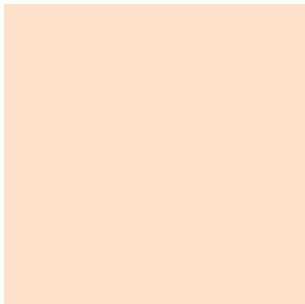
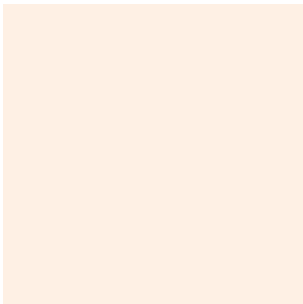


PURe Line
Mixing and Metering Technology



Plastics
Technologies
in Motion.



Having more than 40 years of experience in production technology for the processing of polyurethanes (PU), the FRIMO Group offers its customers complete *PURe* solutions along the entire process chain. *PURe Line* mix-, metering machines and mixing heads as well as the patented FRIMO spray head used for spraying polyurethane complete the range of products. Therefore FRIMO is able to offer customized manufacturing solutions covering the entire range of technologies that are required for PU processing. In this respect, the biggest development and saving potential is the control of the entire process. This means the customer will profit from a substantial added value provided by the accurate interaction of the FRIMO products.



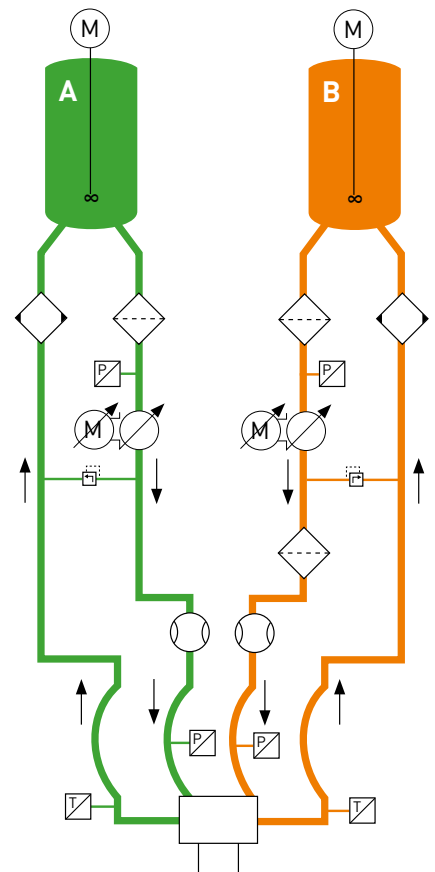
FRIMO Application, Secure Development and Try-Out Center

PURe Line Mix-, Metering Machines

For the production of parts made from diverse PU systems, FRIMO offers as one example the *PURe Line* pump metering machines. The machines are configured according to the customer's product requirements and processing parameters. Even the basic version includes extensive equipment and first-class mechanical and electrical components.



FRIMO *PURe Line*



Exemplary flow diagram

PURe Line: Precise – High Quality – Customized



FRIMO *PURe Line* multi-component dosing with centralized raw material supply

Technical Information

- Close loop controlled metering machine
- Leakage-free metering pumps with magnetic couplings
- Process optimized, jacketed raw material tanks with large heat exchanging area in variable sizes ranging from e.g. 30l to 500l volume
- Output rates from < 10 g/s to 300 kg/min
- Raw material agitators with almost maintenance-free seals, total maintenance free magnetic couplings available on request
- Programmable filling level indicators including automatic filling function
- Additional temperature indicators on the raw material tanks
- Mixing head hydraulic system with air cooling, filling level and temperature control
- Flowmeters with high resolution and low pressure loss
- Solid pipes instead of hoses (except for pump connections)
- Electric and pneumatic cabling within the hollow profile of the machine frame
- Use of globally available, approved component brands

PURe Line Hybrid and Piston Metering Machines

FRIMO *PURe Line* hybrid and piston metering machines are especially used for tailored applications with filled PU systems.

