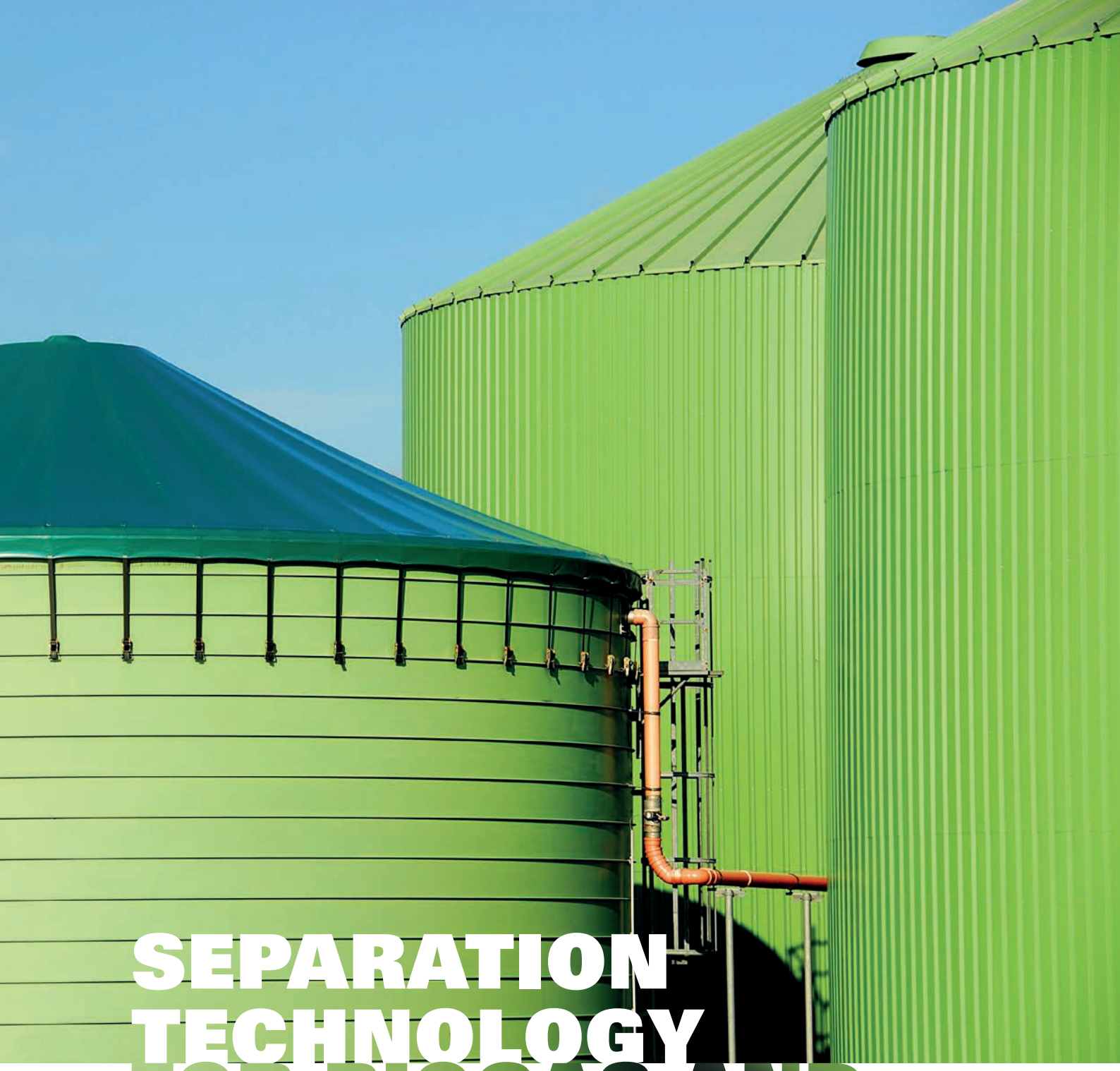


# SEPARATION TECHNOLOGY FOR BIOGAS AND BIOMETHANE PLANTS

More value from digestate

Flottweg

Engineered For Your Success



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# RECYCLING DIGESTATE

Biogas and biomethane make an important contribution to the global energy mix. However, profitable operation of modern plants depends on more than just selling the gases produced. It is equally important to exploit opportunities for additional revenue and ensure efficient, cost-saving processes.

