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Gas welding equipment — Acetylene manifold systems for welding, cutting and allied processes — General requirements

Matériel de soudage aux gaz — Centrales de détente pour la distribution d'acétylène pour le soudage, le coupage et les techniques connexes — Exigences générales

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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Foreword

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The committee responsible for this document is ISO/TC 44, *Welding and allied processes*, Subcommittee SC 8, *Equipment for gas welding, cutting and allied processes*.

This second edition cancels and replaces the first edition (ISO 14114:1999), which has been technically revised.

Introduction

Requests for official interpretations of any aspect of this standard should be directed to the Secretariat of ISO/TC 44/SC 8 via your national standards body, a complete listing which can be found at www.iso.org.

Gas welding equipment — Acetylene manifold systems for welding, cutting and allied processes — General requirements

1 Scope

This standard applies to acetylene cylinder manifold systems extending from the cylinder valve or the bundle outlet connections to the outlet connection of the main shut-off valve. It specifies requirements for design, materials and testing of cylinder manifold systems for the supply of acetylene for use in welding, cutting and allied processes.

This standard applies to acetylene cylinder manifold systems in which acetylene single cylinders or acetylene bundles are coupled for collective gas withdrawal.

NOTE National regulations exist regarding limitation of the amount of single cylinders/bundles.

This standard also covers a test procedure for decomposition blocker.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 5175, *Equipment used in gas welding, cutting and allied processes — Safety devices for fuel gases and oxygen or compressed air — General specifications, requirements and tests*

ISO 7291:2010, *Gas welding equipment — Pressure regulators for manifold systems used in welding, cutting and allied processes up to 30 MPa (300 bar)*

ISO 9539, *Gas welding equipment — Materials for equipment used in gas welding, cutting and allied processes*

ISO 14113, *Gas welding equipment — Rubber and plastics hose and hose assemblies for use with industrial gases up to 450 bar (45 MPa)*

ISO 15296:2004, *Gas welding equipment — Vocabulary — Terms used for gas welding equipment*

ISO 15615:2013, *Gas welding equipment — Acetylene manifold systems for welding, cutting and allied processes — Safety requirements in high-pressure devices*

ISO 10961, *Gas cylinders — Cylinder bundles — Design, manufacture, testing and inspection*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 15296 and the following apply.

3.1
acetylene manifold systems
assembly of devices generally linking one or more gas sources coupled to a user pipeline system, delivering a regulated pressure under specified safe conditions

Note 1 to entry: A manifold includes for example components like collectors, safety devices, and pressure regulators.

3.2
acetylene cylinder bundle
acetylene cylinder pack
assembly of cylinders fastened together, interconnected by a manifold for collective filling and gas withdrawal, and intended to be transported as a single unit

3.3 Pressure, *p*

3.3.1
high pressure
p > 1,5 bar (0,15 MPa) up to 25 bar (2,5 MPa)

Note 1 to entry: All pressures are given as gauge pressures.

3.3.2
low pressure
$p \leq$ 1,5 bar (0,15 MPa)

Note 1 to entry: All pressures are given as gauge pressures.

3.4
manifold high pressure pipework
pipework system extending from the outlet connection of acetylene cylinders or bundles at full charging pressure to the inlet of the pressure regulator, including as required hose assemblies or coiled metal pipes, piping and high pressure valves

3.5
flame arrestor
device which arrests a flame front

[SOURCE: ISO 15296:2004, 2.4.3, modified]

3.6 Low pressure valves

3.6.1
temperature-sensitive cut-off device
device which stops the gas flow when a predetermined temperature is reached

[SOURCE: ISO 15296:2004, 2.4.5, modified]

3.6.2
pressure-sensitive cut-off device
device which interrupts the gas flow in the event of a back pressure wave from the downstream side

[SOURCE: ISO 15296:2004, 2.4.6, modified]

3.6.3
main shut-off valve
main valve downstream of the system

3.7 High pressure valves

3.7.1
quick-acting shut-off device
safety device which prevents the continued withdrawal of acetylene and/or gaseous products of decomposition from the manifold system if an acetylene decomposition or a flashback occurs

3.7.1.1
manual quick acting shut-off valve
manually activated device to quickly stop the gas flow

[SOURCE: ISO 15296:2004, 2.4.9]

3.7.1.2
automatic quick acting shut-off device
self-acting device which closes quickly, e.g. when triggered by acetylene decomposition in the high pressure manifold pipework

3.7.2
high pressure stop valve
device to prevent, when closed, the flow of gas on the high pressure side

3.8
pressure limiting device
device which limits the pressure downstream of the manifold regulator in the event of regulator failure or malfunction

Note 1 to entry: Examples of such devices are: (a) relief valve, (b) pressure actuated shut-off valves, (c) manual or automatic systems to cut the flow, (d) pressure actuated venting device.

