



# HIGH QUALITY SEPARATION TECHNOLOGY

Flottweg Centrifuges for Olive Oil Production

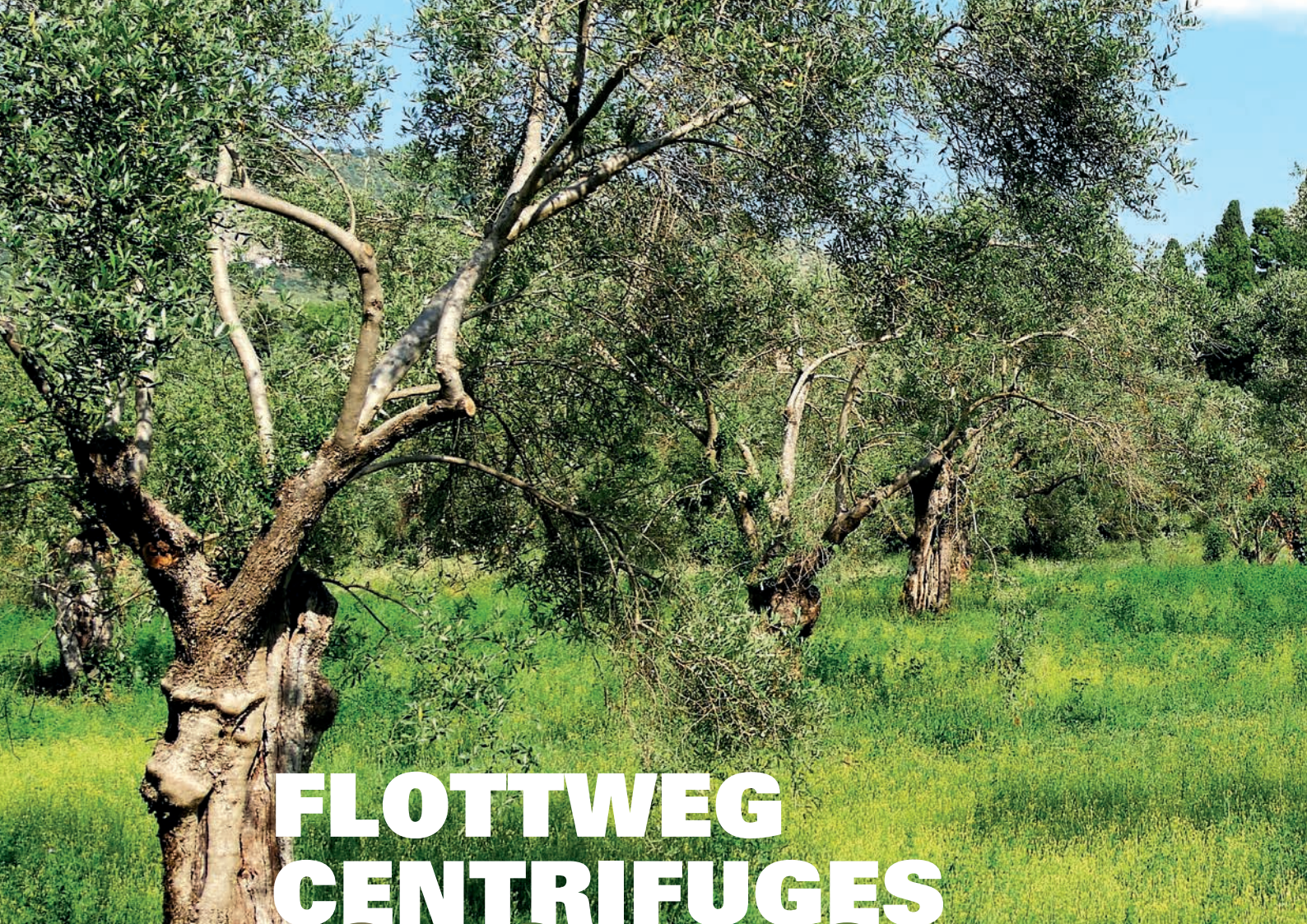


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# FLOTTWEG CENTRIFUGES FOR OLIVE OIL PRODUCTION

## **Olive Oil Has Been Produced Since Antiquity**

Ancient olive-oil making was done exclusively by hand. Later on, simple machines such as mechanical presses and pan grinders driven by human or animal power were used. The separation of oil, fruit water, and pulp was done by static settling. At the present time, olive oil is manufactured in a process using modern machinery.

In the early 1970s, Flottweg was one of the first companies to introduce decanter centrifuges to the olive oil production process, replacing the existing hydraulic press method. At Flottweg, constant development has since been conducted in order to improve the decanter performance in terms of oil yield, throughput capacity, and machine lifetime. During this time, Flottweg has delivered thousands of decanters and Tricanter<sup>®</sup> to all olive oil producing countries in the world.

