Withnell Sensors
Temperature & Humidity Specialists

# Bulkfrost Series
# Temperature range -70/+180°C

The Bulkfrost Climatic and Thermostatic Chamber allows you to control the temperature and humidity inside the test compartment, in a range from -70°C to + 180°C (temperature) and from 10% to 98% (relative humidity).
It guarantees high performance, a generous standard configuration and a large number of accessories for adapting to all the requests of our customers.


**BENEFITS**

*The main benefit of this line of models is that it provides the customer with control over the temperature curve, i.e. the possibility of modulating the time and temperature of the descent and ascent graph- offering optimised freezing of the biological samples. Since the biological world is highly heterogeneous, the temperature curve for each type of sample will be equally heterogeneous, and with this line we are able to offer this essential quality.*

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## *Chamber features in brief*

*The compact body in RAL 7044 gray provides excellent corrosion protection with a powder coated finish. The electromagnetic door lock provides maximum operator safety Ecological refrigerant gas in line with the European Regulation 517/2014 10" touchscreen panel with an intuitive, user-friendly interface New software that allows remote control of all chamber functions Automatic reporting, self-diagnosis, preventive maintenance*

### ***Control and management system and interfaces***
Controlled by PLC and Advanced HMI

### ***Remote access***
There is a wide range of possibilities thanks to the built-in MyKratos™ and MyAngel™, multichamber control also available upon request.

### ***Electromagnetic closing system***
Ensures the security of environmental tests.

### ***Complete product range***
Including E versions (limited performances)

### ***Versatility***
A wide range of optional and custom features is available (sun simulation, LN2 cooling, Air treatment unit kit, Lithium-Ion Battery test, …) to fulfil most of environmental testing market requirements.
The modular design of the equipment makes it easy to service and easy to upgrade.

### ***Ergonomics***
The ergonomic design ensures easy access to the chamber wherever placed, even for maintenance; the control interface is mounted on the front door and the water tank is easily filled from the lower front panel.

### ***Easy to move and position***
Thanks to wheels and feet included as part of the basic configuration, the chamber is easy to move to its working position even on uneven floors

### ***Air treatment system***
Ensures a precise control of the climatic parameters inside the chamber with minimal thermal inertia; an axial fan allows rapid temperature variations of both air and specimen.

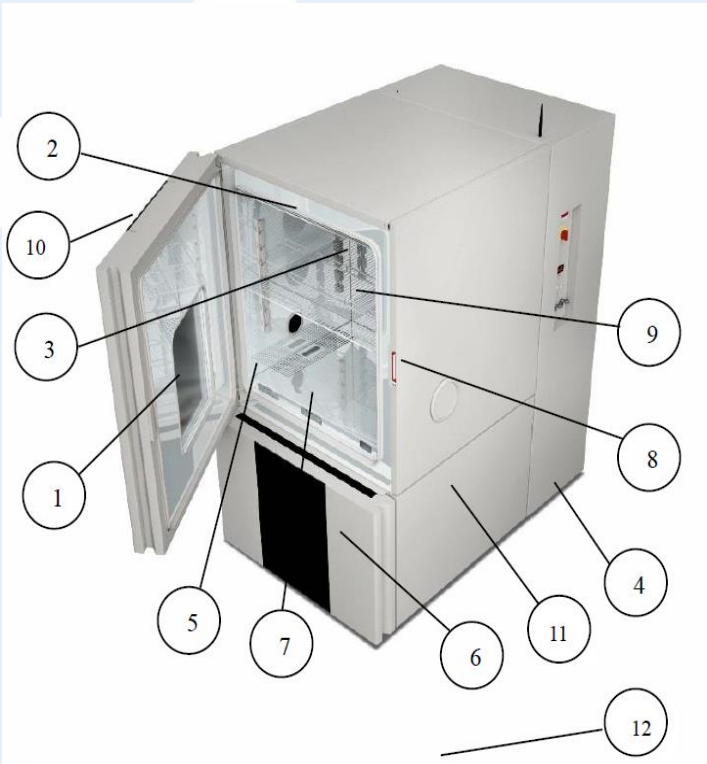
### ***Humidification system***
The humidifier with a self-contained heater and dedicated controlling S/W offers two great advantages:

- it does not require distilled or demineralized water to operate properly;
- it uses 'dry' vapor in order to avoid condensation on the specimens and to reproduce real environmental conditions.

