BS 8602:2013

BSI Standards Publication

Method for assessment of fire integrity of cast resin busbar trunking systems for the safety critical power distribution to life safety and fire fighting systems

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Published by BSI Standards Limited 2013

ISBN 978 0 580 77324 2

ICS 13.220.40; 29.060.20

The following BSI references relate to the work on this document:
Committee reference FSH/1
Draft for comment 12/30256208 DC

Publication history

First published April 2013

Amendments issued since publication

Date	Text affected

Contents

Summary of pages

This document comprises a front cover, an inside front cover, pages i to ii, pages 1 to 12, an inside back cover and a back cover.

Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 30 April 2013. It was prepared by Technical Committee FSH/1, *Fire safety cables*. A list of organizations represented on this committee can be obtained on request to its secretary.

Relationship with other publications

The test method given in this British Standard is based on the furnace method for which general requirements are given in BS EN 1363-1.

Information about this document

The purpose of this test method is to measure the ability of a cast resin busbar trunking system to maintain circuit integrity to life safety and fire fighting systems when exposed to fire.

The test method given in this British Standard has a test duration of 120 min which is considered to be the fire resistance period necessary for life safety and fire fighting applications when applied to busbar trunking distribution systems.

It is emphasized that fire tests do not assess a fire hazard, nor can the results of fire tests alone guarantee safety. They only provide information to assist in the assessment of the suitability of a cast resin busbar trunking for a given application.

Hazard warnings

WARNING. This British Standard calls for the use of substances and/or procedures that can be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.
The test given in this British Standard might involve the use of dangerous voltages and temperatures. Suitable precautions should be taken against the risk of shock, burning, fire and explosion that might be involved and against any noxious fumes that might be produced.

Use of this document

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its methods are expressed as a set of instructions, a description, or in sentences in which the principal auxiliary verb is “shall”.

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

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

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

1 Scope

This British Standard gives a method for assessment of the fire integrity of cast resin busbar trunking systems for the safety critical power distribution to life safety and fire fighting systems, intended to maintain circuit integrity when exposed to fire. It is applicable to cast resin busbar trunkings of rated voltage not exceeding 1 000 V a.c.

NOTE Busbar trunking systems are specified in BS EN 61439-6:2012.

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.

BS 8491:2008, *Method for assessment of fire integrity of large diameter power cables for use as components for smoke and heat control systems and certain other active fire safety systems*

BS EN 1363-1:1999, *Fire resistance tests – Part 1: General requirements*

BS EN 60584-1:1996, *Thermocouples – Part 1: Reference tables*

BS EN 61439-6:2012, *Low-voltage switchgear and controlgear assemblies – Part 6: Busbar trunking systems (busways)*

BS EN ISO 13943:2010, *Fire safety – Vocabulary*

3 Terms and definitions

For the purposes of this standard, the terms and definitions given in BS EN 1363-1:1999, BS EN 61439-6:2012 and BS EN ISO 13943:2010 apply.

4 Apparatus

4.1 *Test equipment*, as specified in BS EN 1363-1:1999, Clause **4**, including the equipment specified in **4.2** to **4.4**.

