CHARLES THOMPSON
Global Engineering Experts

SPECIALISTS IN FILTRATION AND DRYING

FILTER DRYER TECHNICAL BROCHURE

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CHARLES THOMPSON LIMITED (CTL), PROCESS PLANT MANUFACTURERS FOR OVER 30 YEARS, AND LEADING FILTRATION AND DESIGN SPECIALISTS, DESIGN AND MANUFACTURE NUTSCH TYPE FILTER DRYERS FOR THE WORLD'S LEADING PHARMACEUTICAL AND FINE CHEMICAL MANUFACTURERS.

The Filter Dryer is designed using the latest technology, allowing Filtration, Washing, Drying and automated Discharge to be safely performed under an inert and contained environment.

This makes the machine suitable for processing toxic and high value substances with total protection for both the product and operators.

The Filter Dryers are manufactured in the United Kingdom by CTL in their own production facility, giving total project control during manufacture.

THE BASIC PROCESS

Filtration

The Filter Dryer is equipped with a single horizontal filter plate for solid-liquid separation processing. Slurry is fed into the top section of the filter dryer, usually under a nitrogen blanket for safety reasons.

Filtration can then be undertaken by creating a pressure drop across the filter medium. This is achieved in one of two ways. Firstly by applying a pressure above the slurry and secondly by applying a vacuum from below the filter medium. If required both methods can be combined.

The rate of filtration is generally directly proportional to the pressure drop across the filter cake and hence a larger pressure drop will generally increase the rate of filtration.

Care should be taken when the filter cake formed is compressible, as increasing the pressure differential can have a negative effect by collapsing the cake structure, reducing cake permeability and slowing the rate of filtration.
As the filter cake thickness increases, the rate of filtration reduces.

When processing products that are difficult to filter, by lowering the agitator into the slurry, it is possible to mix the slurry to prevent a filter cake from forming. This can considerably increase the rate of filtration. This process should only be used where a 'precoat' or 'heel' is not required to prevent solids bypassing the filter media.

Washing

After filtration is complete, it is usually necessary to wash the filter cake to remove mother liquors and any residual ingredients from the crystallisation process.

This is generally performed in one of two ways:

Reslurry Washing

Wash liquid is added to the top section of the filter dryer and the agitator lowered into the filter cake to re-suspend the solids. The adding of wash liquid dilutes the level of contaminants. The resultant slurry is then filtered again. As this method dilutes the contaminant, it may be necessary to repeat this procedure a number of times until the desired concentration of contaminants is reached.

Displacement Washing

In this alternative method of washing, a layer of clean wash liquid is placed on top of the filter cake and blown through the cake to displace the existing contaminated liquid. To prevent the wash liquid from by-passing through cracks in the filter cake it may be necessary to smooth and compress the surface of the cake by lowering the agitator on to the top of the formed cake and rotating in smooth direction, prior to adding the wash liquid. It is usually necessary to add the wash liquid gently to prevent back mixing of contaminants in the mother liquors with the fresh clean wash liquid.

Drying

After filtration is complete, it is usually necessary to dry the filter cake prior to discharge. This is generally performed by one of the following methods:

Drying by Hot Gas Blowing

Hot nitrogen is blown through the filter cake, which picks up moisture and dries the filter cake. The dryness of the filter cake can usually be correlated against the exit temperature of the nitrogen gas.

During drying, the agitator can be used to smooth any cracks on the cake surface, which may otherwise cause the hot nitrogen to bypass. The agitator can also be used to periodically mix the product to give a more homogeneous product, as the drying front advances through the filter cake.

Vacuum Drying

An alternative drying method is vacuum drying where the vessel is subjected to a vacuum and heat is applied to the vessel jacket system. This method is effectively a boiling process as products evaporate at lower temperatures as the pressure is reduced. On the CTL Filter Dryer, the following items can be provided with heating and jacket systems:

- Shell
- Filter Base
- Upper Dished Head
- Reverse Pulse Jet Filter (RPJF)
- Agitator shaft and blades

The heat transfer from the heated surfaces is usually the rate-determining factor in the drying process.
During this process, the product is usually stirred, presenting fresh material continuously to the heated shell walls. It is usually necessary to install a Reverse Pulse Jet Dust Filter to the top of the vessel to prevent any fine particles being carried away in the vacuum vapour stream.