One area for potential optimization is with the nutrient-rich digestate. It consists of water, organic components, and valuable plant nutrients such as nitrogen, phosphorus, and potassium. Depending on the raw material, the total solids content is typically 3 to 10%. This means that the water content is between 90 and 97%.

As plant sizes increase, the transportation, storage, and recycling of digestate become increasingly important economic factors.

**Optimized treatment of digestate offers significant advantages**

- Compliance with legal fertilizer application rates
- Compliance with increasingly stringent environmental protection requirements and the German Fertilizer Ordinance (DüV)
- Reduction of warehousing and logistics costs
- Improved utilization of nutrients
- Recovery of nitrogen and other valuable raw materials
- Optimization of downstream processes

The benefits of modern treatment of digestate lie not only in the dewatering of the solids. Above all, it is crucial to have a liquid phase that is as free of solids as possible, i.e. a clear centrate.

**Flottweg offers the perfect separation technology:**
**As the world's leading manufacturer of industrial centrifuges, Flottweg develops systems designed to achieve maximum dewatering and produce the clearest possible centrate. This allows for the targeted recycling of both the solid and liquid phases. This increases the value added by the entire biogas or biomethane plant.**

## The benefits at a glance

- **Reduced transport and storage costs**
- **Greater overall economic efficiency of the biogas or biomethane plant**
- **Recovery of valuable raw materials**

**Flottweg separation technology: for biogas and biomethane plants with a consistent focus on cost-effectiveness.**



# SUCCESS IS ... MAKING EFFICIENCY A REALITY

Flottweg decanter centrifuges are used in both biogas plants and biomethane production facilities. They can be integrated into processes where plant-based raw materials, animal byproducts, or organic waste are processed. Wherever digestate are produced during fermentation, our decanters ensure that they are efficiently processed. They do this by reliably separating the liquid phase from the solids, for example in the following applications:

**Biowaste**
For example, organic components from municipal solid waste, as well as separately collected green waste and garden waste, and waste from commercial kitchens and cafeterias

**Digestates from liquid manure**
Cattle and swine manure, poultry manure, or mixtures with other organic ingredients

**Renewable raw materials**
Digestates from energy crops such as corn or sugar beets, often in combination with liquid manure

**Residual materials from agriculture and food production**
For example, byproducts from sugar production, olive pomace from olive oil processing, straw, slaughter byproducts, or residues from milk processing

**... and that's not all:**
Ask us about other ways that solid/liquid separation can make your gas production plant even more successful.

We would be happy to advise you!



# THE BENEFITS OF DIGESTATE PROCESSING

## How to improve the quality of the liquid phase in digestate

For operators of large biogas and biomethane plants, the purity of the centrate is a critical success factor in the overall process. Flottweg decanters operate at centrifugal accelerations of several thousand g. This allows them to reliably and continuously separate out even the finest solid particles. The high separation efficiency reduces the amount of solids carried over into the centrate and creates better conditions for further processing of the liquid.

If the process requires even higher purity, additional centrifuge types can be added downstream, such as a separator or the Flottweg Sedicanter®. They remove any remaining fine particles from the centrate. This can be particularly useful when treating digestate without polymers.

## The benefits at a glance

- **Higher separation efficiency**
- **Clearer centrate**
- **Efficient solid/liquid separation is the key process step following fermentation. It plays a decisive role in determining the quality and the potential applications of the resulting phases.**
- **Improved conditions for nitrogen stripping**
- **Better conditions for evaporators**
- **Improved conditions for membrane processes**
- **Reduced need for additional post-treatment of the liquid**

® = registered trademark in different countries.



# MODERN PROCESSING OF DIGESTATE

After fermentation, the crucial step in the process is the efficient separation of solids and liquids within the digestate – because this determines the quality of the residual materials that can be recycled.