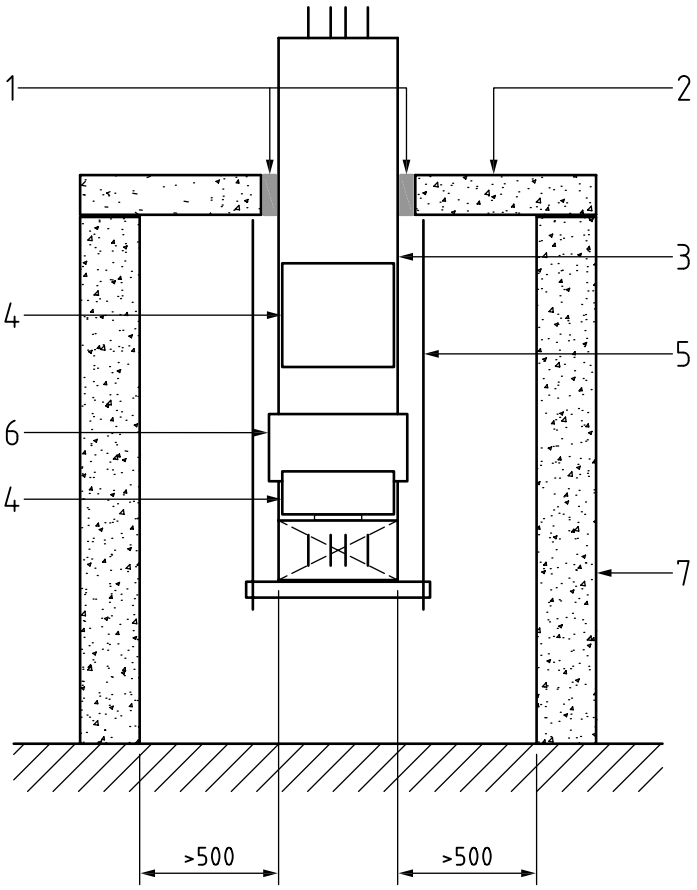
4.2 *Furnace*, capable of subjecting the busbar trunking assembly under test to the standard heating and pressure conditions specified in BS EN 1363-1 and suitable for testing a busbar trunking assembly comprising both a vertical and a horizontal section of busbar trunking as shown in Figure 1. The furnace shall be of sufficient size to accommodate the minimum dimensions of the test specimen comprising the components detailed in Clause **5** and as illustrated in Figure 1. The furnace shall have an opening in the roof for the vertical section of the busbar trunking and an opening in the wall for the horizontal section of the busbar trunking.

4.3 *Six thermocouples*, comprising plate type thermometers, type K as defined in BS EN 60584-1:1996 (see Figure 2), to provide a continuous indication of the temperature at key points within the furnace (see **6.2**).

4.4 *Equipment for measuring and recording furnace pressure,* as specified in BS EN 1363-1:1999, Clause **4**.