## Included in the Basic Configuration

- ❑ MyKratos™ and MyAngel24TM: top of the line HMI for remote control
- ❑ Inspection window: multiple crystal, with double heated transparent film, 550h X 450 mm size
- ❑ Internal lighting
- ❑ Self feeding system (tap water through chamber embedded softener)
- ❑ Wheels and feet
- ❑ Electromagnetic closing system
- ❑ Silicone portholes: 80 mm (left side) and 150 mm diameter (right side) fitted with silicone cap. They allow internal-external electrical, mechanical or hydraulic connections.
- ❑ Digital min./max. thermostat: with independent probe
- ❑ No. 1 internal grid shelf
- ❑ Auxiliary contacts (specimens, alarms)
- ❑ Dehumidification system: it's possible to activate during heating phase. Device included in the climatic basic configuration.
- ❑ Ecological refrigerant gas charge for high stage with GWP<2500 (EU regulation 517/2014) allows to respect refrigerant gas emissions limit imposed by the new European Regulation 517/2014. Starting from 2020 the emissions limit will be set to 2500 GWP (Global Warming Potential: global warming potential caused by a gas).

## *Technical Overview*




**New heated inspection window:**

A fully transparent double heating system (dimensions: 550h X 450 mm) makes it easy to inspect the test compartment and prevents condensation from forming on the glass.

**2. Double ceiling:**
prevents condensation from dripping onto the specimen.

**3. Axial fan:**
allows better distribution of air and helps specimens adapt to temperature variations.

**4. NEW feet together with wheels included in the basic configuration:**
makes moving the chamber to its working position effortless, even on uneven floors.

**5. Rounded corners:**
allows better drainage of condensation and makes the chamber easier to clean.

**6. NEW water tank:**
this easy-to fill-tank for the humidification system is accessible by simply opening the lower door of the chamber.

**7. NEW Double floor:**
improves air distribution inside the chamber.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8. NEW Locking system:
this electromagnetic closing system ensures the security of environmental tests and is now managed by a login/logout system with passwords.

9. NEW easy-to-install Shelf:
the shelf supports have been completely redesigned for quick and easy installation. Moreover, the 600l and 1200l shelf has been redesigned for heavy duty operations.

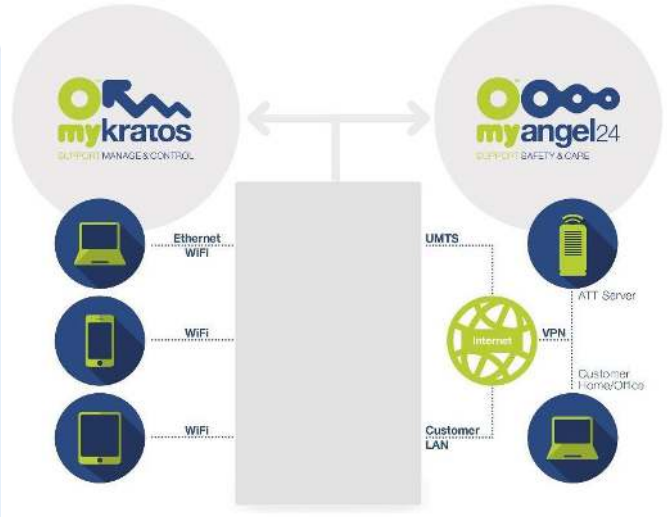
10. NEW Advanced design

11. NEW optimized cooling and electrical system

12. New Control system:
MyKratos™ and MyAngel24TM inside for easy remote access (including Wi-Fi)

## *Control system and user interface*

The chamber is equipped with a PLC (Programmable Logic Controller), used to manage all chamber's functions and safety interlocks.
A special device is used to manage the chamber via "mobile" devices, such as Tablets and Smartphones, or to establish a remote Internet connection.
The HMI system consists of an on-board panel (MyKratos™ On- Board) and a Remote connection control (MyKratos™ and MyAngel™), linked to the chamber as in the figure.
PLC features:




- 512 kB SRAM / Onboard flash 256 kB
- Data protection (1-3 years) with lithium battery
- N.1 USB Programming interface port
- N.1 Ethernet TCP/IP communication port
- N.1 RS 232 communication port
- Dedicated I/O onboard
- I/O bus extension (up to 64 module sockets)
- Expandable I/O modules (up to 1023 I/Os)

## ***Features:***

- Qseven® module I.MX6 Dual" ARM Cortex-A9 -1Ghz
- GPRS/UMTS (3G) module
- WiFi 802.11 b/g/n module
- 2GB RAM DDR3
- eMMC 4GB
- 1 MB L2 Cache
- RTC
- No. 2 ethernet (1x Gigabit, 1x 10/100 Mbps) communication port
- No. 1 RS232 communication port
- No. 1 RS485. communication port
- No. 3 Usb port
- mass storage SSD 8 GByte Conn S-ATA.