3.9
non-return valve
device which prevents passage of gas in the direction opposite to normal flow

[SOURCE: ISO 15296:2004, 2.4.2, modified]

3.10
purge valve
device which enable a pipework system to reach atmospheric pressure or eliminate undesirable gases or residues by flushing

3.11
change-over unit
device in a two sided system allowing switching the supply of gas from the system to either of its bank of cylinders or bundles without interrupting supply

Note 1 to entry: The switching action can be manually or automatically actuated

3.12
three way valve
device which allows gas flow from one side of the high pressure manifold to enter the regulator while isolating flow from the second side

3.13
pressure regulator for manifold systems
device for regulating a generally variable inlet pressure to as constant as possible an outlet pressure when controlling the output of a manifold of cylinders

[SOURCE: ISO 7291:2010, 3.1]

3.14
decomposition blocker
safety device which stops acetylene decomposition incorporating a thermal or pressure-sensitive cut-off valve

3.15
high pressure filter
device to retain particles with a size of 100 μm or greater

4 Design and materials

4.1 Requirements for the manifold system and its components

Acetylene cylinder manifold systems shall be equipped with the following system components:

a) high pressure non-return valve according to ISO 15615 to avoid non-return flows and to prevent air and moisture contamination of the manifold system, located immediately downstream of the cylinder or bundle outlet. Alternatively combination of purge valve and non-return valve located downstream of the coiled metal pipe or high pressure hose can be used;

b) high pressure pipework or coiled metal pipe with pipe wall thicknesses determined according to the methods in ISO 10961 to connect the cylinder or bundle outlet to the manifold inlet, including high pressure hoses according to ISO 14113;

c) manual (only possible for systems up to 2 × 8 cylinders) or automatic quick acting shut-off valves according to ISO 15615 upstream of the manifold regulator;

d) for a one side system, a high pressure stop valve according to ISO 15615:2013, 3.7 shall be used. For a two side system, a three way valve according to ISO 15615:2013, 3.6 can be used instead of the two high pressure stop valves according to ISO 15615:2013, 3.7;

e) pressure regulators for manifold systems according to ISO 7291 or for change over units;

f) pressure limiting device according to ISO 5175 downstream of the manifold regulator. Any vented gas shall be piped to a safe location. The pressure limiting device shall be sized in such a way that the low pressure side of the manifold does not exceed two times the working pressure in any case.

g) low pressure pipework downstream of the pressure regulator;

h) Safety devices according to ISO 5175 for the low pressure output of the manifold system, including as appropriate single or combination devices for non-return flow, flame arresting, temperature or pressure-sensitive cut-off valve. In the case of a pipework with inner diameter ≥ 25 mm at the low pressure side of the system, as an alternative to the above mentioned safety devices, a decomposition blocker (see 5.3) with a temperature- or pressure-sensitive cut-off can be installed, if the downstream system is already protected with non-return valves.

i) High pressure manometers according to ISO 15615 used in the high pressure part of two-sided systems.

Annex A gives examples for the configuration of the system components. If there are more gas sources (cylinders/bundles) in the manifold system, the setup shall be analogue to the setups given in the drawings of Annex A.

4.2 Materials of construction

The materials shall be resistant to acetylene, acetone and dimethylformamide (DMF) as well as to the mechanical, chemical and thermal loads which occur under operating conditions in accordance with ISO 9539 and ISO 14113.

5 Tests

5.1 Strength test

All high pressure and low pressure manifold components shall be tested for their resistance to the pressures likely to be encountered in acetylene service.

For the high pressure part, all components shall withstand an hydraulic test of 315 bar (31,5 MPa) for five minutes unless individual standards covering them require higher pressures. After pressurization

there shall be no visible permanent deformation. Additionally, high pressure pipework design minimum wall thicknesses should allow for acetylene decomposition overpressures.

For the low pressure parts, unless individual standards require higher pressures or hydraulic testing, all components shall withstand a pneumatic test of minimum 24 bar (2,4 MPa).

NOTE Design recommendations for high pressure pipework are given in documents such as IGC 123/04 or equivalent.

