BS EN 1366-2:2015

BSI Standards Publication

Fire resistance tests for service installations

Part 2: Fire dampers

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National foreword

This British Standard is the UK implementation of EN 1366-2:2015. It supersedes BS EN 1366-2:1999 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee FSH/22/-/4, Fire resistance tests for dampers, seals and smoke extraction.

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

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Published by BSI Standards Limited 2015

ISBN 978 0 580 86606 7

ICS 13.220.50

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 June 2015.

Amendments/corrigenda issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1366-2

June 2015

ICS 13.220.50

Supersedes EN 1366-2:1999

English Version

Fire resistance tests for service installations - Part 2: Fire dampers

Essais de résistance au feu des installations techniques - Partie 2 : Clapets résistant au feu

Feuerwiderstandsprüfungen für Installationen - Teil 2: Brandschutzklappen

This European Standard was approved by CEN on 3 April 2015.

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Ref. No. EN 1366-2:2015 E

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Foreword

This document (EN 1366-2:2015) 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of an identical text or by endorsement, at the latest by December 2015, and conflicting national standards shall be withdrawn at the latest by December 2015.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 supersedes EN 1366-2:1999.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

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

— *Part 1: Ventilation ducts*;

— *Part 2: Fire dampers* (the present document);

— *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* (currently at Enquiry stage);

— *Part 12: Non-mechanical fire barrier for ventilation ductwork*.

This standard underwent a formal review process during 2009-2011. Various comments were considered and these were only considered when they added clarity to the procedure. No changes have been made that make historical data redundant. This was deliberately avoided where it was thought to be occurring. If there are some issues with this, consideration should be given to the spirit of the original test combined with the better clarity now given.

The following technical changes were made in this new edition:

— Changes include the fact that symmetry as a concept has been removed. This does not negate original tests, but may now mean that some additional tests are needed.

— The figures have been clarified to show some more detail. Testing away from a wall or floor now has an equal distance between damper and the supporting construction. In this instance, historical data is not negated but any testing done after the publication of this standard needs to be done to the new dimensions.

— Further information is given on thermocouple placement and the concepts of T_3, T_4, etc. have been added to make it clear which thermocouples should be considered and when. The description of details on additional thermocouples around discontinuities has been added for clarification.

— Additional information has been added to show the details for testing fire dampers to demonstrate insulation characteristics where a fire damper is to be used un-ducted, ducted on one side or ducted on both sides.

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 fire damper 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.

The fire damper 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 fire damper in the open position to expose the temperature sensing element of the fire damper to furnace conditions.

Temperature and integrity measurements are carried out in various parts of the test construction during the test. The leakage of the fire damper system is measured (continuously during the test) by direct flow measurements whilst maintaining a constant pressure differential across the closed fire damper of 300 Pa. The leakage of the fire damper in the closed position is also measured at ambient temperature, when a reduced leakage classification needs to be achieved.

An additional test to prove insulation characteristics may be needed if the damper needs to be used un-ducted on one side or on both sides. This test is not needed where such evidence is not required, or if insulation is not a requirement of performance, in the specific application.

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

This standard is not suitable for testing fire dampers in suspended ceilings.

This standard is not suitable for testing non-mechanical fire dampers (see EN 1366-12).

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 1363-1:2012, *Fire resistance tests — Part 1: General Requirements*

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

EN 13501-3, *Fire classification of construction products and building elements — Part 3: Classification using data from fire resistance tests on products and elements used in building service installations: fire resisting ducts and 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 13943, *Fire safety — Vocabulary (ISO 13943)*

ISO 5221, *Air distribution and air diffusion — Rules to methods of measuring air flow rate in an air handling duct*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1363-1:2012 and EN ISO 13943 and the following apply.

3.1
fire damper
device for use in heating, ventilation and air-conditioning (HVAC) systems at fire boundaries to maintain compartmentation and protect means of escape in case of fire

Note 1 to entry: It may have reduced smoke leakage characteristics.

3.2
insulated fire damper
fire damper which satisfies both the integrity and insulation criteria for the anticipated fire resistance period

3.3
uninsulated fire damper
fire damper which satisfies the integrity criteria for the anticipated fire resistance period, but which does not provide a long enough insulation period to gain an EI classification

3.4
cone valve fire damper
fire damper consisting of a cone which closes into a profiled ring in case of fire and which normally has only one duct connection

3.5
fire damper actuating mechanism
mechanism, integral or directly associated with the fire damper which, when initiated causes the damper to change from the "open" to the "closed" position

3.6
temperature sensing element
device that senses temperature, that causes the thermal release mechanism to activate at a defined elevated temperature.

3.7
test specimen
fire damper, connecting frame and (if applicable) the perimeter penetration sealing system

3.8
thermal release mechanism
mechanism, containing/linked to the sensing element, that causes the open damper to release and close in response to elevated temperature

3.9
connecting duct
duct section between the fire damper or supporting construction and the measuring station

3.10
test construction
complete assembly of the test specimen, the connecting duct and the supporting construction

3.11
measuring station
equipment installed between the connecting duct and the exhaust equipment to determine the volume flow rate of gases passing through the fire damper under test

3.12
exhaust equipment
equipment consisting of a fan and balancing or dilution dampers (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 $\pm$ 0,1) mm thick steel of the same size (width x height or diameter) as the fire damper being tested. The duct shall have a length of two times the diagonal dimension of the damper up to a maximum of 2 m. Where a damper 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 damper. 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.

For the test for the cone valve fire damper that is to be undertaken with underpressure on the cone side, the connecting duct shall be securely connected to the frame outside the cone.

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 damper 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 and ISO 5221. It shall be installed between the connecting duct and the exhaust fan to determine the volume flow rate of gases passing through the fire damper under test. The measuring device shall be capable of measuring to an accuracy of ± 5%. Regardless of whether vertical or horizontal fire dampers 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 fire damper may generate quantities of steam during the fire test, a condensing unit having provision for drainage shall be installed between the fire damper 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 fire damper is closed.

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 fire dampers installed in a vertical separating element when the pressure shall be controlled to (15 ± 3) Pa at mid height of the damper. If two such fire dampers are being tested simultaneously, this pressure shall be established at mid height of the lower fire damper.

For fire dampers 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 10.4, the maximum size of fire damper shall be tested. For the determination of leakage at ambient temperature test, see 10.3, both the smallest and the largest size fire damper 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,

— blade pivot axis,

— application with no ducting on one or both sides, where additional evidence of insulation in such applications is required.

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 fire damper 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 fire damper 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. It was also to be considered where the damper 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 damper inside the furnace and one test undertaken with the damper outside the furnace. The face of the damper to be presented to the supporting construction shall be clearly identified so that it 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 damper fixed in this manner, only a damper 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 damper inside the furnace and one test undertaken with the damper outside the furnace. The face of the damper on the side of the supporting construction shall be clearly identified so that it 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.

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

6.2.6 Blade pivot axis

If a fire damper installation method is proposed and it is required that the damper be installed with the blade pivots horizontal and vertical, then the tests above shall be repeated for both horizontal and vertical blade pivots.