If only the polyol component contains abrasive filling materials such as barium sulphate, glass fibres or wollastonite, we recommend the use of a hybrid machine. Here only the polyol containing side is provided with a piston metering unit. Depending on the final product and the PU system in use, both component sides can be equipped with piston metering units. Equipped with the same advantages as all *PURe Line* dosing machines hybrid and piston dosing machines provide the following additional technical features:

- Tailor-made metering piston sizes for e.g.: 1.5l, 3l, 5l, 15l, 25l, 30l
- Automatic piston packing flushing and piston venting
- Extended seal lifetime due to an innovative design accustomed to the special demands of abrasive fillers

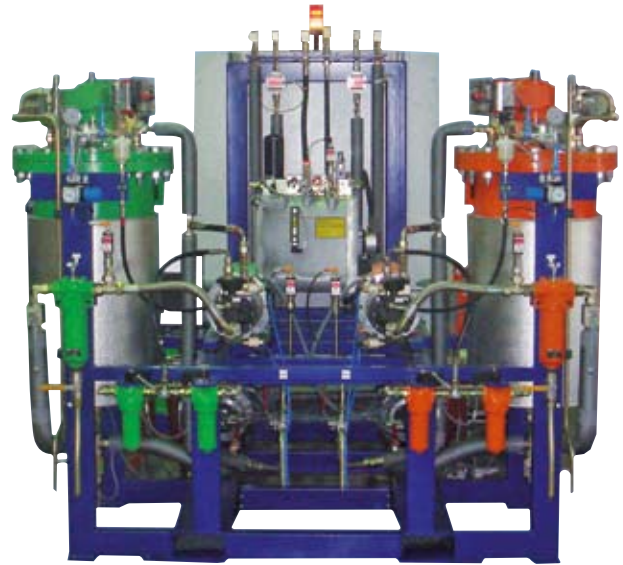


FRIMO *PURe Line*
Hybrid machine

PURe Line Spraying Machines

FRIMO offers *PURe Line* spraying machines for different applications, however mainly for spraying PU surfaces. The application areas do not only include instrument panels, door panels, seats for motorcycles, tractors, or snow mobiles/jet skis but also components for medical applications and other areas of plastic processing. In addition to the extensive equipment of all FRIMO basic metering machines, *PURe Line* spraying machines provide the following features:

- Temperature control optimally adjusted to the process
- High-pressure heaters installed close to the spray head
- Temperature acquisition and regulation directly on the spray head
- Highly accurate output metering of a few g/s



FRIMO *PURe Line* spraying machine



FRIMO Spray development and application center

Peripheral Equipment

In connection with the processing of PUR and the manufacture of PU components, FRIMO also supplies peripheral equipment for all kinds.

FRIMO product portfolio

- Nucleation units
- Color dosing units
- Pre-mixing stations
- Barrel-/ Container stations
- Ventilation systems
- Safety systems
- Robots and manipulators
- Equipment- and working platforms
- Different human machine interfaces available, starting from simple displays to fully network integrated industrial PC solutions

