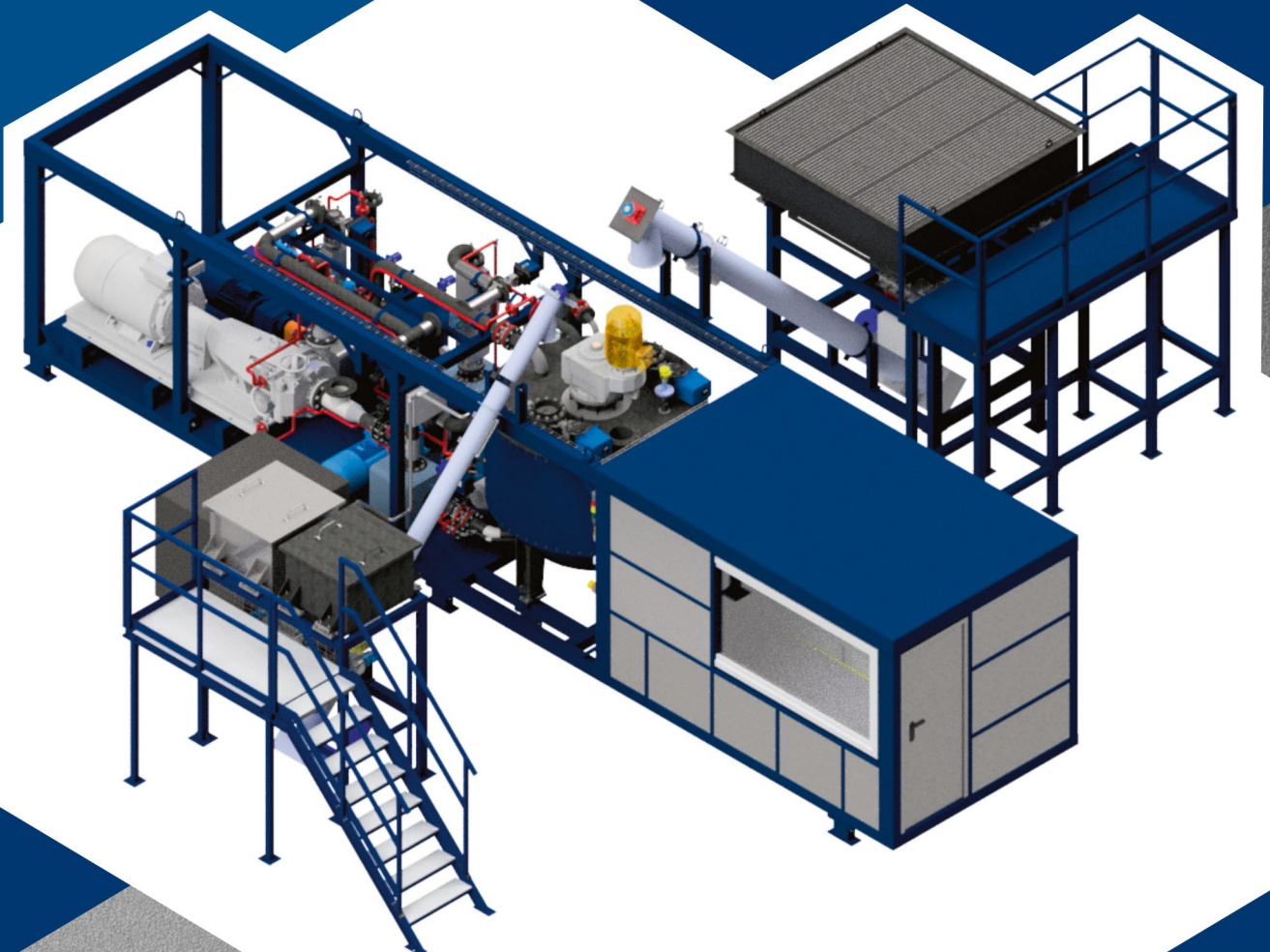




ErichHahn MB
Polymer Modified Bitumen Plant

MB-25/MB-50

TECHNICAL DESCRIPTION



Since 2014, ErichHahn has been designing and supplying equipment for the production, storage, and transportation of viscous and solidifying fluids. Our cumulative knowledge and experience allow us to be a provider of advanced industrial solutions on both regional and global levels. We deliver pumping equipment to the suppliers of bitumen for road construction, including terminals for storage and transportation of viscous and solidifying fluids, mobile and stationary modular plants, and units designed in accordance with individual customer requirements.



The ErichHahn Bitumen Modification Plant is designed for the production of polymer-modified bitumen used in road and infrastructure construction. The plant ensures precise component dosing and stable formation of a homogeneous polymer-bitumen structure in a continuous process. It enables the production of a wide range of PMB, PM, and PG bitumen grades in compliance with international standards. The modular design and full automation ensure easy integration, consistent product quality, and reliable operation.

ErichHahn's mission is to apply our technology and engineering expertise to improve our customers' production processes.

We strive to be a driving force behind our customers' process improvements, business development and production culture, following the principles of innovation, customer focus, reliability, safety and competence.

TECHNICAL DESCRIPTION

ErichHahn MB Polymer Modified Bitumen Plant MB-25/MB-50

Purpose and Configuration of the Unit

The ErichHahn MB-25/MB-50 is designed for the production of polymer-modified bitumen and ensures the manufacture of all grades of PMB, PM, and PG bitumens in accordance with both domestic standards (GOST R 52056, GOST R 58400.1) and international standards (EN 14023).