Actuators shall be mounted at the bottom of the fire damper for the vertical blade pivot test.

NOTE See extended field of application to limit the number of tests required, but at least one would be needed in the proposed alternative blade pivot axis.

6.2.7 Application with no ducting on one or both sides, where additional evidence of insulation in such applications is required

Where specific evidence of insulation performance is required for an application with no ducting on one or either side, the normal tests (both ways round) shall be applied with underpressure and the additional indicative test with thermocouples mounted on the face/blade shall be performed. If the application requires the damper to be installed with no ducting the damper shall be tested both ways round with the thermocouples applied. The addition of grilles may be made to the fire damper, but if it is tested with the grilles the grilles shall be installed in practice. Fire dampers tested without grilles may have them added without further testing. It is possible to perform these tests at the same time as the underpressure tests in the same supporting construction, as long as dimensions of separation are recorded.

NOTE An example of fire damper which can be mounted only with ducting on one side is a cone valve damper, so this only needs to be tested with thermocouples on the cone side. However, a fire damper used for air transfer applications with no ducting on either side would either need to be tested with thermocouples from each direction or can simply be tested as an air transfer grille to the relevant standard, but performing the latter does not imply that the product is a fire damper unless otherwise fully tested to this standard.

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

Fire dampers which are to be installed in both horizontal and vertical constructions shall be tested in both orientations. Dampers installed vertically will need to be tested with the blade spindles horizontal and vertical if this method of installation is expected.

6.3.3 Fire dampers installed within a wall or floor opening

Fire dampers 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 Fire dampers mounted on to the face of a wall or floor

Fire dampers 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 fire dampers which are to be mounted onto the face of a wall or floor shall be tested with the fire damper positioned within the furnace.

Insulated fire dampers 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 fire damper body, and where appropriate the duct, can be evaluated. Fire dampers which can be mounted above or below the floor shall be tested with fire from below.

6.3.5 Fire dampers mounted remote from a wall or floor

6.3.5.1 General

For test purposes, fire dampers 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 fire damper installed at the other end of the duct. This ductwork, its connections, mounting and installation shall be considered as part of the test specimen and shall be installed by the sponsor. Fire dampers which can be mounted above or below the floor shall be tested with fire from below.

6.3.5.2 Fire dampers mounted inside the furnace

The length of ductwork inside the furnace described in 6.3.5.1 shall be (1 000 $\pm$ 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 fire damper mounted remote from a wall inside the furnace is given in Figure 6.

6.3.5.3 Fire dampers mounted outside the furnace

The length of ductwork outside the furnace described in 6.3.5.1 shall be (1 000 $\pm$ 50) mm. An example of a fire damper mounted remote from a wall outside the furnace is given in Figure 7.

6.3.6 Application with no ducting on one or both sides, where additional evidence of insulation in such applications is required

Fire dampers requiring additional evidence of insulation with no ducting on one or both sides, shall be tested as above both ways round with underpressure form each side to prove that they can perform as a fire damper. These tests and the additional test(s) with the thermocouples on the face/blade of the fire damper are shown in Figure 9 (a cone valve fire damper is shown, but any other damper may be tested following the same method).

For a damper that can only be connected from one side, it is not necessary to measure the temperature on the connecting duct on the non-connecting side (perform test 9A, 9B and 9C), If it is intended that there is to be no ducting on either side, it shall be tested both ways round (perform 9A, 9A, damper reversed and 9C and 9C again with the damper reversed).

The method may also be applied with the damper in a vertical orientation and other considerations may include blade axis, etc. if this is relevant.

More than one damper may be tested at the same time, providing a minimum separation of 300 mm is employed between the dampers that are being tested. Therefore, it is possible to complete all the requirements of this clause and as also detailed in Figure 9 for smaller sizes of fire damper.

6.3.7 Temperature sensing element

The temperature sensing element shall be included in the test specimen configuration. Where alternative thermal release mechanisms are in series with the basic temperature sensing element and can be shown not to inhibit the basic thermal release mechanism then only the basic mechanism is required to be tested.

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 fire damper shall be installed and sealed as in practice in a supporting construction in accordance with the manufacturer's instructions. Where the manufacturer of the fire damper 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 fire damper being tested.

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

Information on the applicability of the test results when 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 11 and 12 shall be observed

In the case of flexible supporting walls, the flexible walls shall have minimum dimensions of width 1 450 mm x height 3 000 mm. The clearances shown in Figures 11 and 12 shall be observed. The wall shall have one free edge and one fixed edge.

It is advisable that any sample to be installed in a flexible wall shall 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 damper is tested at the same time the distance between the fire dampers shall not normally be less than 200 mm, as shown in Figures 11 and 12. However, if a specific installation requires fire dampers 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 damper where the gap is ≤ 10 mm wide shall be conditioned for at least 7 d before fire testing.

Water-based materials used to seal the gap between the supporting construction and the damper assembly where the gap is > 10 mm wide shall be conditioned for at least 28 d 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 9. For fire dampers mounted in a wall, the plate thermometers shall be oriented so that side ‘A’ faces towards the back wall of the furnace. For fire dampers 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 fire damper selected, at the positions shown in Figures 3 to 10. At least one thermocouple of each type shall be positioned above, below and on each side of the fire damper. 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 of a minimum of 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 (furnace side) of the fire damper using impervious material, and close the fire damper.

10.1.2 Assemble the connecting duct, the measuring station and the exhaust fan as shown in Figure 1 for wall mounted fire dampers or as shown in Figure 2 for floor mounted fire dampers. 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 and ISO 5221. 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 and ISO 5221.

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 10.3.

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.

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 m^3/h shall be increased by a factor $(P_{(test)}/300)^{0.67}$.

10.1.7 Remove sealing from the inlet aperture of the fire damper.

10.2 Opening and closing test

Carry out this test prior to the tests described in 10.3 or 10.4 to check that the fire damper is installed correctly. Subject the fire damper to 50 opening and closing cycles. Use the same mechanism for closing the fire damper as that which is activated when the temperature sensing element operates.

After the 50th cycle, check that the fire damper still locks in the closed position and that it shows no mechanical damage that will affect its operation. Note any sign of damage or of the fire damper not operating correctly.

For the cone valve fire dampers this shall be done for each fire damper shown in Figure 9.

10.3 Determination of leakage at ambient temperature

Where required to meet the S classification, this test shall be carried out on the specimen (largest size) prior to the fire test described in 10.4. An example of the smallest size of fire damper shall also be tested at ambient temperature to confirm the S classification.

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 pressure in the laboratory.

Record the pressure differential across the orifice plate, venturi or other suitable device at not more than 2 min intervals for a period of 20 min or until stable readings are reached (± 5%).

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 and ISO 5221. Deduct the value for the leakage of the connecting duct and measuring station determined in 10.1 from the measured leakages.

10.4 Fire test procedure

10.4.1 Ensure the fire damper is in its open position.

10.4.2 Connect all instrumentation required by this standard.

10.4.3 With the fire damper(s) fully open, set the exhaust fan system to produce an air velocity of 0,15 m/s across the fire damper 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.

