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Fire resistance tests for service installations

Part 5: Service ducts and shafts

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Fire resistance tests for service installations - Part 5: Service ducts and shafts

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Feuerwiderstandsprüfungen für Installationen - Teil 5: Installationskanäle und -schächte

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European foreword

This document (EN 1366-5:2021) 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of an identical text or by endorsement, at the latest by August 2021, and conflicting national standards shall be withdrawn at the latest by August 2021.

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

This document supersedes EN 1366-5:2010.

Against EN 1366-5:2010 the following changes were introduced:

1) necessary dated references were updated;

2) clearer rules were given for the scope of the standard;

3) terms and definitions clarified and completed;

4) the location of thermocouples was clarified especially when testing the specimen including service outlets and access panels;

5) drawings were improved and aligned to changes;

6) the thermocouple T3 from Version 2010 was deleted. It is not needed for measuring the property „Integrity” and it leads to confusion concerning that property.

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

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

Introduction

The purpose of this test is to measure the ability of a service duct or shaft to resist the spread of fire from one fire compartment to another with fire attack from inside or outside the duct or shaft. The test specimens incorporate joints, service outlets and access openings as intended in practice and are suspended as they would be in practice. Test specimens of service ducts are not loaded as in practice but a standard load is included to represent a typical service load. Test specimens of service shafts are not loaded as in practice, but a standard load is included to represent a typical service load.

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 there is a possibility that toxic and/or harmful smoke and gases may be involved 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 document specifies a method for determining the fire resistance of horizontal service ducts and vertical service shafts, which pass through walls or floors and enclose pipes and cables, to classify them according to EN 13501-2. The test scenario examines the behaviour of ducts and shafts exposed to fire either from outside or from inside the system. This document is intended to be read in conjunction with EN 1363-1.

This document does not examine the risk of fire spread as a result of thermal conduction along the piping or cabling installed in service ducts or shafts or thermal conduction through the media these pipes carry. It does not cover the risk of damage produced by thermal elongation or shortening of tubes and cables as a result of fire or damaged pipe suspensions. This document does not give guidance on how to test one, two or three sided service ducts or shafts.

NOTE Guidance on testing service ducts and shafts of less than four sides will be covered in the extended field of application rules being developed by CEN/TC 127.

This test can be used for systems with boards and also for such systems with continuous covering with intumescent materials on the boards. It cannot be used for systems where intumescent material is only applied in the range of the penetration.

This test is unsuitable for evaluating service ducts or shafts with internal barriers at walls and floors.

This test is unsuitable for evaluating fire protective systems for cable systems and associated components with maintenance of integrity in case of fire. This is covered by EN 1366-11: Fire protective systems for cable systems and associated components - Part 11: Fire protective systems for cable systems and associated components.

Whilst the walls of service ducts or shafts tested to this method may provide specified levels of integrity or insulation, testing according this document does not replace the testing of the functional endurance of small electrical cables which is covered in EN 50200.

Fire resistance testing of ducts for air distribution systems is covered in EN 1366-1.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1363-1:2020, *Fire resistance tests — Part 1: General requirements*

EN 13501-2, *Fire classification of construction products and building elements — Part 2: Classification using data from fire resistance tests, excluding ventilation services*

EN ISO 898-1:2013, *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 1: Bolts, screws and studs with specified property classes — Coarse thread and fine pitch thread (ISO 898-1:2009)*

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 ISO 13943 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.1
service duct
mainly horizontal duct enclosing combustible or non-combustible services, such as pipes or cables

3.2
service shaft
mainly vertical shaft enclosing combustible or non-combustible services, such as pipes or cables

3.3
shutter of access opening
openable door or panel allowing for access to the services within the duct or shaft

3.4
supporting construction
wall, partition or floor which the duct or the shaft passes through in the test

3.5
board
rigid product of cross section in which the thickness is uniform and substantially smaller than the other dimensions of the installations

4 Test equipment

4.1 General

In addition to the test equipment specified in EN 1363-1, the following are required.

4.2 Furnace

The furnace shall be capable of subjecting service ducts and shafts to the standard heating and pressure conditions specified in EN 1363-1 and be suitable for testing horizontal ducts (see Figures 1 and 2) or vertical shafts (see Figures 3 and 4).

4.3 Loading equipment

Continuous stranded steel cables and/or the installations used in practice are used to apply load to the service duct or shaft to represent service loading.

4.4 Gas extraction equipment (optional)

If for safety reasons a laboratory requires to extract gases away from the open end of the duct or shaft, this shall not influence the test conditions.

5 Test conditions

5.1 Furnace

The heating and pressure conditions and the furnace atmosphere shall conform to those given in EN 1363-1.

5.2 Loading

Horizontal service ducts shall be loaded when supporting service installations. In this case, the weight of the load shall be representative of that used in practice.

Vertical service shafts shall not be loaded except in the two following situations:

— when supporting service installations. In this case, the weight of the load shall be representative of that used in practice;

— when the service installation shaft is not supported on each floor or when the height between two supports is greater than 5 m. In this case a weight load representative for the additional shaft weight shall be added to the shaft top.

6 Test specimen

6.1 Size

6.1.1 General

Any cross section of duct or shaft may be tested as required by the sponsor.

6.1.2 Length

The minimum lengths of the parts of the test specimen inside and outside the furnace shall be as given in Table 1.

Table 1 — Straight length of test specimen

Orientation	Length m			
	Inside furnace		Outside furnace	
	fire outside	fire inside	fire outside	fire inside
Horizontal duct	≥ 4,0	0,25 ± 0,05	2,0 ± 0,05	2,5 ± 0,05
Vertical shaft [a]	≥ 2,0	0,25 ± 0,05	2,0 ± 0,05	2,0 ± 0,05
[a] See also 5.2.				

6.1.3 Cross-section

The service ducts and shafts of the same construction type shall be tested with the maximum width and height and the minimum thickness as intended in practice.

6.2 Number

One test specimen shall be tested for each type of orientation, exposure conditions and cross-section.

6.3 Design

6.3.1 General

The test shall be made on a test specimen, representative of the complete service duct or shaft assembly.

6.3.2 Duct and shaft arrangement

6.3.2.1 General

The exposure condition (fire inside or fire outside) shall be as specified by the sponsor. Ducts shall be arranged as shown in Figures 1 or 2 and shafts shall be arranged as shown in Figures 3 or 4. Service ducts or shafts with fire exposure from outside will have no openings in the furnace (except access panels and service outlets). For service ducts or shafts exposed to an internal fire, the end of the service duct or shaft facing into the furnace shall be left open. No service ducts or service shafts shall contain anything other than the loading defined in 4.3.

If a service outlet is part of the system this service outlet shall be tested with a distance to the penetration through the wall or floor not lower than intended in practice.

Where used in practice, each service duct or shaft shall incorporate one access opening as follows:

— fire outside: inside furnace at mid-span of two suspensions;

— fire inside: as shown in Figure 2 (the dimensions may be applied also to vertical shafts).

For the test, the access opening shall be at the bottom of the duct except the access opening is in practice only on a side or on the top. In this case the access opening shall be installed as in practice. The width and height of the access opening shall be representative of the maximum dimensions used in practice, the thickness shall be the minimum dimension used in practice.

Vertical shafts shall be arranged as shown in Figures 3 or 4 and shall penetrate through the furnace roof slab/supporting construction. The shafts shall be supported at the furnace roof level as they would be supported in practice when penetrating a floor (as specified by the sponsor).

6.3.2.2 Joints in horizontal service ducts

For the fire test with fire from outside the test configuration shall include at least one joint inside and at least one joint outside the furnace. There shall be at least one joint for every layer, both inside and outside the furnace.

For the fire test with fire from inside these rules only apply for the part of the specimen outside the furnace.

Outside the furnace, the joint in the outer layer of the fire protection material shall be recorded and it may be not nearer than 100 mm to thermocouples T2 in accordance with 9.1. Inside the furnace, the joint in the outer layer of fire protection material shall be located at approximately mid-span. The location of joints in inner layers shall be as specified by the sponsor.

The distance between joints and suspension devices shall not be less than that used in practice. If the minimum distance has not been specified, suspension devices shall be arranged so that the joint at mid-span lies midway between them. Distances between the suspension devices shall be specified by the sponsor and shall be representative of practice.

6.3.2.3 Joints in vertical service shafts

For the vertical shaft exposed to fire from inside, the test configuration shall include at least one joint outside the furnace. There shall be at least one joint for every layer.

