BS EN 12881-1:2014

BSI Standards Publication

Conveyor belts — Fire simulation flammability testing

Part 1: Propane burner tests

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National foreword

This British Standard is the UK implementation of EN 12881-1:2014. It supersedes BS EN 12881-1:2005+A1:2008 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PRI/67, Conveyor belts.

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

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

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Courroies transporteuses - Essais de simulation d'inflammation - Partie 1: Essais avec brûleur propane

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Foreword

This document (EN 12881-1:2014) has been prepared by Technical Committee CEN/TC 188 “Conveyor belts”, the secretariat of which is held by SNV.

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of an identical text or by endorsement, at the latest by November 2014 and conflicting national standards shall be withdrawn at the latest by November 2014.

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 12881-1:2005+A1:2008.

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

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

The main changes with respect to the previous edition are listed below:

— ‘Laboratory scale fire propagation test' was added (Method D);

— 'Mid-scale fire propagation test' (Method C, 6.1.1 Test gallery) thermal conductivity of the refractory material was included;

— 'Mid-scale fire propagation test' (Method C, 6.1.4 Gas burner) the diameter of the bore jets used was added.

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

This European Standard is a type B1 standard as stated in EN ISO 12100.

The provisions of this European Standard may be supplemented or modified by a type C standard.

The machinery concerned and the extent to which hazards, hazardous situations and events are covered are indicated in the scope of this European Standard.

NOTE For machines which are covered by the scope of a type C standard and which have been designed and built according to the provisions of that standard, the provisions of that type C standard take precedence over the provisions of this type B1 standard.

The methods of test described in EN 12881-1 are intended to provide an indication of the reaction of a conveyor belt to a fire situation. However, in doing so attention is drawn to the fact that in assessing the overall flammability characteristics of conveyor belting for specific installations, it is not sufficient to rely solely on any single method of test but consideration has also to be given to the individual site location.

WARNING — The tests described in EN 12881-1 **can generate large amounts of smoke and heat. It is therefore essential to conduct the tests with caution, having due regard to health and safety considerations and to terminate any test immediately if at any time it is considered advisable to do so. In this regard it is recommended that no test should be supervised by only one person.**

1 Scope

EN 12881-1 describes four methods for measuring the propagation of a flame along a conveyor belt which has been exposed to a relatively high localized heat source such as a fire. The damage suffered by the conveyor belt, as well as its tendency to support combustion, is measured by observing the extent to which the fire spreads along the test piece.

Method A uses a test piece 2 m in length and consumes propane gas through the burner at the rate of (1,30 ± 0,05) kg per 10 min.

Method B uses a test piece 2,5 m in length and consumes propane gas through two burners mounted above and below the test piece trestle at the rate of (1,30 ± 0,05) kg per 10 min for each burner.

Method C uses a test piece 1,5 m in length and consumes propane gas through the burner at the rate of (565 ± 10) g per 50 min.

Method D uses a test piece 1,2 m in length and consumes propane gas through the burner at the rate of 150 l/hr (D1) or 190 l/hr (D2).

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 10088-3, *Stainless steels — Part 3: Technical delivery conditions for semi-finished products, bars, rods, wire, sections and bright products of corrosion resisting steels for general purposes*

EN 22768-1, *General tolerances — Part 1: Tolerances for linear and angular dimensions without individual tolerance indications (ISO 2768-1)*

ISO 65, *Carbon steel tubes suitable for screwing in accordance with ISO 7-1*

ISO 9162, *Petroleum products — Fuels (class F) — Liquefied petroleum gases — Specifications*

3 Propane gas supply

The burners used in each method shall be supplied from bottled propane gas complying with ISO 9162 which shall be fed to each burner, using high pressure propane hose having a minimum internal diameter of 6,3 mm, either:

a) through a pressure reducing valve, a non-return valve and an orifice plate 1,7 mm thick with a 2,5 mm diameter hole; or

b) through a pressure reducing valve and a non-return valve followed by a flow meter calibrated to ensure that the correct mass of gas is consumed.

Before and during the test, immerse each gas cylinder to approximately two-thirds of its height in a bath of water at a temperature of (25 ± 3) °C. Ensure that each gas cylinder is not emptied at the end of a test by more than 90 % of its gas mass capacity.

4 Method A – Two metre single burner test

4.1 Apparatus

4.1.1 Gallery (see Figure 1) having a cross section not greater than 6 m^2, a height of not less than 1,9 m and not greater than 2,25 m and a width of not less than 1,9 m and not greater than 2,75 m through which air is drawn by an adjustable fan. The gallery shall have a concrete floor and shall be not less than 15,0 m long measured from the gallery entrance.

4.1.2 Trestle (see Figure 2) comprising a framework having internal dimensions 2,25 m long x 1,25 m wide and constructed of steel tubing complying with ISO 65, having a bore designation of DN 15 heavy series. The upper sides of the trestle frame shall be fitted with rod retainers to position and retain 15 steel bars manufactured from an austenitic chrome/nickel steel of an appropriate quality, such as 1.4310X10CrNi18-8 complying with EN 10088-3, resistant to rust, acid and heat. The bars shall be 10 mm diameter x 1,4 m in length and form the frame on which the belting rests. The upper surface of the bars shall be 350 mm from the floor.

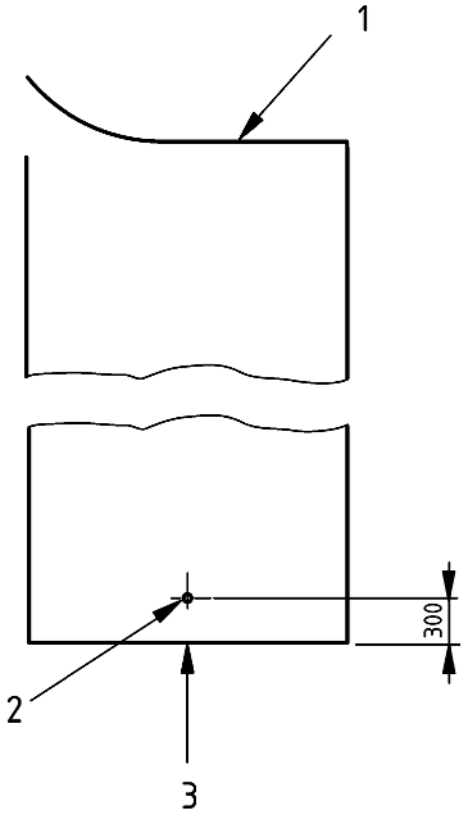
4.1.3 Burner, constructed in accordance with Figure 3, comprising a square having side dimensions of (450 ± 9) mm and an overall height of (220 ± 5) mm. The burner shall be made of welded steel tube complying with ISO 65, having a bore designation of DN 15 medium or heavy series. The tubing shall have 52 holes, each having a diameter of (1,5 ± 0,1) mm, spaced at 50 mm intervals.

4.1.4 Anemometer, or other means of measuring the air velocity in the gallery, which shall be located at a height of 350 mm on the centreline of the gallery, at least 7,25 m inside the gallery entrance and 750 mm from the end of the trestle nearest the gallery entrance.

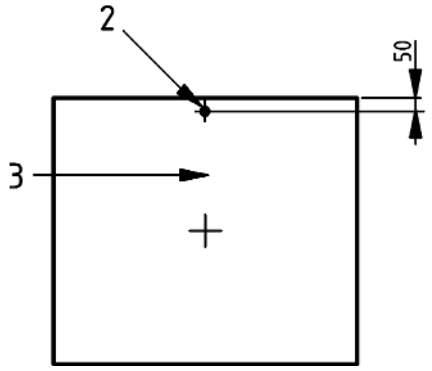
It is important that the air flow in the gallery is laminar and to this end equipment to assist in producing laminar flow may be used.