10.4.4 The exhaust fan may be turned off or left on, but left it at its pre-set value given in 10.4.3.

10.4.5 Ignite the furnace burners, switch on the exhaust fan (if it has been turned off) within 10 s of burners being ignited. The commencement of the test is as described in EN 1363-1.

10.4.6 During the first 2 min of the test closure of the damper shall be assumed when the under pressure inside the connecting duct increases by at least 50 Pa over a 5 s time period. When this occurs, the pressure difference across the damper 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 damper 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 ± 15Pa. 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 Clause 11 a)).

10.4.7 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 Clause 11 a)).

10.4.8 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 fire damper installed in a vertical separating element shall be

maintained at (15 ± 3) Pa. The furnace pressure for a fire damper 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 10.4.7.

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 and ISO 5221. 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 fire damper 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 fire damper assembly during the test. In practice this will be limited to observations made on the furnace side and to the duct/fire damper 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 fire damper shall not exceed 360 m^3 / (h m^2) (corrected to 20 °C).

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

The 360 m^3 / (h m^2) (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 m^3 / (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 T1, T3, T5, Ts, TsA, etc. as shown in the figures and the roving thermocouple. The average temperature shall be determined from thermocouples T2,.T4, T6, etc. as shown in the figures.

c) Leakage:

Before the test, leakage through the fire damper shall not exceed 200 m^3 / (h m^2) at ambient temperature (corrected to 20 °C).

From 5 min after the start of the fire test the leakage through the fire damper shall not exceed 200 m^3 / (h m^2) (corrected to 20 °C).

To gain an S classification to EN 13501-3, the damper shall not exceed 200 m^3 / (h m^2) at ambient temperature (corrected to 20 °C) also on the smallest size.

The 200 m^3 / (h m^2) (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 200 m^3 / (h m^2) (corrected to 20 °C), shall remain and shall not be increased in proportion to the pressure difference.

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 fire damper failed to satisfy the criteria for integrity, insulation or leakage, or the termination of the heating, whichever is the shortest.

The information gathered from an additional test for a fire damper to be installed without ducting on one or both sides shall be assessed against b) above.

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 fire damper, including blade pivot axis (horizontal or vertical) and the materials, components, actuators, etc. used in its construction;

b) a detailed description of any duct included in the test set up to install the damper 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 fire damper 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 fire damper, 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 1366-2;

g) where appropriate, a record of the following relating to the leakage at ambient temperature before the fire test:

   1) a record of the determined leakage of the connecting duct and measuring station;

   2) for the damper leakage - measuring station pressure differential;

   3) for the damper leakage - calculated volume flow rate.

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

   1) connecting duct pressure differential against furnace pressure;

   2) gas temperature at exit of connecting duct;

   3) measuring station gas temperature;

   4) measuring station pressure differential;

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

i) the time at which the fire damper closed after the start of the test (see 10.4.6) and the test duration;

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

k) 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;

l) 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 fire damper

If a leakage classification (S) is not required, a test result obtained for the largest fire damper is applicable to all dampers of the same type (including any aspect ratio) provided that the maximum dimensions do not exceed those tested and that the components remain in the same orientation as those tested.

If a leakage classification (S) is required, an additional fire damper, representing the smallest size, shall satisfy the leakage classification (S) criteria when tested at ambient temperature.

13.2 Fire dampers installed within structural openings

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

13.3 Fire dampers installed onto the face of a wall or a floor

A test result obtained for a fire damper installed onto the face of a wall or floor is only applicable to fire dampers 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 Fire dampers remote from a wall or floor

A test result obtained for a fire damper remote from a wall or floor is applicable to fire dampers of the same type installed with the same ductwork details as tested:

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.

13.5 Fire from above

Fire dampers tested horizontally in floors with fire from below are acceptable in installations where fire might come from above.

13.6 Separation between fire dampers and between fire dampers and construction elements

A test result obtained for only one fire damper or for two fire dampers with a minimum clear separation of 200 mm is applicable to a minimum separation in practice of:

a) 200 mm between fire dampers installed in separate ducts;

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

13.7 Supporting constructions

A test obtained for a fire damper 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 fire damper installation.

Test results obtained with dampers 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 dampers installed in insulated flexible vertical supporting constructions may be applied to applications where the same 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.

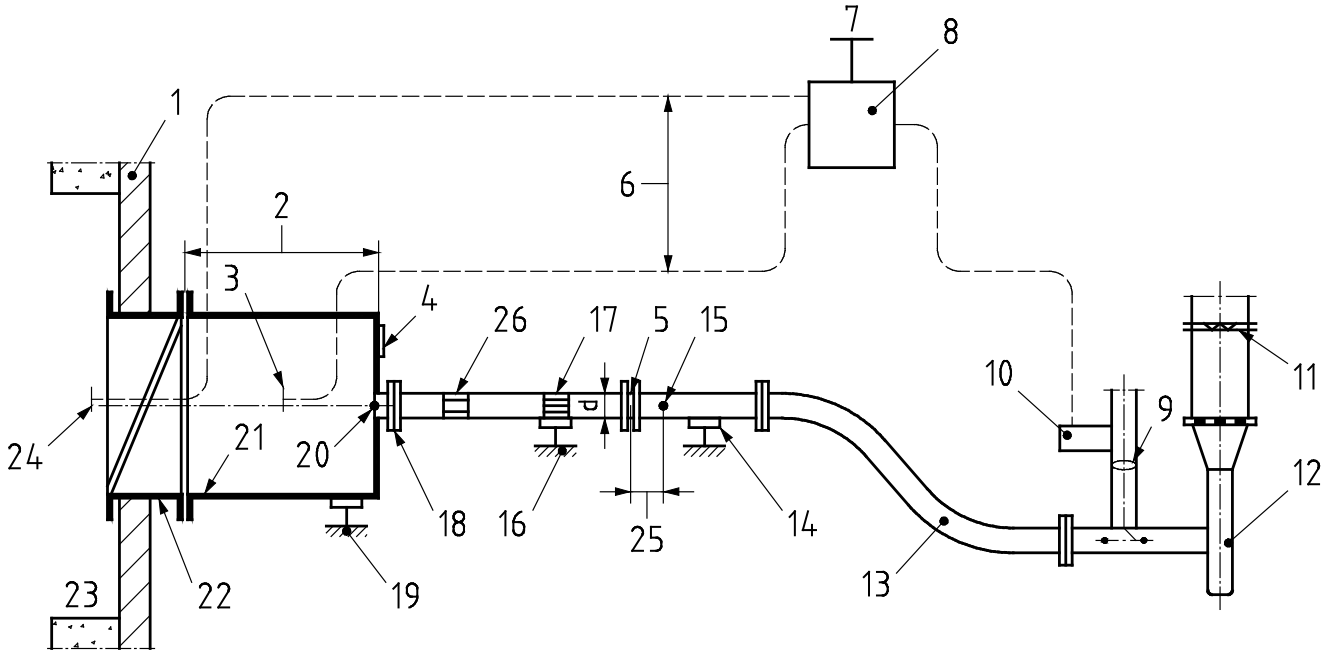
Test results obtained with dampers installed in flexible vertical supporting constructions made with steel studs are not applicable to flexible vertical supporting constructions made using timber studs.

