
**Ships and marine technology — Fire
resistance of metallic pipe components
with resilient and elastomeric seals —
Requirements imposed on the test bench**

*Navires et technologie maritime — Résistance au feu des composants
de tuyaux métalliques avec joints élastiques ou élastomères —
Exigences imposées au banc d'essai*



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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 19922 was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 3, *Piping and machinery*.

Introduction

This International Standard does not apply to components for use in piping systems made of plastic. Such components may be tested in accordance with IMO Resolution A.753 (18), *Guidelines for the application of plastic pipes on ships*.

Tests with reproducible results are possible with the test bench specified in this International Standard for the determination of fire resistance of metallic pipe components containing a resilient or elastomeric seal. As a consequence of the connecting arrangement of the test pieces, it is possible not only to test the fire resistance of the pipeline component's systems but also the connection between the pipeline and pipeline component, which may be critical. The requirement for a burner that covers a wide area and generates flames that envelop the pipeline component under test was intended to simulate a type of flame found in practice.

The limited working pressure of 1 MPa (10 bar) and the requirement for a non-flammable test medium (water) were implemented in order to ensure the safety of operating personnel as well as to protect the test bench in case damage occurs at the test piece during the test.

In case of a request for a flame test under different test conditions, e.g. flame temperature, working pressure or duration of flame application, the test is carried out in accordance with this International Standard and in accordance with ISO 19921, but under the specific conditions requested.

Ships and marine technology — Fire resistance of metallic pipe components with resilient and elastomeric seals — Requirements imposed on the test bench

CAUTION — During exposure to flames using the test bench specified in this International Standard, working pressures up to 1 MPa (10 bar) are possible within the piping system.

1 Scope

This International Standard specifies requirements on a test bench for determining the fire resistance of metallic pipeline components containing a resilient or elastomeric material, in particular by tests according to ISO 19921.

2 Normative references

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

ISO 10012, *Measurement management systems — Requirements for measurement processes and measuring equipment*

IEC 60051-1, *Direct acting indicating analogue electrical measuring instruments and their accessories — Part 1: Definitions and general requirements common to all parts*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

fire resistance

ability of an element of construction, component or structure to fulfil for a stated period of time the required stability, integrity, thermal insulation and/or other expected duty specified, in a standard fire-resistance test

4 Requirements

4.1 Components of test bench

The test bench shall consist of the following components (see Figures 1 and 2):

- burner chamber with connecting device for the test piece, burner and trunk for exhaust gas (see 4.2);
- aggregate box with equipment for conditioning and controlling the test medium (see 4.3);
- equipment for monitoring and recording the test procedure (see 4.4);
- pressure-producing equipment which can load the test piece at the end of flame application with a test pressure as specified in the technical specification (see 4.5).

4.2 Burner chamber

4.2.1 General

The holder of the test piece shall be arranged to an operation height (e.g. 1 100 mm).

Agreement must be reached between the client and operator of the test bench on how the test piece will be attached to the test bench.

A steady airflow from bottom to top shall be provided. The base area of the air supply shall be approximately 0,6 m².

An example arrangement of a burner chamber is given in Figure 2.

4.2.2 Burner

The total burner sectional area shall be at least 150 mm × 500 mm. However, the burner shall be large enough to extend at least 20 mm on all sides of the test piece such that the test piece is completely enclosed by the flames. The sectional area may consist of several single-area burner units.

Burners used shall be of the fan-assisted type with a minimum of 20 nozzles per 10⁻² m².

Each single-area burner unit shall be provided with a mixing fitting for mixing the gas and the combustion air, creating a neutral flame of 800 °C ± 50 °C below the pipeline component under test.

When adjusting the flame, the burner area must be moveable in such a way that the test piece which has been fitted is not exposed to the flames.

The burner shall be variable in height in order that test pieces of all possible nominal diameters can be enveloped by the flame. The temperature measured 15 mm +₀⁵ mm directly under the test piece shall be 800 °C ± 50 °C.

4.2.3 Exhaust gas trunk

The exhaust gas shall be drawn off upwards by means of an exhaust fan. The fan shall be fitted with continuously variable speed control. The upward airflow shall produce a directed flame.

Environmental restrictions according to local law shall be taken into consideration.

4.2.4 Coolant circuit

For controlling the coolant circuit, shut-off valves and measuring instruments shall be provided in the coolant supply and drain line.

