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TESTING LABORATORY CAPABILITIES

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Electromagnetic capability testing capacity

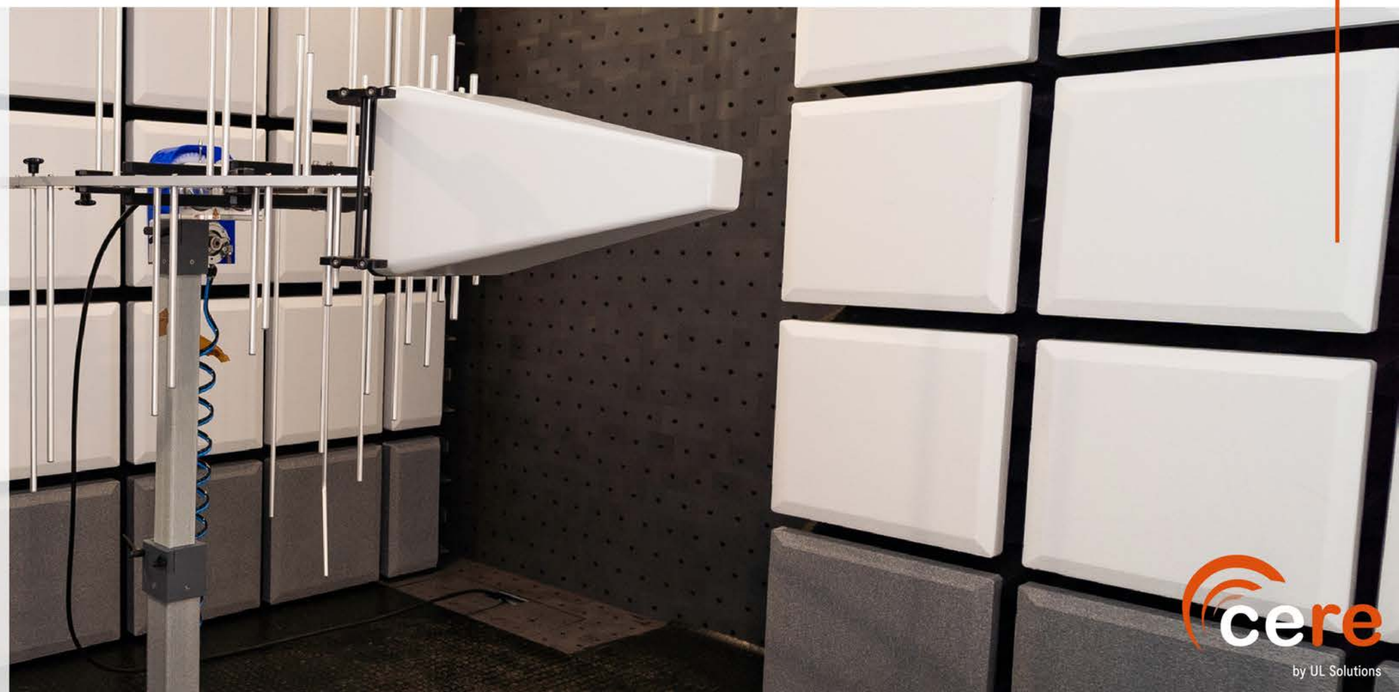
FULL ANECHOIC

CERE, by UL Solutions has a Chamber in its facilities Anechoic, with Quiera Zone (QZ) Ø1.5m (rotary platform), to perform Electromagnetic compatibility tests at 3m for Radiated Immunity and emission, and domestic and Industrial Environments: 80MHz range capability up to 6GHz

Exterior dimensions:
approx. 8.10m x 4.80m x 3.975m

Rotatory platform: 1,5m of diameter.
Door 1,5m x 2,4m H

Inner dimensions in between hybrid absorbers (HT45 model):
(L x W x H) approx. 7.08m x 3.78m x 2.81m.



