

# SEALING OF SYSTEMS FOR HEATING, VENTILATION AND AIR CONDITIONING



# Sealing of heating, ventilation and air conditioning technology against dust and water ingress

Compensating for extreme temperature fluctuations and ensuring a pleasant moderated indoor climate as well as good room air quality through the provision of fresh air are the basis for our well-being in both personal and professional spaces. The reliable control of heating, ventilation and air conditioning (HVAC) systems for safe and healthy conditions in buildings is equally necessary in order to ensure the smooth operation of engineering systems in research, IT infrastructure and production facilities. It is a matter of constantly exchanging air in rooms and removing humidity, odors, smoke, carbon dioxide, heat accumulation, dust or airborne bacteria.

Are you looking for a system solution to seal your HVAC systems, consisting of a sealing material, dosing system and process automation system from a single source?

We offer you a perfectly coordinated sealing solution that will enable you to meet your various technical requirements optimally and reliably. It consists of the matching polyurethane sealing foam, adhesive sealant or silicone elastomer as well as a dosing system for high-precision, fully automatic application of material controlled by contour robots.

Do you require a flexible automation system that can be variably adapted to your production conditions?

The modular design of our mixing and dosing systems with their peripheral interfaces allows flexible use with excellent integration into existing production concepts. We provide you an efficient mixing and dosing system with high levels of repeatability and dosing accuracy along with systematic process monitoring.

This ideal combination of material, dosing machine and automation process allows you to use FERMAPOR K31 polyurethane foams to seal the installation of air filter frames as well as the panels and service doors of air conditioning systems effectively and reliably. Silicone elastomers with high temperature resistance are available to seamlessly seal the installed plate heat exchangers. We also provide adhesive sealants from the FERMADUR product family to bond the filter packs into the filter frames.

Our solutions offer you precisely the levels of durability, quality and reliability that your customers expect from your products.



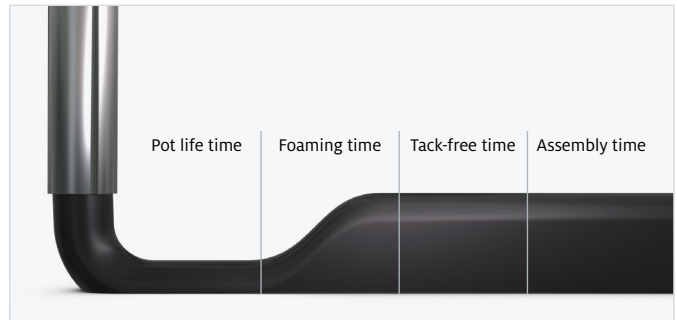
# Bespoke solutions to seal HVAC housings

We carry out developments individually for your specific requirements

The reference material presented has been used by leading HVAC manufacturers for many years, and is tried and tested. We can also adapt our FERMAPOR K31 2-component polyurethane sealing foams to meet your component requirements. Influencing factors include pot life until start of foaming, curing time, the viscosity, hardness and adhesion properties. Thanks to the mixed-cell foam structure, the closing forces when installing the foam gasket are low. It compensates for component tolerances when sealing and has a high resistance to changing temperature differences.

A powder coating gives the HVAC housing permanent corrosion protection for outdoor installation. Our polyurethane foams generally exhibit very good adhesion properties in these applications. On stainless steel surfaces, good adhesion is achieved by pretreatment with primers, plasma or flame treatment.

HVAC housing panels and service doors sealed with FERMAPOR K31-A-6045-2-B-MX and BN-4 (B-component) polyurethane foam achieve high IP protection ratings in the overall construction, including the foam gaskets, depending on the component design and foam system. The low hygroscopicity of the foam gasket offers protection against the ingress of rain, dust, snow and ice in the HVAC housing and protects the air conditioning and electronic units against corrosion.



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



Sealing of HVAC housing panels and service doors	
<b>FERMAPOR K31-</b>	<b>A-6045-2-B-MX</b>
	<b>B-4</b>
<b>Mixing ratio</b>	4 : 1
<b>Pot life time</b>	28 sec.
<b>Tack-free time</b>	3 min.
<b>Viscosity of the A component</b>	56,000 mPas
<b>Density of the foam</b>	0.28 g/cm <sup>3</sup>
<b>Hardness (Shore 00)</b>	55
<b>Temperature resistance</b>	from -40 to +80 °C



