FILTRATION & VACUUM DRYING TECHNOLOGY



AGITATED NUTSCHE FILTER FNB AGITATED NUTSCHE FILTER DRYER FNB-S



AGITATED NUTSCHE FILTER FNB AND AGITATED NUTSCHE FILTER DRYER FNB-S



GENERAL INFORMATION

Filtration, extraction and drying processes in the chemical, pharmaceutical and food industries often involve hazardous, toxic or sensitive products. To ensure maximum safety and avoid cross-contamination, these processes must be carried out in closed, hermetically sealed systems, minimizing product transfers between equipment.

The **AGITATED NUTSCHE FILTER FNB** and the **AGITATED NUTSCHE FILTER DRYER FNB-S** have been specifically developed to meet these requirements, ensuring the production of high-purity substances free from contamination.

Thanks to their robust design and safety features, BACHILLER'S FNB and FNB-S nutsche filters are ideal for handling hazardous, flammable or explosive materials. They meet the highest safety standards and are designed and certified in compliance with **ATEX regulations.**

These Nutsche filters are mainly used for solid-liquid separation of products obtained from synthesis, crystallization or precipitation. They are also highly effective in extraction and purification processes.

The entire batch can be loaded into the vessel, where the suspension remains homogeneous during filtration thanks to a **reversible**, **variablespeed agitator**. This agitator also allows for important pre-filtration operations such as component addition, product maturation, or even carrying out the reaction itself within the same vessel.

During filtration, the system can be **pressurized (up to 10 bar as an option)** to accelerate the process. At the same time, **vacuum can be applied below the filter media**, enhancing filtration efficiency.

Both during filtration and in the previous stages, the **product temperature can be controlled** via an optional **double jacket**, allowing for heating or cooling as required.



During the vacuum drying, stage, the **AGITATED NUTSCHE FILTER DRYER FNB-S** is heated by double jackets located on the shell, the upper end, on the plate/bottom, the agitator shaft and the blades, providing a large heating surface for drying purposes. Vacuum groups and condensers are used to produce vacuums up to 1 mbar.

The **AGITATED NUTSCHE FILTERS FNB / FNB-S** are designed according to **GMP** and **EHEDG** standards for all types of pharmaceutical and fine chemical applications. Our machines are validated for sterile applications and we have special designs for installation in clean rooms. They are also available with fully hydraulic operation mode.

BACHILLER provides fully automated systems incorporating the latest control technologies, offering the user full operational control over all process parameters.

TYPICAL APPLICATIONS

Chemical Industry: Additives, Catalysts, Dyes, Vitamin Supplements, Powdered Metals, Minerals, Pigments, Polymers.

Pharmaceutical and Fine Chemical Industry: APIs, Amoxicillin, Antibiotics, Biotechnology, Dyes, Crystals, Essences and Flavors, Natural Extracts, Omeprazole, Penicillin and Derivatives, Peptides, Pharmaceutical Synthesis, Vitamins.

Food Industry: Additives, Flavors and Aromas, Dyes, Vitamin Supplements, Animal Extracts, Natural Extracts.

AGITATED NUTSCHE FILTER FNB AND AGITATED NUTSCHE FILTER DRYER FNB-S



DESIGN AND OPERATING PRINCIPLES

The **AGITATED NUTSCHE FILTER FNB** and the **AGITATED NUTSCHE FILTER DRYER FNB-S** are pressure and vacuum filtration systems designed to operate in batch mode, or continuously during the filtration phase. Both models allow for the integration of **reaction**, **filtration**, **and cake washing** within a single unit, optimizing process time, reducing product handling, and minimizing the risks associated with transfers between equipment.

The main difference between both models is that the **FNB-S model** includes an integrated **vacuum drying system**, enabling the complete processing cycle — from reaction to the final dry product — to be carried out in one single piece of equipment.

Both models feature a removable bottom flange, which provides easy access to the filter plate for cleaning and maintenance. This plate has a flat design to reduce dead volume, and the filter media can be selected from a variety of formats: textile or synthetic fabrics, single or multilayer metallic meshes, and sintered or ceramic elements.

The equipment is fitted with a specially designed agitator, which is reversible and height-adjustable, allowing a wide range of operations to be performed in the same vessel: **product preparation**, **dissolution**, **reaction**, **smoothing**, **compaction**, **final filtration**, **mixing**, **and discharge scraping**.

A TYPICAL OPERATIONAL SEQUENCE IS AS FOLLOWS:

- Load the product into the equipment.
- Reaction / ending of the process inside the equipment (optional).
- Vessel pressurisation and start of the filtration process.
- Vacuum may be simultaneously applied to the lower section to increase the filtration flow rate.
- Product cake formation over the filter.
- Cake squeezing and smoothing.
- Cake washing by spraying with an adequate solution.
- Repeated cake squeezing and smoothing.
- Cake vacuum drying to obtain the dry product (optional).
- Cake/dried product unloading through the lateral discharge valve using the agitator.