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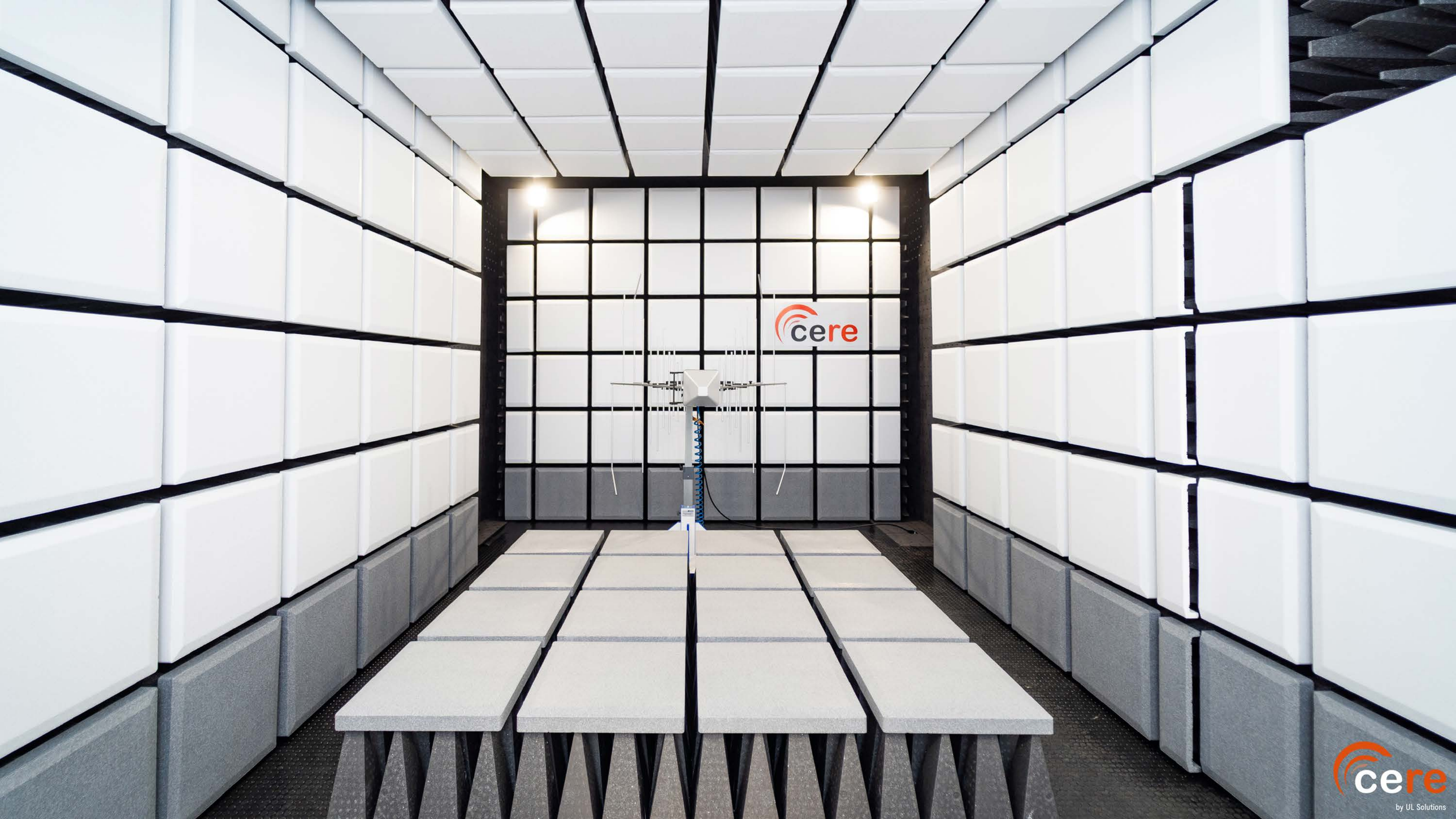

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Dimensions

Exterior dimensions:
approx. 8.10m x 4.80m x 3.975m

Rotatory platform: 1,5m of diameter.

