



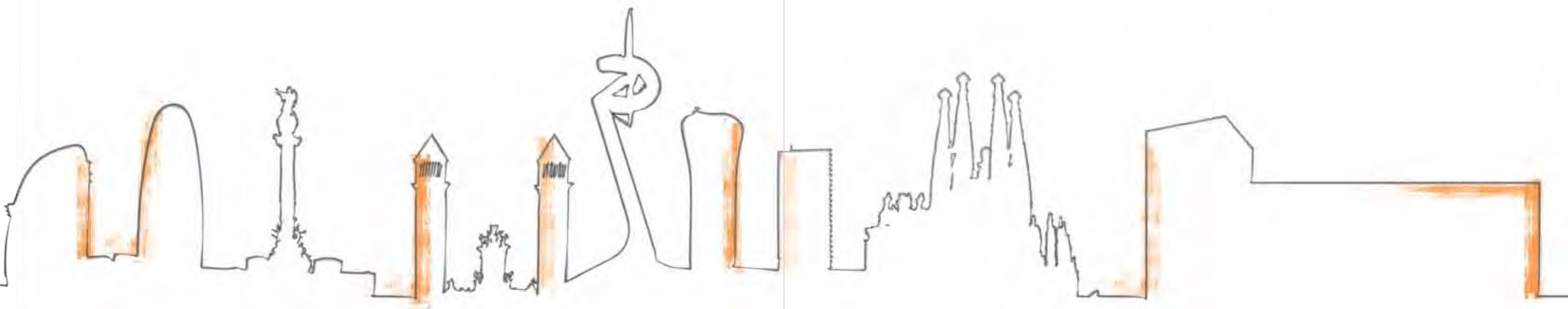
FNB: PRESSURE/VACUUM FILTER - NUCHA/NUTCHE
FNB-S: VACUUM DRYING FILTER - NUCHA/NUTCHE DRYER



**THE LARGEST MANUFACTURER
IN VACUUM DRYERS
AND NUCHA/NUTCHE FILTER
IN THE WORLD**

BACHILER is a company founded in 1968 that manufactures process and pressurised equipment for the pharmaceutical, chemical, fine-chemical, food and similar industries and is present on the five continents with human resources focussed on customised solutions. We are the largest manufacturer of filter and vacuum dryers in the world.

Barcelona has become a leading design reference worldwide and is one of the largest growth poles on technical and design, with the principal congresses and trade shows in the world.





FNB-S

DRYER-FILTER

Pressurised filter / vacuum filter - FNB

Liquid/solid separation filter, with agitator, designed for reaction, extraction, filtration and vacuum drying processes, processing all functions in the same equipment to prevent cross contamination.

Filtration: batch loaded, reversible and height adjustable agitator, for suspension, dissolution, reaction and cake-preparation: smoothing, compacting, squeezing, stirring, washing and discharging.

Drying: The equipment is fully heated, including the agitator and base, with the cake drying under vacuum.

FNB-S PRESSURISED FILTER AND VACUUM-DRYER FILTER



GENERAL

In the filtration, extraction and drying applications in the chemical, pharmaceutical and food industries which, because of their special hazardous or toxic natures or simply in crossed contamination prevention, should be treated in hermetic conditions during the manufacturing processes and transfers between equipment should be avoided as far as possible to prevent risks.

The **NUCHA BACHILLER FNB** filter range and **NUCHA BACHILLER FNB-S** are specially designed in response to these needs in filtration and drying processes, fully guaranteeing the production of pure substances that are free from contaminants.

For this reason, the **NUCHA BACHILLER** filters are specially recommended for all applications involving hazardous, inflammable or explosive products and achieving the maximum safety requirements and of course, designed and certified according to ATEX standards.

The application field of **NUCHA BACHILLER** filters is mainly oriented for the solid-liquid separation of products resulting from synthesis, crystallisation or precipitation, being also highly recommended in extraction and purification processes.

NUCHA BACHILLER filters permit the loading of a previously prepared product batch and to maintain the suspension during filtration by means of a reversible and variable speed agitator. Because of this, certain other stages may be performed prior to filtration, such as products addition, maturation or the reaction.

