HGH
Enlighten the Unseen

ELECTRO OPTICAL
TEST SOLUTIONS

VACUUM COMPATIBLE BLACKBODIES

OPTICAL GROUND SUPPORT EQUIPMENT (OGSE) FOR SPACE AND EARTH RADIATIONS SIMULATIONS

hgh-infrared.com

OGSE - VCBB

A COMPREHENSIVE RANGE OF VACUUM BLACKBODIES

SELECT THE PROPER SOURCE ADAPTED TO YOUR APPLICATION

Vacuum environment compatible blackbodies combine performances of traditional infrared reference sources, increased in order to cope with complex and demanding temperature (from cryogenic to ambient) and pressure conditions (down to High Vacuum) generated by vacuum chambers.

3 KEY POINTS

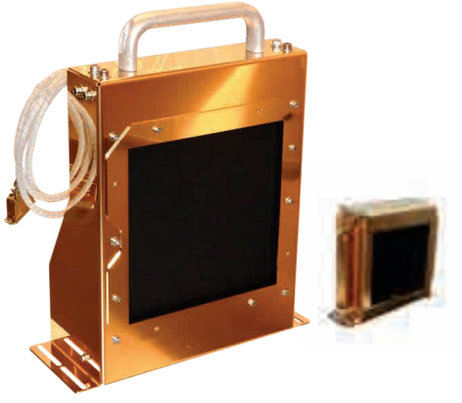
Absolute temperature range from 100K to 423K

High thermal uniformity and emissivity

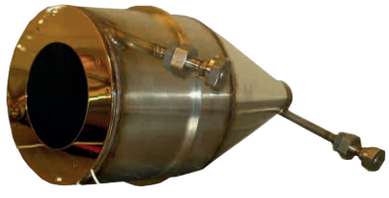
ISO-5 Cleanliness
Vacuum compatible materials

A COMPREHENSIVE RANGE OF VACUUM BLACKBODIES

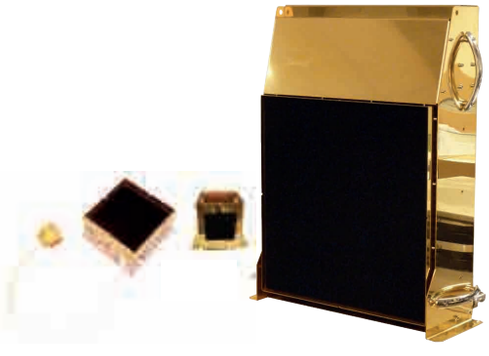
- **DCN 1000 V:** High uniformity and fast regulating TEC based Blackbodies
- **ECN 100 V:** High emissive area extended Blackbodies based on thin flexible resistive heaters
- **RCN V:** Very high emissive cavity Blackbodies, with $\varepsilon > 0.999$



DCN 1000 V



RCN V



ECN V

MAIN APPLICATIONS

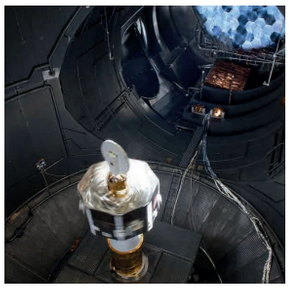
A COMPREHENSIVE RANGE OF VACUUM BLACKBODIES

TESTING AND CALIBRATION OF INFRARED SENSORS, IMAGERS AND SOUNDERS

Our Vacuum Blackbodies aim at simulating space and terrestrial radiations, to test and calibrate space borne infrared optronics instruments. Find below some examples of major space programs we took part in:

METEOSAT THIRD GENERATION (MTG)

METOP-C



ESA LARGE SPACE SIMULATOR

OUR REFERENCES, OUR CUSTOMERS

Sensors manufacturers, the Space industry and the industrial Primes require such equipment, refered to as Optical Ground Support Equipment (OGSE), for Assembly Integration, Verification and Testing (AIVT) processes, in order to meet their calibration needs for the sensors and instruments to be embedded in satellite missions.