For the vertical shaft exposed to fire from outside, the test arrangement shall include at least one joint inside and one joint outside the furnace. There shall be at least one joint both inside and outside the furnace in every layer of fire protection material.

For fire from inside and for fire from outside: outside the furnace, the joint in the outer layer of the fire protection material shall be recorded and it may be not nearer than 100 mm to thermocouples T2 in accordance with 9.1. For fire from outside inside the furnace the joint in the outer layer of fire protection material shall be located at approximately mid-span. The location of joints in inner layers shall be as specified by the sponsor.

For multi-layer systems, the location of joints on the inner layer shall be specified by the sponsor.

7 Installation of test specimen

7.1 General

The sealing between the supporting construction and the duct or the shaft shall be as intended in practice. If the width of the gap around the duct or shaft at the furnace penetration point is not specified, a width of 50 mm shall be used.

Where the duct or shaft passes through an opening in the furnace wall or roof, then the opening shall be of sufficient dimensions to allow for the supporting construction to surround all faces of the duct or shaft by at least 200 mm from the duct/shaft or the outer edge of any fire stopping.

The minimum size of a partition wall as supporting construction for a duct shall be width x height 1,20 m x 2,50 m. The partition wall shall be fixed in the furnace opening only on the top and the bottom of the wall, but not on the sides.

Parts of the ducts or shafts within the furnace shall be exposed to fire from all sides over their whole length. Where vertical shafts are not in practice to be fixed to each floor, then the mass of shafts above shall be reproduced in the test. The simulated height and the mass represented during the test shall be stated in the test report.

There shall be a clearance of at least 500 mm between the top of the horizontal duct and the ceiling, and also at least 500 mm between the underside of the horizontal duct and the floor. Similarly, there shall be a clearance of at least 500 mm between the sides of ducts or shafts and furnace walls. At the furnace wall remote from the penetration point there may be no gap between the duct tested with fire from outside and the furnace wall.

The test specimen shall be installed in a manner representative of its use and practice. For the test the loading occurring in practice by cables, pipes and cable trays (if not included in the test specimen) shall be taken into account by stranded steel cables as replacement.

Apply the loading equipment along the complete length of the bottom, inside face of each horizontal service duct to represent a uniformly distributed load. The minimum load (f) shall be:

$$f = 20 \times \frac{W}{1000}$$

where

f is the load in kilograms per metre (kg/m);

W is the width of service duct in millimetres (mm).

To ensure uniform loading, a minimum of three cables uniformly distributed across the width shall be used. For ducts with a height lower or equal 100 mm the depth of the cables shall not exceed 50 % of the height (a 30 mm diameter stranded steel cable has a mass of approximately 3,8 kg/m).

7.2 Standard supporting construction

Where the type of supporting construction to be used in practice is not known, one of the standard supporting constructions as described in detail in EN 1363-1:2020, 7.2 shall be used.

The standard floor construction as described in detail in EN 1363-1:2020, 7.2 does not cover flexible floor constructions (e.g. containing timber joists). An appropriate flexible standard supporting construction floors should be developed to cover these service shafts.

The choice for the fire rating of the standard supporting construction is to be made by the test sponsor. It is recommended to use a fire rating which is approximately the same at the product to be tested.

7.3 Non-standard supporting constructions

When the test specimen is intended to be used in a form of construction not covered by the standard supporting constructions, it shall be tested in that supporting construction.

8 Conditioning

8.1 General

Conditioning of the test construction shall be in accordance with EN 1363-1.

8.2 Water based sealing materials

Water based sealing materials (like mortar or gypsum) used to seal the gap between the supporting construction and the specimen where the gap is ≤ 10 mm wide shall be conditioned for at least 1 day before fire testing. Water based sealing materials used to seal the gap between the supporting construction and the specimen where the gap is 10 mm < x ≤ 50 mm wide shall be conditioned for at least 7 days before fire testing.

If a gap is > 50 mm wide and it is filled with non-water based sealing materials, but on both sides covered by an outer layer consisting of water based materials ≤ 10 mm it shall be conditioned for at least 7 days.

Water based sealing materials used to seal the gap between the supporting construction and the specimen where the gap is > 50 mm wide shall be conditioned for at least 28 days before fire testing.

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 and shall be positioned as shown in Figure 10. On service ducts or service shafts with fire from outside 3 pairs of plate thermometers shall be positioned in equal distances on the sides of the specimen.

On service ducts or service shafts with fire from inside on all four sides of the specimen plate thermocouples shall be positioned directly on the specimen edge as it can be seen in Figure 10.

The distances of the plate thermocouples to the specimen's surfaces shall be 150 mm ± 50 mm.

For all ducts, the plate thermometers shall be oriented so that side "A" (see Figure 1 in EN 1363-1:2020) faces the walls of the furnace opposite the ducts being evaluated.

9.1.2 Thermocouple locations

9.1.2.1 General

The temperature of the test specimens shall be measured in accordance with EN 1363-1.

9.1.2.2 Temperature at the penetration of the service duct or shaft through the wall or floor

The position of thermocouples at the point of penetration of the duct or shaft through the wall or floor is shown in Figures 5 to 7 for a number of different penetration details. Additional thermocouples T1 shall be located in positions on the outer surface of the fire protection material to coincide with all joints (inner layer joints as well). Thermocouples T2 shall be used to determine the mean temperature rise, and thermocouples T1 and T2 shall be used for determining maximum temperature rises.

If the construction changes, e.g. by changing the thickness of the boards, additional thermocouples T1 and T2 have to be applied as it is given at the penetration, see Figures 5 to 7.

9.1.2.3 Temperature on unexposed face of access door or panel

Surface thermocouples T_a (1 - 5) shall be located as shown in Figure 8. Thermocouples T_a (1 - 5) on the access door/panel shall be at the centre and at the centre of each quarter. Thermocouples T2 around the edges of the door/panel shall be located with the centres of the disc 25 mm from the closing edges.

9.1.2.4 Temperature on service outlets

The temperature on optional service outlets shall be measured as shown in Figure 9 with thermocouples T3 in a distance of 25 mm away from the service outlet on a duct or shaft with fire from the inside and with fire from the outside. All penetrating services shall have on their surface a thermocouple T3 in a distance of 25 mm away from the penetration point. For these thermocouples only the maximum rise shall be taken into consideration. The time has to be determined, when the temperature rise at one of the thermocouples T3 passes a value of 180 K.

9.1.2.5 Temperature of the protected suspension device

If the suspension devices within the furnace are protected, a thermocouple shall be positioned on each component of at least two protected suspension devices.

9.2 Pressure

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

The furnace pressure shall be controlled to 15 Pa throughout the test at the mid-height position of the lowest located horizontal service duct.

For service shafts the furnace pressure shall be controlled to 20 Pa 100 mm below the ceiling.

The tolerance of the pressure differential is given in EN 1363-1.

10 Test procedure

10.1 General

The test shall be carried out using the equipment in Clause 4, the procedures in this document and EN 1363-1. If the service duct or shaft is intended to contain combustible services in practice always the test with fire from inside has to be performed.

10.2 Test measurements and observations

10.2.1 General

Make the following measurements and observations to enable the criteria of integrity and insulation to be assessed.

10.2.2 Integrity

10.2.2.1 Integrity during fire exposure at the outside

a) Look for the formation of cracks and openings in the duct or shaft outside the furnace.

b) Determine the time at which the passage of flames or hot gases causes ignition of the cotton pad according to EN 1363-1, the cotton pad being applied to any crack or hole which develops in the duct or shaft assembly outside the furnace. Measure the size and determine the time at which the size of the gaps exceed the limits specified in EN 1363-1 so that the gap gauges can penetrate into the service duct or shaft or into the furnace.

c) Throughout the test, monitor for a potential integrity failure where the duct or shaft passes through the wall or floor by using the cotton pad or the gap gauges.

10.2.2.2 Integrity during fire exposure from the inside

a) Look for the formation of cracks and openings in the service duct or shaft outside the furnace.

b) Determine the time at which the passage of flames or hot gases causes ignition of the cotton pad according to EN 1363-1, the cotton pad being applied to any crack or hole which develops in the duct or shaft assembly outside the furnace. Measure the size and determine the time at which the size of the gaps exceeds the limits specified in EN 1363-1 so that the gap gauges can penetrate into the service duct or shaft or into the furnace.

c) Throughout the test, monitor for a potential integrity failure where the duct or shaft passes through the wall or floor by using the cotton pad or the gap gauges.