4.1.5 Thermocouple, to measure the temperature of the incoming air, located as shown in Figure 1.

Dimensions in millimetres



a) Plan view of gallery



b) Cross-section of front of gallery

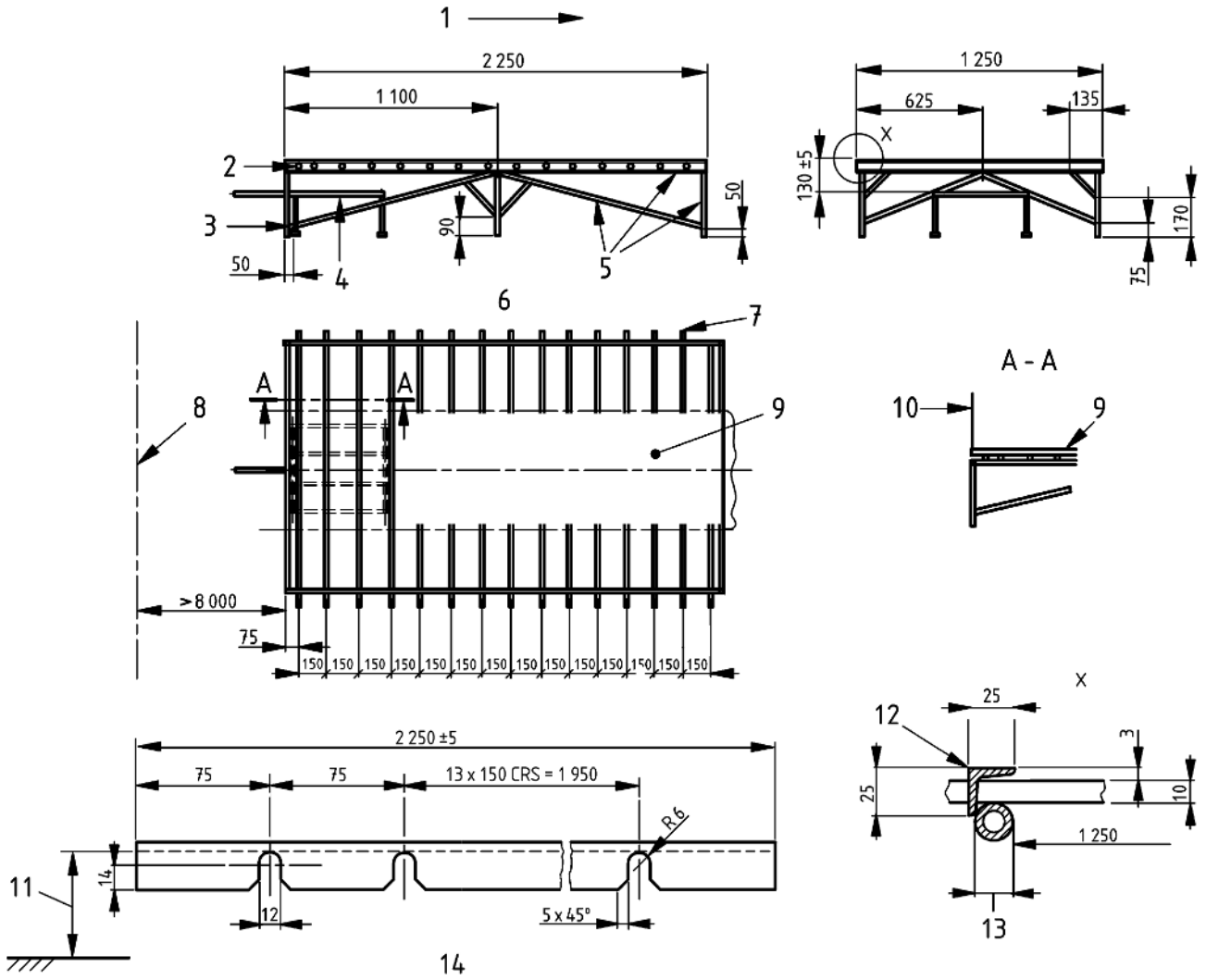
Key

1 rear of gallery
2 position of thermocouple on centre line
3 front of gallery

Figure 1 — Location of thermocouple for measuring the temperature of incoming air

General manufacturing tolerances shall be according to EN 22768-1, unless otherwise stated.

Dimensions in millimetres

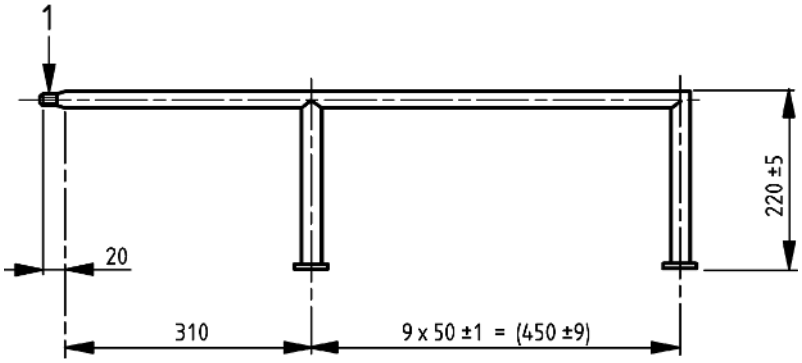


Key

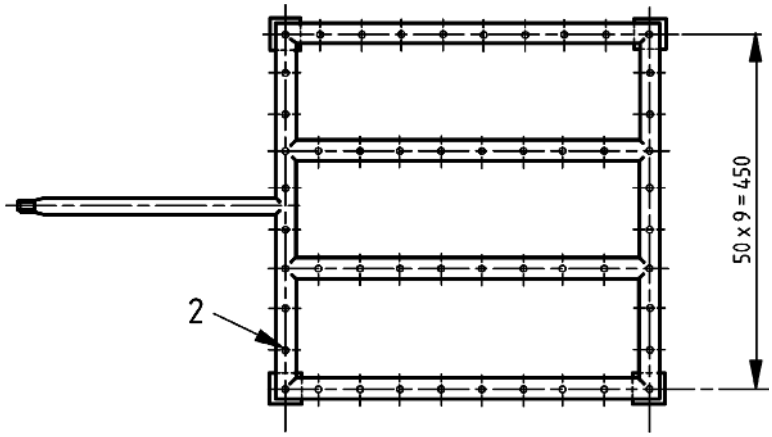
1	direction of air flow	8	gallery entrance
2	additional bar	9	test piece
3	to be clear of any cross bracing	10	edge of test piece flush with front of trestle
4	propane burner	11	350 mm to flow line
5	DN 15 heavy series tube	12	rod retainers
6	detail of trestle	13	DN 15 heavy series trestle
7	bars made of austenitic chrome/nickel steel, diameter 10 mm, length 1,4 m	14	detail of rod retaining angle

Figure 2 — Propane burner trestle showing positions of burner and test piece

Dimensions in millimetres



a) Elevation



b) Plan view

Key

1 threaded

2 hole (x 52)

Figure 3 — Burner for Method A

4.2 Preparation of test pieces

Cut two test pieces, each 2 m long × 1 200 mm wide or of full width if the conveyor belt is less than 1 200 mm wide. Lay the test pieces out for 24 h in dry conditions at any ambient temperature above 0 °C immediately prior to testing to remove residual curvature.

4.3 Temperature at commencement of test

The ambient temperature at the commencement of the test shall be between 5 °C and 30 °C.

4.4 Number of tests

Carry out two tests, one on each side of the belt, so that both covers are tested.

4.5 Procedure

4.5.1 Weigh the propane gas bottle prior to the test.

4.5.2 Install the trestle (4.1.2) centrally on the longitudinal axis of the gallery (4.1.1) with the burner end facing the direction of the ventilation flow. The burner end of the trestle shall be at least 8 m from the gallery entrance.

4.5.3 Place each test piece in turn centrally on the trestle with its transverse edge flush with the burner end of the trestle.

4.5.4 Adjust the air current in the gallery to give an average velocity of (1,5 ± 0,1) m/s at a height of 350 mm. Take the measurement on the centreline of the trestle and at a distance of 750 mm from the end of the trestle nearest the gallery entrance (see Figure 1).

4.5.5 Place the burner centrally with the four parallel burner tubes in line with the longitudinal axis of the test piece, and position it so that the distance from the top of the burner to the top of the bars on which the belt rests is (130 ± 5) mm, with the transverse end row of burner holes 50 mm inside the vertically projected transverse edge of the test piece. Light the burner and adjust the rate of gas consumption immediately to (1,30 ± 0,05) kg per 10 min.