Door: 1,5mx 2,4m H

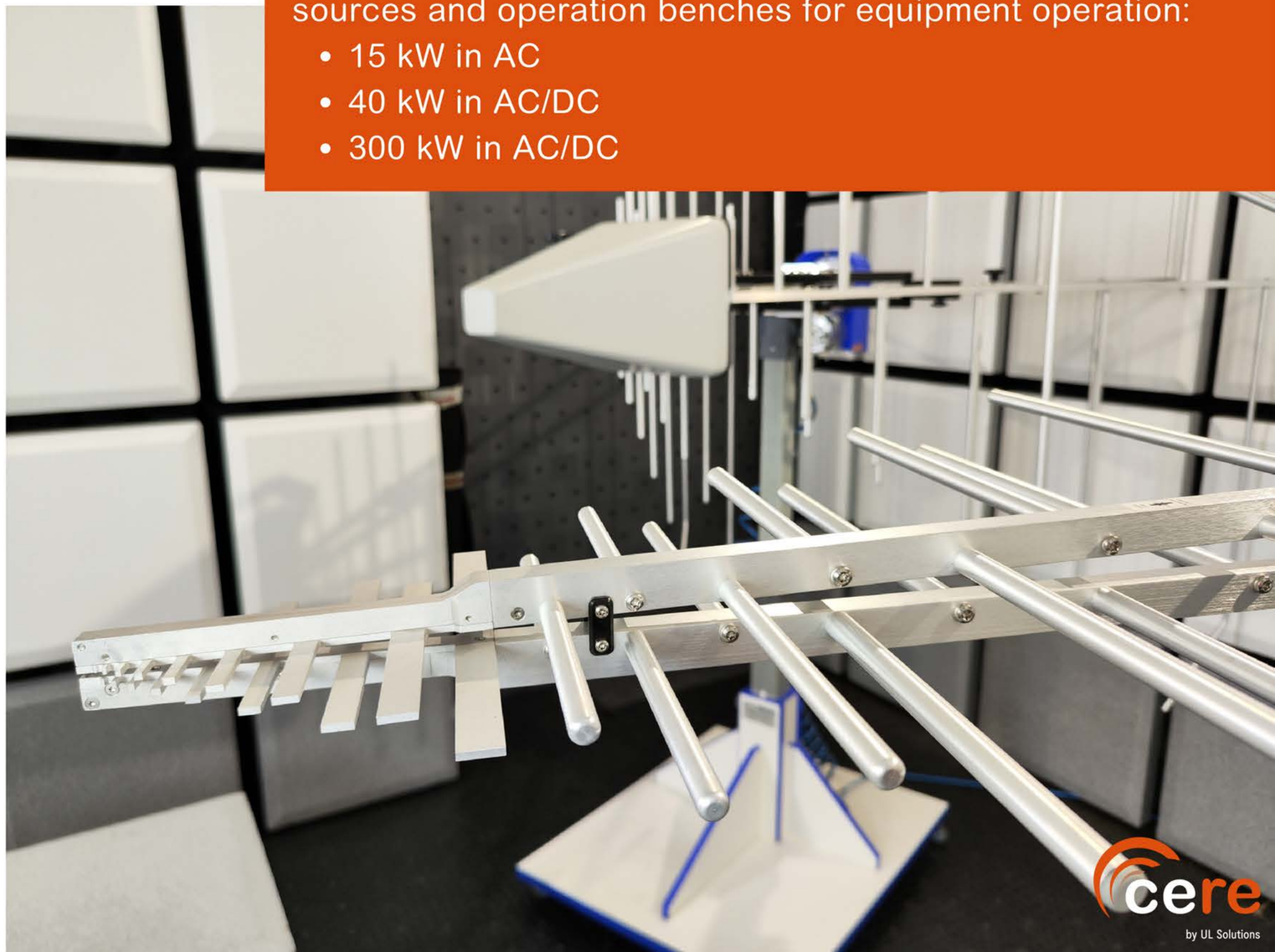
Inner dimensions in between hybrid absorbers (HT45 model):
(L x W x H) approx. 7.08m x 3.78m x 2.81m.

Maximum weight: 700kg.
Equipment up to 1 ton could be considered.

Operating power of the equipment under test

There are three possible configurations based on CERE sources and operation benches for equipment operation:

- 15 kW in AC
- 40 kW in AC/DC
- 300 kW in AC/DC



Technical features

Fully anechoic 3-meter chamber working in the time domain. The combination of these innovative technologies results in measurement time effort between 8 and 10 times shorter than timing required a classic chamber, providing more complete results, since it offers final results with all points in QP. 3D graphical representation of the equipment's emissions.
Measurements up to 6 GHz both in emission and radiated immunity.
Testing capacity for equipment with a power up to 300kW.

