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Fire resistance tests — Fire dampers for air distribution systems —

Part 1: Mechanical dampers

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Contents

Page

Foreword

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

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 92, *Fire safety*, Subcommittee SC 2, *Fire containment*.

This first edition of ISO 21925-1 cancels and replaces ISO 10294-1:1996, ISO 10294-2:1999, ISO 10294-3:1999 and ISO 10294-4:2001, which have been technically revised.

The main changes are as follows:

— integration of the requirements for mechanical dampers, which were published as four separate parts in the former ISO 10294-series, into a single document.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The material in the former ISO 10294-series was used to assess the fire resistance of mechanical fire dampers. The separate publications required multiple maintenance work and resources to keep them current and up-to-date. By having the requirements in a single volume, ISO 21925-1 is intended to improve efficiency and to be more user friendly. It is also anticipated that a single volume will serve the continued efforts to promote the alignment of the requirements contained in regional and national standards for testing fire dampers against this document.

ISO 10294-1:1996 addressed the spread of fire and smoke in buildings through ventilation ducts and other openings in fire-separating walls and floors.

ISO 10294-2:1999 provided classification, criteria and field of application for the test method given in ISO 10294-1:1996.

ISO 10294-3:1999 provided a background to the test method and a rationale to the procedures and the criteria selected with respect to the testing of fire dampers, as given in ISO 10294-1:1996.

ISO 10294-4:2001 provided a test method to evaluate the performance of fire damper-operating mechanisms.

A list of all parts in the ISO 21925-series can be found on the ISO website.

Fire resistance tests — Fire dampers for air distribution systems —

Part 1: Mechanical dampers

SAFETY WARNING — For suitable health precautions to be taken, the attention is drawn to the possibility that toxic or harmful gases can be released while the test is being conducted.

1 Scope

This document specifies a test method for the determination of the resistance of fire dampers to heat, and for the evaluation of their ability to prevent fire and smoke spreading from one fire compartment to another through an air distribution system.

It is applicable to mechanical fire dampers. It is not intended to be used for dampers used only in smoke control systems, for testing fire protection devices which only deal with air transfer applications, or for dampers used in suspended ceilings, as the installation of the damper and duct can have an adverse effect on the performance of the suspended ceiling, requiring other methods of evaluation.

NOTE "Air transfer" is a low-pressure application through a fire separation door (or wall, floor) without any connection to an air duct.

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.

ISO 834-1, *Fire resistance tests — Elements of building construction — Part 1: General requirements*

ISO 5167-7, *Measurement of fluid flow by means of pressure differential devices — Part 7: Orifice plates, nozzles and Venturi tubes inserted in circular cross-section conduits running full*

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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
test construction
complete test assembly, consisting of the separating element, damper and duct sections and penetration seals (if any)

3.2
supporting construction
wall partition or floor into which the damper and duct section are installed for the test

3.3
separating element
wall, partition or floor into which the damper and duct are installed in the building

3.4
connecting duct
duct section between the damper or separating element and the measuring station

3.5
measuring station
equipment consisting of pipe system with an orifice plate or venturi and an air flow straightener (if any), installed between the connecting duct and the exhaust equipment to determine the volume flow rate of gases passing through the damper under test

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

3.7
fire damper
mobile closure within a duct which is operated automatically or manually and is designed to prevent the spread of fire

3.8
actuating mechanism
<damper> mechanism, integral or directly associated with the damper which, when initiated by the damper triggering device, causes the movable component of the damper to change from the "open" to the "closed" position

3.9
insulated damper
damper which satisfies the integrity, leakage and insulation requirements of this document

3.10
uninsulated damper
damper which satisfies the integrity and leakage requirements of this document

3.11
thermal release mechanism
system which evaluates the parameters of temperature in the airflow of the ventilation duct and initiates the closing of the fire damper before a predicted threshold limit is reached

Note 1 to entry: The sensing element may be, for example, a fusible link, memory metal, frangible bulb or electrical sensor.

3.12
threshold limit
maximum operational temperature of the thermal release mechanism

4 Principles of the test

The damper with its fixing device is built into, or attached directly, or remotely via a section of ducting, to a fire-separating building element in a manner representative of good practice. Tests are performed starting with the damper in the open position so as to expose the actuating mechanism of the damper to furnace conditions. Temperature and integrity measurements are carried out in various parts of the test construction during the test. The tightness of the damper system is measured by direct flow measurements whilst maintaining a constant pressure differential across the closed damper of 300 Pa. For special applications, higher underpressures may be employed. The tightness of the damper in the closed position is also measured at ambient temperature prior to the start of the furnace test.

