

TECHNICAL SPECIFICATION

Pilot/Production Scale Continuous Carousel Filter Dryer AWL CCFD20 Vision



System:

The AWL Continuous Carousel Filter Dryer “CCFD” has been designed to produce filtered, washed and dried products in a continuous manner. The core technology is based on well-established Nutsche filtration, processing thin cakes in a fully automated system. The carousel is a series of hollow cylinders moved around a central axis to fixed processing stations. The CCFD20 Vision has an onboard vision system which monitors cake and liquid levels allowing fine control over filtration and washing, improving purity, yield and quality attributes. The vision system also enables the processing of slurries with ‘non-settling’ particles or particles with a prolonged settling time. The CCFD is supplied complete with all valves, pumps and vessels to allow for fully continuous operation, the user merely needs to connect their vacuum and compressed air supplies and drying gas supply if required.

The standard supply consists of a support structure with the following main components; slurry buffer tank, solvent wash tank (x2), wash solvent pumps (x2), Wash-in-Place “WIP” tank, WIP pump, combined carousel filter/dryer, camera vision system, filtrate receiver (x1), drying solvent/WIP Receiver, filtrate sampling bottles, solids discharge chute terminated with a tri-clamp outlet flange, and a PLC / touch screen control system. The filter carousel consists of ten 20 mm diameter, 60 ml capacity filtration chambers. The carousel and filter base has been designed to be easily removed for thorough manual cleaning if required.

This system is designed for use in a safe area and is not suitable for an ATEX environment.

Carousel Filtration and Drying:

The DN20 CCFD Vision is a pilot/production scale continuously operating filter dryer. It is capable of automatic filtering, washing (with two different solvents), deliquoring, drying and discharge of filtered dry solids. Integrated wash-in-place (WIP) is included. Solid-liquid separation is done using a vacuum over a sintered multilayer filter plate. Industrial standard filter plate material is available in various micron ratings, from 2 to 40 microns. The system operates by individuals controlling filtration and washing in each port simultaneously. The camera vision system detects the cake and liquid levels allowing the filtration and washing to stop at or near the dryland. Drying is achieved through a heated nitrogen system.

Warm Nitrogen Drying:

The flow and temperature of the drying gas are controlled using the following:

- N₂ heated by AWL’s electric heated transfer line technology.
- Maximum jacket temperature 100°C
- PID loop control
- Inlet & outlet temperatures measured by K-Type thermocouples (displayed on HMI)

Vision System:

The system is supplied with a high-resolution camera and lighting system used to monitor the cake and liquid levels with a resolution of 1 ml. The system can detect dryland, to allow filtration and wash draining to stop at or just before dryland. Wash solvent volumes are monitored to automatically dispense wash volumes calculated from the measured cake height. This allows for fine control of filtration and washing parameters to maximise yields and purity. The cake is not fully de-liquored until washing is complete, thereby avoiding cake cracking and increasing wash efficiency.

Functionality:

All automatic functions are recipe controlled via the HMI touch screen and can be adjusted to suit different chemistries.

The following functions are included in the supply:

- Auto transfer function from external reactor/crystalliser
- Auto filtration and wash cycle
- Auto wash solvent dosing systems (x2)
- Auto WIP dosing system
- Vision system for fine control over filtration and washing.
- Ability to process 'settling' or 'non-settling' slurries.
- Heated Nitrogen/Air drying with temperature control.
- Filtrate receiver and WIP receiver with auto-drain feature
- Selectable wash contact time for diffusional washing.
- Filtrate sampling bottles for offline analysis of the filtrate
- Auto data population, recall and presentation.
- Auto WIP sequence
- End-of-Day automated cleaning routine

Process Sequence:

First, the slurry is transferred from the jacketed, agitated buffer vessel into a charge vessel via vacuum transfer. The slurry volume is then dispensed into the first port of the carousel. The carousel rotation is controlled by a servo motor which indexes the carousel ports to fixed processing stations. The process sequence for each port position is as follows:

- Port Position 1: Solid-liquid separation stopping before dryland.
- Port Position 2: 1st Wash, either Solvent 1 or 2. Stops drain before dryland.
- Port Position 3: 2nd Wash, either Solvent 1 or 2. Stops drain before dryland.
- Port Position 4: 3rd Wash, either Solvent 1 or 2 and deliquor
- Port Positions 5-9: Drying via heated nitrogen or air.
- Port Position 10: Cake Discharge

Wash Solvent 1: Removes Impurities

Wash Solvent 2: Solvent exchange, for instance, to reduce drying time or agglomeration.