The unit is designed using continuous (in-line) production technology and is capable of meeting the highest customer requirements for the production of high-quality road materials. The continuous process ensures maximum production flexibility.

The modular design and modern equipment allow the unit to be rapidly implemented both in new production facilities and in the modernization of existing ones.

The basic configuration of the unit includes

1

Bitumen modification block in modular design:

- Bitumen dosing system;
- Plasticizer dosing system;
- Polymer feeding system;
- Mixing tank (Mixer);
- Homogenisation system;
- Automatic fire alarm system.

2

Control cabin:

- Automated Operator Workstation (main AOW);
- Access control system (ACS);
- Control cabinet;
- Climate control system;
- Lighting.

The equipment of the bitumen modification block in modular design is compactly arranged within a frame structure and can be transported in a 40-foot container. The control cabin is designed as a room providing comfortable working conditions for the operator. Process control is performed by an industrial programmable logic controller (PLC), ensuring the safety of the technological process in automatic mode. Operator access to the room is provided via contactless cards, which are also used for operator authorization at the AOW.

The standard configuration of the control cabin includes:

- Automated Operator Workstation (AOW):
 - personal computer;
 - furniture with antistatic coating;
 - contactless card reader.
- Control cabinet based on an industrial programmable logic controller (PLC);
- Climate control system;
- Automatic fire alarm system;
- Access control and management system (ACS);
- SMS notification system.

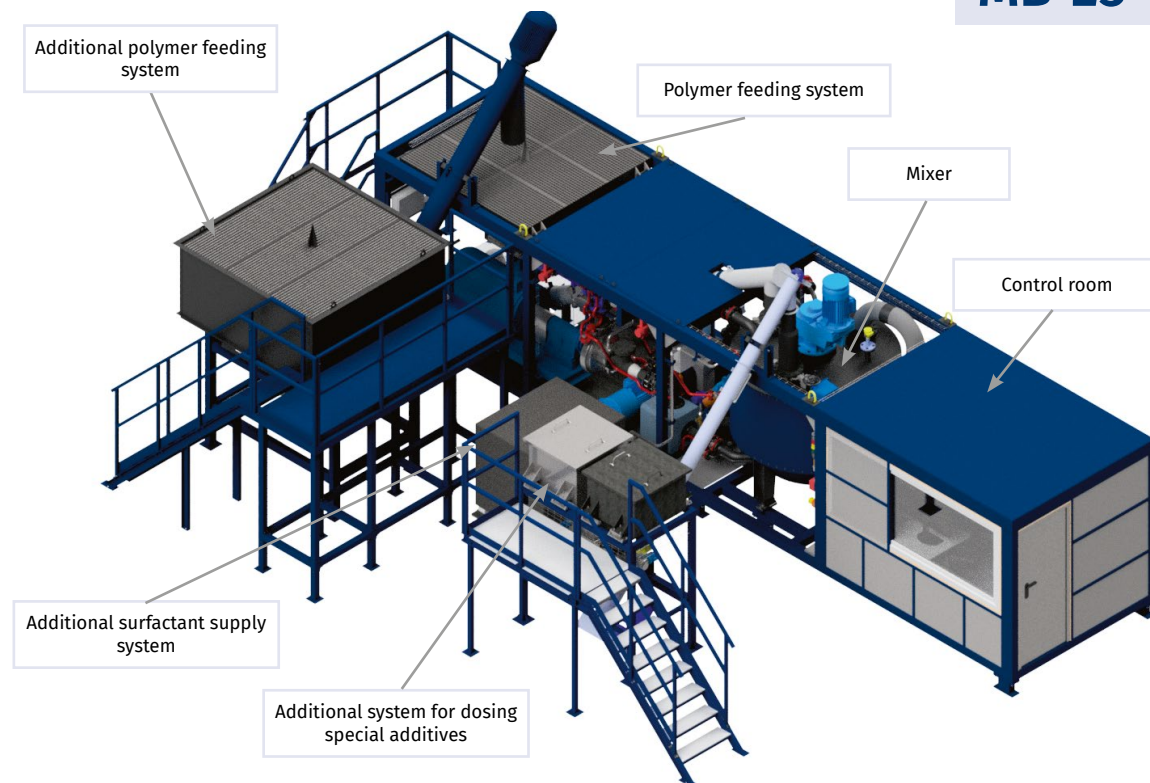
Optional equipment:

- Additional polymer feeding block;
- Additional system for supplying special additives;
- Additional Automated Operator Workstation (AOW);
- Tank and surfactant supply system (Surfactant Supply System);
- Video surveillance system.

