PermaDos

Automatic potassium permanganate ($KMnO_4$) preparation and dosing system



PermaDos is a fully automatic, modular and expandable system designed for the continuous preparation of potassium permanganate solutions from dry product. Essential in municipal and industrial wastewater treatment plants, it delivers high performance in pre-oxidation, sedimentation, clarification and sludge dewatering processes. The system uses advanced technology (brushless motors) and high-quality construction materials (HDPE, PPH, PVC, AISI 304 and 316), ensuring continuous, safe operation with low maintenance and energy requirements.

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Construction

PermaDos features HDPE tanks and a PPH powder dosing unit with a hopper connected to an expandable, hermetically sealable container, ensuring maximum operator safety. A plastic-coated screw conveyor is housed inside.

The powder feeder and four-blade propeller mixers, driven by brushless motors, provide precise speed control and significantly reduce energy consumption.

The system includes a water circuit with an electronic meter, solenoid valve and control valve. A concentration measurement probe, radar level probe and integrated safety alarm devices make the system fully automatic.

Operating principle

The process consists of three sequential, continuous stages:

Stage	Description
1. Mixing	Initial dosing and homogenization of the reagent
2. Concentration	Reaction and stabilization of the solution concentration
3. Withdrawal	Precise, steady delivery of the solution

Process description

The feeder doses potassium permanganate powder into the premixing device, where it is immediately and thoroughly wetted with dissolution water. The solution then enters the preparation chamber, where it is homogenized by the mixer (or the second mixer in two-tank configurations).

Preparation uses proportional dosing — a proportional powder-to-water ratio — at concentrations of 1%–2%, up to 5% as required.

At the end of the cycle, a probe immersed in the preparation chamber measures the solution concentration. When the concentration reaches the setpoint controlled by a PID algorithm, the powder feeder stops dosing and restarts only when the concentration falls below the set hysteresis threshold. Meanwhile, preparation water continues to fill the tank until the high level is reached.

The concentration control system checks that $KMnO_4$ powder is being dosed correctly and generates low-concentration alarms.

Determining the dosing rate

The dosing rate is determined using the following parameters:

- Raw water flow rate
- Required $KMnO_4$ dose (mg/l)
- Solution concentration (g/l)
- Solution dosing rate (l/h)
- Powder dosing rate (g/h)

Calculation example

Raw water flow rate (m^3/h)	$KMnO_4$ (mg/l)	Concentration	Solution dosing rate (l/h)	Powder dosing rate (g/h)
1,000	1.00	1% (10 g/l)	100	1,000

The prepared solution is dosed by proportional metering pumps controlled by an analog signal generated by the HMI based on the raw water flow rate, the required dose in ppm (set by the operator) and the concentration (g/l) in the preparation unit.

Main components

PPH powder feeder

- Brushless motor control with electronic adjustment via HMI
- 35-liter loading hopper with vibrator
- Radar powder level monitoring (minimum level)
- Powder dosing concentration adjustment from 1.00 to 50.00 g/l

Preparation water supply

- Electronic flow meter
- Radar solution level controller

Concentration measurement

- Immersed concentration probe, with readings in g/l, for solution concentration control

Mixer

- Three-phase L1000 brushless motor
- Four-blade propeller, Ø 400 mm

Electrical control panel

- Equipment control via 7-inch touchscreen HMI
- Ethernet TCP/IP communication
- Integrated software for dosing management via proportional metering pumps (analog signal)
- IP65 ABS enclosure to protect electronic components

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Technical data

Type / Model	PD-1500-1	PD-3000-2
Total tank volume	1,702 l	3,404 l
Tank material	PEHD	PEHD
Max. output	1,500 l/h	3,000 l/h
Module configuration	1 module	2 modules

Models and product loading system

The PermaDos 400 range comprises six models, combining three dry-product loading systems (SE, CB, CB KG) with two tank configurations (1 Tank or 2 Tank).