The rate of gas consumption may be regulated by controlling the gas pressure at the high pressure side of the orifice plate to approximately 0,16 MPa for a gas consumption rate of 0,13 kg/min. The pressure reducing valve, the non-return valve and the orifice plate should be positioned as close to each other as possible. A sensitive precision pressure gauge should be used to monitor the pressure at the high pressure side of the orifice plate.

4.5.6 After 10 min switch off the gas. Leave the test piece on the trestle until all flame and glowing have ceased (see also 4.6). However, terminate the test early if the extent of the fire appears to be a danger to persons or equipment.

4.5.7 Re-weigh the gas bottle at the end of the test.

4.5.8 Measure the damage to the test piece as described in 4.7.

4.6 Termination of tests

4.6.1 Normal termination

A test shall be terminated, and shall be deemed to be terminated normally, when a period of at least 10 min has elapsed after all flaming and glowing on the test piece and debris has ceased.

4.6.2 Premature termination

Any test terminated for safety reasons shall be deemed to be terminated prematurely and shall be recorded on the test report (see 4.8) as 'test terminated prematurely'.

4.7 Measurement of damage to test pieces

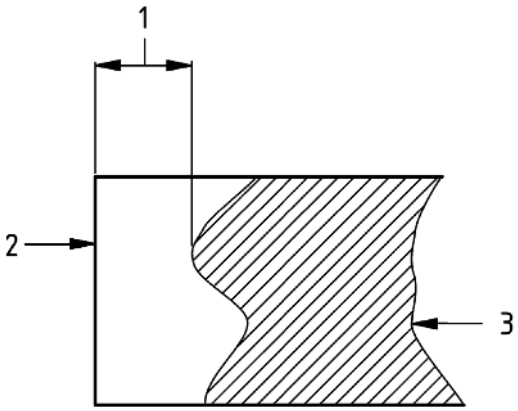
4.7.1 Criteria for assessment of damage

After testing and in order to determine, for the purposes of damage assessment, the length of the test piece which remains undamaged, any embrittlement or hardening, cracking, blistering or other blemishes not originally present shall be regarded as damage.

4.7.2 Length of belting undamaged

Measure the length of the test piece which remains undamaged over its full width from the trailing edge, as shown in Figure 4, on both the upper and lower surfaces. Record the lower of the two measurements as the length of belting that remains undamaged.

Measurement in each case shall be made in a direction parallel to the longitudinal axis of the belt. If the edges of the test piece are not parallel because of uneven shrinkage, the direction of the longitudinal axis shall be judged by eye. Measurement shall be made along the surface of the test piece even if the test piece has become curved.



Key

1 length of undamaged belting
2 trailing edge
3 damaged belting

Figure 4 — Measurement of length of undamaged belting

4.8 Test report

The test report shall include the following:

a) reference to this part of EN 12281 and method, i.e. “EN 12881-1:2014, Method A”;

b) name of institution carrying out the test;

c) name of belt manufacturer;

d) date of test;

e) identification of the belt under test;

f) for each test piece, the minimum length measured as being undamaged (4.7.2);

g) mass of gas consumed;

h) signature and name of person responsible for the test;

i) any deviations from the procedure, including whether the test was terminated prematurely;

j) the following statement: “The test results relate only to the behaviour of the test pieces of a product under the particular conditions of test; they are not intended to be the sole criterion for assessing the potential fire hazard of the product in use”.

5 Method B – Double burner test

5.1 Apparatus

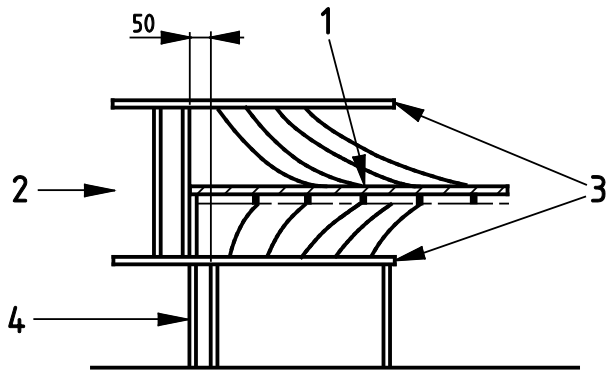
5.1.1 **Gallery**, as described in 4.1.1.

5.1.2 **Trestle** (see Figure 5), as described in 4.1.2, except that its length shall be 2,70 m instead of 2,25 m and it shall retain 18 steel bars of 12 mm diameter instead of 15 steel bars of 10 mm diameter.

5.1.3 **Burner**, constructed in accordance with Figure 6, comprising two squares, having side dimensions of (450 ± 9) mm, situated one above the other in two parallel planes 280 mm apart. The centreline of the lower part of the burner shall be situated at a height of (210 ± 5) mm. The burner shall be made of welded steel tube complying with ISO 65, having a bore designation of DN 15 medium or heavy series. The tubing shall have 104 holes (52 in each element), each having a diameter of (1,5 ± 0,1) mm, spaced at 50 mm intervals. Each element of the burner shall have its own gas supply.

5.1.4 **Anemometer**, or other means of measuring the air velocity in the gallery, which shall be located at a height of 350 mm on the centreline of the gallery, at least 750 mm from the end of the trestle nearest the gallery entrance.

Dimensions in millimetres

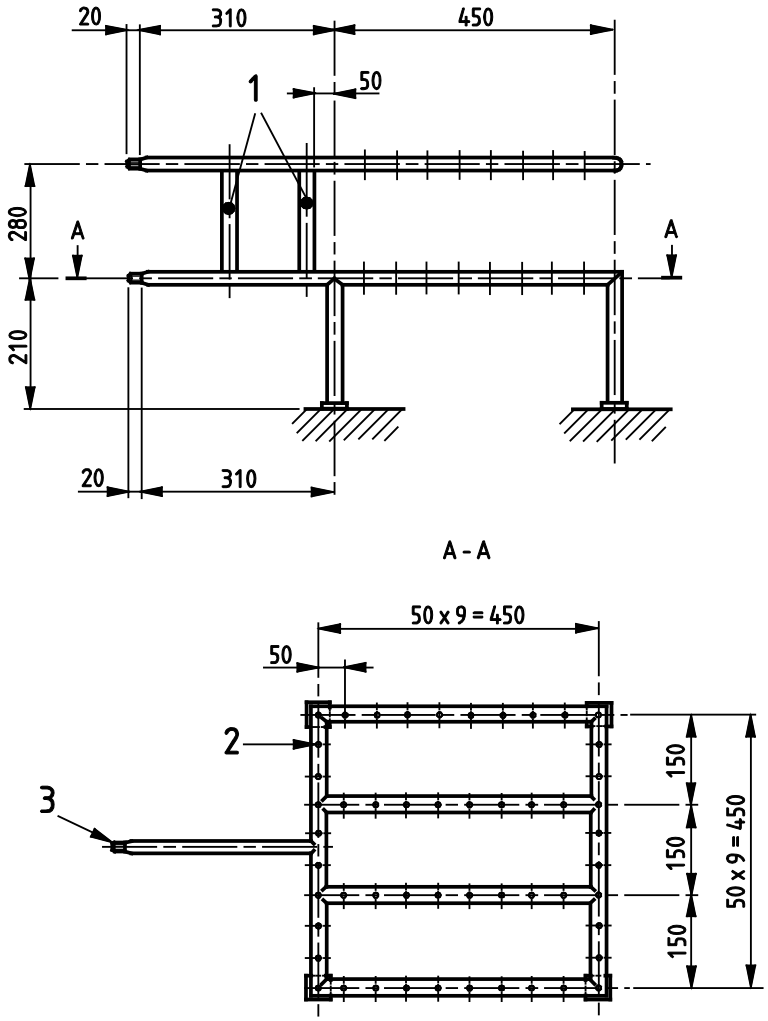


Key

1 test piece
2 direction of air flow
3 double burner
4 trestle

Figure 5 — Positions of trestle, double burner and test piece for Method B

Dimensions in millimetres



Key

1 supports
2 hole (x 52)
3 centre line of burner

Figure 6 — Burner for Method B

5.2 Preparation of test pieces

Cut two test pieces, each 2,5 m long × 1 200 mm wide or of full width if the conveyor belt is less than 1 200 mm wide. Lay the test pieces out for 24 h in dry conditions at any ambient temperature above 0 °C immediately prior to testing to remove residual curvature.