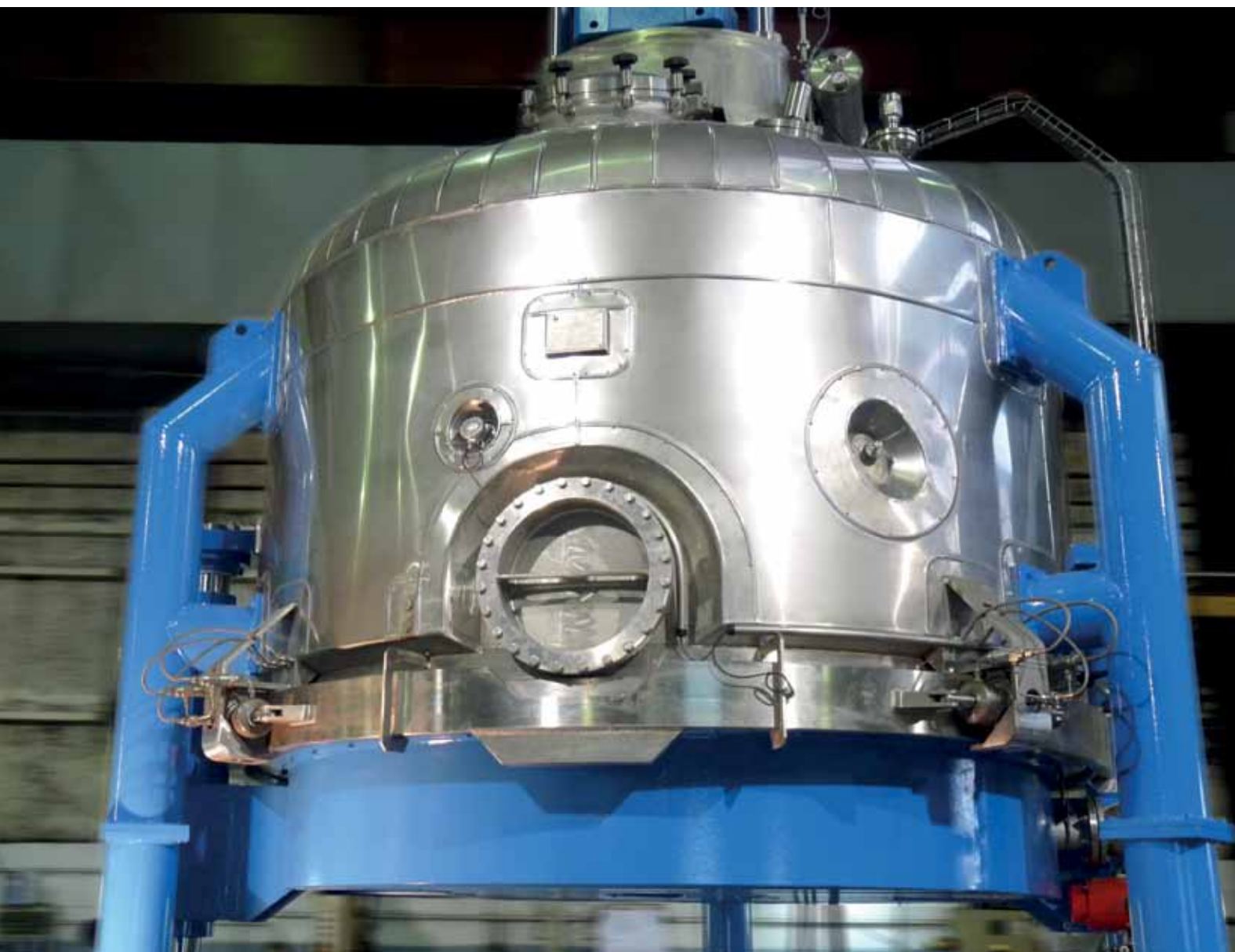
During the filtration process, **NUCHA BACHILLER** filters can be pressurised (optionally up to 10 bar) in order to force the filtration. Vacuum can also be simultaneously applied below the filter fabric multiplying the filtration effect. During the previous stages, as well as in the filtration stage, the product temperature can be modified by means of a double jacket (optional).

During the drying stage, the **NUCHA BACHILLER** filters are 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 Torr.

NUCHA BACHILLER filters 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.

BACHILLER supplies fully automatic systems that incorporate the latest control options, providing the user with maximum operability in all process parameters: vacuum, pressure, agitator speed, agitator torque, temperature and drying time etc.

They are also available with fully hydraulic operation mode.



