



**FLOTTWEG CENTRIFUGE TECHNOLOGY
FOR PROCESSING DRILLING MUD,
DRILLING EMULSIONS, AND DRILLING FLUIDS**

Maximize efficiency and minimize your costs!



MECHANICAL SEPARATION FOR PROCESSING DRILLING MUD, DRILLING EMULSIONS, AND DRILLING FLUID

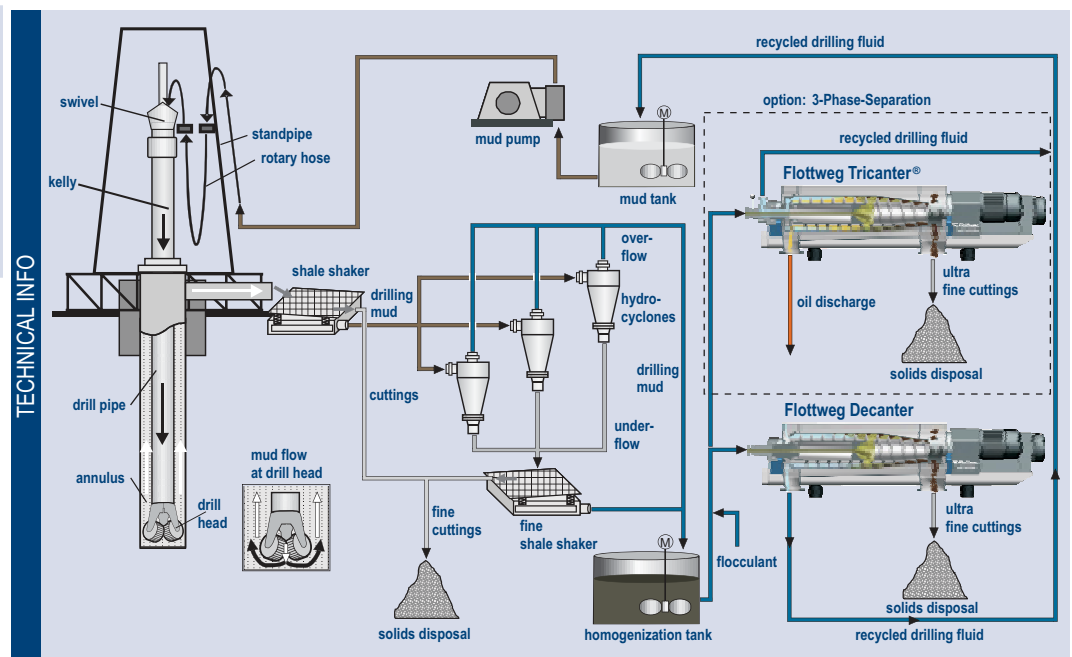
Enhance the Effectiveness of the Drilling Process

The motivation for processing drilling mud, drilling emulsions, and drilling fluids is easy to understand: on oil platforms, in tunneling, or in other industrial sectors where drilling systems are applied, continuous cleaning of these liquids is crucial in order to guarantee and enhance the optimum processing of the drilling systems. Furthermore, constraints and requirements regarding the environment (pollution of groundwater and seawater) are getting stricter, requiring continuous treatment and separation of drilling mud, fluids, and emulsions.

Drilling mud has to fulfill multiple functions: It has to lubricate and cool the drill head and carry the bits of rock and detritus away which are cut off. Drilling muds are based on water, oil, or polymer along with various additives such as stabilizers, flocculants, corrosion inhibitors,

defoamers, surfactants, detergents, lubricants, and more. Modern drilling systems form a closed cycle from which no solids are able to escape. As a result, any particle which gets into the closed system has to be separated. Shaking screens and hydrocyclones can separate out coarse particles, but a Flottweg Decanter separates small and fine particles.

For a better overview and understanding of how drilling mud, fluids and emulsions are separated and processed using a Flottweg Decanter, please have a look at the process scheme below.