## This is how the Flottweg decanter separates the digestate after the fermentation process:

### Pre-shredding
Removal of contaminants, screening, and pumping

### Removal of digestate
Raw fermented residue from the fermenter/secondary fermenter with 3–10% TS

### Screw press (optional)
Removal of coarse material

### Dewatering with a Flottweg decanter
25–35% TS in the solids

### Centrate recycling
Liquid fertilizer

**Properties**
- Rich in nitrogen and potassium
- Ideal for further processing of nutrients
- Ideal foundation for stripping, membrane, and evaporation processes

### Application of solids
Solid fertilizer

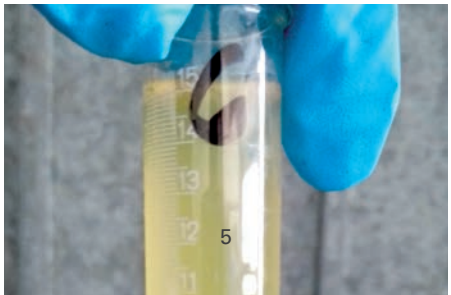
**Properties**
- Rich in phosphorus
- Stackable
- Suitable for storage
- Efficient transportation

**The high separation performance lays the foundation for cost-effective nutrient management and full utilization of the digestate.**

**Example: Swine manure**



**Liquid phase after the centrifuge**



**Solids after the centrifuge (use of polymer)**



# MORE OPPORTUNITIES. MORE YIELD.

The Flottweg decanter separates the liquid portion from your digestate – with the highest possible purity. But Flottweg separation technology influences more than just this single project step: It helps you unlock more opportunities from your biogas or methane plant along the entire value chain. Here are a few examples of how Flottweg makes the difference:

## Higher dewatering rate

Depending on the substrate and process, solid contents ranging from 25 to 35% TS are achieved. This results in solids that are stackable and easy and inexpensive to transport.

## Higher-quality centrate

Compared to screw presses, the decanter removes significantly more fine solids from the liquid phase. This significantly improves the process stability of subsequent processing steps.

## Reduced return loads

Less solids in the centrate means:
- Fewer deposits
- Reduced membrane fouling
- Higher availability of downstream systems
- More reliable nitrogen recovery

## Reduced operating costs

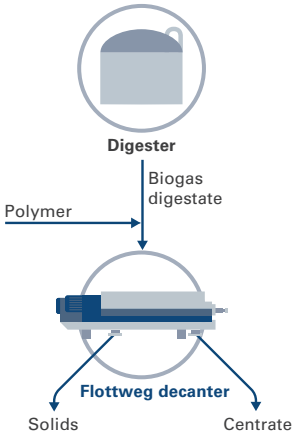
Depending on the application, operation with less (or even no) polymer is possible. This reduces consumption of chemicals and process complexity.



# THE CHOICE IS YOURS

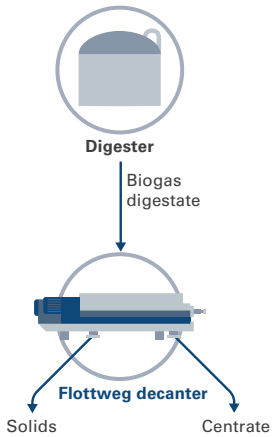
The use of polymer improves the separation of fine particles and generally enhances the quality of the centrate. At the same time, this may require additional filtration steps and limit the subsequent use of the solid phase or the centrate.

This allows the process to be specifically tailored to the raw material, quality requirements, and recycling route.




## Dewatering of biogas digestate using polymers

- Flocculants, or polymers, help remove fine particles
- Recommended when a particularly high-quality centrate is required, especially prior to downstream membrane filtration
- The subsequent marketing of the digestate as fertilizer may be limited. The use of the polymer must be permitted for the specific recycling method and in the specific country.