Model	Model	Product loading	Packaging
PermaDos 400-1500 SE 1 Tank	1	180° safety box	25 kg pails
PermaDos 400-1500 CB 1 Tank	2	Cycle Bin support	Cycle Bin 1,000 kg
PermaDos 400-1500 CB KG 1 Tank	3	Cycle Bin support with load cells	Cycle Bin 1,000 kg
PermaDos 400-3000 SE 2 Tank	4	180° safety box	25 kg pails
PermaDos 400-3000 CB 2 Tank	5	Cycle Bin support	Cycle Bin 1,000 kg
PermaDos 400-3000 CB KG 2 Tank	6	Cycle Bin support with load cells	Cycle Bin 1,000 kg

Loading systems

SE: 180° safety box for 25 kg pails

CB: support device for 1,000 kg Cycle Bins

CB KG: support device for 1,000 kg Cycle Bins with load cells for product weighing.

Dimensions and connections

Single tank (W × D × H)	1,390 × 1,390 × 1,215 mm
Powder hopper capacity	35 liters; optional extension to 70 liters
Drain and overflow connections	2”
Module assembly	Rectangular flanges with gaskets and M8 screws

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Expandable modular system

The system features an independent master tank that can be expanded with additional modules to meet different dosing and storage requirements. Assembly using rectangular flanges with gaskets and M8 screws ensures strength and quick installation.

Applications

- Municipal and industrial wastewater treatment plants
- Sludge and wastewater treatment
- Odor control; arsenic, iron and manganese oxidation
- Site remediation / environmental restoration

Benefits

- **Automatic preparation:** less manual work and fewer errors; ready-to-use solution.
- **Maximum precision:** solution concentration control via a measurement probe in g/l.
- **Maximum efficiency:** optimized solution use.
- **Flexibility:** modular configurations for different requirements.
- **Savings:** less waste, lower energy consumption and simpler maintenance.
- **High performance:** continuous processing and consistent quality.
- **Safety:** no powder released into the environment.
- **Solution dosing:** automatic management of metering pump dosing.

Alarms and safety features

- Emergency stop
- Low dilution water flow
- High and low solution concentration alarms
- Minimum solution level
- High level (H)
- Overflow level (HH)
- Minimum powder level

Construction materials

Tanks	HDPE / PEHD
Powder feeder	PPH
Piping and water circuit	PVC
Metal components	AISI 304 and 316
Electrical panel enclosure	ABS – IP65 protection rating

General specifications

Power supply

Power supply	240 Vac – 50/60 Hz
Total power consumption (complete system)	170 W – 0.74 A

Weights

Item	Value	≈ lb
Empty weight – PD-1500 SE (1 Tank)	100 kg	220.5 lb
Empty weight – PD-1500 CB (1 Tank)	170 kg	374.8 lb
Empty weight of additional tank	70 kg	154.3 lb

Operating conditions

Ambient temperature (min. to max.)	+10 °C ÷ +40 °C (+50 °F ÷ +104 °F)
Max. relative humidity	95%
Noise level at 1 m	60 dB(A) with vibrator running – 40 dB(A) when idle
Installation type	Indoor / sheltered outdoor
Maximum altitude	Up to 1,000 m without restrictions; from 1,000 to 2,000 m, derating of 1.5% per 100 m

Preparation water quality

Feed water	Filtered water < 50 µm
Hardness[1]	< 10 °F
Minimum and maximum pressure	2 – 4 bar
Feed water temperature[2]	+5 °C ÷ +25 °C (+41 °F ÷ +77 °F)

1 At higher hardness levels, solutions with concentrations above 10 g/l require more time for dissolution.

2 At low temperatures, concentrations above 10 g/l require more time for dissolution.

Compliance and CE marking

The system complies with the following directives (CE marking):

- Machinery Directive 2006/42/EC
- EMC Directive – electromagnetic compatibility 2014/30/EU
- Low Voltage Directive 2014/35/EU

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Suitability for $KMnO_4$ dosing



Oxidizing (GHS03)

Machine specifically engineered and made compliant for dosing potassium permanganate ($KMnO_4$), a substance classified as oxidizing.