Figure 1 **Arrangement of the test specimen in the furnace**

Dimensions in millimetres



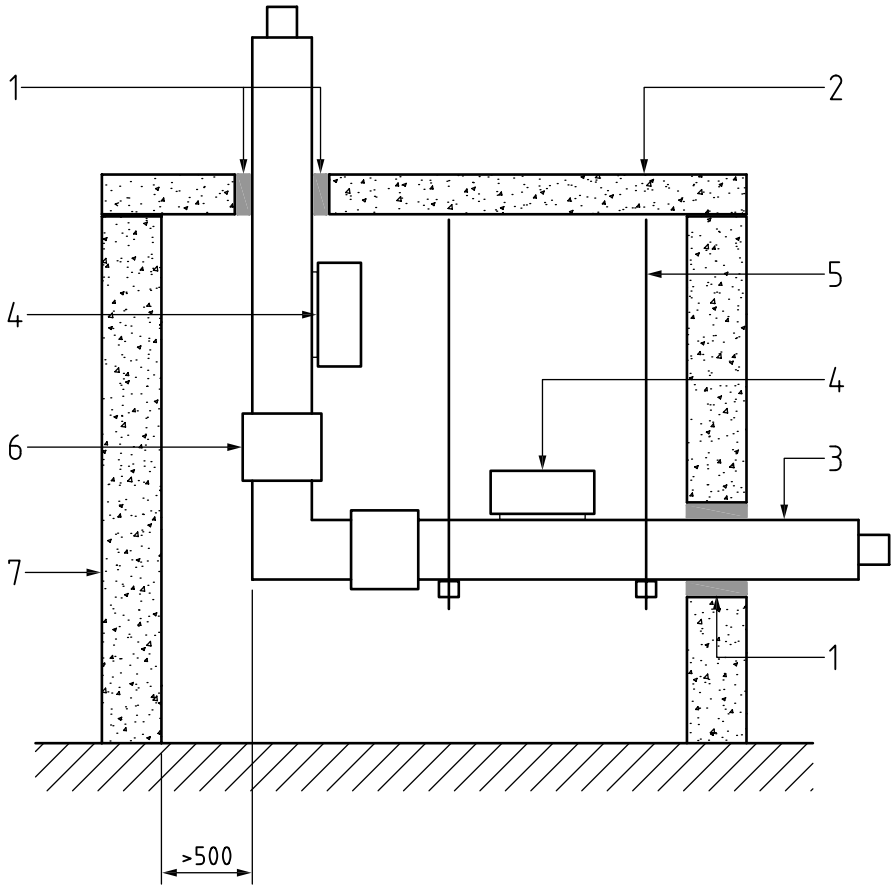
a) Front elevation

Key

1 Fire stopping
2 Furnace roof
3 Busbar trunking specimen
4 Fire rated tap-off unit (if applicable)
5 Suspension device
6 Joint
7 Furnace wall

Figure 1 **Arrangement of the test specimen in the furnace**

Dimensions in millimetres



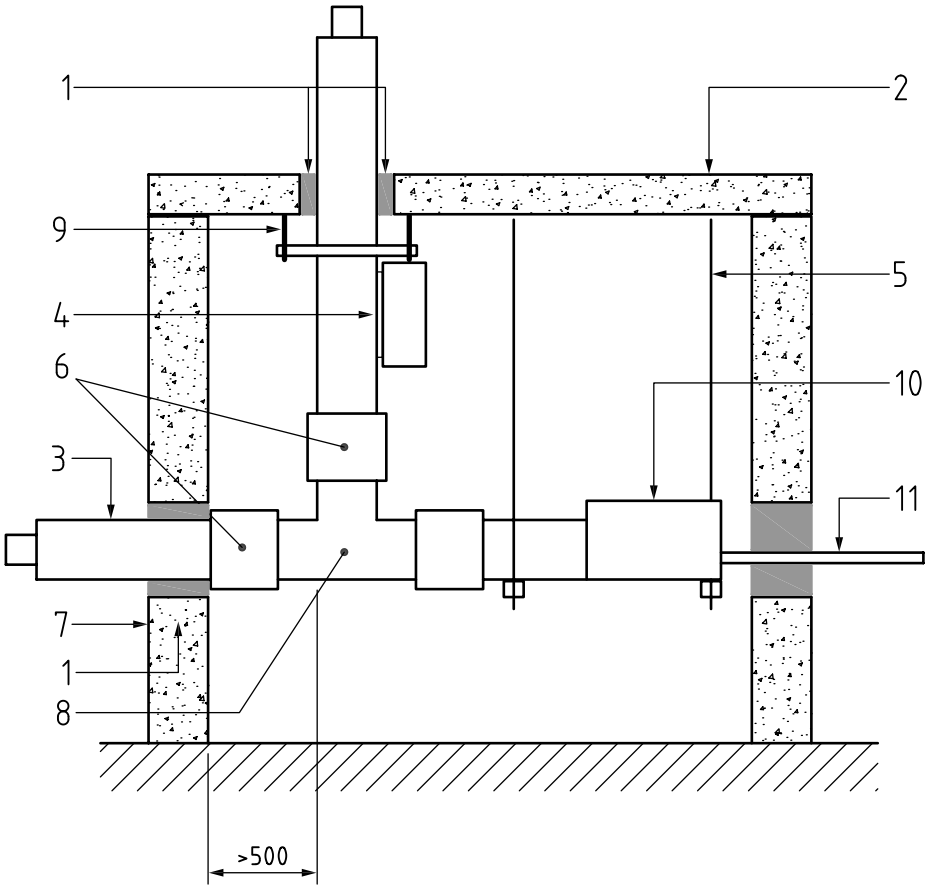
b) Side elevation

Key

1	Fire stopping	5	Suspension device
2	Furnace roof	6	Joint
3	Busbar trunking specimen	7	Furnace wall
4	Fire rated tap-off unit (if applicable)		

