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BSI Standards Publication

Fire resistance tests for service installations

Part 12: Non-mechanical fire barrier for ventilation ductwork

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National foreword

This British Standard is the UK implementation of EN 1366-12:2014.

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A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Foreword

This document (EN 1366-12:2014) has been prepared by Technical Committee CEN/TC 127 “Fire safety in buildings”, the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2015 and conflicting national standards shall be withdrawn at the latest by April 2015.

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

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directives.

EN 1366, *Fire resistance tests for service installations,* consists of the following parts:

— *Part 1: Ventilation ducts*;

— *Part 2: Fire dampers*;

— *Part 3: Penetration seals*;

— *Part 4: Linear joint seals*;

— *Part 5: Service ducts and shafts*;

— *Part 6: Raised access and hollow core floors*;

— *Part 7: Conveyor systems and their closures*;

— *Part 8: Smoke extraction ducts*;

— *Part 9: Single compartment smoke extraction ducts*;

— *Part 10: Smoke control dampers*;

— *Part 11: Fire protective systems for cable systems and associated components (in preparation)*;

— *Part 12: Non-mechanical fire barrier for ventilation ductwork (this document)*;

— *Part 13: 1-, 2-, 3- sided ducts (in preparation)*;

— *Part 14: Kitchen extract ducts;*

— *Part 15*: *Mixed penetrations including pipes cables, ducts and dampers*.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

The purpose of the test is to evaluate the ability of a non-mechanical (no moving parts) fire barrier (see Annex A) to prevent fire and smoke spreading from one fire compartment to another through the air ductwork system which may penetrate fire separating walls and floors.

Non-mechanical fire barriers are unable to achieve an “S” classification, which requires a known limited ambient leakage, as they are unable to be closed except under fire conditions.

The non-mechanical fire barrier is attached (directly or remotely via a section of ducting), to a fire separating element in a manner representative of practice.

Tests are performed starting with the non-mechanical fire barrier in its cold standard state to expose it to furnace conditions.

Temperature and integrity measurements are carried out in various parts of the test construction during the test. The leakage of the non-mechanical fire barrier system is measured (continuously during the test) by direct flow measurements while maintaining a constant pressure differential across the closed non-mechanical fire barrier of 300 Pa.

Caution:

The attention of all persons concerned with managing and carrying out this fire resistance test is drawn to the fact that fire testing may be hazardous and that there is a possibility that toxic and/or harmful smoke and gases may be evolved during the test. Mechanical and operational hazards may also arise during the construction of the test elements or structures, their testing and disposal of test residues.

An assessment of all potential hazards and risks to health should be made and safety precautions should be identified and provided. Written safety instructions should be issued. Appropriate training should be given to relevant personnel. Laboratory personnel should ensure that they follow written safety instructions at all times.

1 Scope

This part of EN 1366 specifies a method for determining the fire resistance of non-mechanical fire barriers installed in fire separating elements designed to withstand heat and the passage of smoke and gases at high temperature. This European Standard is used in conjunction with EN 1363-1 and EN 1366-2.

This European Standard is not suitable for testing non-mechanical fire barriers in suspended ceilings without modification.

This European Standard is not suitable for testing fire dampers, see EN 1366-2.

This European Standard is not suitable for testing such products as air transfer grilles, as the pressures and flows involved are different and may cause differing behaviour.

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.

EN 1363-1, *Fire resistance tests - Part 1: General Requirements*

EN 1363-2, *Fire resistance tests - Part 2: Alternative and additional procedures*

EN 1366-2, *Fire resistance tests for service installations - Part 2: Fire dampers*

EN ISO 5167-1, *Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full - Part 1: General principles and requirements (ISO 5167-1)*

EN ISO 5167-2, *Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full - Part 2: Orifice plates (ISO 5167-2)*

EN ISO 5167-3, *Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full - Part 3: Nozzles and Venturi nozzles (ISO 5167-3)*

EN ISO 13943, *Fire safety - Vocabulary (ISO 13943)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1363-1, EN 1366-2 and EN ISO 13943, together with the following, apply.

3.1
non-mechanical fire barrier
open device with no moving parts for use in HVAC ventilation systems at fire boundaries that only closes to maintain compartmentation in the event of a fire

3.2
test specimen
non-mechanical fire barrier, connecting frame and (if applicable) the perimeter penetration sealing system

3.3
connecting duct
duct section between the non-mechanical fire barrier or supporting construction and the measuring station

3.4
test construction
complete assembly of the test specimen, the connecting duct and the supporting construction

3.5
measuring station
equipment installed between the connecting duct and the exhaust equipment to determine the volume flow rate of gases passing through the fire barrier under test

3.6
exhaust equipment
equipment consisting of a fan and balancing or dilution barriers (if any), to apply and maintain the underpressure in the connecting duct

4 Test equipment

4.1 General

In addition to the test equipment specified in EN 1363-1, and if applicable, EN 1363-2, the following is required. Examples of test configurations are shown in Figures 1 and 2.

4.2 Connecting duct

The connecting duct shall be of all welded construction fabricated from (1,5 ± 0,1) mm thick steel of the same size (width x height or diameter) as the non-mechanical fire barrier being tested. The duct shall have a length of two times the diagonal dimension of the non-mechanical fire barrier up to a maximum of 2 m. Where a non-mechanical fire barrier that has a short spigot such that connection to the connecting duct is difficult, this spigot shall be extended by 500 mm using material of the same type and thickness of the spigot in order to provide a secure air-tight connection without unduly stiffening the non-mechanical fire barrier. This extended spigot shall be all welded the same as the connecting duct. The length of the connecting duct shall then be reduced by 500 mm.

The connecting duct may be provided with a gas tight observation window.

Care should be taken in the event of testing to Figure 4, to select a method of connecting the non-mechanical fire barrier to the ductwork to ensure that accurate leakage is recorded.

4.3 Volume flow measuring station

This shall consist of a venturi, orifice plate, or other suitable device and (where necessary) an air flow straightener, installed in straight lengths of pipe, all sized to EN ISO 5167-1, EN ISO 5167-2 and EN ISO 5167-3. It shall be installed between the connecting duct and the exhaust fan to determine the volume flow rate of gases passing through the non-mechanical fire barrier under test. The measuring device shall be capable of measuring to an accuracy of ± 5 %. Regardless of whether vertical or horizontal non-mechanical fire barriers are being tested, the volume flow measuring station shall always be used in a horizontal orientation.

4.4 Condensing unit

Where materials used in the construction of a non-mechanical fire barrier may generate quantities of steam during the fire test, a condensing unit having provision for drainage shall be installed between the non-

mechanical fire barrier and the flow measuring device. When using the condensing device, the temperature recorded by the thermocouple positioned downstream of the flow measuring device described in 4.3 shall not exceed 40 °C.

4.5 Gas temperature measuring devices

These shall be positioned adjacent to the flow measuring device. A suitable device is a 1,5 mm diameter sheathed thermocouple orientated vertically with its measuring junction located at the centre line of the measuring duct and at a distance equal to twice the diameter of the measuring duct downstream from the flow measuring device. A similar thermocouple may be located at the exit from the connecting duct plenum for information purposes only (see Figure 1).

4.6 Exhaust fan system

This shall be capable of controlling the flow rates and maintaining the specified pressure differential between the connecting duct and the furnace when the non-mechanical fire barrier is closed under fire conditions.

The 300 Pa (or higher if applicable) pressure differential shall be regulated by a suitable control system. The pressure shall be controlled to within ± 5 % of the specified value.

5 Test conditions

The heating conditions and the furnace atmosphere shall conform to those given in EN 1363-1, or if applicable, EN 1363-2.

The furnace pressure shall be controlled to EN 1363-1, except in the case of testing non-mechanical fire barriers installed in a vertical separating element when the pressure shall be controlled to (15 ± 3) Pa at mid height of the non-mechanical fire barrier. If two or more such non-mechanical fire barriers are being tested simultaneously, this pressure shall be established at mid height of the lower non-mechanical fire barrier.

For non-mechanical fire barriers installed in a horizontal separating element the pressure shall be controlled to (20 ± 3) Pa at 100 mm below the underside of the separating element to which it is fixed.

Details of pressure conditions within the connecting duct are given in 9.2.

6 Test specimen

6.1 Size

For the fire test, see 10.2, the maximum size of non-mechanical fire barrier shall be tested. If this is made from sections, the maximum number of sections with all their framework (transoms and mullions) shall be tested.

6.2 Number of tests

6.2.1 General

The number of tests depends on various factors.

- Supporting construction;
- method of installation in the supporting construction;
- method of installation on to the supporting construction;

- method of installation away from the supporting construction.