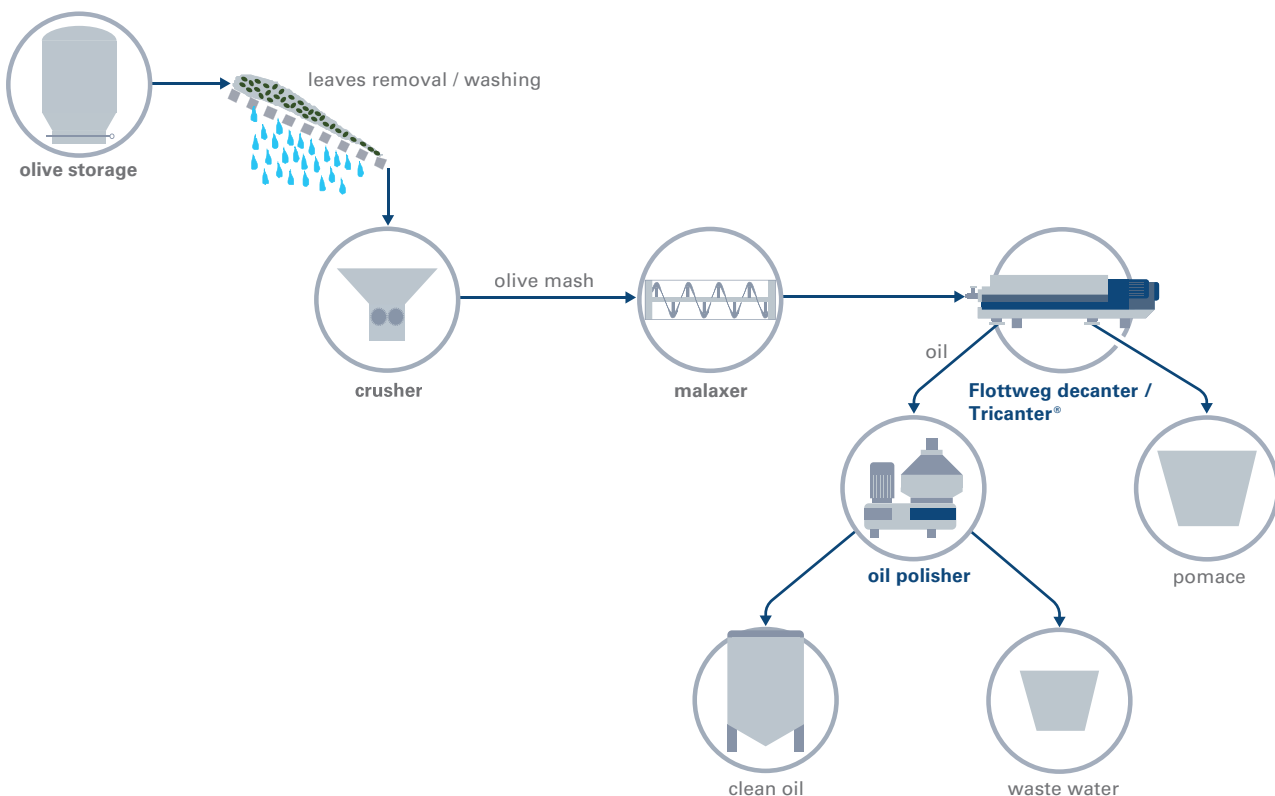


# OLIVE OIL PROCESSING

Prior to processing, olives are cleaned to remove leaves, bits of branches, stones, soil, and other impurities. Then a mash is produced by crushing the olives and the olive stones. This mash is conveyed to the malaxer or kneading mill. Through malaxing, the oil is released from the oil cells by which it is encapsulated. The malaxing procedure is critical for oil yield and oil quality. The influencing parameters are holding time and temperature. Then the mash is pumped to the Flottweg decanter (2-phase) or Tricanter® (3-phase) for separation. In the Tricanter® (3-phase), the mash is separated into oil, fruit water and solids, i.e. olive stone debris and pulp. On the way to the Tricanter®, dilution water is added to the feed in order to fluidize the mash. In the 2-phase process, the mash is separated into oil as liquid phase and solid phase (pomace) consisting of olive stone debris, pulp and fruit water. The 2-phase process requires very little or no dilution water in the feed to the decanter. The oil from the Flottweg decanter or Tricanter® is then polished using a disc stack centrifuge, which separates the residual amount of water and solid impurities to obtain a clean oil. In the 3-phase process, a second disc stack centrifuge is used to recover the residual oil from the water phase.

The advantage of the 2-phase process is low water consumption and a low amount of waste water produced; however, it delivers a solid phase with a high moisture content which is difficult to process further, such as thermal drying and solvent extraction of residual oil. Conversely, in the 3-phase process, the solid phase is significantly dryer and easier to handle for transportation and processing. Water consumption and related waste water production are noticeably higher than using the 2-phase process. The decision of whether to apply 2- or 3-phase processing depends on local and individual circumstances.

A certain amount of residual oil remains in the pomace from the extraction. In order to recover this oil, the pomace undergoes extraction again via a second stage. Generally, for the second extraction the same kind of equipment is used as for the first extraction. In some cases there is a de-pitter to separate the stone debris from the pulp prior to the second extraction. The products after the second extraction are oil for refining or industrial use depending on the quality, husk for incineration (fuel), pulp for fertilizer and black water for depuration.