Figure 1 **Arrangement of the test specimen in the furnace**

Dimensions in millimetres



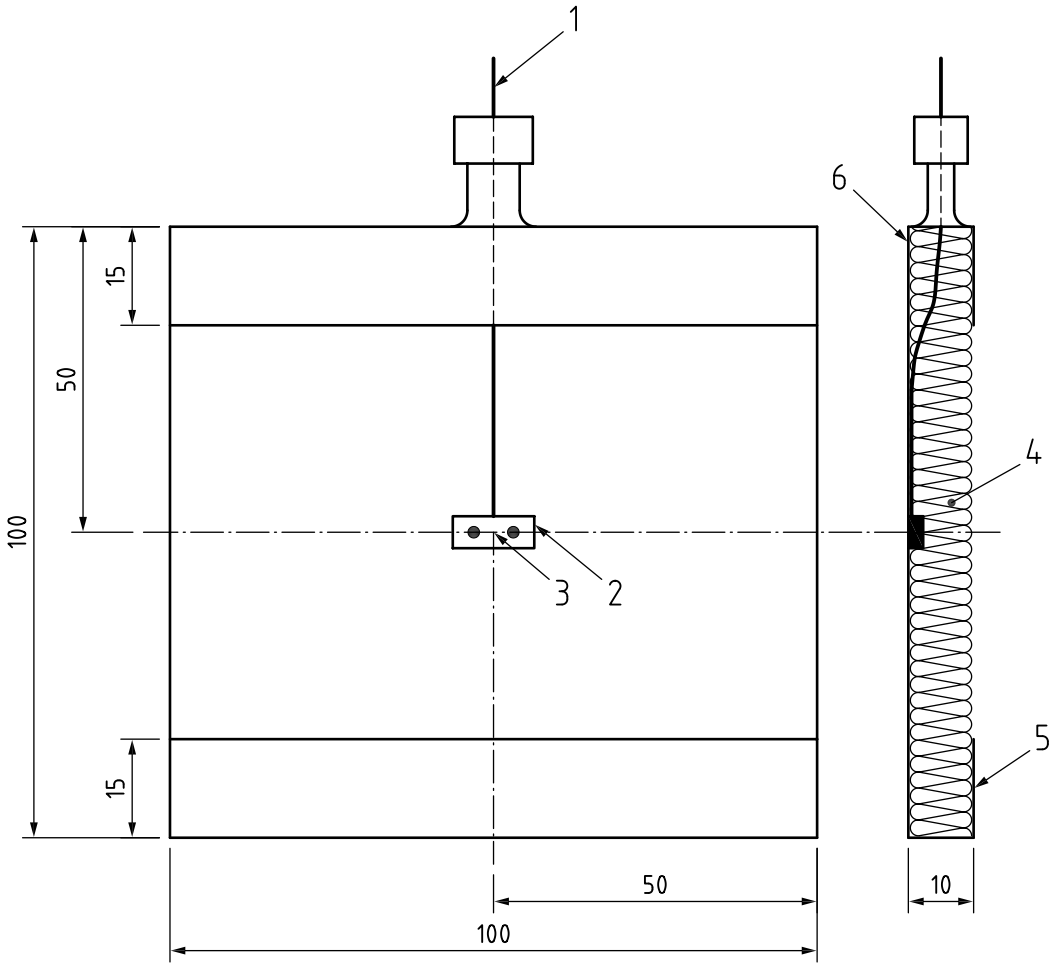
c) Side elevation (where a tee section is to be tested)

Key

1	Fire stopping	7	Furnace wall
2	Furnace roof	8	Tee section
3	Busbar trunking specimen	9	Spring hanger
4	Fire rated tap-off unit (if applicable)	10	End feed box
5	Suspension device	11	Fire rated cable
6	Joints		

Figure 2 **Design of plate thermometer**

Dimensions in millimetres



Key

1	Sheathed thermocouple with insulated hot junction	4	Insulation material
2	Spot welded or screwed steel strip	5	Nickel alloy strip (0.7 ±0.1) mm thick
3	Hot junction of thermocouple	6	Face 'A'

NOTE This figure is identical to BS EN 1363-1:1999, Figure 1.