Cross-section of a polyurethane foam bead – unpressed



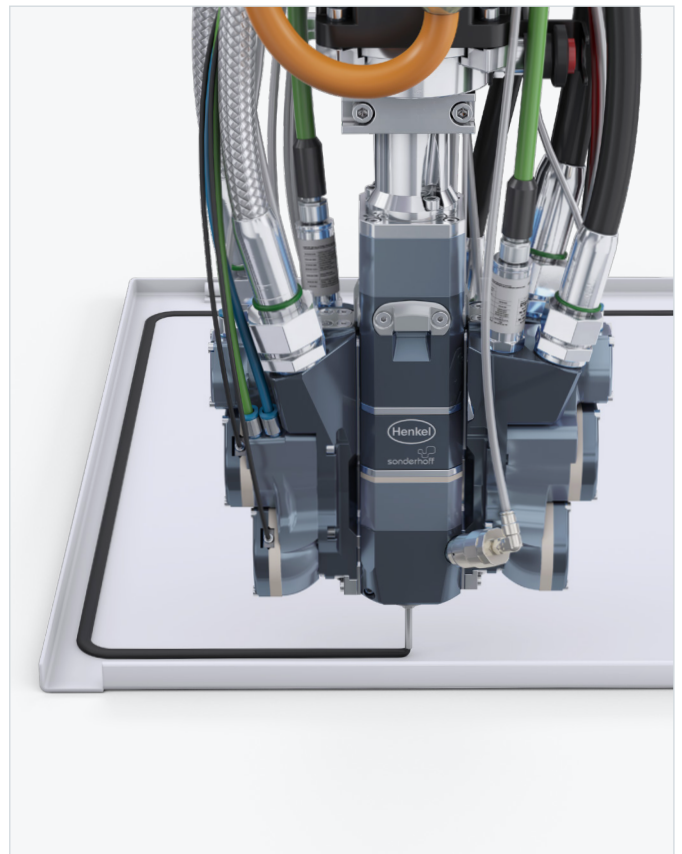
Cross-section of a polyurethane foam bead with 50% compression

Due to its excellent shape recovery characteristics, the mixed-cell foam structure of the polyurethane gasket can still be compressed even after years (tested according to DIN EN ISO 1856). This allows frequent opening and re-closing of the service doors of HVAC systems for maintenance purposes, while maintaining a consistent sealing effect of the foam gasket.

Cost savings can be achieved by alternatively using FERMAPOR K31 FAST-CURE foams. They offer short curing times along with rapid further processing of the HVAC housings through to final assembly. Intermediate storage of components to allow curing of the foam gaskets is therefore minimized.



HVAC unit with external housing comprising powder-coated panels with a PU foam gasket



Application of PU foam gasket to an HVAC panel

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

## DM 502 mixing and dosing system with 3-axis linear robot for the application of sealing foams to HVAC housing components

As process experts, we support you with tailored advice for the automation of your manufacturing processes. To achieve this, we offer numerous configuration and equipment options for semi-automatic or fully automatic production systems.

The reference configuration shown here for the application of sealing foam to HVAC housing components and service doors consists of the DM 502 mixing and dosing system with a 3-axis linear robot and the WT 1-LEVEL shuttle table. Parts are picked up and processed in continuous shuttle mode in one plane. Alternatively, we can offer the WT 2-LEVEL shuttle table with pick-up plates operating in shuttle mode, one above the other in two planes.

The highly efficient LR-HE plus 3-axis linear robot used or, alternatively, the highly dynamic LR-HD ensures that the MK 800 PRO precision mixing head is repeatedly guided accurately over the component. At the same time, the mixing head applies the sealing foam to the pre-programmed contour fully automatically with high dosing accuracy. After the dosing cycle, the coupling point of the foam gasket closes seamlessly and is therefore almost invisible. The applied material foams, expanding to several times its original volume, and forms an elastic soft foam gasket with the desired foam hardness at room temperature.

This consequently ensures that the contours of the HVAC housing components are seamlessly sealed by the precision processing and true-to-contour application of foam using our fully automatic mixing and dosing machines. The dosing system can also 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, fail-safe plant engineering, minimized maintenance times and consistent dosing quality.



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



Optional: **WT 2-LEVEL shuttle / sliding table** Two pick-up plates operating in shuttle mode in two planes



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



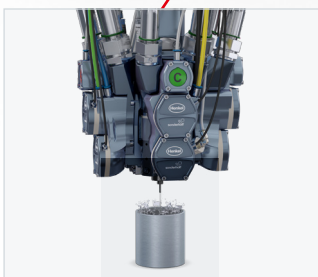
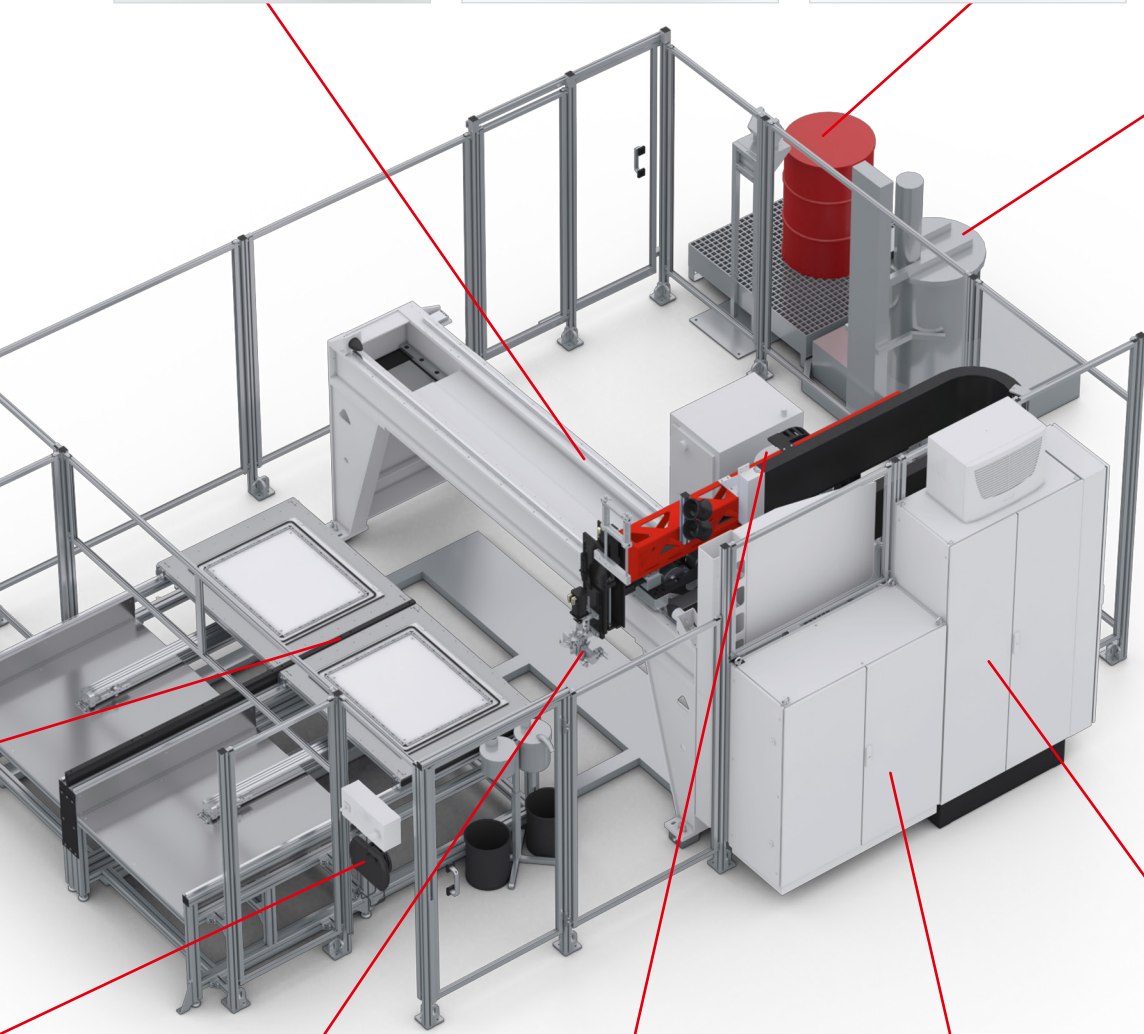
The multi-function **MP 2 mobile panel (10.1" WXGA TFT)** enables convenient operation of the dosing system.