5.3 Temperature at commencement of test

The ambient temperature at the commencement of the test shall be between 5 °C and 30 °C.

5.4 Number of tests

Carry out two tests, one on each side of the belt, so that both covers are tested.

5.5 Procedure

5.5.1 Weigh the propane gas bottle prior to the test.

5.5.2 Install the trestle (5.1.2) centrally on the longitudinal axis of the gallery (5.1.1) with the burner end facing the direction of the ventilation flow. The burner end of the trestle shall be at least 8 m from the gallery entrance.

5.5.3 Place each test piece in turn centrally on the trestle with its transverse edge flush with the burner end of the trestle.

5.5.4 Adjust the air current in the gallery to give an average velocity of (1,5 ± 0,1) m/s at a height of 350 mm. Take the measurement on the centreline of the trestle and at a distance of 750 mm from the end of the trestle nearest the gallery entrance (see Figure 1).

5.5.5 When the air velocity has stabilized at (1,5 ± 0,1) m/s, place the burner centrally with the four parallel burner tubes on each burner in line with the longitudinal axis of the test piece, and position it so that the transverse end row of burner holes is 50 mm inside the vertically projected transverse edge of the test piece.

5.5.6 Light the burners and adjust the rate of gas consumption immediately to (1,30 ± 0,05) kg per 10 min for each burner.

The rate of gas consumption may be regulated by controlling the gas pressure at the high-pressure side of the orifice plate to approximately 0,16 MPa for a gas consumption rate of 0,13 kg/min. The pressure reducing valve, the non-return valve and the orifice plate should be positioned as close to each other as possible. A sensitive precision pressure gauge should be used to monitor the pressure at the high pressure side of the orifice plate.

5.5.7 After 20 min switch off the gas to both burners. Leave the test piece on the trestle until all flame and glowing have ceased (see also 5.6). However, terminate the test early if the extent of the fire appears to be a danger to persons or equipment.

5.5.8 Re-weigh the gas bottle at the end of the test.

5.5.9 Measure the damage to the test piece as described in 5.7.

5.6 Termination of tests

5.6.1 Normal termination

A test shall be terminated, and shall be deemed to be terminated normally, when a period of at least 10 min has elapsed after all flaming and glowing on the test piece and debris has ceased.

5.6.2 Premature termination

Any test terminated for safety reasons shall be deemed to be terminated prematurely and shall be recorded on the test report (see 5.8) as 'test terminated prematurely'.

5.7 Measurement of damage to test pieces

5.7.1 Criteria for assessment of damage

After testing and in order to determine, for the purposes of damage assessment, the length of the test piece which remains undamaged, any embrittlement or hardening, cracking, blistering or other blemishes not originally present shall be regarded as damage.

5.7.2 Length of belting undamaged

Measure the length of the test piece which remains undamaged over its full width from the trailing edge, as shown in Figure 4, on both the upper and lower surfaces. Record the lower of the two measurements as the length of belting that remains undamaged.

Measurement in each case shall be made in a direction parallel to the longitudinal axis of the belt. If the edges of the test piece are not parallel because of uneven shrinkage, the direction of the longitudinal axis shall be judged by eye. Measurement shall be made along the surface of the test piece even if the test piece has become curved.

5.8 Test report

The test report shall include the following:

a) reference to this part of EN 12281 and method, i.e. “EN 12881-1:2014, Method B”;

b) name of institution carrying out the test;

c) name of belt manufacturer;

d) date of test;

e) identification of the belt under test;

f) for each test piece, the minimum length measured as being undamaged (5.7.2);

g) mass of gas consumed;

h) signature and name of person responsible for the test;

i) any deviations from the procedure, including whether the test was terminated prematurely;

j) the following statement: “The test results relate only to the behaviour of the test pieces of a product under the particular conditions of test; they are not intended to be the sole criterion for assessing the potential fire hazard of the product in use”.

6 Method C – Mid-scale fire propagation test

6.1 Apparatus

6.1.1 Test gallery (see Figures 7 and 8), comprising a chamber made from 25 mm thick refractory material, with an opening measuring 460 mm × 460 mm and a length of 1 676 mm, connected to a 300 mm diameter exhaust duct by a conical transition section (plenum) made of stainless steel, 1,5 mm thick. The refractory material shall have a thermal conductivity at 20 °C to 200 °C of (0,14 ± 0,02) W/(m·K). A fan shall be situated in the exhaust duct to enable air to be drawn through the gallery, the speed of which is controlled by dampers.

6.1.2 Exhaust hood, made of stainless steel, 1,5 mm thick, placed over the test chamber to extract smoke and fumes that may escape from the front of the chamber during a test.

6.1.3 Trestle, (see Figure 9), to carry the belt sample. This shall be 1 500 mm long, 220 mm wide and 160 mm high, made from 10 mm diameter mild steel rod. It shall have lugs by which the belt sample can be wired down to the frame.

6.1.4 Gas burner, (see Figure 10), comprising six 3kW Type 1 Atmospheric Burner Heads with 0,7 mm diameter bore jets (for propane), with dimensions as shown in Figure 11, mounted in two rows of three inclined at 45° inwards and positioned on a frame to place them beneath the test sample.

6.1.5 Propane gas (see Clause 3), supplied at a constant rate to the burner via a flow meter, such that the mass of gas consumed during the test is (565 ± 10) g (see 6.6.4 for details of the flow rate needed to achieve this gas consumption).

6.1.6 Weighing instrument, capable of weighing the belt sample and the gas bottle before and after the test to an accuracy of 5 g or better.

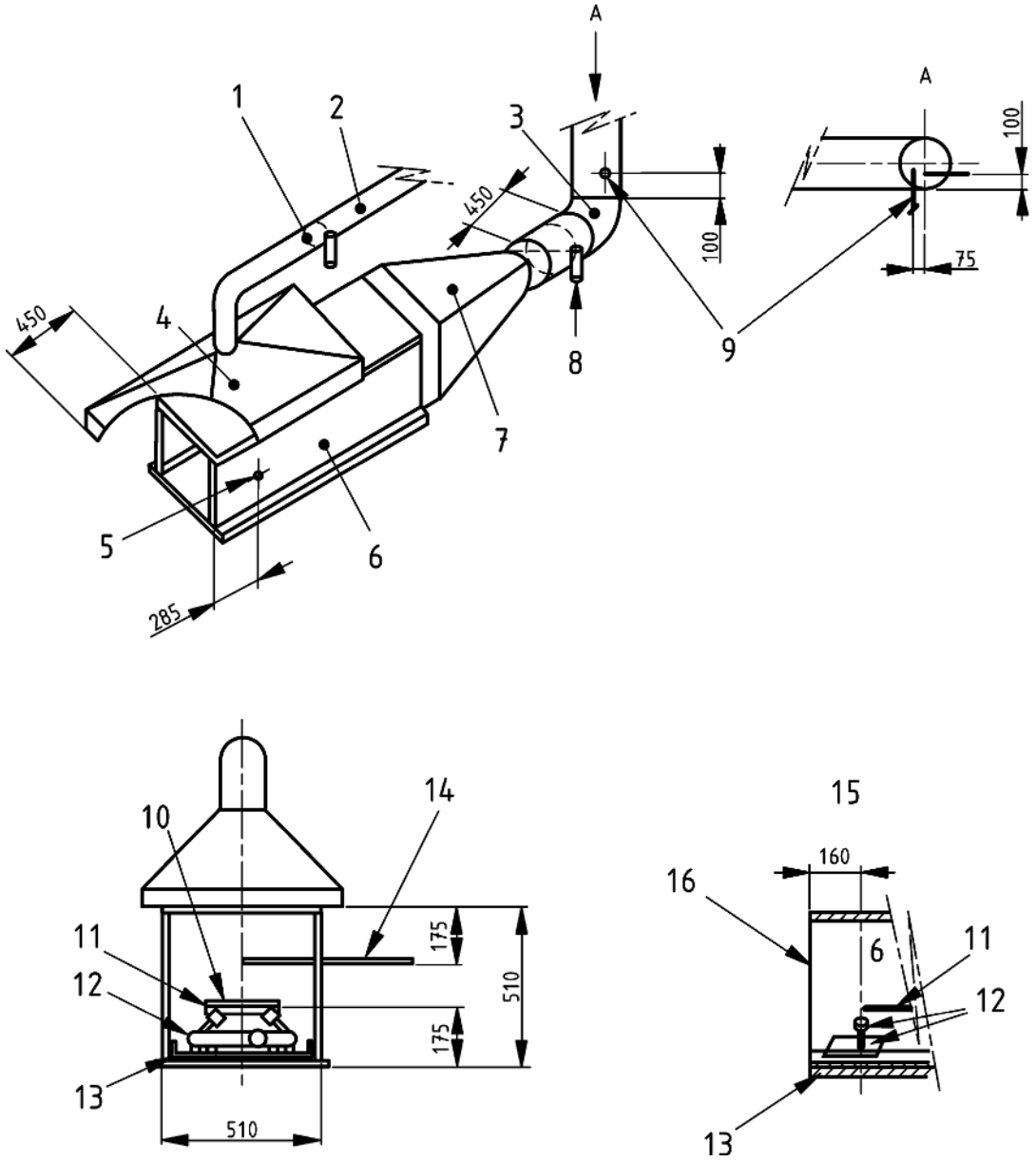
6.1.7 Anemometer, positioned on the centreline of the test chamber at a height of 310 mm above the floor and 285 mm from the front.