5 Test specimen

5.1 General

The busbar trunking test specimen shall incorporate the following busbar trunking units and accessories:

- straight lengths;
- bends;
- tee sections (if applicable);
- panel flanges (if applicable);
- support assemblies;
- joints;

- spring hangers; and
- tap-off units (if applicable).

In the test specimen the busbar trunking configuration shall be representative of the manufacturer's recommended installation arrangement.

The test specimen shall comprise of both a vertical and a horizontal section of busbar trunking, each coupled to a 90° bend (as shown in Figure 1) utilizing the manufacturer's fire rated jointing materials (see **5.2**).

5.2 Joints

The test specimen shall incorporate the manufacturer's standard jointing assembly, which shall be installed and assembled strictly in accordance with the manufacturer's installation instructions.

The jointing process used, which is a critical element of the test, shall be accurately recorded and documented in the test report, identifying the jointing methods and materials utilized.

Time shall be allowed for the conditioning of the jointing materials, as required by the manufacturer's installation instructions, prior to the fire test commencing.

5.3 Busbar trunking supports

The test specimen shall be fixed and supported as a busbar trunking assembly would be in practice, by means of the manufacturer's standard support hangers in accordance with the manufacturer's installation instructions.

The busbar trunking supports shall be installed at the maximum spacing from the centre line of the joint recommended by the manufacturer, to give the worst case installation conditions.

5.4 Fire rated tap-off units

One or more fire rated tap-off units shall be included as part of the test specimen, when applicable.

NOTE Where the busbar trunking is to be used in a riser with tap-off units at various floor levels it would be necessary to include the tap-off unit as part of the test specimen. However, where the busbar trunking is to be used as a feeder from point A to point B without tap-off circuits along the busbar trunking length, it would not be necessary to incorporate the tap-off unit in the test specimen.

If fire rated tap-off units are installed, they shall be installed on the horizontal and/or vertical busbar trunking sections, as they would be in practice.

5.5 Description of busbar trunking assembly in the test specimen

A detailed description of the complete busbar trunking assembly in the test specimen and all of its individual components shall be provided as part of the test report.

5.6 Application of fire retardant material

Where a busbar trunking assembly of the type being tested would normally have fire retardant material applied, fire retardant material shall be applied to the test specimen.

6 Installation of the test specimen in the furnace

6.1 General

The test specimen shall be located within the furnace in such a way as to prevent direct flame impingement on the test specimen.

The vertical and horizontal sections of busbar trunking in the test specimen shall be installed so as to allow for the expansion of the test specimen. The vertical section shall be installed through the roof of the furnace and shall incorporate the manufacturer's standard spring hanger assembly that would be used for the installation of the busbar trunking within a riser.

The vertical section of the busbar trunking assembly shall be sufficiently long to give a minimum straight section length of 1 m within the furnace (excluding the bend and joining materials).

The horizontal section of the busbar trunking assembly shall be sufficiently long to give a minimum straight section length of 3 m within the furnace (excluding the bend and jointing materials).

The test specimen shall be installed in the furnace in a manner representative of its use in practice.

The structural openings in the wall and roof of the furnace after the busbar trunking has been installed shall be fire stopped.

NOTE 1 The method of fire stopping is at the tester's discretion.

NOTE 2 The fire stopping materials selected should be sufficiently robust to maintain the test conditions within the furnace.

The parts of the busbar trunking assembly within the furnace shall be installed in such a way that they are exposed to the heat from the flames from the furnace burners from all sides over their whole length.