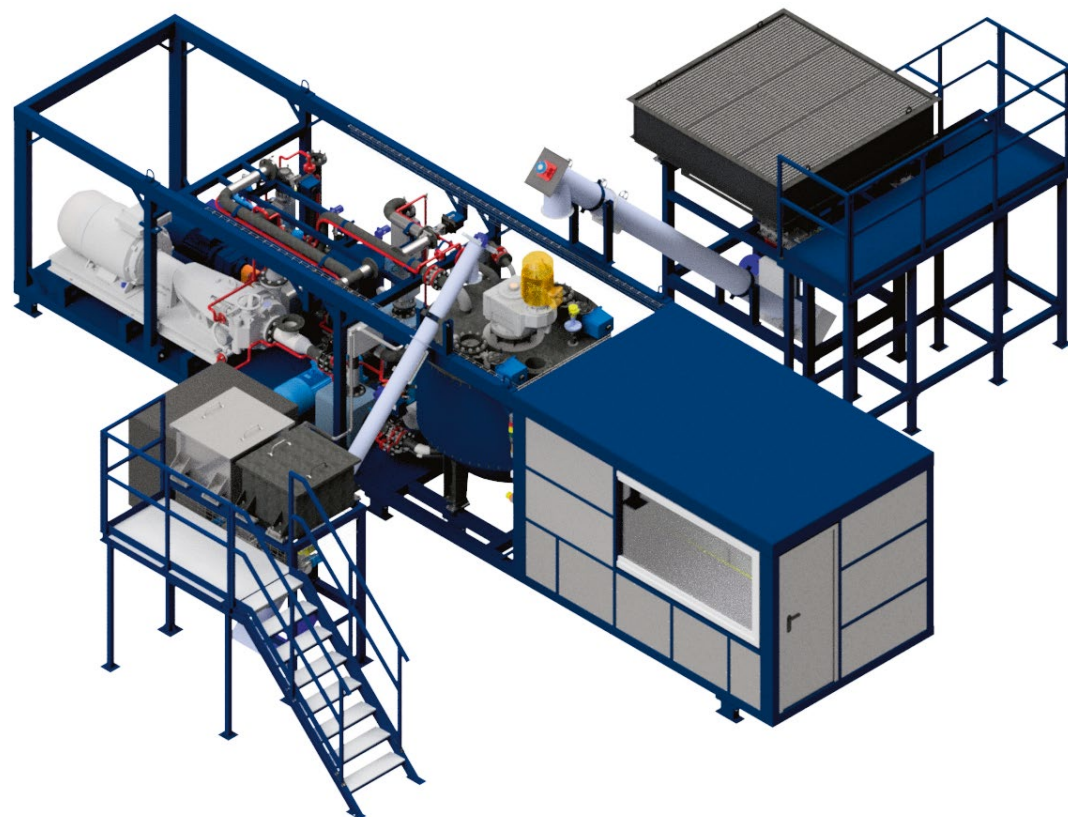
Optional:

- Additional Automated Operator Workstation (AOW);
- Video surveillance system;
- Printer.

MB-25



MB-50



Advantages of the ErichHahn

- Compact design;
- Modular construction;
- Modern equipment;
- Continuous technological process;
- Capability to operate with concentrate;
- High dosing accuracy;
- Recycling capability when required;
- Use of a wide range of additives;
- Full process automation for any recipe.

Operating Principle of the ErichHahn

Before starting the unit, the operator selects preset recipes and, if required by production needs, enters a new component formulation into the control system. Prior to any start-up, the unit must be preheated to the required operating temperature.

The control system allows all necessary recipes to be stored for subsequent use.

In accordance with the selected formulation, the components are automatically fed into the mixing tank:

- Bitumen, plasticizer, and liquid adhesion additives (surfactants) are supplied by pumping equipment;
- The flow rate of supplied bitumen and plasticizer is controlled by Coriolis-type flow meters;
- The quantity (mass) of supplied surfactant is measured by a weighing transmitter with load cells installed on the IBC container frame;
- Bulk additives (polymer, wax, sulfur, etc.) are automatically dosed from hoppers and conveyed by a screw conveyor;

- Gravimetric feeding systems for bulk additives are based on the principle of weight dosing. The mass of the dosed material is measured by load cells installed on the weighing frame, while the weighing transmitter ensures accurate control and recording of dosing parameters.

In the mixing tank, the components are mixed to ensure uniform distribution and to prepare the composition for the homogenisation stage.

The product is then fed by a booster pump to a colloid mill, where intensive hydrodynamic and shear effects disperse the polymer particles to the required size and form a stable polymer-bitumen structure.

The MB unit provides for the production of polymer-modified bitumen from a concentrate with a high polymer content. The unit is equipped with a line including a pump and a flow meter for supplying bitumen to the concentrate and then to a static mixer. Due to its design, the static mixer minimizes the formation of air bubbles and promotes more effective interaction of the ingredients.

In the MB unit, a three-way valve is installed on the homogenisation system line. It provides process flexibility by directing the product either further to stabilization or back to the mixing tank for recirculation.

For heating the unit and maintaining the required temperature, a heat tracing system (satellite heating) is used, installed on the equipment and pipelines. The working heat-transfer medium in this system is high-temperature thermal oil.

Fire protection of the unit is ensured by a thermal and fire alarm system, automatic shutdown of equipment at emergency temperatures, grounding and protection against static electricity, the use of heat-resistant and non-combustible materials, as well as the availability of primary fire-fighting equipment and emergency stop buttons.

Technical Description of the Main Equipment

Homogenisation system

The homogenisation system is designed for dispersing and uniformly distributing polymer particles in the bitumen mass, ensuring the production of stable and homogeneous polymer-modified bitumen (PMB). The system includes a booster pump, a colloid mill, and a piping network with a auxiliary thermal oil heating system and instrumentation.

From the mixing tank, the mixture is fed by a booster gear pump to the Supraton 449-5.03 (MB-25)/Siefer SM-D3/HK (MB-50) colloid mill. The pump provides a stable flow and the required pressure for uniform feeding of the mill, preventing pulsations and flow fluctuations. Additionally, the booster pump generates the necessary head for supplying the product to maturation tanks.