System components which have been pressure tested according to other standards for acetylene service shall be removed or otherwise protected before the strength test, e.g. pressure gauges, relief valves, regulators.

5.2 External gas tightness test

The manifold system shall be tested for leaks at commissioning on site by the installer. No visible leakage shall be detected when tested as specified below.

Two tightness tests shall be performed on the high pressure part:

a) a test at low pressure at 1 bar (0,1 MPa);

b) a test at high pressure at least at 18 bar (1,8 MPa).

The low pressure part [between the regulator outlet and the outlet connection of the main shut-off valve (see 17 in Table A.1)] shall be tested at the maximum outlet pressure of the regulator.

5.3 Decomposition blocker

The decomposition blocker shall stop acetylene decomposition, when tested in accordance with Annex B.

When the decomposition blocker is subjected to acetylene decomposition, there shall be no visible permanent deformation or part ejection:

a) on the gas inlet side at an initial gauge pressure of 1,5 bar (0,15 MPa), triggered by an upstream high pressure section at a gauge pressure of 25 bar (2,5 MPa);

b) on the gas outlet side at an initial gauge pressure of 2,5 bar (0,25 MPa).

The flame detector shall not detect a flame.

6 Marking

The following information shall be clearly and permanently marked on a plate permanently fixed to the manifold system:

a) number of this standard;

b) name or trademark of the manufacturer or distributor;

c) type of gas “Acetylene”;

d) maximum regulated pressure [bar] [MPa];

e) maximum flow of the system at 15 °C [m^3/h];

f) minimum and maximum operation temperature (– 20 °C/+ 60 °C);

g) year and month of manufacturing/installation.

7 Instructions for use

The manufacturer, supplier or distributor shall supply instructions for use with each manifold system, covering:

a) field of application of the manifold system;

b) description of manifold system, location and the meaning of the marking;

c) the safe and correct installation of the manifold system;

d) the commissioning tests that are necessary to prove safe and correct installation prior to service;

e) the use, maintenance, disassembly and disposal of the manifold system; this includes trouble shooting, hazards and safety precautions.

If acetylene decomposition has entered a flame arrestor or a decomposition blocker, users should inspect the entire supply system especially the manifold regulator.

If any damage is detected in the manifold regulator or any other parts of the system, they should be refurbished in accordance with the instructions of the manufacturer.

Annex A
(normative)

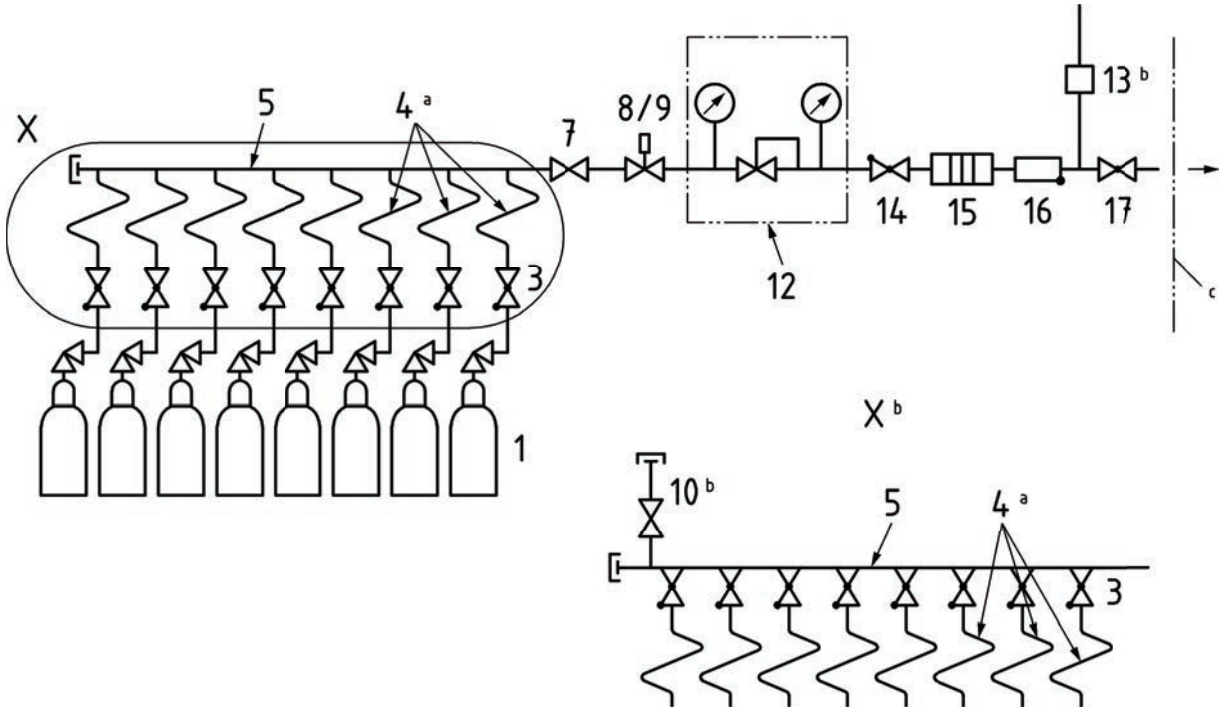
Configurations of acetylene manifold systems