Emission

- Radiated emission
- Conducted emission measurements by LISN, voltage and current probe
- Clicks
- Harmonics and Flicker

Immunity

- IEC 61000-4-2: Electrostatic discharges (ESD)
- IEC 61000-4-3: Radiated immunity to electromagnetic fields
- IEC 61000-4-4: Bursts
- IEC 61000-4-5: Shock waves
- IEC 61000-4-6: Conducted immunity
- IEC 61000-4-8: Electromagentic fields immunity
- IEC 61000-4-11 & IEC 61000-4-34: Abnormal voltages
- IEC 61000-4-12: Ring wave

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Power testing capability

CERE, by UL Solutions has in its facilities several sources of DC and AC power supply as well as test benches to work in power up to 500kVA, 1,500 V in DC, 800 V in AC and from 0 to 400Hz in frequency. We have a photovoltaic simulator, batteries simulator and adjustable source DC as well as AC source for all kinds of tests. Sources can also act as electronic loads for unintentional islanding test

Technical features

	Test site / Bench 1 Cere 175 -Cere 250 (Conecta - Cinegia)	Test site / Bench 2 Cere 251 -Cere 258 (GeiserDC - Cinergia)	Test site / Bench 3 Cere 173 -Cere 249 (Zigor - Cinergia)	Test site / Bench 4 Cere 174 (Geiser)
Maximum Power	160kVA	160kVA (x3_up to 480 kVA)	100kVA	400kVA
Operational Modes	DC Power supply	DC Power supply	DC Power supply	DC Power supply
	Grid Formning (AC Power supply)	Grid Formning (AC Power supply)	Grid Formning (AC Power supply)	Grid Formning (AC Power supply)
	Grid Following (P/I - RLC)	Grid Following (P/I - RLC)	Grid Following (P/I - RLC)	Grid Following (P/I - RLC)
	--	FV Simulador	--	FV Simulador
	--	Battery Emulator	--	Battery Emulator
Maximum DC power - Pdc	200kW	500kW	100kW	700kW
Voltage range - Vdc	700-1100V (1100V max)	700-1500V (1500V max)	0 -700V (700V max)	580-1500V (1500V max)
Maximum DC Current - Idc	285 A	714 A	350 A	600 A
Maximum AC power - Pac	160 kVA a 230 Vrms Fase	160 kVA (x3_up to 480 kVA) a 230 Vrms Fase	160 kVA a 230 Vrms Fase	400 kVA a 230 Vrms Fase (700 kVA a 400 Vrms Fase)
Voltage range - Vac	0-400-690 Vrms (opcional 800 Vrms)	0-400-690 Vrms (opcional 800 Vrms)	0-400-690 Vrms (opcional 800 Vrms)	0-400-690 Vrms (opcional 800 Vrms)
Frequency range - F (Hz)	0-400 Hz	0-400 Hz	0-400 Hz	40-70 Hz
Uncertainties (Uac% y F%)	0,10%U - 0,002%F	0,10%U - 0,002%F	0,10%U - 0,002%F	0,10%U - 0,02%F
Limit of AC current (Aac)	234,32 Arms Fase (292,90A 10min / 351,48A 1min 468,64A 2s)	234,32 Arms Fase (ampliable x3) (292,90A 10min / 351,48A 1min 468,64A 2s)	234,32 Arms Fase (292,90A 10min / 351,48A 1min 468,64A 2s)	600 Arms Fase
Grid Transformer	200kVA (400V/690V); 400V/690V; YNyn0	500kVA (400V /690V); 400V/690V; YNy0	100kVA; 400V; 1:1; Dyn (cinergía) / 100kVA (Zigor)	50kVA; 400V; 1:1
Back to Back Transformer	290kVA (400V)/500kVA (690V); 400V/690V; YNyn0	500kVA (400V /690V); 400V/690V; YNy0	--	500kVA (400V /690V); 400V/690V; YNy0
Loud Transformer - P/I - RLC	--	--	--	500kVA (400V /690V); 400V/690V; YNy0
Auto-Transformer of 800V	400kVA (800V /690V)			
Scc (MVA)	8,00	13,50	--	13,50