Modes of Operation:

- Optimisation Mode: Processing in optimisation mode allows one aliquot to be automatically processed in the system. Once the filtrate and solids are analysed (offline), the process can be adjusted to achieve the optimised washing, filtration and drying with minimal input material. On completion, the operating parameters can be saved to a recipe for use in production mode.
- Production Mode: Maximum throughput operation including automatic solid-liquid separation, dosing of wash solvents and drying.
- Manual Mode: All valves, pumps and operations can be controlled manually via the touchscreen control panel.
- Automated calibration modes: Slurry transfer volume, pump calibration, camera calibration, cake height calibration (for non-settling slurries)
- End-of-Day WIP: The filter internals can be cleaned by an automated wash-in-place sequence which sprays the carousel filter using the WIP pump system. The filter system is flooded and drained to remove residual material

Interfacing with upstream processing:

The filtration system is designed to accept slurry from a batch or continuous source. It can operate as a stand-alone unit or interface directly with a reactor or crystalliser. Valves are included within the standard scope of supply to allow auto-transfer from an upstream process. Transfer volumes and intervals can be specified by the end user.

Process Vessels:

The following process vessels are provided with the system.

- 1 Litre capacity jacketed, agitated slurry buffer vessel
- 60 ml capacity jacketed slurry dosing vessel
- 2 Litre capacity Wash Vessels (x2) complete with peristaltic pump.
- 2 Litre capacity WIP Vessel complete with peristaltic pump.
- 3.5 Litre capacity Filtrate Receiver vessel
- 3.5 Litre capacity WIP Receiver vessel
- 1 Litre solids receiver bottle (supplied with solids discharge adapter to attach bottle)
- 0.1 Litre pressure-rated laboratory bottle for filtrate sampling (x5) Vessels

are manufactured from borosilicate 3.3 glass.

The 3.5 L capacity receiver vessels function as a buffer for the filtrate and wash waste from the system. The auto drain sequence is managed by the onboard control system. It is the end user's responsibility to connect the receiver outlets to the appropriate waste/collection stream.

PLC / Control System:

The control system consists of a pre-programmed PLC system, a 9" touch screen, safety circuits and a power isolator. Controls are enclosed within the framework of the Carousel Filter Dryer and the HMI touch screen is housed in a separate Local Operating Panel. DCS remote access / Control is available.

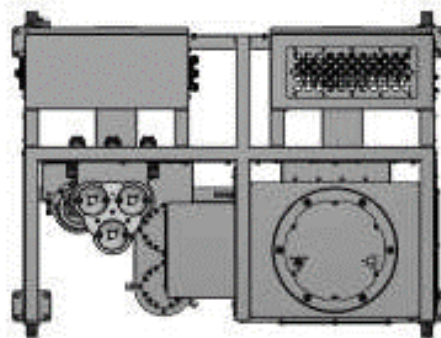
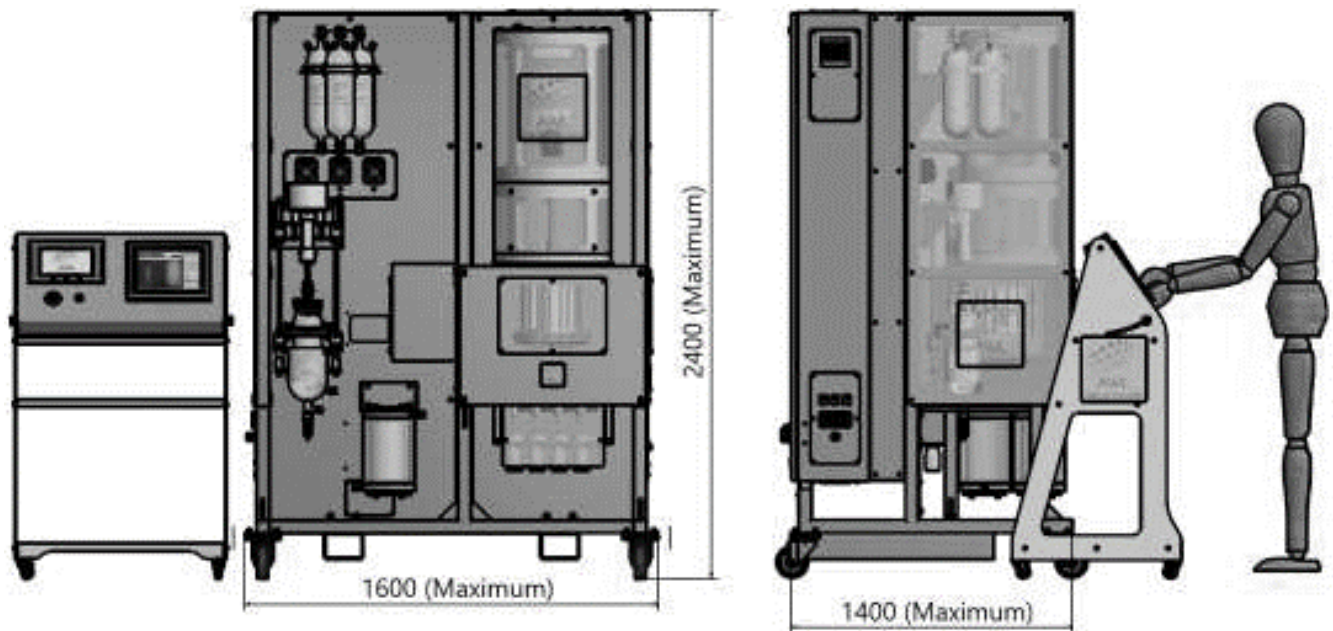
Support Structure:

The CCFD and ancillary process vessels are mounted on a self-supporting 304 stainless steel mobile framework and mounted on four castors. Utility connections (compressed air, vacuum, nitrogen(optional), and electrical supply) are provided on the side of the structure.

Overall Dimensions / Weight:

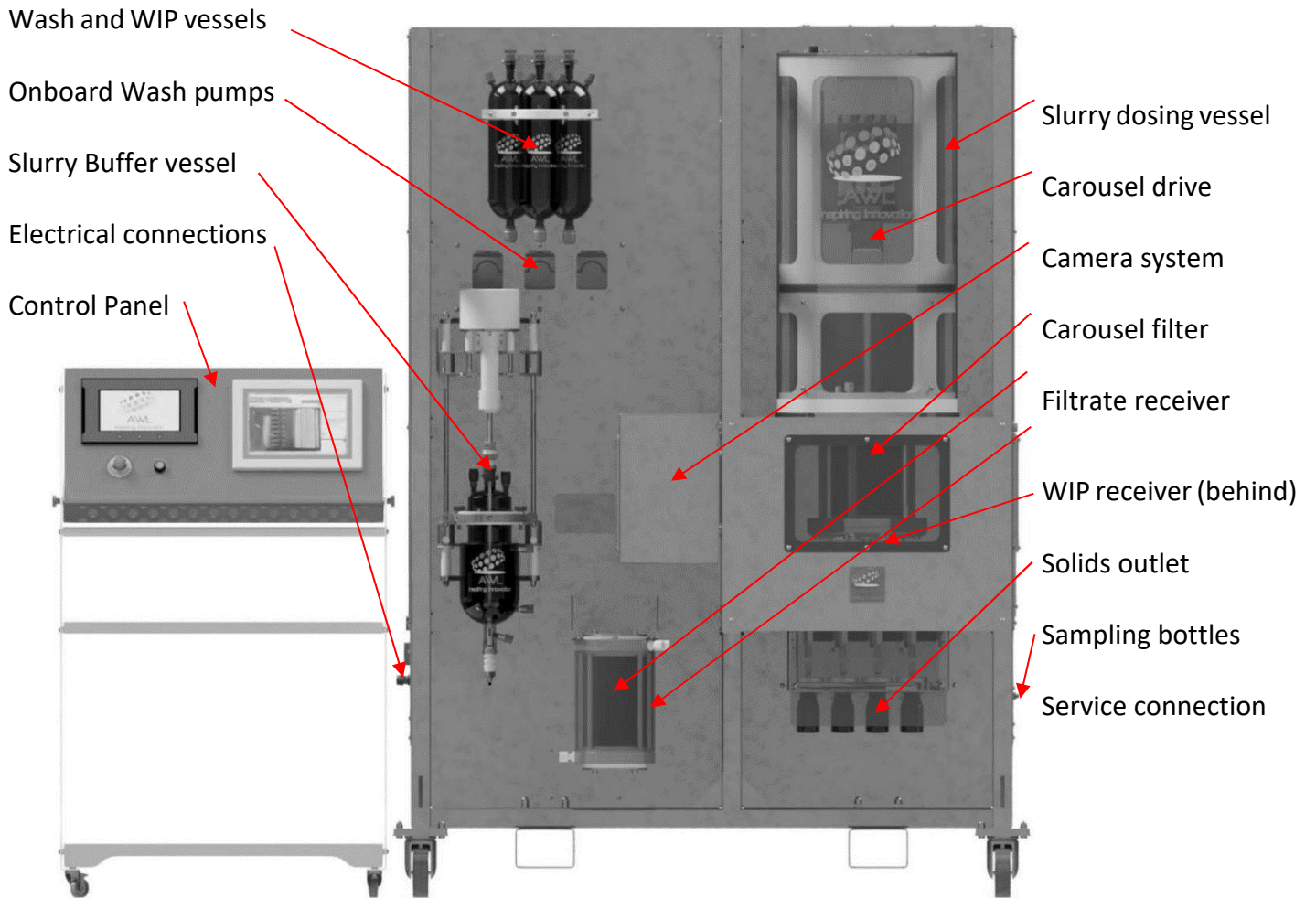
Approximate Weight: 750 kg (complete system)
Dimensions: 1600mm Wide x 1400mm Deep x 2400 mm High
The above dimensions are the footprint of the filter unit.
A minimum of 1700 mm x 1500 mm is advised to allow for the connection of services.