As the test conditions and tolerances for the beginning of the fire test are not specified in detail, the fire test enables only a limited assessment of the actuating mechanism to be carried out.

Annex A gives the historical background of the test.

5 Apparatus

The test apparatus specified in 5.1 to 5.8, including the instrumentation, shall be in accordance with ISO 834-1 except where specifically stated otherwise.

An example of a test arrangement is shown in Figure 1.

5.1 Furnace, capable of achieving the heating and pressure conditions specified in ISO 834-1.

5.2 Damper under test, attached to the connecting duct in accordance with the manufacturer's instructions.

5.3 Connecting duct, of all welded construction fabricated from (1,5 ± 0,1) mm thick steel with a width and height appropriate to the size of the damper under test. The duct shall have a length of 2× the diagonal dimension of the damper, up to a maximum of 2 m. The connecting duct shall be provided with a gas-tight observation port.

5.4 Measuring station, consisting of an orifice plate, venturi, or other suitable device, an air flow straightener (if required) and straight lengths of pipe sized in accordance with ISO 5167-1 installed between the connecting duct and the exhaust fan to determine the volume flow rate of gases passing through the damper under test. When testing dampers installed in floors, it is still possible to use the measuring station horizontally. A suitable mounting detail is shown in Figure 2.

5.5 Exhaust fan system, capable of controlling flow rates and maintaining a pressure difference between the connecting duct and the furnace, as required, when the damper is closed.

Regardless of what test pressure is chosen, the fan should be capable of achieving a 200 Pa pressure difference higher than the test pressure difference chosen for the test.

Regulation of the 300 Pa (or higher pressure differential) may be by means of a dilution damper installed just before the fan inlet. The pressure shall be controlled to within ±5 % of the required pressure. A balancing damper shall be fitted at the outlet of the fan to adjust the pressure range of the systems to suit the damper under test. A variable speed fan may be used instead of the dilution damper.

5.6 Instrumentation for measuring and recording the furnace temperature, in accordance with ISO 834-1. Locations of the furnace thermocouples for a number of different test arrangements are shown in Figures 3, 4, 5, 6, 7 and 8.

The gas temperature adjacent to the flow measuring device shall be measured by a 0,25 mm bare wire thermocouple enclosed in a 6 mm diameter porcelain twin wall tube with its measuring junction located at the centreline 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 shall be located at the exit from the connecting duct plenum (see Figures 1 and 2). Alternative thermocouples may be used provided it can be shown that they have equivalent response time.

5.7 Instrumentation for measuring and recording surface temperature, in accordance with ISO 834-1.

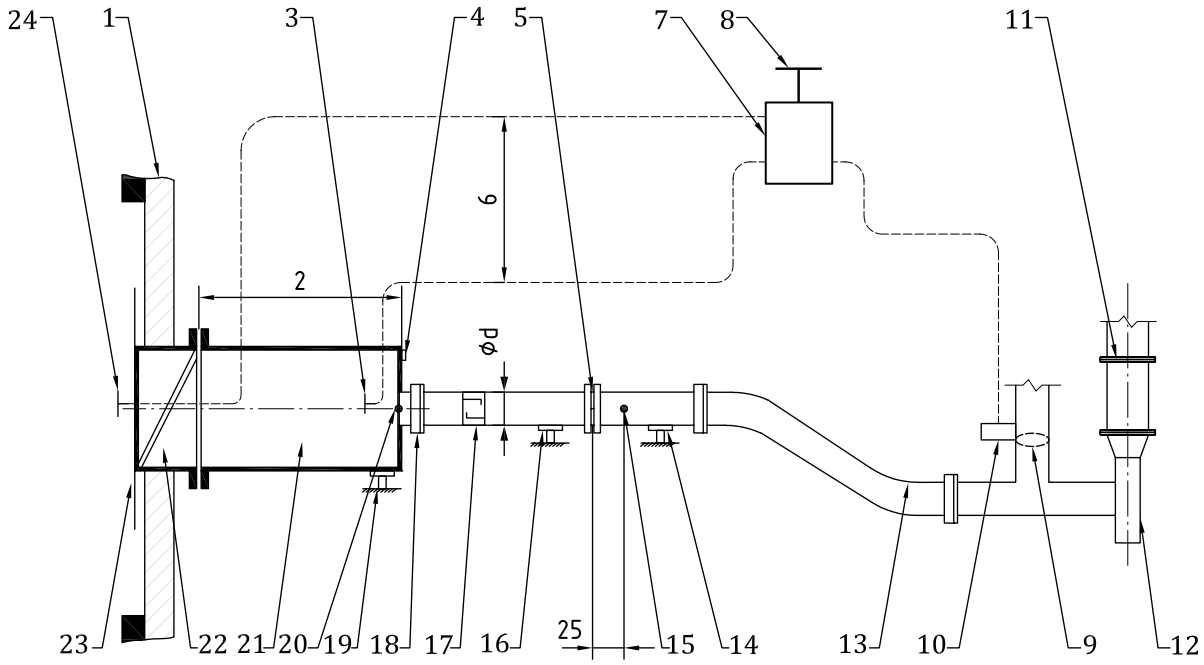
It shall be located, depending on the method of mounting the damper selected, in the positions shown in Figures 3, 4, 5, 6, 7 or 8.