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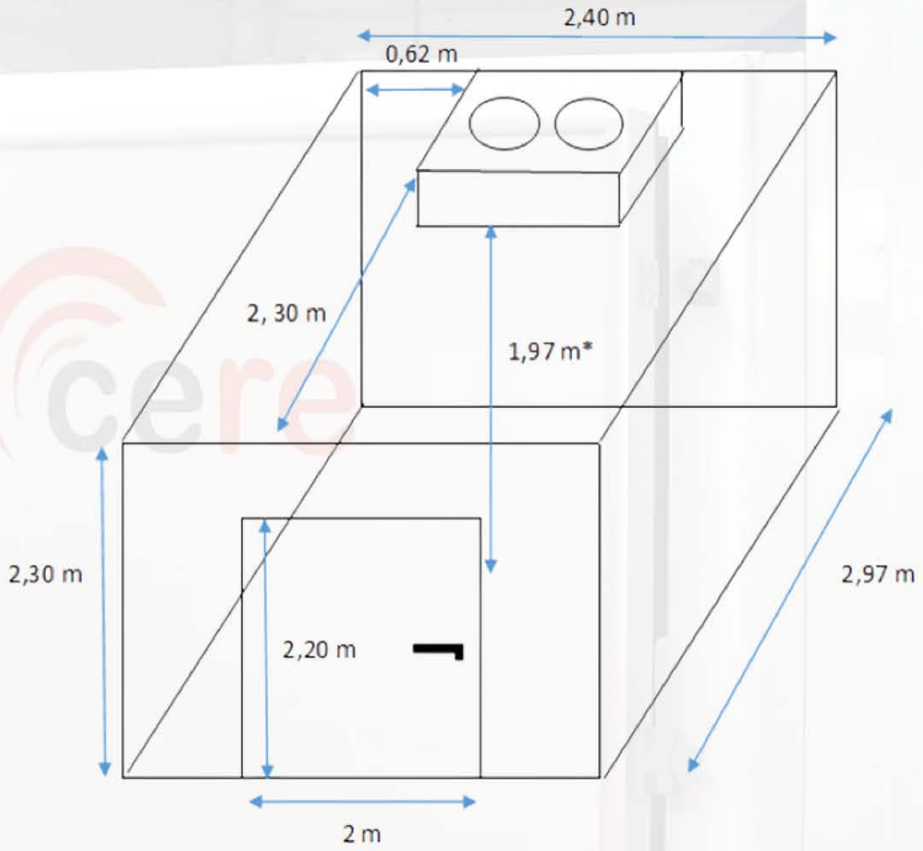
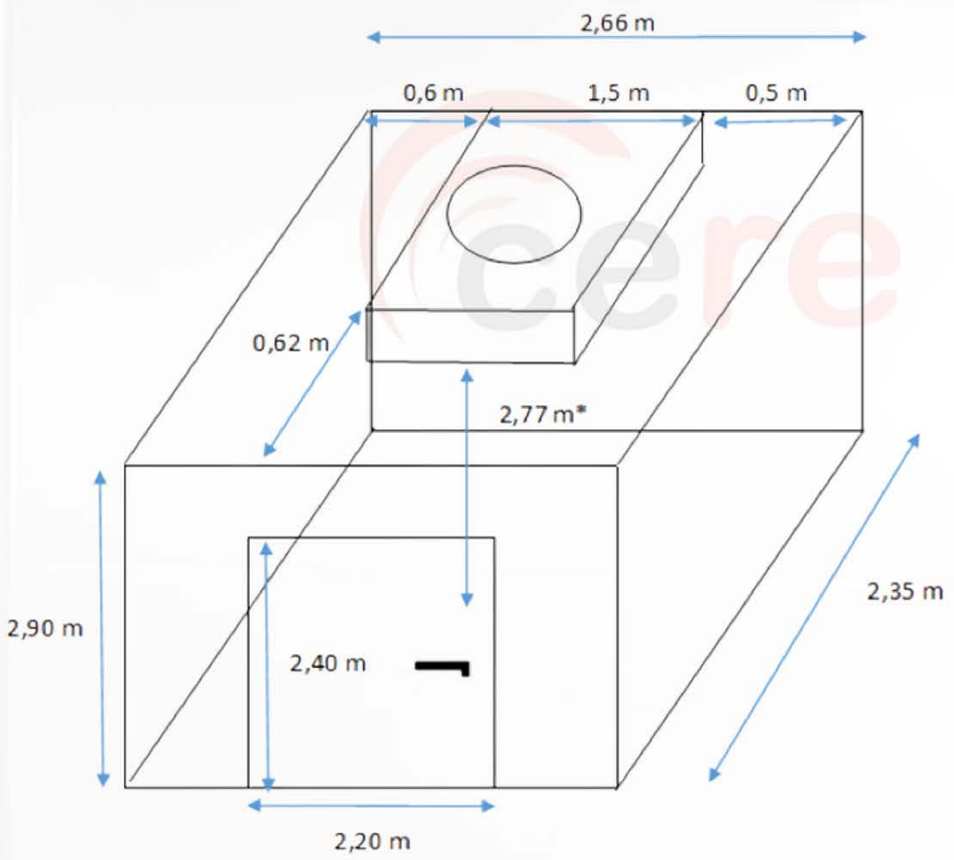
Environmental testing capability