A.1 Components of acetylene manifold systems

A list of components contained in Figures A.1 to A.5 can be found in Table A.1.

Table A.1 — List of components contained in Figures A.1 to A.5

Component number	Component description
1	cylinder
2	bundle (see 3.2)
3	high pressure non-return valve (see 3.9)
4	high pressure hose assembly or coiled metal pipe
5	high pressure piping (see 3.4)
6	three-way valve (see 3.12)
7	high pressure stop valve (see 3.7.2)
8	manual quick acting shut-off device (see 3.7.1.1)
9	automatic quick acting shut-off device (see 3.7.1.2)
10	high pressure purge valve(optional, see 3.10)
11	high pressure filter (optional, see 3.15)
12	manifold regulator (see 3.13)
13	pressure limiting device (see 3.8)
14	low pressure non-return valve (see 3.9)
15	flame arrestor (see 3.5) or decomposition blocker (see 3.14)
16	temperature-sensitive cut-off device (see 3.6.1) or pressure-sensitive cut-off device (see 3.6.2)
17	main shut-off valve (see 3.6.3)



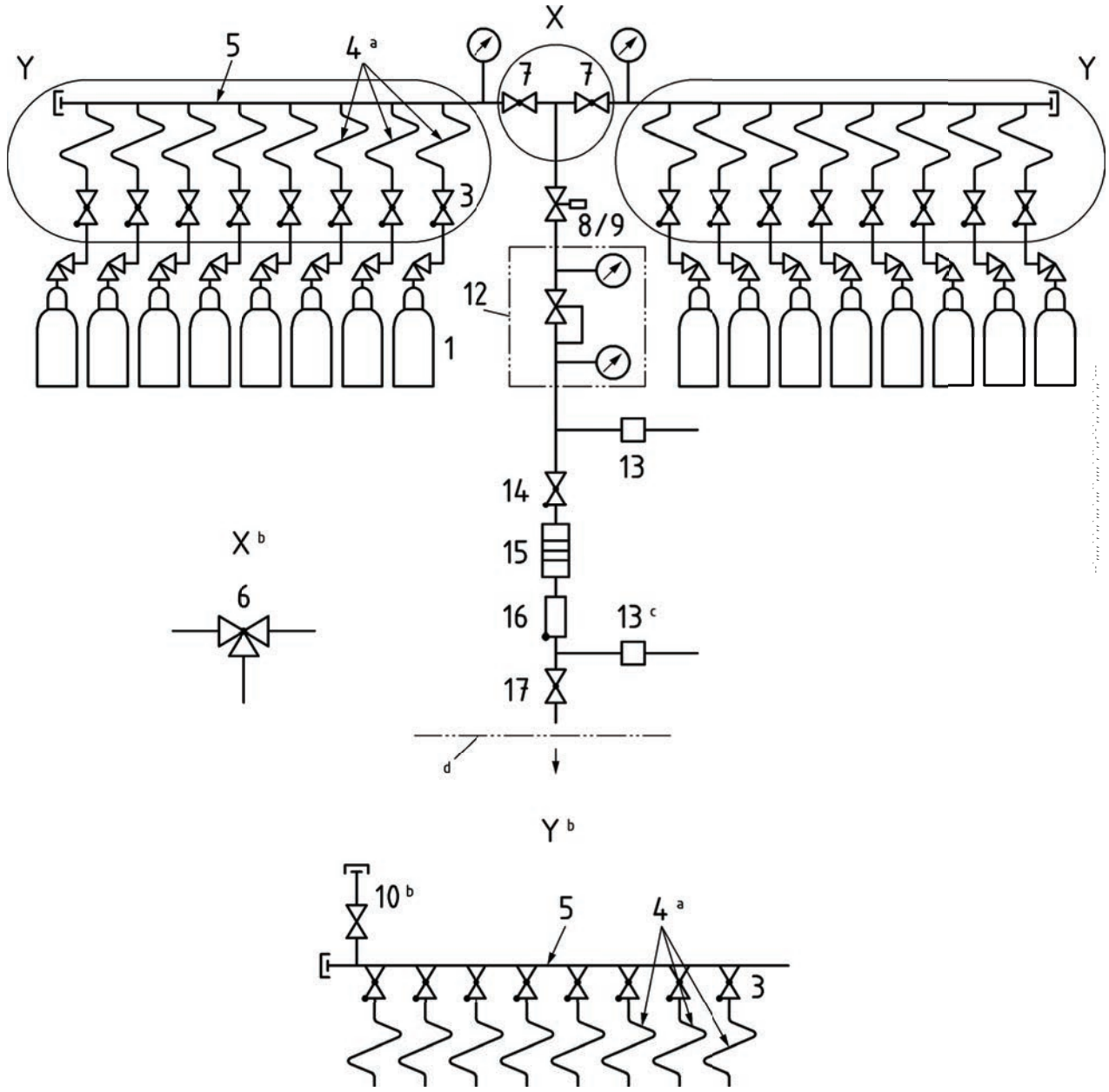
Key

a and/or 5

b alternative

c scope of the standard

Figure A.1 — One sided cylinder system (1 × 8 cylinder shown)