FILTRATE FILTERABILITY AND PERFORMANCE

The filterability characteristics of products are highly diverse and vary mainly depending on their morphology and the conditions of the medium in which they are found.

Based on this specific characteristic of each product, the maximum height of the filter cake is calculated, which in turn will determine the required surface area of the equipment for a given batch.



Cake heights can range from 30 mm in products with very poor filtration characteristics to 800 mm in products with excellent filtration characteristics.

The filtration characteristics of the product also influence the final moisture content after filtration, which generally results in very low residual moisture.

VACUUM DRYING

The vacuum drying process is carried out when filtration is completed. No other intermediate stage is required; temperature is applied by the double jackets installed in the shell, on the upper and lower ends and on the agitator shaft and blades.

The cake is gently agitated in order to produce constant renovation of the product in contact with the heated surfaces of the filter. This action facilitates the release of vapours towards the vacuum filter, located in the upper end of the **AGITATED NUTSCHE FILTER DRYER FNB-S** to prevent powder being dragged into the vacuum line.

Vacuums up to 1 mbar can be achieved and total dryness can be obtained at the end of the process.

ADVANTAGES OF NUTSCHE FILTERS AND NUTSCHE FILTER DRYERS

- Hermetic production. No product is wasted and the risk of contamination is eliminated.
- Carrying out several operations using the same equipment (reaction / suspension, filtration, re-dissolution, washing and/ or drying).
- Increase of operational safety by minimising material handling/ transfer.
- Obtaining high purity and homogeneous products independently of the granulometry.
- Filtration of suspensions with high solid contents.
- Filtration with pre-layer formation.
- Filtration of thixotropic or difficult-to-extract products.
- Performing energetic washing of the filtration cake.
- Selective pre-drying.
- Solid-liquid extractions.
- Space and installation costs reduction.
- Full automatic and semi-automatic processes.
- Low energy consumption.
- Time reduction for cleaning, maintenance and filter element replacement.

AGITATED NUTSCHE FILTER FNB AND AGITATED NUTSCHE FILTER DRYER FNB-S



ADVANTAGES OF AGITATED NUTSCHE FILTERS FNB / FNB-S

Secure attachment of the textile or metal filter cloth without perimeter fasteners

This system enables the attachment of one-piece filter cloths in a simple, rapid, and clean manner. It eliminates conventional methods that rely on numerous perimeter fasteners.

The filter bottom with flat design without dead spaces

This extra-flat filter plate design is used to increase the heat thermal transfer between the product and the dryer, minimising the heating fluid and the drying time and avoiding dead spaces where the filter bottom joins the shell. Furthermore, the filter plate is completely levelled with the discharge valve, facilitating complete product discharge.

Filter bottom closing using the SUPERCLAMP system

This is an exclusive patented BACHILLER system for easily opening and closing the filter bottom with the shell, which is incredibly fast and clean. The SUPERCLAMP system can be manually or hydraulically operated.

Filter bottom lowering

This system enables the filter bottom to be lowered to a suitable height, so that the operator can comfortably access the filtering element. Contrary to conventional systems (base movement via wheels and rails), our system avoids the need to disconnect the base every time to extract it from the filter, with the associated space saving. Special execution to locate the filter between floors as option. A conventional wheel and rail system is available as an option.

Hydraulically actuated side discharge valve for solids, with seal and self-cleaning system

Our combined sealing and self-cleaning system ensures a complete seal without the need for manual cleaning after each operation.

AGITATOR SYSTEM FOR AGITATED NUTSCHE FILTERS FNB / FNB-S





Scraper effect

The filtration time for slow filtrate products can be reduced by agitating the area closest to the filter surface.



Removing effect

The combination of the rotation and elevation movements allow for complete washing of the entire cake thickness achieving a high-purity solid product.



Distribution effect

The cake for fast-sedimentation products can be formed in successive layers by vertically elevating of the agitator. This provides perfect cake distribution.



Dehydrating effect

The wash liquid is uniformly distributed using nozzles and thus ensures sprayed washing.



Smoothing effect

This happens when the agitator smooths the cake to cover up cracking. This ensures uniform permeability. It also provide slight pressing of the cake.



Unloading effect

The agitator scrapes the cake from top to base and helps to discharge the product trough the lateral discharge valve.

