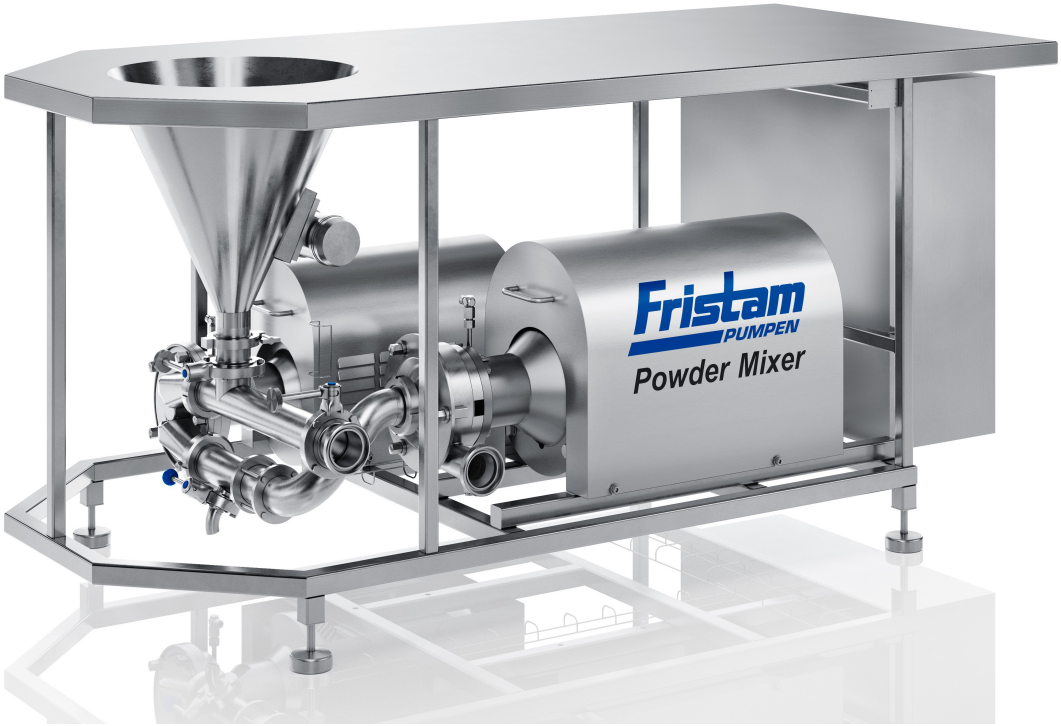
Original Instructions

Powder mixer
PM
PM-V
PM-D



Powder mixer size:

Powder mixer no.:

DISTRIBUTED BY:

Holland
APPLIED TECHNOLOGIES

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The original version of this document is the German version.
All other language versions are translations of the original German version.

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1 Introduction

1.1 Foreword

This operator's manual describes all sizes, designs and versions of the PM-V/PM-D powder mixer.

Information on the model, size, version, and accessories applicable to your powder mixer can be found on the rating plate on your powder mixer and in the enclosed order-related documents.

1.2 Manufacturer

FRISTAM Pumpen KG (GmbH & Co.)

Kurt-A.-Körber-Chaussee 55

21033 Hamburg

GERMANY

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E-mail: info@fristam.de

1.3 Scope of delivery

The delivery includes the following items:

- Table
- Adjustable machine feet or casters
- Hopper

  Optional: Protective grilles, screen, guard or CIP cover, screw-in bushing for fill level sensor, vibration motor
- Feed pump

PM	PM-V	PM-D
Centrifugal pump FZ	Positive displacement pump FL3	Double screw pump FDS

Table 1 Feed pump

- Shear pump type *Fristam* FSP
- Piping system with valves, pressure gages, inline sight glass, and connections

  Optional: Adapter, pneumatic or electro-pneumatic valve actuator, bypass, pressure transducer
- Other optional equipment:

  Control cabinet with switches, buttons, indicators; frequency converter with control panel, connecting cable and CEE three-phase plug according to DIN EN 60309.

1.4 Documentation

The documentation includes the following items:

- This operator's manual
- Technical data of powder mixer
- Operator's manual of feed pump (see *Table 1 „Feed pump"*)
- Operator's manual of FSP shear pump

– Technical documentation for other components
– Order-related documents
– Circuit diagram of control cabinet (if applicable)

Please read the above documents before installing and operating the powder mixer.

1.5 About this operator's manual

Please read this operator's manual before using the powder mixer and keep a copy of the manual available near the powder mixer.

Always comply with the applicable statutory regulations and the internal work and safety instructions.

All tasks described in this document must be performed by qualified technicians and with the necessary caution.

Risk of contamination: When handling or processing hazardous substances, always comply with the statutory safety regulations and internal safety instructions.

1.6 Typographical conventions

List items are preceded by dashes:

– Part 1
– Part 2

Tasks that must be performed in a specified order are numbered:

1. Switch device on.
2. Switch device off.

Tasks that do not need to be performed in a specific order are preceded by triangles:

► Action.
► Action.

1.6.1 Safety instructions

⚠ DANGER

A safety instruction with signal word "Danger" indicates a hazard that causes death or serious injury.

⚠ WARNING

A safety instruction with signal word "Warning" indicates a hazard that may cause death or serious injury.

⚠ CAUTION

A safety instruction with signal word "Caution" indicates a hazard that may cause minor or moderate injury.

NOTICE

A safety instruction with signal word "Note" warns of the risk of damage to equipment and material.

2 Safety

2.1 Intended use

The powder mixer has been designed for applications where stringent hygiene standards must be maintained, for instance in the food, pharmaceutical or biotechnology industries.

The powder mixer is intended for the blending of liquid base media with additives in powder or liquid form. In standard use, the powder mixer is run to process individual batches of powders supplied in bags. For continuous operation in conjunction with a conveyor system, the machine must be upgraded accordingly.

Each powder mixer is designed and manufactured to customer requirements, and the sealing materials are specifically selected to be compatible with the medium.

The supply and pumping of the base medium must be done in compliance with the maximum temperatures and pressures specified for the given powder mixer version and size. For details, see enclosed technical data and information in the order documentation.
The pumps must be run exclusively in the specified direction of rotation. Otherwise, the vacuum required to suck in the powder cannot be produced.

The powder mixer must only be operated under the conditions specified in the order confirmation from Fristam. If the actual operating conditions deviate from those in the order confirmation, contact *Fristam*.

2.2 Foreseeable misuse

- The standard Powder mixer PM/PM-V/PM-D versions must not be operated in potentially explosive atmospheres.
- The introduction and pumping of foreign bodies in the pumped medium can block and/or destroy the pipes, valves, and pumps.
- Pumping base media or powders other than those specified above can destroy pipes, valves and pumps. The seal materials (elastomers) and the pumps have been selected to suit specific base media and mixtures. For details, see order documentation.
- For trouble-free operation, adhere to the specified particle size and flowability of the powder, and the viscosity of the mixture (see order documents).
- Modifications to the powder mixer are only permissible with the consent of Fristam.

2.3 Machine-specific safety instructions

⚠ CAUTION

Inadmissible pressure and temperature range

Risk of injury and damage to property from leakage or bursting pumps, pipes and valves.

► Keep the pump, pipe, and valve pressures within the specified pressure and temperature range. For details, see technical data of components and order documentation.

⚠ WARNING

Hot surfaces

Risk of injury from burns when touching hot machine components.

► Before touching a component, make sure that it is not hot.

► Wear suitable protective gloves.

⚠ CAUTION

Noise emission from running powder mixer

Permanent hearing damage. The A-weighted sound pressure level of the powder mixer can be higher than 80 dBA.