Key

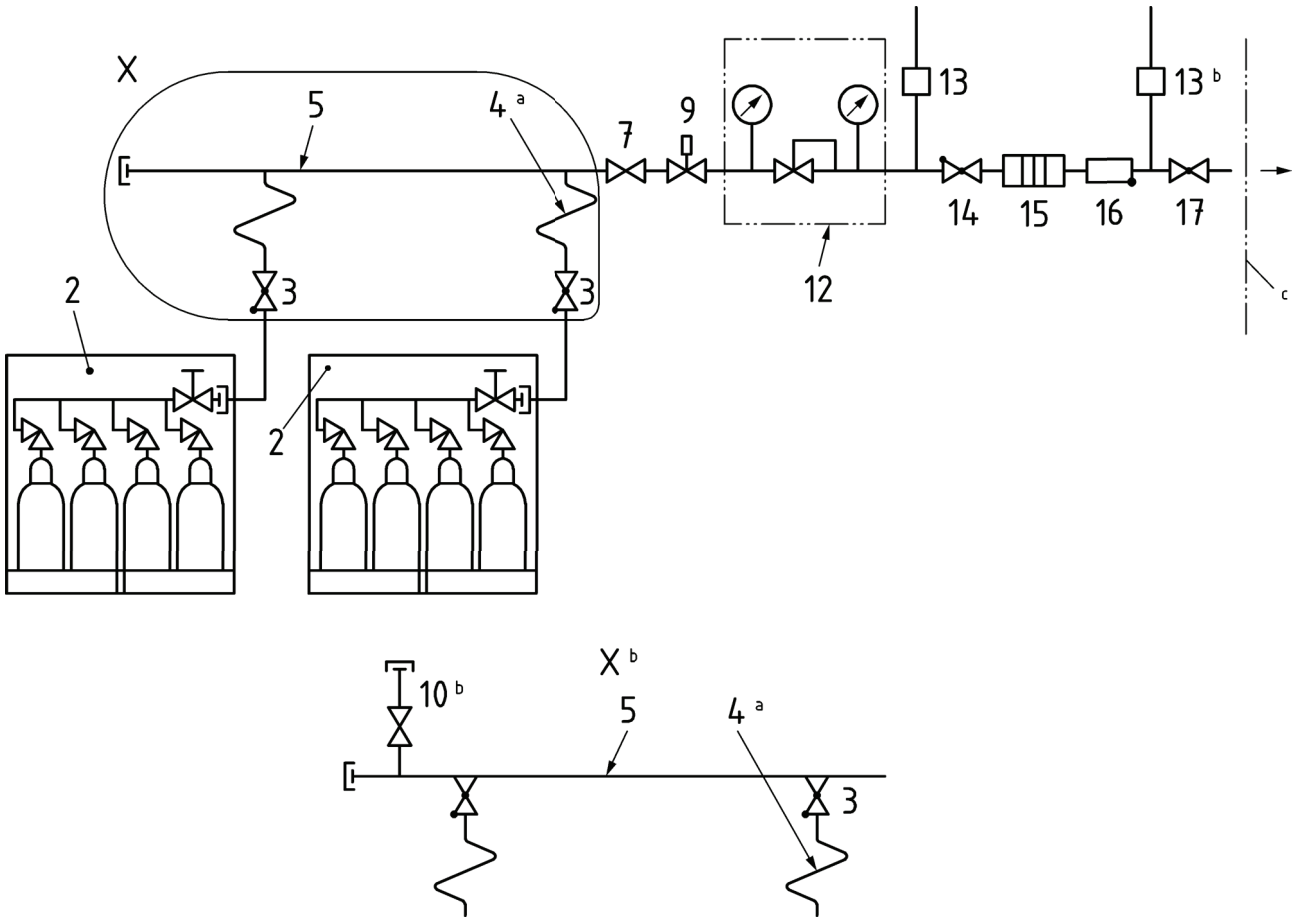
a and/or 5

b alternative

c optional

d scope of the standard

Figure A.2 — Two sided cylinder system (2 × 8 cylinder shown)