DESIGN AND OPERATING PRINCIPLES

The **FNB-S** is a batch and continuous (only in the filtration process) pressure/vacuum filter/dryer. It is basically a recipient, designed for pressure and vacuum, with a filter element inside.

The **FNB-S** design is based on multi-operation using the same equipment: reaction, filtration and vacuum drying, eliminating dead times and the costs for changing equipment, as well as the inherent risks.

The equipment is fitted with a lower flange that allows the lower base (filter plate) an easy access to the filter element for cleaning or maintenance.

It is also has a special reversible, height-adjustable agitator system that allows all the operations required during the filtration stage: preparation, suspension, dissolution, reaction, smoothing, compaction, squeezing, agitating and scraping for discharge.

The filtering element is fixed over the flat bottom (filtration plate), which is flat to minimise the filtered liquid dead volume. The filtering element can be of several types, from fabric or synthetic to metal mesh, multi-layer metal mesh, sinterised and ceramic elements.

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

Product filterability specifications are highly variable, mainly depending on their morphology and the conditions of the media in which they are. The maximum cake height is calculated depending on the specifications of each product which, in fact, determines the required **FNB-S** filter surface area for a determined batch.

Cake heights may vary from 200 mm for products with very poor filterability to 550 mm in those with excellent filterability. Product filterability also conditions the final moisture level after filtration which, in general, results in very low residual moisture values.

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 **FNB-S** to prevent powder being dragged into the vacuum line.

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

Advantages of the NUCHA filters and 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.



FNB-S: PRESSURISED FILTER AND VACUUM DRYER FILTER



CONSTRUCTION MATERIALS

BACHILLER completely manufactures the **FNB-S** in its workshops in Parets del Vallés. The used materials are:

- Austenitic stainless steels, types AISI-304L, AISI-316L, 1.4541 and 1.4571 etc.
- Super austenitic stainless steels, types 904L, 254 SMO, 1.4529, etc.
- Duplex and super duplex steels, types SAF-2205, SAF-2507, 1.4362, etc.
- Nickel and chromium alloys, such as Hastelloy (C-276, C-22, etc.) Monel, Alloy 59, Nickel, etc.
- Titanium.

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.

FARMA APPLICATIONS. GMP AND EHEDG DESIGN

The FARMA version of the **FNB-S** is designed to facilitate cleaning operations by eliminating all dead spaces inside the filter. There are no bolts or other hidden areas that could lead to contamination since the filter fabric is secured by a joint-free system.

Agitator sealing: double mechanical seal, with gas or liquid barrier, manufactured using inert products and FDA certified.

Unloading: hydraulic and faired in order to guarantee product isolation from the exterior. The hydraulic shaft closure is achieved using pressurised leap seals with inert gas to prevent contamination.

Cleaning: automatic by means of a CIP or SIP system, including the discharge valve and in the vacuum filter.

The **FNB-S** installation system 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.

FNB-S: THE STIRRER



ADVANTAGES OF THE FNB-S BACHILLER

As a result of our constant R+D policy, the **FNB-S** is the equipment that incorporates the latest technical solutions found on the market that sets it apart from any other similar filter. These differences are basically as follows:

Securing of the filtering element, metallic or textile, without any perimetric bolts:

This system allows filtering element to be fixed in a very simple manner, which is incredibly fast and clean. Conventional systems with uncountable perimetric securing bolts are avoided.

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. Time saving (cleaning, opening and closing) from conventional system like eye bolts, or the product remaining in the lower sections of the bayonet systems. 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.

Lateral discharge valve, hydraulically operated, with metal-to-metal seal or with seal and automatic cleaning system:

The conventional lateral discharge valves are known critical points and require manual cleaning after each operation in order to achieve full hermetic sealing. Our mixed automatic cleaning system and metal-to-metal seal guarantee full closing without any need for manual cleaning after each operation. The valve protective fairing can be easily dismantled by means of a clamp.

Mixed agitator protective bellows for Teflon-metal:

Conventional metal bellows systems, usually have limited lifetime to a relatively low number of operating cycles and with an extremely high cost. Moreover, their design is full of inevitable and difficult-to-clean spaces. Our solution of mixed bellows for stainless steel and Teflon enable Teflon bellows to be employed, with a 50,000-cycle lifetime and much lower cost. In processes where Teflon bellows are not permitted, the equipment design allows the use of metal ones.