- ► When standing close to the running powder mixer, wear suitable hearing protection.
- ► Comply with the statutory noise exposure regulations.
- ► For noise emission values of pumps, see enclosed operator's manuals.

⚠ WARNING

Risk of injury from crushing when moving powder mixer on casters

Injury to feet from casters.

- ► Wear safety footwear.

NOTICE

Firefighting with cold water

Risk of damage to components from bursting.

- ► When extinguishing a fire, avoid temperature shocks to components by cold water.

⚠ WARNING

Unsuitable working height and direction

Risk of injury when working on raised table.

- ► To lift the powder bag, use suitable aids.
- ► Place a working platform beside the table and work from the platform.
- ► Work on the side of the table designated for this purpose.

⚠ WARNING

Handling big bags

Risk of injury from heavy loads.

- ► To lift and move big bags, use suitable frames/equipment to be provided on site.
- ► Do not place the weight of big bags on the powder mixture.

⚠ WARNING

Automatically actuated valves

Risk of injury from moving valve components.

- ► Protect automatically actuated valves with suitable guards.

2.4 Signs attached to mixer

- ► Do not alter or remove the signs attached to the powder mixer.
- ► Replace damaged or missing signs without delay.

2.4.1 Safety signs



Fig. 1 "Hot surface"

The "Hot surface" sign indicates that parts of the machine might become hot during operation or that a hot base medium might be pumped. Before touching a component, make sure that it is not hot. Wear suitable protective gloves.



Fig. 2 "Do not reach into hopper"

The "Do not reach into hopper" sign indicates that it is forbidden to reach into the hopper while the mixer is running. There is a risk of injury from the valve.



Fig. 3 "Do not bend over hopper"

The "Do not bend over hopper" sign indicates that breathing in dust or aerosols escaping from the hopper must be avoided. Dust and aerosols can irritate the respiratory tract. If required, wear a dust mask.
If the machine is incorrectly operated, there is a risk that liquid escapes at high pressure from the hopper, causing injury.



Fig. 4 "Do not place small parts in hopper"

The "Do not place small parts in hopper" sign indicates that it is forbidden to place small, solid parts such as rocks or metal components in the powder mixer, as they might damage or even destroy pumps and other components, and contaminate the product. In an emergency, press the emergency stop button and remove small parts from the mixer.



Fig. 5 "Wear hearing protection"

The "Wear hearing protection" sign indicates that there is a risk of damage to hearing from high noise emissions. While the powder mixer is in operation, wear hearing protection.

2.4.2 Rating plate

The rating plate is attached to the frame beside the shear pump.

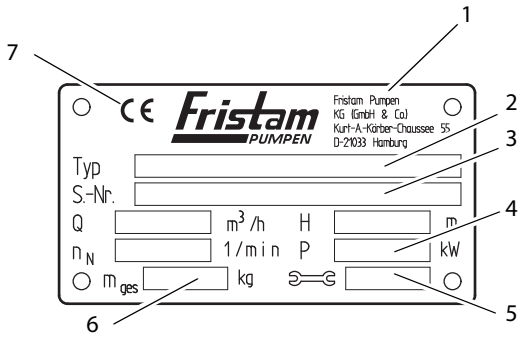


Fig. 6 Rating plate

1	Manufacturer
2	Type: Powder mixer
3	Serial no.: Serial number of powder mixture
4	P: Motor power (total) [kW]
5	Year of manufacture
6	m_{ges}: Mass (total) [kg]
7	CE Mark

2.5 Noise emissions

It is the responsibility of the machine owner to determine the actual sound pressure level on site and to take suitable measures to protect personnel, through instruction and the provision of protective equipment.

⚠ CAUTION

Noise generated by running pump

Risk of damage to hearing

► Comply with the statutory noise protection regulations. For noise emission values of the pumps, refer to the respective operator's manuals.

⚠ CAUTION

Noise generated by running vibration motor

Risk of damage to hearing

► Powder mixers with two hoppers or multiple vibration motors might generate higher noise emissions.

When operating the powder mixer with pumps or shakers whose specified sound pressure level is above 80 dBA, wear hearing protection. See "*Kapitel 10.1.2 „Noise emissions“, Seite 32*" and the operator's manual of the vibration motor.

2.6 Disposal

► Observe the instructions in the operator's manuals of the various powder mixer components.

2.6.1 Disposing of transport packaging

► The transport packaging can be recycled.

2.6.2 Disposing of grease

► Dispose of grease and implements contaminated by lubricants according to the statutory waste disposal regulations.

2.6.3 Disposing of lubricating oil

► Dispose of oil and implements contaminated by lubricants according to the statutory waste disposal regulations.

2.6.4 Disposing of powder mixer

1. Clean the powder mixer. Dispose of residue according to the statutory waste disposal regulations.
2. Dismantle the powder mixer into its constituent parts.
3. Dispose of the individual components according to the statutory waste disposal regulations.

2.6.5 Disposing of electrical and electronic waste

► Dispose of electrical and electronic waste according to the statutory waste disposal regulations.

3 Design and function

3.1 Principle of design

The powder mixture includes a feed pump (P1), a shear pump (P2), and a hopper connected to a piping system. The components are mounted on a table with a base frame. The hopper can be equipped with an optional vibration motor. The entire system stands on casters or feet.

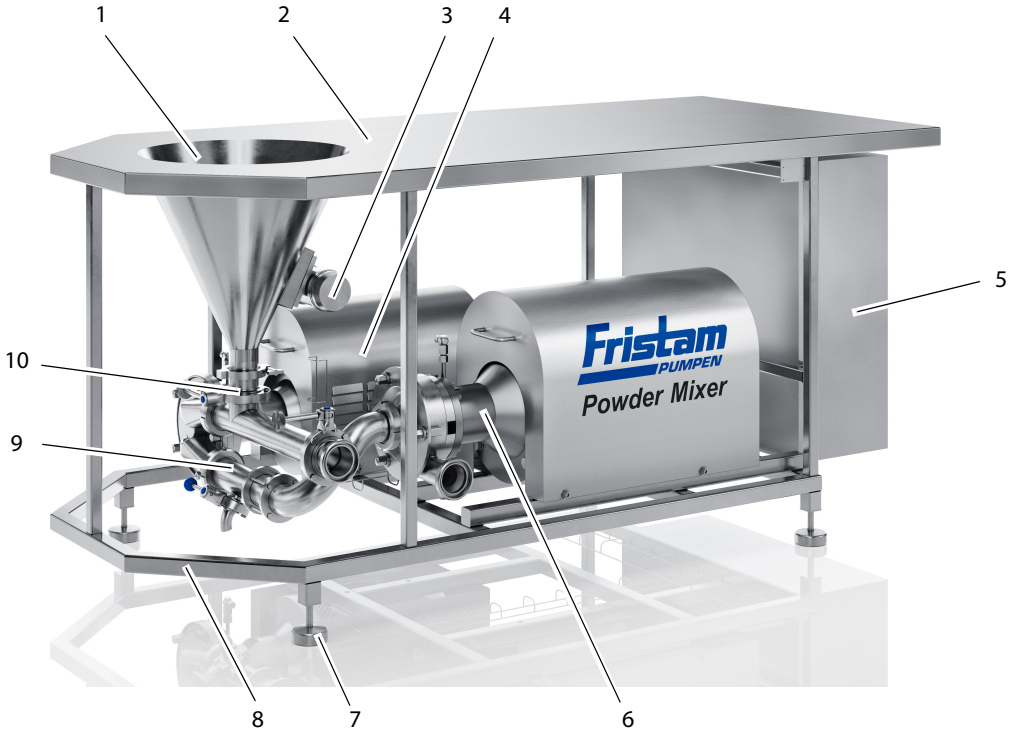


Fig. 7 Components of powder mixer

1	Hopper, protective grille (optional)
2	Table
3	Vibration motor (optional)
4	Feed pump P1 (FZ, FL, FDS)
5	Control cabinet (optional)
6	Shear pump P2 (FSP)
7	Machine feet/casters (optional)
8	Frame
9	Pipes
10	Powder inlet

3.2 Hopper

Powder or liquid additive media is poured into the hopper from where it is added to the base medium in the pipe. The hopper is sealed by the metering valve V1 at its bottom outlet. Other optional equipment includes protective grilles, filters, CIP covers, screw-in bushings for fill level sensors and vibration motors.