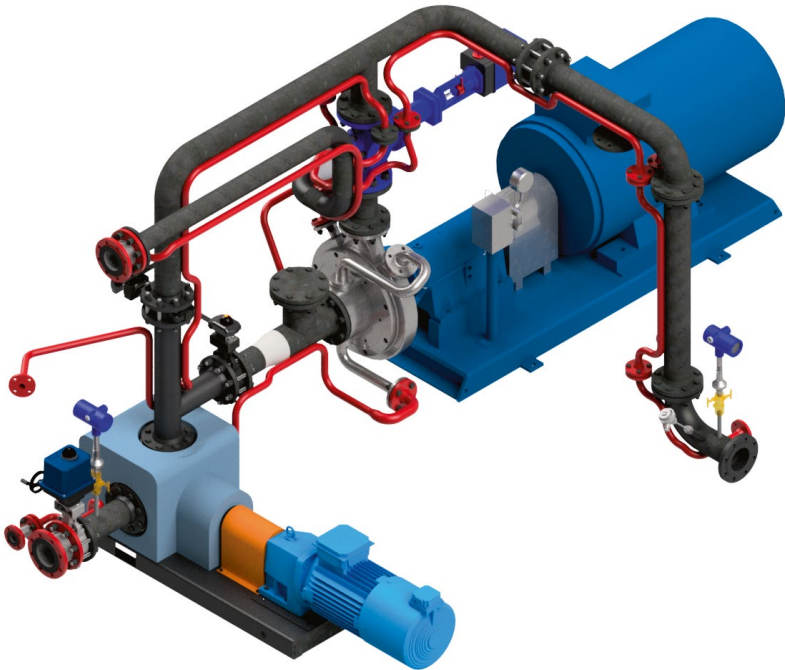
The Supraton 449-5.03 (MB-25)/Siefer SM-D3/HK (MB-50) colloid mill is the main working element of the system. Its operation is based on passing the mixture through a narrow adjustable gap between the rotor and the stator, creating high shear and turbulent loads. Under these loads, mechanical dispersion and intensified mixing occur, ensuring fine grinding of polymer particles and their uniform distribution in the bitumen phase. The mill housing is equipped with a auxiliary thermal oil heating system, maintaining the required operating temperature and providing preheating of the equipment before start-up.

The MB unit is designed for the production of PMB with a polymer content of 2 to 6–8 % by mass, with the colloid mill ensuring the nominal process throughput. Additionally, the system allows modification of bitumen using polymer concentrate with up to 12 % polymer content by mass.

Mill operation is fully automated, and all parameters are monitored via the unit’s automated process control system (APCS).

When operating with concentrate, the product discharge line (equipped with a static mixer) includes a bitumen blending line. The static mixer ensures complete dispersion of the concentrate by passing the flow through a system of fixed mixing elements that repeatedly split, redirect, and twist the flow, creating shear zones and ensuring uniform distribution of the concentrate in the bitumen for high-quality homogeneous product. The finished modified bitumen is discharged through the outlet pipe and fed into a storage tank for subsequent dosing.

The MB unit includes a three-way valve to redirect the product either to the product discharge line (for dosing) or back to the mixing tank for recirculation. Control is fully automatic, with the operator able to adjust the recirculation ratio according to process requirements.



Technical Specifications of the Homogenisation System

Name of Component	Model / Type	Main Parameters	Notes
Colloid mill (MB-25)	Supraton 449-5.03 ¹⁾	Drive power – 160 kW Rotation speed – up to 3000 rpm Capacity – up to 25 t/h	Homogenisation: two-phase (dispersion + stabilization) in an adjustable rotor–stator gap
Colloid mill (MB-50)	Mill SIEFER TRIGONAL type SM-D3/HK ²⁾	Drive power – 160 kW Rotational speed – up to 3,000 rpm Capacity – up to 50 t/h	Homogenisation in an adjustable rotor–stator gap
Booster pump (MB-25)	Gear pump R-105 (Victor Pump)	Capacity – up to 37 m³/h Drive power – 15 kW Rotation speed – 287 rpm	Provides stable feed to the mill Frequency-controlled drive
Booster pump (MB-50)	Gear-type HPS-55 (Victor Pump)	Capacity – up to 30 m³/h Drive power – 18.5 kW Rotational speed – 450 rpm	Ensures stable feed to the mill Variable frequency control
Mill electric motor	Siemens / equivalent	Power – 160 kW, IP55	
Static mixer	Tubular	DN100 Length – 1 m Mixing intensity – high Pressure drop – 10–20 kPa	
Three-way valve	ARI ARMATUREN STEVI/ equivalent	DN 100 Input signal – 4–20 mA or 0–10 V Premio Plus 2G, 12 kN, power supply 100–240 V 50/60 Hz, IP65	
Mill heating system	Thermal oil	Maintains temperature at not less than 175 °C	Automatic regulation
Monitoring sensors	Siemens / equivalent	Temperature, pressure, and flow control	Data transmission to the APCS
Pipelines and valves	Steel, with thermal insulation	Operating temperature – up to 200 °C	Heated loop
Control system	APCS (Siemens PLC + SCADA)	Operating mode, pressure, and temperature control	Automatic coordination with other units