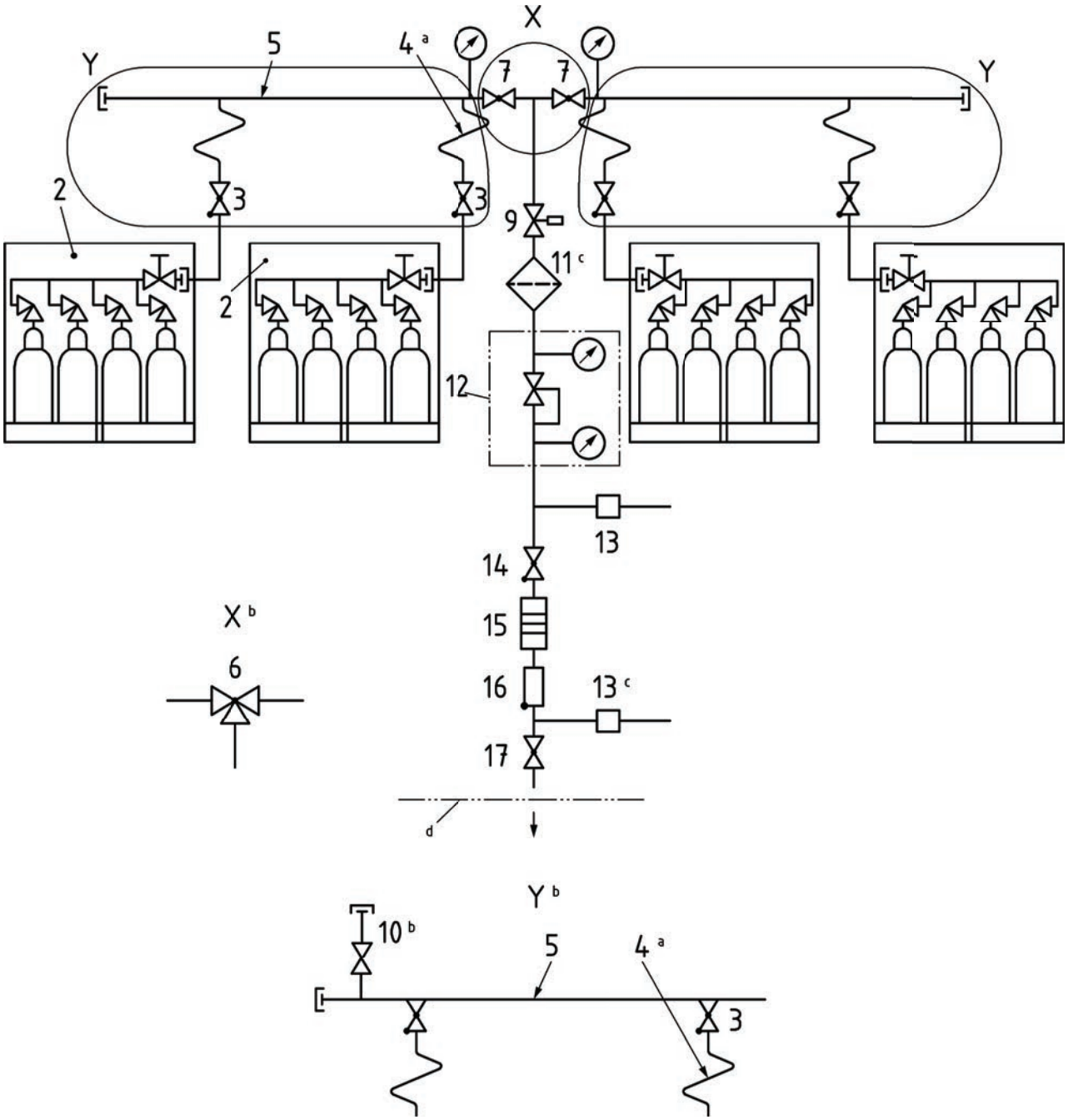
Key

a and/or 5

b alternative

c scope of the standard

Figure A.3 — One sided bundle system (two bundles shown)



Key