6.1.8 K-type thermocouple, positioned in the exhaust duct as shown in Figure 7, and connected to a recording device (6.1.9).

6.1.9 Recording device, capable of recording the temperature at least six times per minute.

6.1.10 Timer, capable of measuring to within 1 s.

Dimensions in millimetres

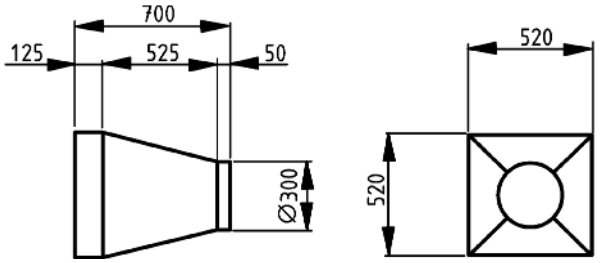


Key

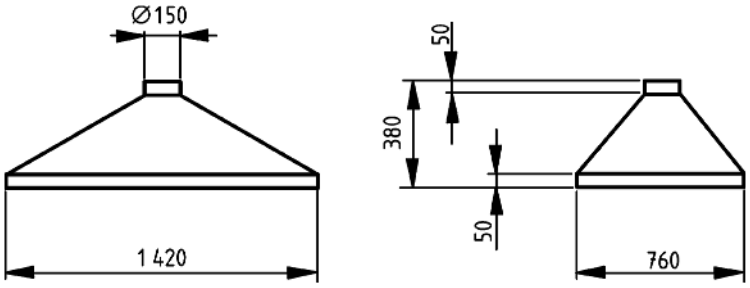
1	exhaust control gate	9	thermocouple
2	exhaust duct, diameter 150 mm	10	test piece
3	exhaust duct, diameter 300 mm	11	trestle
4	exhaust hood	12	burner
5	anemometer position	13	debris tray, stainless steel, thickness 1,5 mm
6	test chamber	14	anemometer position
7	plenum	15	exhaust hood not shown
8	exhaust control gate	16	front face

Figure 7 — Mid-scale fire tunnel (general)