There shall be a clearance of (500 ±50) mm between the top of the busbar trunking or busbar trunking tap-off and the roof of the furnace and also at least 500 mm between the underside of the horizontal section of the busbar trunking assembly and the floor of the furnace. Similarly there shall be a clearance of >500 mm between the sides of the busbar trunking assembly and the furnace walls. There shall also be a clearance of >500 mm between the vertical section of the busbar trunking assembly and the furnace walls.

Where two or more test specimens are to be tested in the furnace at the same time, at least 500 mm clearance shall be provided between the specimens.

6.2 Application of instrumentation

The six thermocouples (**4.3**) shall be installed in the furnace; three thermocouples shall be located either side of the test specimen, equally spaced along the length of the horizontal run of busbar trunking, at a distance of (100 ±50) mm from the exposed face of the test specimen and at the mid-height of the specimen, to ensure they give a reliable indication of the mean temperature in the vicinity of the test specimen.

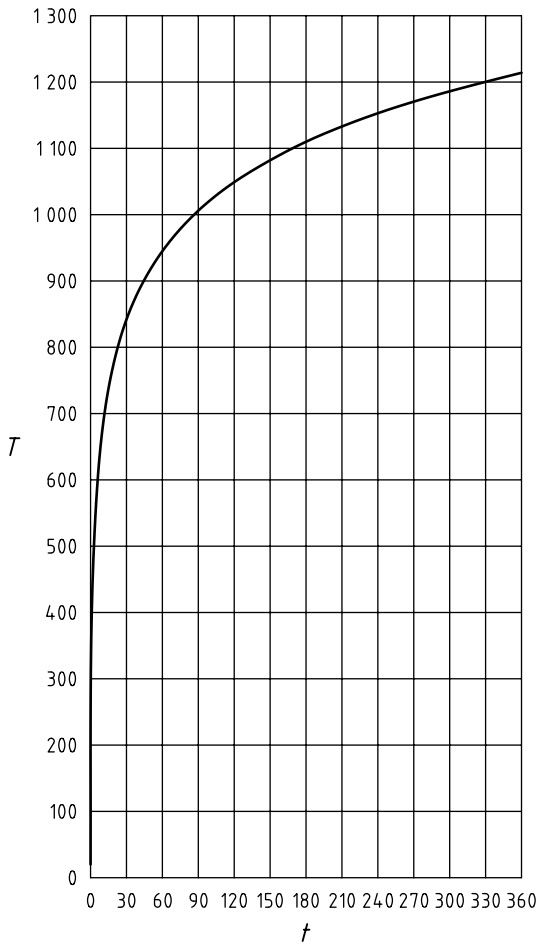
The thermocouples shall be positioned so that they are not in contact with the flames from the furnace burners and so that they are at least 450 mm away from the floor, roof or any wall of the furnace.

The furnace temperature given by the mean value of the readings from the six thermocouples shall be recorded at intervals not exceeding 1 min for the duration of the heating period.

The mean temperature of the furnace derived from the mean reading of the six thermocouples shall be monitored and controlled such that it follows the standard time temperature curve indicated in Figure 3.

A pressure of 20 Pa shall be maintained within the furnace measured 100 mm below the roof of the furnace. The furnace pressure shall be measured and recorded continuously or at intervals of not more than 1 min.

Figure 3 **Standard temperature/time curve**



Key
T Temperature (°C)
t Time (min)

NOTE This figure is identical to BS EN 1363-1:1999, Figure 7.

6.3 Electrical connections to the test specimen

The exposed conductors at each end of the busbar trunking test specimen shall be connected as indicated in Figure 4. The transformer(s) windings shall be connected to the phase conductors at one end of the test specimen, whilst the neutral and protective conductors shall be connected to earth as indicated. Any metal screen casings or support brackets shall be connected to earth.

For a three-phase busbar trunking test specimen each phase conductor shall be connected to a separate phase of the transformer(s) via a 2 A fuse or circuit breaker in each phase.