4.3 Aggregate box

Heating and cooling arrangements shall be provided for supplying the test piece with water of 80 °C ± 2 °C at the test-piece inlet.

The velocity of flow of the test medium in the test piece shall be adjustable to ≥ 0,1 m/s.

The installation shall provide for an adjustable working pressure, with a minimum required pressure of 500 kPa (5 bar) adjustable up to 1 MPa (10 bar) during the fire test, with the test piece fitted. For safety reasons, the design pressure of the piping system shall be at least 1,2 MPa (12 bar).

4.4 Monitoring and recording

4.4.1 Control and adjustments

The parameters listed in Figure 1 and Table 1 shall be controllable or adjustable in the given range via suitable means.

Table 1 — Parameter control and adjustment ranges

| Item reference in Figure 1 | Parameter | Range | Remarks |
|----------------------------|---------------------------|--|---|
| a and b | water temperature | at test piece, inlet: 80 °C ± 2 °C, at test piece, outlet: max. 85 °C | — |
| c | flame temperature | 800 °C ± 50 °C | Temperature 15 mm $^{+5}_0$ mm below test piece |
| d | flow rate of water | — | The flow rate of water shall be large enough for the requirements imposed on the temperature of the throughput medium to be met |
| e | working pressure of water | up to 1 MPa (10 bar), max. deviation: ± 10 kPa (± 0,1 bar) | Working pressure selectable; deviation limit applies to pressure selected |
| f | test duration | max. 9 999 s | Stop at end of test or interruption |

4.4.2 Parameter recording

Test parameters shall be measured, recorded and indicated as detailed in Table 2.

Table 2 — Parameter recording requirements

| Item reference in Figure 1 | Parameter | Measurement, recording and indication |
|----------------------------|--|---------------------------------------|
| a | water temperature at test piece, inlet | X |
| b | water temperature at test piece, outlet | X |
| c | flame temperature below centre of test piece | X |
| d | volume flow rate of water | X |
| e | working pressure during test | X |
| f | test duration | |
| | | |

Additional measuring instruments, e.g. for gas consumption, and signal bulbs for going above and below permitted temperatures, pressures, etc. may be provided by the operator of the test bench. The net calorific value of the used gas and the computation of heat consumption shall be recorded.

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The instruments shall correspond to following precision classes, or have the following tolerances:

Pressure gauges: 1,0 % of max. scale value.

Electrical measuring instruments: Class 1 in accordance with IEC 60051-1.

Non-electrical measuring instruments: 1,0 % of max. scale value.

The survey of the testing equipment shall be carried out according to an admitted quality control system, e.g. according to ISO 10012.

4.4.3 Safety equipment

4.4.3.1 Requirements

The following requirements apply to the test bench set-up.

- a) A thermo-electrical ignition safety feature shall protect the gas supply to the burner. The gas supply to the burner shall automatically be switched off when
 - the flame extinguishes by itself;
 - the pressure drops in the test piece;
 - the test box is opened;
 - the gas exhaust is insufficient;
 - an emergency stop occurs.
- b) In case of switching off for safety reasons, quick closing valves shall cut off at the test piece inlet and outlet. The circuit pressure shall be released.
- c) In case the test piece is destroyed, the evacuation of leakage water from the burner shall be ensured.
- d) The working pressure in the water circuit shall be limited to 1,1 MPa (11 bar) by a safety valve.

4.4.3.2 Test

The conditions specified in 4.4.3.1 a) for a switch-off of the gas supply shall be set. The gas supply shall be interrupted.

After all switching off according to 4.4.3.1 a), proof shall be established that the requirements according to 4.4.3.1 b) are met.