10.2.3 Insulation (temperature of the surfaces outside the furnace – for both fire exposure at the inside and exposure at the outside)

Measure the mean and maximum temperatures of the unexposed faces of the test specimens as specified in 9.1.2 and in accordance with EN 1363-1, using also a roving thermocouple to locate points of high temperature not covered by the fixed thermocouples.

10.2.4 Additional observations

Throughout the test, make observations of all changes and occurrences which do not affect the performance criteria but which could create hazards in a building, including, for example:

a) deflections; this will cover the general behaviour of the service duct or shaft, which direction it is deflecting in; precise measurements are not required;

b) the emissions of smoke from the service duct or shaft outside the furnace, for example, attributable to its coverings and/or linings. Only limited observations may be possible and in view of the subjective nature of such observations the information should be used with some degree of caution.

c) The part of the duct or shaft inside the furnace has to be observed whether or not it is collapsing in total or in parts respectively whether or not openings are developing, through which the fire can enter into the specimen.

10.3 Termination of the test

Terminate the test for the reasons given in EN 1363-1.

11 Performance criteria

11.1 Integrity

Integrity failure shall be deemed to have occurred if any observations are made as described in EN 1363-1 (see also 10.2.2).

11.2 Insulation

11.2.1 Insulation criteria for service ducts and shafts with combustible and noncombustible services

Insulation failure shall be deemed to have occurred when the temperature rises above initial ambient temperature in the laboratory on the unexposed surface of the test specimen outside the furnace exceed either:

a) 140 K as a mean value (thermocouples T2 shall be used to determine the mean temperature rise, see 9.1.2.2); and in respect of access panels located outside the furnace, thermocouples T_a (1-5) (see Figure 8); or

b) 180 K as a maximum value read by any surface thermocouple described in 9.1.2.2 and 9.1.2.4, or those described in 9.1.2.3 for access panels located outside the furnace.

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 reference that the test was carried out in accordance with EN 1366-5;

b) the method of fixing, support and mounting, as appropriate for the type of test specimen;

c) a description of the method and materials used to seal the gap between the duct or shaft and the opening provided in the wall or floor to accommodate the service duct or shaft;

d) the details of the supporting construction;

e) the load of the stranded steel cables and the other installation used for loading the test specimen;

f) the specific installation tested;

g) any other observations made during the test.

13 Field of direct application of test results

13.1 Walls or floors through which the service ducts or shafts lead

A test result obtained for a fire resisting service duct or shaft passing through a standard supporting wall or floor construction made of masonry, concrete or a standard supporting lightweight partition wall is applicable to the same type of wall or floor with a fire rating, thickness and density equal to or greater than that of the wall or floor used for the test.

Test results obtained in a lightweight partition wall are applicable to walls made from concrete or masonry of at least the same thickness provided that the classified fire resistance of that construction is greater than or equal to the one used for the test.

A test result obtained for a fire resisting service duct or shaft passing through a non-standard supporting construction according to 7.3 is only applicable to that supporting construction as it was tested.

13.2 Sizes of ducts or shafts

The results of ducts or shafts made from boards tested with the size given by the sponsor are applicable up to the width and height as tested and a thickness greater or equal.

13.3 Shapes

These test results cover the forms of T-pieces, branches and direction changing pieces using the same jointing techniques and the same fixing/suspension system.

13.4 Admissible services

The results of tests following this document may be used for service ducts and shafts which include all usual services. For service ducts with cable trays not included in the test specimen this applies only to a maximum mass of the loading equipment used for testing the specimen.

It should be noted that some services in normal use and/or in case of fire have significant thermal elongation and can thus lead to a loss of integrity.

13.5 Suspension devices for ducts

13.5.1 Material and sizing

As the test configuration does not allow an assessment of the loadbearing capacity, the suspension devices shall be made of steel and be sized so that the calculated stresses do not exceed the values given in Table 2. This is valid for a maximum length of the hangers of 1,5 m.

Table 2 — Maximum values of stresses in suspension devices depending on duration of fire resistance

Type of load	**Maximum stresses** N/mm^2	
	Duration of fire resistance	
	≤ 60 min	**> 60 min and ≤ 120 min**
Tensile stress in all vertically orientated components	9	6
Shearing stress in screws of property Class 4.6 to Tables 2 and following of EN ISO 898-1:2013	15	10

This rule does not apply if the construction contains a predetermined breaking point in the vicinity of the penetration through the wall and is tested.

13.5.2 Elongation

The elongation in millimetres of the suspension devices of the test ducts can be calculated on the basis of temperature increases and stress levels. For unprotected steel suspension devices, the temperature used shall be the maximum furnace temperature. For protected steel suspension devices, the maximum recorded suspension device temperature shall be used. The value calculated represents the elongation limit for suspension devices with a greater length than in the test.

13.6 Distances

13.6.1 Distance to the supporting construction

The test is also applicable for 4-sided service shafts or service ducts directly fixed on the wall or floor without distance.

13.6.2 Distance of the first joint after the supporting construction

The distance of the first joint after the supporting construction may not be closer in practice as tested.

13.6.3 Distance between service ducts or service shafts in practice

The distance between service ducts and shafts may in practice be bigger or smaller as tested, but not smaller than 100 mm. If the distance between the systems is deemed to be smaller than 100 mm this shall be tested separately.

13.6.4 Distance between service outlets and penetrated wall or floor

The distance between service outlets and penetrated wall or floor may not be smaller as it has been tested.

13.7 Access panels

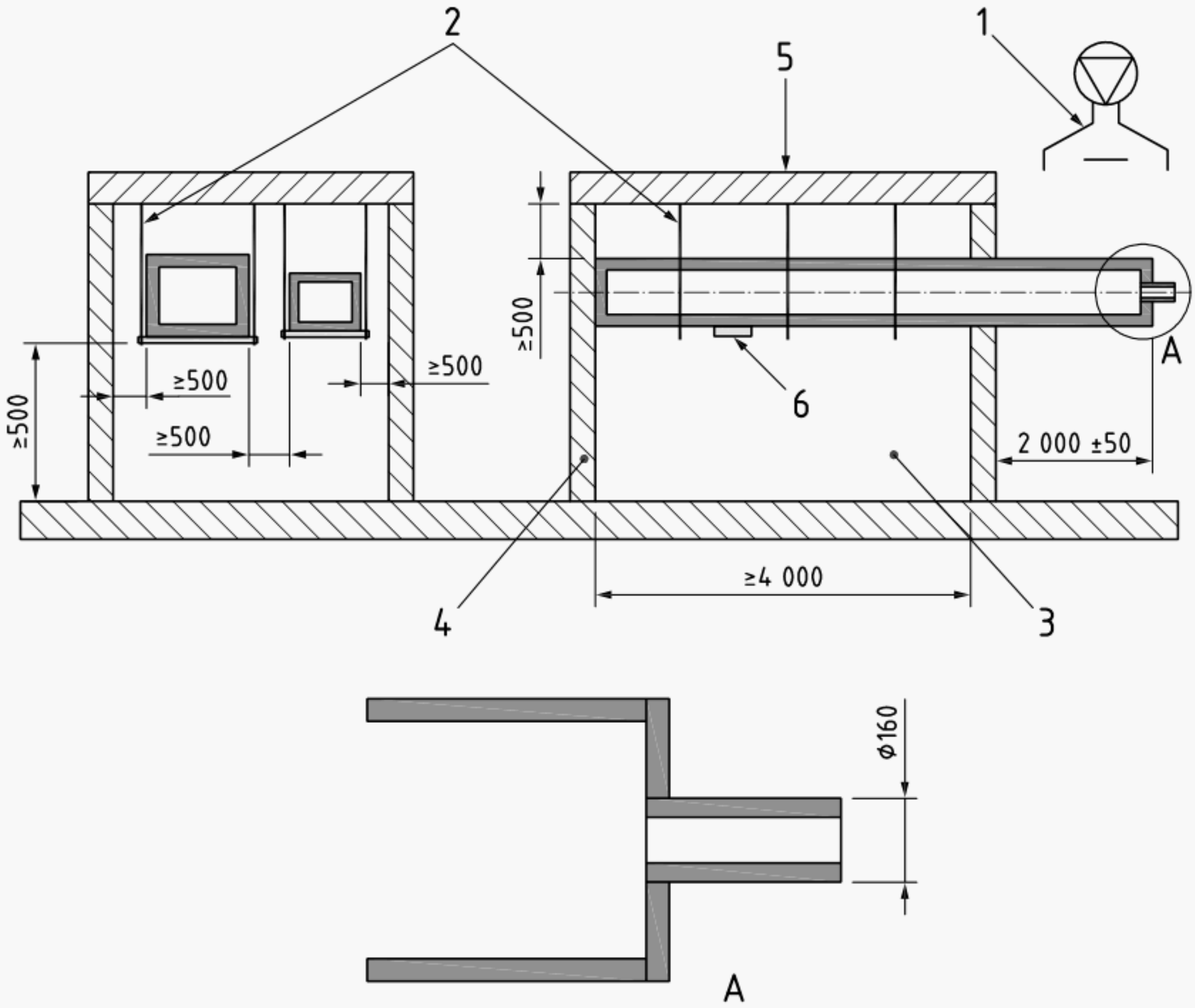
An access panel may only be used as tested with width and height smaller or equal and a thickness greater or equal.