At the end of the test specimen remote from the transformer(s):

a) each phase conductor, or group of conductors, shall be connected to one terminal of a suitable load and indicating device, such that a current suitable for circuit continuity checking is achieved, the other terminal of each device being earthed;

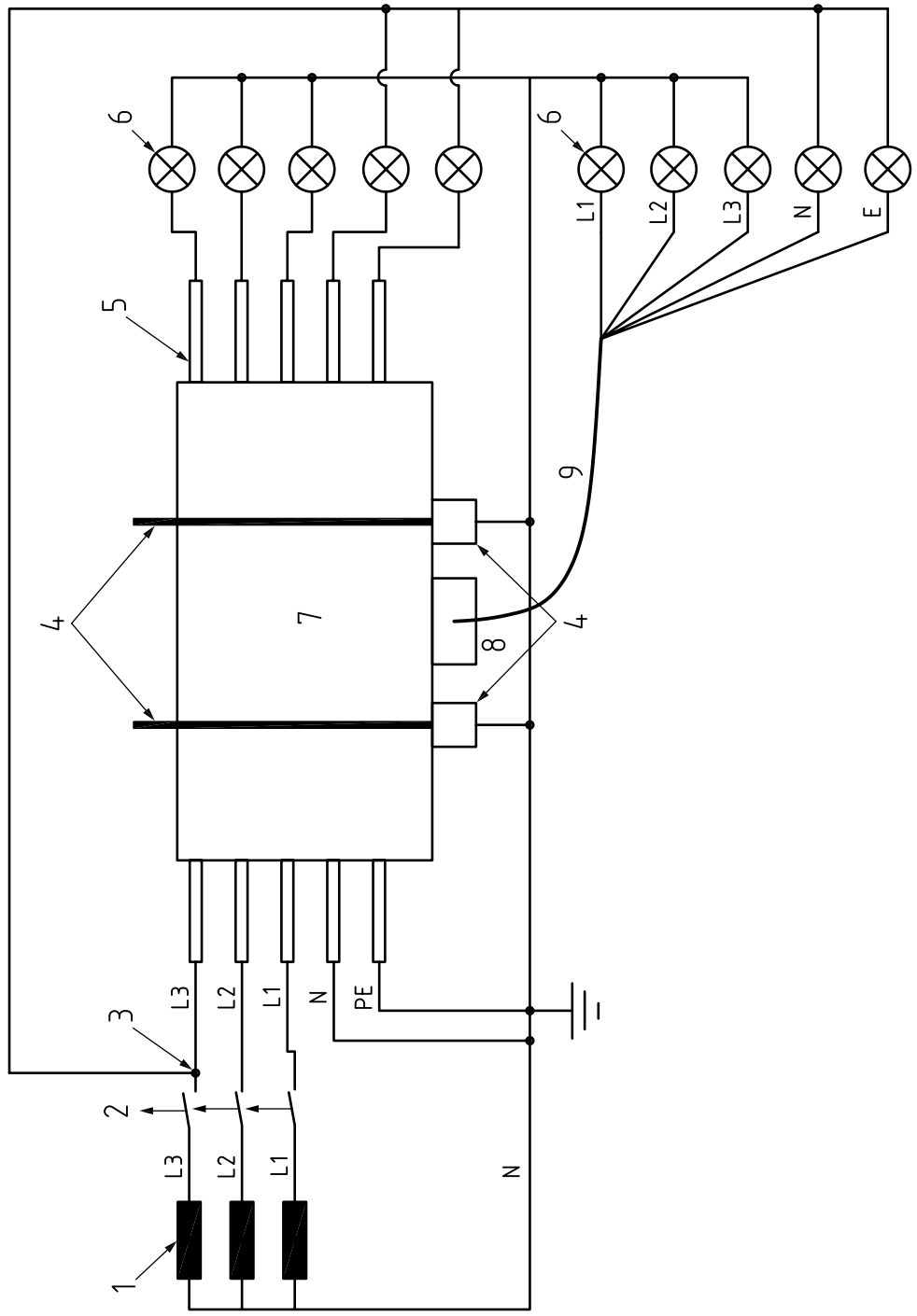
   NOTE A current of 0.25 A at the test voltage, through each conductor or group of conductors, is suitable.

