FLUE GAS DESULPHURISATION (FGD)
VERTICAL GYPSUM CENTRIFUGES
FLUE GAS

DESULPHURISATION PROCESS

FLUE GAS CLEANING STEPS

In most plants flue gas cleaning comprises of three main steps:

+ DeNOx: NOx gases are removed from the flue gas. Air and ammonia are added, water and nitrogen are generated
+ Dust removal: dust in the flue gas is removed by an electro-filter
+ Desulphurisation: sulphur dioxide is removed from the flue gas

DESULPHURISATION (FGD) METHODS

Depending on plant conditions (size, construction, emission regulations, waste removal, etc.) different flue gas desulphurisation methods can be used:

+ Dry process
+ Semi-dry process
+ Wet scrubbing process

The most common method is wet scrubbing using limestone slurry as absorbent. Centrifuges are used only for wet scrubbing processes.

1 | Limestone slurry is sprayed into the flue gas and reacts with sulphur dioxide (SO₂). Calcium sulphite and carbon dioxide are generated.

2 | Calcium sulphite slurry is collected in the bottom part of the scrubber. Through air injection this slurry is enriched with oxygen and the calcium sulphite is oxidised to calcium sulphate dihydrate (gypsum).

3 | Pre-thickening with hydrocyclones and buffer system or equivalent.

4 | In the centrifuge, impurities (mainly chlorides) are washed out and the gypsum slurry is dewatered.

5 | The gypsum washed and dewatered in the centrifuge has a very high quality with low residual moisture (6-10 %w/w) and low chlorides content (< 100 ppm). This gypsum can be used in the building materials industry for gypsum wall boards, etc.
TYPE VGC

This centrifuge is specially designed for the dewatering of gypsum from flue gas desulphurisation applications in coal fired power plants and waste incineration plants.

SPECIAL DESIGN FEATURES

+ Robust and reliable design
+ Highest availability in permanent operation, even under extreme and irregular plant conditions
+ Minimum power consumption
+ Quiet and clean work environment
+ Best separation performance
+ High quality gypsum with maximum purity and minimal residual moisture
+ High throughput

VGC, Vertical Gypsum Centrifuge
Process steps | The solid-liquid separation process using vertical gypsum centrifuges is discontinuous in a sequence of specific process steps as described below. Depending on the type of control system, the process can be operated fully automatic (in most cases), semi-automatic or manual.

Filling | Before filling, the sorter mounted at the solids discharge cone is shifted to liquid discharge position. This prevents liquid reaching the next solids process step. The gypsum suspension is applied evenly to the centrifuge basket via two feed pipes. The fill level control prevents overfilling of the basket.

Intermediate centrifugation | The basket accelerates to centrifuge liquid from the cake.

Washing | After intermediate centrifugation, wash liquid is sprayed evenly to the product cake using the wash pipe. Impurities (mainly chlorides) are washed out.

Centrifugation | After washing, centrifugation takes place until the required residual moisture of the filter cake is reached.

Scraping, solids discharge | Before scraping, the product sorter is shifted to solids discharge position. At reduced speed the scraper knife swings into the filter cake and scrapes out the product vertically downwards.

Residual heel removal | To protect the filter cloth during scraping, a residual heel is left on the filter cloth. Before residual heel removal, the product sorter is shifted to liquid discharge position. The residual heel can be removed periodically by using a separate wash pipe.
Automation of centrifuges is of central importance to Ferrum. Ferrum has invested many years into the development of centrifuge automation systems. Proven, standardised hardware and software modules are used as a basis and are supplemented with customer specific elements.

**OVERVIEW OF THE RANGE OF CONTROL SYSTEMS AND DRIVES**

+ Safety analyses, safety circuits
+ Automation of the process, software programming
+ Design and installation of cabinets for control systems and drives, as well as operator panels
+ Sensors and monitoring equipment
+ Connection to distributed control systems, remote maintenance
+ Explosion protection up to Ex zone 1 (according to Directive 2014/34/EU)
+ Documentation: diagrams, concept descriptions, operating instructions, safety certificates, etc.
+ Commissioning of complete systems on-site

**DRIVE SYSTEMS AND SAFETY CONTROL SYSTEMS**

Our drive systems and safety control systems guarantee a safe and optimised operation of the centrifuge. The systems are state of the art. They are continuously developed and adapted to our risk analyses as well as to the latest directives and standards.