Test results obtained with dampers 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.

13.8 Blade pivot axis

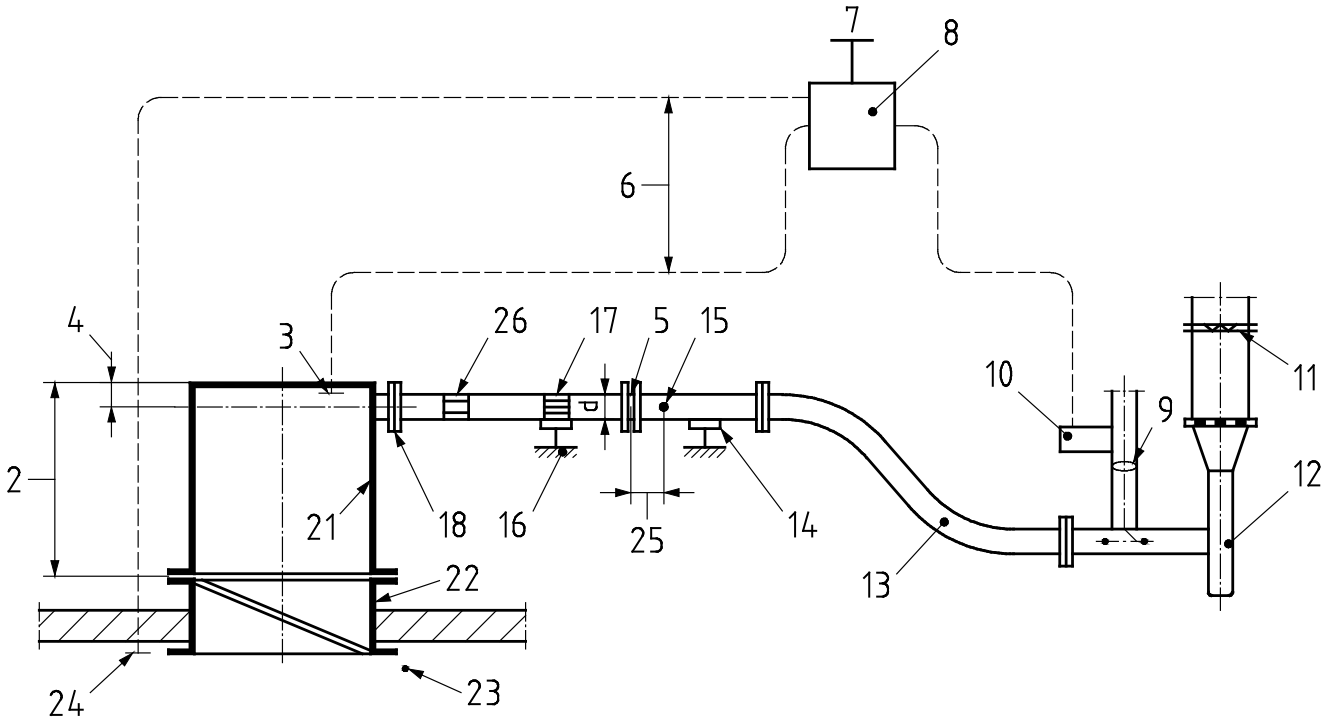
Tests with the actuator mounted at the bottom of the fire damper for a test with the blades with a vertical pivot axis shall allow the damper to be installed with the actuator at the top of the unit.



Key

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

Figure 1 — Example of general test arrangement



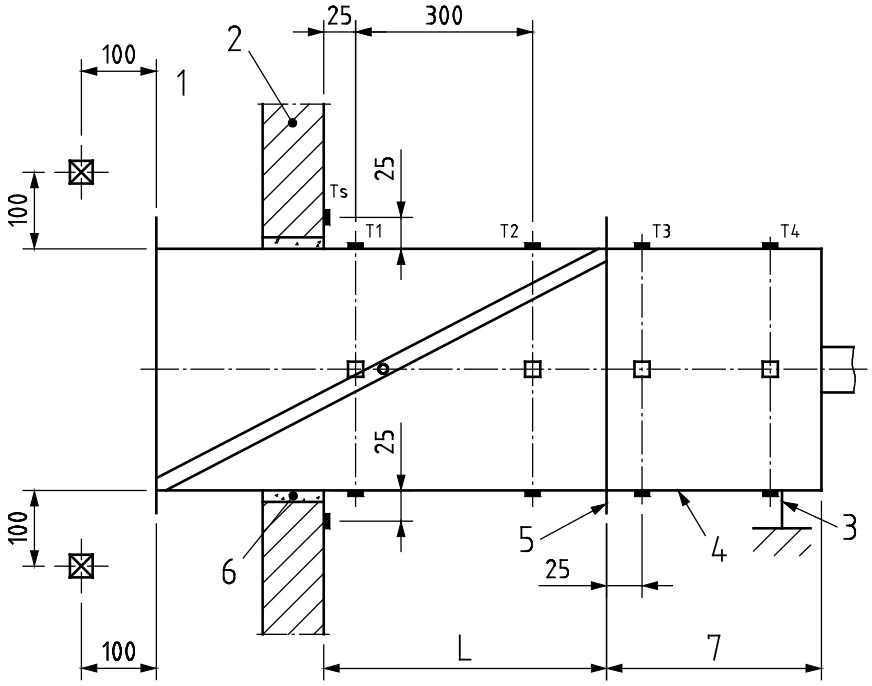
Key

2 2 × diagonal (to a maximum of 2 m)
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 1,5 mm diameter
16 support
17 flow straightener (where necessary)
18 flange
21 connecting duct
22 test damper
23 furnace chamber
24 pressure sensor 100 mm below top of furnace
25 distance: thermocouple - orifice plate - 2*d*
26 condensing device (if required)

Figure 2 — Example of an alternative arrangement when testing dampers in floor

Circular fire dampers tested with the blade axis horizontal and also tested with blade axis vertical may be installed with the blade axis at any angle.