THE GENERAL ARRANGEMENT OF THE CCFD20 VISION



Representative example of the CCFD 20 Vision

SYSTEM CONFIGURATION



PROCESS SECTION - OPERATING PARAMETERS & DESIGN CRITERIA:

Filter:

Temperature Range:	-20°C to +100°C
Design Pressure:	-1.0 bar to +50 mbar
Material of Construction:	Wetted parts - 316L, PTFE, Polypropylene, PEEK, FEP, Borosilicate 3.3 Glass
Filter plates (standard)	Sintered Mesh 20-micron, 5 layers, 316L (other filter plates available on request)

Process Vessels:

Temperature Range:	-20°C to +100°C
Design Pressure:	-1.0 bar to +50 mbar
Material of Construction:	Borosilicate 3.3 Glass

Process Valves and Pipework:

Process Valves:	Wetted parts: PTFE / PEEK, FFKM, 316L
Pipework:	FEP, PTFE
Fittings:	PFA, PTFE, Polypropylene, 316 L

Typical flow rates:

Typical Slurry flow rate	from 2.5 l/hr to 5 l/hr slurry (Chemistry dependent)
Typical Solids throughput	From 0.5 to 1 kg/hr dried solids (Chemistry dependent) (Based on 20% Solid Loading)

Service Requirements:

Electrical Specifications:	1 phase, N and Bonded Earth, 230 Volts, 50 Hz, 16 Amps (or 110V 60 Hz) (Local geographical variations to be discussed)
Compressed Air specifications:	4-6 bar compressed air @ 10 l/min
Vacuum Specifications:	2 independent vacuum supplies capable of >900 mbar vacuum. One with a 100 L/min flow rate, one with a 20 L/min flow rate and both with condenser or solvent-compatible pumps.
Nitrogen Specifications (optional):	120 L/min in production mode (depending on drying and filterability of processed material) All

Utility connections are provided on the side of the structure.

NOTES: - All pressures in this document are stated as a bar gauge

- Flow rates are chemistry dependent.*
- Carousel is not actively cooled; filtration, washing, and de-liquoring take place at ambient temperatures*
- Alternative wetted parts can be made available to suit user chemistry.*

DOCUMENTATION PACK:

Each filter is supplied with two sets of documents (one hard and one electronic) consisting of the following:

- Operation and Maintenance Manual
- Engineering Drawings / Parts Lists
- Electrical Schematics
- OEM manuals for non-proprietary equipment
- Declaration of Conformity
- Safety documentation

STANDARDS AND DIRECTIVES:

As a minimum all the AWL Carousel Filter ranges are designed and built to meet the following standards, others are available on request:

2014/35/EU:	Low Voltage Directive
2014/30/EU:	Electromagnetic Compatibility Directive
EN 13849-1:	2015 Safety of Machinery – Safety-related parts of control systems
EN ISO 12100:	2010 General principles for design. Risk assessment & Risk Reduction
EN 61000-6-4:	2007 Generic Immunity Standard – Industrial Environment
EN 61000-6-6:	2003 Generic Emission Standard – Industrial Environment

OPTIONS:

The following options can be added to the unit if specified at the time of order:

- Nitrogen Blanket System: Includes low-pressure regulator and valves to control nitrogen blanketing.
- Materials of construction: Various available, particularly wetted parts.
- Dosing of slurry via tube-in-tube temperature-controlled transfer line. Available as a stand-alone product.
- Dosing of wash solvent via a liquid/liquid heat exchange ensuring that wash solvents are cool on arrival at the carousel filter.
- DCS control via OPC server.
 - Provision is made for remote control and access to the relevant process information via a communication module. Our standard communication is achieved using an OPC Server (KEPServer). All process-related signals, readings and data are accessible. Remote access to functions is limited to those deemed safe to operate without the presence of an operator at the filter operating panel.

WHO WE ARE

Alconbury Weston Ltd (AWL) are at the forefront of the design, manufacture & supply of Continuous Processing Technologies & Systems.

We truly live and breathe inspiring innovation. In the past 8 years, we have taken the much-talked-about and highly anticipated continuous processing theories and turned them into a reality for use in the Chemical, Food and Pharmaceutical Industries today.

“The advance in technology is based on making it fit in so that you don't even really notice it”.

Bill Gates

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