## *On-Board Panel (MyKratos™ On-Board):*

### ***Hardware***

10.1-inch Analog Touch Panel 16 million color with
TFT technology

### ***Software:***

Allows access to all the features of the Mykratos ™, described in the paragraph "MyKratos ™ software".
Allows the management of the switching on and off of the internal chamber light
Allows the management of the electromagnetic opening door of the chamber (if present).

## *MyKratos™ software*

MyKratos™ is the Supervision and Management system operating on any mobile and desktop device. The wireless connection (WiFi) makes possible to use different kind of Tablets and Smartphones (iOS 8 and Android 4.2.1 or later compatible). The operator interface can also be remotely accessed via customer's LAN connections.

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## *Main features*

- ✓ WiFi or Ethernet connection to the chamber.
- ✓ Visualization and graphical analysis of measures and recordings.
- ✓ Synoptic graphs of the entire system.
- ✓ Multilanguage support.
- ✓ High configurability of chamber parameters.
- ✓ Unlimited possibilities of measures recording
- ✓ Program and Manual mode of chamber operation
- ✓ Delayed start of a program
- ✓ Ability to select more than one chamber from a single Tablet: the multiple password levelsensure secure access.
- ✓ Automatic notifications of event and alarms
- ✓ Archive manager for an easy access to the stored recordings
- ✓ Ability to send email notification to various recipients via customer's LAN connection.

## *Test program editor*

- ✓ Unlimited possibilities of storing cycles of 350 segments delaying their execution.
- ✓ Internal repetitions of 10 groups of segments up to 999 times each
- ✓ Upload, edit, export, and delete existing cycles and recordings.
- ✓ Graphical and numerical profile's parameters data entry.

## *Graphic functions (Graphic viewer)*

- ✓ Live data update of measures on the charts
- ✓ Graphic charts or numeric table representation views on the monitor
- ✓ Graphic cursor for in-chart data measurements and evaluations.
- ✓ Calculation of Measure Slopes and reports generation.
- ✓ Enable/disable of chart display.
- ✓ Zoom in, zoom out and scroll functions
- ✓ Export function to convert the MyKratos™ log file into ASCII format (usable in Excel or other applications)
- ✓

## *MyAngel24™ tool:*

MyAngel24™ is a remote-assistance system via GPRS/UMTS wireless connection, complete with SIM card. Cabled connection is also available, via customer's LAN.
This remote-assistance system via GPRS / UMTS wireless connection, complete with SIM card, allows you to remotely access the operator interface via VPN and to send SMS notifications.
**N.B.:** The activation of MyAngel24™ must be confirmed by the customer with the appropriate form attached to the offer, to be returned with the order.

## *MyKratos™ Multichamber S/W for multichamber remote control by PC*

PC Software to monitor and control multiple and diverse environmental test chambers:

- Manages a variable number of chambers dependent on PC resources
- Monitors all the chambers at the same time and, if necessary, to have a full-screen view of a single chamber
- Personalizes the order of the chambers in the display grid
- Learns connectivity and run/stop status of the chambers
- Alerts operators when an alarm is present and indicates which chamber the alarm relates to
- Grid display can show any web-compatible application (i.e.: software for cameras or other equivalent tools)
- Compatible with the main operating system


## *More details about constructive design*

### 1. ***Temperature- and Humidity Control***

Temperature Measurement with Pt100 thermal probe Class A, max precision 0,3K
Relative humidity measurement with Assmann psychrometric system complete with Pt100 thermal probes. The psychrometric principle (dry & wet bulbs) is used for the measures in the test chamber. This allows the set and measurement of relative humidity expressed directly in % R.H.
Relative Humidity range from 10% to 98% within the temperature range [+10°C; +95°C]

Dew Point range:
AREA 1, from +4°C to +94°C for continuous tests
AREA 2, down to -3°C for limited periods based on starting conditions and foreseen testing time
The values refer to the basic version at ambient temperature of +22°C, with temperature and humidity measurement made in the air inlet.