FLOTTWEG EXPERT KNOWLEDGE IN TUNNELING

Improve the Process of Tunneling

Tunneling is a specific and crucial method of drilling to create tunnels such as sewage, subway, or freeway tunnels. For this type of drilling, the utilized drilling mud needs to be as clean as possible, which means the drill cuttings need to be continuously separated to ensure a functioning cycle of cooling and washing/rinsing of the drill head. Due to the fact that tunneling is very time-consuming and expensive, there must be an optimum process throughout all stages of the drilling procedure. Moreover, a constant high throughput in terms of the amount of drilling mud which can be processed per hour is an essential parameter for the operator. Specifically developed for these purposes, Flottweg Decanters enable a continuous and efficient drilling procedure for the best possible outcome for the operator.

and so on). Both kinds of tunneling produce large amounts of drill cuttings, which illustrates the importance of drilling fluids in the process.

Flottweg Decanters ensure that particles which get into the closed system will be separated (> 25 metric tons per hour of dry substance). This is needed due to the fact that modern drilling fluids form a closed cycle from which no solids are able to escape. Consequently, drill cuttings which get into this cycle have to be separated. Hydrocyclones and shaking screens detach



Example of a tunnel project using Flottweg Decanters



Processed drilling fluid



Solids discharge after processing with a Flottweg Decanter

A tunneling machine works as a horizontal drill in many cases, in which the drill cuttings are omnipresent while the tunneling boring machine (TBM) is continuously excavating the tunnel. Two different kinds of tunneling are utilized: Traffic tunneling > 4.20 meters to a maximum of 18 meters in diameter (railway, motorway etc.), or utility tunneling, used for drilling procedures < 4.20 meters in diameter (sewers, pipes, shafts,

rough particles, while Flottweg Decanters detach the fine and small particles. Hence, Flottweg Decanters ensure cost minimization due to Flottweg's highly developed and advanced knowledge in the field of tunneling and separation.

Separated solids after processing with a Flottweg Decanter



FLOTTWEG EXPERT KNOWLEDGE IN DRILLING AND TUNNELING

Flottweg Decanter for Use in Drilling Operations

Flottweg System Z4E



Flottweg Separation Technology is in use all over the world



Flottweg Systems and Plants Engineering



2-PHASE OPERATING PRINCIPLE

Flottweg Decanters for Drilling and Tunneling

FEED

The product is fed through a stationary pipe into the feed zone located in the center of the rotating assembly. The product is then accelerated circumferentially and delivered through ports in the scroll into the bowl.

SCROLL

The scroll rotates at a slightly different speed compared to the bowl and conveys the separated solids toward the conical end of the bowl. This differential speed determines the residence time of the solids in the bowl. Residence time is a critical factor for cake dryness. It can be automatically adjusted by changing the differential speed of the scroll thus providing optimal separation. Depending on the physical properties of the product, Flottweg Decanters can be supplied with a different scroll design or by modifying an existing scroll. Scroll pitch and single or multiple lead configurations are important design variables.

BOWL

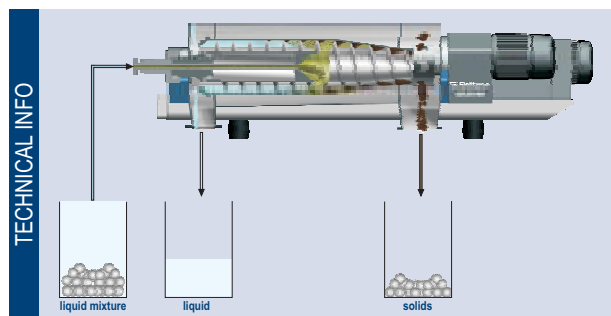
The bowl has a cylindrical and conical section. The rotational speed is pre-set optimally to the application and requirements. The slurry rotates with the bowl at the operating speed and forms a concentric layer on the bowl wall. The solids contained in the product are packed against the bowl wall by centrifugal force. The length of the cylindrical bowl section and the cone angle are selected to meet the specific requirements of an application.