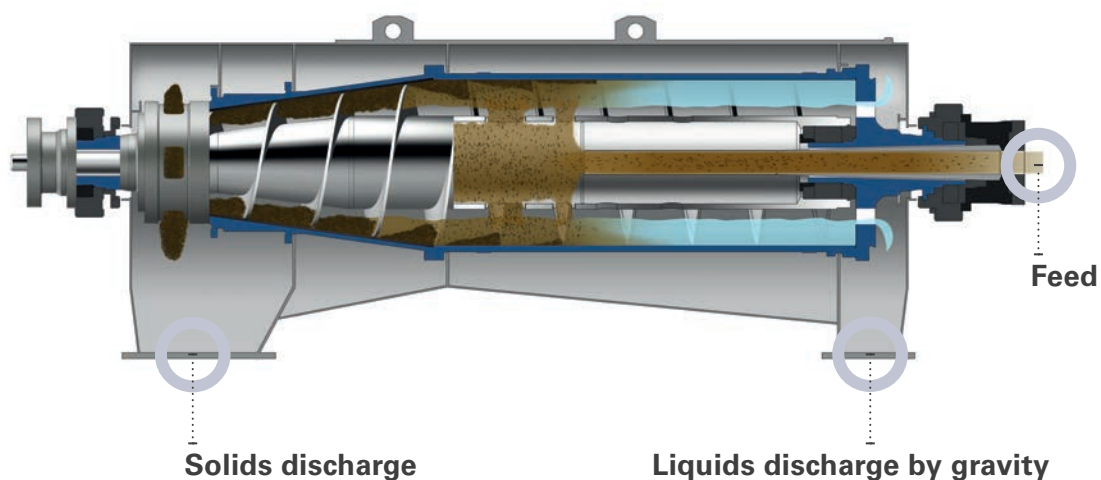


# THE FLOTTWEG DECANTER/TRICANTER® FOR OLIVE OIL EXTRACTION

The essential part of the Flottweg decanter/Tricanter® is the rotating part, consisting of a cylindrical/conical bowl with a conveyor scroll inside which rotates at a differential speed. The rotating part is driven by electric motors via belt transmission. Feed enters the bowl through a central feed pipe. Through ports in the scroll body, the feed passes into the bowl where separation by centrifugal force takes place.

## The Flottweg Decanter

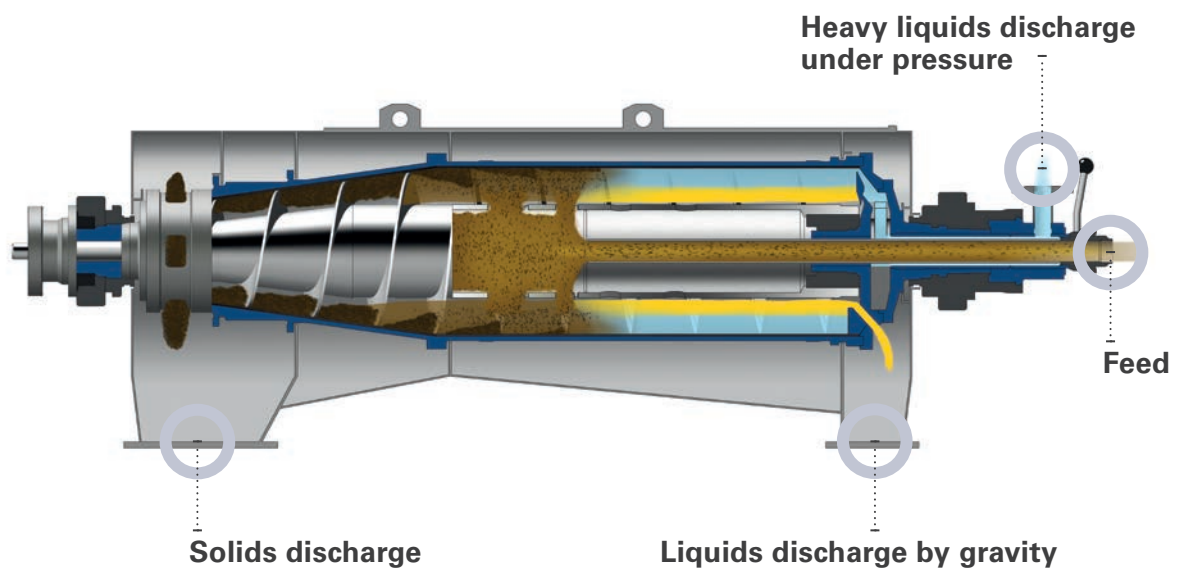
In a decanter, the product is separated into a liquid phase (oil) and a solid phase (stone debris, pulp, and fruit water).