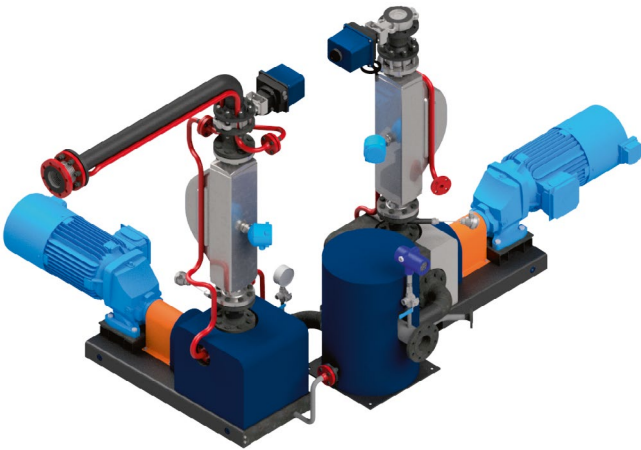
1) ErichHahn provides the option to equip the unit with an alternative to the Supraton mill – the SIEFER TRIGONAL mill, type SM-290/HK.
2) ErichHahn provides the option to equip the unit with an alternative to the SIEFER mill – the Supraton 549-5.03 mill.

Bitumen dosing system

The bitumen supply system is designed for the transportation and metered feeding of bitumen at a temperature of not less than 175 °C from the storage tank to the unit's mixing tank, as well as to the product discharge line when operating with concentrate. The system comprises two pump units, a filter, a heat-tracing system, and instrumentation.

A coarse filter is installed upstream of the pump units to prevent mechanical impurities from entering the pump and the flow meter. Feeding is performed by a gear pump, which ensures a stable flow of the viscous product at high temperature. The pump drive is equipped with a frequency converter, allowing precise adjustment of capacity in accordance with process requirements. Mass and volumetric flow control is carried out by a Coriolis flow meter, with data transmitted to the automated process control system (APCS).

The Coriolis flow meter is a high-precision instrument for measuring the mass flow, density, and temperature of bitumen. It provides stable readings, has no moving parts, and is suitable for operation with viscous and heated products, ensuring accurate dosing according to the selected recipe.



Technical Specifications of the Bitumen Supply System

Name of Unit / Component	Model / Type	Main Parameters	Notes
Bitumen supply pump to the mixing tank	Gear pump R80 (Victor Pump) / equivalent	Capacity – up to 30 m³/h (MB-25); up to 55 m³/h (MB-50);	
Bitumen pump for the homogenisation line	Gear pump R80 (Victor Pump) / equivalent	Capacity – up to 30 m³/h Rotation speed – 476 rpm Drive power – 15 kW	
Motor–gear unit	NORD / equivalent	Three-phase, IP55, insulation class F	Equipped with a frequency converter
Bitumen line filter	–	Removable mesh element Operating temperature – up to 200 °C Mesh size – 8 mm	Installed upstream of the pump
Coriolis flow meter on the line to the mixing tank	Emerson Micro Motion F300S / equivalent	DN 80 (MB-25); DN 100 (MB-50); Material – stainless steel 316L Accuracy class – 0.2 %	Measurement of mass and volumetric flow
Coriolis flow meter on the homogenisation line	Emerson Micro Motion F300S / equivalent	DN 80 Material – stainless steel 316L Accuracy class – 0.2 %	Measurement of mass and volumetric flow
Heating system	Thermal oil	Maintains bitumen temperature at not less than 175 °C	General heating circulation loop
Control system	APCS (Siemens PLC + SCADA)	Automatic pump capacity control	Synchronized with mixer feed

Plasticizer dosing system

The plasticizer supply system is designed for the transportation and metered feeding of liquid plasticizer from the storage tank to the unit's mixing tank.

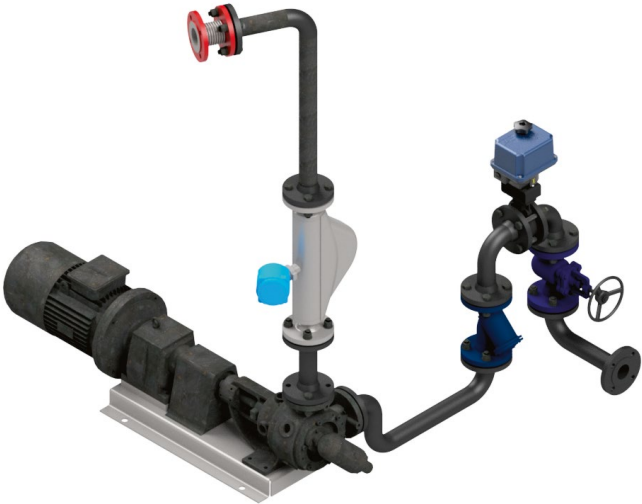
The line consists of a pump unit, filter, flow meter, and heated piping, ensuring stable flow and temperature parameters.

A coarse filter is installed upstream of the pump to prevent mechanical impurities from entering the pump and flow meter. The main component of the system is a gear pump, which provides uniform plasticizer feed with adjustable flow.

The pump drive is equipped with a frequency converter, allowing precise adjustment of the flow according to process requirements. A Coriolis flow meter is installed for monitoring and recording, providing high-precision measurement stability when working with viscous liquids.

The measured mass and volumetric flow values are transmitted to the APCS, where automatic flow correction is performed according to the recipe. The piping line is equipped with thermal oil heating and insulation, preventing cooling of the product and viscosity changes during transport.