CERE, by UL Solutions has several climatic chambers on the Laboratory facilities for temperature and humidity testing, for EUT within 3 tones and 2.4 meter high. Our capabilities include cycle programming, gradients, temperature steps, and all kind of variations. Temperature range is within -40ºC and +125ºC and RH up to 95%.



* Ground clearance

High temperature Chamber



* Ground clearance

Low temperature Chamber

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High temperature chamber

- Upper and lower operating temperature limits with their respective relative humidity values: 85 °C with up to%RH: 85± 3 %, 70 °C with up to %RH: 95± 3 %
- Gradients range: Manual selection
- Max %RH: 95± 3 %
- EUT operating power: Power connected to power benches 1, 2 and 3 independently or in parallel up to 500kVA.

The dry heat test (without humidity), is performed at rated power and for the high humidity test, the equipment is not connected

Low temperature chamber

- Upper and lower operating temperature limits: +5°C to -40°C
- Gradients range: Manual selection
- EUT operating power: Power connected to power benches 1, 2 and 3 independently or in parallel up to 500kVA.

Heat drying oven

- Dimensions: 420x395x350 mm
- Volume: 50 liters Temperature
- Range: 25°C to 250°C
- Also used for pressure ball testing.

Dycometal temperature chamber

- Dimensions: 780 x 810 x 720 mm
- Upper and lower operating temperature limits: -40 to 125 ºC without humidity / 85º and 85 % H.R.
- Programable gradient range: 2ºC / minute of heating 1ºC / minute of cooling
- Max %RH: 95± 3 %
- EUT operating power: Depending on the source or operating bench.

Binder temperature chamber

- Dimensions: 650 x 785 x 485 mm
- Upper and lower operating temperature limits: -40 to 125 ºC without humidity / 85º and 85 % H.R.
- Programable gradient range: 2ºC / minute of heating 1ºC / minute of cooling
- Max%RH: 95± 3 %
- EUT operating power: Depending on the source or operating bench

IPXX and Nema Laboratory Capabilities

- Tests can be performed up to IP 65
- Dust chamber dimensions for IP5X / IP6X: (960 x 960 x 980)
- NEMA tests: Rain Test
- Sprinkler test

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CTS Climatic chamber

- Chamber dimensions: 1000 x 1050 x 2000 mm
- Capacity: Aprox. 2000 l

CLIMATIC TESTS

- Upper and lower operating temperature limits: 10 to 95 ºC
- Temperature fluctuation: Temporary of ±0,1 to ±0,3 K
- Humidity range: 10 % to 98 %
- Dew point range: 5 to 89 ºC
- Humidity fluctuation: Temporary of ±1% to ±3 %

TEMPERATURE TESTS

- Upper and lower operating temperature limits: -70 to 180 ºC
- Temperature fluctuation: Temporary of ±0,3ºC
- Programable gradient ranger: 2ºC / minute of heating 2ºC / minute of cooling
- EUT: 200 Kg of photovoltaic panel

Incandescent wire chambrer

- Chamber dimensions: 1100 × 700 × 1300 mm, exhaust hole Ø100mm
- Power: 800 VA, 220 V, 48-60 Hz
- Capacity : >0.5 m3
- Upper and lower operating temperature limits: 500-1000°C ± 2 °C continuously adjustable
- Glow wire: Ø 4 mm ± 0.04 mm Ni/Cr (80/20)
- Penetration depth: 7 mm ± 0.5 mm

CTI test chamber

- Chamber dimensions: 1100 x 700 x 1300 mm.
- Power: 800 VA, 220 V, 48-60 Hz
- Capacity: >0.5 m3
- Electrode distance: 4 mm ± 0.1 mm, 60 ± 5° angle.
- Test voltage: 100 - 600 V adjustable.
- Test current: Limited to 1 A ± 0.1 A adjustable.