Microwave Drying

For certain products, microwave energy drying will substantially reduce drying times and thus increase plant capacity and throughput.

The microwave energy field is produced by a microwave generator, which is situated in a non-hazardous area or enclosure, and enters the filter dryer via a wave-guide.

The heating of the product is volumetric in nature, and ideally the product should be transparent to the energy field with the liquid only being heated.

The design of the filter dryer and its components considers the following three areas:

- Microwave containment
- Prevention of arcing within the cavity
- Microwave distribution within the cavity

It is assumed that the future microwave energy input into the filter dryer is:

- Input Power = Nominally 2kW per m2
- Frequency = 2450MHz (Wavelength = 12.24cm)

Leakage from the unit is designed to be less than: 5mW/cm2, 5cm from source.

Discharge

Following drying, the product can be discharged from the Filter Dryer automatically, by opening the side discharge port and lowering the rotating agitator into the product. The agitator should be rotating in the 'plough' or 'mix' direction. Each full revolution of the agitator will give two 'pulses' of discharged product, and the volume of product discharged is dependant on distance the agitator has been lowered into the cake.

Discharge is performed in a contained and inert atmosphere, and normally via one of the following devices:

Discharge Valve

A specially designed side discharge valve is fitted to the filter dryer and is connected to a discharge chute and drum loading system.

The valve has pressure seals, a wiper seal design and metal-to-metal seats.

The discharge cabinet is designed as a glovebox on the DV300 and larger valves to allow contained access to the discharge plug for cleaning activities.

Discharge Isolator

In place of the side discharge valve, a single or double chamber discharge isolator (Glove Box) is fitted. Product offloading can be performed via a number of devices, including, continuous liners, Rapid Transfer Ports, Split Butterfly Valves and Packing Heads.

The discharge isolator allows manual product sampling and heel recovery to be performed in a contained manner.

FILTER DRYER TECHNICAL BROCHURE

THE CTL SOLUTION

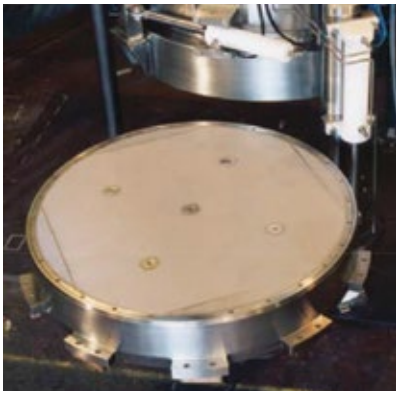
Charles Thompson Limited's range of Filter Dryer's includes laboratory scale, pilot plant and bulk manufacturing machines.

See separate literature the CTL range of Filter Dryers.

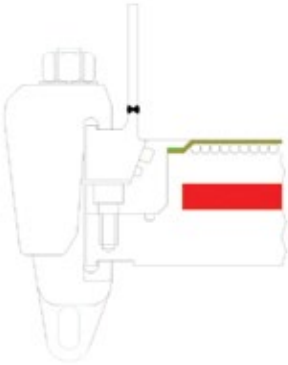
Your Filter Dryer can be specially designed to suit your specific needs, with features that have been developed through years of experience by our team of engineers.

The solutions will provide maximum performance and CTL filters dryer designs can include:

- Material of Construction including Alloy C276, C22 and Hastelloy® C2000, Stainless Steel and Lined Equipment
  (Hastelloy is a registered trademark of Haynes International Inc.)
- cGMP design philosophy
- Heated Jacket Design including, Vessel Wall complete with spiral forced circulation baffle design, Base plate, Vessel Head, Reverse Pulse Jet Filter Housing, Agitator shaft and Blade System.
- Bayonet Style closure for the Filter Base plate system, or conventional 'C' clamp design.



- Filter Base design suitable for sintered filter media, textile cloth or both. A boltless cGMP base design is provided as standard.



- Base designed to lower and pivot about Filter Dryer main support leg, preventing the need for hydraulic services during maintenance and cloth change duties.

- Sintered Filter media base design suitable for accepting backpressure to increase mass transfer.
- Validated CIP designs.

- Additional Lump Breaker shaft for reducing product balling during drying phase.