It may be seen that there are considerable combinations of supporting constructions, installation methods etc. and this leads to a large number of tests.

Reference should be made to the extended field of application standard before starting a test program as careful consideration of this may reduce the number of tests that need to be completed. It is advisable that this is done in conjunction with a notified body or test authority.

6.2.2 Supporting construction

Typical supporting constructions would be masonry walls, blockwork walls, dry walls, concrete floors etc. Other supporting constructions may be available and these should be used if it is proposed that the non-mechanical fire barrier be tested in conjunction with them.

6.2.3 Method of installation in the supporting construction

Each method proposed for installation in each supporting construction shall be tested. The non-mechanical fire barrier shall be tested both ways round.

NOTE There were many discussions on symmetry in the revision and development of this standard. It proved impossible to define symmetry in an objective way to allow all test or authorizing bodies to apply rules in a similar way, particularly in the case of installation in the supporting construction. Also to be considered was where the non-mechanical fire barrier was installed in the depth of the wall and so on. The concept of symmetry has been removed from the standard.

6.2.4 Method of installation on to the supporting construction

Each method proposed for installation on to each supporting construction shall be tested. One test shall be undertaken with the non-mechanical fire barrier inside the furnace and one test undertaken with the non-mechanical fire barrier outside the furnace. The face of the non-mechanical fire barrier to be presented to the supporting construction shall be clearly identified so that in cannot be installed the wrong way round on site. If it is to be allowed to be installed either way round it shall be tested both ways round inside the furnace and both ways round outside the furnace.

In the case of an uninsulated non-mechanical fire barrier fixed in this manner, only a barrier on the inside of the furnace needs to be tested, as this is considered to be to the most onerous condition.

6.2.5 Method of installation away from the supporting construction

Each method proposed for installation away from each supporting construction shall be tested. One test shall be undertaken with the non-mechanical fire barrier inside the furnace and one test undertaken with the non-mechanical fire barrier outside the furnace. The face of the non-mechanical fire barrier on the side of the supporting construction shall be clearly identified so that in cannot be installed the wrong way round on site. If it is to be allowed to be installed either way round it shall be tested both ways round inside the furnace and both ways round outside the furnace.

In addition to the largest size, when testing on the outside of the furnace only, a non-mechanical fire barrier of the smallest size shall be tested. This is to prove closure when restricted exposure is given to the radiant heat of the furnace.

The method of support of the ductwork through the supporting construction shall be clearly defined as this will form part of the installation method

6.3 Design

6.3.1 General

The test shall be made on a test specimen representative of the assembly on which information is required. The general test layouts and equipment references are shown in Figures 1 and 2 for walls and floors respectively.

6.3.2 Orientation to be tested

Non-mechanical fire barriers which are to be installed in both horizontal and vertical constructions shall be tested in both orientations. Non-mechanical fire barriers which may be installed vertically but in different design orientations shall be tested in both orientations – e.g. slots vertical and slots horizontal.

6.3.3 Non-mechanical fire barriers installed within a wall or floor opening

Non-mechanical fire barriers which are to be installed within an opening in line with a wall or floor shall be tested as generally shown in Figure 3.

6.3.4 Non-mechanical fire barriers mounted on to the face of a wall or floor

Non-mechanical fire barriers which are to be installed mounted on to the face of a wall or floor shall be tested as generally shown in Figures 4 and 5.

Uninsulated non-mechanical fire barriers which are to be mounted onto the face of a wall or floor shall be tested with the non-mechanical fire barrier positioned within the furnace.

Insulated non-mechanical fire barriers which are to be mounted onto the face of a wall or floor shall be tested from both sides so that the insulation properties of the non-mechanical fire barrier body, and where appropriate the duct, can be evaluated. Non-mechanical fire barriers which can be mounted above or below the floor shall be tested with fire from below.

6.3.5 Non-mechanical fire barriers mounted remote from a wall or floor

6.3.5.1 General

For test purposes, non-mechanical fire barriers which are to be mounted remote from the wall or floor shall be attached to a length of ductwork. This duct shall be attached to the supporting construction with the non-mechanical fire barrier installed at the other end of the duct. This ductwork shall be considered as part of the test specimen and shall be installed by the sponsor. Non-mechanical fire barriers which can be mounted above or below the floor shall be tested with fire from below.

6.3.5.2 Non-mechanical fire barriers mounted inside the furnace

The length of ductwork inside the furnace described in 6.3.5.1 shall be (1 000 ± 50) mm. The distance between the outer surface of the duct and the furnace wall, roof or floor shall be not less than 500 mm. An example of a non-mechanical fire barrier mounted remote from a wall inside the furnace is given in Figure 6.

6.3.5.3 Non-mechanical fire barriers mounted outside the furnace

The length of ductwork outside the furnace described in 6.3.5.1 shall be (1 000 ± 50) mm. An example of a non-mechanical fire barrier mounted remote from a wall outside the furnace is given in Figure 7.

7 Installation of test specimen

7.1 General

The test specimen shall be installed, as far as possible, in a manner representative of practice.

The non-mechanical fire barrier shall be installed and sealed as in practice in a supporting construction in accordance with the manufacturer's instructions. Where the manufacturer of the non-mechanical fire barrier requires it to be tested in a length of insulated ductwork he shall specify the details of materials and construction and the length over which the duct is to be insulated as shown in Figure 8.

7.2 Supporting construction

The supporting construction selected shall have fire resistance equal to (or less than) the anticipated fire resistance of the non-mechanical fire barrier being tested.

If at the end of the test duration, the non-mechanical fire barrier is performing better than it is intended, the test should be allowed to continue provided the non-mechanical fire barrier can still stay in place.

Information on the applicability of the test results when a using a specific supporting construction is given in Clause 13.

Standard vertical supporting constructions shall be selected using the specifications as described in detail in EN 1363-1.

Vertical supporting constructions of all rigid walls have no minimum dimensions, but the clearances shown in Figures 10 and 11 shall be observed.

In the case of flexible supporting walls, the flexible walls shall have minimum dimensions of width 1 500 mm × height 3 000 mm. The clearances shown in Figures 10 and 11 shall be observed. The wall shall have one free edge and one fixed edge.

NOTE It is advisable that any sample to be installed in a flexible wall interrupt at least one vertical stud (see also direct field of application) and that the sample is installed in the centre of the wall to show response to maximum deflection.

Standard floor constructions are shown in Table 1.

Table 1 — Standard floor constructions

Type of construction	**Thickness** mm	**Density** kg/m^3	**Test duration *t*** h
Normal concrete	110 ± 10	2 200 ± 200	$t \leq 1{,}5$
	150 ± 10	2 200 ± 200	$1{,}5 < t \leq 3$
	175 ± 10	2 200 ± 200	$3 < t \leq 4$
Aerated concrete	125 ± 10	650 ± 200	$t \leq 2$
	150 ± 10	650 ± 200	$2 < t \leq 4$

7.3 Minimum separation

If more than one barrier is tested at one time the distance between the non-mechanical fire barriers shall not normally be less than 200 mm, as shown in Figures 10 and 11. However, if a specific installation requires non-mechanical fire barriers to be closer, then they shall be tested to the minimum separation used in practice.

8 Conditioning

8.1 General

The test specimen and installation construction shall be conditioned in accordance with EN 1363-1.

8.2 Water-based sealing materials

Water-based materials (e.g. mortar, concrete, …) used to seal the gap between the supporting construction and the non-mechanical fire barrier where the gap is < 10 mm wide shall be conditioned for at least seven days before fire testing.

Water-based materials used to seal the gap between the supporting construction and the non-mechanical fire barrier assembly where the gap is > 10 mm wide shall be conditioned for at least 28 days before fire testing.

Thin skins of sealants/mastics of up to 2 mm thick shall be given a minimum of 48 h drying time.

9 Application of instrumentation

9.1 Thermocouples

9.1.1 Furnace thermocouples (plate thermometers)

Plate thermometers shall be provided in accordance with EN 1363-1. Examples of positions of plate thermometers for a number of different configurations are shown in Figures 3 to 8. For non-mechanical fire barriers mounted in a wall, the plate thermometers shall be oriented so that side ‘A’ faces towards the back wall of the furnace. For non-mechanical fire barriers mounted in a floor, the plate thermometers shall be oriented so that side ‘A’ faces the floor of the furnace.

9.1.2 Unexposed surface temperature

The positions of unexposed surface thermocouples shall be in accordance with EN 1363-1 and, depending on the method of mounting the non-mechanical fire barrier selected, at the positions shown in Figures 3 to 9. At least one thermocouple of each type shall be positioned above, below and on each side of the non-mechanical fire barrier. A roving thermocouple shall be used for additional evaluation of maximum temperature.