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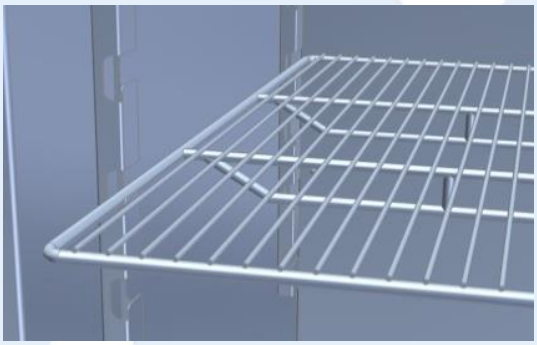
## 2. ***General features***

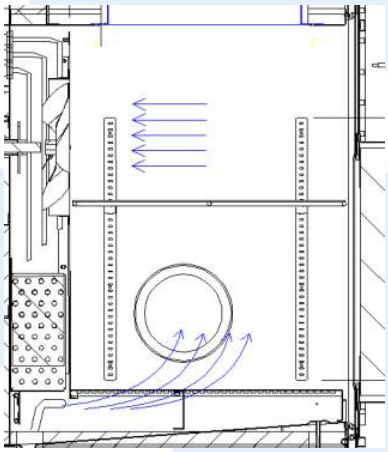
- Optimized devices (control system/refrigeration system/Humidification system)
- Compact enclosure; excellent protection against corrosion is achieved by Powder coating (thermosetting powder polyester resin) Grey RAL 7044
- Insulation thickness 125 mm (mineral wool)
- Door system: stainless steel back, with 135 mm of insulation, electromagnetic closing system
- Choice of opening on the control panel after login or through a button. Opening temperature range is configurable; for safety reasons, the default setting is from 0°C to 60°C

## 3. ***Chamber floor loading and specification details***



- Max. floor load 100 kg/m² approx. (equally distributed)
- Max. load of the shelf 50 kg approx. (equally distributed)
- The internal test space is made of stainless steel (material 1.4301, equivalent of AISI 304)
- All seams are TIG welded and vapor tight
- The internal surfaces have round corners for easy cleaning
- Internal rails for mounting the grid shelves at the requested height
- Internal lighting for easy loading operations

## 4. ***Air treatment system***



Realized into an air treatment duct positioned on the end wall.
The following elements are included:

- cooling evaporator
- heating system
- dehumidification system (only climatic version)
- steam for humidification inlet (only climatic version)
- thermoregulation air circulation fan
- temperature and humidity probes

Thermo regulated air flows into the air treatment, passing through the above-mentioned elements before entering the test chamber.
Air circulation is from the floor to the fan.

## 5. ***Cooling***

Mechanical cooling based on single stage system (-40°C) or cascade systems (–70°C).
The cooling system is realized with semi-hermetic alternative type compressors with an advanced and high-quality design. The main body is made of special cast iron; the cylinders and light metal alloy pistons are easy to dismount.

The cooling system is complete with an automatic injection-type protection system for the compressor. This protects
the compressors when they are cooling down from high temperatures.
This system allows a self-regulating cooling of the compressors, in order to avoid high temperature (no damages to motor winding).
The compressors have the following advantages:

- Greater reliability by improved lubrication and lower cylinders temperatures
- Streamlined body to improve gas management, reduce pressure drop, increase efficiency
- Multi- port suction to provide uniform cylinders cooling for reducing wear
- Discharge valve in optimized position to provide durability minimizing discharge tube pulsation.

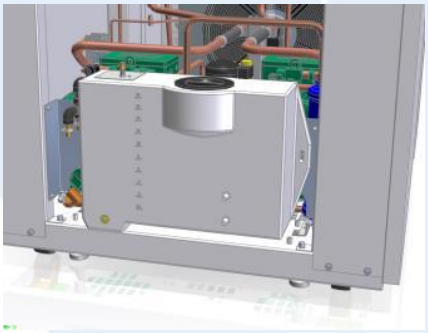
## 6. ***Heating***

The chamber is heated by means of electrical heaters, protected by safe thermostats that disconnect overall chamber main power components (such as compressors, fans and heaters) in case of accidental over-temperature.

## *7. Humidification and Dehumidification*

Direct humidification occurs through an electrical vapor humidifier with an orifice arranged in the airflow after the recirculating air fan. This ensures aerosol free humidification. The humidifier is controlled by a dedicated algorithm for better reliability. The chamber is equipped with a water storage tank (about 18l capacity) and a water connection on the back of the chamber for automatic refilling.
There are three ways to ensure the water supply needed for any kind of climatic tests:

1. Connecting the chamber to normal tap water network by means of suitable water connection1;
2. Manually refilling the tank with demineralized water2;
3. Connecting the chamber to demineralized network3.