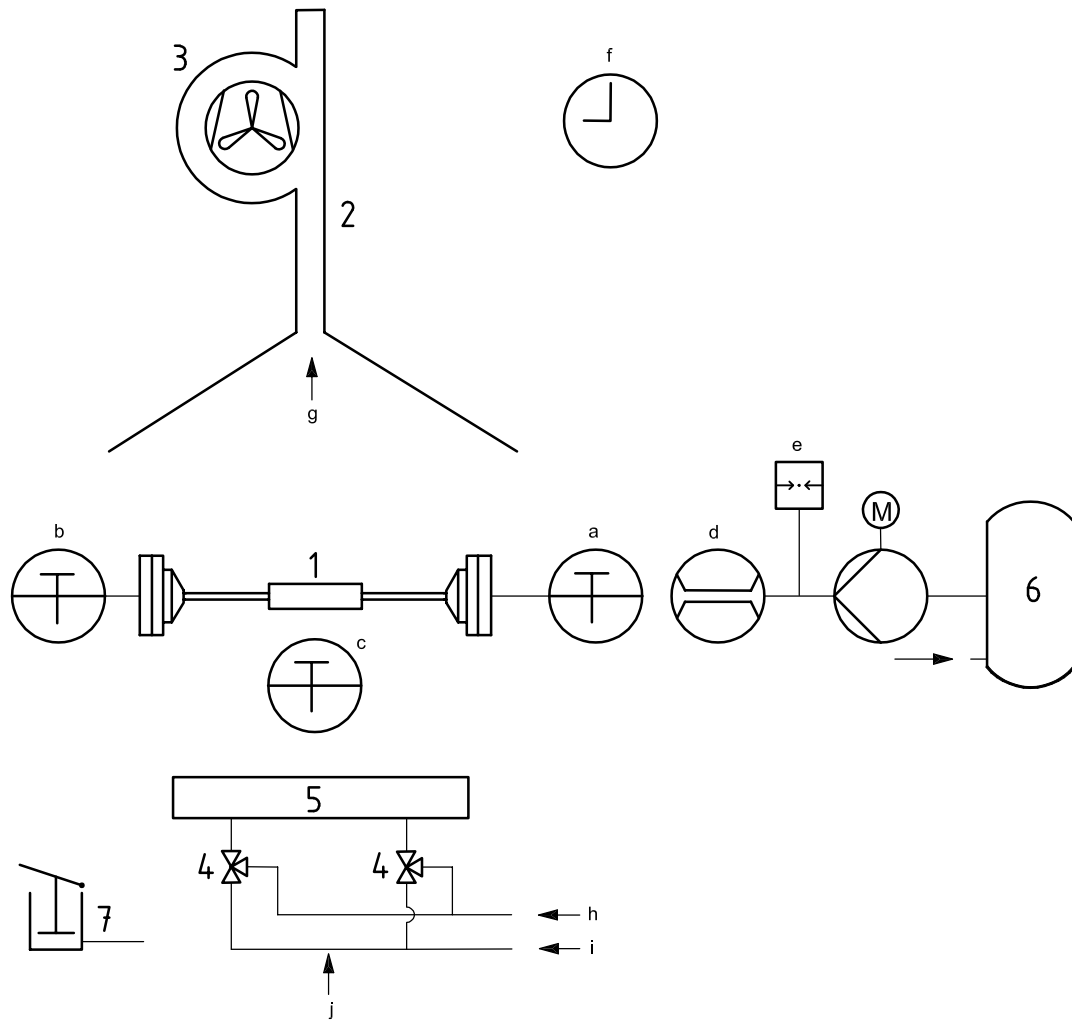
The burner shall be flooded once, while the gas supply is switched off. Proof shall be established that the water is evacuated as required in 4.4.3.1 c).

Proof shall be established that the working pressure safety valve limits the working pressure in the system to 1,1 MPa (11 bar) as required in 4.4.3.1 d).

4.5 Pressure-producing equipment

Pressure-producing equipment, which can load the test piece with an internal working pressure up to its test pressure according to a standard or other specification at the end of the flame application, shall be provided.

This pressure-producing equipment can be arranged outside the actual test bench.