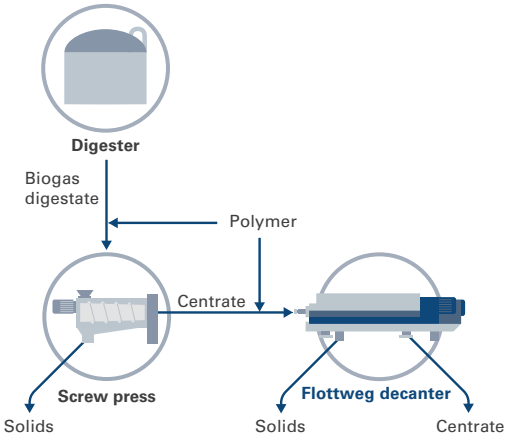



## Dewatering of biogas digestate without polymers

- Can be used as agricultural fertilizer without leaving polymer residues
- Flexible further processing of the centrate without polymer residues
- Lower operating costs
- Reduced complexity of the plant
- Lower centrate quality, but higher total solids content in the discharged solid phase

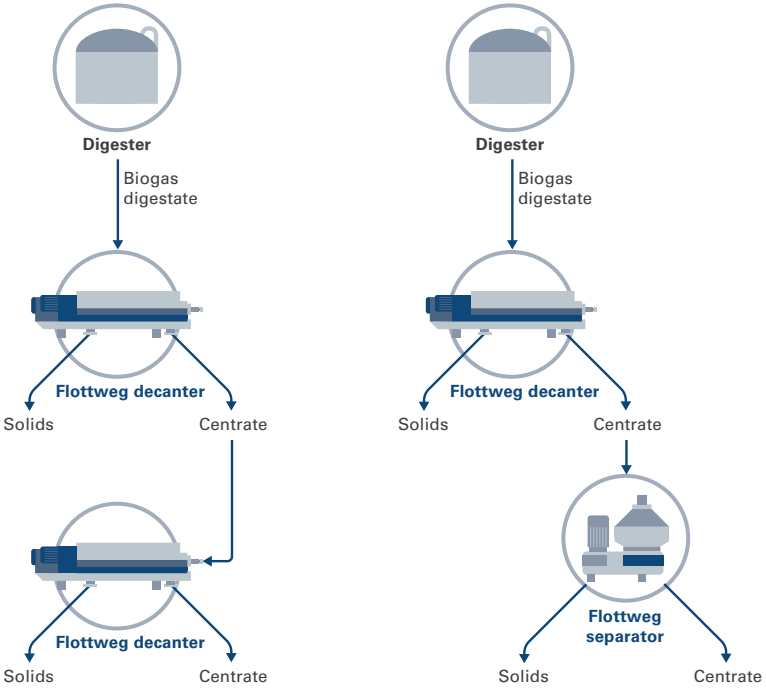
# THE SUCCESS IS YOURS

Flottweg decanters can be flexibly integrated into existing processes and configured for a variety of tasks. Possible options include, for example, a multi-stage dewatering process or the post-treatment of the centrate from an existing screw press. These solutions can also create opportunities to improve separation performance, centrate quality, and cost-effectiveness in existing biogas and biomethane plants.




## Post-treatment of the centrate from a screw press

- Finest particles separated out from the screw press centrate
- Decanter can be operated with or without polymer
- Frequently used in SSO (source-separated organics) and in OFMSW processes (organics from municipal solid waste)




## Multi-stage dewatering

- Suitable when polymers cannot or should not be used, but a particularly high-quality centrate is still required
- Depending on the process and the properties of the centrate, secondary settling is performed using a second decanter or a separator
- Depending on capacity, the quantity of solids, and the properties of the solids, the use of a Sedicanter® may be advisable

® = registered trademark in different countries.