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.

Optional: Highly dynamic **LR-HD 3-axis linear robot** for precise guidance of mixing heads for the application of polymer reaction materials. The rack-and-pinion drive with high stiffness and acceleration enables dynamic application speeds.

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

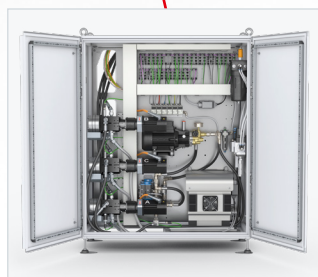
Optional: Automatic **ELEVATOR drum refilling station** for the **A component** with pneumatic lift and agitator



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



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.



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

# Material systems for sealing plate heat exchangers

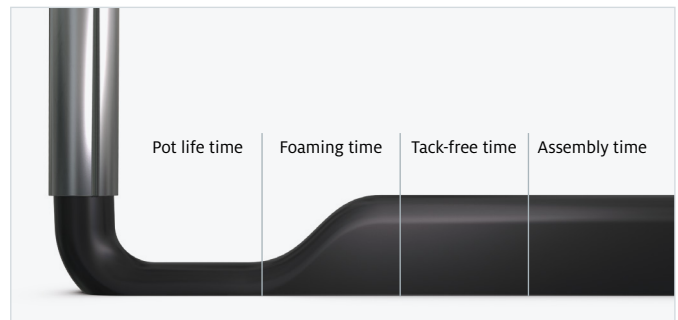
## 2-component silicone elastomers for your specific requirements

2-component silicone elastomers with high temperature resistance are used for the seamless sealing of plate heat exchangers, and are applied fully automatically by the robot-controlled mixing head of the DM 502 mixing and dosing system from Henkel.

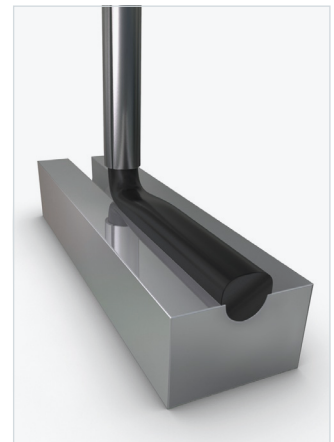
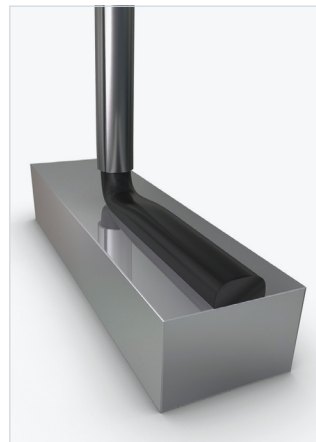
The silicone elastomers usually adhere well to the stainless steel surfaces of the heat exchanger plates. The adhesion can be further improved by pretreatment with primers, plasma or flame treatment.

When the viscosity is appropriate, the 2-component silicone elastomers employed generally flow well on the surfaces of the heat exchanger plates.