SOLIDS DISCHARGE

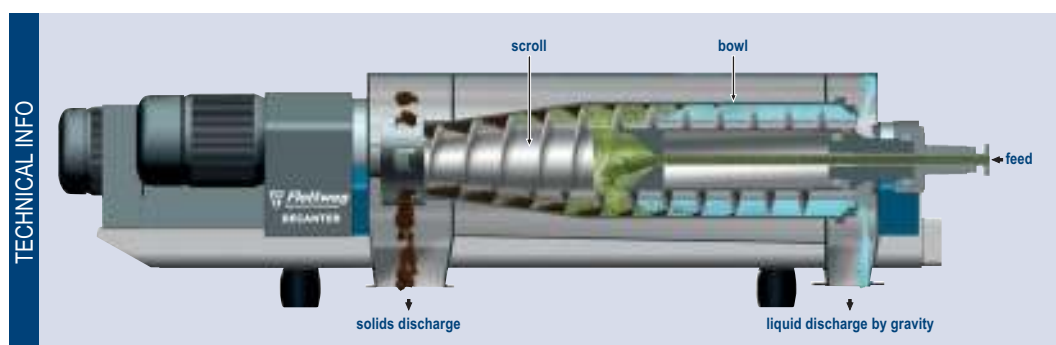
Settled solids are ejected through ports at the conical end of the bowl into the solids housing and fall vertically through the discharge chute.

OVERFLOW WEIRS

The clarified liquids flow to the cylindrical end of the bowl where they exit over weir plates. Easily adjustable weir plates allow for precise adjustment of the pond depth in the bowl. The liquid overflow is then collected in a centrate chamber and discharged by gravity.



Flow of liquids and solids in a Flottweg Decanter



Flottweg Decanter for the separation of solids from liquids with discharge of the liquid phase (centrate) by gravity

The picture shows a decanter scroll



FLOTTWEG DECANTER CENTRIFUGES FOR SEPARATING AND PROCESSING DRILLING MUDS, FLUIDS AND EMULSIONS

There are numerous advantages to the use of a Flottweg Decanter:

SAVING COSTS

Reduction in mud due to a closed system and therefore lower disposal fees. Cost savings of nearly 60% for maintenance and servicing. Due to the reduction of abrasion, sludge pumps and drillers last longer, so cost savings can be achieved. Because of the optimum Flottweg Systems, the drilling mud, fluids, and emulsions can be in use for much longer (extended lifetime), allowing considerable cost savings here, too.

EXPERIENCED AND FIELD-PROVEN

As one of the world's leading suppliers of mechanical separation systems, Flottweg not only has more than 30 years of experience in the drilling industry, but Flottweg Decanter Centrifuges have also been extensively field-proven in this area. Moreover, Flottweg has decades of experience in manufacturing decanters equipped with hydraulic drive systems.

FLOTTWEG SYSTEMS AND PLANT ENGINEERING

For separating and processing drilling mud, Flottweg Machines are also available as skid-mounted systems (see below) with the decanters consisting of the control panel, explosion-proof operating panel, automatic feed regulation, flow meter, nitrogen purge, control system, pre-heating, flushing, and steaming control. Flottweg Systems are completely piped, wired, tested and commissioned on site by Flottweg's factory-trained and experienced service personnel.

Key success factors

- High g-forces guarantee the best separation results and ensure that fine solids of micrometer size can be separated.
- Flottweg Simp Drive® enables high throughput performance due to high bowl speed and precisely adjusted differential speed.
- Unique wear protection is a key success factor due to the fact that it enables an optimum process even under difficult conditions.
- Flottweg Machines are designed and manufactured to provide all the aforementioned success factors, so as to ensure the best possible results for an operator.