9.2 Furnace pressure

9.2.1 General

Furnace pressure shall be measured in accordance with EN 1363-1.

9.2.2 Pressure differential measurement, furnace and connecting duct

A pressure tapping shall be located on the centre line, at mid height, of one vertical side wall of the connecting duct. Instrumentation to determine the pressure differential between the furnace and the connecting duct shall be provided. The instrument shall have a measurement capacity 300 Pa higher than the test pressure chosen for the test.

10 Test procedure

10.1 Determination of leakage of connecting duct and measuring station

10.1.1 Seal the inlet aperture of the non-mechanical fire barrier using impervious material.

10.1.2 Assemble the connecting duct, the measuring station and the exhaust fan as shown in Figure 1 for wall mounted non-mechanical fire barriers or as shown in Figure 2 for floor mounted non-mechanical fire barriers. The joints between each component shall be sealed with high temperature gaskets and/or sealants.

10.1.3 Connect an orifice plate, venturi or other suitable device to a suitable recording instrument calibrated and complying with EN ISO 5167-1, EN ISO 5167-2and EN ISO 5167-3. Calculate the leakage from the recorded pressure differential from the orifice plate, venturi or other suitable device using the formulae for volume flow rates given in EN ISO 5167-1, EN ISO 5167-2 and EN ISO 5167-3.

NOTE It may be necessary to use a different size of orifice plate, venturi or other suitable device for the determination of the leakage of the connecting duct and measuring station to that used for the leakage tests described in 10.2.

10.1.4 Adjust the exhaust fan so that the air leakage through the connecting duct and measuring station can be measured at 300 Pa. The pressure differential shall be maintained for 60 s before the leakage is recorded. For pressure differentials higher than 300 Pa, the measurement of leakage shall be performed at the required test pressure.

NOTE If the laboratory wants to use a different method involving more points, this is acceptable as long as the value at the test pressure is recorded.

10.1.5 Measure the leakage at 300 Pa, or at the higher selected pressure differential as appropriate.

10.1.6 If the leakage at 300 Pa is more than 12 m^3/h improve the sealing of joints in the construction, until the leakage criterion can be met. For pressure differentials higher than 300 Pa the leakage of 12 m3/h shall be increased by a factor $(P(test)/300)^{0,67}$.

10.1.7 Remove sealing from the inlet aperture of the non-mechanical fire barrier.

NOTE The 50 cycle opening and closing test (as described in EN 1366–2) is not applicable to non-mechanical fire barriers. Ambient leakage is not relevant for non-mechanical fire barriers.

10.2 Fire test procedure

10.2.1 Connect all instrumentation required by this standard.

10.2.2 Set the exhaust fan system to produce an air velocity of 0,15 m/s across the non-mechanical fire barrier opening. This shall be measured by the orifice plate, venturi or other suitable device located within the measuring duct. Maintain the air velocity at (0,15 ± 0,02) m/s.

10.2.3 Switch off the exhaust fan, but leave it at its pre-set value given in 10.2.2.

10.2.4 Ignite the furnace, switch on the exhaust fan within 10 s of burners being ignited. The commencement of the test is as described in EN 1363-1.

10.2.5 During the first 2 min of the test closure of the non-mechanical fire barrier shall be assumed when the under pressure inside the connecting duct increases by at least 50 Pa over a 5 second time period. When this occurs the pressure difference across the non-mechanical fire barrier shall be adjusted to 300 Pa ± 15 Pa. An observation shall be recorded.

If an abrupt pressure increase inside the connecting duct does not happen within the first 2 min of the test, the non-mechanical fire barrier shall be deemed to have not closed and the test failed.

The system shall then be run with the pressure difference being continuously controlled to 300 Pa ± 15 Pa. At 5 min from the commencement of the test the first classification leakage reading shall be recorded. The criteria for leakage classification shall then be applied (see 11a)).

10.2.6 For the remainder of the test continuously adjust the exhaust fan to maintain an underpressure of (300 ± 15) Pa (or higher underpressure, subject to ± 5 % tolerance) in the connecting duct relative to the furnace.

If the sponsor has requested a higher pressure differential this will replace the 300 Pa referred to in the clauses above. However the same pass/fail criteria shall then be applied (see 11a)).

10.2.7 Carry out the following during the test:

a) Control and record the furnace temperature generally in accordance with EN 1363-1 with furnace thermocouples (plate thermometers) placed as shown in Figures 3 to 8.

b) Control and record the pressure generally in accordance with EN 1363-1 with the following corrections. The furnace pressure at the horizontal centre line of a non-mechanical fire barrier installed in a vertical separating element shall be maintained at (15 ± 3) Pa. The furnace pressure for a non-mechanical fire barrier installed in a horizontal separating element shall be maintained at (20 ± 3) Pa at 100 mm below the underside of the separating element to which it is fixed.

c) Maintain the pressure differential specified in 10.2.6.

d) Record the pressure differential across the orifice plate, venturi or other suitable device and the local gas temperature at not more than two minute intervals.

Calculate constants for the orifice plate, venturi or other suitable devices in accordance with EN ISO 5167-1 over the range of anticipated gas temperatures. As a function of time and measured gas temperatures select the corresponding orifice plate, venturi or other suitable device constants and calculate the volume flow rate at the measuring station gas temperatures using the formulae for volume flow rates given in EN ISO 5167-1, EN ISO 5167-2 and EN ISO 5167-3. Correct the measured volume flow rate to 20 °C. Deduct the value for the leakage of the connecting duct and measuring station determined in 10.1 from the measured leakages.

e) Record the temperature on the external surface of the supporting construction, the non-mechanical fire barrier and of the connecting duct as specified in EN 1363-1.

f) Evaluate the integrity of the junction between the supporting construction and connecting duct as specified in EN 1363-1.

g) Observe the general behaviour of the non-mechanical fire barrier assembly during the test. In practice this will be limited to observations made on the furnace side and to the duct/non-mechanical fire barrier junction and adjacent area on the non-furnace side.

11 Performance criteria

The following performance criteria apply after 5 min from the start of the fire test:

a) Integrity:

From 5 min after the start of the fire test the leakage through the non-mechanical fire barrier shall not exceed 360 $m^3/(h\ m^2)$ of the cross sectional area of the non-mechanical fire barrier at the duct connection to the non-mechanical fire barrier) (corrected to 20 °C).

The integrity around the perimeter of the non-mechanical fire barrier shall be judged in accordance with the criteria given in EN 1363-1.

The 360 $m^3/(h\ m^2)$ of the cross sectional area of the non-mechanical fire barrier at the duct connection to the non-mechanical fire barrier) (corrected to 20 °C) is a fixed value, correspondingly, if the test was to be undertaken at a different pressure difference (e.g. 500 pa), this value of 360 m3/(h m^2) (corrected to 20 °C), shall remain and shall not be increased in proportion to the pressure difference.

b) Insulation

The temperature criteria shall be as defined in EN 1363-1. The maximum temperature shall be taken from thermocouples T_1, T_3, T_5, T_s, T_{sA} as shown in the figures and the roving thermocouple. The average temperature shall be determined from thermocouples T_2, T_4, T_6 etc as shown in the figures.

NOTE An S leakage classification is not achievable, because no ambient leakage performance is possible.

The result of the fire test shall be stated in terms of the time elapsed to the completed minute from the commencement of the heating to the time when the non-mechanical fire barrier failed to satisfy the criteria for integrity, insulation or leakage, or the termination of the heating, whichever is the shortest.

12 Test report

In addition to the items required by EN 1363-1, the following shall also be included in the test report:

a) a detailed technical specification and description of the non-mechanical fire barrier, including design orientation (e.g. slots vertical or horizontal) and other materials used in its construction;

b) a detailed description of any duct included in the test set up to install the non-mechanical fire barrier remote from the supporting construction;

c) a description of the wall or floor used for the test, including its thickness and density;

d) a detailed technical specification and description of the method and materials used to seal the non-mechanical fire barrier into the supporting test construction;

e) details of the dimension from the exposed face of the supporting construction to the centre line of the plane of operation of the non-mechanical fire barrier, with a clear statement whether that dimension was in the direction of the furnace or away from it;

f) reference that the test was carried out in accordance with EN 1366-12;

g) a record of the determined leakage of the connecting duct and measuring station at ambient temperature before the fire test;

h) a record of the following relating to the fire test as a function of time:

   i) connecting duct pressure differential against furnace pressure;

   ii) gas temperature at exit of connecting duct;

   iii) measuring station gas temperature;

   iv) measuring station pressure differential;

   v) calculated volume flow rate corrected to 20 °C;

i) the time at which the non-mechanical fire barrier closed after the start of the test and the test duration (see 10.2.5);

j) any observations which were made during the course of the test, particularly with respect to loss of integrity at the joints between the non-mechanical fire barrier and its connecting duct and the non-mechanical fire barrier assembly and the supporting construction;

k) the test duration

l) where the test has been undertaken using a higher underpressure than 300 Pa, a clear statement of this together with an explanation of the basis for such a value being selected. All calculated volume flows shall be clearly identified as relating to the selected higher underpressure;

m) times from the start of the fire test at which each of the performance criteria was exceeded.