## The Flottweg Tricanter®

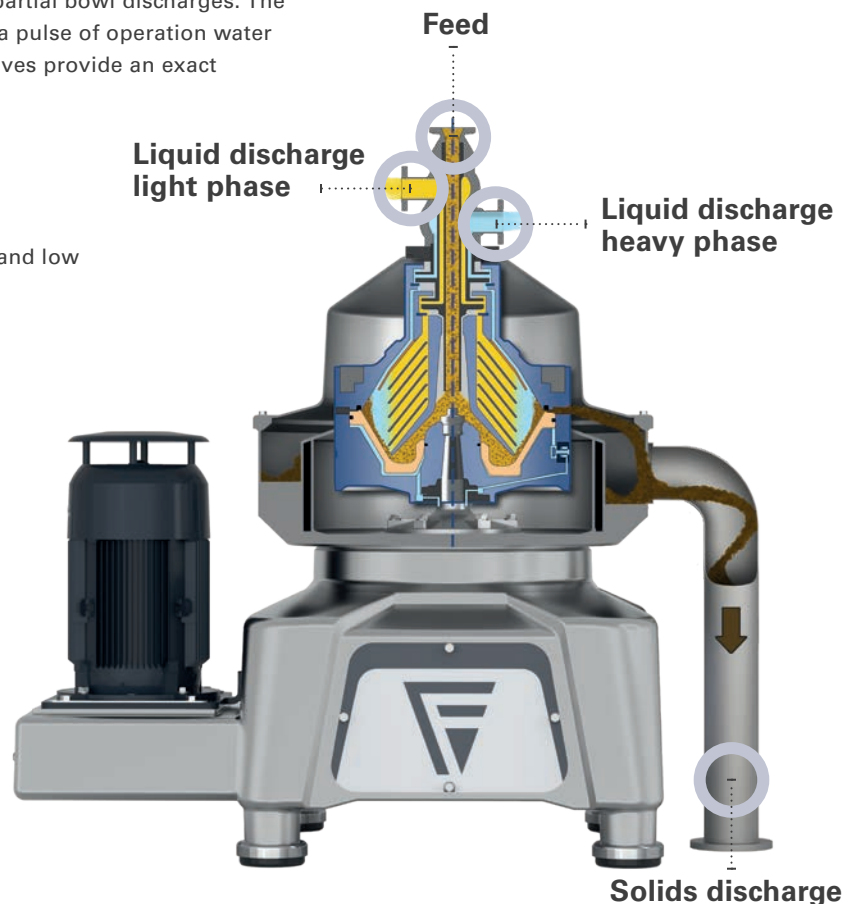
In a Tricanter®, the product is separated into a light liquid phase (oil), a heavy liquid phase (water), and a solid phase (stone debris and pulp). The separated oil is discharged by gravity in both cases, while in addition in a Tricanter®, the separated water phase is discharged by an impeller under pressure or by gravity. The separated solids are conveyed by the scroll to the conical end of the bowl and are discharged.



# FLOTTWEG DISC STACK CENTRIFUGES FOR OPTIMUM OLIVE OIL PURIFICATION

Disc stack centrifuges with a self cleaning bowl are used for the separation of oil, water, and solids. Via a fixed feed pipe, the product to be separated enters the inside of the bowl which is rotating at high speed. The product flow is divided into multiple thin layers by the disc stack and a large surface area is created. From the disc stack, the separated liquids flow to the upper part of the bowl where the oil is discharged under pressure via an impeller. The separated water leaves the bowl by gravity over a ring dam. Due to high centrifugal force, the separated solids are packed tightly against the bowl wall. The separated solids are ejected at full speed by means of a hydraulic system in the bowl bottom. The hydraulic system of the Flottweg AC-centrifuge enables total and partial bowl discharges. The opening/closing procedure is released by a pulse of operation water directly before the discharge. Solenoid valves provide an exact proportioning of the operation water.

For power transmission, there is a sturdy and low maintenance belt drive. The drive-motor control via frequency converter ensures smooth acceleration up to operational speed and generator braking. All monitoring and control functions of the centrifuge are handled by a modern PLC control unit.





After the first separation by means of the Flottweg decanter/Tricanter®, the second separation via the Flottweg disc stack centrifuge is critical for oil quality, yield, and overall efficiency.

Flottweg AC-series disc stack centrifuges perform both partial and total bowl discharge in any combination. The operation is fully automated via PLC. Using automatic valves for feed and water, the oil content in the bowl is displaced by water prior to bowl discharge. Operation via partial discharge results in virtually no oil loss. Using the total discharge, the bowl stays clean for an extended period of time. Depending on olive quality and operational circumstances, the most suitable combination can easily be programmed.



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### Benefits:

- **Virtually no oil loss during bowl discharge by fully automated partial discharge and oil displacement**
- **Reduced air contact by closed construction of feed and oil discharge (via impeller)**
- **User-friendly, continuous and automatic operation by control via PLC**
- **Reduced downtime by enhanced cleaning capability**



# SIMP DRIVE

## SOME FEATURES THAT MAKE THE FLOTTWEG CENTRIFUGES UNIQUE

Optimal performance in terms of oil yield, cake dryness, and power consumption, even under varying olive quality and operation conditions, are achieved by:



### Gear Drive (VFD)

The bowl is driven via a frequency controlled motor enabling a continuously adjustable bowl speed and a fixed gear ratio for differential speed.