5.8 Instrumentation for measuring pressure differential between the furnace and the connecting duct.

A pressure tapping shall be located on the centreline of one vertical side wall of the connecting duct. Instrumentation shall have a 300 Pa measurement capacity higher than the test pressure chosen for the test. Instrumentation shall also be provided for measuring the pressure difference between inside and outside (ambient) of the furnace.

5.9 Timing device, capable of running throughout the test period.

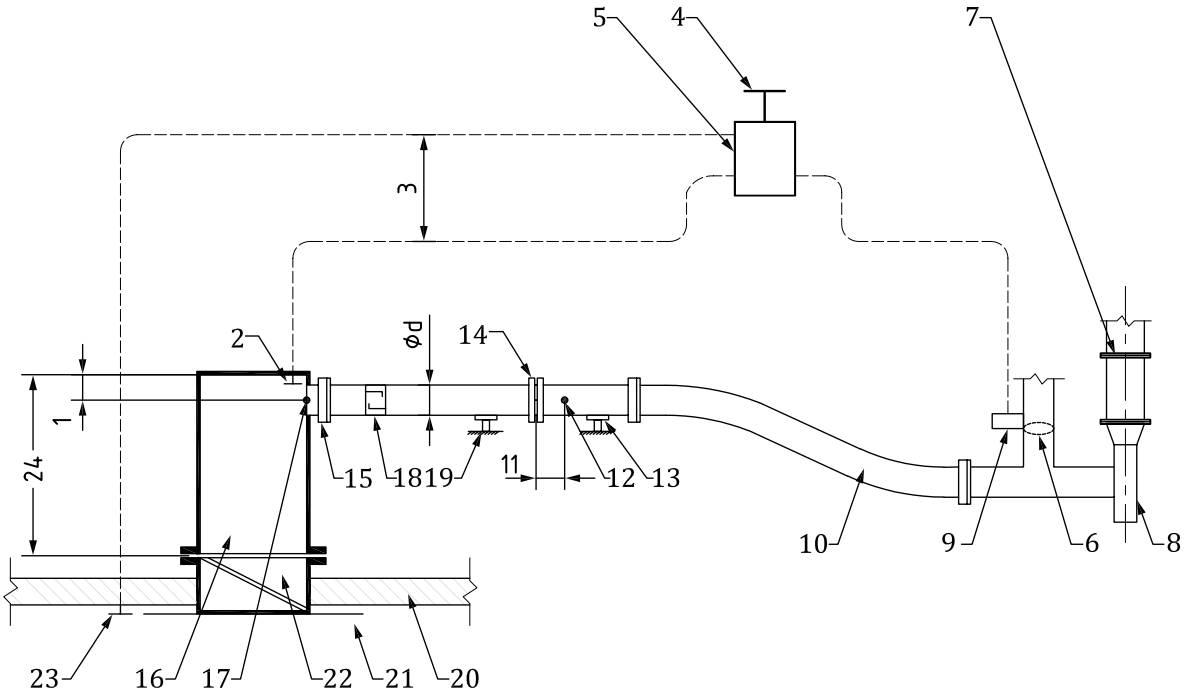
5.10 Gap gauges and cotton pad, according to ISO 834-1, to judge the integrity of the joints between the damper and its connecting duct and the damper assembly and the supporting construction of the test arrangement.



Key

1 supporting construction (wall)
2 2× diagonal (to a maximum of 2 m)
3 pressure sensor (on centreline)
4 observation port
5 orifice plate or venturi
6 pressure differential (300 Pa)
7 pressure differential control box
8 pressure sensor in laboratory
9 pressure control dilution damper
10 pneumatic actuator or manual control
11 balancing damper
12 fan
13 flexible connecting duct
14 support
15 thermocouple
16 support
17 flow straightener
18 flange
19 support
20 thermocouple at exit from plenum
21 connecting duct
22 test damper
23 furnace chamber
24 pressure sensor (on centreline of damper)
25 distance: thermocouple to orifice plate = 2 d