13 Field of direct application of test results

13.1 Size of non-mechanical fire barrier

A test result obtained for the largest non-mechanical fire barrier is applicable to all non-mechanical fire barriers of the same type (including any aspect ratio) provided that the maximum dimensions (height and width) do not exceed those tested and that the components remain in the same orientation as those tested.

13.2 Non-mechanical fire barriers installed within structural openings

A test result obtained for a non-mechanical fire barrier installed within a structural opening is only applicable to non-mechanical fire barriers of the same type installed in the same orientation and position in relation to the supporting construction as that tested.

13.3 Non-mechanical fire barriers installed onto the face of a wall or a floor

A test result obtained for a non-mechanical fire barrier installed onto the face of a wall or floor is only applicable to non-mechanical fire barriers of the same type installed onto the face of a separating element in the same orientation and position in relation to the supporting construction as that tested.

13.4 Non-mechanical fire barriers remote from a wall or floor

A test result obtained for a non-mechanical fire barrier remote from a wall or floor is applicable to non-mechanical fire barriers of the same type installed with the same ductwork details:

a) mounted remote from a wall and attached to a length of a horizontal fire resisting ductwork when tested remote from a wall (two tests, see Figures 6 and 7);

b) mounted remote from a floor and attached to a length of vertical fire resisting ductwork on the side above the floor when tested above the floor;

c) mounted remote from a floor and attached to a length of vertical fire resisting ductwork on the side below the floor when tested below the floor;

d) mounted up to the same distance that was tested from the wall/floor and up to the same width and height of duct tested.

A test result obtained with the duct passing through a standard supporting construction is applicable to a supporting construction with a fire resistance equal to or greater than that of the standard supporting construction used for the test (thicker, denser, more layers of board, as appropriate).

Test results obtained with duct passing through flexible vertical supporting constructions may be applied to rigid supporting constructions of a thickness equal to or greater than that of the element used in the tests, provided that the classified fire resistance of the rigid supporting construction is greater than or equal to the one used for the test.

To be applicable for use away from a wall on an unexposed side, both the largest and smaller size of non-mechanical fire barrier shall be tested under fire conditions (see 6.2.5).

13.5 Fire from above

Non-mechanical fire barrier tested horizontally in floors with fire from below are acceptable in installations where fire might come from above.

13.6 Separation between non-mechanical fire barriers and between non-mechanical fire barriers and construction elements

A test result obtained for only one non-mechanical fire barrier or for two non-mechanical fire barriers with a minimum clear separation of 200 mm is applicable to a minimum separation in practice of:

a) 200 mm between non-mechanical fire barriers installed in separate ducts – Figures 10 and 11;

b) 75 mm between non-mechanical fire barriers and a construction element (wall/floor)) – e.g. for a non-mechanical barrier in a wall, this is the distance between the non-mechanical barrier casing (largest dimension) mounted in the supporting construction and a wall or floor adjacent to that supporting construction.

13.7 Supporting constructions

A test result obtained for a non-mechanical fire barrier mounted in or on the face of a standard supporting construction is applicable to a supporting construction of the same type with a fire resistance equal to or greater than that of the standard supporting construction used in the test (thicker, denser, more layers of board, as appropriate).

The test result can also apply to cellular or hollow masonry blocks or slabs that have a fire resistance time equal or greater than the fire resistance required for the non-mechanical fire barrier installation.

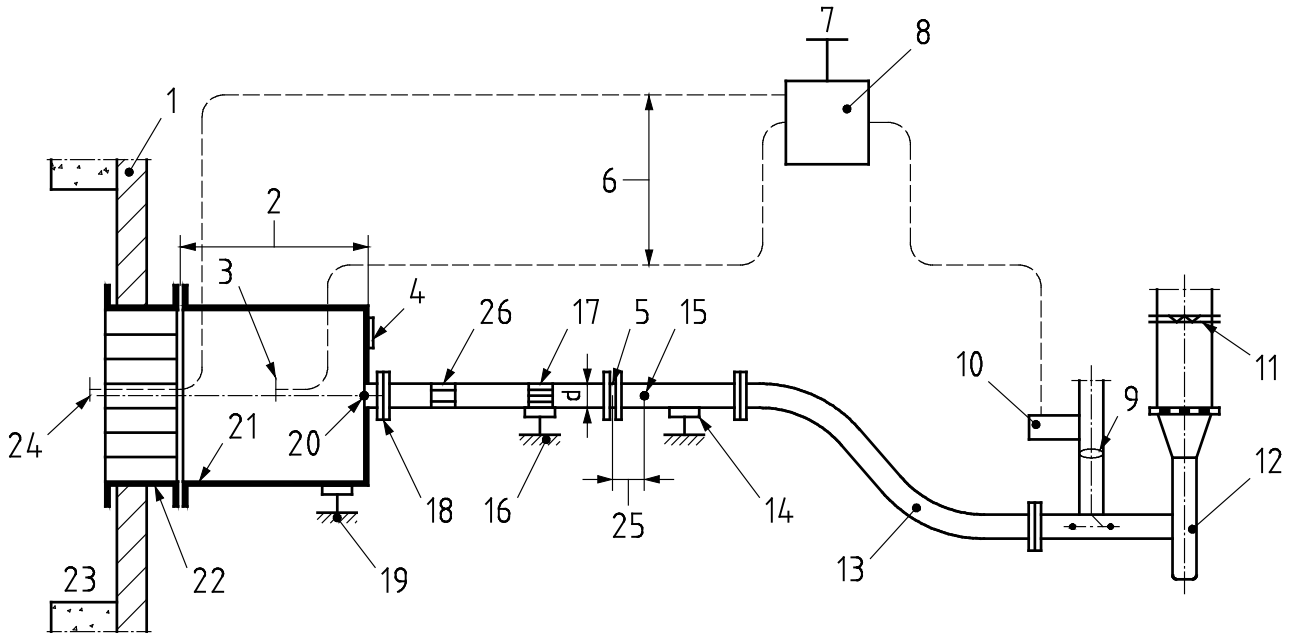
Test results obtained with non-mechanical fire barriers installed in flexible vertical supporting constructions may be applied to rigid supporting constructions of a thickness equal to or greater than that of the element used in the tests, provided that the classified fire resistance of the rigid supporting construction is greater than or equal to the one used for the test. The sealants used shall be the same as those tested. Any fasteners used shall be fire rated to suit the supporting construction that is used.

Test results obtained with non-mechanical fire barriers installed in insulated flexible vertical supporting constructions may be applied to applications where the flexible vertical supporting construction is uninsulated (less onerous as per EN 1363-1) – aperture framing shall be used using the same materials as used in the test partition construction, using the same number of boards as was tested.

Test results obtained with non-mechanical fire barriers installed in flexible vertical supporting constructions made with steel studs are not applicable to flexible vertical supporting constructions made using timber studs.

Test results obtained with non-mechanical fire barriers installed in aerated concrete are applicable to rigid constructions made from hollow blocks, provided that the holes are filled/closed before the addition of the final penetration seal.

