Rotor Weighfeeder Pfister

TRW-K

Highly accurate and reliable gravimetric feeding of crushed coal to the coal mill in power plants

The Pfister TRW-K for dosing crushed coal in power plants, is based on FLSmidth Pfister’s patented rotor weighfeeder technology which reliability has been proved over 20 years in operation worldwide with more than 1,700 installed units. The robust and wear-resistant design makes the system extremely reliable. High measuring loads provide high dosing accuracy. Powered by the state-of-the-art dosing strategy ProsCon®, the flow rate is controlled to high stability. This makes it possible to achieve constant and accurate dosing of crushed coal. The TRW-K is designed as a totally closed, dust-tight and all-metal device in an explosion-proof design. This altogether guarantees a coal firing process with maximum efficiency.

Pfister TRW-K + ProsCon®: the innovative solution for dosing of crushed coal.

www.pfister.de
History

FLSmidth Pfister has more than 110 years of experience in manufacturing industrial weighing equipment and is part of the FLSmidth group since 1998.

The rotor weighfeeder technology was developed for highly accurate dosing of bulk material by FLSmidth Pfister in 1984 and it is now time tested and state of the art in the cement production industry. Over 1,700 systems are in operation world-wide.

With that experience, FLSmidth Pfister developed in 1996 the Pfister TRW to feed all kind of coarse material. More then 150 units are successfully in operation world-wide. The Pfister TRW-K is especially designed to dose and feed crushed coal to mills in power plants. The benefits are highly accurate gravimetric dosing and simple design resulting in high reliability and high efficiency.

Pfister Weighfeeders are:

- Engineered
- Designed
- Assembled
- Tested

in Augsburg—Germany
General Principle

The Pfister TRW-K rotor weighfeeder is a breakthrough in continuous, gravimetric dosing of granular and lump coal or coke into a mill. The dosing system is hermetically sealed and explosion-proof. The motor and weighing devices are accessible from the outside.

The simple and closed design enables extraction of raw coal directly from the silo and provides a highly accurate flow rate at the outlet. Because of the large inlet diameter of 600 mm, it is possible to handle single coal lump sizes up to 200 mm. The TRW-K combines the functions in...

...one single machine for:
- Extraction
- Weighing
- Feeding

Operation Principle

The crushed coal is transported in the rotor wheel (2) from the inlet (1) to the outlet (3) by scraper bars. The weighing axis (A-A) is located through both bearings (4) and through the middle of both inlet and outlet. However, the axis is eccentric to the middle of the rotor and its shaft. The gravimetric force of the coal in the feeder is measured by the load cell (5). The measured value provides information on the coal mass in the rotor weighfeeder before material discharge. The content of the rotor weighfeeder with the related rotor position is stored by the Pfister weighing electronics CSC.

The weighing electronics calculates the required speed of the motor (6) for the time of the discharge.
The Weighing Electronics ProsCon®

The speed of the rotor wheel (2) is controlled inverse to the coal loading of the rotor at the outlet (3). With the patented principle, the so-called prospective control (ProsCon®), the TRW-K achieves an extremely high short- and long-term accuracy and therefore an increase in the efficiency of the boiler firing process.

The relatively large mass of crushed coal in the rotor weighfeeder results in a high momentary load in the measuring section. In practice this means that the effects of any externally disturbing forces can be neglected. Any pressure fluctuations from the material inlet or outlet are eliminated by the particular configuration of the bearings. This makes the Pfister TRW-K completely insensitive to pressure fluctuations.

All data are collected in the:

- **Pfister CPI**
  (Can Process Interface, at feeder)
  and transferred via Can-Bus to the:

- **Pfister CSC**
  (Can System Controller, in MCC)

The communication between the CSC and the plant control system can be realised either via:

- Serial-Interface (ModBus RTU).
- Network-Interface. (Profi-Bus DP, DeviceNet)
- Analog/Digital-Hardwired Interface.

▲ To achieve highly accurate feeding, the angular speed of rotor is controlled invers to rotor weighfeeder loading.

▲ Electronic Control System of the Pfister TRW-K.
Benefits

The Pfister rotor weighfeeder is an advanced and highly developed system. The benefits are described in the following comparison of gravimetric and volumetric feeders as well as with comparing rotor weighfeeders to traditional encapsulated belt weighfeeders.