3.3 Pipes

The pipe system includes fittings, a pressure gage, manual and pneumatic valves, and the sight glass. The manual valves are equipped with manually operated levers as standard. These levers can be locked in the 0° and 90° positions. Other levers or actuators are available as options.

The premix made up of the base medium and the powder or added liquid is formed in the pipe section between the throttle valve V2 and the feed pump.

The homogeneous end product is produced by the shear pump P2 upstream of the discharge-side connection.

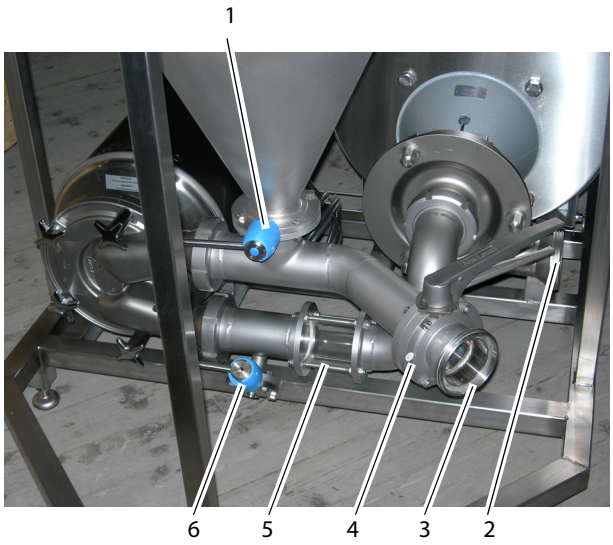


Fig. 8 Pipe system, version with manual valves

1	Metering valve V1
2	Discharge-side connection
3	Suction-side connection
4	Throttle valve V2
5	Sight glass
6	Discharge valve V3

3.3.1 Valves

The manual valves in the standard version are set as follows:

1. Pull the lever out.
2. Rotate the lever to the desired position.

3.3.2 Metering valve V1

The metering valve V1 is a manual valve and equipped with a continuously adjustable lever.

As an option, V1 can be equipped with an electro-pneumatic actuator controlled with an 4-20 mA input signal.

3.3.3 Throttle valve V2

The throttle valve V2 can be equipped with a continuously adjustable hand lever.

As an option, V2 can be equipped with an electro-pneumatic actuator controlled with an 4-20 mA input signal.

3.3.4 Discharge valve V3

The discharge valve V3 is a manual valve with a standard lever that can be set to positions "open" and "closed".

As an option, V3 can be equipped with an electro-pneumatic actuator opening and closing the valve.

3.4 Pumps

3.4.1 Feed pump

The FZ (or FL3 or FDS) series feed pump draws in the supplied base medium and conveys the premix through a short pipe to the shear pump.

In conjunction with the throttle valve V2, the pump produces the vacuum necessary to take in the powder or additive from the hopper to mix it with the base medium.

Observe the instructions in the enclosed feed pump documentation.

3.4.2 Shear pump

The FSP series shear pump acts as a rotary homogenizer. It whirls the premix of base medium and powder, and completely breaks down the remaining clumps with the help of high turbulence and high circumferential speeds.

Observe the instructions in the enclosed FSP pump documentation.

3.5 Control cabinet (optional)

The powder mixer is controlled and monitored by means of the control and display elements on the control cabinet.

The pump drives are operated with a star delta starter or a frequency converter. The (optional) sensors and actuators are connected to the terminals in the control cabinet, so that they can be easily integrated into the on-site control system.

The circuit diagram can be found in the control cabinet.

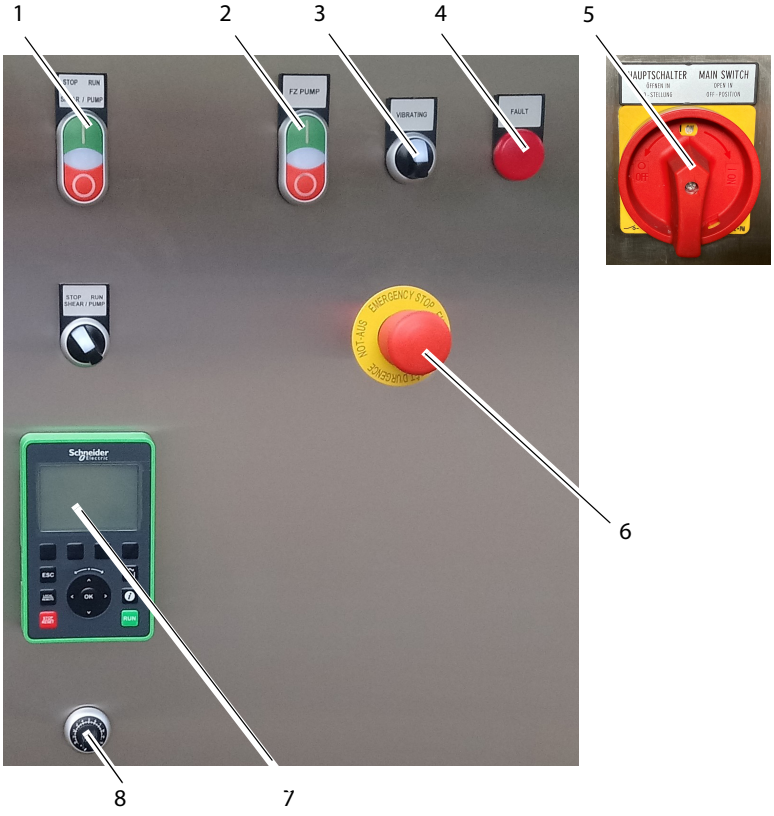


Fig. 9 Control cabinet (example)

No.	Element	Design	Function
1	Switch for shear pump	Rocker switch with indicator light	Switching shear pump on/off
2	Switch for feed pump	Rocker switch with indicator light	Switching feed pump on/off
3	Vibration motor switch	Selector switch with set positions or selector dial	Switching vibration motor on/off
4	Fault indicator	Indicator light	Lights up when a fault occurs (see "Faults")
5	Main switch	Selector dial	Switching powder mixer on/off
6	EMERGENCY-STOP button	Impact button	Switching powder mixer off in an emergency
7	Display and control panel for frequency converter (optional)	Panel with LCDs, buttons and controls	Control of frequency converter
8	Setpoint potentiometer (optional)	Control dial	Adjusting pump setpoint speed

Table 2 Control and display elements at control cabinet

In mixers with FC control, buttons 1 and 2 respectively switch on the power supply to the frequency converter.

In such models, the control cabinet is fitted with start/stop buttons for the respective pumps, potentiometers for speed selection, and control panels, if required.

3.6 Vibration motor (optional)

The vibration motor causes the hopper to vibrate and facilitates steady powder flow towards the hopper base.