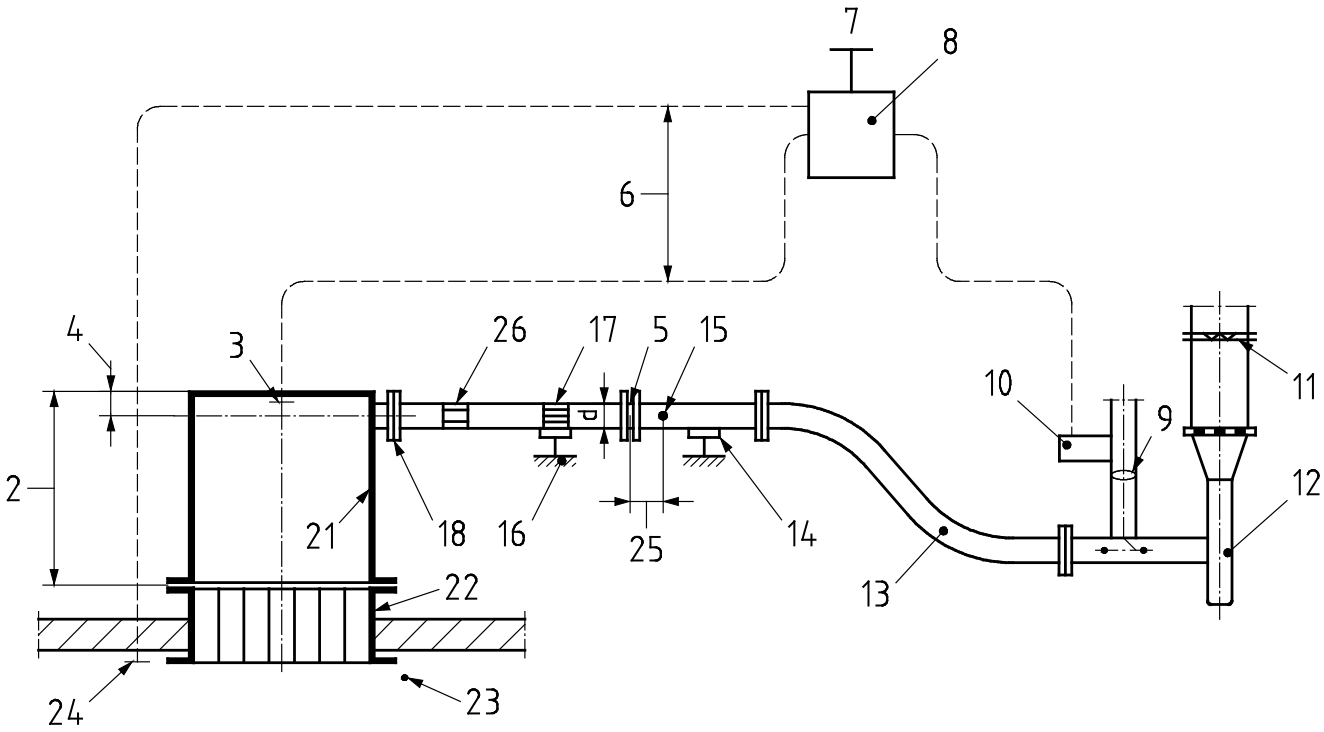
If a specific supporting construction different from those described in 7.2 is selected, the test results obtained are applicable only to that specific wall, partition or floor having a thickness and/or density equal or greater than that tested.



Key

1 supporting construction (wall)
2 2 × diagonal (to a maximum of 2 m)
3 pressure sensor (on centre line)
4 observation window
5 orifice plate or venturi
6 differential pressure - 300 Pa
7 pressure sensor in laboratory
8 pressure differential control box
9 pressure control dilution damper (if required)
10 actuator or manual control (if required)
11 balancing damper (if required)
12 fan
13 flexible connecting duct
14 support
15 thermocouple 1,5 mm diameter
16 support
17 flow straightener (where necessary)
18 flange
19 support
20 thermocouple at exit from plenum
21 connecting duct
22 test non-mechanical fire barrier
23 furnace chamber
24 pressure sensor (on centre line of the damper)
25 distance: thermocouple - orifice plate - 2d
26 condensing device (if required)

Figure 1 — Example of general test arrangement

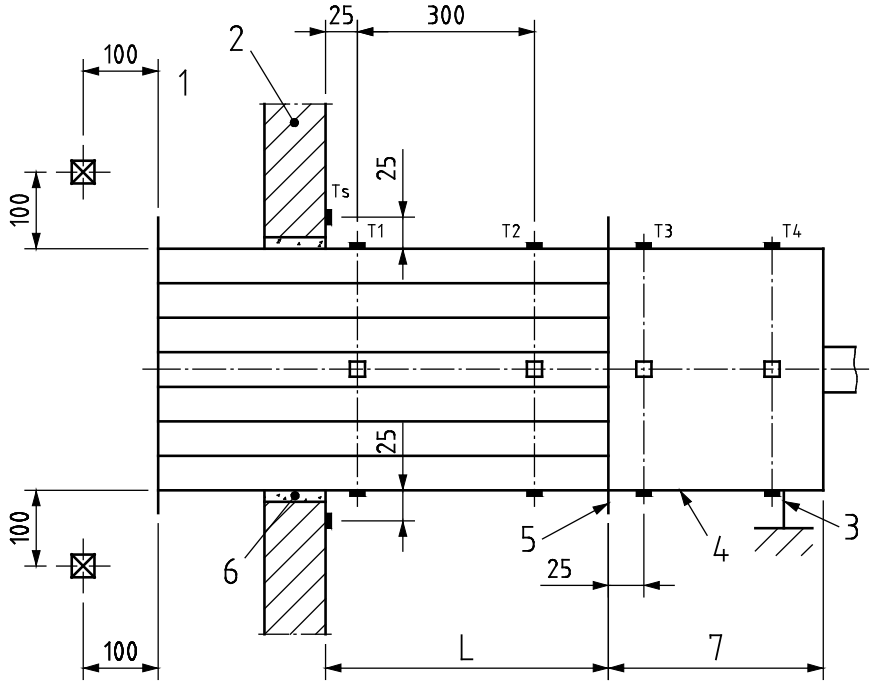


Key

1 supporting construction (floor)
2 2 × diagonal (to a maximum of 2m)
3 pressure sensor 100 mm below end of plenum
4 dimension = diameter of measuring station
5 orifice plate or venturi
6 differential pressure - 300 Pa
7 pressure sensor in laboratory
8 pressure differential control box
9 pressure control dilution damper (if required)
10 actuator or manual control (if required)
11 balancing damper (if required)
12 fan
13 flexible connecting duct
14 support
15 thermocouple 1,5mm diameter
16 support
17 flow straightener (where necessary)
18 flange
21 connecting duct
22 test non-mechanical fire barrier
23 furnace chamber
24 pressure sensor 100 mm below top of furnace
25 distance: thermocouple - orifice plate - 2d
26 condensing device (if required)

Figure 2 — Example of an alternative arrangement when testing non-mechanical fire barriers in floor

Dimensions in mm



Key

1 furnace

2 supporting construction

3 support

4 connecting duct

5 connecting angle

6 infill material if required

7 length - connecting duct see 4.2

L length to be specified by non-mechanical fire barrier manufacturer

Ts maximum temperature at 25 mm up the supporting construction from the non-mechanical fire barrier or duct – see detail in Figure 9 for clarification and use at discontinuities

T1 maximum temperature at 25 mm back from the supporting construction on the non-mechanical fire barrier or duct – see detail in Figure 9 for clarification and use at discontinuities

T3 maximum temperature at 25 mm back from the non-mechanical fire barrier /connecting duct joint

T2 average temperature at 300 mm back from T1 if L ≥ 350 mm

T4 average temperature at 300 mm back from T3

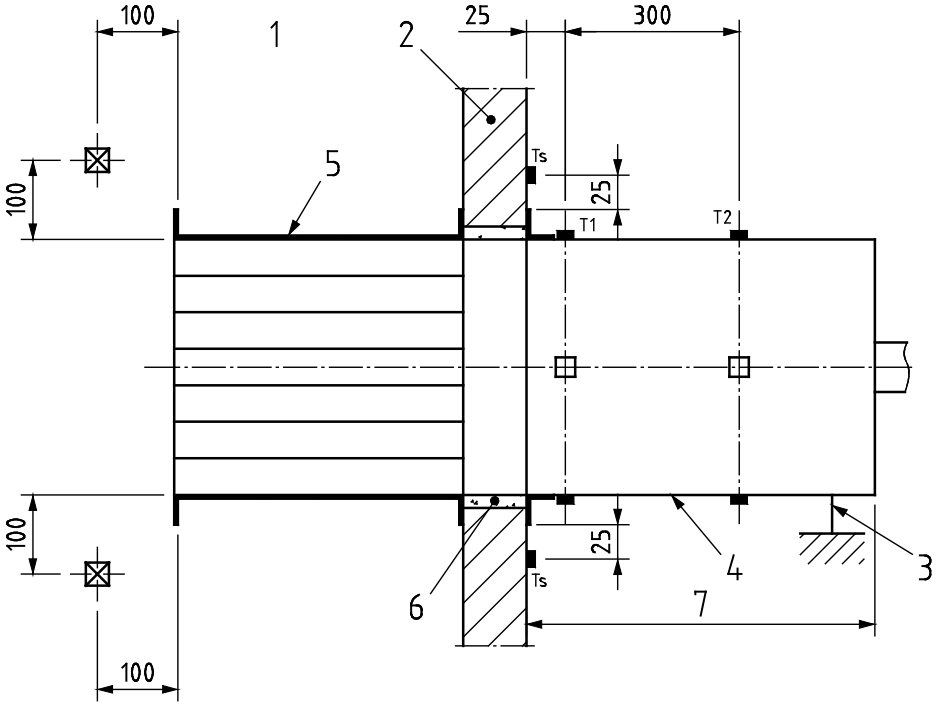
Use all thermocouples, Ts, T1, T2, T3 and T4, except if L < 350 when T2 not required or considered