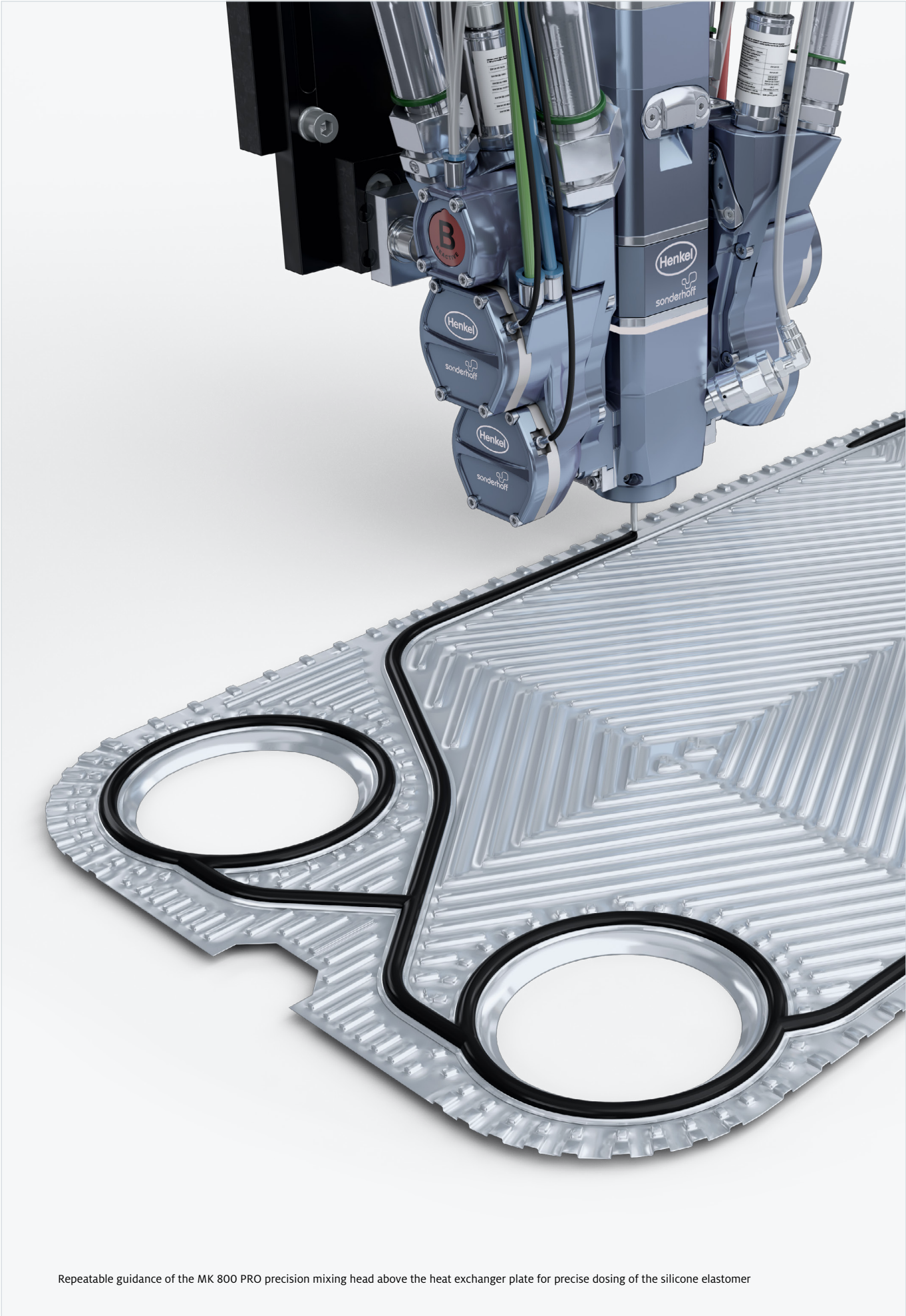
Our high-precision dosing systems permit the material bead to have a constant height-to-width ratio and seamless completion of the contour despite multiple coupling points. This allows the individual plates of the heat exchanger to be mounted flat on top of each other very easily.



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







Repeatable guidance of the MK 800 PRO precision mixing head above the heat exchanger plate for precise dosing of the silicone elastomer

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

## DM 502 mixing and dosing system with 3-axis linear robot for the sealing of plate heat exchangers

The reference configuration shown here for sealing plate heat exchangers consists of the DM 502 mixing and dosing system with a 3-axis linear robot and the WT 2-LEVEL shuttle table. The parts are processed in continuous shuttle mode on the pick-up plates, which are positioned above one another on two planes. Alternatively, we can offer the WT 1-LEVEL shuttle table with two pick-up plates in one plane.

The highly dynamic LR-HD 3-axis linear robot used or, alternatively, the highly efficient LR-HE plus ensures that the MK 800 PRO precision mixing head is repeatedly guided accurately over the component. The silicone elastomer used is applied here with high dosing accuracy in accordance with the pre-programmed dosing contour to the surface of the heat exchanger plates fully automatically.

Precise dosing of the silicone elastomer, which is applied as a liquid, is crucial for the evenness of the coupling points, which are seamless at several points along the contour. This makes them virtually invisible and they achieve a uniform height-to-width ratio with very low tolerances along the entire course of the silicone elastomer. This is important because when assembled the individual plates of the heat exchanger must lie absolutely flat on top of each other layer by layer before they are pressed together.

The refilling stations ensure material-specific preparation of the material systems used - without contamination with the products to be filled. The optional equipment with an automatic lifting device offers more operating convenience and greater occupational and system safety. In addition, agitators stir the materials and therefore ensure the consistency is homogeneous before they are put into service.