The benefits are essential for the firing of the boiler and a big step towards more economical and ecological operation of coal fired power plants.

Volumetric Feeding Compared with Gravimetric Feeding

The main difference between gravimetric and volumetric feeders is the high accuracy of gravimetric feeders regarding the calorific (energy) trough-put.

The accuracy of volumetric feeders is mainly influenced by the variations in the following coal characteristics:

- Density
- Calorific value
- Displacement volume (lump size)

Gravimetric feeders are able to reduce the influence of most of the variations as shown in the chart.

The chart shows that the biggest variations are eliminated when using gravimetric feeders which results in a much higher accuracy in the feedrate of calorific (energy) value.

![Chart showing % Variation in Energy Feed between Volumetric and Gravimetric Feeders.](image-url)
Any efficient combustion process has three primary requirements:

- Feed just the right amount of fuel to meet demand for energy input.
- Provide exactly enough air to ensure complete combustion of the fuel.
- Ensure a stable process in order to get the highest efficiency.

For burners, it is necessary to supply a sufficient excess-air cushion to avoid dangerous conditions because of incomplete combustion. A combustion with too much fuel (coal dust) and lack of combustion air creates carbon-monoxide (CO) which can react with oxygen (O₂) in an explosion.

On the other hand, too much excess-air wastes energy because the excess air is heated and lost in the atmosphere. Using less excess air is therefore significantly more economic. The amount of excess air is depending on the possible variations of the fuel-feedrate. With higher variations in feedrate, more excess-air is needed to prevent dangerous conditions. Therefore with higher accuracy and constancy of feedrate, less excess air is needed.

The rotor weighfeeder, based on the gravimetric weighing principle, is doing exactly that: supplying high short-term accuracy in fuel feedrate.

Further benefits:

- **Less Slagging**
  Reduced variation in feedrate results in less variance in excess air between the burners. This results in more even gas temperatures and less slagging of the burner environment.¹

- **Less Corrosion of Furnace Walls**
  Combustion of fossil fuels creates complex sulphur (H₂S). Together with carbon-monoxide (CO), which itself results from an incomplete combustion, it causes corrosion of the furnace walls.²

- **Less NOₓ Formation**
  To minimise NOₓ formation in the burning process when running with a low excess-air cushion, accurate control of excess air is necessary. This can be accomplished when the amount of fed fuel is measured accurately.³

- **Accurate Energy Accounting**
  With using gravimetric feeders for feeding crushed coal to the coal mill, it is also possible to produce a highly accurate record of coal consumption (energy accounting) and to calculate the efficiency of all units and burners independently.

- **Fast & Stable Boiler Load Changes**
  Gravimetric feeders have a high accuracy in the whole feedrange of 1:10 of the maximum feedrate. Therefore, the feedrate is instantly and accurately adjustable which makes load changes of the boiler process very fast, stable and more efficient.

It is easy to see, that all advantages result in an overall increase of the power plant performance and the efficiency of the process.

¹ (Kraftwerkstechnik, VDI-Buch, Springer Verlag, Karl Strauss, 10.1998)
²
³
Rotor Weighfeeder Compared with Traditional Belt Weighfeeders

The rotor weighfeeder is outstanding because of its compact, robust and closed design. A minimal amount of moving parts and the low number of machine components that are in contact with crushed coal makes it an uncomplex system.

Complementary to other feeders such as belt weighfeeders, the rotor weighfeeder contains:
- no rubber parts
- no belt
- no pulleys
- no idlers
- and only one shaft which is additionally sealed by purge air.

This results apparently in:
- less maintenance work
- easy to perform maintenance
- higher reliability
- higher efficiency

Further Benefits of the Rotor Weighfeeder Design:
- There is no spillage possible, which can effect the operation or which needs to be cleaned. It is no spillage conveyor necessary, therefore less complexity, less power consumption and lower maintenance.
- Even sharp or wedge-shaped parts do not harm the feeder like it is with belt weighfeeders.
- If there are large foreign bodies in the coal silo, it is possible to remove them easily from the rotor weighfeeder through its service openings right next to the inlet.
- All measuring parts are accessible from the outside. This makes repair and maintenance work very easy to accomplish.