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Salt fog chamber

- Chamber dimensions: 600 x 450 x 400 mm
- Power: 220 V, 1.5 KW, 50 Hz
- Capacity : Aprox. 108 l
- Salt spray test: 35°C ± 1°C (Test room temperature), 47°C±1°C (Saturated air barrel temperature)
- Corrosion test: 50°C ± 1°C (Test room temperature), 63°C±1°C (Saturated air barrel temperature)

Needle flame chamber

- Chamber dimensions: 1100 × 700 × 1300 mm, exhaust orifice Ø100mm
- Power: 800 VA, 220 V, 48-60 Hz
- Capacity: >0.5 m3
- Test temperature range: 0 - 1000 °C
- Flame temperature: from 100 °C ± 2 °C liters to 700 °C ± 3 °C liters in 23.5 s ± 1 s

Storage System testing capability

Closed loop testing circuit, consisting of BESS1 and BESS2, with loss feed from laboratory supply and conversion to DC for a DC/DC conversion system and energy transfer from BESS1 to BESS 2 and vice versa in order to carry out standard tests.
Current limitation of 1400 kWh of discharge capacity at 1 C

General regulatory requirements for Power Supply Systems:

- **UL 9540 Energy Storage System (ESS) Requirements.**
- **UL 9540A; 2019, Test method for evaluating thermal Runaway Fire propagation in Battery Energy Storage systems**
- **IEC 62933-2-1:2017 Electrical energy storage (EES) systems - Part 2-1: Unit parameters and testing methods - General specification.**
- **IEC 62933-5-1:2017 Electrical energy storage (EES) systems - Part 5-1: Safety considerations for grid-integrated EES systems**
- **IEC 62933-5-2:2020 Electrical energy storage (EES) systems - Part 5-2: Safety requirements for grid-integrated EES systems - Electrochemical-based systems**
- **UNE-EN 1364-1:2019**
- **IEC 61439-1:2020 Low-voltage switchgear and control gear assemblies - Part 1: General rules**
- **IEC 61439-2:2020 Low-voltage switchgear and control gear assemblies - Part 2: Power switchgear and control gear assemblies**
- **IEC 62477-1:2012+AMD1:2016 Safety requirements for power electronic converter systems and equipment - Part 1: General**

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Simulation department capability

Team consisting of more than 10 people with material and licenses for double shift work of: PSS/e, DIgSILENT PowerFactory, PSCAD, MATLAB, SIMULINK among others.

Capabilities and skills:

- **Experience in generation units, such as converters, solar inverters and wind turbines and additional plant accessories such as Power plant controllers (PPCs) and statcoms.**
- **Verification of compliance of these equipment models with the different regulation and grid code requirements globally: NTS, VDE, G99, Chile, Colombia, etc,**
- **Elaboration of plant models**
- **Short circuit study**
- **Electrical losses calculation study**
- **Load-flow calculation study**
- **Power quality study**
- **Grid code compliance studies (for any grid code globally).**
- **Robustness verification study.**
- **Stability study**
- **Protection adjustment and coordination study:**
- **Transient studies.**
- **Study of damping of oscillations at the connection point (according to NTS, chapter 5.10).**
- **Complementary simulations in accordance with NTS and PO12.2.**
- **PO9: Operating Procedure 9 of REE:**
- **Inertia emulation study (according to NTS, chapter 5.6).**

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Electric Safety and EMC Testing laboratory capability

SAFETY

- Voltage Withstand Test up to 5kV AC and 6kV DC
- Temperature Tests -45°C to +120°C
- Humidity Tests up to 95%RH
- Insulation Tests
- IP Tests up to IP65
- IK Tests up to IK10
- Ground Continuity and Equipotentiality
- Megger Tests up to 500A AC
- Burn and Flammability Tests
- Tests in Salt Atmospheres on Specimens
- Vibration up to 15kG
- Capacitor Discharge Tests

EMC

- Conducted and radiated emissions up to 6 GHz
- Conducted and radiated immunity up to 2700 MHz
- Harmonics
- Flickers
- Clicks
- Electrostatic discharge
- Electric fast transient (Transients)
- Bursts
- Voltage dips and short interruptions
- Impulses, Surges, Ringwave, and Oscillatory Wave Impulse

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