Dimensions in millimetres



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 damper manufacturer
Ts maximum temperature at 25 mm up the supporting construction from the damper or duct – see detail in Figure 10 for clarification and use at discontinuities
T1 maximum temperature at 25 mm back from the supporting construction on the damper or duct – see detail in Figure 10 for clarification and use at discontinuities
T3 maximum temperature at 25 mm back from the damper/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

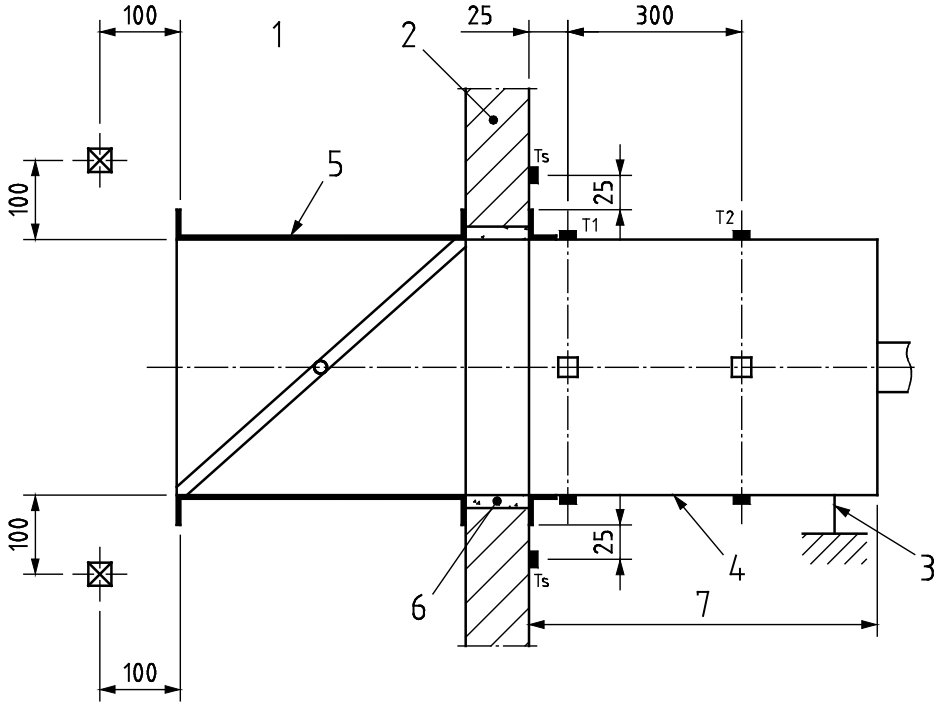
Use all thermocouples, Ts, T1, T2, T3 and T4, except if L < 350 when T2 not required or considered.

⊠ furnace thermocouples

damper symbol

Figure 3 — Damper mounted in standard supporting construction

Dimensions in millimetres



Key

1 furnace
2 supporting construction
3 support
4 connecting duct
5 damper
6 infill material
7 length - connecting duct see 4.2
Ts maximum temperature at 25 mm up the supporting construction from the damper or duct – see detail in Figure 10 for clarification and use at discontinuities
T1 maximum temperature at 25 mm back from the supporting construction on the damper or duct – see detail in Figure 10 for clarification and use at discontinuities
T2 average temperature at 300 mm back from T1

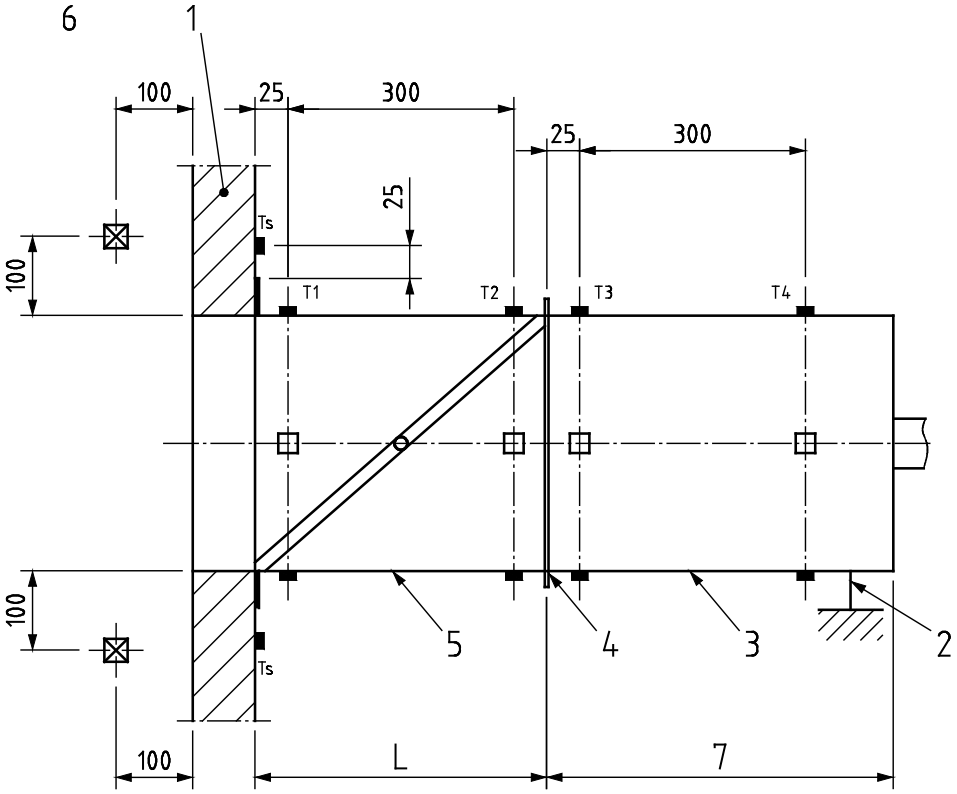
Use all thermocouples, Ts, T1 and T2.

⊠ furnace thermocouples

damper symbol

Figure 4 — Damper mounted onto face of supporting construction within the furnace

Dimensions in millimetres



Key

1 supporting construction
2 support
3 connecting duct
4 connecting angle
5 damper
6 furnace
7 length - connecting duct see 4.2
L length to be specified by damper manufacturer
Ts maximum temperature at 25 mm up the supporting construction from the damper or duct – see detail in Figure 10 for clarification and use at discontinuities
T1 maximum temperature at 25 mm back from the supporting construction on the damper or duct – see detail in Figure 10 for clarification and use at discontinuities
T3 maximum temperature at 25 mm back from the damper/connecting duct joint
T2 average temperature at 300 mm back from T_1 if L ≥ 350 mm
T4 average temperature at 300 mm back from T_3

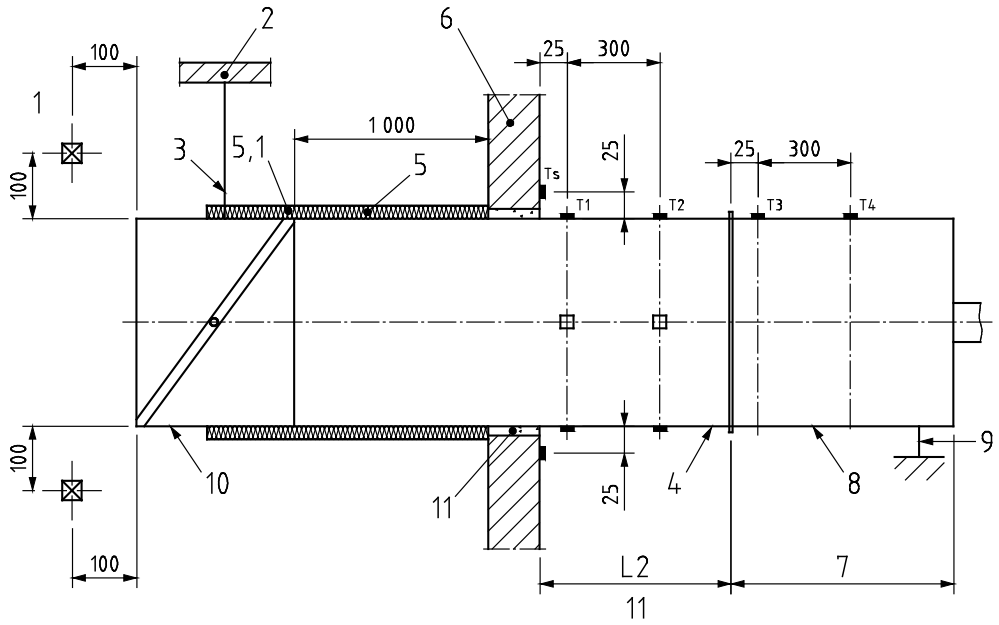
Use all thermocouples, Ts, T1, T2, T3 and T4, except if L < 350 when T2 not required or considered.