# FEATURES AND CAPACITIES

## Intelligently designed

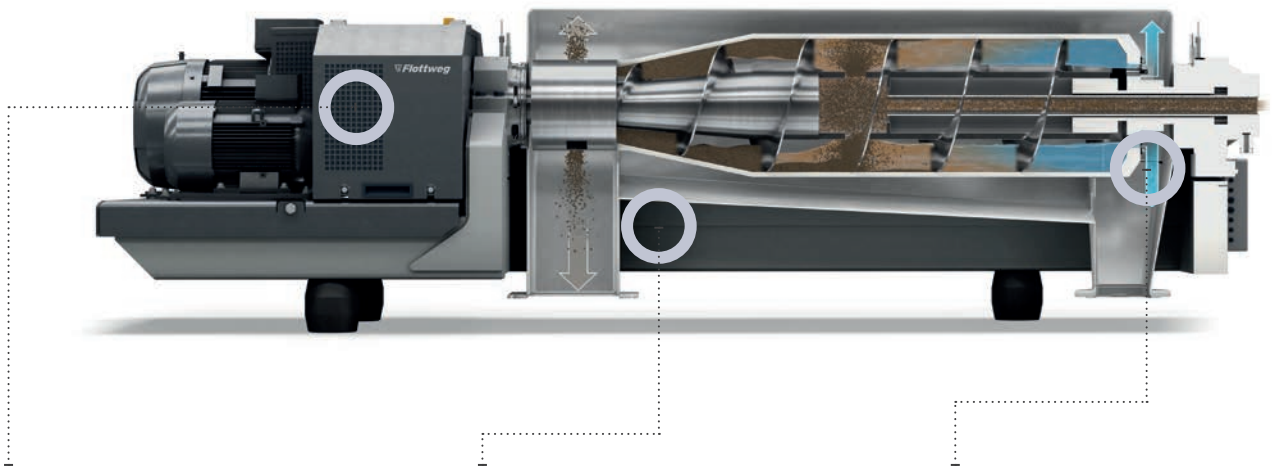
- Low space requirements allow you to invest in replacements without the need for structural work
- Maintenance-friendly, easily accessible design promotes maximum availability and minimum downtime during servicing
- Replacement of spare and wear parts, as well as operational safety checks (accident prevention regulations), are generally carried out on site

## Fully automatic

- 24-hour operation, including scheduled switch-on and switch-off
- Industry 4.0-ready – all remote monitoring and maintenance options on request
- Individual integration of the centrifuge controller into your overall control system for maximum efficiency and operational reliability of your system

## Wear protection and material

- Full abrasion protection package
- Armor on the scroll helix
- Protective chilled cast iron on all inlet and outlet openings
- All decanter components that come into contact with the product are made of high-quality stainless steel




## Flottweg Simp Drive®

- Economical thanks to the intelligent combination of rotor and scroll drives; conversion losses are reduced
- Automatic regulation of the thickened sludge concentration depending on the current loading of the machine
- Optimal dewatering even under varying feed conditions

## Closed design

- Closed design and good shielding of the (workplace) environment
- No health hazards for operating personnel (no aerosols or odors)

## Flottweg Recuvane®

- Additional reduction in operating costs thanks to lower energy consumption
- Reduces the energy consumption of your decanter by up to 30%*
- Easy adjustment of the pond depth
- Can be retrofitted without substantial effort; quick amortization
- Existing separation processes remain unchanged

*Dependent on pond depth and sludge suitability

® = registered trademark in different countries.




## Containers

As an option, Flottweg plants and systems can be pre-assembled on platforms and in containers:

- Protected against dirt, snow, and rain
- Efficient implementation of a processing plant
- Advice on separation technology, including specifications for all components in the process
- Customer-specific automation and process integration
- Remote diagnostics available upon request for reliable monitoring of your process
- Plug-and-play installation reduced on-site installation time