A comprehensive risk assessment for the use of $KMnO_4$ with the PermaDos system is available.

PermaDos SE fed from 25 kg pails

The innovative SE system is a box that tips 25 kg potassium permanganate pails through 180°.

It complies with safety standards for discharging powder into dosing hoppers, aiming to reduce manual handling of the powdered product, which is a strong oxidizer and generates hazardous dust.

PermaDos CB fed from 1,000 kg Cycle Bins

The innovative CB system uses an AISI 316 container approved for land and sea transport. It holds 1,000 kg of permanganate; its Clap-On discharge outlet is connected directly to the powder feeder hopper.

It complies with safety standards for discharging powder into dosing hoppers, aiming to reduce manual handling of the powdered product, which is a strong oxidizer and generates hazardous dust.

As an option, PermaDos 400-1500 or 3000 can be equipped with a weighing system comprising four load cells installed in the PermaDos support frame. In this case, order the

PermaDos 400-1500 or 3000 CB KG model.

Because Cycle Bins are made entirely of AISI 316, the contents cannot be checked visually. The KG load-cell system allows the quantity of permanganate inside the Cycle Bin to be viewed at any time directly on the HMI or through the DCS.

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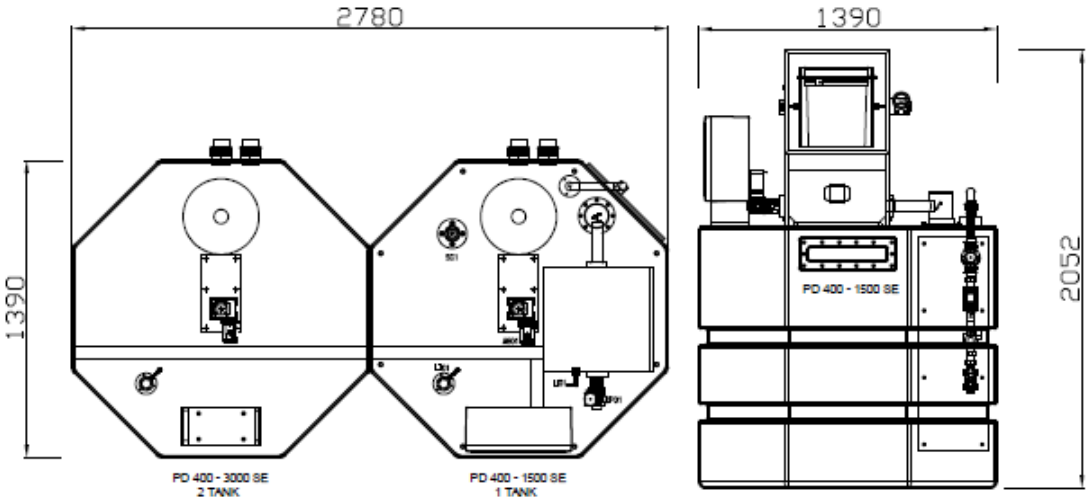
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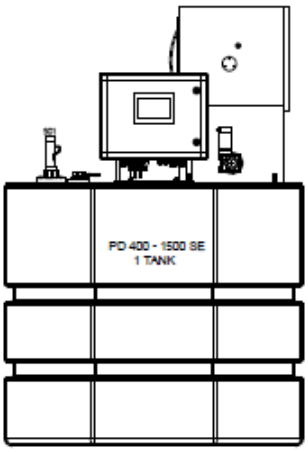
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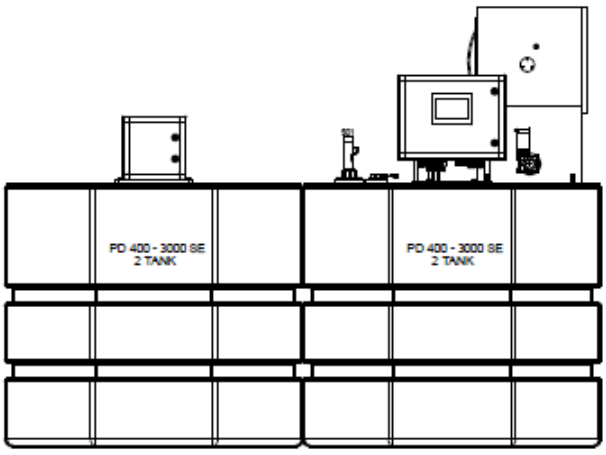
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PermaDos SE model dimensions