Flottweg Decanter used for drilling operations



FLOTTWEG PRODUCT FEATURES FOR SEPARATING AND PROCESSING DRILLING MUDS

Benefits of Using a Flottweg Decanter



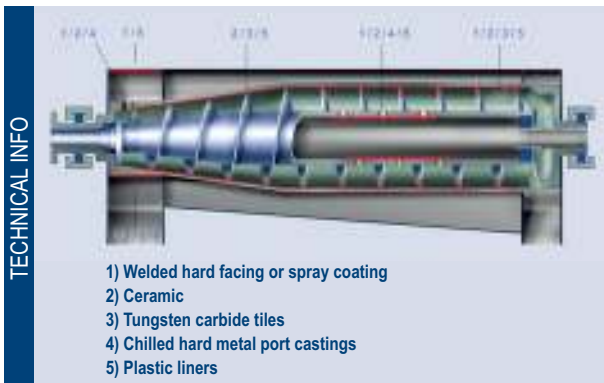
SIMP DRIVE®: SIMPLE, INTELLIGENT, MODULAR AND POWERFUL

The Simp Drive® regulates the differential speed between the decanter bowl and scroll depending on the prevailing scroll torque. The differential speed determines the length of time the solid remains in the bowl, and thus has a significant influence on the separation process. The bowl speed and differential speed can be adjusted independently of one another during ongoing operation. This is guaranteed by a special transmission mechanism of the Simp Drive® (special planetary epicyclic gear unit).



WEAR PROTECTION

Optimum wear protection is crucial when using a Flottweg Decanter or Tricanter® for many applications. All wearing parts are protected by special metal hard surfaces utilizing tungsten carbide, and replaceable wear bushings. Under operating conditions, Flottweg Wear Protection lasts more than 15,000 operating hours.



Replaceable wear protection elements

HIGH G-FORCES

Flottweg Decanters not only feature intelligent drives but also unique wear protection as well as outstanding g-forces. High g-forces are important for efficiency because drilling and tunneling processes require large throughput capacities. And the higher the g-force, the better the result of separation. Flottweg Decanters are attractive for operators of drilling and tunneling projects because of their high level of versatility in terms of the available g-forces of up to 4,200 g. For hard separation tasks like tunneling and drilling, this delivers a worldwide leading processing advantage.

Customer benefits of Flottweg Simp Drive®

- High flexibility in the selection of the operating speed (high g-forces possible for separating very fine particles)
- High throughput performance due to high bowl speed and precisely adjusted differential speed
- Simp Drive® for a broad range of applications in which continuous adaptation of operating parameters is required
- Lower energy requirements than conventional gear units due to higher efficiency (cost saving)
- Machine can be cleared out even at a standstill, because the scroll can still be turned nevertheless (no need to dismantle system components).

Customer benefits of Flottweg Wear Protection

- Increased temperature resistance
- Improved corrosion resistance
- High hardness and armoring
- Enhanced surface characteristics
- Improved durability of the decanter
- Increased consistency and reliability of the process

Customer benefits of high g-forces

- High g-forces for best possible efficiency
- A wide variation of available g-forces for the fulfillment of individual customer demands
- Increased throughput with higher g-force
- Even the finest solids can be separated by the use of Flottweg Decanters and their applied g-forces.

TAKE ADVANTAGE OF OUR EXPERTISE

and Many Years of Experience in the Drilling
and Tunneling Industry!

Flottweg Decanters Z 92 for optimum performance in the drilling and tunneling industry



Flottweg Decanter for a tunneling project



Best results in terms of high dryness of solids and high throughput using a Flottweg Decanter



... and many more.
Ask our sales agents for references

PROCESS ENGINEERING AND EXPERTS

Discover New Potential

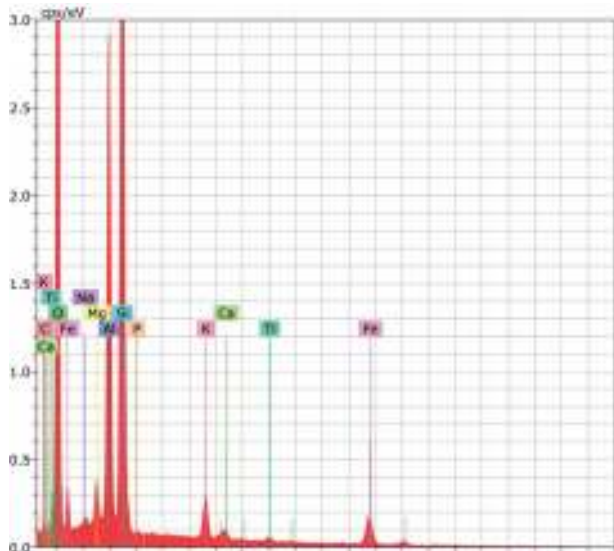
Every process is different. The various parameters have a significant influence on the separation efficiency. Knowing these parameters means increasing the efficiency and yield of your separation process.