b) the neutral conductor and any protective conductor shall be connected to one terminal of a load and indicating device, the other terminal of each device being connected to phase conductor L1 (or L2 or L3) at the transformer end of the test specimen, as illustrated in Figure 4. In the case of a test specimen of a busbar trunking intended for a fire rated application, the connection shall be made to the protective conductor that is an integral part of the busbar trunking construction.

Where the test specimen includes a fire rated tap-off unit the unit shall be connected to an enhanced fire performance cable with a fire rating of 120 min which has been tested in accordance with BS 8491:2008.

The cable termination shall incorporate the cable manufacturer's recommended cable gland and lugs. The cable shall exit the furnace and be connected to a secondary load (see Figure 4).

Figure 4 **Basic circuit diagram**



Key

1	Transformer(s)	6	Load and indicating devices
2	Fuse(s) or circuit-breaker(s)	7	Test specimen
3	Connection to phase conductor L1 or L2 or L3	8	Tap-off unit
4	Busbar trunking support brackets	9	Fire rated cable
5	Conductor or group of conductors	N	Neutral conductor (if present)
		PE	Protective conductor (if present)

NOTE This figure is adapted from BS 8491:2008, Figure 10.

7 Test procedure

WARNING. Because this test procedure is carried out at voltages of up to 600/1 000 V, it is essential that a risk assessment is carried out before testing and a safe system of work adopted throughout the testing.

7.1 General

Carry out the test procedure in accordance with BS EN 1363-1:1999, Clause **10**, together with **7.2** to **7.4** of this British Standard.

7.2 Setting up the apparatus and starting the test

Assemble the complete busbar trunking test specimen within the furnace, strictly in accordance with the manufacturer's installation instructions and guidance. Commence the test by igniting the furnace.

7.3 Test voltage application

Start the timer and immediately switch on the electricity supply and adjust the voltage to the rated voltage of the busbar trunking, i.e. the test voltage between conductors shall be equal to the rated voltage between conductors and the test voltage from conductor to earth shall be equal to the rated voltage from conductor to earth.

7.4 Duration of test

Run the test for 120 min or until either:

a) one of the fuses blows or one of the circuit breakers interrupts the circuit; or

b) a conductor in the test specimen ruptures, as indicated by one of the circuit continuity indicating devices (e.g. a lamp extinguishes).

7.5 Assessment of test result

The test specimen shall be deemed to have failed the test if, before the end of the 120 min test duration, either:

a) one of the fuses blows or one of the circuit breakers interrupts the circuit; or

b) a conductor in the test specimen ruptures, as indicated by one of the circuit continuity indicating devices (e.g. a lamp extinguishes).

8 Recording of results

Record whether the test specimen survived the test, or whether it failed, in which case record the time after which it failed.

9 Test report

The test report shall include the following information:

a) the number and date of this British Standard, i.e. BS 8602:2013;

b) the name and address of the manufacturer of the busbar trunking tested;

c) a detailed description of the complete busbar trunking assembly in the test specimen and all its individual components, including a list of manufacturer's part numbers;

d) the method of fixing, support and mounting of the test specimen in the furnace;

e) a description of the method and materials used to fire stop the gap between the test specimen and the openings provided in the wall and roof of the furnace to accommodate the test specimen;

f) the jointing process used in assembly of the test specimen, identifying the jointing methods and materials utilized;

g) the details of the supporting construction;

h) the test voltage;

i) any other observations made during the test;

j) whether the test specimen survived the test or, if it did not, the time after which it failed;

k) a declaration confirming that the parts specified in item c) used in the test specimen were standard factory products, without enhancement or modification;

l) details of any fire retardants applied to the test specimen.

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