PRIMES CONTRACTORS AND INTEGRATORS

- Ball Aerospace
- Airbus DEFENCE & SPACE
- THALES ALENIA SPACE
- BERTIN Technologies

NATIONAL SPACE AGENCIES AND SPACE RESEARCH CENTRES

- NASA - Jet Propulsion Lab
- JAXA - Tsukuba Space Centre
- ISRO - Space Application Centre & Solid State Physics Laboratory
- ESA - ESTEC
- CSL

THE ESSENCE OF OGSE AND THEIR CONFIGURATIONS

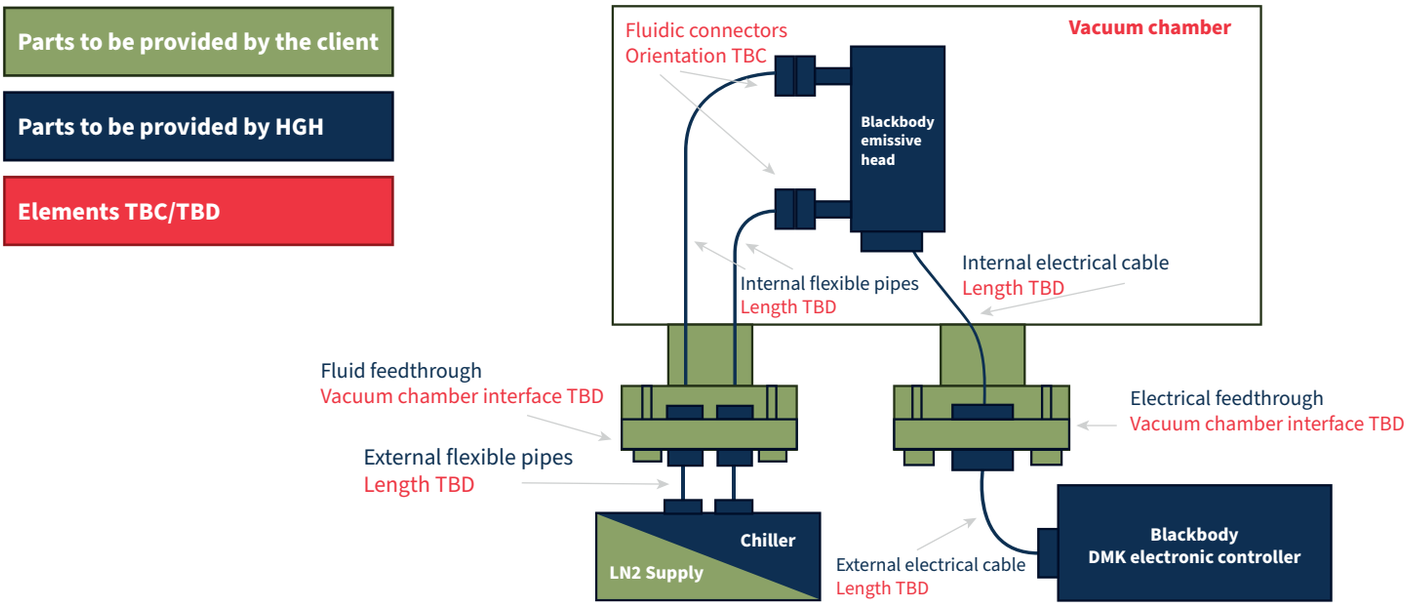
For decades now satellites have been launched, embedding diverse instruments each time. Nowadays, all the instruments of a satellite constitute its payload and correspond to the necessary tools to achieve the goal (military, scientific, industrial) assigned to the satellite. The definition of a satellite mission is complex and its success relies on the proper functioning of its instruments.

Ground Support Equipment (GSE) constitute all the tools required by the Space industry – Sensors manufacturers and Primes – to make sure the embedded instruments won't present technical issues or malfunctioning as maintenance in flight is not an easy task. They can be of different sorts: mechanical, electrical ... and optical.

Thanks to their specific design and excellent radiating performances , HGH's Vacuum Compatible Blackbodies can easily manage the stress as well as the extreme temperatures and vacuum generated by space conditions, explaining why they are often chosen as part of the **Optical Ground Support Equipment (OGSE) used in the Assembly Integrating and Verification/Testing phases of satellite missions** to calibrate thermal imagers and sounders (SWIR/MWIR and LWIR bandwidth) before launch.