The refilling stations of the modular DM 502 system periphery ensure that material is supplied continuously to the material pressure tanks for fully automatic production processes. Capacitive sensors on the material pressure tanks monitor the filling level and control refilling. This means that the production process is not interrupted in the event of a material change.



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



Optional: **WT 1-LEVEL shuttle/sliding table** with two pick-up plates operating in shuttle mode in one plane



**WT 2-LEVEL shuttle/sliding table**  
Two pick-up plates operating in shuttle mode in two planes



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

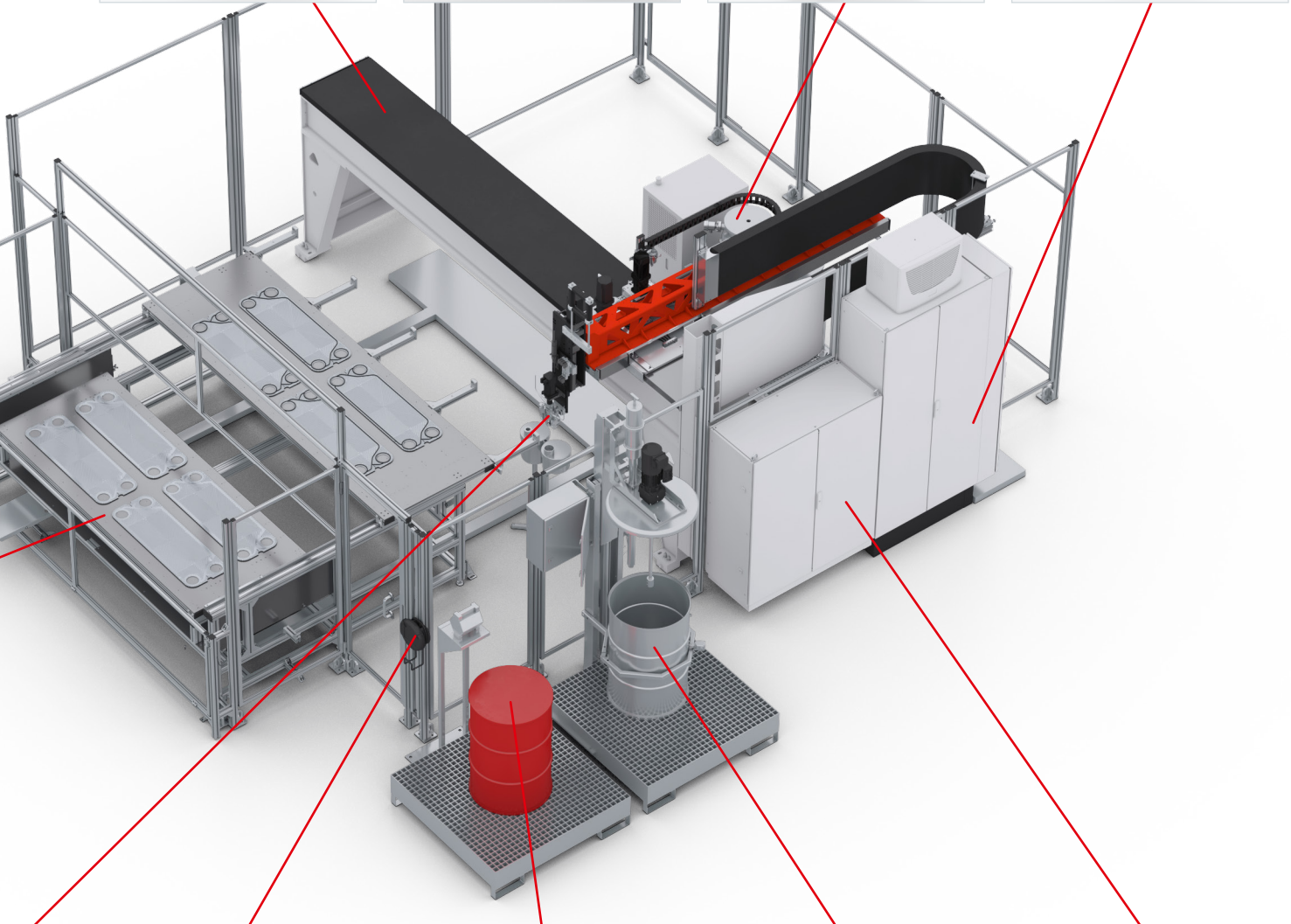


Highly dynamic **LR-HD 3-axis linear robot** for precise guidance of mixing heads for the application of polymer reaction materials. The rack-and-pinion drive with high stiffness and acceleration enables dynamic application speeds.

Optional: 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

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



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

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

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

# Bespoke solutions to seal and bond filter frames

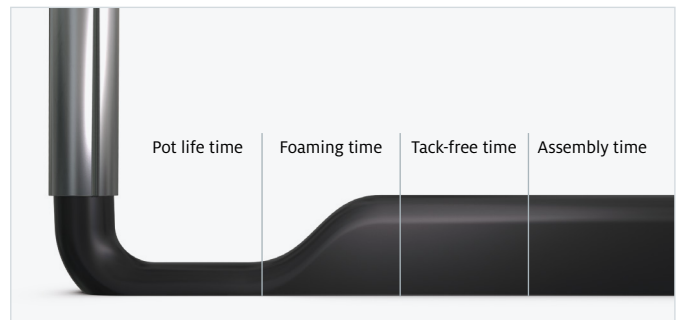
We carry out developments individually for your specific requirements

The reference material presented has been used by leading manufacturers of HVAC systems and air filters for many years, and is tried and tested. We also offer FERMAPOR K31 2-component polyurethane sealing foams to seal filter frames and FERMADUR adhesive sealants to bond filter packs into filter frames. Whenever possible, we can also customize our material systems to meet your specific requirements.

