFG technology in your production process

- + Advantages of the Formed-In-Place Foam Gasket Technology**
- › Sealing standard in many industrial sectors
  - › Highly accurate material application controlled by contour robots
  - › Processing and full curing at room temperature
  - › Perfect coordination of the material system and dosing system
  - › Suitable for 2D and complex 3D part geometries
  - › More efficient use of materials compared to punched seals
  - › Cheaper compared to 2-C injection molding, as there are no tooling costs
  - › High degree of future viability, due to suitability for use in a wide variety of industries & applications

- + Advantages of our mixing and dosing machines**
- › Combination of processes (bonding, foaming, caulking, potting)
  - › High flexibility of the dosing system
  - › Simple, intuitive operation
  - › Automatic material preparation incl. handling
  - › High dosing and repeat accuracy
  - › Short machine downtimes and cycle times
  - › Fine-cell foam structure due to dynamic mixing
  - › Reproducible foam quality
  - › Ecological high-pressure water rinsing
  - › Easy maintenance

- + Advantages of our FIPFG foam gaskets**
- › More cost-effective than compact systems due to lower foam density
  - › Seamless seal / hardly visible coupling point
  - › Compensation of component tolerances
  - › Good resilience
  - › Multiple compression and release processes possible
  - › Broad range of properties / wide variety of recipes
  - › Individually adaptable recipes
  - › Good form fit to the component contour
  - › Resistant to moisture, dust, temperature & media
  - › Flame-retardant according to UL 94
  - › IP classes up to IP 68 or NEMA 4 to 6 and NEMA 12
  - › Special PU foam with low VOC emissions
  - › Very fast reacting PU foam (Fast-Cure)

# Perfectly coordinated solutions of material, machine and contract manufacturing

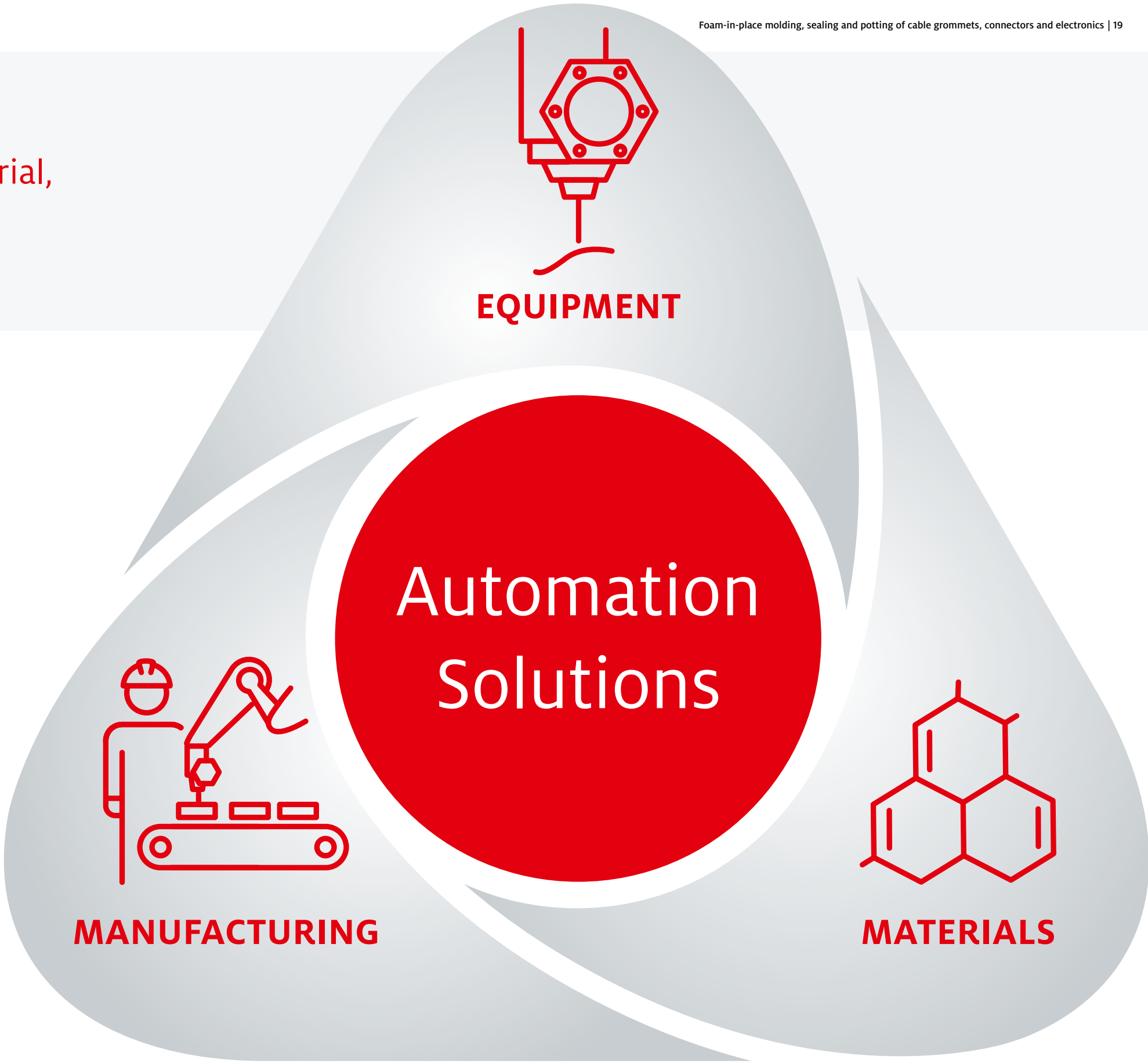
With its Sonderhoff brand, Henkel has not only acquired many years of experience in the manufacture of tailor-made two-component sealing systems and mixing and dosing machines, but also as a process expert for application-specific material application using the FIPFG (Formed-In-Place-Foam-Gasket) technology.