The SE model is designed for low permanganate consumption, from 1 to 20 kg/h. Suitability also depends on how frequently an operator can be available for loading.







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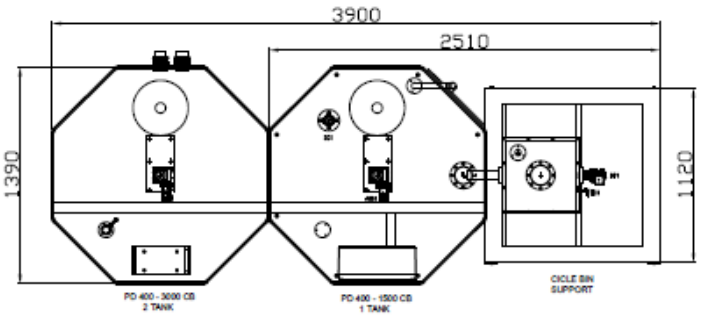
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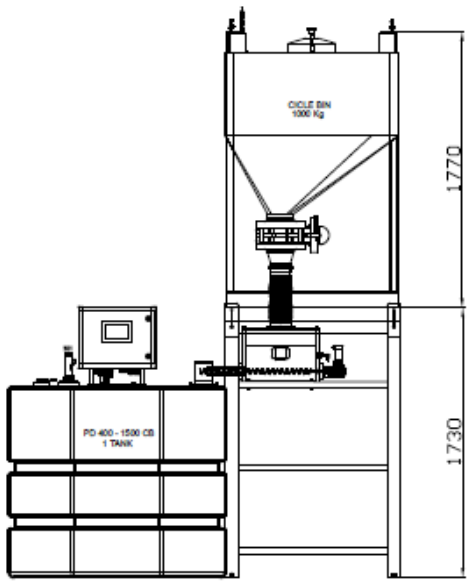
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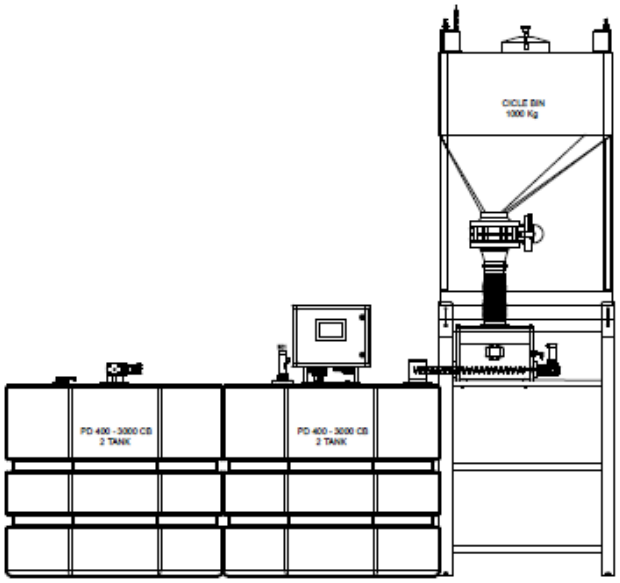
PermaDos CB model dimensions

The CB model is designed for high permanganate consumption, from 1 to 50 kg/h.

It is also essential where operator attendance is limited or the plant is unattended, providing several weeks of autonomy.







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