If the vibration motor is activated, it runs at specified switching cycles.

3.7 Screen (optional)

Various screens for installation in the hopper are available. Screens improve the powder flow in the hopper and prevent the powder from clumping.

Depending on the application, screens also make it easier to fill the hopper.



Fig. 10 Hopper with grille

1	Hopper
2	Screen (optional)
3	Metering valve (here: disc valve)

3.8 Protective grille (optional)

Powder mixers with an automatic valve V1 are equipped with a protective grille. It prevents access to the valve whose settings cannot be changed by the operator. The protective grille is permanently mounted in the hopper above the valve.

3.9 Mixer sizes and standard equipment

The following standard version of the powder mixer are available:

Size	Centrif. pump	Power [kW]	Shear pump	Power [kW]	Approx. dimensions H/W/L [mm]	Connection DIN 11851	Approx. weight [kg]
PM01	FZ 15 PM KD	2.2...4.0	FSP 712 VD	4.0...5.5	800 1000 1200	DN40	250
PM02	FZ 17 PM KD	4.0...5.5	FSP 3522 VD	4.0...11.0	800 1000 1700	DN50	300
PM03	FZ 20 PM KD	5.5...11.0	FSP 3532 VD	7.5...18.5	800 1000 1700	DN50	350
PM04	FZ 22 PM KD	11.0...15.0	FSP 3542 VD	15.0...30.0	1050 1000 2050	DN65	450
PM05	FZ 25 PM KD	15.0...18.5	FSP 3552 VD	22.0...45.0	1050 1000 2050	DN80	620

Table 3 PM powder mixer sizes

Size	Displ. pump	Power [kW]	Shear pump	Power [kW]	Approx. dimensions H/W/L [mm]	Connection DIN 11851	Approx. weight [kg]
PM-V01	FL2 75 L3	2.2…4.0	FSP 712 VD	5.5…7.5	900 1000 1800	DN40	300
PM-V02	FL2 75 L3	4.0…5.5	FSP 3522 VD	7.5…11.0	900 1000 1800	DN50	350
PM-V03	FL2 75 L3	5.5…7.5	FSP 3532 VD	11.0…22.0	1000 1100 2000	DN50	400
PM-V04	FL2 100 L3	5.5…7.5	FSP 3542 VD	22.0…37.0	1000 1200 2000	DN80	550
PM-V05	FL2 100 L3	7.5…11.0	FSP 3552 VD	37.0…75.0	1000 1200 2000	DN100	720

Table 4 PM-V powder mixer sizes

Size	Double screw pump	Power [kW]	Shear pump	Power [kW]	Approx. dimensions H/W/L [mm]	Connection DIN 11851	Approx. weight [kg]
PM-D01	FDS 1 U	1.1…5.5	FSP 712 VD	2.2…7.5	900 900 1500	DN50	depending on FDS type and motor
PM-D02	FDS 1 U or 2 U	3.0…7.5	FSP 3522 VD	4.0…11.0	1000 1000 2000	DN65	depending on FDS type and motor
PM-D03	FDS 2 U or 3 U	5.5…15	FSP 3532 VD	11.0…30.0	1150 1200 2200	DN80	depending on FDS type and motor
PM-D04	FDS 3 U or 4 U	11…37	FSP 3542 VD	15.0…45.0	1150 1200 2200	DN100	depending on FDS type and motor

Table 5 PM-D powder mixer sizes

Depending on the application, other combinations of pumps and fittings can be used. The dimensions of the pipes and fittings may vary, depending on the application (throughput rate, viscosity, etc.).

3.10 Hydraulic diagram

The feed pump P1 takes the base medium from the tank B1 and transfers it to the powder mixer. By throttling the valve V2, a vacuum is produced. This helps suck the powder or additive from the hopper.

The powder flow can be controlled with the metering valve V1. The resulting premix is fed by the fed pump P1 to the shear pump P2

where the mixture is homogenized. Subsequently, the finished mixture is discharged through the powder mixer's discharge connection.

Depending on the product, circulation through the tank B1 might be required to improve its homogeneity.

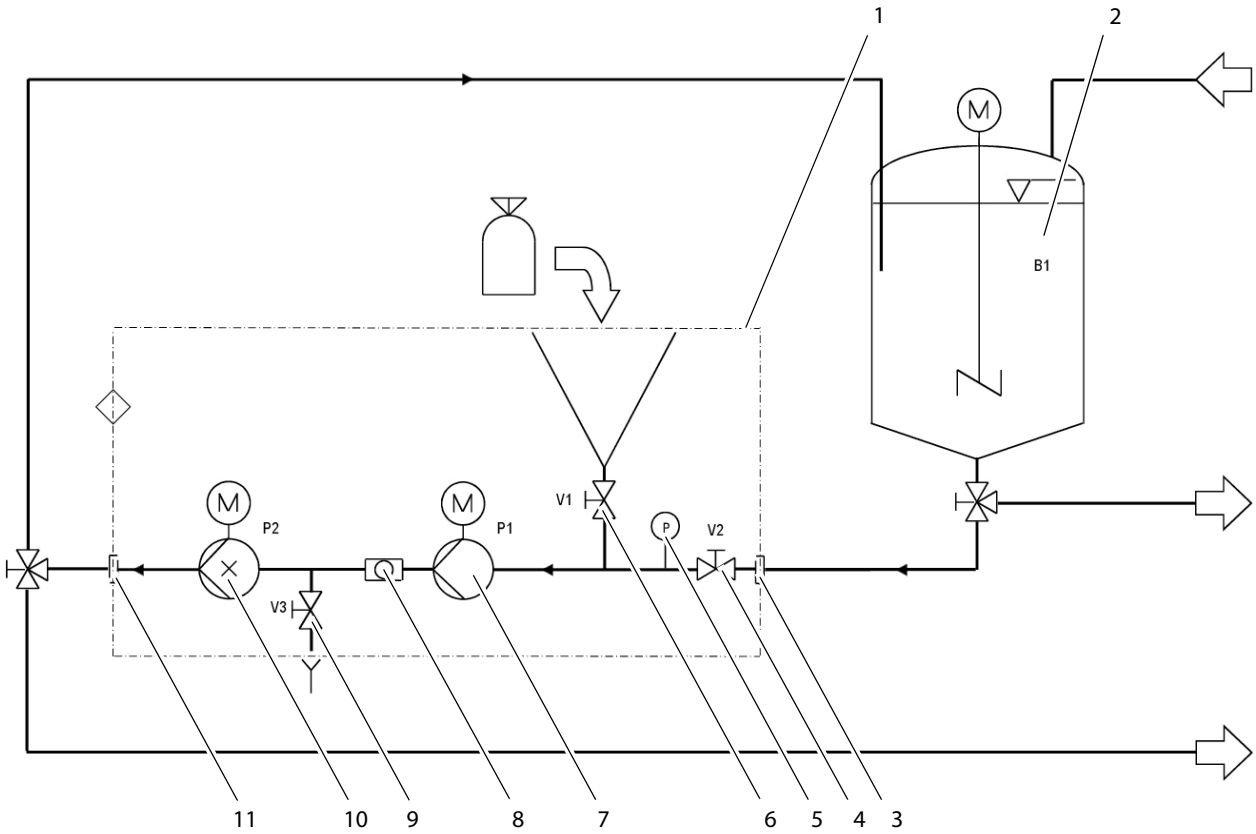


Fig. 11 Hydraulic diagram

1	Scope of delivery of powder mixer
2	Tank B1 with base medium
3	Suction-side connection
4	Throttle valve V2
5	Pressure gage
6	Metering valve V1
7	Feed pump P1
8	Sight glass
9	Discharge valve V3
10	Shear pump (FSP) P2
11	Discharge-side connection

3.11 Function

The powder mixer is a system in which powder or liquid ingredients (e.g., sugar, milk powder, cocoa powder, thickeners, oils, flavorings, etc.) are added to and dispersed in a base medium solution.