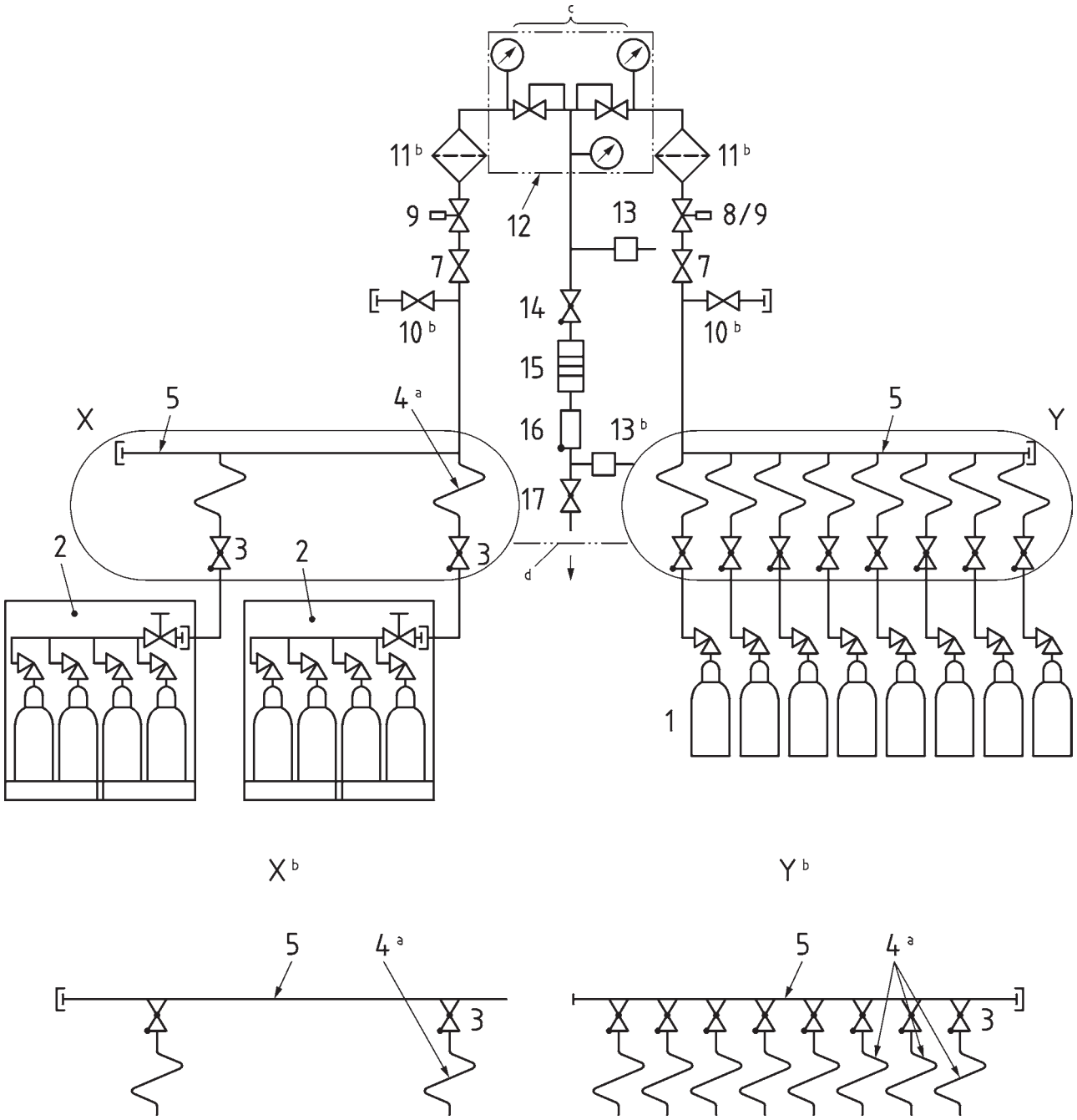
a and/or 5

b alternative

c optional

d scope of the standard

Figure A.4 — Two sided bundle system (2 × 2 bundles shown)