⊠ furnace thermocouples

damper symbol

Figure 5 — Damper mounted onto standard supporting construction outside the furnace

Dimensions in millimetres



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 end of the damper blade, in the case of a steel damper casing
6	supporting construction
7	length - connecting duct see 4.2
8	connecting duct
9	support
10	damper
11	stiffening of the duct may be required at the supporting construction to prevent integrity failure. This shall be recorded in the installation statement.
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 10 for clarification and use at discontinuities
T1	maximum temperature at 25 mm back from the supporting construction on the duct – see detail in Figure 10 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

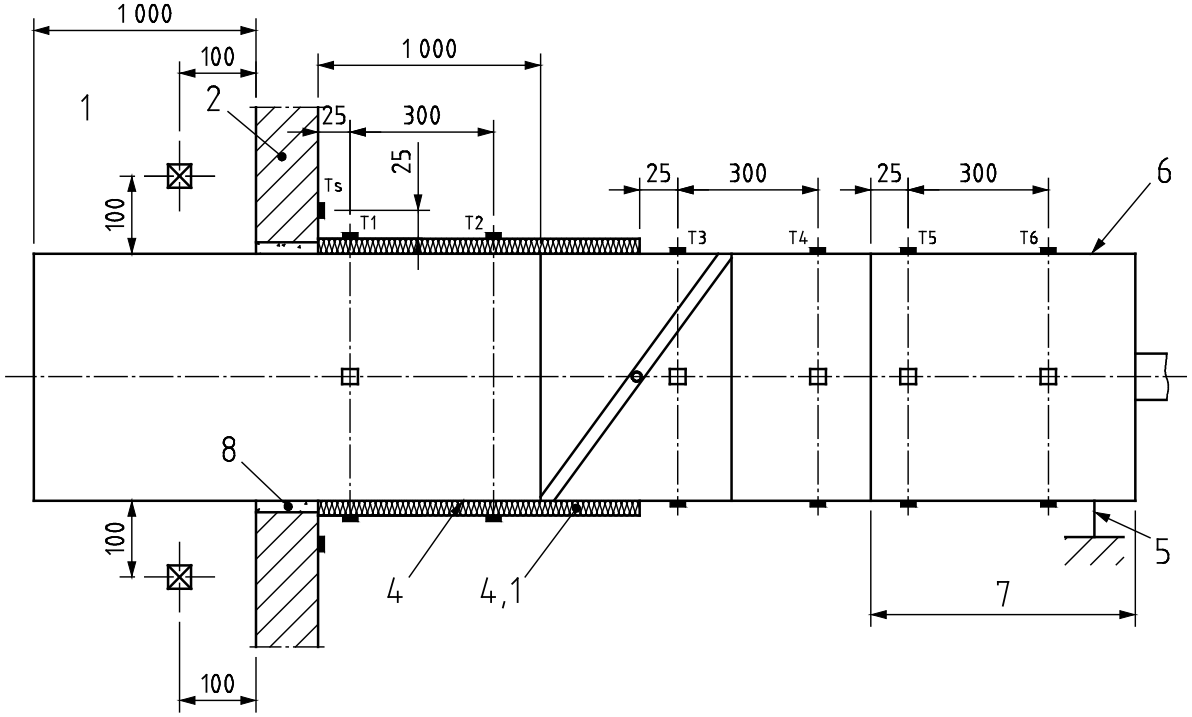
Use all thermocouples, Ts, T_1, T_2, T_3 and T_4.

⊠ furnace thermocouples

damper symbol

Figure 6 — Damper mounted remote from the standard supporting and inside the furnace

Dimensions in millimetres



Key

1 furnace

2 supporting construction

4 insulated duct outside furnace

4.1 insulated duct outside furnace up to the end of the damper blade, in the case of a steel damper casing

5 support

6 connecting duct

7 length - connecting duct see 4.2

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

Ts maximum temperature at 25 mm up the supporting construction from the insulated duct – see detail in Figure 10 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 10 for clarification and use at discontinuities

T3 maximum temperature at 25 mm back from the end of the insulation on the duct/damper

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

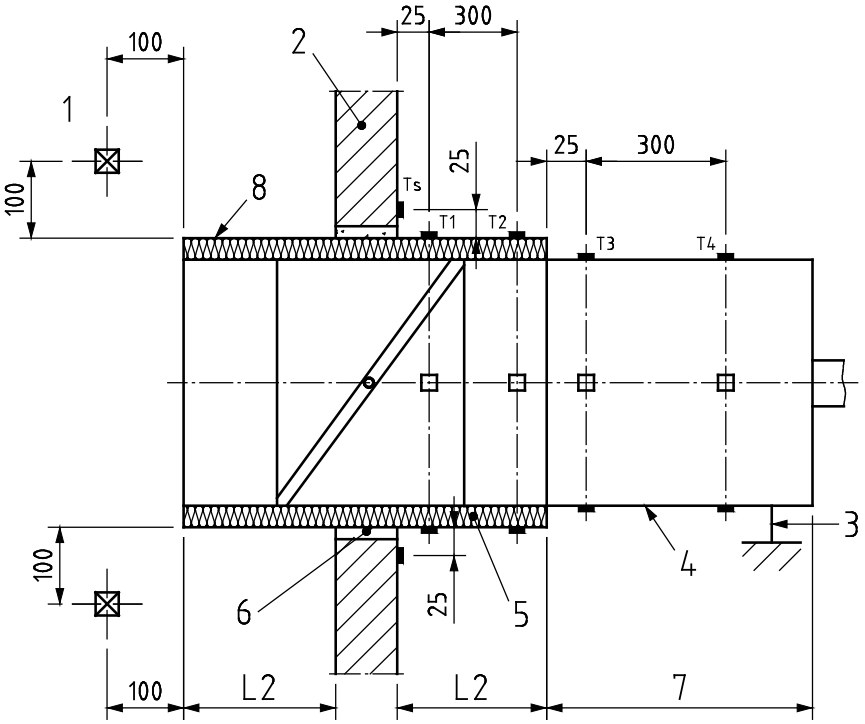
Use all thermocouples, Ts, T1, T2, T3, T4, T5 and T6.