The feed pump draws in the base liquid from a tank and conveys it through a short pipe to the shear pump. As the throttle valve upstream of the feed pump is throttled, a vacuum is produced in the section between the valve and the pump This is the section where the hopper containing the additive connected to the system.

The vacuum sucks the powder or liquid from the hopper into the liquid flow. The premix, which at this stage tends to be in homogeneous, enters the feed pump where it is premixed before it is transferred to the shear pump.
In the shear pump, any remaining clumps are dissolved by high turbulence and circumferential speeds.
In the process, a perfectly homogeneous mixture is produced.

4 Transport

The mixer must be transported by instructed personnel.

The powder mixer can be moved on an industrial truck or by crane.

Always transport the powder mixer in its installation position.

4.1 Safety instructions

⚠ WARNING

Rolling away on slope

Risk of injury from crushing, risk of damage to property.

- ► Ensure that the powder mixer is placed on a level surface.
- ► Apply the caster brakes.
- ► Before operation, secure the frame.

⚠ WARNING

Falling parts

Risk of injury from impact or crushing.

- ► Use only suitable transport equipment and slings. The weight of the powder mixer is specified in the enclosed documentation and printed on the rating plate attached to the mixer frame.
- ► When transporting the powder mixer, secure it to the vehicle or hoist to prevent it from becoming dislodged.
- ► Secure the pipes and attachment parts, and check fittings.

NOTICE

Contamination, impact and moisture

Risk of damage to pipes, valves and pumps.

- Prior to installation, remove the protective foil.
- The pipe fitting covers must only be removed just before connecting the pipes.

4.2 Transporting powder mixer on industrial truck

Preparation

► If the powder mixer is placed on a pallet, ensure that it is properly secured.

Procedure

1. Lift the powder mixer (pallet) with the forks of the industrial truck.
2. Carefully transport the powder mixer (pallet) to the new location and lower it to the floor.

4.3 Transport by crane

⚠ WARNING

Falling parts

Risk of fatal injury from crushing, risk of damage to property.

► Only use slings that are designed for the total weight of the powder mixer.

► Ensure that no persons are standing under the lifted powder mixer.

⚠ WARNING

Swaying parts

Risk of serious injury from crushing.

► Start and stop the crane with powder mixer smoothly.

► Ensure that no persons are standing within the danger zone of the powder mixer.

Auxiliary equipment

Slings: round slings approved in accordance with DIN EN 1492-1 and 1492-2.

Procedure

1. Wrap the round sling twice around the frame of the powder mixer.
2. Guide both loops of the sling to the crane hook and rotate by 180° to ensure that they cannot slip from the hook.
3. Taking into account the center of gravity, secure the powder mixer in a horizontal position.
4. Lift the powder mixer.

5 Storage

5.1 Safety instructions

► Observe the instructions in the operator's manuals of the various powder mixer components.

5.2 Storage conditions

► Store the powder mixer as follows:

- Dry, at low rel. humidity
- Protected against frost and heat, preferably at a temperature between 20°C and 25°C
- Ventilated
- Free of dust

► All movable parts of the powder mixer must be rotated every three months.

5.3 Mothballing powder mixer

If the powder mixer is to be taken out of operation for more than six months, it must be mothballed. Preparation for mothballing:

► Remove all shaft seals of the pumps and store them separately.

► Open the valves.

► Cover the hopper opening.

5.4 Recommissioning

► After mothballing and before starting the powder mixer, inspect the connections, fittings, seals and bearings. Also check the oil level in the pumps.

► Check the hopper and pipes for foreign objects and remove them.

► Mount the shaft seals.

6 Installation

Remove the packaging and protective foil from the mixer and the casters. Inspect the powder mixer for damage Remove any foreign objects from the hopper and pipes

Connect the powder mixer to the power supply. See *Kapitel 6.8 „Connection of power supply“, Seite 25*.

6.1 Safety instructions

⚠ WARNING

Unstable installation

Risk of serious injury from crushing, risk of damage to property.

- ► Tighten the screws with the specified tightening torque (see *Kapitel 10.1.1 „Tightening torques“, Seite 32*).
- ► Use a torque wrench or an impact driver with adjustable torque.
- ► Observe the instructions regarding the location of installation (see *Kapitel 6.2 „Location of installation“, Seite 22*).

6.2 Location of installation

The location of installation of the powder mixer must meet the following requirements:

- Non-explosive atmosphere (exception: ATEX models).
- Dust-free environment; operation of extraction system removing air contaminated with dust or aerosols.
- Ambient temperature: –20 °C to +40 °C.
- Moisture and salt content of ambient air:
  For details, refer to the operator's manuals of the pump motors in the enclosed documentation.
- Foundation able to bear the load of the mixer.
- Horizontal and level floor.
- Installation area able to bear the load of the mixer.
  - ► Take into account the point loads under the casters or legs of the powder mixer.
- For clearances around the machine, refer to the operator's manuals of the pumps.
- Sufficient space for maintenance work.
- Adequate air supply for pump cooling.

6.3 Measures to reduce noise and vibration

⚠ CAUTION

High noise emissions

Risk of damage to hearing.

- ► Wear personal protective equipment (hearing protection).

6.3.1 Primary measures

– Only operate the vibration motor intermittently.
– Operate the powder mixer pumps within the optimum working range.
– Decouple the suction and discharge lines from vibrating parts.
  ► Support the lines.
  ► Align the lines.
  ► Install vibration dampers.

6.3.2 Secondary measures

► Take structural measures such as:
  – Installing acoustic panels.
  – Mounting a housing.

6.4 Fixture of powder mixer

1. Place the powder mixer at the installation location. Apply the brakes of the casters (if installed), or secure the frame with chocks.
2. Ground the frame to prevent electrostatic charging.
3. Install hose lines so that they cannot be damaged.

6.5 Installing and connecting pipes

⚠ WARNING

Electrostatic charging

Risk of injury from electric shock.

► Ground the pipes and the pump/powder mixer.

6.5.1 Installing and connecting pipes

► Keep the pipe resistance as low as possible: Avoid installing unnecessary valves, elbows, and abrupt pipe transitions.

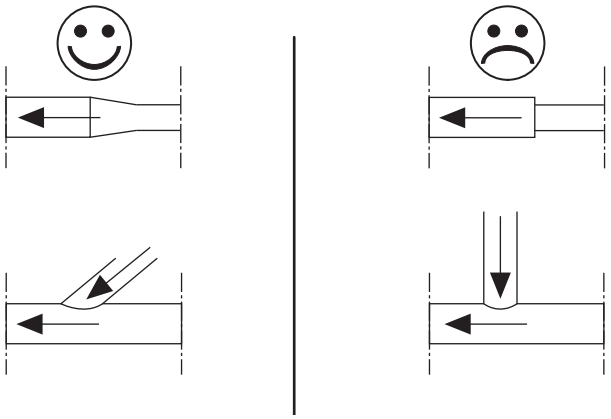


Fig. 12 Pipe transitions

► Choose a pipe cross-section that prevents unnecessary pressure loss or cavitation in the suction and feed section.

► Install a shut-off valve in the suction and discharge line.