The rule concerning the orientation of 6.3.2.1 has to be taken into consideration.

13.8 Service outlets

Service outlets may only be used in the size and shape as tested or with smaller sizes.

Dimensions in millimetres

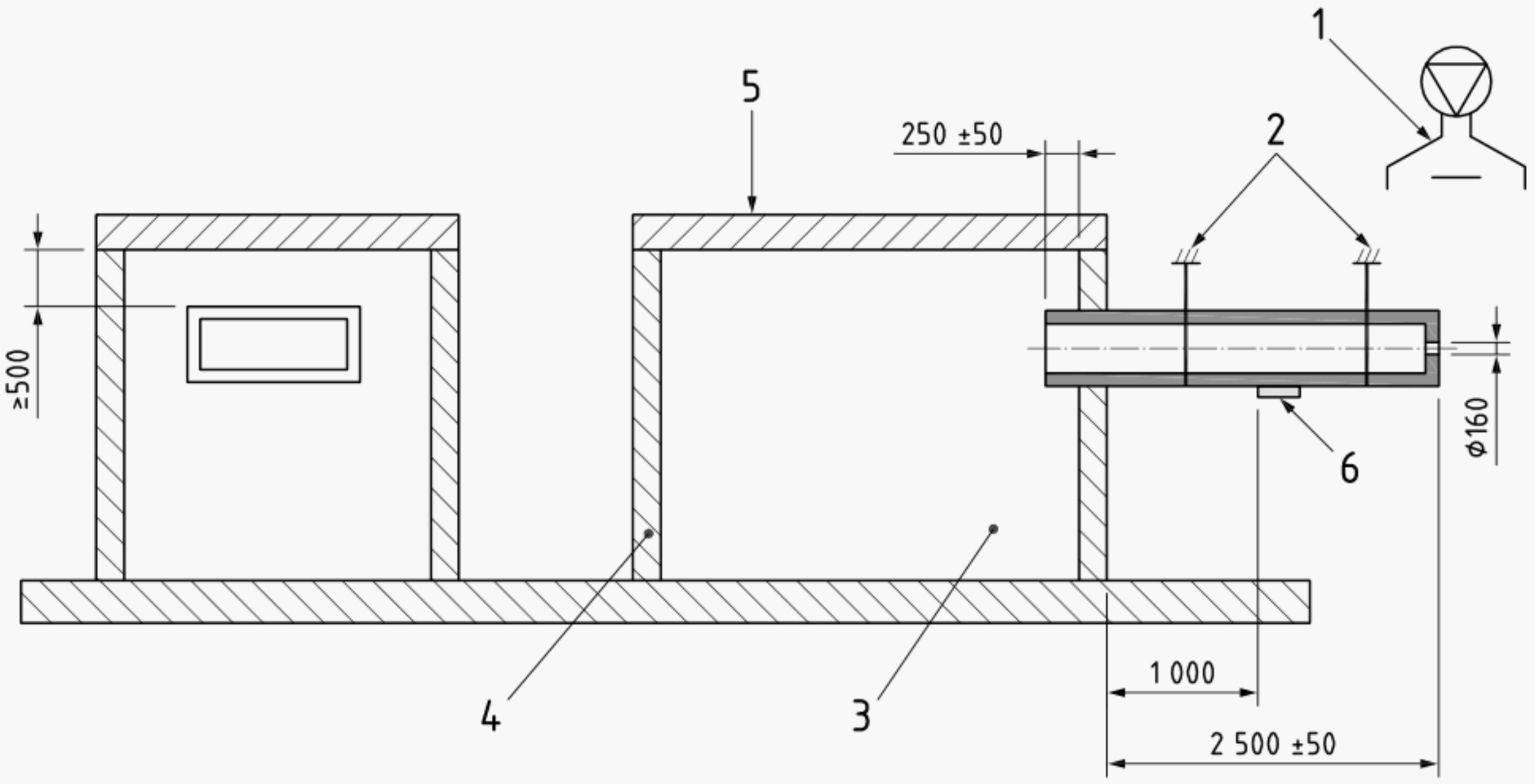


Key

1 optional fan and extract hood
2 suspension devices
3 furnace
4 furnace walls
5 furnace roof
6 access panel at midspan between hangers

Figure 1 — Example of test arrangement for horizontal service ducts (fire exposure from outside)

Dimensions in millimetres

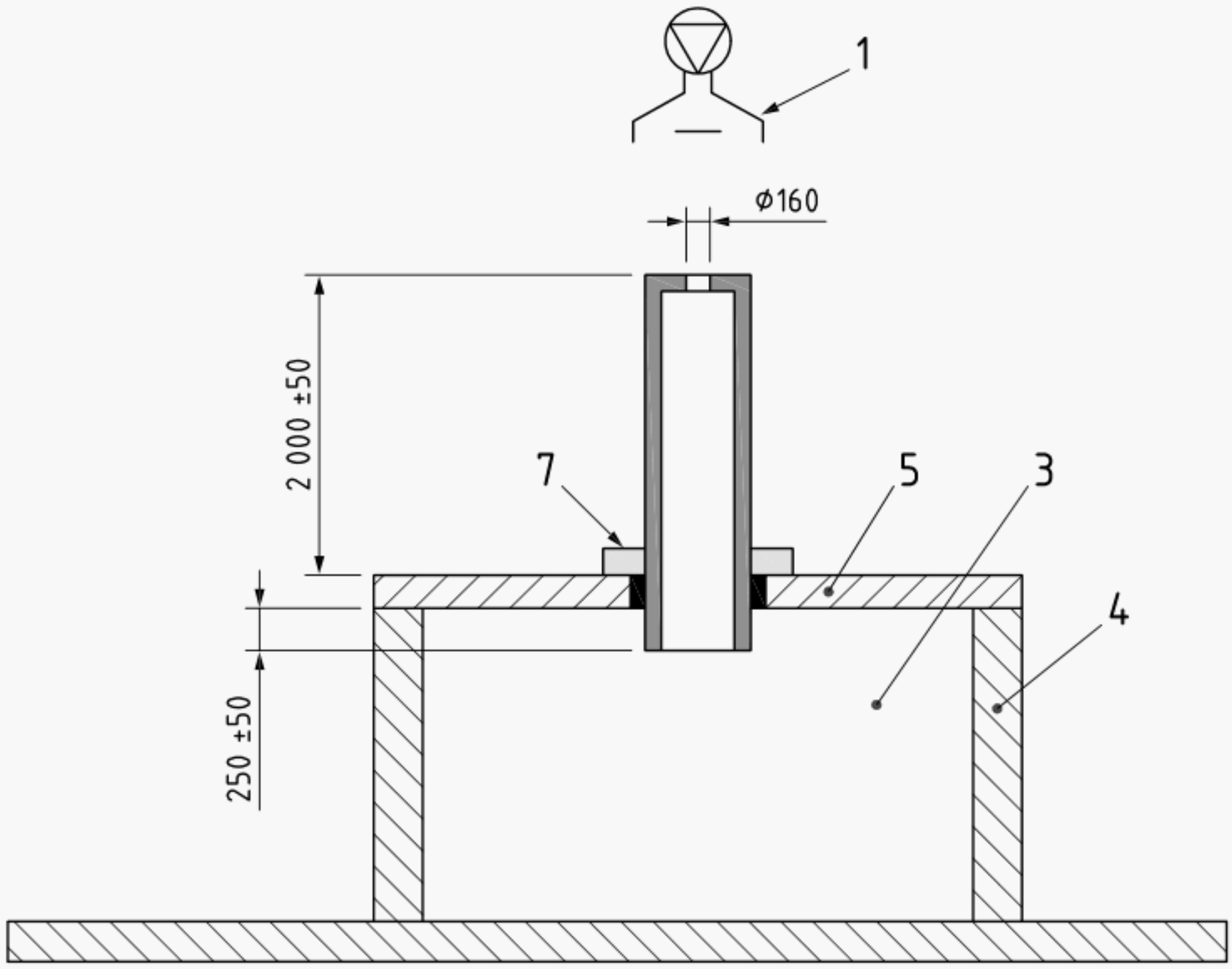


Key

1 optional fan and extract hood
2 suspension devices
3 furnace
4 furnace walls
5 furnace roof
6 access panel