Figure 1 — Example of general test arrangement

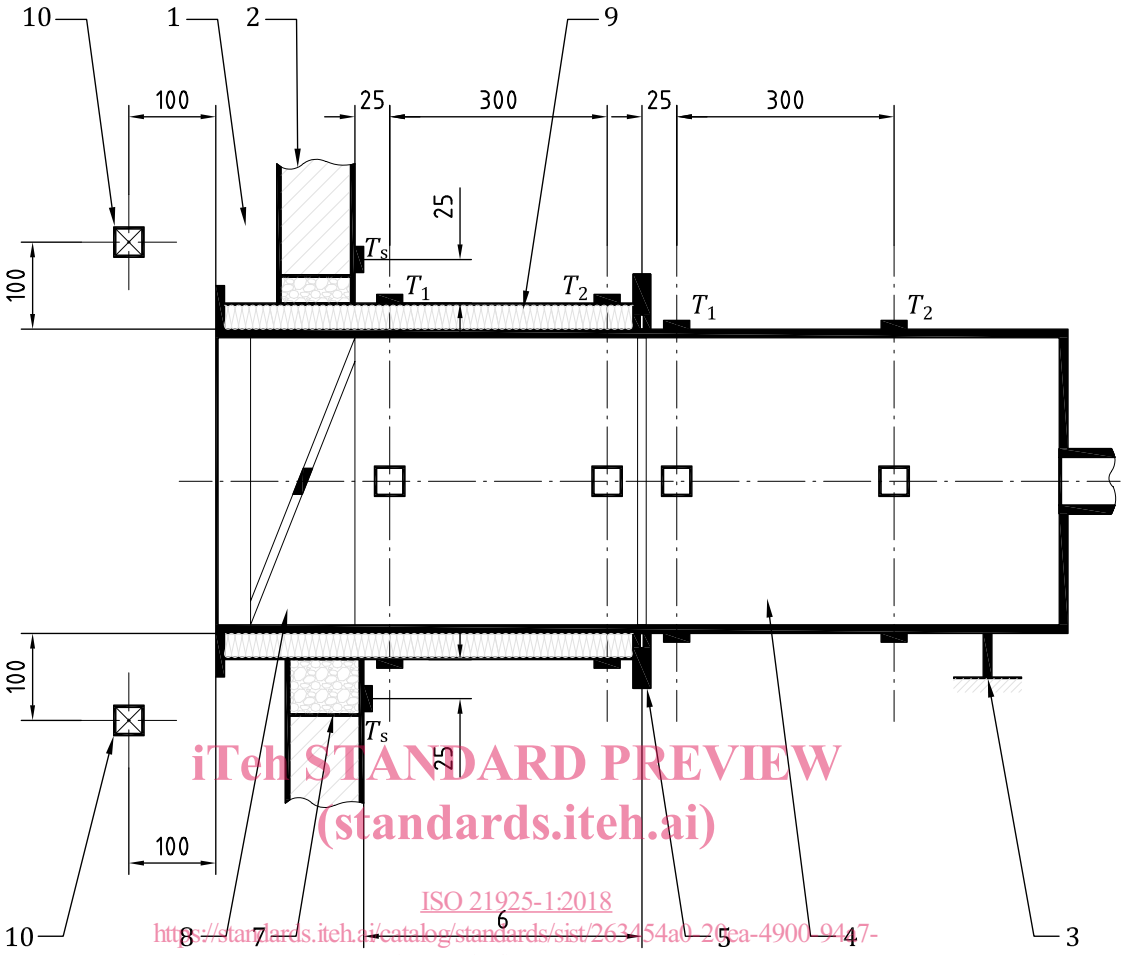


Key

1 dimension equal to the diameter of the measuring station
2 pressure sensor
3 pressure differential (300 Pa)
4 pressure sensor in laboratory
5 pressure differential control box
6 pressure control dilution damper
7 balancing damper
8 fan
9 pneumatic actuator or manual control
10 flexible connecting duct
11 distance: thermocouple to orifice plate = 2 d
12 thermocouple
13 support
14 orifice plate or venturi
15 flange
16 connecting duct
17 thermocouple at exit from plenum
18 flow straightener
19 support
20 supporting construction {floor)
21 furnace chamber
22 test damper
23 pressure sensor
24 2× diagonal (to a maximum of 2 m)

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

Dimensions in millimetres



Key

1	furnace
2	supporting construction
3	support
4	connecting duct
5	connecting angle
6	length "L" to be specified by damper manufacturer
7	infill material, provided it is necessary
8	damper
9	insulated ductwork
10	furnace thermocouples, 4 places
T_s, T_1, T_2	unexposed surface thermocouples (minimum of one each side)

Figure 3 — Position of surface thermocouples when damper is installed in an insulated duct