With the Sonderhoff portfolio, we offer you the advantages of a system provider from a single source and the solutions to meet your technical and commercial challenges.

With the dosing technology that is tailored to our sealing foams, we ensure efficient production processes in accordance with the requirements of fully automated series production.

If you would like to take advantage of all the benefits of the FIPFG technology for your production in a flexible, fast, uncomplicated manner and without having to make your own acquisition investments, we can provide expert sealing for your components at one of our contract manufacturing sites worldwide. There, the spectrum ranges from the sampling of prototypes and small batch series to production scale manufacturing.

The choice is yours! You can either decide in favor of our all-inclusive package, consisting of material, machine and contract manufacturing, supported by application advice, sampling and training or you can choose the individual solutions that suit you best. We combine our products and services from a single source in such a way that you receive the optimum solution for your requirements profile.



*Flexibility & Precision*



# Customer-specific solutions – worldwide and for many industries

The Henkel specialists for the Sonderhoff portfolio  
are available globally

Every year, more than 300 million seals are manufactured in more than 50 countries using products from Henkel’s Sonderhoff portfolio. At our Centers of Expertise and Regional Hubs, our specialists offer application engineering advice, e.g. selecting a suitable material sys- tem and sampling of your components, as well as project management for dosing systems and automation. You will receive training from us on how to use the FIPFG technology and we will support you with the selection of spare parts and a regular service offering. Further- more, we will be pleased to take over parts of your production for you – from small to large series – at our subcontracting locations.

Sales staff at all other Henkel locations worldwide will also be happy to answer any questions and provide you with further information on our sealing, bonding, and potting solutions. We look forward to hearing from you.

- KOŁO, POLAND  
External Subcontracting Location
- DÜSSELDORF, GERMANY  
Center of Expertise
- ELGIN, ILLINOIS, USA  
Regional Hub
- RICHMOND (KANSAS CITY), USA  
Regional Hub
- DORNBIRN, AUSTRIA  
Center of Expertise
- BARCELONA, SPAIN  
External Subcontracting Location
- OGGIONO, ITALY  
Regional Hub
- INCHEON, KOREA  
External Subcontracting Location
- SHANGHAI, CHINA  
Regional Hub
- PUNE, INDIA  
Regional Hub
- PUNE, INDIA  
External Subcontracting Location
- SÃO PAULO, BRAZIL  
External Subcontracting Location

Global presence

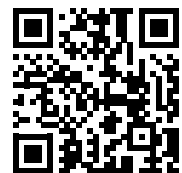


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