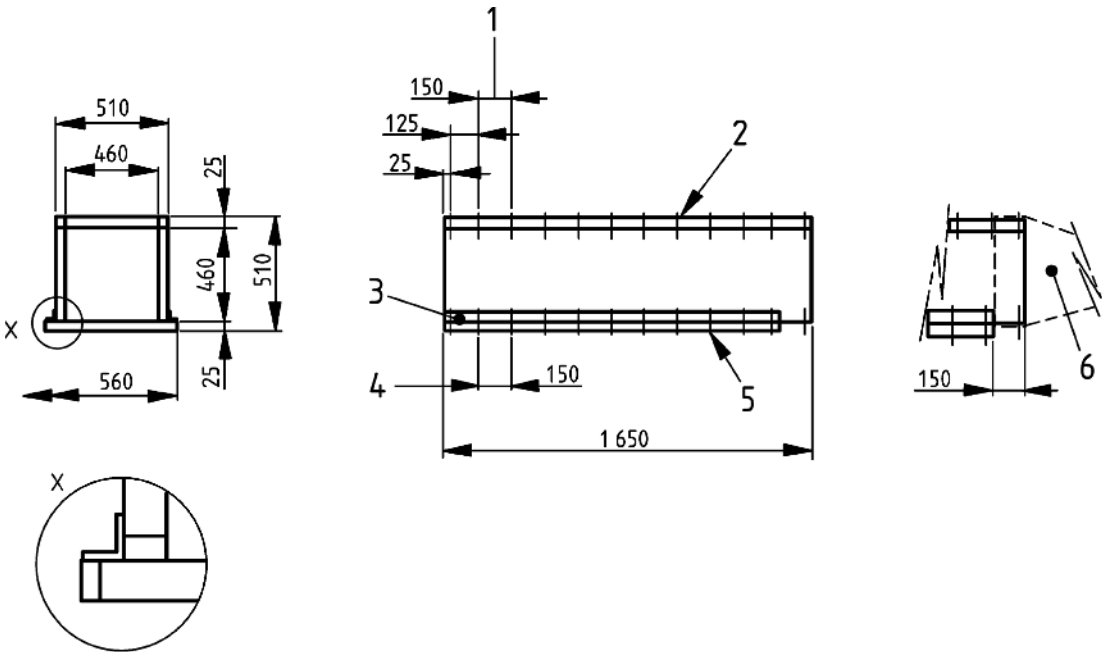
Dimensions in millimetres



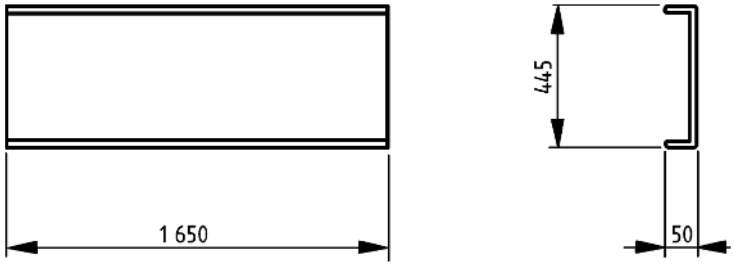
a) Plenum



b) Exhaust hood



c) Test chamber



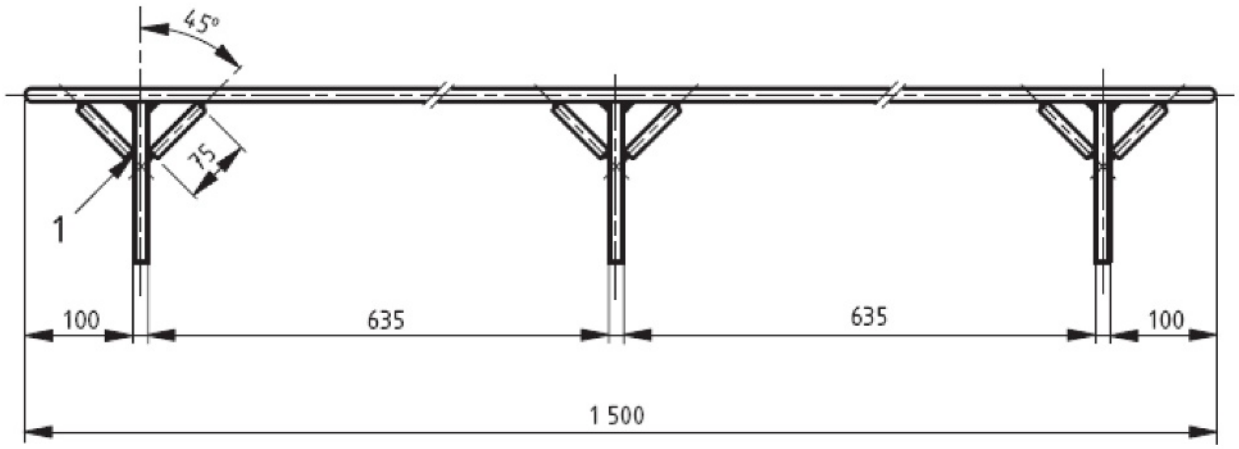
d) Debris tray

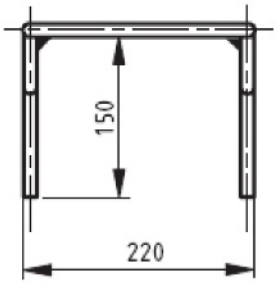
Key

1 150 mm (x 9)
2 self-tapping screw 2 mm x 50 mm (x 24)
3 metal support, 25 mm x 25 mm x 3 mm rolled section angle (RSA)
4 150 mm (x 8)
5 self-tapping screw 1,1 mm x 25 mm (x 44)
6 cut floor and rolled section angle (RSA) as shown to fit plenum

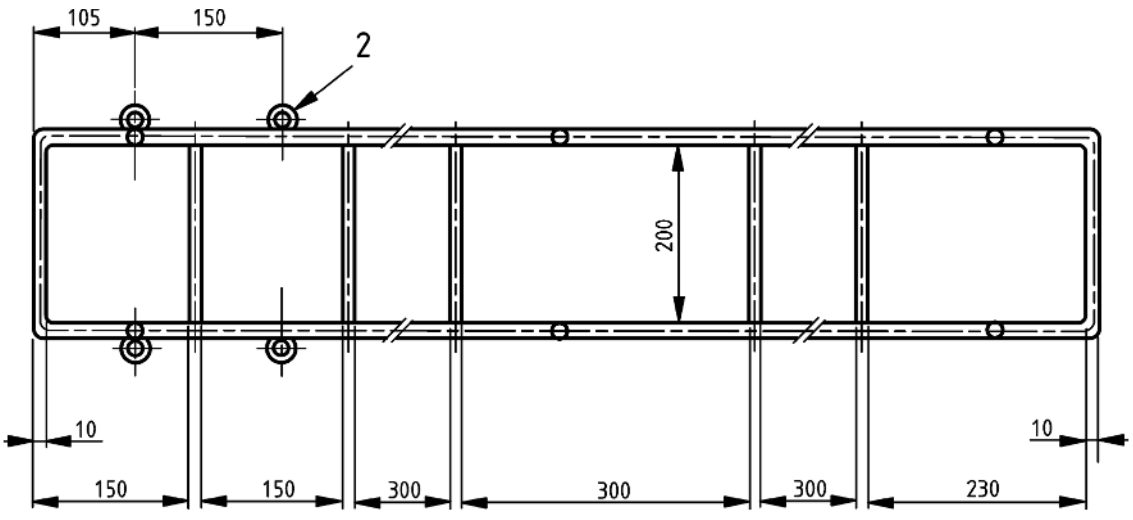
Figure 8 — Mid-scale fire tunnel (details)

Dimensions in millimetres





a) Elevation



b) Plan view

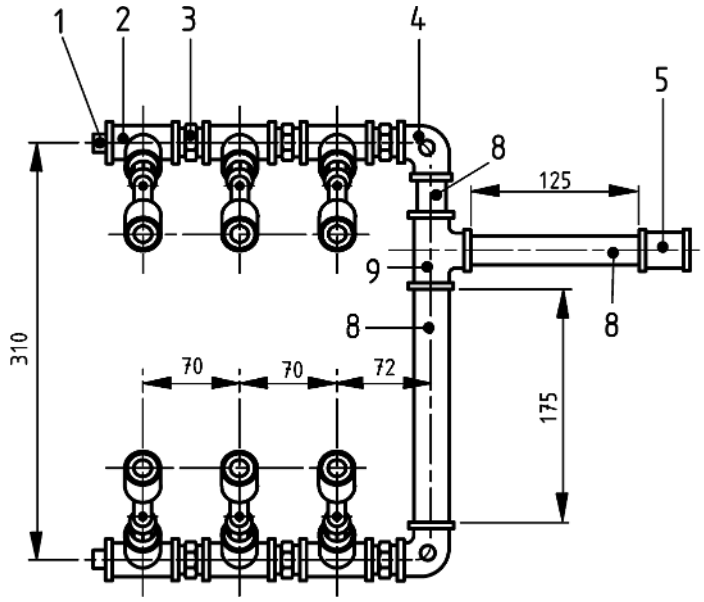
Key

1 weld (x 12)

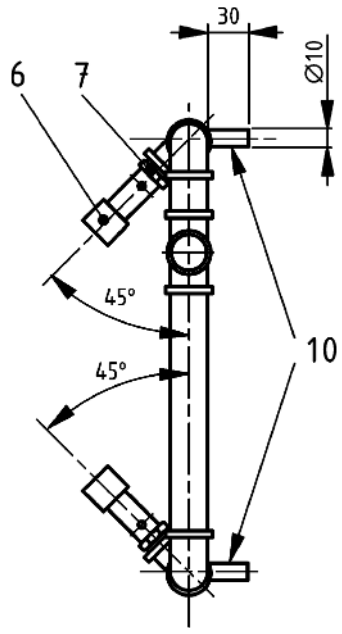
2 washer, diameter 12 mm, cut to hole edge weld as shown (x 4)

Figure 9 — Trestle

Dimensions in millimetres



a) Plan view



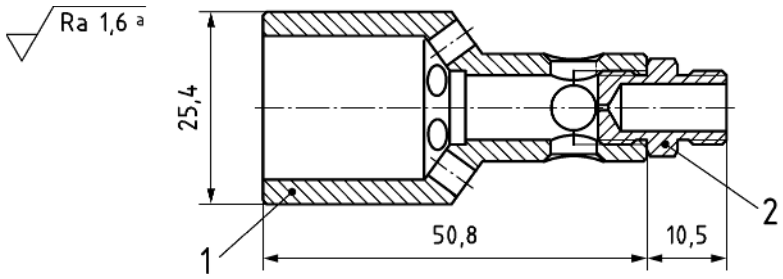
b) End elevation showing angle of burners

Key

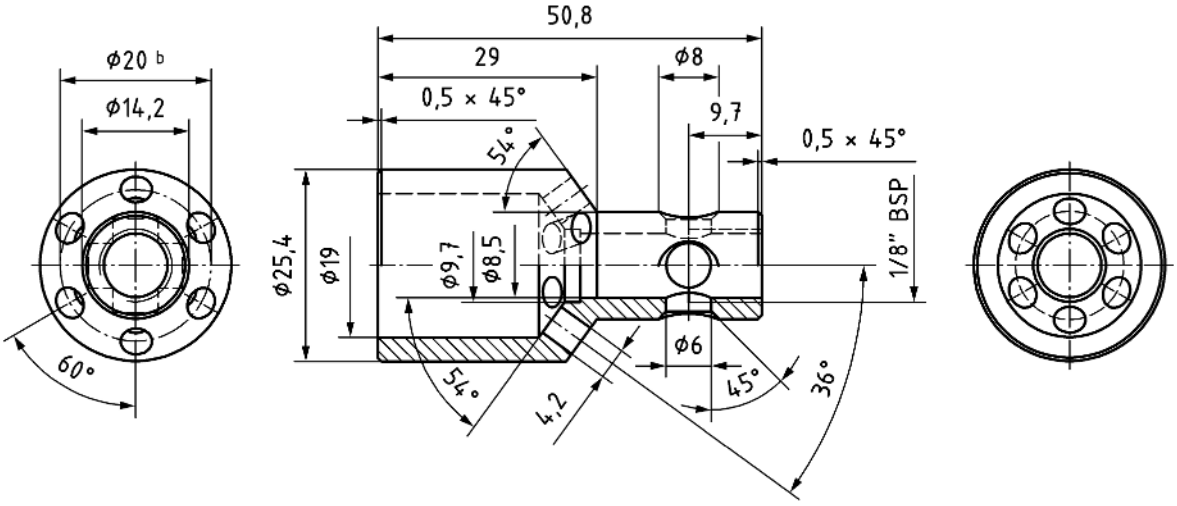
1	solid plug	7	reducing bush
2	reducing tee	8	12,7 mm nominal bore
3	hexagonal nipple	9	equal tee
4	90° elbow	10	four mild steel feet welded to the underside of items 2 and 4
5	socket		
6	gas burner		