The system operates fully automatically and is synchronized with the feed of bitumen and polymer to the mixing tank according to the recipe.



Technical Specifications of the Plasticizer Supply System

Name of Component	Model / Type	Main Parameters	Notes
Plasticizer feed pump	«Gear pump, YKF2 (Yildiz Pompa) (MB-25); R50 (Victor Pump) (MB-50);/ equivalent»	Capacity – 10–15 m³/h Rotation speed – 540 rpm (MB-25); 702 rpm (MB-50); Drive power – 5.5 kW	
Motor–gear unit	NORD / equivalent	Three-phase, IP55, insulation class F	Equipped with a frequency converter
Line filter	–	«Removable mesh element Operating temperature – up to 110 °C Mesh size – 2 mm»	Installed on the suction side
Coriolis flow meter	Emerson Micro Motion G200S / equivalent	«DN50 Material – stainless steel 316L Accuracy class – 0.2 %»	Measurement of mass and volumetric flow
Pipeline heating	Auxiliary thermal oil loop	Maintains temperature at 160–180 °C	With insulation
Control system	APCS (Siemens PLC + SCADA)	Automatic flow regulation and temperature contr	Synchronized with the bitumen line

Polymer feeding system

The polymer feeding system is designed for receiving, storing, dosing, and supplying granular or powdered polymer to the unit's mixing tank. The line ensures precise dosing of solid components according to the recipe and operates automatically under the control of the APCS.

The system comprises:

- Hopper** – a vertical metal container with a capacity of approximately 2/3.6 m³ depending on the plant, equipped with a platform vibrator to prevent bridging, compaction, and material settling;
- Screw conveyor** – diameter Ø219/273 mm depending on the plant, length 4.5 m, ensuring uniform transfer of material from the hopper to the mixing tank;
- Rotary feeder**, installed between the hopper and screw conveyor, provides hermetic, metered delivery of the polymer and prevents backflow of hot air from the mixing zone. It is driven by a motor–gear unit with frequency control, allowing precise adjustment of feed rate;

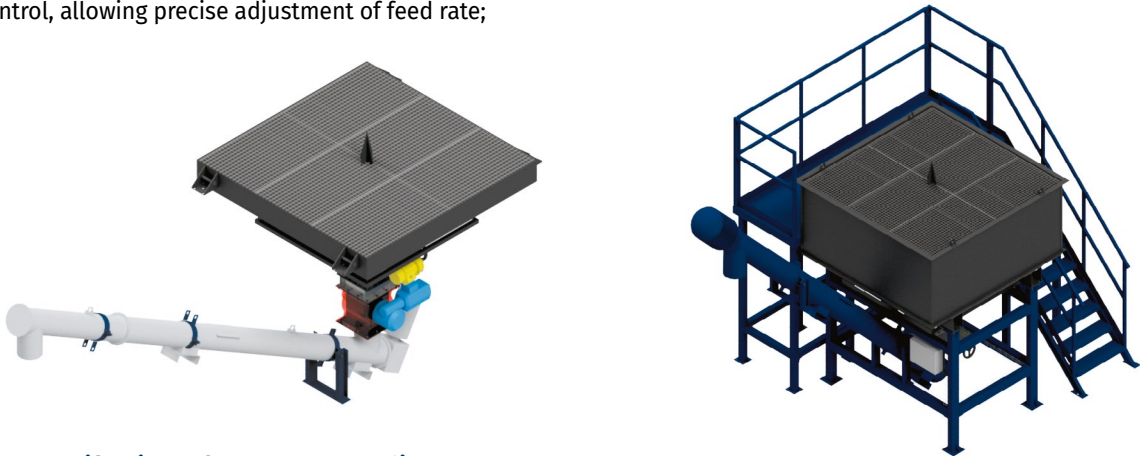
- Load cells**, integrated into the hopper frame, provide continuous mass measurement and transmit signals to the control system.

Optionally, the unit can be equipped with an additional polymer feeding block. The additional hopper accelerates, facilitates, and ensures a continuous production process.

Operating principle of the system:

The polymer is loaded into the hopper, where it remains in a freely flowing state. Upon a signal from the APCS, the rotary feeder and screw conveyor activate to feed material into the mixer. Depending on the recipe, the rotation speed of the rotary feeder is automatically adjusted, with mass monitored by the load cells. This ensures high dosing accuracy and stable polymer feed with minimal flow fluctuations.

All system components are enclosed, ensuring safe and clean operation of the equipment.



Technical Specifications of the Polymer Feeding System

Name of Component	Model / Type	Main Parameters	Notes
Polymer hopper	–	Capacity – 2 m³ (MB-25); 3,6 m³ (MB-50); Equipped with a platform vibrator Material – carbon steel with anti-corrosion coating	Prevents material bridging and compaction
Screw conveyor (polymer hopper to mixing tank)	Ø219 mm / L ≈ 4.5 m (MB-25); Ø273 mm / L ≈ 4.5 m (MB-50);	Rotation speed – adjustable	Polymer feed to the mixer
Screw conveyor motor–gear unit (polymer hopper to mixing tank)	NORD / SEW / equivalent	Power – 5.5 kW With frequency control	Smooth feed rate adjustment
Rotary feeder (polymer hopper)	–	Flow-sealed Drive – 1.5 kW	Prevents air backflow
Load cells (polymer hopper)	HBM / equivalent	Range – up to 2000 kg Accuracy class – 0.1 %	Real-time mass monitoring
Additional hopper	–	Capacity – 3.6 m³ Equipped with a platform vibrator Material – carbon steel with anti-corrosion coating	Prevents material bridging and compaction
Screw conveyor (additional hopper)	Ø273 mm / L ≈ 4.5 m	Rotation speed – adjustable	Polymer feed to the mixer
Screw conveyor motor–gear unit (additional polymer)	NORD / SEW / equivalent	Power – 5.5 kW With frequency control	Smooth feed rate adjustment
Rotary feeder (additional polymer)	–	Flow-sealed Drive – 1.5 kW	Prevents air backflow