⊠ furnace thermocouples

non-mechanical fire barrier symbol

Figure 3 — Non-mechanical fire barrier mounted in standard supporting construction

Dimensions in mm



Key

1 furnace

2 supporting construction

3 support

4 connecting duct

5 non-mechanical fire barrier

6 infill material

7 length - connecting duct see 4.2

Ts maximum temperature at 25 mm up the supporting construction from the non-mechanical fire barrier or duct – see detail in Figure 9 for clarification and use at discontinuities

T1 maximum temperature at 25 mm back from the supporting construction on the non-mechanical fire barrier or duct – see detail in Figure 9 for clarification and use at discontinuities

T2 average temperature at 300 mm back from T1

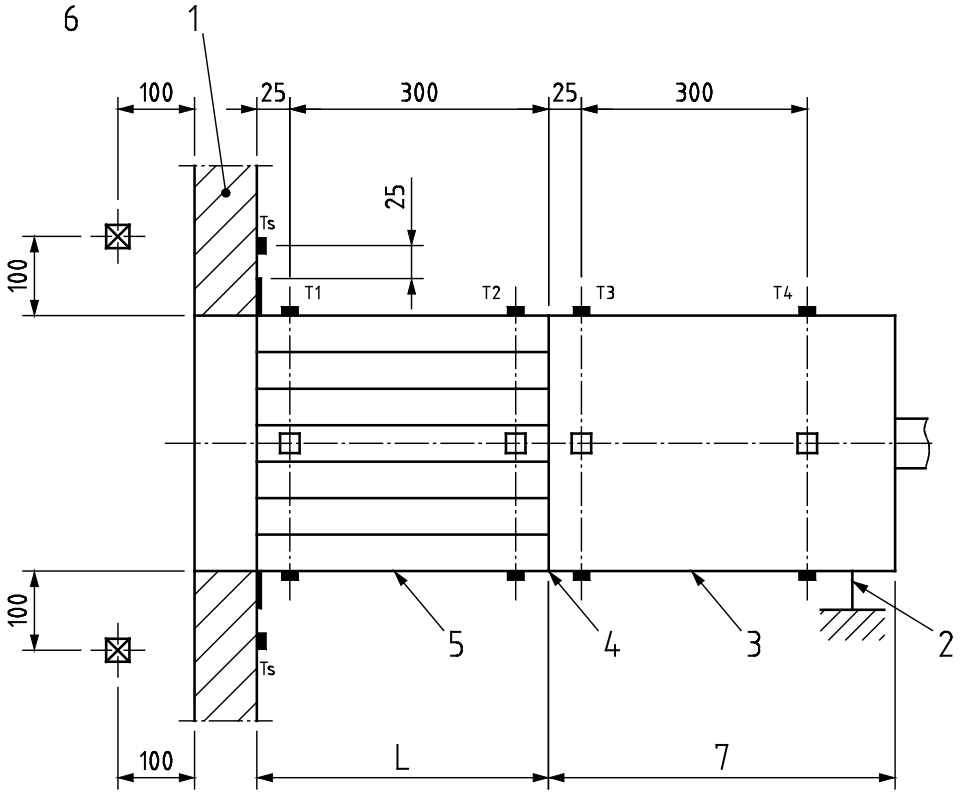
Use all thermocouples, Ts, T1 and T2

⊠ furnace thermocouples

non-mechanical fire barrier symbol

Figure 4 — Non-mechanical fire barrier mounted onto face of supporting construction within the furnace

Dimensions in mm



Key

1 supporting construction

2 support

3 connecting duct

4 connecting angle

5 non-mechanical fire barrier

6 furnace

7 length - connecting duct see 4.2

L length to be specified by non-mechanical fire barrier manufacturer

Ts maximum temperature at 25 mm up the supporting construction from the non-mechanical fire barrier or duct – see detail in Figure 9 for clarification and use at discontinuities

T1 maximum temperature at 25 mm back from the supporting construction on the non-mechanical fire barrier or duct – see detail in Figure 9 for clarification and use at discontinuities

T3 maximum temperature at 25 mm back from the non-mechanical fire barrier/connecting duct joint

T2 average temperature at 300 mm back from T1 if L ≥ 350 mm

T4 average temperature at 300 mm back from T3

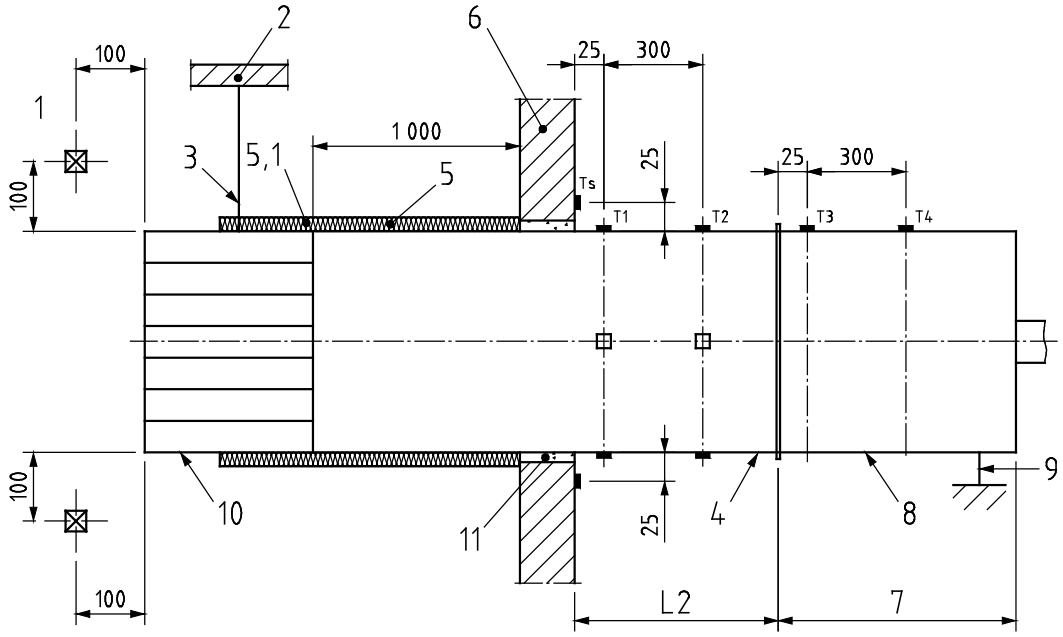
Use all thermocouples, Ts, T1, T2, T3 and T4, except if L < 350 when T2 not required or considered

☒ furnace thermocouples

non-mechanical fire barrier symbol

Figure 5 — Non-mechanical fire barrier mounted onto standard supporting construction outside the furnace