- ► Keep the suction lines as short as possible.
- ► Install the suction lines in a horizontal position or at a slight dropping angle towards the pump unit. Take measure to prevent air pockets and dips in the pipes.
- ► Install and connect the pipes in such a way that there is no stress on the fittings of the powder mixer.
- ► Secure the pipes to ceilings, walls, or floors, using pipe clamps.
- ► Align the pipes so that they are flush to the connections, using a bracket.

6.6 Connections

The powder mixer is equipped with the following connections on suction and discharge sides (according to DIN 11851 (milk tube fittings)):

Model	Centrifugal pump	Shear pump	Connection
PM 01	FZ 15 PM KD	FSP 712 VD	DN 40
PM 02	FZ 17 PM KD	FSP 3522 VD	DN 50
PM 03	FZ 20 PM KD	FSP 3532 VD	DN 50
PM 04	FZ 22 PM KD	FSP 3542 VD	DN 65
PM 05	FZ 25 PM KD	FSP 3552 VD	DN 80

Table 6 PM connections

Model	Positive displacement pump	Shear pump	Connection
PM-V01	FL2 75 L3	FSP 712 VD	DN 40
PM-V02	FL2 75 L3	FSP 3522 VD	DN 50
PM-V03	FL2 75 L3	FSP 3532 VD	DN 50
PM-V04	FL2 100 L3	FSP 3542 VD	DN 80
PM-V05	FL2 100 L3	FSP 3552 VD	DN 100

Table 7 PM-V connections

Model	Double screw pump	Shear pump	Connection
PM-D01	FDS 1 U	FSP 712 VD	DN 50
PM-D02	FDS 1 U or 2 U	FSP 3522 VD	DN 65
PM-D03	FDS 2 U or 3 U	FSP 3532 VD	DN 80
PM-D04	FDS 3 U or 4 U	FSP 3542 VD	DN 100

Table 8 PM-D connections

6.7 Hydraulic connection

The hydraulic connection depends on the machine size, project specifications, or customer requirements (see order confirmation).

6.7.1 Suction-side connection

A low system pressure is required on the suction side to ensure free inflow of the base medium into the powder mixer. We recommend a hydrostatic pressure from the supply tank of approx. 0.05–0.5 bar (0.5–5.0 m intake head).

- ► The suction-side feed pump must be adjustable so that the system pressure can be optimized while preventing liquid ingress to the hopper.

6.7.2 Discharge-side connection

The pipe resistance downstream of the powder mixer must be as small as possible. Therefore, the discharge pipe cross-section must be as large and the pipe length as short as possible. The standard version of the powder mixer caters for a maximum back pressure of 0.5–0.6 bar for optimum powder intake. Units with higher pressure ratings are available on request.

► If additional components such as heat exchangers or filters that might lead to significant pressure loss are to be added, we recommend installing an additional pump downstream of the discharge-side connection of the powder mixer.

6.8 Connection of power supply

When connecting the powder mixer to the power supply, adhere to the relevant VDE rules and statutory regulations.

– Standard power supply rating: 3 x 400 V, 50 Hz, 32 A or 63 A. Always refer to the order documentation.

– CEE plug conforming to DIN 49462 or DIN 49463 according to VDE, and best engineering practice. Backup fuse: 32A ... 160 A, depending on installed on-site power source. For correct connection, always refer to the order documentation.

– If the mixer is shipped with a control cabinet, the pump motors are connected to the terminals in such a way that the pumps rotate correctly with a clockwise rotating field.

6.9 Checking direction of rotation of pumps

NOTICE

Risk of damage to pumps

Risk of damage to seals.

► Never let the pumps of the powder mixer run dry.

1. Close the throttle valve V2.
2. Close the discharge valve V3.
3. Open the metering valve V1.
4. Fill the hopper with water until the pipes are filled.
   – The mechanical seals are now properly wetted as is required to protect them.
5. Switch on the feed pump for a few seconds and then switch it off again to check whether the direction of rotation is correct.
   For details, see the operator's manual of the pump.
6. Switch on the shear pump for a few seconds and then switch it off again to check whether the direction of rotation is correct.
   For details, see the operator's manual of the pump.
7. If the direction of rotation is incorrect, exchange the terminal connections of the respective motor.

6.10 Cleaning

Only use cleaning agents that meet the hygiene standards for the base medium and additives.

Before commissioning the machine, clean the pump and the piping system thoroughly.

⚠ CAUTION

Risk of injury from crushing, irritation to eyes, skin and respiratory tract

Contact with cleaning solutions or vapors from cleaning agents.

- ► Use caution when opening valve V1 and discharge valve V3.
- ► Wear safety footwear.
- ► Wear safety goggles, protective gloves, and a rubber apron.

⚠ CAUTION

Risk of injury from scaling and chemical burns

Contact with cleaning solutions or vapors from cleaning agents.

- ► Always observe the use instructions of the cleaning agent manufacturer.
- ► Wear personal protective equipment.

6.10.1 Cleaning powder mixer

1. Connect the pipes.
2. Fill the connected cleaning tank with cleaning solution.
3. Close the discharge valve V3.
4. Fully open the throttle valve V2 and the valve at the cleaning tank outlet.
   - The cleaning solution can also be added through the hopper.
5. Wait until the cleaning solution has reached the pumps.
6. Make sure that valve V1 is closed.
7. Switch on both pumps.

   To let cleaning solution flow from the hopper into the pipes, carefully open valve V1. When the hopper is empty, close valve V1.

   To clean the discharge valve V3, open it briefly.

6.10.2 Cleaning mixer with CIP system

If there is a CIP system in operation on site, the powder mixer can be connected to it for cleaning.

For cleaning with CIP system, the throttle valve V2 must be fully opened and the metering valve V1 and the discharge valve V3 must be closed.

1. During the cleaning process, briefly open the discharge valve V3 to clean it.
   Caution: Risk of splashing.

6.10.3 Draining off cleaning solution

1. Close the outlet valve of the cleaning tank.
2. Empty the hose line through the throttle valve V2 (which is still open) and the discharge valve V3.
3. Open the metering valve V1.

The table and the hopper must be cleaned by hand, following the internal work instructions. After cleaning, let the hopper dry. When the powder mixer has been fully cleaned, connect it to the supply system.

7 Operation

NOTICE

Risk of damage to pumps

Risk of damage to mechanical seals from product residues.

► Clean the powder mixer after each use.

NOTICE

Risk of damage to pumps

Risk of damage to seals.

► Never let the pumps of the powder mixer run dry.

⚠ CAUTION

Risk of injury from crushing, irritation to eyes, skin and respiratory tract

Risk of injury to feet.

Contact with dust or aerosol.

► Wear safety shoes and protective clothing.

► If required, wear a dust mask.

If the powder mixer pumps are controlled by a frequency converter, observe the information in the operator's manual of the frequency converter.

7.1 Switching powder mixer on (mixer with control cabinet)

1. Set the main switch to position "ON".

In mixers with frequency converter:

2. The "Fault" indicator is lit.
3. Switch on the frequency converter by pressing the respective button.
4. The "Fault" indicator is off.

7.2 Starting powder mixer

7.2.1 Preparation

⚠ CAUTION

Risk of crushing, severing of limbs

Risk of injury to fingers at metering valve.

► Do not reach into the hopper.

► If the machine is equipped with an automatic valve V1, install the protective grille in the hopper.

1. If necessary, clean the powder mixer (see *Kapitel 6.10 „Cleaning“, Seite 26*).
2. Ensure that:
   - There is adequate base medium in the supply system.
   - There is no powder in the hopper.

– The hopper is dry.

3. Close the discharge valve V3.
4. Close the metering valve V1 at the hopper.
5. Open the supply system outlet valve.
6. Fully open the throttle valve V2.