Additive feeding system – Optional

Optionally, the unit can be equipped with a system for supplying special additives: sulfur and wax granules. The system consists of two hoppers—one for sulfur and one for wax—connected to a screw conveyor with a diameter of Ø168 mm and a length of 4 m. Each hopper is fitted with a rotary feeder. Load cells integrated into the frame of each hopper provide continuous mass measurement and transmit signals to the control system.

The introduction of sulfur and wax into the PMB production process enables the manufacture of any grade of PMB and PG bitumen. This allows not only the achievement of the required product quality and properties, but also optimization of the production process by reducing costs and increasing efficiency.



Technical Specifications of the Additive Feeding System

Name of Component	Model / Type	Main Parameters	Notes
Sulfur and wax hoppers (2 units)	–	Capacity of each – 0.17 m³ Equipped with a platform vibrator Material – carbon steel with anti-corrosion coating	
Screw conveyor (sulfur/wax hopper to mixing tank)	Ø168 mm / L ≈ 4.0 m	Rotation speed – adjustable	Sulfur/wax feed to the mixer
Screw conveyor motor–gear unit	NORD / SEW / equivalent	Power – 5.5 kW With frequency control	Smooth feed rate adjustment
Rotary feeder	–	Flow-sealed Drive – 1.5 kW	
Load cells	HBM / equivalent	Range – up to 250 kg Accuracy class – 0.1 %	Real-time mass monitoring

Mixer

Mixing tank (mixer) is designed for receiving and pre-mixing components—bitumen, plasticizer, polymer, and all necessary additives according to the recipe—before feeding them into the homogenisation system. The apparatus ensures uniform distribution of components and consistent preparation of the mixture for further transfer to the booster pump and colloid mill.

The construction consists of a vertical cylindrical steel tank mounted on load cells, which provide continuous measurement of the mass of the charged components and participate in automatic control of dosing and recipe ratios during product preparation. The tank is equipped with an external spiral-type heating jacket and insulation, ensuring uniform heating along the height and stable product temperature. Inside the tank, a mechanical agitator provides effective mixing of the components and is driven by a motor-gear unit installed on the top of the mixer.

At the top of the tank are inlet nozzles for bitumen, plasticizer, polymer, wax, and sulfur, as well as a vapor-gas outlet nozzle. At the bottom, there is a discharge nozzle through which the prepared mixture is sent to the booster pump. Temperature and level are monitored by sensors connected to the automated control system.

The mixer operates fully automatically, with all parameters—mass, temperature, and level—monitored and controlled via the unit’s APCS.



Technical Specifications of the Mixing Tank

Name of Component	Model / Type	Main Parameters	Notes
Tank (mixer)	Vertical cylindrical, steel	Working volume – 2.1 m³ Material – carbon steel Spiral-type heating jacket	With insulation
Load cells	HBM / equivalent	Quantity – 3 pcs Measuring range – up to 2000 kg Accuracy class – 0.1 %	Direct measurement of tank mass
Agitator	Anchor type	Rotation speed – 40 rpm Diameter – 1800 mm Drive type – motor-gear unit	
Motor-gear unit	NORD / equivalent	Power – 15 kW Protection class – IP55	—
Thermal oil heating system	Spiral-type auxiliary thermal oil jacket	Maintains temperature at 160–185 °C	Automatic control
Monitoring sensors	—	Temperature, level	Signal transmission to the APCS
Control system	APCS (Siemens PLC + SCADA)	Temperature, level, and mass control	Automatic mode

Surfactant supply system

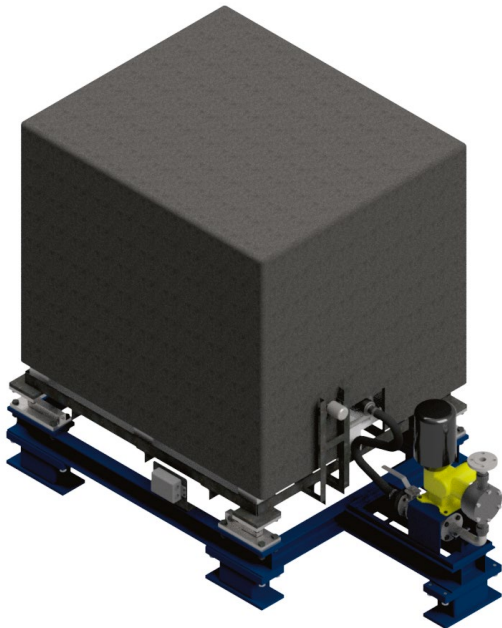
Optionally, the unit can be equipped with a tank for liquid adhesion additive (surfactant).

The system is designed for automated dosing of the surfactant into the mixing tank during the production of polymer-modified bitumen.