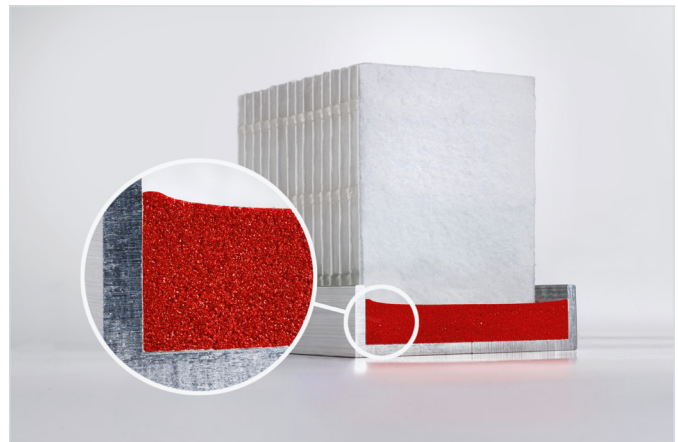
The influencing factors for sealing foams include pot life until start of foaming, curing time, the viscosity, hardness and adhesion properties. Thanks to the mixed-cell foam structure, the closing forces when installing the foam gasket are low. When installing the air filter in the air conditioning system, the tongue-and-groove design ensures that the foam gasket of the filter frame is firmly bonded to its counterpart. The gasket therefore prevents unfiltered outside air from being drawn past the filter.

The very good shape recovery characteristics of the FERMAPOR K31 polyurethane foam gasket allows repeated installation and removal of the air filter for maintenance purposes and renewed compression of the foam structure while maintaining a consistent sealing effect (tested according to DIN EN ISO 1856).

Besides the compact material systems, we also offer foamed filter adhesives with a lower density from the FERMADUR product family to bond the filter packs into the filter frames.



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

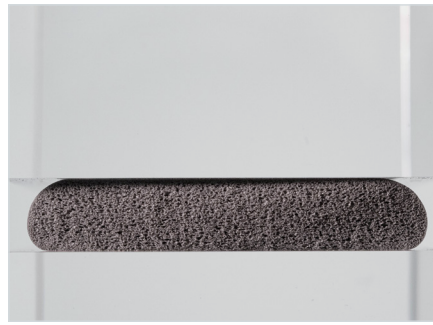


Frame bonding of filters with FERMADUR foamed adhesive sealant

	Sealing of filter frames	Frame filter bonding
	FERMAPOR K31-A-3030-1-MX	FERMADUR A-45D05-1-W-CT
	FERMAPOR K31-B-N	FERMADUR B-N
<b>Mixing ratio</b>	6 : 1	4.5 : 1
<b>Pot life time</b>	35 sec.	27 sec
<b>Tack-free time</b>	5 min.	1.5 min.
<b>Viscosity of the A component</b>	33,000 mPas	5,500 mPas
<b>Density of the foam</b>	0.2 g/cm <sup>3</sup>	1.38 g/cm <sup>3</sup>
<b>Hardness</b>	26 (Shore 00)	40 (Shore A)
<b>Temperature resistance</b>	from -40 to +80 °C	from -40 to +130 °C