⊠ furnace thermocouples

damper symbol

Figure 7 — Damper mounted remote from the standard supporting and outside the furnace

Dimensions in millimetres



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
8 insulated duct (inside furnace)
Ts maximum temperature at 25 mm up the supporting construction from the insulated duct – see detail in Figure 10 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 10 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

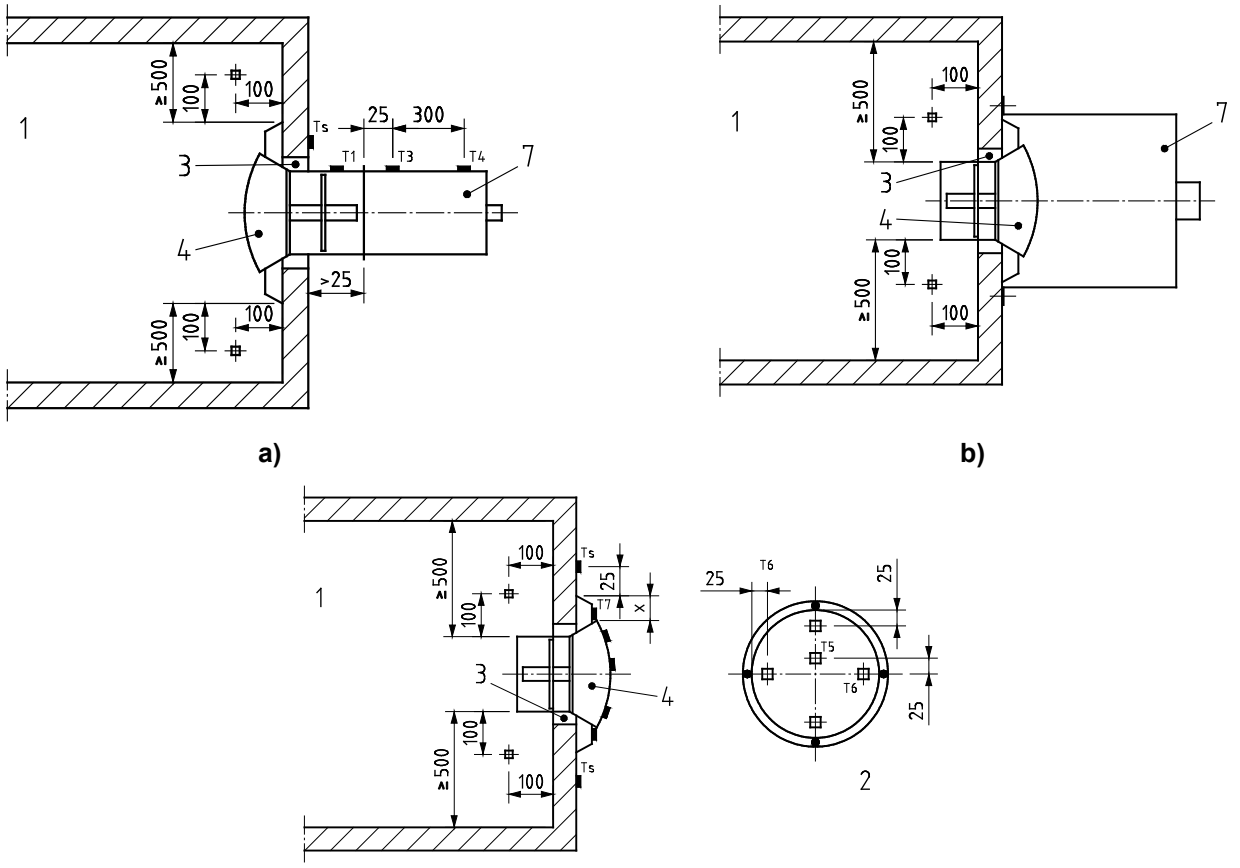
Use all thermocouples, Ts, T1, T2, T3 and T4.

⊠ furnace thermocouples

damper symbol

Figure 8 — Damper mounted in an insulated duct

Dimensions in millimetres



Key

1 furnace

2 face view

3 infill material if required

4 fire damper

NOTE A cone valve fire damper is shown, but the method can be applied for all fire dampers – see 6.3.6.

7 connecting duct - for length see 4.2

Ts maximum temperature at 25 mm up the supporting construction from the damper or duct – see detail in Figure 10 for clarification and use at discontinuities

T1 maximum temperature at 25 mm back from the supporting construction on the damper or duct – see detail in Figure 10 for clarification and use at discontinuities

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

T4 average temperature at 300 mm back from T3

T5 maximum temperature on the middle of the cone

T6 average temperature on the cone

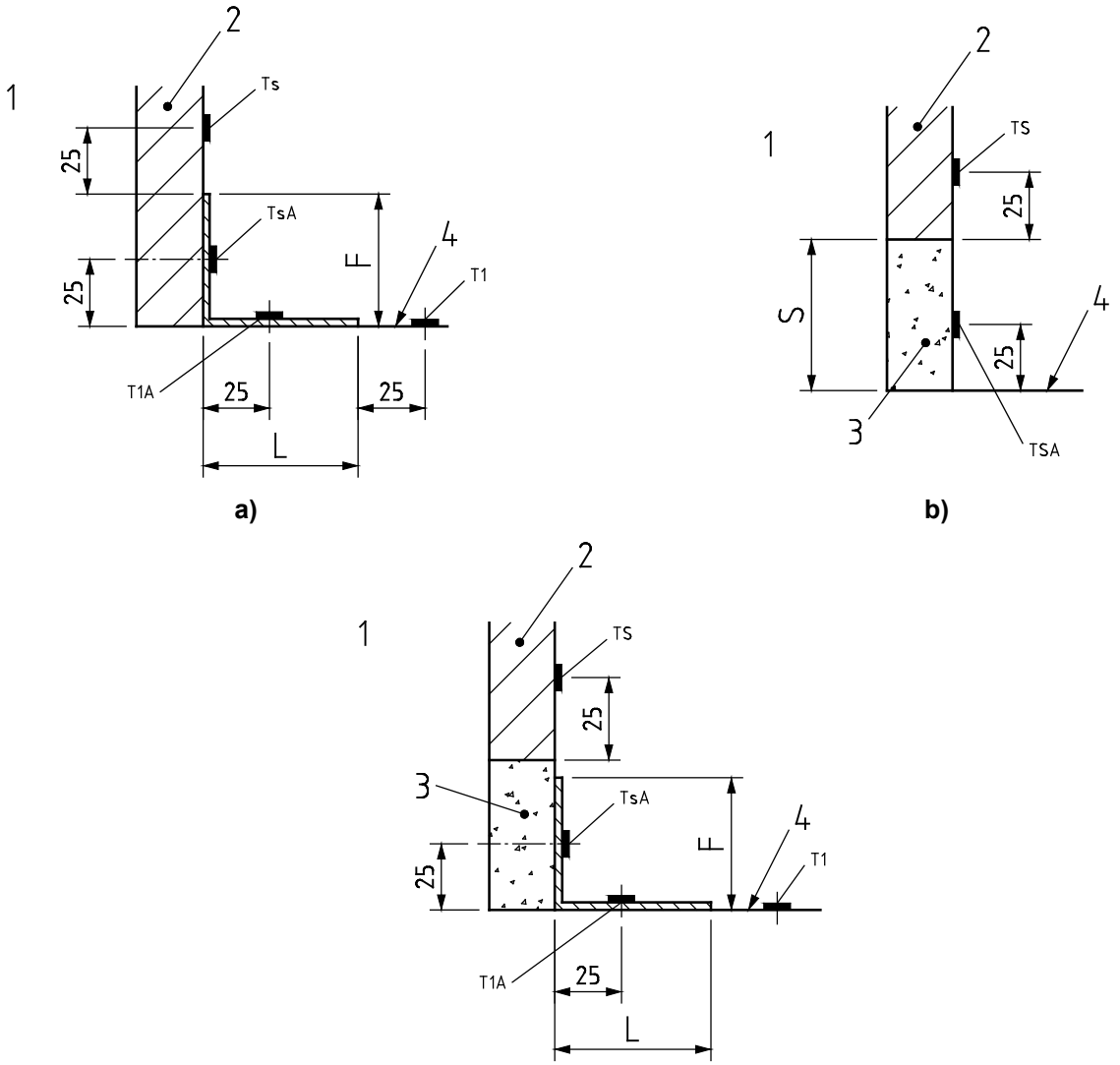
T7 maximum temperature on the centre of the frame, only applied if dimension “X” exceeds 30 mm