   Feed the medium from the supply tank to pump P1. Pump P1 needs to be primed with a small amount of liquid. If necessary, add this liquid to the hopper.
7. Switch on the feed pump P1 and to pump the base medium into the circuit.
8. Switch on the shear pump P2.

Note: In mixers with frequency converter, first switch on the frequency converter and then the pump.

7.2.2 Mixing operation

⚠ CAUTION

Risk of respiratory tract irritation, breathing difficulties

Inhalation of dust or aerosol.

► Do not bend over the hopper.

► Extract air contaminated with dust particles or aerosols.

► If required, wear a dust mask.

1. Partly close the throttle valve V2 until the pressure gage shows a pressure of -0.3 to -0.5 bar.
2. Fully close the throttle valve V1.
3. Add the powder or liquid additive into the hopper.
4. Slowly open the metering valve V1.

   With welling products such as pectin or carrageen, proceed with extra caution to ensure that the pumps do not become clogged.
5. As soon as there is a proper powder flow, open the metering valve V1 further.
6. If necessary, switch on the vibration motor (if installed).

7.3 Monitoring mixing operation

Constantly monitor the quality of the premix through the sight glass. Check the air content and the particle size of the homogenized product.

► Monitor the mixing process: If there is insufficient powder flow, close valve V2 further to increase the vacuum. Ensure however that there is sufficient liquid flow to prevent the pumps from becoming clogged.

► A decrease in suction with increasing product stream viscosity can be compensated to a certain extent by opening the throttle valve V2 further.

► As soon as all powder has been taken in from the hopper, close the metering valve V1 to prevent air from entering the mixture.

► If necessary, top up the hopper with powder. Repeat the steps described in *7.2.2 „Mixing operation“*.

7.4 Switching powder mixer off

1. Switch off the vibration motor (if installed).
2. Switch off the feed pump P1.
3. Switch off the shear pump P2.
4. Close the supply system outlet valve.
5. Close the throttle valve V2.
6. Switch off the frequency converter (if installed).
7. Switch off the main switch.
8. To empty the mixer, open the discharge valve V3. Collect the medium in a suitable container.

NOTICE

Risk of damage to pumps

Risk of damage to mechanical seals from product residues.

► Always clean the powder mixer after switching it off.

8 Faults

For information on faults, possible causes, and remedies, see *Kapitel 10.4 „Troubleshooting table“, Seite 34* in the appendix.

8.1 Safety instructions

⚠ CAUTION

Hot surfaces

Risk of injury from burns when touching hot pumps or pipes. Pumping of hot media can cause the pumps and pipes to become very hot.

► Before touching mixer components, make sure that they are not hot.

► Pumps must only be touched with suitable protective gloves.

⚠ CAUTION

Dust production when hopper is clogged

Risk of irritation to respiratory tract from inhalation of dust or aerosol.

► Do not overfill the hopper.

► Do not bend over the hopper.

► Wear a dust mask.

9 Maintenance

For information on maintenance intervals, see *Kapitel 10.5 „Maintenance intervals“, Seite 37*.

9.1 Safety instructions

⚠ WARNING

Rotating parts

Risk of injury and damage to property.

► Before removing the coupling protection and the motor guard, switch off the pump and secure it against restarting.

⚠ CAUTION

Uncontrolled outflow of liquids

Risk of injury and damage to property from chemical burns, poisoning, and contamination.

Before performing maintenance or cleaning work on the powder mixer:

► Wear personal protective equipment.

► Close the suction and discharge lines.

► Completely empty the pipes before opening them.

► Before opening the pump, empty the pump housing.

NOTICE

Rapid cooling of pipes or pumps

Stress cracks.

► Do not rapidly cool the pipes or pumps.

Use of hard driving tools

Scratching of polished surfaces.

► To tighten screws or nuts on polished surfaces, use a copper socket wrench insert.

9.2 Spare parts

When using spare parts other than those approved by *Fristam*, there is an increased risk of injury or damage to property. If you have any questions regarding approved spare parts, please contact *Fristam*.

Fristam keeps records of all shipped powder mixers. For ordering *Fristam* spare parts, please have the following information ready:

1. Order number.
2. Serial number of powder mixer (see rating plate on powder mixer frame).
3. For pumps: serial number of pump (see rating plate or punched pump number).
4. Designation of spare part and material; for details see enclosed order documentation).

10 Appendix

10.1 Technical data

The technical data of your powder mixer are included in the order documentation.

10.1.1 Tightening torques

Tightening torques for screws and nuts

Material: steel, strength class 8.8

Thread	M8	M10	M12	M16
Tightening torque [Nm]	25	49	85	210

Material: steel, strength class 70

Thread	M8	M10	M12	M16
Tightening torque [Nm]	17.5	35	62	144

10.1.2 Noise emissions

The noise emissions depend on the pumps, the vibration motor and the size and fill level of the hopper. They are also influenced by the viscosity and other properties of the pumped media.

The specified values apply to operation of the powder mixer at optimum efficiency (see also pump characteristics and the technical data in the enclosed operator's manuals).

The noise level at other operating points might differ considerably from that specified in this document.

Size	Sound pressure level [dB (A)]
PM ...01	80
PM ...02	81
PM ...03	82
PM ...04	84
PM ...05	87

Table 9 Noise emissions without operation of a vibration motor

10.2 Power data

Sample data for granulated sugar

Size	Centrifugal pump	Power at 1450 rpm and 50 Hz [kW]	Shear pump	Power at 2950 rpm and 50 Hz [kW]	Max. powder input through hopper [kg/h]
PM01	FZ 15 PM KD	2.2...4.0	FSP 712 VD	4.0...5.5	500
PM02	FZ 17 PM KD	4.0...5.5	FSP 3522 VD	4.0...11.0	1800
PM03	FZ 20 PM KD	5.5...11.0	FSP 3532 VD	7.5...18.5	3,500
PM04	FZ 22 PM KD	11.0...15.0	FSP 3542 VD	15.8...30.0	5,000
PM05	FZ 25 PM KD	15.0...18.5	FSP 3552 VD	22.0...45.0	10,000

Table 10 Power data for granulated sugar (example)

Size	Positive displacement pump	Power at 1450 rpm and 50 Hz [kW]	Shear pump	Power at 2950 rpm and 50 Hz [kW]	Max. powder input through hopper [kg/h]
PM-V01	FL2 75 L3	2.2...4.0	FSP 712 VD	5.5…7.5	500
PM-V02	FL2 75 L3	4.0...5.5	FSP 3522 VD	7.5...11.0	1800
PM-V03	FL2 75 L3	5.5…7.5	FSP 3532 VD	11.0...22.0	3,500
PM-V04	FL2 100 L3	5.5…7.5	FSP 3542 VD	22.0...37.0	5,000
PM-V05	FL2 100 L3	7.5...11.0	FSP 3552 VD	37.0...75.0	10,000

Table 11 PM-V power data for granulated sugar (example)

Size	Double screw pump	Power [kW]	Shear pump	Power [kW]	Max. powder input through hopper [kg/h]
PM-D01	FDS 1 U	1.1...5.5	FSP 712 VD	2.2...7.5	500
PM-D02	FDS 1 U or 2 U	3.0…7.5	FSP 3522 VD	4.0...11.0	1800
PM-D03	FDS 2 U or 3 U	5.5…15.0	FSP 3532 VD	11.0...30.0	3,500
PM-D04	FDS 3 U or 4 U	11.0...37.0	FSP 3542 VD	15.0...45.0	5,000

Table 12 PM-D power data for granulated sugar (example)

10.2.1 Pump combination

The actual feed and shear pump combination depends on the application. For certain tasks, other motor outputs might be required.