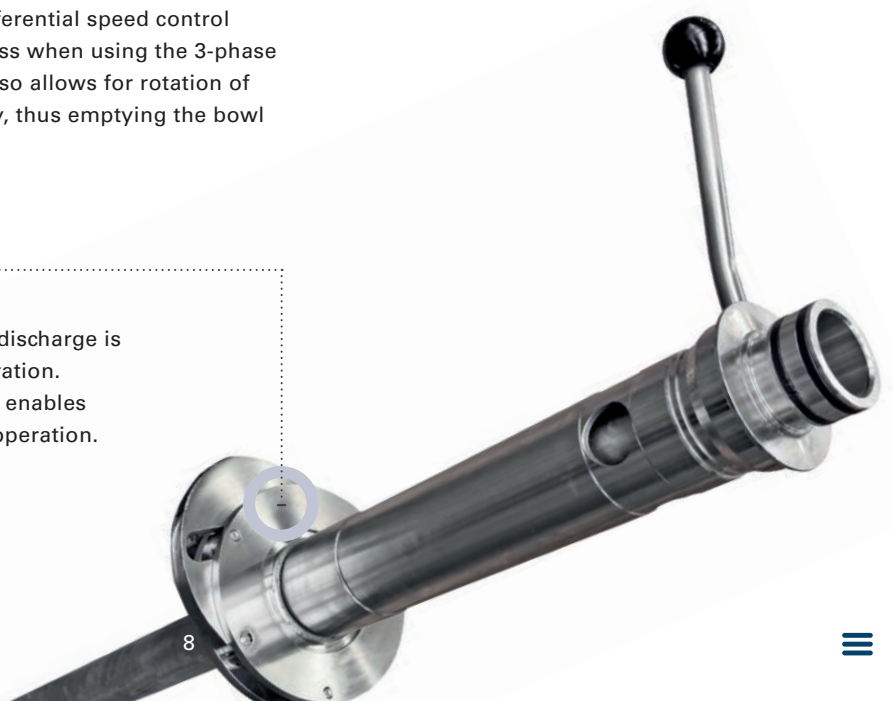
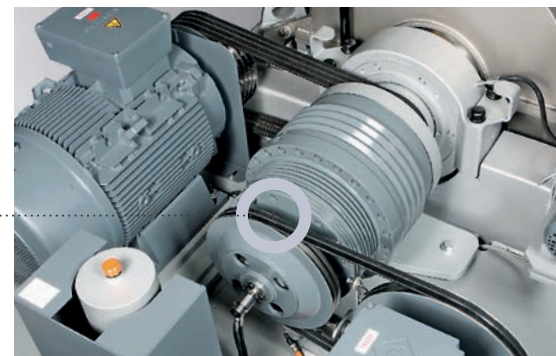
### Flottweg Simp Drive®

In addition to the gear drive, the scroll is driven independently from the bowl by a secondary motor and via a special gear unit. This allows for torque-dependent differential speed control which results in optimum cake dryness when using the 3-phase process. The Flottweg Simp Drive® also allows for rotation of the scroll while the bowl is stationary, thus emptying the bowl content.



### Adjustable Impeller

A highly precise setting in the liquid discharge is required for optimum oil-water separation. The Flottweg Tricanter® with impeller enables continuous adjustment even during operation.



# FEATURES FOR HIGH RELIABILITY AND AVAILABILITY



## Unique Highly Durable Wear Protection

All parts exposed to wear are protected by means of features such as special hard facing, wear bushings, and inserts. Bushings and inserts are easily exchangeable, even under field conditions.



## Efficient Bearing Lubrication

Flottweg decanters and Tricanters® can be equipped with a manually operated grease-lubrication device. All bearings are lubricated in a single step. The Flottweg air-oil (droplet) lubrication is available as an option for the Z6E machine.



## Maintenance Friendly

Z4E and Z5E models are equipped with covers for the bowl and drive which are able to be opened by a single person without the need for a lifting device. For service and repair jobs, the design allows the lifting of the entire rotor as a single piece. The gear unit is placed outside the area that comes into contact with the product.