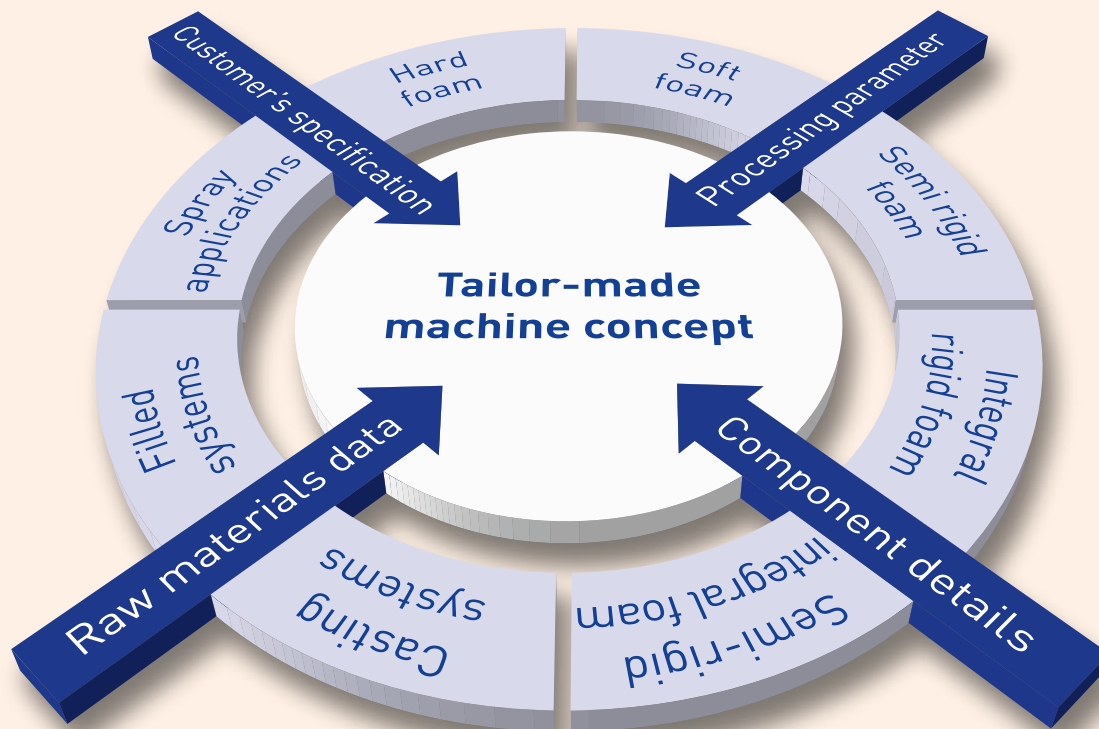


Example of FRIMO *PURe Line* user surface

One Stop. All Services.