Service & Support

Whether putting new systems in operation or requiring maintenance for Pfister equipment that is already in operation – Pfister service technicians are well trained and have years of experience in handling all Pfister equipment.

FLSmidth Pfister supports with the following services:
- All rotor weighfeeders are 100% tested in the FLSmidth Pfister workshop before delivery.
- World-wide FLSmidth Pfister representation through several subsidiaries.
- Training for operators and maintenance personal.
- 24 hours technical hotline.
- Short notice support by FLSmidth Pfister service specialists.
Dimensions

▲ Side view, Pfister TRW-K.

▲ Top view, Pfister TRW-K.
Easy installation of the Pfister TRW-K using a down pipe for connection with a coal silo cone.

Installation of the Pfister TRW-K with vibrating chute to support material extraction.
Pfister rotor weighfeeder TRW-K. Series of rotor weighfeeders TRW-K for boiler application at an Indian power plant, ready to ship.

Pfister TRW-K and electrical control cabinet which contains the Pfister CSC controller. Pfister TRW-K and pneumatic unit for purge air fixed to the upper left of the frame. Small electrical cabinet with Pfister CPI fixed to the upper right of the frame.

Top view of a Pfister TRW-K. Variable speed drive (left) and coal inlet with special wear resistant lining (right). Inside view of the rotor weighfeeder. The inner walls are moving with the material.
Old Installation: traditional volumetric drag chain feeder.

New Installation: Pfister TRW-K at an Indian power plant.

Power Plant in India
What applications are there?

Power Plant in India

Old Installation:
Replacement of a chain conveyor by a Pfister TRW-K at Power Plant

New Installation:
Pfister TRW-K
Each of the four boilers is fed by six Pfister rotor weighfeeders
Power Plant in Mexico

▲ New Installation: Replacement of a gravimetric belt weighfeeder by a Pfister TRW-K. An inclined chute connects the outlet of the feeder with the former outlet point of the belt weighfeeder.

▲ Service platforms allow easy access to all weighing parts and drive since they are all located on the outside. Also the service openings at the weighfeeders allow problem solving.
Refinery in Germany

▲ New Installation: Pfister TRW-K replaced a belt weigh-feeder for petroleum coke feeding.

▲ Bulk Material: wet & sticky petroleum coke.

▲ View into the rotor weighfeeder towards the material outlet.
Technical Facts

**What are the technical facts?**

**Pfister TRW-K**

**Application:** gravimetric feeding of crushed coal to the coal mill in power plants.

**Bulk material:** crushed coal
- Single coal lumps up to 200 mm
- Nominal lump size 0 .. 70 mm

**Design**
- Machine is engineered, designed, assembled and tested in Germany.
- All bulk material touching parts are made of special wear resistant steel.

**Execution**
- Certification: DIN EN ISO 9001
- According to NFPA Code 5803
- Pressure shock resistant up to 3.5 bar (higher pressure levels available)

**Dimensions**
- Height: 1900 mm
- Distance: 920 mm (centre inlet to centre outlet)
- Rotor diameter: 1800 mm
- Rotor height: 500 mm
- Inlet diameter: 600 mm

**Weight:** 4,800 kg

**Feedrate:** 3.0 to 150 t/h

**Feedrange:** 10% to 100%

**Accuracy:** ± 0.5%

**Rotor speed:** max. 4 rotations per min.

**Motor**
- Power consumption during operation: approx. 1.5 kW
- Rated Motor power: max. 4 kW
- Motor class protection: IP 55
- Motor / frequency converter manufacturer: SEW Eurodrives

**Electronics Temperature Range:**
- Standard: 0°C to +40°C
- With heater*: -20°C to +40°C
- With cooler*: 0°C to +55°C
*Installed in local electric cabinet at feeder

**Electronic Controller:**
- Pfister CSC controller with prospective control strategy ProsCon®

**Interface to Plant Control System:**
- Serial-Interface (ModBus RTU).
- Network-Interface.
  (Profi-Bus DP, DeviceNet)
- Analog/Digital-Hardwired Interface.
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