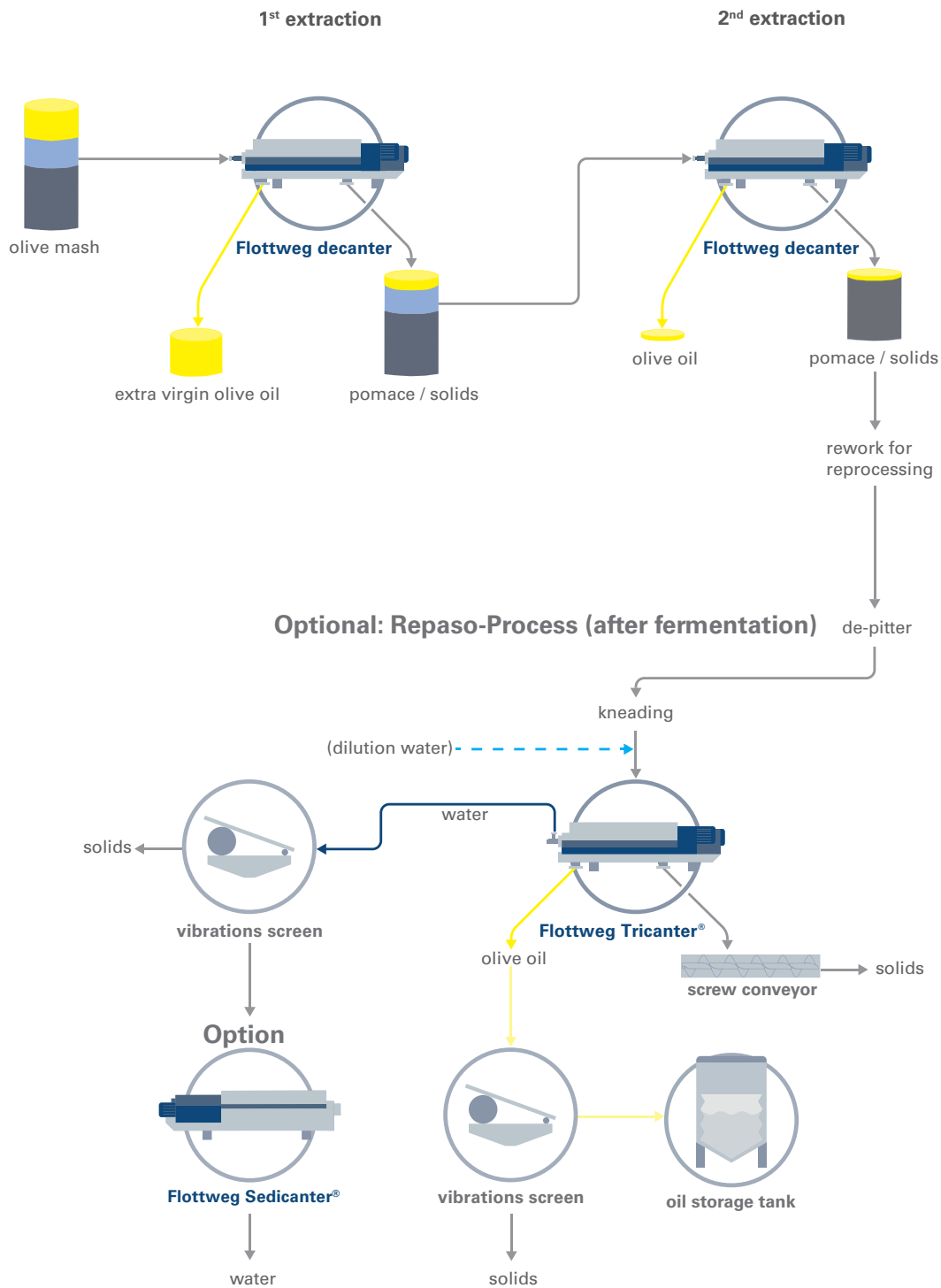
### Benefits:

- Optimum oil yield by tailor-made scroll design for olive oil extraction in 2- and 3-phase separation
- High cake dryness in 3-phase operation by torque-dependent differential speed control (Flottweg Simp Drive®)
- Long service life by sophisticated wear protection based on experience over decades





# INCREASING THE OIL YIELD





## Higher Profit Through Second Extraction

Flottweg decanters and Tricanters® are optimized for maximum oil yield. Nevertheless, the technical yield in oil during the first extraction is typically in the range between 85 to more than 90 %, due to the olive variety, operation temperature and other process parameters. This is true for 2- as well as 3-phase operation.

The pomace after first extraction contains a certain amount of residual oil which is worthwhile recovering. Depending on the efficiency of the first extraction, i.e. oil concentration in the pomace, up to 50 % of the oil can be recovered via a second mechanical extraction thus increasing the gross yield in oil significantly. The second extraction can be performed in 2- or 3-phase operation normally without addition of water. However, the 3-phase operation in the second extraction is the better option due to the lower moisture content in the pomace, which is favorable for further handling and processing.

## Residue Becomes Value

The way that the byproducts of pulp and stone debris are used has changed. In the past, especially when the first extraction was performed via presses or 3-phase operation, the pomace was thermally dried and the residual oil extracted using organic solvents. The dry residue consisting of dry pulp and stone debris or pits was recycled to the oil mills to be used as fuel for the boiler.

After the introduction of the 2-phase operation, this process became less efficient because the pomace from 2-phase operation has a higher moisture content than in the case of 3-phase operation or extraction via presses. As a result, the residual oil is usually recovered via second mechanical extraction. The pomace is then separated into pulp and stone debris via a de-pitter. The separated pits are dry enough to be used as fuel for heat and power generation. The separated pulp is composted and used as fertilizer.





# FLOTTWEG QUALITY AND SERVICE



## Guaranteed Flottweg Quality

Typical “Made in Germany” quality: We have a very clear idea about quality and do not make any compromises here. Often, our customers have to deal with aggressive substances contained in wastewater. That is why we only use rustproof and acid-resistant materials for wetted parts.

Our optimally equipped machines will withstand your demands permanently – in extreme cases 24/7.

Our strict quality controls (DIN ISO 9001:2015) as well as the ability to track all critical components provide additional product safety.



## Our Service – Always Available for You!

Almost 1100 employees located globally throughout our network of more than 60 sales and service points are ready to assist you.

