

Fixed Extinguishing Installations



**Position Paper on design,
dimensioning and testing of
high-pressure pipework for
gas extinguishing systems**

1 Conformity of pipework for special extinguishing systems with the EC Pressure Equipment Directive (Directive 2014/68/EU)

Conformity of piping for special extinguishing systems with the EC Pressure Equipment Directive (Directive 2014/68/EU) Pressure equipment within the meaning of the directive is all assemblies that are subjected to a pressure of more than 0.5 bar.¹ The manufacturers guarantee the conformity of all components and assemblies in accordance with the Pressure Equipment Directive or other harmonised standards or directives during manufacture and testing.

Exception: Pipe connections are generally only made at the place of use during system installation, creating a new pressure equipment. Proof of conformity within the meaning of the Pressure Equipment Directive must be provided prior to the intended use. The position paper focuses on this issue.

2 Requirements for pressure equipment manufactured on site

According to the Pressure Equipment Directive, depending on the classification of the pressure equipment, hydrostatic pressure tests are required to verify the pressure resistance and tightness. If the hydrostatic pressure test is unfavourable or not feasible, other tests that have proven to be effective can be carried out.

Suitable materials, machines, tools and trained specialist personnel are always required for the manufacture of pressure equipment.

To determine the test procedures, the pipework must be divided into the following sections:

- I. Piping and compatible connection technology (manifold and section manifold) whose conformity has been verified in accordance with the Pressure Equipment Directive (flanges, machined connections, welded connections) and are factory-made and tested
- II. Pipelines (manifolds and section distributors) with connections made from tested components whose threads/welded joints are produced manually on the construction site
- III. Open extinguishing pipes up to an operating pressure of 60 bar, whose threads/welded connections are produced manually on site.

3 Proof of conformity for sections I. to III.

Section I:

- All components (pipes, fittings) require tool certificates in accordance with DIN EN 10204 and an acceptance test certificate 3.1
- Components assembled at the factory by welding, which represent a new pressure device, are subjected to a hydrostatic strength test
- Pressure equipment that is assembled with factory-produced assemblies only needs to undergo a leak test on site

Section II:

- Welded or threaded connections are made on manufactured on site: Proof of compressive strength and tightness only via hydrostatic pressure tests or non-destructive tests

Section III:

- The pipework is manufactured on site using suitable and tested pipe materials and joining techniques. A hydrostatic pressure test is required for this.

¹ The Pressure Equipment Directive 2014/68/EU applies to the manufacture, design and conformity assessment of assemblies and pressure equipment with a pressure of more than 0.5 bar. An assembly is to be seen as a unit of several items of pressure equipment that is put into circulation assembled by a manufacturer. It can either be used directly or only as a sub-assembly for installation in an even larger assembly. Large and complex assemblies include, for example, refrigeration systems, while fire extinguishers are among the simpler ones. Pressure equipment includes pressure vessels, steam boilers, pipelines, equipment with a safety function and pressure-retaining equipment.

4 Compensation measures for pressurised equipment manufactured on site

In principle, the Pressure Equipment Directive requires hydrostatic pressure resistance and leakage tests. If the hydrostatic pressure test is unfavourable or cannot be carried out, other tests that have proven to be effective can be carried out. For tests other than the hydrostatic pressure test, additional measures, such as non-destructive tests or other equivalent methods, must be applied beforehand.

The following procedure applies to pipework in accordance with Section I:

Pipes and connecting parts are manufactured and tested in the factory with a high degree of repeat accuracy and their CE conformity is documented. The pressure equipment assembled on site (manifold, connecting pipe, distribution pipe) therefore does not need to be subjected to a new pressure resistance test. However, a leak test must be carried out for the connections of the pressure equipment. Condition: 3 bar with a maximum deviation of 20 % drop in the test pressure within 10 min. This is a leak test with gas.

The following procedure applies to pipework in accordance with Section II:

Pipelines and connections that are manufactured on site do not guarantee a high level of repeat accuracy. The pressure equipment manufactured on site must therefore be subjected to a hydrostatic pressure test in accordance with the Pressure Equipment Directive and documented.

The following procedure applies to pipework in accordance with Section III:

In the case of open pipework including the nozzle pipe network, hydrostatic verification cannot be carried out because the water used can cause damage in the event of a faulty connection. Complete drying is not possible with complex pipework systems. The pipework system would have to be opened for complete drying, which is contrary to the previous test.

For the above reasons, test methods are used for open pipelines with a maximum operating pressure of 60 bar.

These have proven to be effective for decades in providing statistical proof of strength. A prerequisite for the measures described below is that a visual inspection is always carried out, paying particular attention to the proper connection of bolted and flanged joints:

Testing of the installed pipe network by means of pressurisation during full or partial flooding. All components are pressurised in the same way as when an automatic extinguishing system is triggered; all dynamic pressure ratios are recorded.

Partial flooding

In the case of partial flooding, the pipe network to be tested is pressurised using part of the supply quantity, at least 10 %.

Full flooding

Full flooding and concentration measurements are alternative detection methods for the quantity design of the extinguishing agent if, for example, additional quantities for outflow losses are dispensed with.

In the case of full flooding, the pipe network to be tested is pressurised using the entire supply volume.

5 Quality requirements for material and connection technology

Material properties

Minimum requirements for pipes and connections are defined in the VdS planning and installation guidelines and are generally recognised as the state of the art.

Connection techniques

Only standardised connection techniques (e.g. threaded and flanged connections) are used.

Mathematical proof

The installer carries out the mathematical verification taking into account, among other things

- Operating pressure
- Temperature
- Material properties
- Type of connection technology.

Proof of quality

Factory certificates and test certificates from the manufacturers of pipes and joining techniques serve as proof of quality. Necessary quality inspections in the course of system assembly are documented by the extinguishing system installer by means of corresponding test certificates.

Qualification of assembly personnel

All connections made on site are made by the installer's trained specialists.

6 Declaration of Conformity

Gas extinguishing systems generally fall into the higher category according to the Pressure Equipment Directive, so that a conformity assessment is necessary.

In accordance with the requirements defined in this document, the extinguishing system installer confirms compliance with the Pressure Equipment Directive by means of a declaration of conformity and affixes the CE mark to the system.