Figure 2 — Example of test arrangement for horizontal service ducts (fire exposure from inside)

Dimensions in millimetres

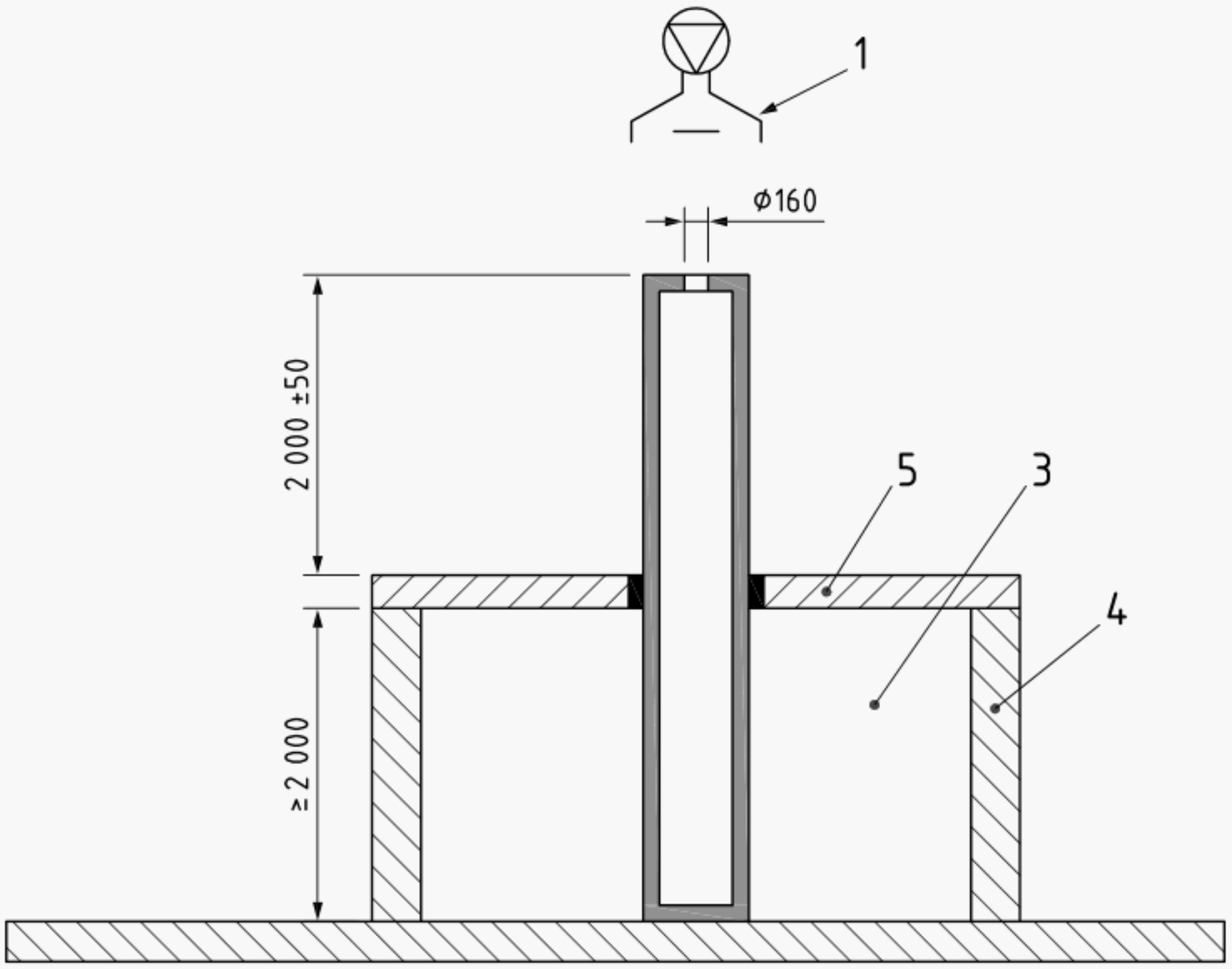


Key

1 optional fan and extract hood
3 furnace
4 furnace walls
5 furnace roof
7 collar to support the load of the shaft by the floor (if intended in practice – see 6.3.2.1)

Figure 3 — Example of test arrangement for vertical service shafts (fire exposure from inside)

Dimensions in millimetres

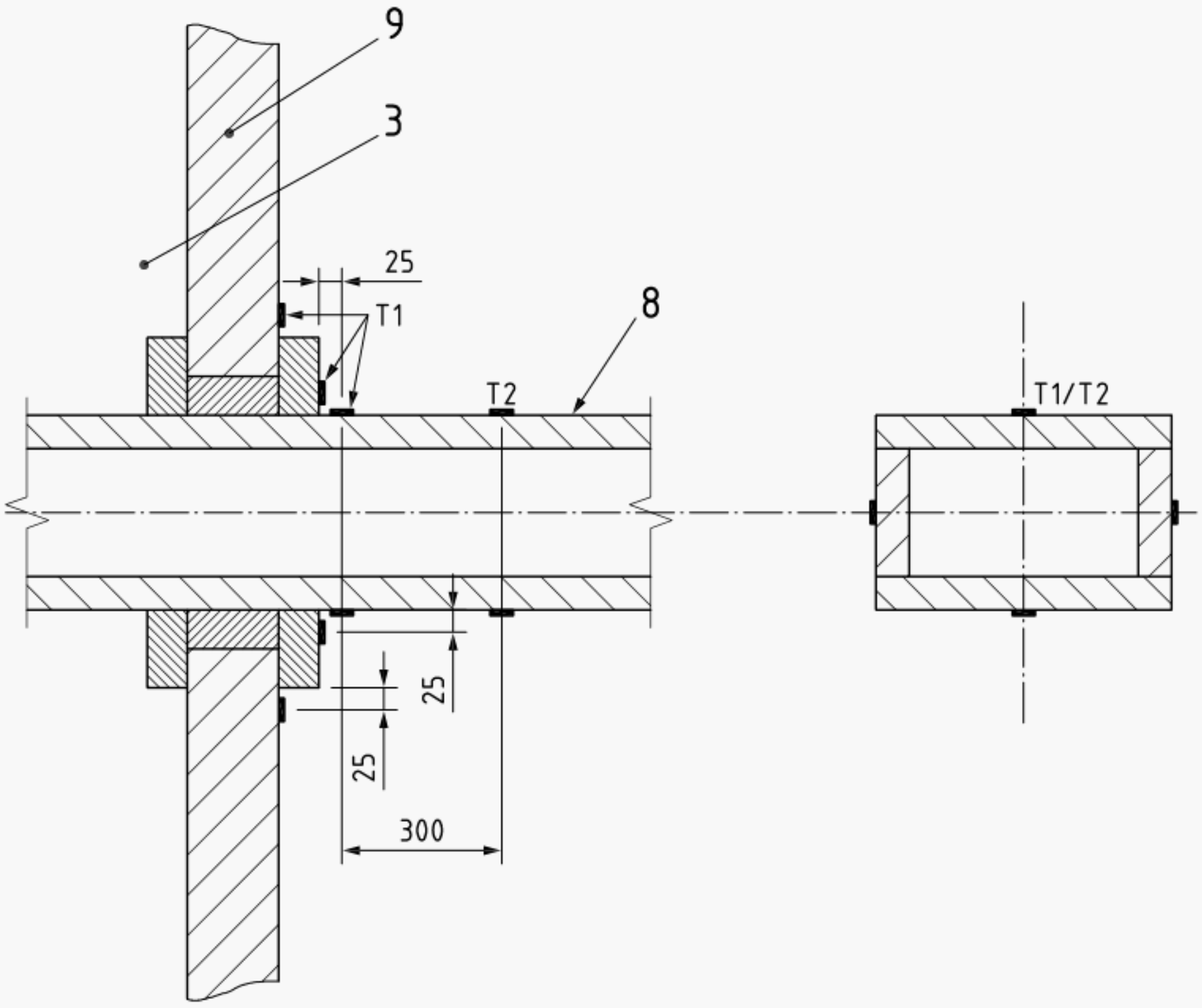


Key

1 optional fan and extract hood
3 furnace
4 furnace walls
5 furnace roof

Figure 4 — Example of test arrangement for vertical service shafts (fire exposure from outside)