Dimensions in mm



Key

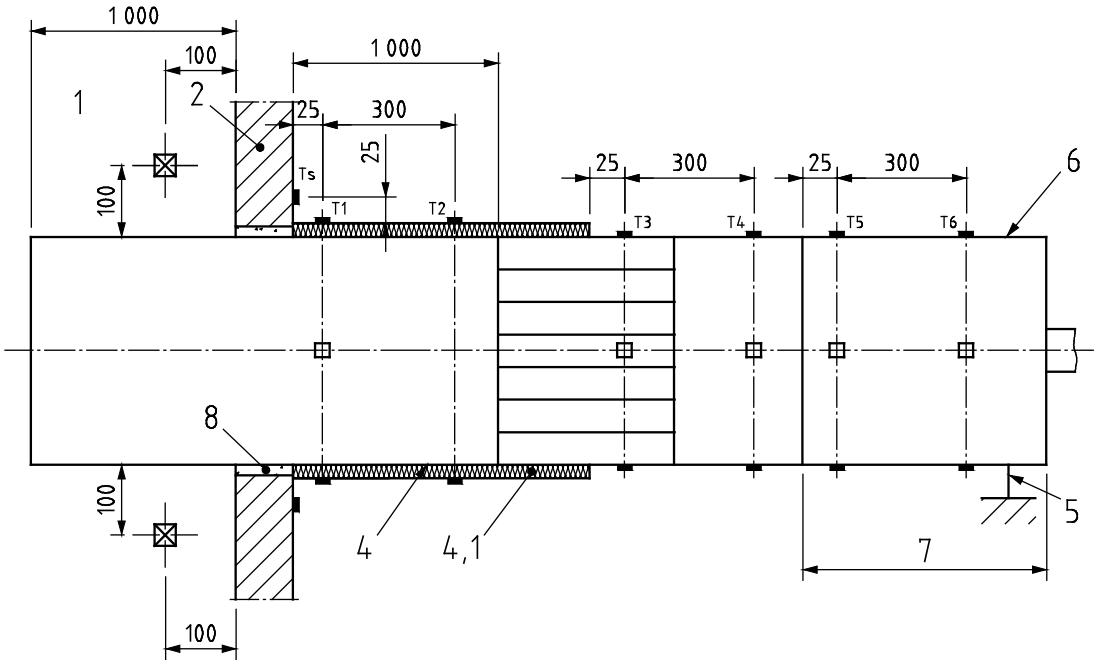
1	furnace
2	support from floor
3	attachment as in practice
4	duct outside furnace
5	insulated duct inside furnace
5.1	insulated duct inside furnace up to the centre of the non-mechanical fire barrier construction, in the case of a steel non-mechanical fire barrier casing
6	supporting construction
7	length - connecting duct see 4.2
8	connecting duct
9	support
10	non-mechanical fire barrier
L2	length of duct on outside of furnace before the connecting duct (allows fitting of thermocouples) 350 mm < L2 < 1 000 mm
Ts	maximum temperature at 25 mm up the supporting construction from the duct – see detail in Figure 9 for clarification and use at discontinuities
T1	maximum temperature at 25 mm back from the supporting construction on the duct – see detail in Figure 9 for clarification and use at discontinuities
T3	maximum temperature at 25 mm back from the duct/connecting duct joint
T2	average temperature at 300 mm back from T1
T4	average temperature at 300 mm back from T3

Use all thermocouples, Ts, T1, T2, T3 and T4

11	Stiffening of the duct may be required at the supporting construction to prevent integrity failure. This shall be recorded in the installation statement.
⊠	furnace thermocouples
	non-mechanical fire barrier symbol

Figure 6 — Non-mechanical fire barrier mounted remote from the standard supporting construction and inside the furnace

Dimensions in mm



Key

1 furnace

2 supporting construction

3 attachment as in practice

4 insulated duct outside furnace

4.1 insulated duct outside furnace up to the centre of the non-mechanical fire barrier construction, in the case of a steel non-mechanical fire barrier casing

5 support

6 connecting duct

7 length - connecting duct see 4.2

L2 length of duct on inside of furnace to allow installation – 350 mm < L2 < 1 000 mm

Ts maximum temperature at 25 mm up the supporting construction from the insulated duct – see detail in Figure 9 for clarification and use at discontinuities

T1 maximum temperature at 25 mm back from the supporting construction on the insulated duct – see detail in Figure 9 for clarification and use at discontinuities

T3 maximum temperature at 25 mm back from the end of the insulation on the duct/ non-mechanical fire barrier

T5 maximum temperature at 25 mm back from the duct/connecting duct joint

T2 average temperature at 300 mm back from T1

T4 average temperature at 300 mm back from T3

T6 average temperature at 300 mm back from T5

Use all thermocouples, Ts, T1, T2, T3, T4, T5 and T6

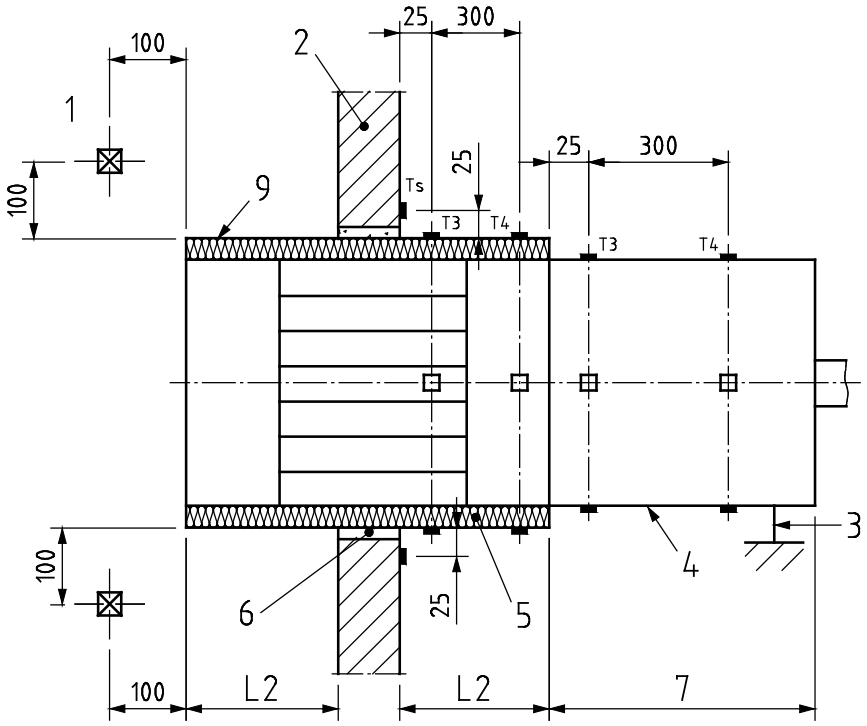
8 Stiffening of the duct may be required at the supporting construction to prevent integrity failure. This shall be recorded in the installation statement.

⊠ furnace thermocouples

non-mechanical fire barrier symbol

Figure 7 — Non-mechanical fire barrier mounted remote from the standard supporting construction and outside the furnace

Dimensions in mm



Key

1 furnace

2 supporting construction

3 support

4 connecting duct

5 insulated duct (outside furnace)

6 infill material

7 length - connecting duct see 4.2

9 insulated duct (inside furnace)

Ts maximum temperature at 25 mm up the supporting construction from the insulated duct – see detail in Figure 9 for clarification and use at discontinuities

T1 maximum temperature at 25 mm back from the supporting construction on the insulated duct – see detail in Figure 9 for clarification and use at discontinuities

T3 maximum temperature at 25 mm back from the duct/connecting duct joint

T2 average temperature at 300 mm back from T1

T4 average temperature at 300 mm back from T3

L2 length of duct on inside and outside of furnace (equal), outside before the connecting duct (allows fitting of thermocouples) 400 mm < L2 < 2 500 mm

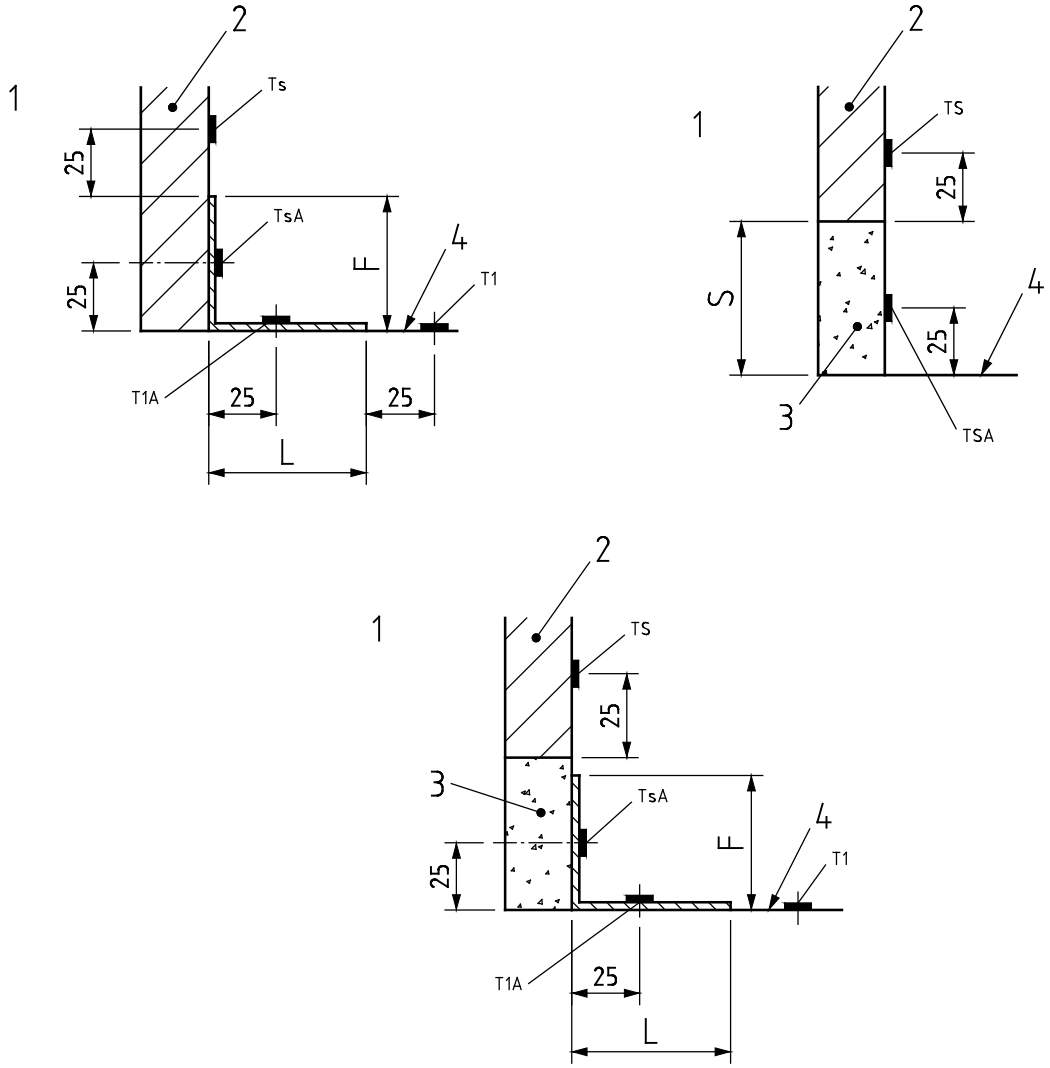
Use all thermocouples, Ts, T1, T2, T3 and T4