10.2.2 Shear pump performance

The performance of the shear pump depends on the properties of the end production and the following process parameters:

- Concentration of end product
- Temperature of base medium
- Dissolution properties of powder
- Viscosity of end product
- Pipe cross-section
- Pipe length

10.2.3 Dissolution properties of powder

The viscosity of the premix below the hopper is higher than the viscosity of the end product. There is an overconcentration of powder in this pipe section.
When devising the motor output, the solubility of the powder to the mixed must be taken into accounts.

10.3 Lubricants

Only use lubricants approved for the actual application.

Lube points:

- Fittings at pump heads
- Fittings on pipelines
- Fittings of other components

In addition to the instructions in this document, observe the operator's manual of the pumps and other installed components.

10.4 Troubleshooting table

Problem	Possible cause	Remedy
Liquid leaking from hopper See *operator's manual of pump*	Feed pump fails to run; incorrect direction of rotation of feed pump	Close the metering valve V1; eliminate the pump fault; change the direction of rotation of the pump. After restarting the mixer, empty the hopper through the metering valve V1; close the metering valve V1; clean and dry the hopper. Resume operation.
	Throttle valve V2 opened too far; static system pressure too high	Close the throttle valve V2 further. After cleaning the hopper, empty it through the metering valve V1; close the metering valve V1; clean and dry the hopper. Resume operation.
	Product flow blocked	Clear the product flow path; clean the screens. After cleaning, empty the hopper through the metering valve V1; close the metering valve V1; clean and dry the hopper. Resume operation.
	Pump head of controlled feed pump too high	Reduce feed pump speed. After restarting the mixer, empty the hopper through the metering valve V1; close the metering valve V1; clean and dry the hopper. Resume operation.

Table 13 Troubleshooting table

Problem	Possible cause	Remedy
Pump fails to pump or runs irregularly See *operator's manual of pump*	The pump is not completely filled with liquid, or pump has not been vented	Fill the pump with liquid
	Suction line blocked or clogged	Open and clean the suction line.
	Fitting in suction line blocked or contaminated	Clean fitting in suction line and check it for proper functioning.
	Suction line leaking; seal of pump cover leaking and drawing in air.	Seal the suction line; replace the cover seal.
	Air pocket in suction line	Install the suction line along a straight line and at a slight incline.
	Pump blocked; foreign object in pump	Clean the inside of the pump; perform a visual inspection; consult *Fristam*.
	Viscosity of medium too high	Consult *Fristam*.
	Coupling damaged by overload	Consult *Fristam*.
Flow rate too high See *operator's manual of pump*	Pump oversized	Consult *Fristam*.
	Throttle valve opened too far	Close the throttle valve in the supply line further.
Flow rate too low; discharge head too low See *operator's manual of pump*	Selected pump too small; motor speed too low due to incorrect voltage	Consult *Fristam*; connect according to motor rating plate.
	Suction line leaking and drawing in air	Seal all leaks.
	Viscosity of pumped medium too high	Check whether the mixer should be upgraded for heating; consult *Fristam*.
	Backpressure too high	Clear the product path; clean the screens in the tank return line.
	Direction of rotation incorrect	Correct pipe and electrical connections.
Metallic noise **Foreign objects in pipe** See *operator's manual of pump*	Foreign objects inside pump	Disassemble, inspect, and repair; consult *Fristam*.
	Impeller touches pump housing/cover	Disassemble, inspect, and correct clearance; consult .
	Excessive wear of bearings and gearwheels from overload or inadequate lubrication	Disassemble, inspect, and repair. Ensure regular maintenance and lubrication.
	Speed too high	Use motor with frequency converter; consult *Fristam*.
	Pump running dry; shaft seal running dry	Immediately add medium or sealing water to system.
	Medium temperature too high; clearance between impeller and cover or impeller and housing too small due to elevated temperature	Check operating conditions; disassemble, rework and set correct clearance; consult *Fristam*.
Flow noise	Operation in overload or partial load range	Adjust working point.
	Flow losses in suction line too high	Increase nominal diameters; eliminate throttling.
	Cavitation	Check conditions for NPSH evaluation; refer to *Kapitel 6.5 „Installing and connecting pipes", Seite 23*; consult *Fristam*.
Vibration	Own weight and hydraulic forces on pipes put stress on pump	Support pipes so that the pump is not stressed; install vibration dampers, if necessary; protect pump against water hammers; refer to *Kapitel 6.5 „Installing and connecting pipes", Seite 23*.
Excessive heating of pump shaft bearings and gearbox	Damage to bearing	Disassemble; replace bearings.
	Insufficient lubricating oil	Change oil; for instruction, see the operator's manual of the pumps; ensure regular maintenance, see *Kapitel 10.5 „Maintenance intervals", Seite 37*.

Table 13 Troubleshooting table

Problem	Possible cause	Remedy
Motor power consumption too high	Resistance in discharge line too high; excessive throttling at pump	Increase nominal diameter of discharge line; open throttle valve; reduce speed by means of frequency converter on motor or control gear.
	Viscosity and/or density of medium too high	Consult *Fristam*.
	Damage to pump shaft bearing or gear motor	Disassemble and inspect; consult *Fristam*.
Leakage at shaft seal	Mechanical damage/wear to shaft seal	Replace mechanical seal and rotary shaft seal (including all secondary seals); change to seals of different material, if necessary; consult *Fristam*.
	Shaft seal running dry; suction head too high; medium temperature too high	Reduce suction head; use double shaft seals; consult *Fristam*.
	Sealing or flushing water pressure too high	Adjust pressure by means of throttle valve and pressure gage.
	Sealing or flushing water pressure too low; sealing water tubes clogged; shaft seal encrusted or damaged	Change material Convert to cooling or double shaft seals; consult *Fristam*.
	Shaft seal materials not chemically resistant against medium; medium temperature too high	Adjust sealing water inlet and outlet; clean sealing water tubes; replace shaft seal.
	Sealing water contaminated or too hot	Use drinking water at a temperature of max. 70°C.

Table 13 Troubleshooting table

10.5 Maintenance intervals

Refer to the operator's manuals of the pumps, motors and other components.

Maintenance to be performed as necessary:

- ► Replace the mechanical seals.
- ► All seals must be inspected at least once a month for damage.
- ► The machine must be thoroughly cleaned at least once a month, depending on the application and processed products.

10.6 EC Declaration of Conformity

The manufacturer: FRISTAM Pumpen KG (GmbH&Co.)
Kurt-A.-Körber-Chaussee 55
21033 Hamburg, Germany

declares that the product (pump with motor):

- Centrifugal pump types: FP, FPE, FP…V, FPH, FPEH, FPH…V, FSPE, FSP…V, FM, FZ, FC, CF, CFE
- Positive displacement pump types: FK, FKL, FL, FL2, FL3
- Powder mixer types: PM, PM-V, PM-D
- Serial number: see cover page of operator's manual

conforms to all relevant requirements of the **EU Machinery Directive (2006/42/EC)**.

The machine also conforms to the relevant requirements laid down in the **Low Voltage Directive (2014/35/EU)**, the **EMC Directive (2014/30/EU)**, EU Regulation No. 1935/2004 and FDA.

The following harmonized standards have been applied:

- DIN EN 809:2012-10: Pumps and pump units for liquids - Common safety requirements
- DIN EN ISO 12100:2011-03: Safety of machinery - General principles for design- Risk assessment and risk reduction

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Hamburg, September 4, 2020



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