Dimensions in millimetres

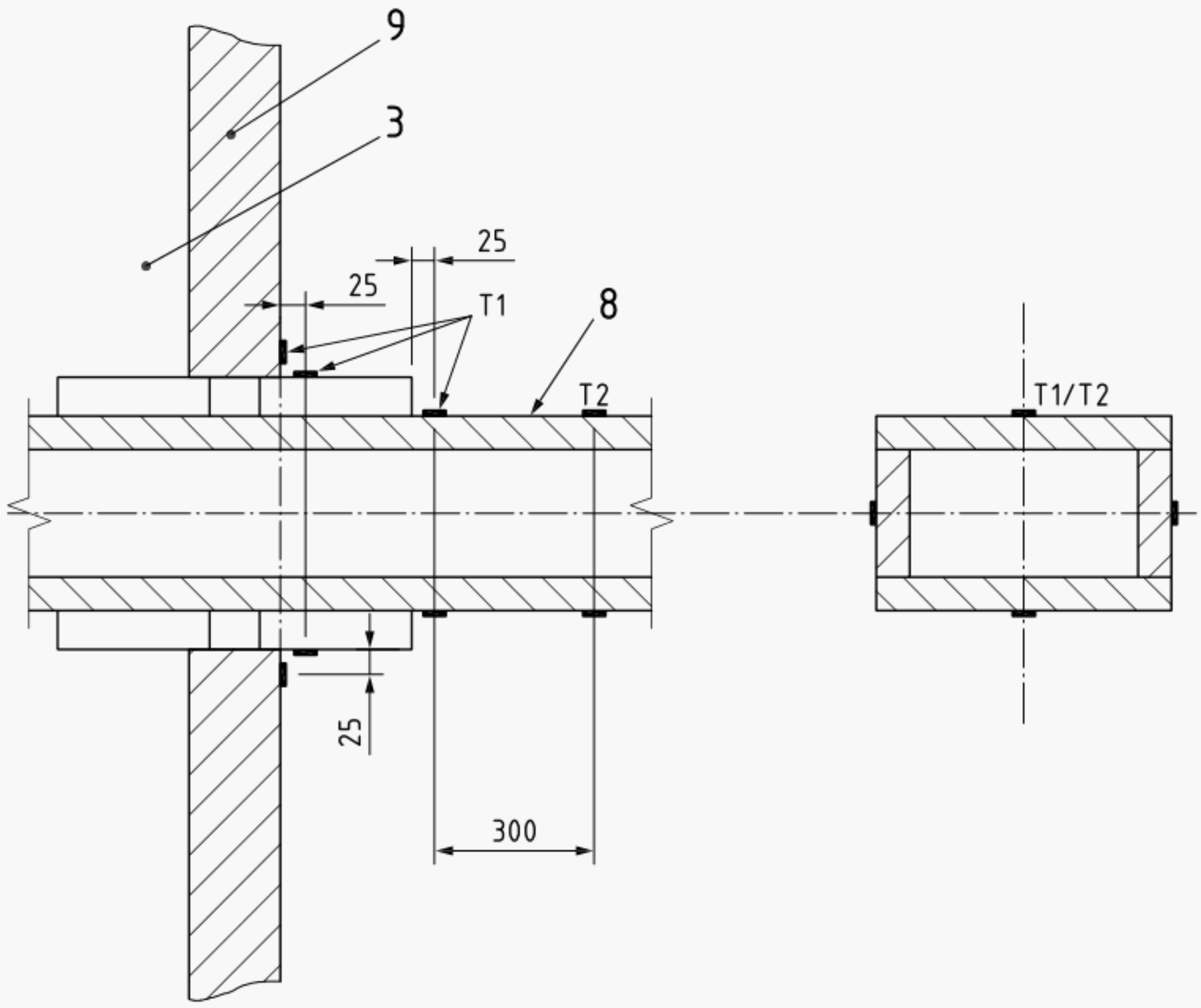


Key

3	furnace
8	service duct or shaft
9	supporting construction
T1	surface thermocouples for determining maximum temperature
T2	surface thermocouples for determining average and maximum temperature
T1, T2	minimum of one on each side of the duct or shaft

Figure 5 — Example for location of surface thermocouples with various penetrations

Dimensions in millimetres

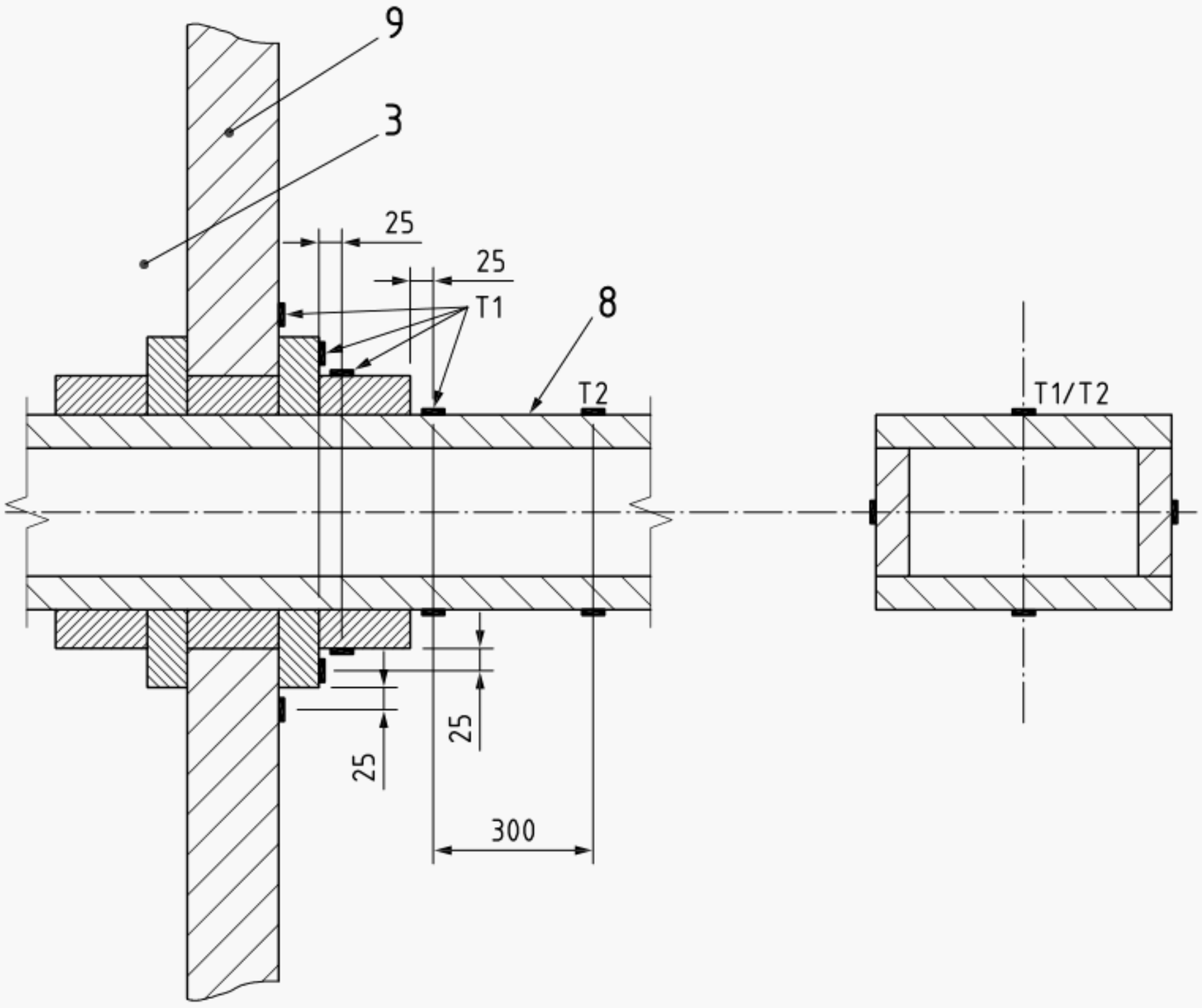


Key

3	furnace
8	service duct or shaft
9	supporting construction
T1	surface thermocouples for determining maximum temperature
T2	surface thermocouples for determining average and maximum temperature
T1, T2	minimum of one on each side of the duct or shaft