Scraper effect

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



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.



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.



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.



Dehydration effect

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

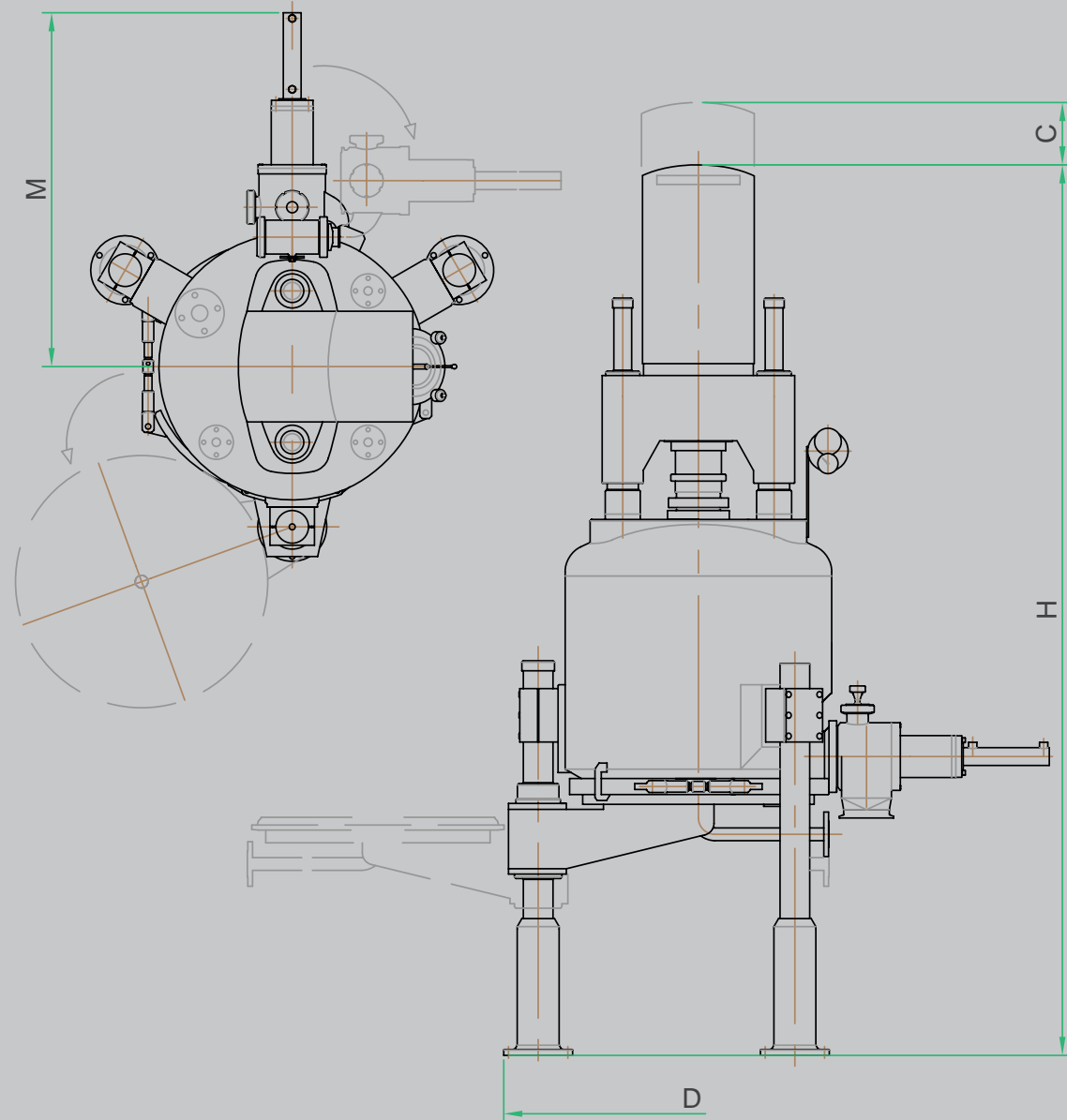


Unloading effect

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

FNB-S: PRESSURISED FILTER AND VACUUM DRYER FILTER

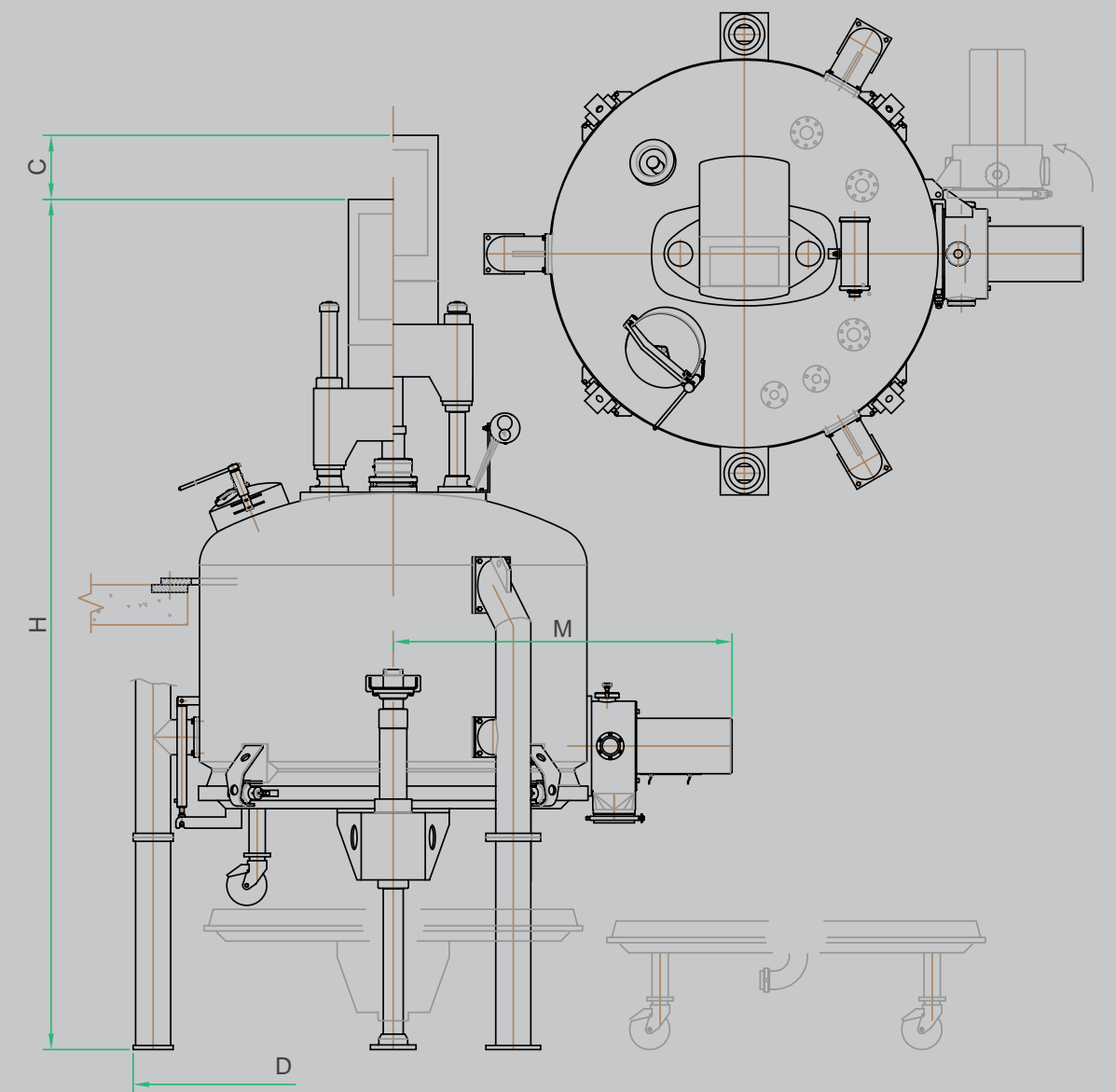
EQUIPMENT RANGE PILOT PLANT



| MODEL | KW | m ² | BLADE DISPL. | D | H | M | Ø DISCHARGE VALVE |
|----------|------|----------------|--------------|------|------|------|-------------------|
| FNM 007S | 0,55 | 0,07 | 150 | - | 1950 | - | 80 |
| FNB 02S | 2,2 | 0,2 | 175 | 1200 | 2900 | 800 | 100 |
| FNB 04S | 4 | 0,4 | 200 | 1400 | 3250 | 850 | 100-150 |
| FNB 06S | 5,5 | 0,6 | 320 | 1500 | 3800 | 1200 | 150-200 |
| FNB 07S | 5,5 | 0,7 | 320 | 1550 | 3800 | 1200 | 150-200 |
| FNB 1S | 7,5 | 1 | 320 | 1900 | 3950 | 1400 | 150-200-300 |