In order to reduce water consumption, water recycling can be activated through a button on the control panel (only possible when the specimen does not contaminate the water
during the test).
Dehumidification is performed by the condensation cooler (dew point cooler) directly connected to the refrigeration circuit.
This principle permits high stability of parameters in conjunction with energy-efficient dehumidification.

## *8. Electric equipment*

The electrical equipment complies with the provisions on CE marking and the relevant product standards.
With particular regard to safety, the electrical equipment is made in accordance with the main harmonized IEC-EN regulations which are accepted worldwide.
The applicable guidelines and standards are:

- Directive 2006/42/EC - Machinery Directive - EC
- Directive 2014/35/UE - Low-voltage electrical equipment
- Directive 2014/30/UE - Electromagnetic Compatibility
- IEC 61000-6-1/2/3/4/5 – Basis standard of electromagnetic compatibility
- IEC 61439-1/2 - Distribution switchgear
- IEC-60204-1 - Electrical equipment of machines
- UNI-ISO-13849-1/2
- EN 62061

The components meet the standards for maximum quality and environmental compatibility.

## *9. Incorporated safety*

Configuration, constructive design and workmanship are in compliance with the currently valid EN and IEC codes.
The chamber is equipped with:

- a lockable master switch (according to IEC standards)
- safe thermostats that disconnect overall chamber main power components (such as compressors, fans and heaters) in case of accidental over-temperature.

Moreover, the control system is monitoring:

- excess and low temperatures for test compartment by means of digital undertemperature/overtemperature switch with independent probe
- recirculating air fan
- compressor (thermal protection, overpressure)
- condenser fan

In case of malfunctions or failure of individual components, the built-in safety devices will cause the system or individual groups to shutdown to prevent any consequential damage. Detailed fault alarms in plain text ensure the prompt detection of system malfunctions.

## *10. Environmental safety*

We use environmental friendly R449A and R23 (for systems down to –70°C) refrigerants only. Asbestos-free mineral fibers are used for insulation purposes. The resistant powder coating will not release any solvents into the environment

## *Technical data*

| | Bulkfrost 340 (*) | Bulkfrost 600 | Bulkfrost 1200 | Bulkfrost 1600 |
|---|---|---|---|---|
| Useful capacity (l) | 337 | 553 | 1076 | 1439 |
| Internal dimensions approx. (mm) (WxDxH) | 601x 810x 694 | 850x730x892 | 1000x1130x953 | 1000x1510x953 |
| External dimensions approx. (mm)(WxDxH) | 875x 1786x1765 | 1124x1768x2049 | 1278x 2222x 2111 | 1278x2600x211 |
| Temperature range (°C) | -75…+180 | -75…+180 | -75…+180 | -75…+180 |
| Temperature fluctuation (K) | ±0.5...±1 | ±0.1...±0.3 | ±0.1...±0.3 | ±0.1...±0.3 |
| Temperature changing rate Heating [1] | 8 K/min | 6 K/min | 6 K/min | 4,5K/min |
| Temperature changing rate Cooling[2] | 5,5 K/min | 5,5 K/min | 5 K/min | 2,3K/min |
| | | | | |
| Maximum thermal Load (W)[3] | 3000 | 3000 | 3000 | 3000 |
| Rated power (kW) | 12 | 14.3 | 20.9 | 15 |
| Rated current absorption (A) | 21 | 29.2 | 41 | 28 |
| Weight (kg) | 755 | 1090 | 1280 | 1300 |
| Sound pressure level dB(A)[4] | 63 | 66 | 68 | 63 |
| Supply voltage (Vac) | 400V ±10%/50Hz/3 + N + G | | | |

(*): Only available with water condensation

[1] According to IEC60068-3-5 and IEC60068-3-6. Performance data refer to +22°C ambient temperature, 400V nominal voltage, without specimen

[2] According to IEC60068-3-5 and IEC60068-3-6. Performance data refer to +22°C ambient temperature, 400V nominal voltage, without specimen

[3] Performance data refer to +22°C ambient temperature, 400V nominal voltage, without specimen

[4] Measured at 1 m distance in front of the unit in 1.6m height, free field measurement

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