⊠ furnace thermocouples

non-mechanical fire barrier symbol

Figure 8 — Non-mechanical fire barrier mounted in an insulated duct

Dimensions in mm

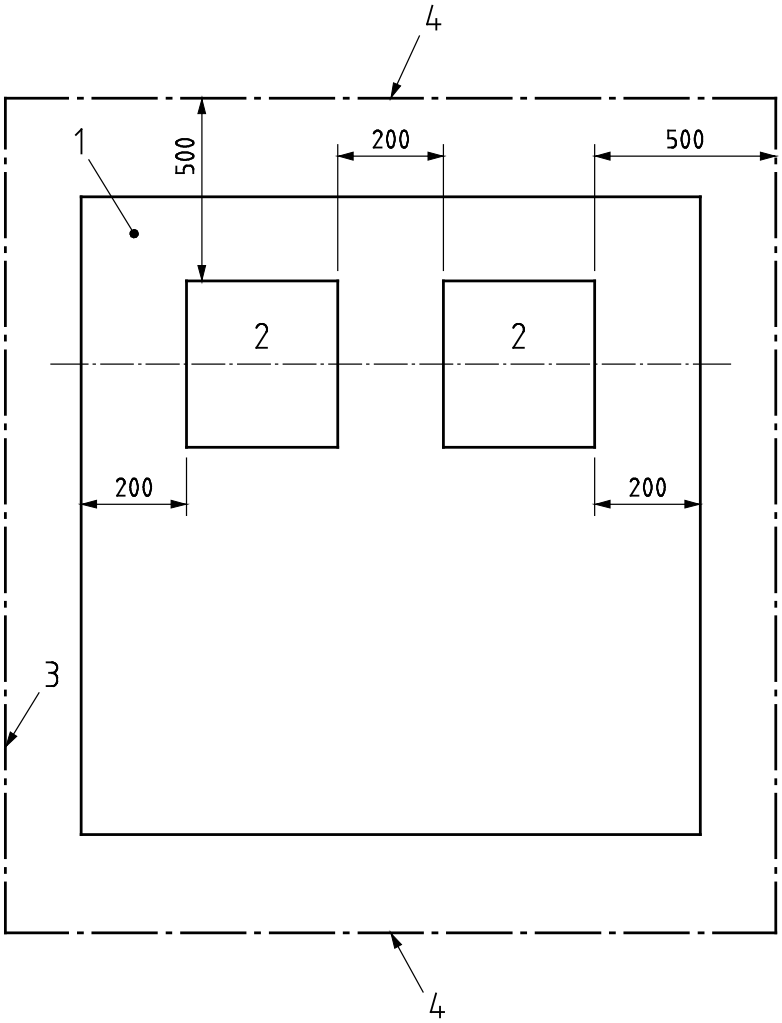


Key

1	furnace
2	supporting construction
3	infill material
4	non-mechanical fire barrier casing/insulation or duct/duct insulation
Ts	position of standard Ts
TsA	position of additional Ts if F or S ≥ 50mm – both Ts and TsA to be measured as maximum temperature
T1	position of standard T1
T1A	position of additional T1 if L ≥ 50mm – both T1 and T1A to be measured as maximum temperature

Figure 9 — Detail for the application of thermocouples TS and T1 on the supporting construction at discontinuities

Dimensions in mm



Key

1 supporting construction

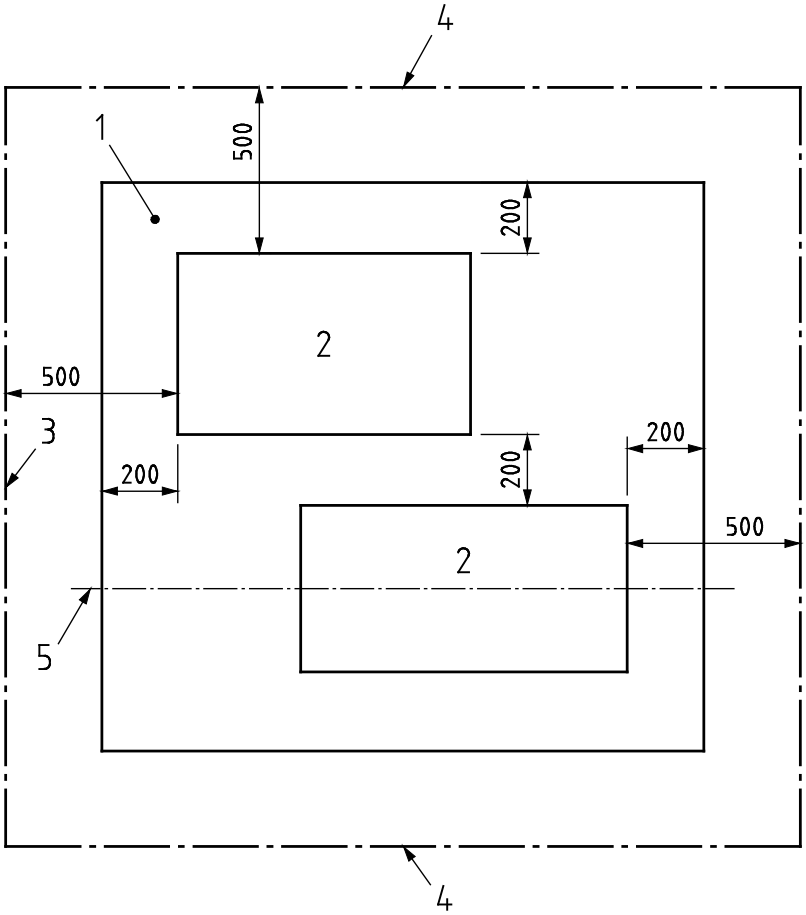
2 non-mechanical fire barrier

3 inner surface of furnace wall

4 inner surface of furnace floor and roof

Figure 10 — Minimum separation

Dimensions in mm



Key

1 supporting construction

2 non-mechanical fire barrier

3 inner surface of furnace wall

4 inner surface of furnace floor and roof

5 pressure of 15 ± 3 Pa maintained at this height

Figure 11 — Non-mechanical fire barriers mounted in different horizontal planes

Annex A
(normative)

EOTA TR026 - Characterization, Aspects of Durability and Factory Production Control for Reactive Materials, Components and Products

This EOTA Technical Report is intended to be used as a reference source for harmonized product specifications, specifying the terminology, methods of verification and criteria for the durability of reactive materials, components and products. It is also intended for the identification of these materials, components or products and for the verification of performance within the framework of factory production control.

Non-mechanical fire barriers or relevant components of these non-mechanical fire barriers shall be subject to the relevant requirements of TR026.

This Technical Report may cover issues that are not necessarily applicable for all reactive materials, components or products due to their nature and/or the way they are incorporated in construction products.

Materials, components and products exposed to a specific industrial, polluted or aggressive atmosphere are not considered in this TR.

Bibliography

[1] EN 520, *Gypsum plasterboards - Definitions, requirements and test methods*

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