FNB-S: PRESSURISED FILTER AND VACUUM DRYER FILTER

EQUIPMENT RANGE INDUSTRIAL PLANT & SPECIAL EXECUTION BETWEEN FLOORS



| MODEL | KW | m ² | BLADE DISPL. | D | H | M | Ø DISCHARGE VALVE |
|---------|------|----------------|--------------|------|------|------|-------------------|
| FNB 2S | 11 | 2 | 400 | 2600 | 4400 | 1650 | 150-200-300 |
| FNB 3S | 15 | 3 | 400 | 3000 | 4700 | 1900 | 200-300-400 |
| FNB 4S | 18,5 | 4 | 400 | 3350 | 5000 | 2150 | 200-300-400 |
| FNB 5S | 22 | 5 | 400 | 3600 | 5200 | 2300 | 300-400 |
| FNB 6S | 30 | 6 | 400 | 3850 | 5700 | 2500 | 300-400 |
| FNB 7S | 30 | 7 | 400 | 4100 | 5900 | 2600 | 300-400 |
| FNB 8S | 37 | 8 | 400 | 4400 | 6000 | 2700 | 300-400 |
| FNB 9S | 45 | 9 | 500 | 4800 | 6100 | 2950 | 300-400 |
| FNB 10S | 45 | 10 | 500 | 5250 | 6200 | 3100 | 300-400 |
| FNB 12S | 55 | 12 | 500 | 5700 | 6300 | 3300 | 300-400 |
| FNB 15S | 55 | 15 | 500 | 5900 | 6450 | 3450 | 300-400 |

BACHILLER YOUR TECHNOLOGICAL PARTNER



TURNKEY PROJECTS AND SERVICES

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

Engineering, turnkey projects and services:

Here at BACHILLER, we place our almost fifty years of experience and our Engineering Department at the disposal of our clients in order to provide them with complete, risk-free solutions.

- Equipment calculation and design, with more than thirty engineers at your service.
- 2D and 3D designs with virtual simulations.
- We can guarantee your process with trials in our laboratory.
- Modular designs for a full Factory Acceptance Test (FAT) at our facilities, minimising commissioning and start up problems.
- Protocols: IQ, OQ and DQ.
- SAT, commissioning, start up and training all over the world.

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 and cooling skids:

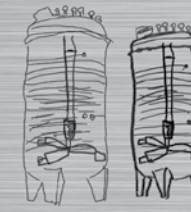
For optimal control of the operating temperature during the filtration, drying and subsequent cooling stage.

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

Electrical and process control boards:

- **BACHILLER standard:** touch screen, manual and automatic operation and access levels etc.
- **Client standard:** our electrical department will configure control according to the client's standards: PLC, SCADA, touch screen, industrial PC, Ethernet, Profibus, etc.
- For ATEX classified areas.
- CFR21 (part 11).
- etc.

PROCESSES



REACTION



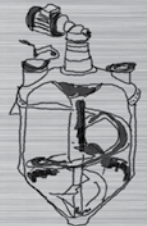
FILTRATION
DRYING



VACUUM
DRYING



MICRONISATION



MIXING AND
HOMOGENISATION

CODES AND STANDARDS

BACHILLER is in possession of the certifications:

- ISO9001.
- HP-0 stamp from TUV, according to AD-Merkblätter.
- "U" stamp: ASME VIII, division 1.
- U2 stamp: ASME VIII, division 2.
- SQL stamp from AQSIQ China.
- H1 certification, according to the Pressure Equipment Directive (PED).
- Dryer official approval, according to ATEX95 categories 2GD and 3GD.
- Our sanitary equipment complies with GMP and EDHEDG standards.
- We prepare the equipment for FDA validation.
- We prepare the equipment for GOST validation.





Can Guasch, 3
Pol. Ind. Levante
Post Office Box, 19
08150 Parets del Vallès
Barcelona (España)

Tel. [+34] 93 573 07 70
Fax. [+34] 93 562 30 10
bachiller@bachiller.com
www.bachiller.com