## WITHOUT POLYMER – Throughflow capacities of Flottweg decanters

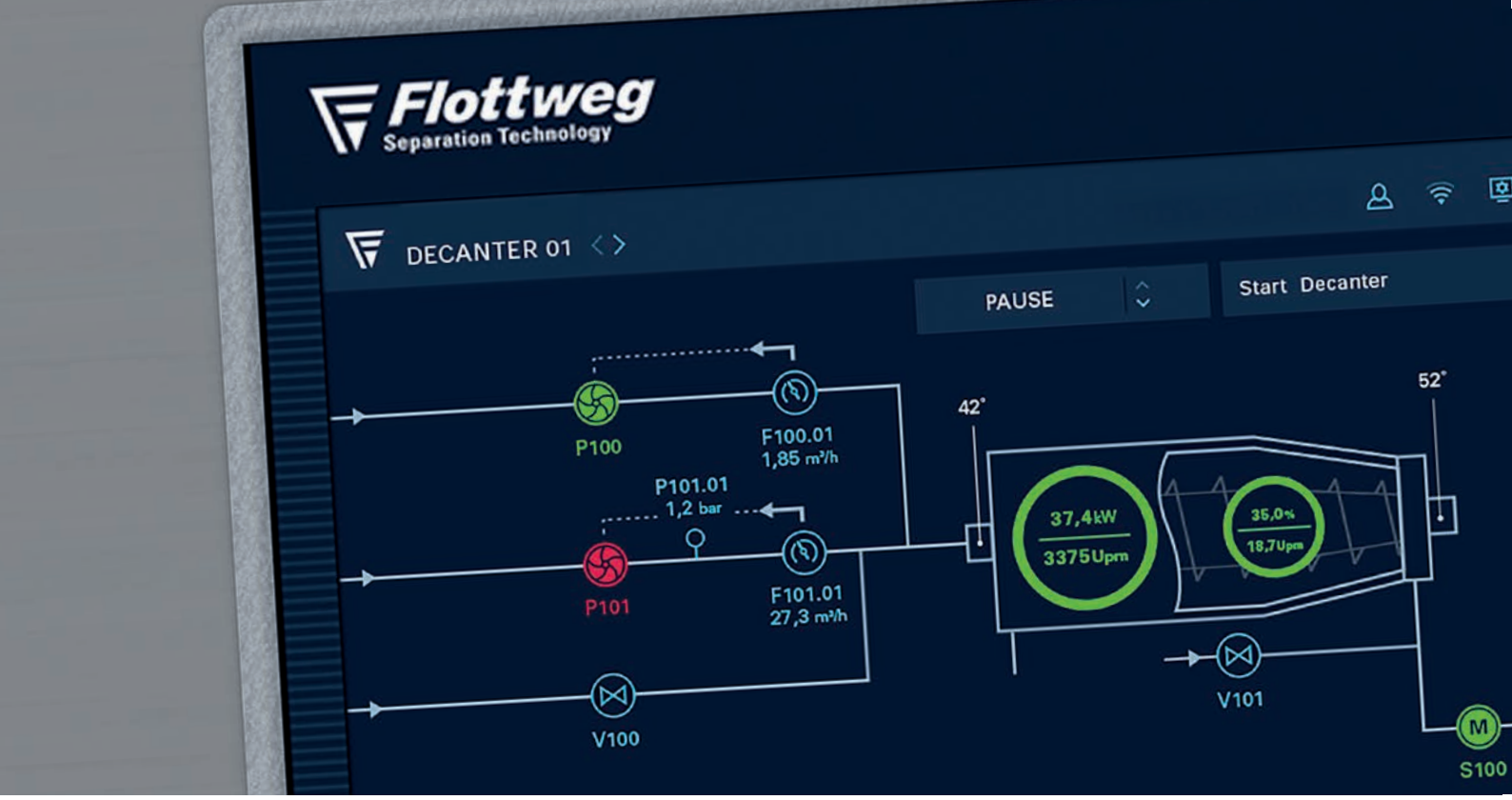
| | FW400 | C4E | C5E | C7E |
|---|---|---|---|---|
| **Throughflow [m³/h]*** | 5–10 | 10–20 | 15–35 | 20–50 |
| **Solids capacity [TSS/h] optimum [kg]** | 120–230 | 190–400 | 325–700 | 550–1200 |
| **Solids capacity [TSS/h] maximum [kg]** | 230–375 | 350–600 | 550–950 | 900–1600 |

* Throughflow depends on the properties of the digestate, the TSS concentration (= total suspended solids), and the desired separation results.