FRIMO *PUR*e Technology offers

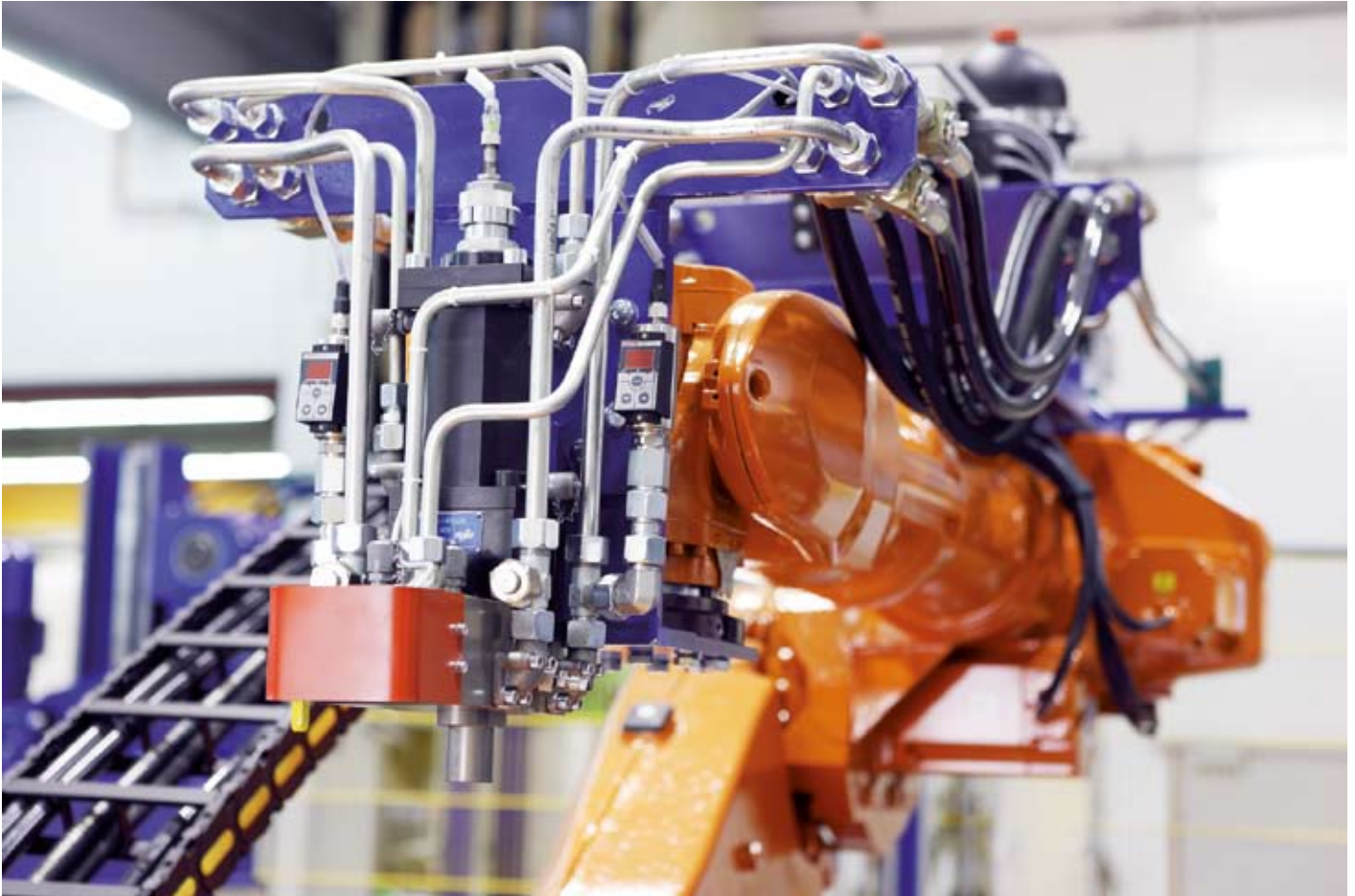
- Extensive global component competency and many years of experience in the polyurethane processing industry
- Support with component design for optimization of producibility and for reduction of material consumption
- Process neutral consultation for optimum technical and economic solutions
- Application specific consultation for an optimally designed manufacturing concept
- Delivery of tools, machines, and plants for the processing of polyurethanes and other reactive materials from one source. Bundled competency for fewer interfaces and shorter ways
- "In-house" sample, prototype and spare part production with modern equipment and all relevant processes
- Modification, relocation, upgrading and service of existing tools, machines, and plants



Advantages of FRIMO *PUR*e Line Mixing and Metering Technology

- Tailor-made machine concept
- Modular, compact design
- "Plug-and-produce" philosophy
- Simple relocation
- Fully equipped basic version
- Close loop metering machines
- "Open" visualization software
- Leakage free metering pumps with magnetic couplings
- Process optimized, jacketed raw material tanks
- Mixing and spray heads with first-class mixture
- One Stop. All Services.





PURe Line Mixing and Spray Heads

Hydraulically operated high-pressure mixing heads of the FRIMO *PURe Line* program function according to the countercurrent double-angle mixing principle. Depending on the requirement, there are different transfer and linear mixing heads available for open or closed pour application, adjusted to the customer's specific product requirements.

Technical Information

- Output rates of a few grams per second up to 5.000 g/s with first-class mixture
- Self-cleaning mixing head principle
- Homogeneous mixing from shot start to shot end due to simultaneous opening and closing of the component feed lines
- Special steel qualities and modern finishing and coating procedures for nearly frictionless run of the mixing and cleaning pistons are unequaled
- Only one nozzle per raw material component required. Hence it follows the adjustment of the mixing pressure during the recirculation phase can be carried out steplessly at the identical place
- High- and low-pressure circulation of the components before and after the shot is effected via recirculation grooves
- Optionally available as armored type for filled PU systems
- Two and multiple component mixing heads available

The right mixture is important!