We support our customers along the entire process chain, from R&D raw material analyses to approval tests. Flottweg offers all necessary methods for analyzing your products and evaluating new potential.

Our worldwide locations and network guarantee support and service for our customers. With the help of our experience and testing capability we develop made-to-measure solutions to meet your individual requirements.

Our services

- Laboratory analysis – discover new options and performance parameters
- Processing department – performance optimization of our separation solutions
- Project planning department – customized systems and solutions



Sample analysis with EDX (Energy-Dispersive X-ray Spectroscopy)



Keep a close eye on your product quality – SEM – Analysis (Scanning Electron Microscope) of a typical drilling sludge



GLOBAL AFTERMARKET SUPPORT NETWORK

No Matter Where You Are in the World

CUSTOMER SERVICE IS OUR STRENGTH

Application-based project planning, high-quality manufacturing, and professional after-sales service are all essential for trouble-free operation. Experienced and reliable service engineers from our customer service department are ready to respond quickly if needed. The Flottweg Service Group is also available to perform preventive maintenance in order to avoid interruptions in production.

QUALITY "MADE IN GERMANY"

Flottweg is ISO 9001 certified and manufactures its products in compliance with all the latest technical standards.



Flottweg Services include

- Experienced advice on separation processes
- Pilot tests on-site or at the Flottweg Laboratory and Test Center
- Selection and sizing of appropriate equipment
- Customer-specific automation/control systems and process integration
- Design and construction of complete process systems
- Installation, commissioning, maintenance, repair and spare parts, service worldwide

FLOTTWEG AFTER-SALES CUSTOMER SERVICE

Even the best machinery needs to be maintained and serviced. Flottweg has established a worldwide service network consisting of its own subsidiaries, branch offices, and representatives to provide our customers with localized service and spare parts.

Our service engineers and technicians are qualified for any kind of installation commissioning, repair and maintenance.



