

Acetylene Decomposition Test of High Pressure Devices for Acetylene

Key words

Acetylene, high pressure device, safety device, flame arrestor, detonative acetylene decomposition

Fields of application

Safety assessments of safety devices and fittings for high pressure acetylene also in cooperation with the BAM Certification Body (BZS). Testing is carried out according to the standards EN ISO 14113 "Gas welding equipment – Rubber and plastic hoses assembled for compressed or liquefied gases up to a maximum design pressure of 450 bar" and EN ISO 15615 "Gas welding equipment – Acetylene manifold systems for welding, cutting and allied processes – Safety requirements in high-pressure devices".

Methodology and instrumentation

During the acetylene decomposition test high pressure devices for acetylene are subjected to a detonative acetylene decomposition. The acetylene decomposition is initiated by igniting acetylene at an initial over-pressure of 2.5 MPa (25 bar) (for some devices additionally at an initial overpressure of 0.6 MPa (6 bar)) and generates a detonation within a 5 m long tube which is arranged downstream of the test sample.

Items tested

Types tested are mainly the following high pressure devices for acetylene:

- a) Shut-off valves
- b) Quick acting shut-off devices
- c) Non-return valves
- d) High pressure hoses
- e) Flame arrestors

Quantities / characteristics tested

During testing there shall not be any escape of gas from the test samples and the test samples shall not show any permanent deformation. For certain devices a functional test shall be carried out in connection with the acetylene decomposition test in addition. These functional tests are mainly the internal gas tightness of the test samples after the acetylene decomposition test and the trip test of automatic quick acting shut-off devices.

Uncertainty / reliability of results

The validity of the qualitative test results is ensured by control with calibrated measurement equipment and by a functional check of the test assembly before the test.

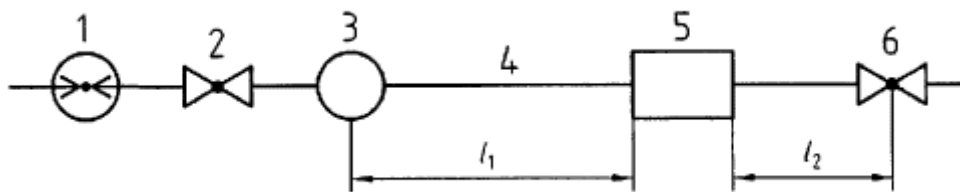
Qualification and quality assurance

To our knowledge within Europe only one other institute is able to carry out acetylene decomposition tests of high pressure devices for acetylene.

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Further information

Safety devices and fittings for high pressure acetylene have to be able to withstand a potential acetylene decomposition within the acetylene plant and fulfil their intended function reliably. Since in pipes for high pressure acetylene an acetylene decomposition may always become a detonation with temporary pressures of more than 100 MPa (1000 bar), the main test for high pressure devices according to EN ISO 14113 and EN ISO 15615 includes subjection to a detonative acetylene decomposition. The test assembly is shown schematically in the figure. This assembly basically corresponds to the testing conditions of the Technical Regulations for Acetylene Plants and Calcium Carbide Storage (TRAC), but the geometrical dimensions of the tubes are specified more precisely and require a 5 m long ignition tube downstream of the test sample and a 1 m long outlet tube upstream of the test sample. Particularly the outlet tube is a modification which to some extent results in more difficult testing conditions. In this tube a detonation can be generated again which then is reflected and hits the test sample a second time.



Test assembly for the acetylene decomposition test

- 1 Pressure measurement device
- 2 Inlet valve
- 3 Ignition unit
- 4 Steel tube, $l_1 = 5 \text{ m}$, $l_2 = 1 \text{ m}$
- 5 Test sample
- 6 Outlet valve