Figure 6 — Example for location of surface thermocouples with various penetrations

Dimensions in millimetres

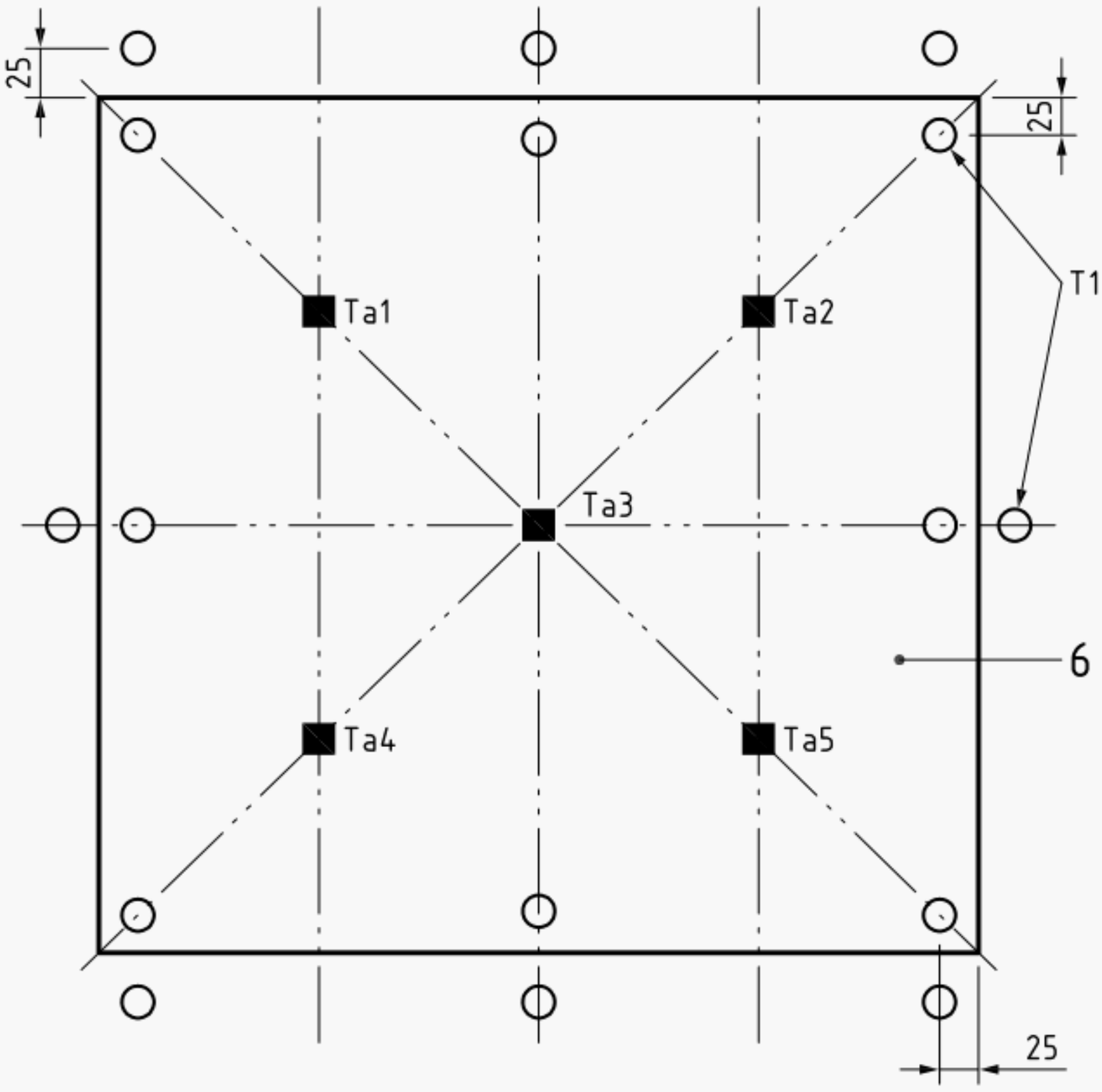


Key

3	furnace
8	service duct or shaft
9	supporting construction
T1	surface thermocouples for determining maximum temperature
T2	surface thermocouples for determining average and maximum temperature
T1, T2	minimum of one on each side of the duct or shaft

Figure 7 — Example for location of surface thermocouples with various penetrations

Dimensions in millimetres



Key

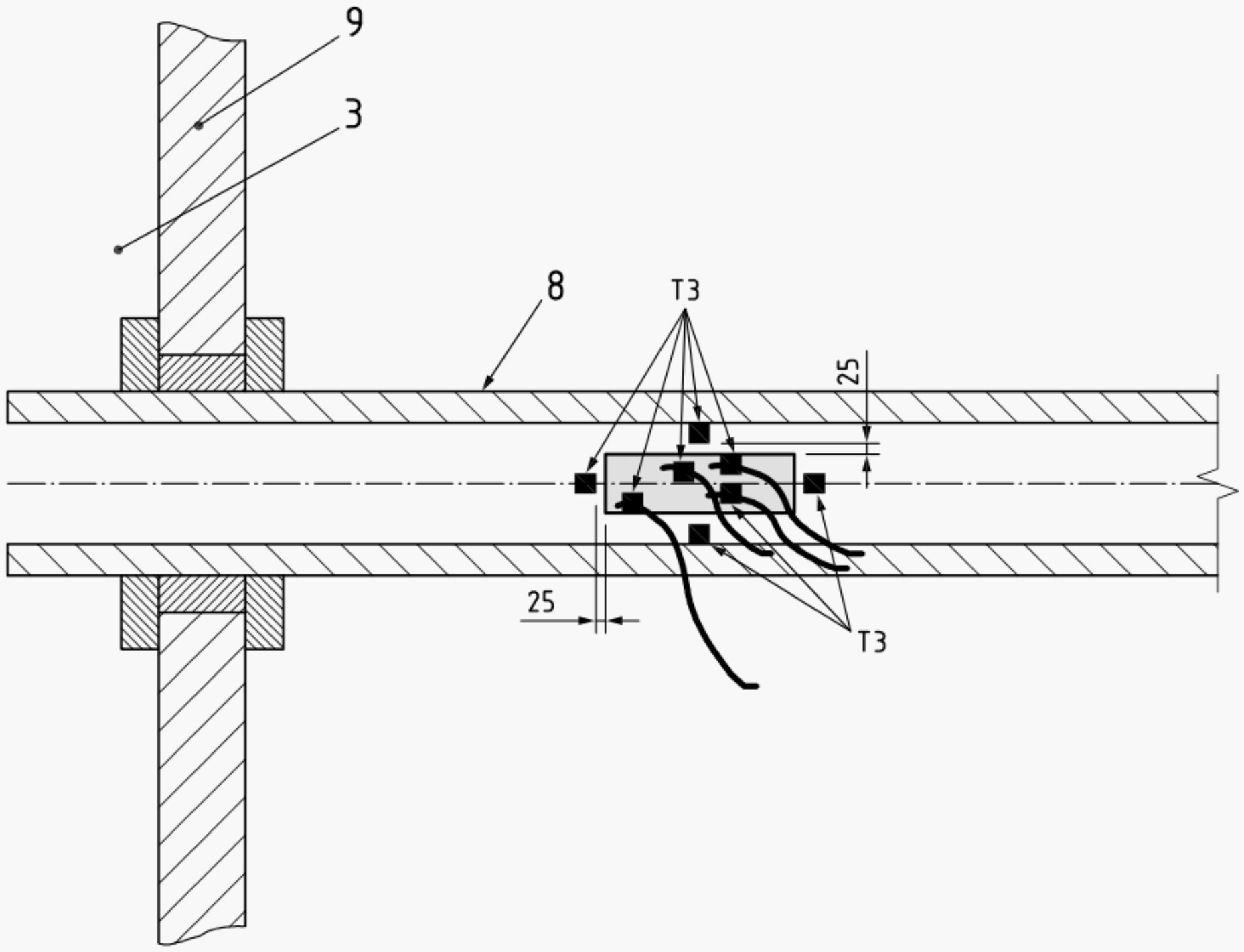
T1 surface thermocouples on and around perimeter of access panel for determining maximum temperature rise