The surfactant is stored in a heated and insulated IBC container, ensuring its viscosity and flowability are maintained until dosing. The container is mounted on a frame with load cells, allowing real-time monitoring of the surfactant mass and providing immediate information on how much remains in the tank and how much is being fed.

A diaphragm pump provides metered, uniform, and repeatable delivery of the surfactant directly from the container to the mixing tank. Once the surfactant enters the mixer, it is combined with bitumen (and, if necessary, other components), after which the mixture is blended to achieve a homogeneous composition.

The system continuously monitors the remaining surfactant in the container, preventing overuse and ensuring accurate dosing according to the specified recipe.



Technical Specifications of the Surfactant Supply System

Name of Component	Model / Type	Main Parameters	Notes
IBC container		Working volume – 1 m³	With heating jacket Power – 2 kW Insulation thickness – 25 mm
Diaphragm pump		Capacity – up to 240 L/h (MB-25); up to 5120 L/h (MB-50); Drive power – 0.37 kW (MB-25); 0.55 kW (MB-50);	
Load cells	HBM / equivalent	Quantity – 4 pcs Measuring range – up to 2000 kg Accuracy class – 0.1 %	Direct measurement of container mass

Control Cabin of the MB Unit

The control cabin of the MB unit provides all necessary conditions for the safe and comfortable operation of personnel. An access card system and air conditioning are installed, with optional video surveillance. The cabin is furnished for convenient accommodation of operating personnel and fully equipped with control cabinets for housing electrical and instrumentation equipment.

The control system is based on Siemens SIMATIC S7-1500/ ET200SP microcontrollers and includes a computer; if required, the computer can be placed in a separate room. Pump drives are controlled via frequency converters. The system supports remote monitoring, control, and supervision of the technological processes through SCADA (operator workstation). It also enables seamless integration and data exchange with external APCS via Modbus TCP (Modbus RTU, OPC UA – optional).

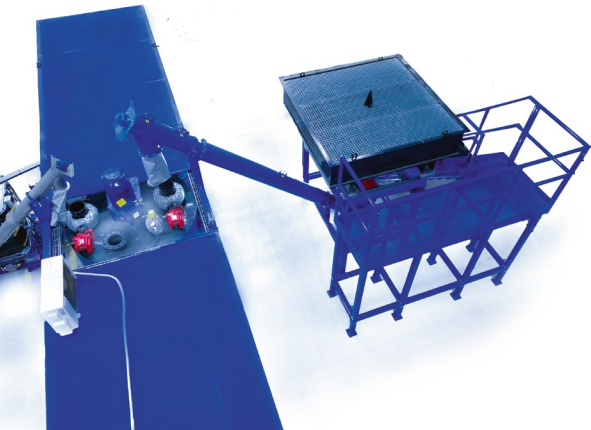
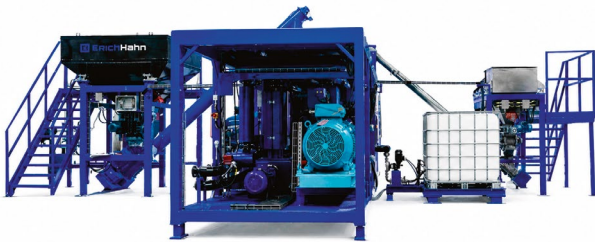
The system automatically maintains pump throughput according to the recipe. The control system performs the following functions:

- Creation, editing, and storage of bitumen modification recipes;
- Automatic control of the bitumen modification process;
- Monitoring of technological parameters — temperature, pressure, level, and flow;

- Management and supervision of the mill, pumps, feed lines, and heating system according to the technological process;
- Ensuring uniform incorporation of raw components according to the selected recipe;
- Visualization of the status of all unit components on the operator workstation;
- Collection, processing, and transmission of data to the enterprise's external APCS using standard data protocols;
- Emergency and warning alarms (visual and audible) in case of parameter deviations;
- Automatic protection of technological equipment, placing it in a safe state;
- Archiving of events, alarms, and technological parameters in chronological order for further analysis. Archived data are displayed on the operator workstation as event lists and/or graphs, with filter options available;
- Ensuring safe and stable operation of the unit in accordance with the technological regulations.

Main Technical Specifications of the MB Unit

	MB-25	MB-50
Operating medium	Viscous and solidifying petroleum product	
Climatic conditions	Temperate Climate	
Ambient temperature, °C	from -25 to +40 °C	
Unit capacity (at 4 % polymer), t/h	30	50
Mixing operating temperature, not less than, °C	175	
Operating pressure at unit outlet, MPa	0,6	
Installed electrical power, kW	350	
Rated voltage, V	380	
Ingress protection (external), at least	IP 55	
Ingress protection (internal), at least	IP 44	
Frequency, Hz	50	
Heating	Thermal Oil	
Insulation thickness of pipelines/tank, mm	50/100	



Polymer Modified Bitumen Plant MB-50



Turkey

Efe Tower, Odunluk Mah. Akpınar
Cad. 15/A, Nilüfer - TÜRKİYE

+90 224 550 00 55

sales@erichhahn.com.tr

Germany

Römerstr. 81
56130 Bad Ems

+49 (0) 2603-5069 557

hans.gebert@erichhahn.eu

Kazakhstan

151, office 123, Mymbaev street,
Almaty

+7 (727) 31 080 31

sales@erichhahn.asia



www.erichhahn.eu