Use all thermocouples, Ts, T1, T3, T4, T5 and T6. Use T7 as directed.

☒ furnace thermocouples

Figure 9 — Detail for fire damper for application with no ducting on one or both sides, where additional evidence of insulation in such applications is required

Dimensions in millimetres

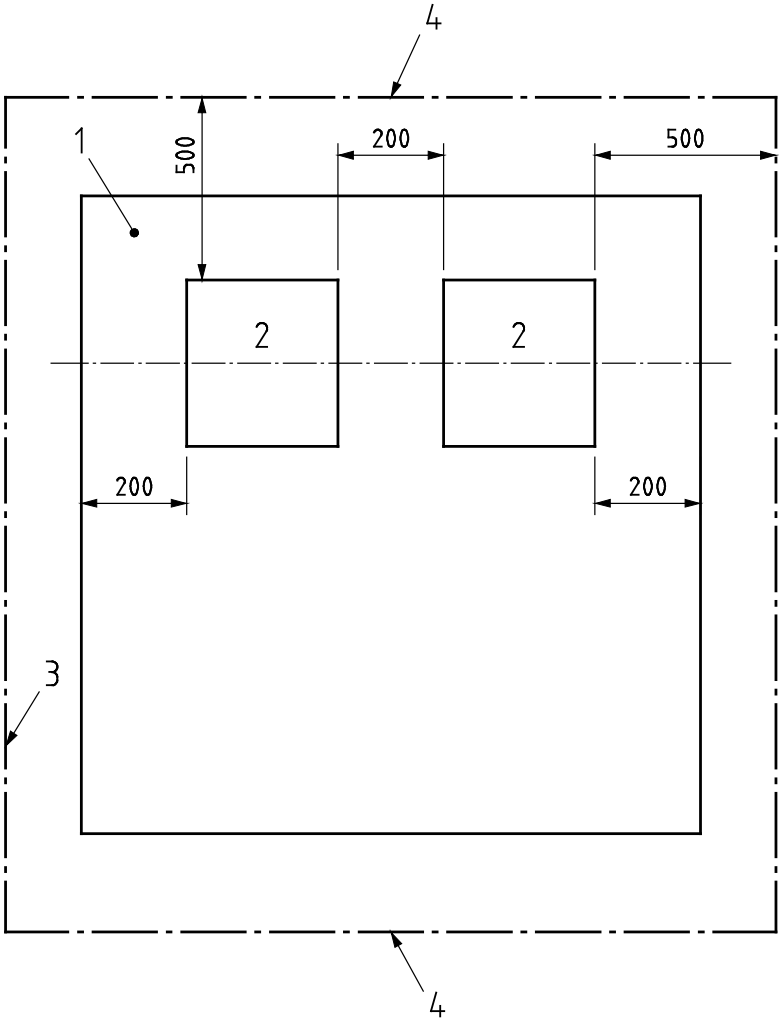


Key

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

Figure 10 — Detail for the application of thermocouples TS and T1 on the supporting construction at discontinuities

Dimensions in millimetres

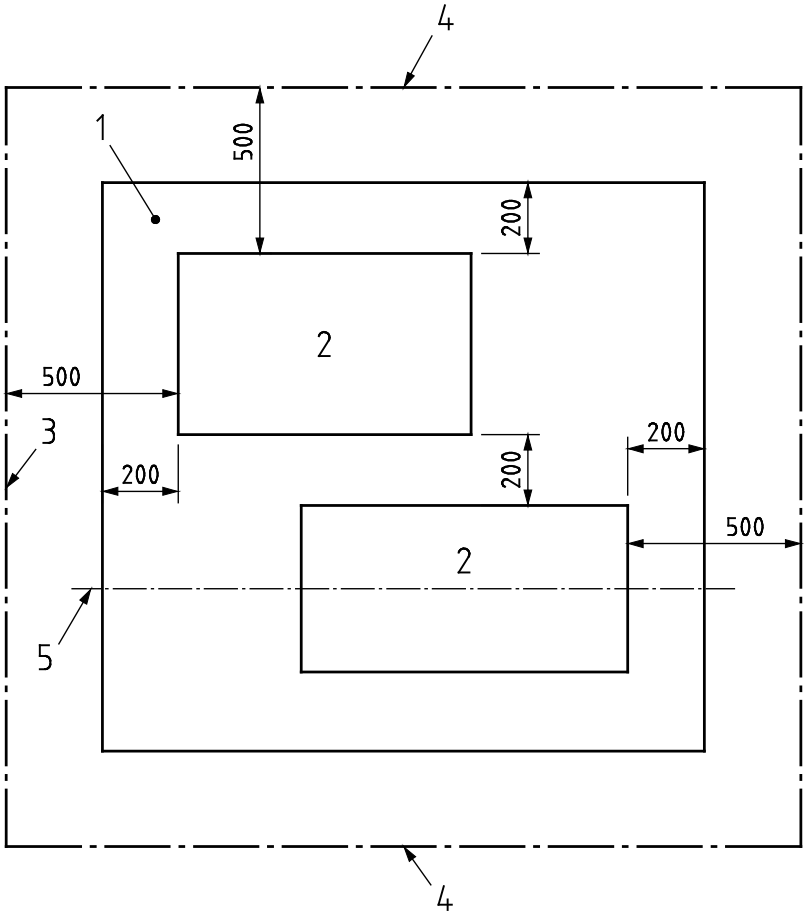


Key

1 supporting construction
2 damper
3 inner surface of furnace wall
4 inner surface of furnace floor and roof

Figure 11 — Minimum separation

Dimensions in millimetres



Key

1 supporting construction
2 damper
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 12 — Dampers mounted in different horizontal planes

Bibliography

[1] EN 1366-12, *Fire resistance tests for service installations — Part 12: Non-mechanical fire barrier for ventilation ductwork*

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