Transfer mixing heads

- Ideal laminar output over the entire output range
- Adjustable cleaning piston for manipulation of the mixing chamber discharge cross-section, to intensify the mixing and to optimize the laminar flow at different output rates
- User-friendly nozzle / needle cartridge assembly

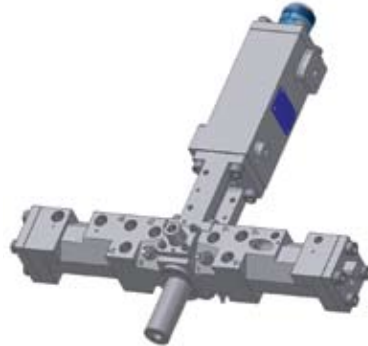


Example: FMH 8/12 - 2CLS - 40



Example: FMH 12/18 - 2CLS - 40

Multi-component mixing heads



Example: FMH 8-8/12-3CLS;
2 x 3-component duplex-mixing head

- Single selectable (open and close) nozzles allow for the individual switch on/off of single components, e.g. for products in different colours (shoe soles, steering wheels, etc.)
- Another possibility is the realization of different hardness within a foam part (e.g. seat cushions with multi hardness and multi densities)
- Mixing heads with two mixing chambers, each chamber for two, three or four components, and with one common cleanout piston, so called "duplex" mixing heads allow the usage of two completely different PU systems
- Due to the two fully separated mixing chambers contamination of one system by the other is eliminated. Therefore a residue-free component change from shot to shot, eventually including colour, can be carried out with only one mixing head



Example: FMH 16-4CLS - 40; 4-component linear mixing head for abrasive filled PU systems

Spray heads



Spray head type FSH

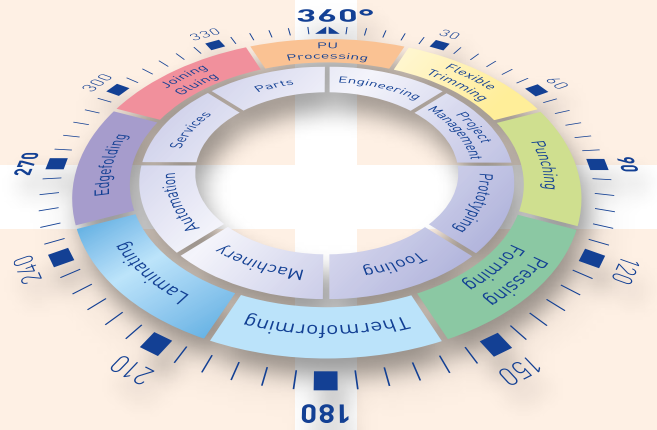


Spray lance with customized nozzle design for each application

- Patented hydraulically operated spray mixing head with up to four components
- Excellent high-pressure mixing of the components
- Special nozzles for different spraying patterns
- Variable output rates, e.g. from 10 to 120 g/s
- Small, compact size, low weight
- Length and angle of spray lances individually designed to the mold geometry
- Service-friendly design, consisting of a few components
- Nearly self-cleaning, countercurrent mixing principle without static mixer
- Patented flushing system for lance and spray nozzles

The FRIMO logo is displayed in white text on a dark blue square background. The letters are bold and italicized, with a white swoosh underline that starts under the 'F' and loops under the 'O'.

Plastics
Technologies
in Motion.



FRIMO Lotte GmbH

Hansaring 1
49504 Lotte, Germany

Tel.: +49 (0) 5404 886 - 0
Fax: +49 (0) 5404 886 - 188
info.lotte@frimo.com

FRIMO Inc.

50685 Century Court
Wixom, MI 48393, USA

Tel.: +1 (248) 668 - 3160
Fax: +1 (248) 668 - 3040
info.usa@frimo.com

FRIMO Automotive Trim Tooling & Equipment Co. Ltd.

Building 1, No. 568 Longpan Rd.
201801 Shanghai, China

Tel.: +86 (21) 516515 - 68
Fax: +86 (21) 516515 - 69
info.china@frimo.com

www.frimo.com