

Large Cube

Testing for heavy industry

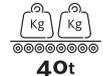
The test in a nutshell



Temperature ranging



Rain



40t
Load capacity

terraXcube

terraXcube is Eurac Research's extreme climate simulation centre at the NOI Techpark in Bolzano, South Tyrol, Italy. Within its chambers, even the most extreme of all our Planet's environmental conditions can be created. By combining hypobaric and altitude technology with state-of-the-art environmental simulation, we aim to investigate the effects of extreme climate conditions on humans, ecological processes and industrial products.

The climate chambers differ in size and equipment and can accommodate people, plants and other living organisms for up to extended periods and have the space to accommodate large machines and products.

Each day our team breaks new ground with scientists and industry partners and prepares the path to gain discoveries.

Test description

This test focuses on the qualitative and quantitative responses of large and heavy objects subjected to harsh conditions. The test object is a 7-tonne forklift upon which several tests must be performed, due to the demands of the client's different r&d departments.

Once the forklift has been delivered to the terraXcube, it is placed in front of the Large Cube in the set-up area where all the necessary sensors are connected, and the data acquisition system is configured. The vehicle is then ready to be placed inside the test room of the Large Cube where the temperature is set to -20°C according to the test design previously agreed upon with the customer. The object is then left in the test room until a predefined part of the vehicle reaches the temperature of -20°C. This process is called soaking and could take up to several hours

to be achieved, depending on the object's mass and materials. At temperatures below 0°C, a technician can enter the room and thanks to a portable hose, spray a mist of water on specific parts of the forklift cabin such as doors, windshield and heat exchangers. This is to simulate a night in which the temperature, after a rainy day, drops to minus degrees leaving the forklift wet. Once soaking is complete, the real tests can begin.

Initially, all the doors and handles are checked to ensure their functionality. The handles must work, and the doors have to open even when covered with a layer of ice. If there are any problems with functionality, the handles and doors can be inspected in order to find a solution.

Following the completion of the test, it is then time to check the response of the engine at low temperatures during the so-called 'cold start test'.

The hose of the gas exhaust extraction system is placed on the exhaust pipe and the fan switched on.

The engine (combustion or even electric motor) must switch on via a wired remote control in the control room. The test is only considered passed, if the engine switches on immediately, with no major issues. During this test, the data acquisition system in the control room collects all the environmental parameters in the chamber as well as the temperature in specific points of the engine, if the customer so requires. With the engine still running at idle speed, there are three other possible tests that can be carried out. The first is related to the ability of the cabin heating system to heat the cabin from -20°C to a more comfortable temperature, previously agreed upon with the customer. Again, several temperature sensors are placed in the cabin and their value is recorded, a timer is then started in order to record how long it takes for the temperature to rise to the desired level.

The second test examines the windshield defrosting system and how effectively it defrosts, either partially or completely. The defrosted area is measured at defined intervals and then compared with the frosted parts of the windscreen. This test can reveal cold spots and possible new design solutions. In the third test, the temperature of the oil in different parts of the hydraulic system is measured continuously from the moment the engine is at idle speed. The less time it takes for the hydraulic system to reach the operating temperature, the faster the forklift can move and start working.

Large Cube - General Characteristics and Environment Control

Internal dimensions	12 m x 6 m x 5 m (L x W x H)
Useful Square Footage	137 m ² + 100 m ² for test setup
Access to the chamber	Large sliding door: 3.6 m x 4 m (W x H)
Load Capacity	Objects and vehicles with a mass up to 40 t
Maximum simulated altitude	9,000 m ±10 m (~ 30,000 ft)
Maximum Rate of Climb (ROC)	6 m/s (~ 1,180 ft/min); 14 m/s (~ 2,756 ft/min) in the airlock
Minimum Rate of Climb (ROC)	0.1 m/s (~ 20 ft/min)
Temperature Range <small>According to IEC 60068-3-5</small>	-40...+60°C (± 1°C in time ± 2°C in space)
Temperature Rate of Change <small>According to IEC 60068-3-5</small>	± 0.5°C/min (cooling & heating)
Relative Humidity <small>T > 4°C and according to IEC 60068-3-6</small>	10...95% ± 3%
Humidity Rate of Change <small>T > 4°C and according to IEC 60068-3-6</small>	0.4%/ min cooling; 0.5%/ min heating
Wind	Up to 30 m/s
Precipitations	Rain: 0...60 ±1 mm/h Snow: up to 50 mm/h

Other Features

Power Supply	230Vac 1~ 50Hz, 400Vac 3~ 50Hz, 63A
Data-acquisition equipment Smoke/Fire detection system + Fire suppression system CC cameras	
Network connection	Gigabit-Ethernet (1000BaseT) PoE, Wi-Fi