Ta surface thermocouples for determining average and maximum temperature rise on access panel

6 access panel

Figure 8 — Shutters for access openings – Location of thermocouples

Dimensions in millimetres

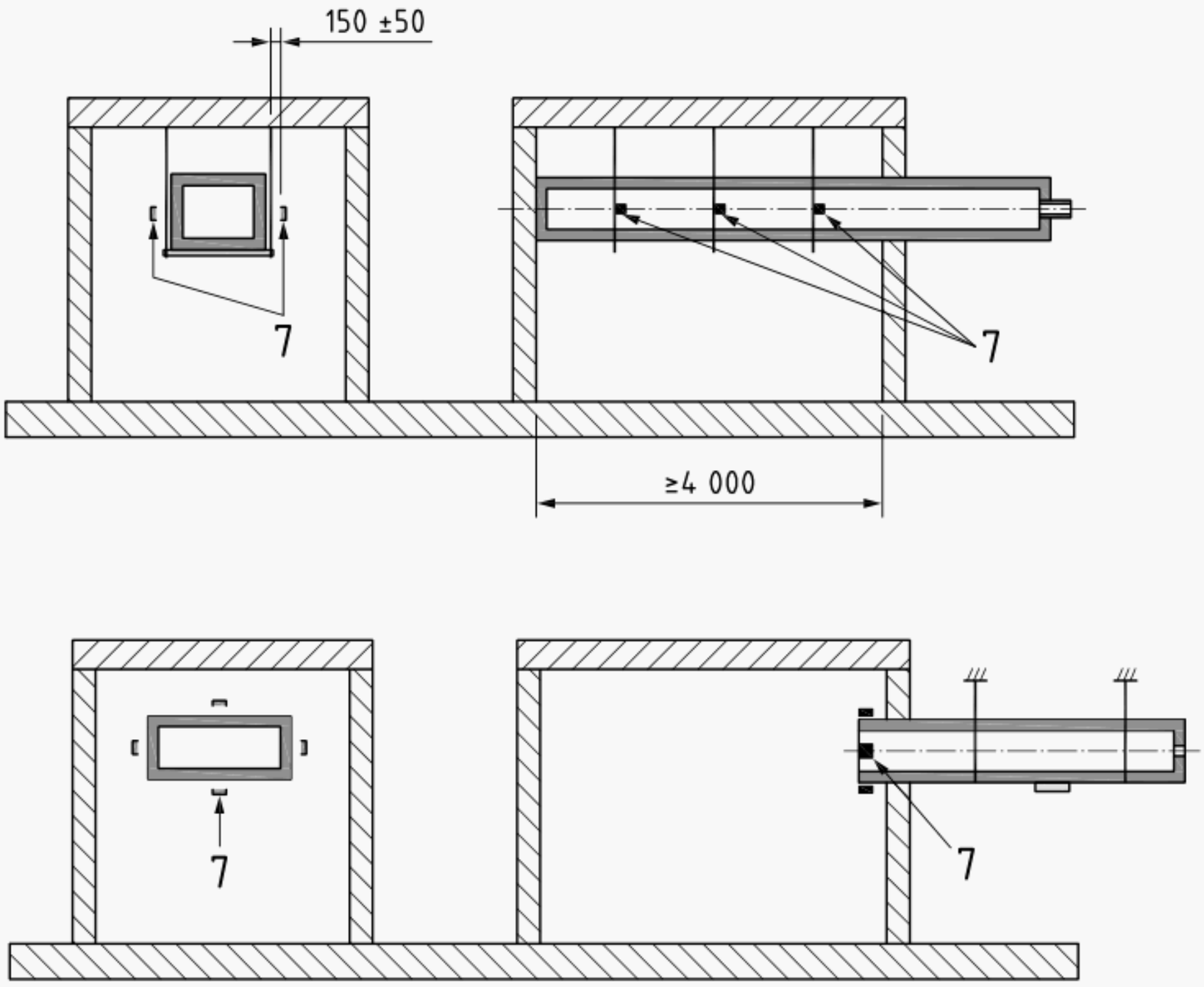


Key

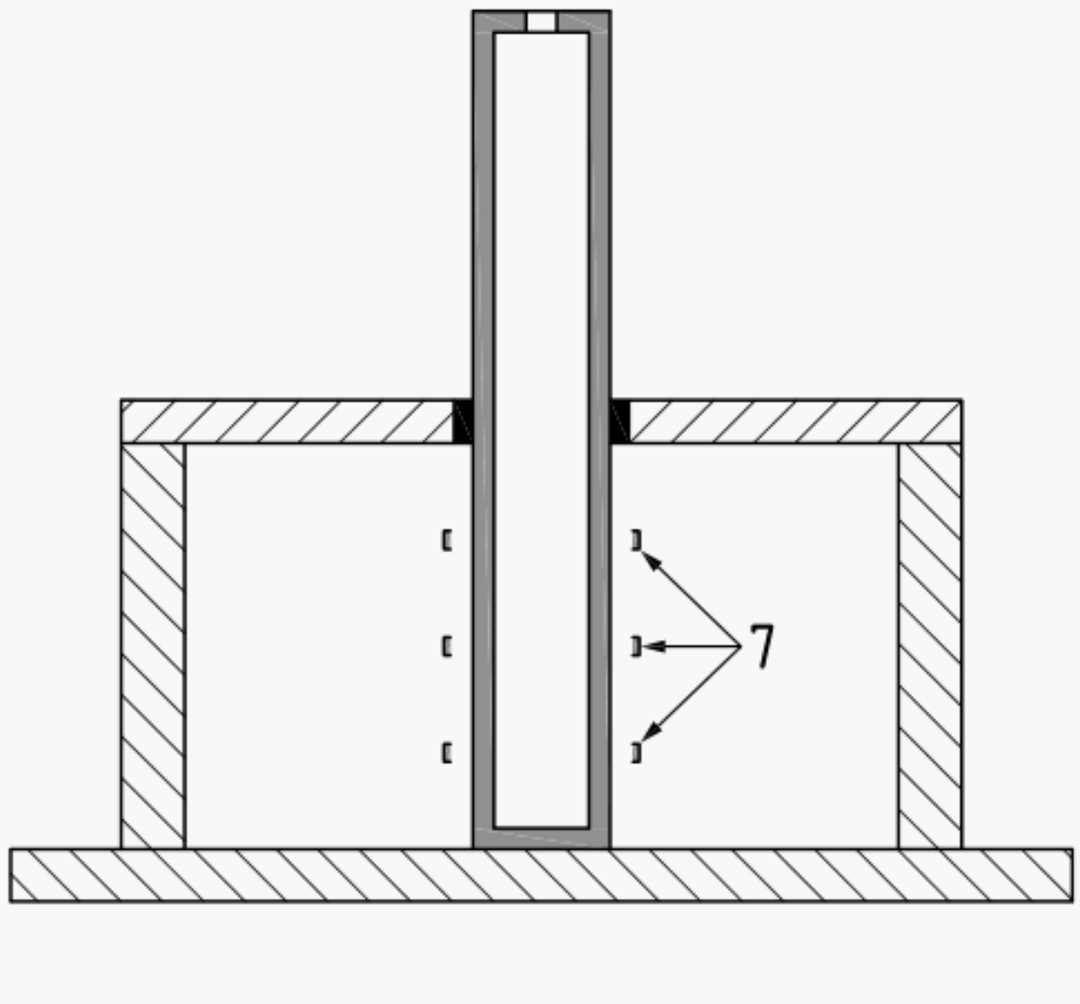
3	furnace
8	service duct or shaft
9	supporting construction
T3	surface thermocouples for determining maximum temperature 25 mm distant from the service outlet on the service duct or shaft and on the service outlet penetrations

Figure 9 — Example for location of surface thermocouples on a service outlet on a horizontal duct with fire from inside

Dimensions in millimetres



Arrangement on shafts with fire from inside is equivalent



Key

7 plate thermocouples, distances to specimen 150 ± 50

Figure 10 — Location of plate thermocouples for service ducts and service shafts

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[4] EN 50200, *Method of test for resistance to fire of unprotected small cables for use in emergency circuits*

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