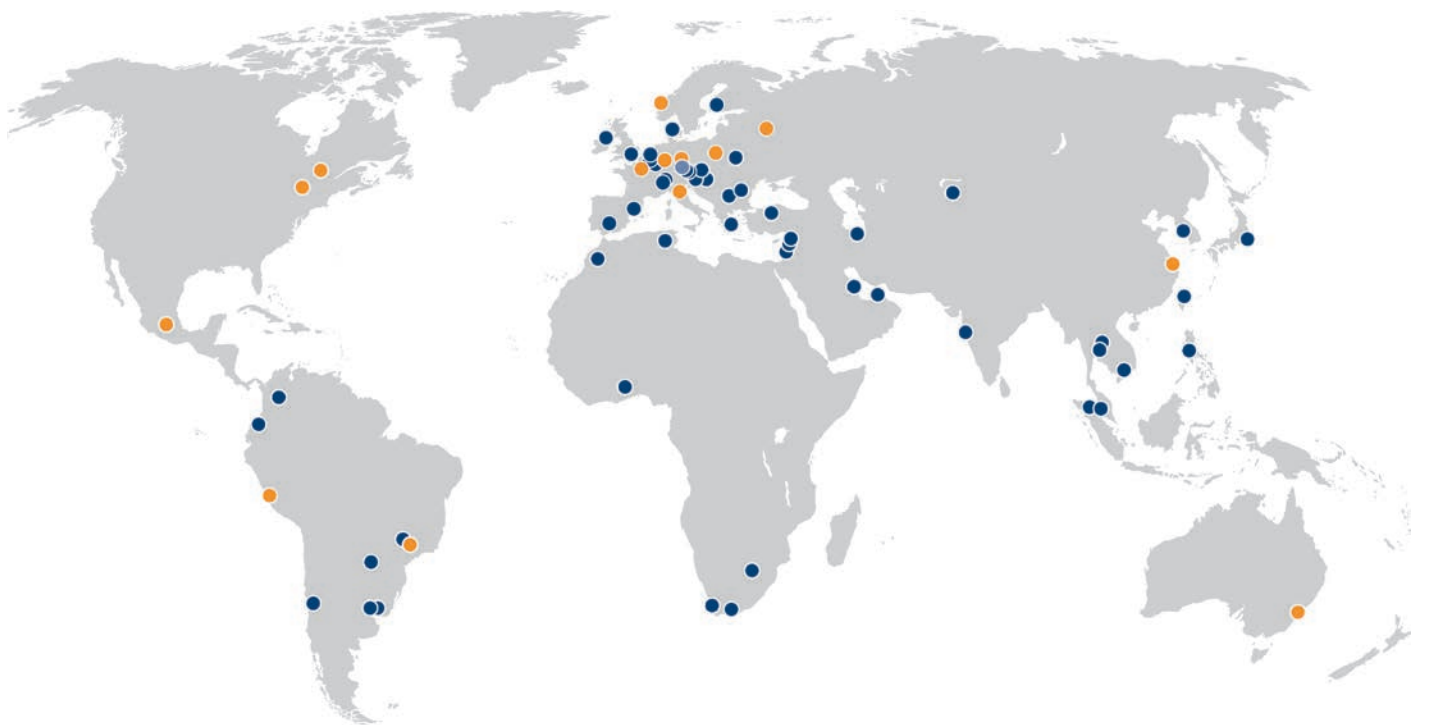
We not only strive to provide excellence when selecting and dimensioning our systems, but we are ready to assist you also afterward, whenever you need us – in more than 100 countries worldwide and 24/7.

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## Any questions? Then don't hesitate to contact us!

We will show you how you can save costs and energy when using the Flottweg turn-key systems. Together with our experts, we'll discover your precise optimization potential.

For more information, please visit our website: [www.flottweg.com](http://www.flottweg.com).



- – Headquarters
- – Subsidiary
- – Representative office





# FLOTTWEG DISC STACK CENTRIFUGES

Technical data of the Flottweg disc stack centrifuges\*

Type	AC1200	AC1500a	AC1700	AC2000
<b>Materials</b>	All parts that come into contact with the product are made of high grade stainless steel such as Duplex stainless steel, 1.4404 (AISI 316L), etc.			
<b>Max. bowl speed (rpm)</b>	7800	6800	6800	5700
<b>Dimensions (mm) (L x W x H)</b>	1200 x 900 x 1300	1400 x 1010 x 1450	1365 x 1010 x 1450	1600 x 1200 x 1800
<b>Gross weight (kg)</b>	910	1350	1400	2900
<b>Motor for bowl drive (kW)</b>	7.5	15	18.5	30
<b>Capacity (l/h)</b>	up to 1250	up to 2300	up to 3300	up to 4300

\* The listed figures are guidelines only. Actual capacity depends on the individual characteristics of the product. Subject to technical changes.