## WITH POLYMER – Throughflow capacities of Flottweg decanters

| | FW400 | C4E | C5E | C7E |
|---|---|---|---|---|
| **Throughflow [m³/h]*** | 5–15 | 10–25 | 15–50 | 25–85 |
| **Solids capacity [TSS/h] optimum [kg]** | 160–340 | 275–550 | 450–900 | 750–1500 |
| **Solids capacity [TSS/h] maximum [kg]** | 340–530 | 530–850 | 850–1400 | 1400–2400 |

* Throughflow depends on the properties of the digestate, the TSS concentration (= total suspended solids), and the desired separation results.




# RELIABLE PROCESSES, LOWER COSTS

## INto the system and GO: Flottweg InGo user interface for easy control

**Each Flottweg centrifuge is equipped with a pre-installed and factory-tested control package including the InGo operating concept. The Flottweg automation package offers you the following benefits:**

- High process reliability combined with low costs thanks to an intuitive operating concept
- High functional reliability thanks to climate-controlled control cabinets for safe operation under extreme conditions such as heat, dust and moisture
- Worldwide support is possible thanks to the integrated remote maintenance system: direct, secure VPN connection to all network participants of the Flottweg control system (PLC, VFD, HMI, etc.)
- Simple data connection of the Flottweg control system to customer PLC or SCADA systems via individual protocols (Profibus, Profinet, Ethernet IP, Modbus, OPC UA)
- Optional: Control of customer units (pumps, valves, etc.)



The modern machine control combined with the InGo operating system enables a fully automatic interplay between the individual process and system components. Users can see the operating state at a glance – including in poor lighting conditions or outdoors. The control system also meets the highest standards in terms of operational and machine safety. This ensures high process availability, including when FW control components are integrated into the customer's control system.

## With InGo ...

- **you always have a complete overview and full control over all process components**
- **you save time and costs when operating the system**
- **you operate the centrifuge intuitively, as InGo is based on the established concepts of smartphones and PCs**
- **user acceptance is guaranteed – without the need for extensive training**
- **you always retain control over all process parameters**




# FLOTTWEG PROCESS CENTER: WORKING FOR YOUR INVESTMENT

Flottweg decanters and separators are customized to meet the specific requirements of each industry. This ensures that your machine settings are optimally tailored to your specific application. For new applications and process variations, we test your product or raw materials at the Flottweg Process Center under real-world conditions – from the initial analysis through to industrial scales. This allows you to make decisions based on validated data before you invest. At the Flottweg Process Center, we can determine the following and more under real-world conditions:

- Whether the planned separation process will work reliably
- Which Flottweg separation technology is best suited for the overall process
- What separation results and yields can be achieved






## Our approach

**Laboratory > Technical center > Scale-up**

- Laboratory: rapid feasibility analysis
- Technical center: tests using original machines
- Scale-up: transition to industrial processes

Our specialists will help you make informed decisions and get the most out of your application.

## Your benefits

- **Optimized machine design**
- **Faster commissioning**
- **Greater process reliability**
- **Verifiable performance metrics**

**Less investment risk overall**




## Typical use cases

- Development of new applications
- Optimization of existing processes
- Scale-up from the laboratory to production
- Comparison of process variants
- Analysis of optimization potential



# FLOTTWEG QUALITY AND SERVICE




## Guaranteed Flottweg quality

Typical "Made in Germany": We have a clear understanding of what quality is and do not compromise on it. In the food industry, our products must comply with high standards of hygiene. Therefore, the Flottweg centrifuge components that come into direct contact with the medium to be processed (e.g. bowl, scroll, and feed) are made exclusively of high-grade, rust and acid-resistant stainless steels. This also makes it possible to increase the strength and improve the resistance.

Our machines are equipped to meet your requirements permanently – in extreme cases 24 hours a day, 7 days a week. Our strict quality controls (ISO 9001:2015) and the traceability of all critical components ensure additional product safety.

## Our service – always there for you!

Over 1,100 employees worldwide in a network of more than 60 sales and service locations are available to assist you. We not only strive for first-class advice on the selection and design of our systems, but we are also there for you afterward, whenever you need us – in more than 100 countries around the world.

## Success can be planned. In just three steps.

**Are you planning your own success story for your products?
Then get in touch with Flottweg and benefit from our 3-step roadmap:**

**01** We discuss your separation task and business goals with you.

**02** In the pre-engineering stage, we analyze your raw materials in our laboratory and carry out customized tests at the Flottweg Technical Center or on site at your business premises. The first product samples can also be provided at this point.