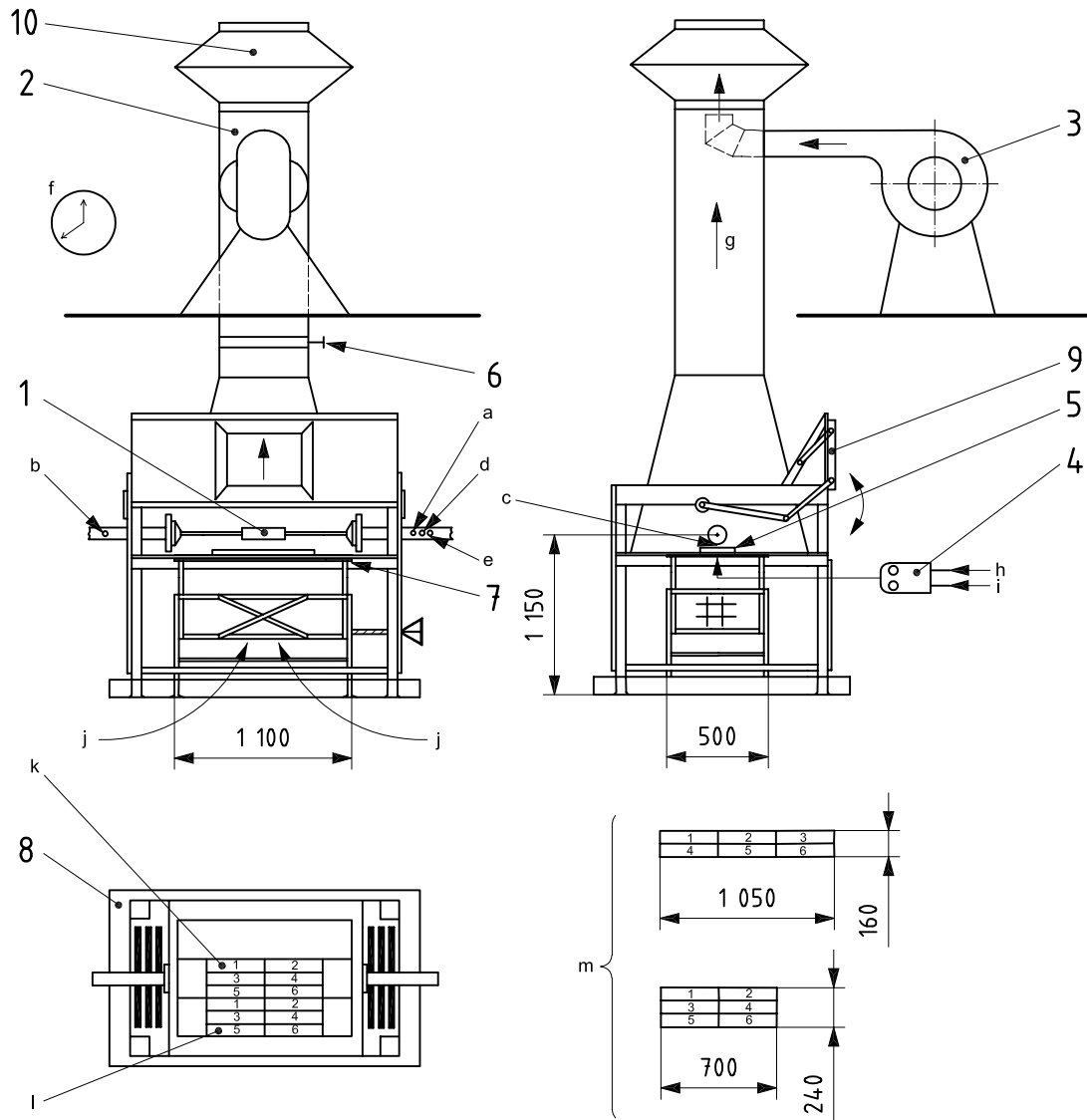


Key

- 1 test piece
- 2 exhaust gas trunk
- 3 exhaust fan
- 4 mixing valve
- 5 sectional area burner
- 6 water tank with heating/cooling
- 7 pump for pressure test

- a Water temperature at test piece, inlet.
- b Water temperature at test piece, outlet.
- c Flame temperature below centre of test piece.
- d Flow rate of water.
- e Working pressure during test.
- f Test duration.
- g Exhaust gas.
- h Gas.
- i Combustion air.
- j Air supply.

Figure 1 — Diagram of test bench and burner chamber



Key

- 1 test piece
 - 2 exhaust gas trunk
 - 3 exhaust fan
 - 4 mixing valve
 - 5 sectional area burner
 - 6 throttle valve
 - 7 burner support
 - 8 drip tray for water, residues of combustion
 - 9 view window
 - 10 diffuser
- a Water temperature at test piece, inlet.
 - b Water temperature at test piece, outlet.
 - c Flame temperature below centre of test piece.
 - d Flow rate of water.
 - e Working pressure during test.
 - f Test duration.
 - g Exhaust gas.
 - h Gas.
 - i Combustion air.
 - j Air supply.
 - k Working position of sectional area burner.
 - l Position of sectional area burner while adjusting flame temperature.
 - m Example of burner arrangement: six burner units forming two different burner sectional areas.

Figure 2 — Example of a burner chamber

Bibliography

- [1] ISO 19921, *Ships and marine technology — Fire resistance of metallic pipe components with resilient and elastomeric seals — Test methods*
- [2] ISO 2768-1, *General tolerances — Part 1: Tolerances for linear and angular dimensions without individual tolerances indications*