Figure 10 — Burner assembly for Method C

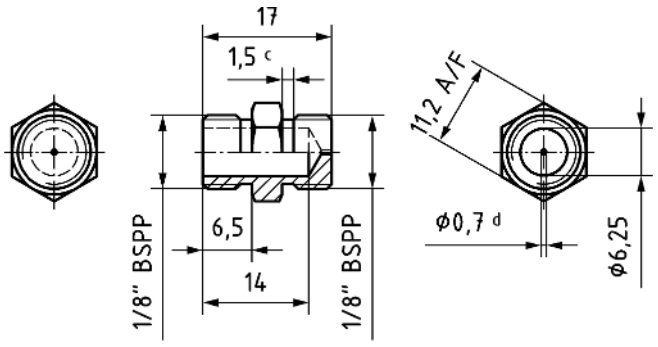
Dimensions in millimetres



a) Propane gas jet assembly



b) Gas jet holder – mild steel



c) Propane gas jet – brass

Key

1	gas jet holder	2	propane gas jet with DIA 0,7 bore
a	machine all over	b	PCD on face
c	U´cut	d	bore jet

Figure 11 — Jets for burner for Method C

6.2 Preparation of test pieces

6.2.1 For belts with top and bottom covers of equal thickness, cut two test pieces measuring 1 500 mm long by 230 mm wide in a longitudinal direction from the conveyor belt to be tested. For belts with covers of unequal thickness cut three samples. Ensure that the test pieces have clean-cut edges and are not taken from within 50 mm of the edges of the belt. Weigh each test piece after cutting. Allow the test pieces to lie flat for 24 h prior to testing.

6.2.2 To enable the test pieces to be secured to the trestle, drill six holes, using an 8 mm diameter drill bit, in the test pieces as follows:

a) four holes through the belt 50 mm in from each side of the belt and 50 mm from the front and rear of the test piece; and

b) two holes through the test piece 20 mm in from the sides and 330 mm from the front edge.

6.2.3 Lay the test piece on the trestle and secure it to the frame using 25 gauge wire through the six drilled holes. In addition, pass two pieces of the wire over the test piece at positions 100 mm and 250 mm from the front and secure the test piece tightly down to the lugs on the frame.

6.3 Installation of the test pieces and burner

6.3.1 Place the trestle in the test chamber centrally with the front edge of the test piece 160 mm from the front of the test chamber.

6.3.2 Install the burner centrally beneath the trestle such that the front jets are in line with the front edge of the test piece.

6.4 Temperature at commencement of test

The ambient temperature at the commencement of the test shall be between 5 °C and 30 °C.

NOTE A substantial amount of heat is absorbed by the gallery during each test and this can affect subsequent tests. It is important, therefore, that the gallery be allowed to cool to ambient temperature between each test. In practice, a period of three hours has proved to be satisfactory.

6.5 Number of tests

6.5.1 For belting with top and bottom covers that are of equal thickness, conduct two tests.

6.5.2 For belting with top and bottom covers that are of unequal thickness, conduct three tests as follows:

a) test one test piece with the top cover uppermost;

b) test one test piece with the top cover face downwards;

c) test the third test piece in the configuration a) or b) that gave the worse result.

6.6 Procedure

6.6.1 Weigh the propane gas bottle prior to the test.

6.6.2 Set the air velocity to (1,0 ± 0,05) m/s using the anemometer positioned as described in 6.1.7.

6.6.3 Record the temperature of the exhaust air for between 2 min and 5 min to give a measure of the ambient air temperature.

6.6.4 Set the gas flow to approximately 350 l/h and light the burner. Start the timer. Adjust the gas flow to (345 ± 5) l/h.

6.6.5 After 50 min turn off the gas to the burner and allow the test piece and trestle to cool (see also 6.7). Terminate the test early if the extent of the fire appears to be a danger to persons or equipment.

6.6.6 Re-weigh the gas bottle at the end of the test and confirm that the mass of gas consumed during the test is equivalent to (565 ± 10) g over 50 min. If it is not, adjust the flow rate accordingly and repeat the test.

6.6.7 Remove all belting remaining on the trestle and allow it to cool to ambient temperature. Detach any friable material and weigh the belting.

6.7 Termination of tests

6.7.1 Normal termination

A test shall be terminated, and shall be deemed to be terminated normally, when a period of at least 10 min has elapsed after all flaming and glowing on the test piece and debris has ceased.

6.7.2 Premature termination

Any test terminated for safety reasons shall be deemed to be terminated prematurely and shall be recorded on the test report (see 6.10) as 'test terminated prematurely'.

6.8 Measurement of damage to test pieces

6.8.1 Criteria for assessment of damage

After testing and in order to determine, for the purposes of damage assessment, the length of the test piece which remains undamaged, any embrittlement or hardening, cracking, blistering or other blemishes not originally present shall be regarded as damage.

6.8.2 Length of belting undamaged

Measure the length of the test piece which remains undamaged over its full width from the trailing edge, as shown in Figure 4, on both the upper and lower surfaces. Record the lower of the two measurements as the length of belting that remains undamaged.

Measurement in each case shall be made in a direction parallel to the longitudinal axis of the belt. If the edges of the test piece are not parallel because of uneven shrinkage, the direction of the longitudinal axis shall be judged by eye. Measurement shall be made along the surface of the test piece even if the test piece has become curved.

6.8.3 Temperature rise

From the temperature measurements taken during the test calculate the maximum average temperature rise over ambient in any one minute period during the test. Record this value as the maximum average temperature rise.

6.8.4 Length of belting consumed

Determine the length of belting consumed during the test from measurements of mass before and after testing.

Calculate the length consumed, in millimetres, as follows:

$$\text{length consumed} = \frac{\text{mass before test - mass after test}}{\text{mass before test}} \times 1\ 500 \quad (1)$$

6.9 Exhaust temperature calibration

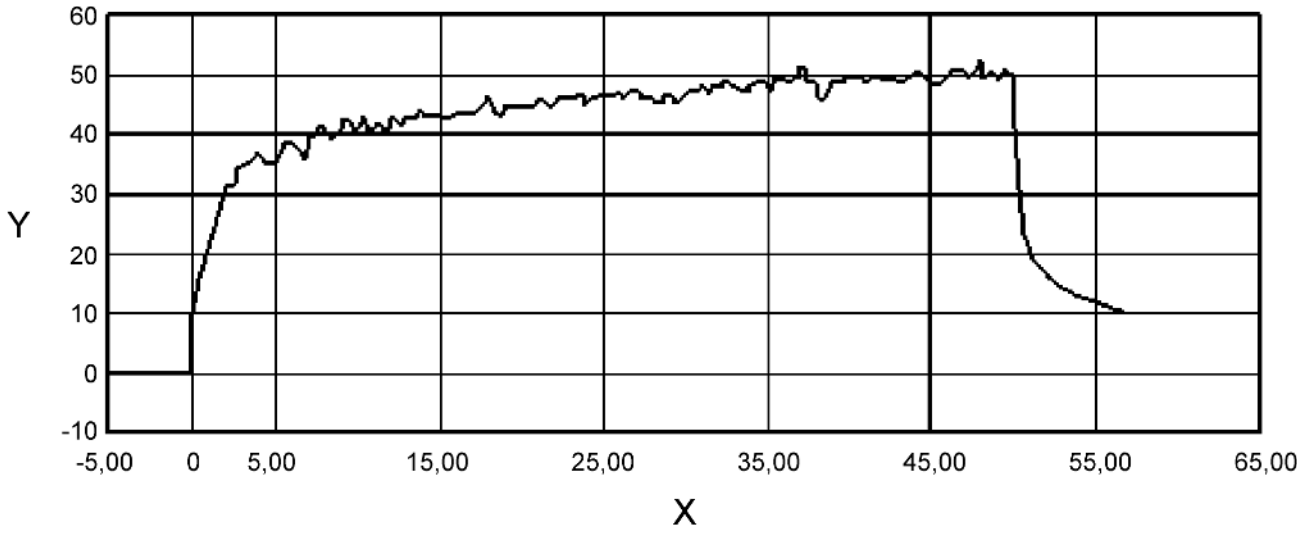
6.9.1 Carry out the calibration described in 6.9.2 in the following circumstances:

a) before a new gallery is used for the first time;

b) following maintenance work to the gallery; and

c) periodically, to ensure that accidental changes to conditions have not occurred.