MAIN APPLICATIONS

OVERVIEW AND ENVIRONMENT



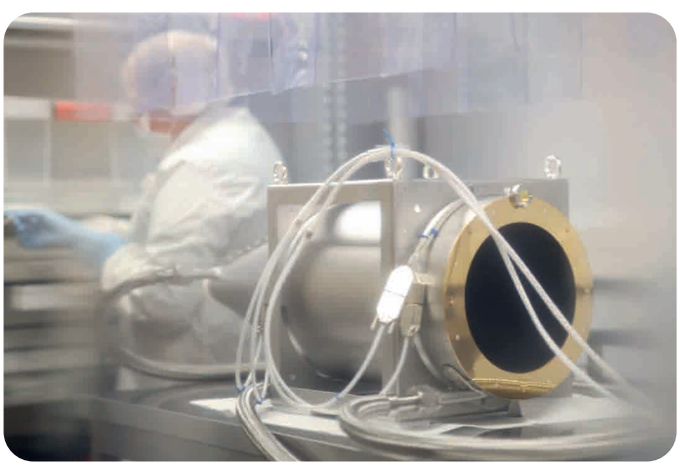
ISO5-COMPLIANT CLEANROOMS FOR VACUUM BLACKBODIES MANUFACTURING

In the space industry, a cleanroom is a prerequisite in order to use, assemble and test equipment to be sent to space.

Cleanliness requirements and standards are therefore extremely stringent.

HGH clean room is free of all impurities and compliant with ISO5 standards.
It can receive all necessary components - previously cleaned in an ultrasound bath - before their integration to the Blackbody.
Its operation is based on a positive air-pressure technique, removing all impurities and preventing potential incoming ones.

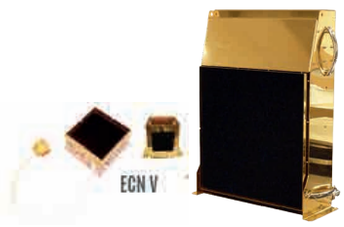
HGH facility is compatible with the storage, assemblying, cleaning and testing standards of the space industry and constitute a comprehensive chain to accelerate the manufacturing process.



ECN100V VACUUM COMPATIBLE BLACKBODIES

Heating occurs through resistances based film covering completely the rear side of the copper based emissive surface and ensuring an optimal thermal uniformity due to its high intrinsic thermal conductivity.

Temperature control is achieved by conduction effect thanks to a thermal bridge and a LN2-based heat disspator.



The emissive surface has its temperature measured in real time through high precision Platinium Pt100 sensors calibrated at the French National Metrology Institute (LNE).

BENEFITS

- Extended area up to 500x500mm2
- Microgrooved emissive surface
- High emissivity greater than 0.99
- High thermal uniformity down to 10mK (RMS) and 50mK (P-V)
- Temperature range from 80K to 423K
- Temperature stabilization better than 3mK (RMS)
- Real time display of temperature data in C°, K and F
- Integration in ISO 5 cleanroom
- Cooling from ambient to 100K in one hour
- Vacuum compatible emisisve coating
- Golden coated parts to reduce incident straylight
- Electrical feedthrough + connector
- Remote control of temperature
- Communication protocols : Ethernet, RS232, GPIB
- Built-in test equipment (BITE)

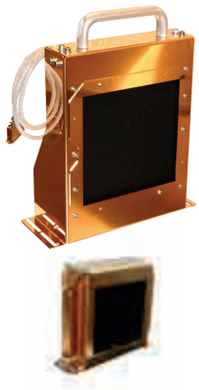
SPECIFICATIONS

		ECN100V2	ECN100V7	ECN100V12	ECN100V20
	Surface Emissive Dimensions	50x50 mm	190x190 mm	300x300 mm	500x500 mm
Operating conditions	Absolute temperature range				
	Vacuum chamber radiated temperature < 100K Cooling fluid: LN2	[100K; 423K]			
	Vacuum chamber radiated temperature ~293K Cooling fluid: LN2	[110K; 423K]	[150K; 423K]		
	Cooling time from 293K to minimum temperature				
	Vacuum chamber radiated temperature < 100K Cooling fluid: LN2	< 45’	< 2h	< 2.5h	< 3h
	Vacuum chamber radiated temperature ~293K Cooling fluid: LN2	< 1h	< 3.5h	< 3h	< 4.5h

DCN1000V

VACUUM COMPATIBLE BLACKBODIES

DCN1000V VACUUM COMPATIBLE BLACKBODIES



Thanks to a specific vacuum compatible emissive coating applied on a highly conductive micro- grooved surface, compliant with the space industry standards, and to a highly accurate temperature control ensured by the optimization of losses through radiation and conduction, DCN1000V infrared reference sources radiate with an emissivity greater than 0.99 over an extended temperature range and with the best-in-class uniformity and stability.