AGITATED NUTSCHE FILTER DRYER FNB-S





PHARMA APPLICATIONS

The pharmaceutical version of the **AGITATED NUTSCHE FILTERS FNB / FNB-S** is designed to facilitate cleaning operations by eliminating all dead zones within the machine. There are no bolts or hidden areas that could lead to contamination, as the filter cloth is secured using an exclusive gasket-based system.

The installation system of these units between floors enables the upper technical area, containing the motors and instruments, to be separated from the lower clean area, where the discharge valve is placed and the bottom is lowered to perform cleaning or filtering element replacement.

CONSTRUCTION MATERIALS

BACHILLER completely manufactures the units in its workshops in Parets del Vallés. The used materials are:

- Austenitic stainless steels such as AISI 304L, AISI 316L, 1.4541, 1.4571, etc.
- Super austenitic stainless steels such as 904L, 254 SMO, 1.4529, etc.
- Duplex and super duplex steels such as SAF 2205, SAF 2507, etc.

- Nickel and chromium alloys, such as Hastelloy (C-276, C-22, etc.), Monel, Alloy 59, Nickel, and others.
- **Titanium** in its various grades.

FINISH

BACHILLER has its own polishing department on its facilities. Finish vary from simple pickling and passivation to different levels of mechanical polishing (maximum mirror polishing, $Ra < 0.2\mu$) and electric polishing.

Optionally, the motors and gearboxes can be also be faired with stainless steel.



TURNKEY PROJECTS AND SERVICES

A turnkey drying installation is completed with several peripheral elements that can optionally be supplied with the **AGITATED NUTSCHE FILTER DRYER FNB-S**.

Engineering & Turnkey Projects

At BACHILLER, we leverage over 50 years of experience and the know-how of our engineering department to provide our clients with comprehensive, reliable, and risk-free process solutions.

Vacuum Skid and Solvent Recovery

Skid with all the required elements for dryer vacuum and solvent recovery, including:

- Calculations and design.
- Vacuum pump: One or two stages.
- Condenser + solvent collection tank.
- Interconnection piping and element wiring.
- Valves, sensors and other elements.
- Control.

Heating or Cooling Skid

For optimal control of the operating temperature during the filtration, drying and subsequent cooling stage:

- Tanks, pumps and heat exchangers are dimensioned according to the available services and operating conditions.
- Proportional control valves and temperature regulators.

cGMP AND EHEDG DESIGN

The **AGITATED NUTSCHE FILTERS FNB / FNB-S** can be equipped with a range of additional accessories, including:

- Various levels of polishing and electropolishing.
- Clamp-type connections and conical nozzles.
- WIP, CIP, and SIP systems.
- DQ, IQ, and OQ documentation for FDA and EHEDG validation.

PILOT NUTSCHE FILTER



MONSTER NUTSCHE FILTER







PILOT MODEL	POWER (Kw)	(m²)	A (MM)	B (MM)	Ø DISCHARGE VALVE (MM)
FNB-02S	2,2	0,2	2.900	800	100
FNB-04S	4	0,4	3.250	850	100-150
FNB-06S	5,5	0,6	3.800	1.200	150-200
FNB-07S	5,5	0,7	3.800	1.200	150-200
FNB-1S	7,5	1	3.950	1.400	150-200-300
INDUSTRIAL MODEL	POWER (Kw)	(m²)	A (MM)	B (MM)	Ø DISCHARGE VALVE (MM)
FNB-2S	11	2	4.400	1.650	150-200-300
FNB-3S	15	3	4.700	1.900	200-300-400
FNB-4S	18,5	4	5.000	2.150	200-300-400
FNB-5S	22	5	5.200	2.300	300-400
FNB-6S	30	6	5.700	2.500	300-400
FNB-7S	30	7	5.900	2.600	300-400
MONSTER MODEL	POWER (Kw)	(m²)	A (MM)	B (MM)	ØDISCHARGE VALVE (MM)
FNB-8S	37	8	6.000	2.700	300-400
FNB-9S	45	9	6.100	2.950	300-400
FNB-10S	45	10	6.200	3.100	300-400
FNB-12S	55	12	6.300	3.300	300-400
FNB-15S	55	15	6.450	3,450	300-400

CODES AND STANDARDS

BACHILLER has the following certifications:

- ISO9001 ISO14001.
- Stamp HP-0 by TUV, acc. AD-Merkblätter.
- Stamp U: ASME VIII div. 1.
- Stamp U2: ASME VIII div. 2.
- Stamp SQL by AQSIQ Chinese.
- H1 Certification, according to the Pressure Equipment.
- Directive PED.

- Homologation according to ATEX95 category 1GD, 2GD and 3GD.
- Our sanitary equipment are designed according to cGMP and EHEDG.
- We deliver equipments ready for FDA validations
- We deliver equipments ready for GOST validations.



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