# FLOTTWEG DECANTERS C-SERIES

Technical data of Flottweg decanters C-series\*

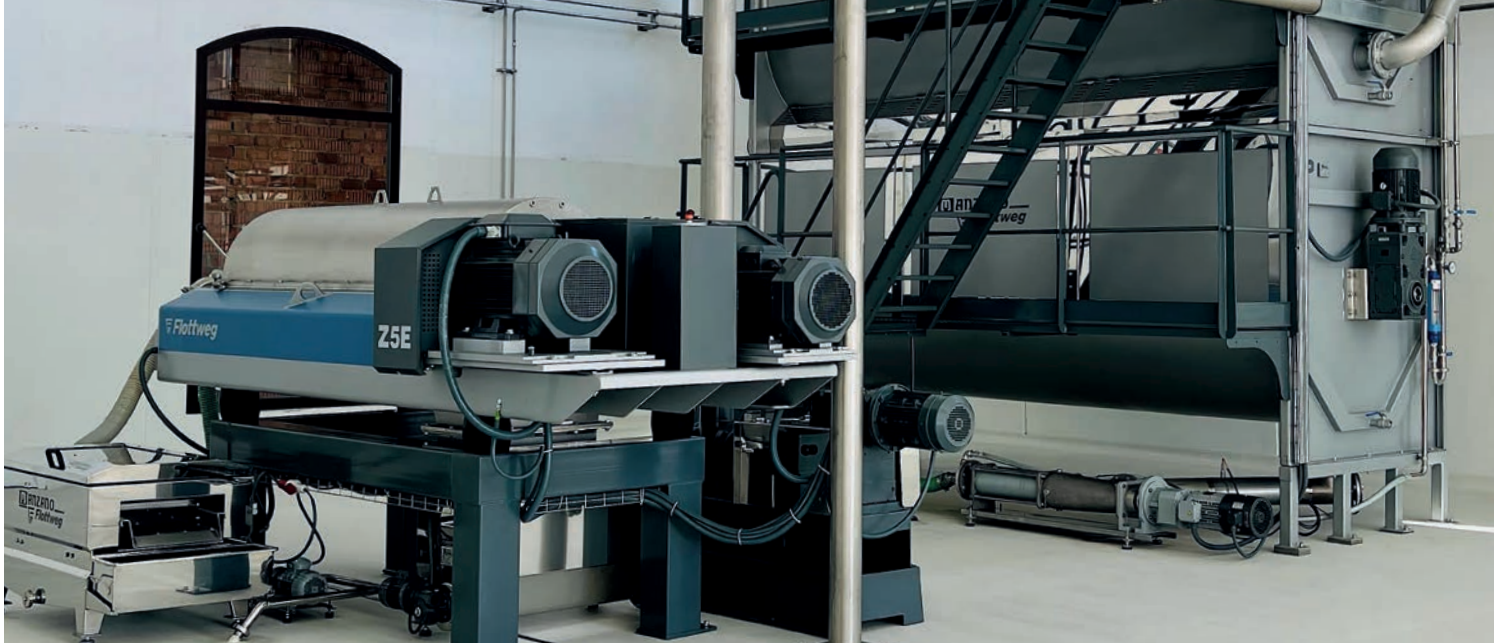
Type	C3E-4	C4E/L	C4E-4	C5E/L	C5E-4
<b>Materials</b>	All parts that come into contact with the product are made of high grade stainless steel such as Duplex, AISI 316TI (1.471), etc.				
<b>Max. bowl speed (rpm)</b>	4000	3520	3520	2800	2800
<b>Dimensions (mm) (L x W x H)</b>	2980 x 940 x 900	3520 x 1140 x 1030	3520 x 1140 x 1030	4100 x 1520 x 1210	4100 x 1520 x 1210
<b>Gross weight (kg)</b>	1735	2660	2760	4940	5060
<b>Motor for bowl drive (kW)</b>	18.5	30	30	30	30
<b>Motor for scroll drive (kW)</b>	5.5	11	15	22	22
<b>Capacity (t/day) (Repaso)</b>	43 - 52	72 - 96	84 - 120	120 - 144	144 - 192 (200 - 250)

\* The listed figures are guidelines only. Actual capacity depends on the individual characteristics of the product. Subject to technical changes.

Flottweg C-series decanters are configured for use in the 2-phase process. The separated oil is discharged by gravity.







# FLOTTWEG DECANTERS AND TRICANTERS® Z-SERIES

Technical data of Flottweg decanters and Tricanters® Z-series\*

Type	Z3E	Z4E	Z4E-4	Z5E	Z5E-4	Z6E	Z8E
<b>Materials</b>	All parts that come into contact with the product are made of high grade stainless steel such as Duplex, AISI 316TI (1.471), etc.						
<b>Max. bowl speed (rpm)</b>	5250	4200	4200	3500	3500	3200	2650
<b>Dimensions (mm) (L x W x H)</b>	2645 x 1180 x 850	3400 x 1000 x 1200	3400 x 1000 x 1200	4490 x 1590 x 1120	4490 x 1590 x 1120	5180 x 1770 x 1300	6440 x 2000 x 1480
<b>Gross weight (kg)</b>	1850	2870	3000	6100	6200	8500	14140
<b>Motor for bowl drive (kW)</b>	15	22 - 30	22	30 - 37	30 - 37	45 - 75	90
<b>Motor for scroll drive (kW)</b> Flottweg Simp Drive®	5	n.a.	11	n.a.	22 - 37	22 - 55	90
<b>Capacity 1<sup>st</sup> extraction (t/day) (Repasso)</b>	30 - 40	48 - 72	60 - 84	96 - 120	108 - 220 (220 - 280)	300 - 400 (400 - 550)	500 - 650 (750 - 1000)

\* The listed figures are guidelines only. Actual capacity depends on the individual characteristics of the product. Subject to technical changes.

Flottweg Z-series decanters and Tricanters® are available for the use in 2- or 3-phase processes. For 2-phase operation, the adjustable impeller disc is available as an option for discharging the oil under pressure. The Flottweg Tricanters® are equipped as standard with an adjustable impeller disc for discharging the water under pressure whereas the oil is discharged by gravity.







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