Frequency converters of the latest generation with integrated safety functions are used to control the speed.

**CONTROL SYSTEMS AND TERMINALS TO FACILITATE EASE OF USE**

The control and visualisation software permits easy operation and control of the solid-liquid separation process. Thanks to our extensive range of different control systems, operator panels and components from leading suppliers, we efficiently implement comprehensive customer requirements.

Ferrum can supply operator panels for fully automatic and visualised process control systems with integrated safety functions which can be controlled by a safety control system.

The centrifuge can be operated in an automatic, semi-automatic, manual or service mode. A wide range of production recipes can be saved in an easy-to-use recipe management system.
Ferrum offers various automation solutions for gypsum centrifuge applications, according to customer’s requirements. Our automation systems ensure a safe and optimised solid-liquid separation process with high gypsum throughput.

**Typical automation system for a gypsum application with 3 or more centrifuges.**
To ensure smooth operation each centrifuge runs at a different process step.

**A | Main power supply cabinet**
In this cabinet the main power supply and the energy regeneration systems are monitored. In addition the main control and optionally a DCS interface are integrated.

**B | Control and drive cabinets**
Here the centrifuge control, operator panel and frequency converter are integrated. The cabinet is interfaced with the main power supply, the centrifuge and peripheral devices (valves, pumps, etc.).

**C | Centrifuge with sensors**
The centrifuge is equipped with various safety and position sensors. The sensor data for each centrifuge is monitored by a designated control and drive cabinet.
CENTRIFUGE ADVANTAGES OVER VACUUM BELT FILTERS

SIGNIFICANT COST ADVANTAGES

+ Lower energy costs due to lower power consumption and energy regeneration
+ Reduced wash liquid costs achieved by lower water consumption
+ Lower building costs due to lower space requirements for the centrifuges (approx. ⅔ lower than for a vacuum belt filter installation)
+ Lower facility costs obtained by cleaner operation in a totally enclosed centrifuge system
+ Reduced maintenance costs

A centrifuge system generates higher procurement costs but lower running costs (maintenance, power consumption, etc.) over the vacuum belt filter system. Already after 4-5 years operation the centrifuge system generates lower total costs compared to the vacuum belt filter system.
ENVIRONMENTAL PROTECTION
+ Cleaner and quieter work environment achieved by a totally enclosed centrifuge system
+ Gypsum can be used in the construction industry instead of being dumped in environmentally harmful landfill sites
+ Today the focus on energy, water and maintenance costs as well as environmental protection has increased considerably. Ferrum gypsum centrifuges give advantages on all these aspects.

BETTER PRODUCT QUALITY
+ High product purity due to efficient product wash capabilities
+ Lower residual moisture achieved by more efficient liquid separation (6-10 %-w/w)
It is our objective, in collaboration with you, to realise trouble-free solid-liquid separation with maximum performance, minimum energy consumption and consistent, reproducible product quality.

**CONFIGURATION**

Our process engineers configure the centrifuges and peripheral components to suit the specific application in accordance with your requirements. With more than 6200 centrifuges delivered worldwide, we can draw on extensive experience in the field of solid-liquid separation.

**PRODUCT TESTS**

Product tests are undertaken as required in our fully equipped laboratory or directly on your site. On request we will optimise your existing installations on-site and undertake pilot tests.

**CLEAR DOCUMENTATION**

With our centrifuges we supply detailed, customer-specific documentation fulfilling all directives and standards. This documentation includes documents to meet obligations as per customer specification (e.g. EN 10204 3.1 certification), data sheets, operating manuals as well as a clear spare parts catalogue.

**EFFICIENT PROJECT MANAGEMENT**

From project start (kick-off) through acceptance test (FAT) in our factory to commissioning (SAT) on your site, our project managers guarantee a professional project management. Together we will run through the various approval as well as project phases based on an agreed schedule.
METALLIC FILTER CLOTH

Metallic filter cloths show many advantages compared to standard filter cloths in PP or E-CTFE. Ferrum offers a patented retrofit solution to incorporate all of these positive attributes. The filter cloths are available with different mesh sizes.

+ Fibre free product
+ Longer lifetime, higher productivity
+ Available for Ferrum scraper centrifuges (horizontal and vertical)
+ Switch back to synthetic filter cloths possible at any time