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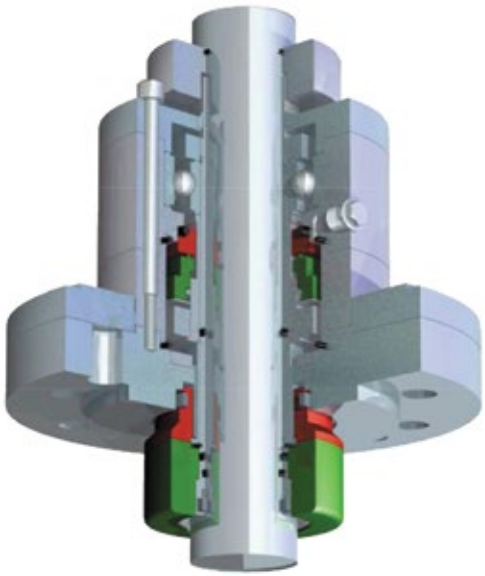
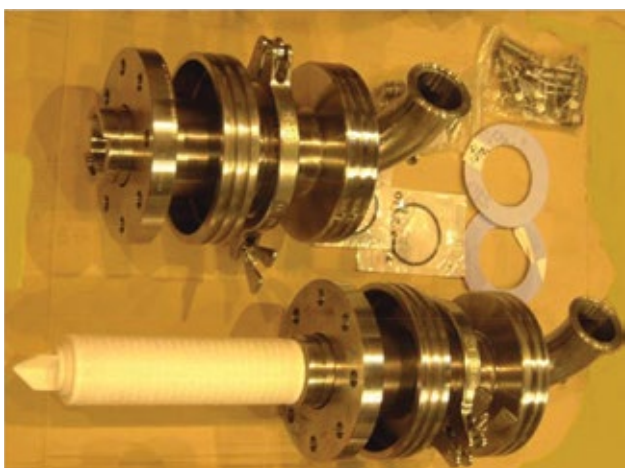
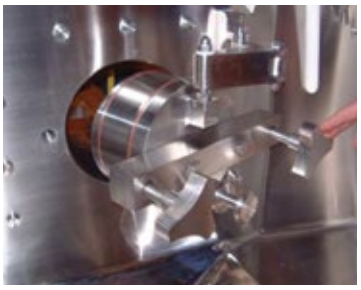
- Non-Contacting, dry running mechanical seal, specially designed for use within a pharmaceutical environment.

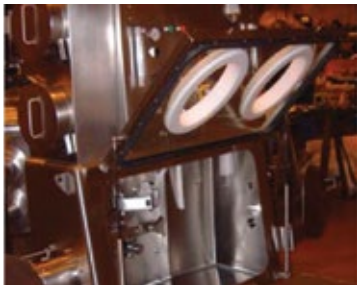


- Design suitable for hazardous area operation, including ATEX certification..
- Design suitable for microwave drying
- Reverse Pulse Jet Filter systems, including Safe change Filter Cartridge options.



- Glove box Discharge Isolators, including contained Heel Recovery and Sample facility.





- cGMP 'sealed for life' insulation cladding.
- 'In-House' Control and Instrumentation design, providing hazardous area and safe area control equipment.
- 'In-House' fully validated PLC programming capability.
- Reslurry port option, complete with sidewall mounted CTL design reslurry valve.

Additional Services

The following services are provided in addition to the manufacture of new equipment:.

- Full In-House equipment validation, including Factory, Hardware and Software testing.
- On-Site Commissioning.
- Assistance with site installation
- On-Site training
- Repair, Servicing, and refurbishment of CTL and equipment from other manufacturers, including:
    - Analysis, Supply and stocking of Spare Parts
    - Servicing and Lubrication
    - Filter Mesh supply, replacement and design analysis
    - cGMP upgrades and design analysis

Quality System

Charles Thompson Limited operate a quality system approved to ISO 9001:2008.
Charles Thompson Limited hold the ASME VIII Division 1 'U' Stamp accreditation.

Other Products

Charles Thompson Limited supply the following products:

Nutsch Style Oyster Filters
Lined Oyster Filters
Pressure Vessels and Shell and Tube Heat Exchangers
Skid Mounted Process Module
ElectroChlorination Modules

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TALK TO US ...

Please contact CTL if you require additional information for any of the above products

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