Flottweg Service Technicians are always available for you

FLOTTWEG WORLDWIDE

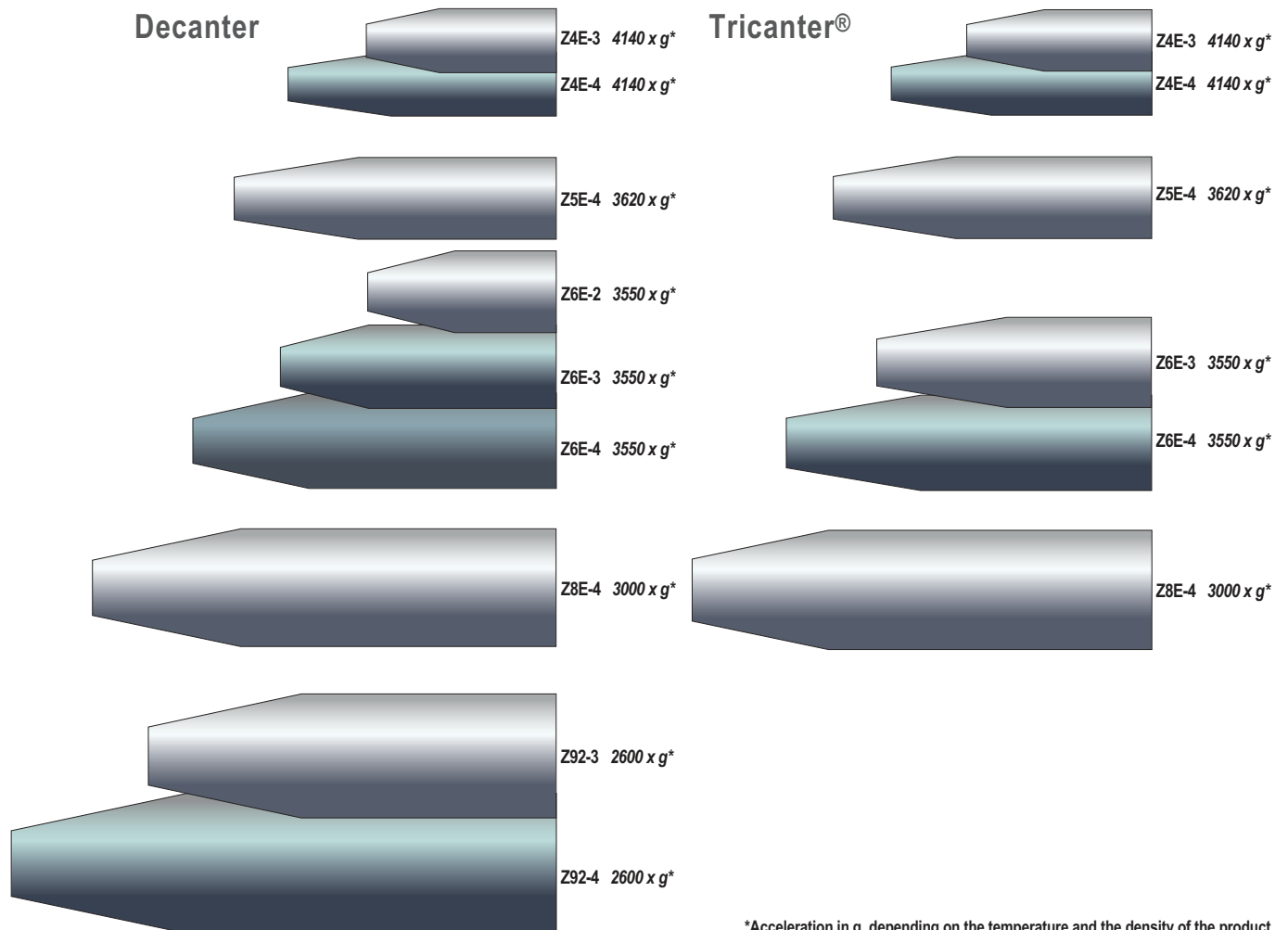
Flottweg is headquartered in Vilsbiburg, Germany (near Munich), and has branch offices in Cologne and Leipzig as well as subsidiaries in Australia, Brazil, China, France, Italy, Mexico, Peru, Poland, Russia, and the United States, in addition to representatives in nearly all countries worldwide.

Check out our website at www.flottweg.com to find a competent contact person.



TECHNICAL DATA

Decanter Z-Series and Tricanter®



*Acceleration in g, depending on the temperature and the density of the product

TECHNICAL DATA OF FLOTTWEG DECANTERS AND TRICANTERS®					
Model	Z4E	Z5E	Z6E	Z8E	Z92
Dimensions* (L x W x H)	3500 x 1000 x 1200 mm 138 x 39 x 47 inch	4200 x 1300 x 1150 mm 165 x 51 x 45 inch	4800 x 1800 x 1250 mm 189 x 70 x 49 inch	6200 x 2000 x 1500 mm 244 x 78 x 59 inch	5900 x 2800 x 1750 mm 232 x 110 x 69 inch
Gross weight*	3000 kg / 6600 lb	6200 kg / 13600 lb	9750 kg / 21500 lb	14150 kg / 31200 lb	18000 kg / 39700 lb
Motor for bowl drive	45 kW	90 kW	132 kW	160 kW	250 kW
Motor for scroll drive Flottweg Simp Drive®	15 kW	55 kW	110 kW	110 kW	110 kW
Max. hydraulic capacity**	35 m³/h	60 m³/h	80 m³/h	160 m³/h	180 m³/h

*The listed figures are to be understood as guidelines. Actual capacity depends on the individual characteristics of the feed product.

**Data based on water, g-force depending on temperature, special material, and product density. Data to be understood as guidelines only.

Flottweg Separation Technology – Engineered For Your Success



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