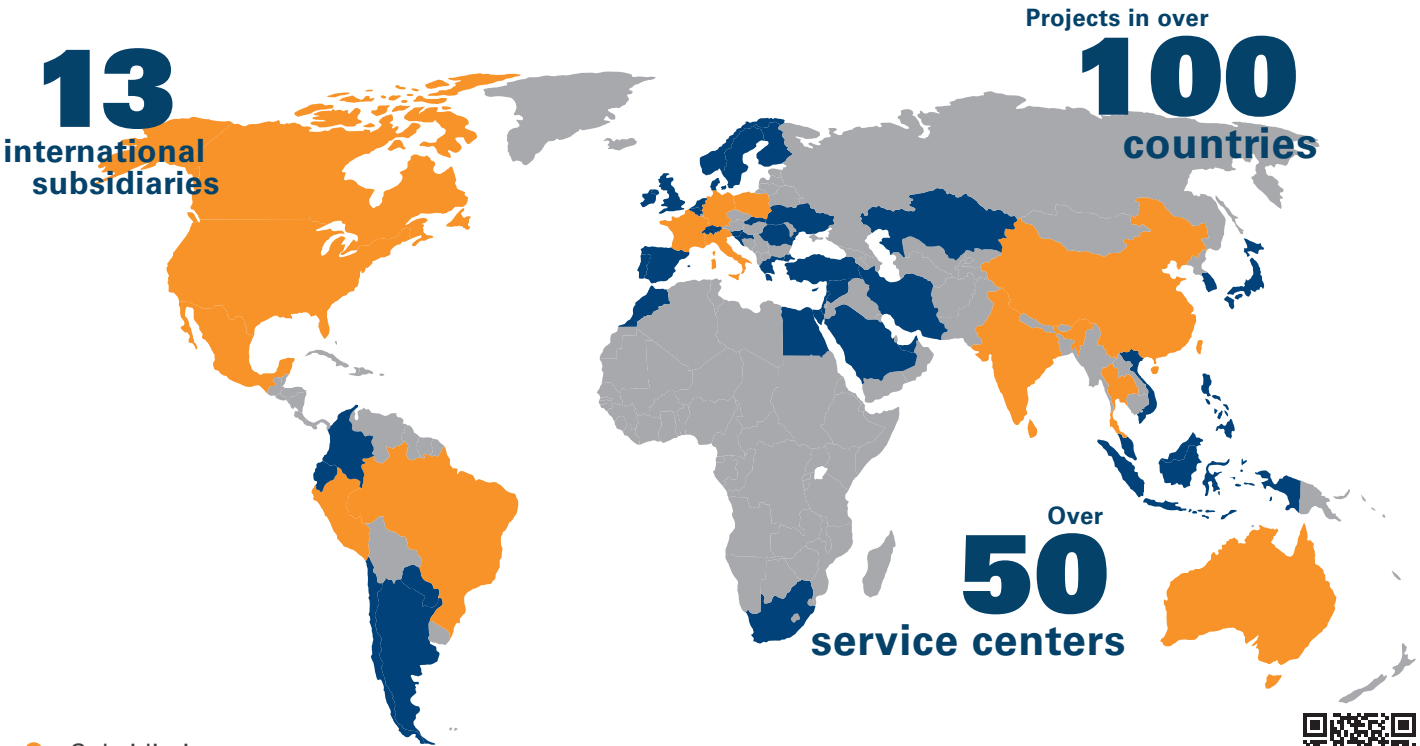
**03** After the design and detailed development process, you will receive a concrete offer including all relevant line figures for your individual Flottweg application.

**Make Flottweg the engineer of your success:
Our sales partners are looking forward to hearing about your ideas and challenges!**




## Flottweg worldwide

To be able to serve our customers worldwide, we maintain an international sales and service network: We are represented in over 100 countries. All branches and representatives have specially trained service technicians, some of whom we train in our in-house Flottweg Academy.




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