Cross-section of a polyurethane foam bead – unpressed

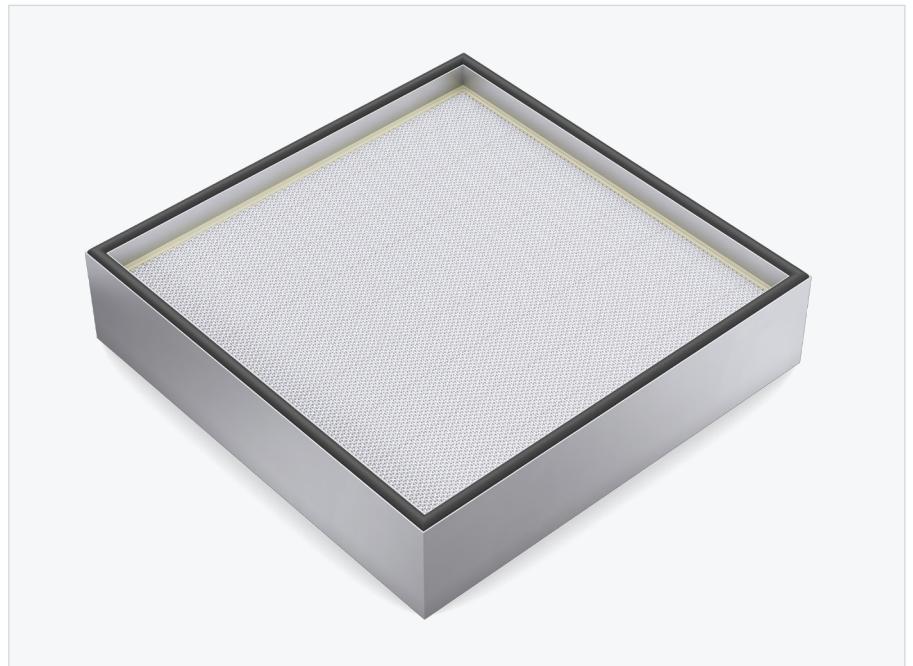


Cross-section of a polyurethane foam bead with 50% compression

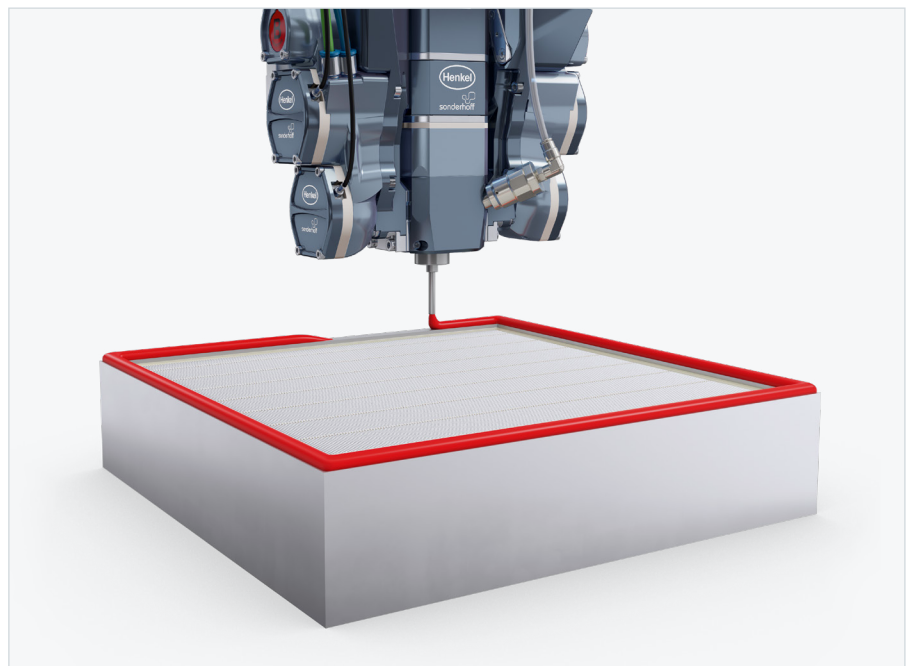
The lower weight ensures lighter – and therefore easier – handling of the parts. It also leads to a marked reduction in the amount of adhesive used per filter and therefore saves costs. The requirements for high-quality filter bonding are still satisfied.

The good flow properties of FERMADUR adhesive sealants ensure they are applied to the entire surface on the inside of the filter frame and the filter pack. The filter pack positioned in the filter frame is therefore optimally bonded and sealed on all sides.

The foam and adhesive are cured at room temperature. This saves the expense of an annealing oven, which has to be used for other processes.



Air filter with circumferential PU foam gasket and bonding of the filter pack in the frame with FERMADUR 2K PU adhesive sealant



Application of FERMAPOR K31 2K PU sealing foam using MK 800 PRO

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

## DM 503 mixing and dosing system with 3-axis linear robot for the sealing and bonding of filter frames

The reference configuration shown here for sealing filter frames with polyurethane foam and bonding filter packs into filter frames using adhesive sealant consists of the DM 503 mixing and dosing system with a 3-axis linear robot and the WT 1-LEVEL shuttle table. Parts are picked up and processed in continuous shuttle mode in one plane. Alternatively, we can offer the WT 2-LEVEL shuttle table with pick-up plates operating in shuttle mode, one above the other in two planes.

The highly dynamic LR-HD 3-axis linear robot used or, alternatively, the highly efficient LR-HE plus ensures that the MK 800 PRO precision mixing head is repeatedly guided accurately over the component. In this process, the FERMAPOR K31 sealing foams are precisely applied to the pre-programmed contour of the filter frame fully automatically and with high dosing accuracy. After the dosing cycle, the coupling point of the foam gasket closes seamlessly and is therefore almost invisible. The applied material foams, expanding to several times its original volume, and forms an elastic soft foam gasket with the desired foam hardness at room temperature.

The 2-component FERMAPOR adhesive sealants are applied by the mixing head to the inside surfaces of the filter frame in a process-reliable manner. In addition, the good flow properties of FERMAPOR ensure that the adhesive is applied to the entire surface. This ensures that the filter pack is optimally bonded and sealed within the frame on all sides.

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



Optional: **WT 2-LEVEL shuttle / sliding table** Two pick-up plates operating in shuttle mode in two planes