The emissive head is positioned in a vacuum chamber and connected to our DMK electronic controller positioned outside the walls of the chamber thanks to a flanged electronical feedthrough.

An absolute and differential temperature regulation is enabled by TEC elements in contact with the emissive surface and the assistance of a chiller flowing a calorific fluid in the VBB's pipe. Temperature of the emissive surface is measured in real time thanks to high precision Platinium Pt100 temperature sensors calibrated at the French National Metrology Institute (LNE). Storage of the necessary parts to be integrated in the OGSE is done in clean rooms, complying with ISO5 standards.

BENEFITS

- Fast stabilization time
- Flat or microgrooved emissive surface
- High emissivity greater than 0.99
- High thermal uniformity better than 10mK
- Temperature ranges from 233K to 423K
- Temperature stabilization better than 2mK (RMS)
- Real time display of temperature data in C°, K and F
- Integration in ISO 5 cleanroom
- Vacuum compatible emisisve coating
- Golden coated parts to reduce incident starylight
- Electrical feedthrough + connector
- Remote control of temperature
- Communication protocols : Ethernet, RS232, GPIB
- Built-in test equipment (BITE)

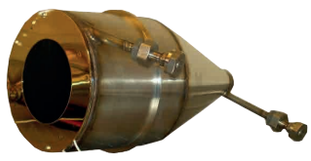
SPECIFICATIONS

		DCN1000V4
	Surface Emissive Dimensions	100x100 mm
Operating conditions	Absolute temperature range	
	Vacuum chamber radiated temperature: [-20°C; +20°C] Temperature regulation: TEC + Chiller Cooling fluid: Ethylene + Glycol	[233K; 423K]
	Heating and cooling times from minimum to maximum temperature	
	Vacuum chamber radiated temperature: [-20°C; +20°C] Temperature regulation: TEC + Chiller Cooling fluid: Ethylene + Glycol	< 45'

RCNV VACUUM COMPATIBLE BLACKBODIES

Thanks to a specific vacuum compatible emissive coating, compliant with the space industry standards, and to a cavity shape design acting as beam-trap, RCNV vacuum blackbodies radiate with the best-in-class emissivity of 0.999.

A highly accurate temperature control is ensured by the optimization of losses through radiation and conduction, but also through the use of a high-performance chiller flowing a calorific fluid wrapping the cavity or through the use of LN2.



The emissive head is positioned in a vacuum chamber and connected to an Electronic Measuring Unit positioned outside the walls of the chamber for the acquisition of the blackbody's temperature.

Temperature of the cavity is measured in real time via high precision calibrated Pt Sensors.
Thermal uniformity is defined by the temperature gradient of three Pt sensors inserted in the cavity.

Storage of the necessary parts to be integrated in the OGSE is done in clean rooms, complying with ISO5 standards.

RCNV VACUUM COMPATIBLE BLACKBODIES

- Cavity diameter aperture: up to 200mm
- **High emissivity greater than 0.999**
- High thermal uniformity : 150mK (P-V)
- Temperature ranges: 80K and [220K ; 350K]
- Temperature stabilization down to 10mK
- Real time display of temperature data in C°, K and F
- Integration in clean room conditions, compliant with ISO 5 cleanroom specifications
- Cooling from ambient to 100K in one hour
- Vacuum compatible emisisve coating
- Golden coated parts to reduce incident starylight
- Electrical feedthrough + connector
- Remote control of temperature
- Communication protocols : Ethernet, RS232, GPIB
- Built-in test equipment (BITE)

ABSOLUTE TEMPERATURE RANGE

Absolute temperature range	RCNV
RCNV-D Cooling fluid: LN2	80K
RCNV-E Calorific fluid (ethylene + glycol)	[220K; 350K]

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Contact us : hgh@hgh-infrared.com | hgh-infrared.com

EUROPE

10 rue Maryse Bastié
91430 Igny, FRANCE
Phone: +33 1 69 35 47 70

USA

1240 E Campbell Rd Ste. 200,
Richardson, TX 75081, USA
Tel: +1 805 965 6701

ASIA

1 Paya Lebar Link, #04-01
Singapore 408533
Phone: +65 6955 8585