Key

a and/or 5

b alternative

c change over unit

d scope of the standard

Figure A.5 — Two sided system for cylinders or bundles with an example of change over unit (two bundles shown on left side, eight cylinders shown on right side)

Annex B
(informative)

Test procedure for decomposition blocker

B.1 General

Three samples of decomposition blockers from the gas inlet side and three from the gas outlet side shall be subjected to decomposition with static pure acetylene.

The tests in B.2 and B.3 shall be carried out under the following general test procedure:

— The whole test assembly shall be leak tested with nitrogen corresponding to the initial test pressure and then evacuated up to 10 mbar (absolute pressure).

— The entire system shall be filled with acetylene according to a pressure given in the drawings of the test assembly.

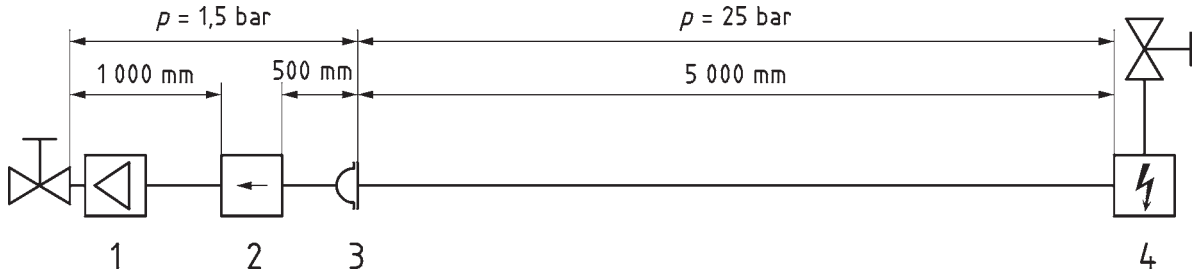
— The test assembly shall be isolated from the acetylene gas supply. Shut-off valves shall be closed.

— The ignition circuit shall be operated and it shall be checked whether a detonation or a deflagration respectively has occurred.

The initial pressure of acetylene is as defined at a temperature of (20 ± 5) °C. If the temperature at the test assembly is outside the range of (20 ± 5) °C, the pressure should be corrected according to the ideal gas law. The minimum temperature is 5 °C.

B.2 Test from the gas inlet side

See Figure B.1.



Key

1 flame detector

2 test sample with direction of gas flow

3 bursting disc (bursts at 40 bar ± 5 bar (4,0 MPa ± 0,5 MPa)) with throttle (inner diameter: 10 mm)

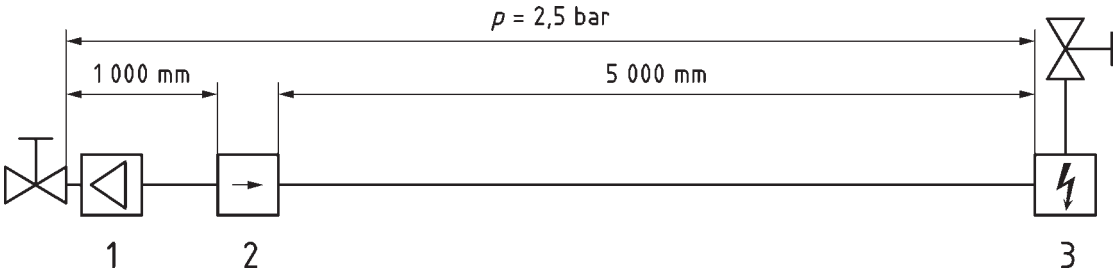
4 ignition by fusible metal wire, ignition energy less than 100 J

Figure B.1 — Test setup for the test from the gas inlet side

The tube diameters between 1 and 2 and between 2 and 3 shall be equal to the nominal bore of the test sample. The tube inner diameter between 3 and 4 shall be 25 mm.

B.3 Test from the gas outlet side

See Figure B.2.



Key

1 flame detector

2 test sample with direction of gas flow

3 ignition by fusible metal wire, ignition energy less than 100 J

Figure B.2 — Test setup for the test from the gas outlet side

The tube diameters shall be equal to the nominal bore of the test sample.

ICS 25.160.30

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