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



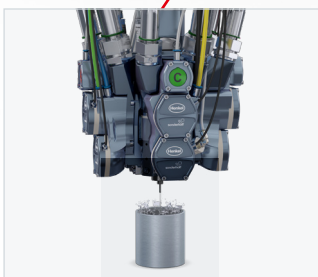
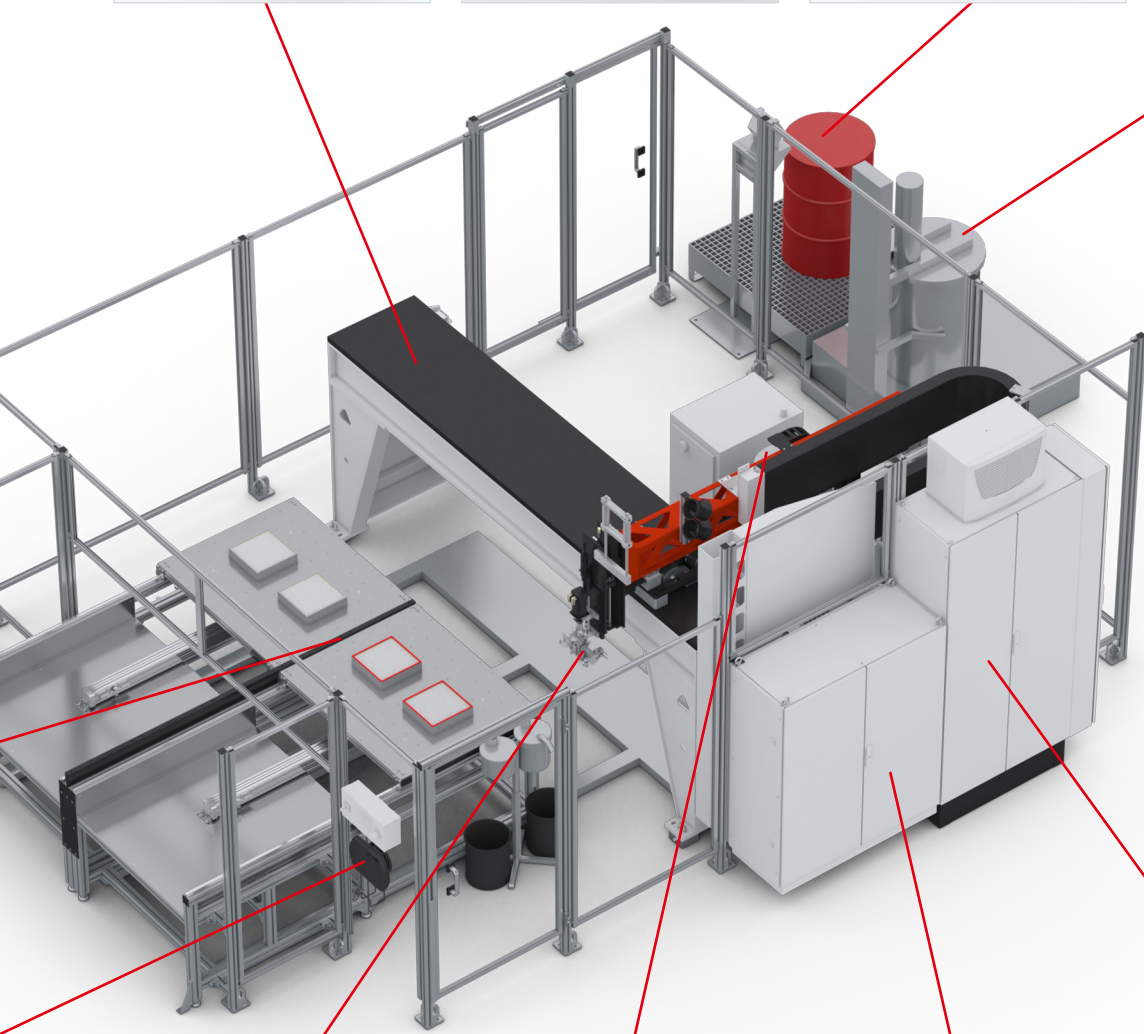
The multi-function **MP 2 mobile panel (10.1" WXGA TFT)** enables convenient operation of the dosing system.

Highly dynamic **LR-HD 3-axis linear robot** for precise guidance of mixing heads for the application of polymer reaction materials. The rack-and-pinion drive with high stiffness and acceleration enables dynamic application speeds.

Optional: 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.

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

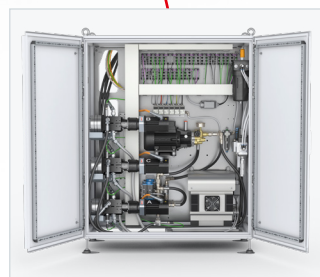
Optional: Automatic **ELEVATOR drum refilling station** for the **A component** with pneumatic lift and agitator



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



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.



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



sonderhoff

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

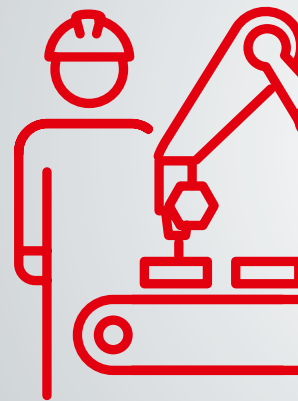
With its Sonderhoff brand, Henkel has not only acquired many years of experience in the manufacture of tailor-made two-component sealing systems and mixing and dosing machines, but also as a process expert for application-specific material application using the FIPFG (Formed-In-Place-Foam-Gasket) technology.

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.



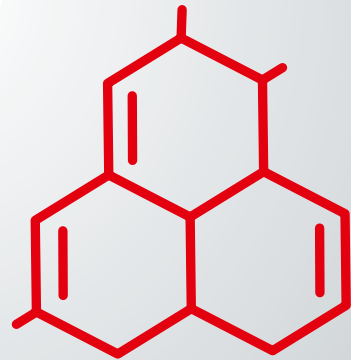
**MANUFACT**

# *Flexibility & Precision*



**EQUIPMENT**

# Automation Solutions



**MATERIALS**



**URING**

# Customer-specific solutions – worldwide and for many industries

The Henkel specialists for the Sonderhoff portfolio  
are available globally

**KOLO, 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*



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 system 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. Furthermore, 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.



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