



ATECOS s.r.l.
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**Production of
blast-resistant structures.**

Scientific research and solutions.

PRESENTATION OF A DEVICE FOR EXPLOSION TESTS ®

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This presentation will explain the features of a Partially Confined Test Chamber®, PCTC, an equipment that allows to conduct tests of resistance to explosions. These tests may be conducted on several types of products; they may implement diversified scientific objectives too.

TEST EXPLANATION

The equipment consists of a chamber whose walls can withstand a predetermined pressure level, corresponding to the maximum test pressure. One of these walls is free and has anchor points that allow to set the object to be tested; the other walls, the floor and the ceiling may be partially removed. The explosive mixture is placed in a volume obtained with sheets of weak materials. Within this volume, before triggering off the mixture, a system that mixes substances is switched on. A sort of temperature and humidity control may be activated too. The trigger is activated from a safe distance. The chamber can also be equipped with sensors that measure overpressure, temperature, forces, etc., and also with high-frequency video cameras.

The device to be tested can be assembled so as to seal up the chamber. This sort of assembly is typically adopted for objects used to create continuous compartments; it allows to verify the capability of the object under test to reduce or to stop the shock wave. But devices to be tested can also be assembled without sealing up the chamber. In this kind of tests the objective is to verify the capability to withstand the occurrence of an explosion without damaging. In this kind of test the explosion spreads over the object itself without being blocked.

So this equipment is useful to evaluate behaviors of objects exposed to the impact of a shock wave rather than to characterize the explosiveness of different substances.

INNOVATIVE ASPECTS

A feature of the PCTC is that it allows to simulate a realistic pattern of overpressure. Several configurations, in fact, can be obtained removing portions of walls; to each configuration correspond a certain duration of the explosion and you can get the occurrence of negative pressure peak (depression). With appropriate calibration is therefore possible to conduct tests with at least two advantages: 1) you may optimize the resistance of the structures with respect to a completely confined test; in this last kind of tests the maximum peak overpressure last enough to amplify stresses in a some excessive way; 2) the presence of the negative peak submits the object to a more realistic test condition. What really happens, in fact, is a positive overpressure peak suddenly followed by a negative one; so, an object tested with a positive pressure only may not be able to withstand the succession of the positive and the negative phase occurring in real explosions.

KINDS OF TESTABLE OBJECTS

With regard to dimensional features and anchorages the test device provides maximum flexibility. There are no theoretical constraints, in fact, both about sizes and kind of anchorage. Each chamber's configuration, however, corresponds to a specific cost and then the constraint is rather economic.

In practice, you could test:

- building components (divider panels, doors, windows, etc.) designed to partition an area, potentially exposed to an explosion, which must be protected;
- equipment, components, system parts, etc., for which it must be demonstrated that they are able to maintain a certain functionality level even after they have been hit by a shock wave;

- the real behavior of the openings and vent surfaces. This kind of test may be conducted both in relation to shape and measures of surfaces and depending on the eventual presence of obstructions that prevent the free flow of exhaust gases. This can be useful if a theoretical modeling could be prohibitively expensive or introduce significant uncertainties.

TECHNICAL REFERENCE

The typical configuration of the PCTC is:

- chamber volume: 10mc
- maximum overpressure (positive peak): 4bar

Anyhow it is possible to improve this characteristics to different volumes and maximum overpressure.