6.9.2 Operate the test gallery, without the test piece present, at a gas flow rate equivalent to (565 ± 10) g/50 min. Ensure that the exhaust gas temperature, measured in the ducting over the final minute of the test, rises over the ambient temperature by (50 ± 5) °C. Plot the exhaust gas temperature against time for the period of the test, and ensure that the temperature rise above ambient follows the form shown in Figure 12.



Key

X time (min)

Y temperature rise (°C)

Figure 12 — Plot of temperature against time when no test piece is present

6.10 Test report

The test report shall include the following:

a) reference to this part of EN 12881 and method, i.e. “EN 12881-1:2014, Method C”;

b) name of institution carrying out the test;

c) name of belt manufacturer;

d) date of test;

e) identification of the belt under test;

f) for each test piece, the minimum length measured as being undamaged (6.8.2);

g) length of belting consumed by mass (6.8.4);

h) maximum average temperature rise (6.8.3);

i) mass of gas consumed;

j) signature and name of person responsible for the test;

k) any deviations from the procedure, including whether the test was terminated prematurely;

l) the following statement: “The test results relate only to the behaviour of the test pieces of a product under the particular conditions of test; they are not intended to be the sole criterion for assessing the potential fire hazard of the product in use”.

7 Method D Laboratory scale Fire Propagation Test

7.1 Apparatus

7.1.1 Test gallery (Figure 13, 14 and 15) with internal dimensions of 350 mm x 350 mm x 2100 mm and comprising an outer casing of stainless steel with a 5 mm thick base and 1,5 mm thick sides and top lined on the sides and top with 25mm thick refractory material having an apparent density of 450 kg/m^3, compression strength of approximately 4 MPa and a thermal conductivity of 0,08 W/(m·K). The test gallery is connected to a 130 mm diameter exhaust duct by a conical transition section (plenum) made of stainless steel, 1,5 mm thick. The observation windows in the side walls of the test gallery shall be made from 4 mm thick heat resistant glass with a thermal conductivity of 1,1 W/(m·K).

7.1.2 Exhaust hood (Figure 15), made of stainless steel, 1,5 mm thick, placed over the test chamber to extract smoke and fumes that may escape from the front of the chamber during a test. The exhaust hood shall be constructed in such a way that it does not influence the air flow within the test chamber.

7.1.3 Adjustable ventilation shall be fitted to the end of the exhaust ducting.

7.1.4 Trestle (Figure 16) to carry the belt sample. The main body shall be made from 10 mm diameter mild steel rod and be 1330 mm in length. The width and height shall be adjustable to comply with the requirements of the test conditions and procedure. The height, *a*, of the holder clamp (see Figure 16) shall be selected according to the thickness of the test piece so as to prevent the test piece distorting during the test.

7.1.5 Gas burner for propane gas as per Figure 18 with ceramic sieve.

7.1.6 Propane gas (see Clause 3), supplied at a constant rate (see Table 1) to the burner via a flow meter which shall be capable of measuring volume flows of between 23 l/hr and 230 l/hr at standard temperature and pressure.

7.1.7 Anemometer, positioned in the centreline of the test chamber at a height of 180mm above the floor and 1180mm from the front via an opening in the side (Position C, Figure 13).

7.1.8 K-type thermocouple, with a measuring range up to 400 °C, for measuring the temperature at the centre of the wall of the test chamber at a point 640 mm from the front and 45 mm from the roof.

7.2 Preparation of test pieces

Cut five test pieces from the conveyor belt to be tested each measuring 1200 ± 2 mm long and 90 ± 2 mm or 120 ± 2 mm wide (see Table 1) The pieces shall not be taken from within 100 mm from the edges of the belt. The test pieces should be stored flat for at least 24 h at a room temperature of (20 ± 5) °C before testing.

7.3 Installation of the test piece and burner

7.3.1 Place the test piece in the trestle such that the belt is within the holding clamps with the thinnest (non-carry) cover down.

7.3.2 Adjust the height of the trestle so that the top of the test piece is 85 mm below the roof of the test chamber.

7.3.3 Place the trestle in the test chamber centrally with the front edge of the test piece 330 mm from the front edge of the test chamber.

7.3.4 Install the burner centrally beneath the trestle such that the centre of the burner is 500 mm from the front edge of the test chamber (170 mm from the front edge of the test piece). See Figure 17.

7.4 Test Conditions

Test conditions 1 or 2 (see Table 1) apply according to the type and width of the belt. Further details are given in EN 14973 and EN 12882.

Table 1 — Test Conditions

Technical Data				Test Condition	
				1	2
Test piece width		mm	±2	90	120
Temperature at measurement point ‘A’		°C	±5	48	68
Ambient temperature		°C	±5	20	20
Air speed		ms^{-1}	±0,1	0,5	0,5
Burner:	Propane pressure	kPa		40	60
	Gas flow	$l\ hr^{-1}$		150	190
	Flame temperature	°C	±10	925	950
Ignition time		min		15	15

7.5 Procedure

7.5.1 Before starting each individual test, the empty test chamber shall be adjusted so that the appropriate temperature of the wall at measurement point ‘A’ (Figure 13) is obtained. The ambient temperature shall also be measured.

7.5.2 Set the air velocity in the test chamber to (0,5 ± 0,1) ms^{-1} using the anemometer positioned as described in 7.1.7; this setting is not changed for the duration of the test.

7.5.3 Remove the burner from the test chamber, set the required gas flow and ignite. Adjust the supply of air to the burner such that the yellow edge to the flame disappears and the blue cone is approximately 10 mm. The temperature 40 mm above the centre point of the ceramic sieve shall be measured.

7.5.4 Reposition the burner beneath the test sample for 15 min after which the burner shall be removed and the test piece and trestle allowed to cool. Terminate the test early if the extent of the fire appears to be a danger to persons or equipment.

7.6 Termination of tests

7.6.1 Normal termination

A test shall be terminated, and shall be deemed to be terminated normally, when a period of at least 5 min has elapsed after all flaming and glowing on the test piece and debris has ceased.

7.6.2 Premature termination

Any test terminated for safety reasons shall be deemed to be terminated prematurely and shall be recorded on the test report (see 7.8) as ‘test terminated prematurely’.

7.7 Measurement of damage to test pieces

7.7.1 Criteria for assessment of damage

After testing and in order to determine, for the purposes of damage assessment, the length of the test piece which remains undamaged, any embrittlement or hardening, cracking, blistering or other blemishes not originally present shall be regarded as damage.

7.7.2 Length of belting undamaged

Measure the length of the test piece which remains undamaged over its full width from the trailing edge, as shown in Figure 4, on both the upper and lower surfaces. Record the lower of the two measurements as the length of belting that remains undamaged.

Measurement in each case shall be made in a direction parallel to the longitudinal axis of the belt. If the edges of the test piece are not parallel because of uneven shrinkage, the direction of the longitudinal axis shall be judged by eye. Measurement shall be made along the surface of the test piece even if the test piece has become curved.

7.8 Test report

The test report shall include the following:

a) reference to this part of EN 12881 and method i.e. “EN 12881-1:2014, Method D”;

b) name of institution carrying out the test;

c) name of the belt manufacturer;

d) date of test;

e) identification of the belt under test, including any markings;

f) for each test piece, the minimum length measured as being undamaged (7.7.2);

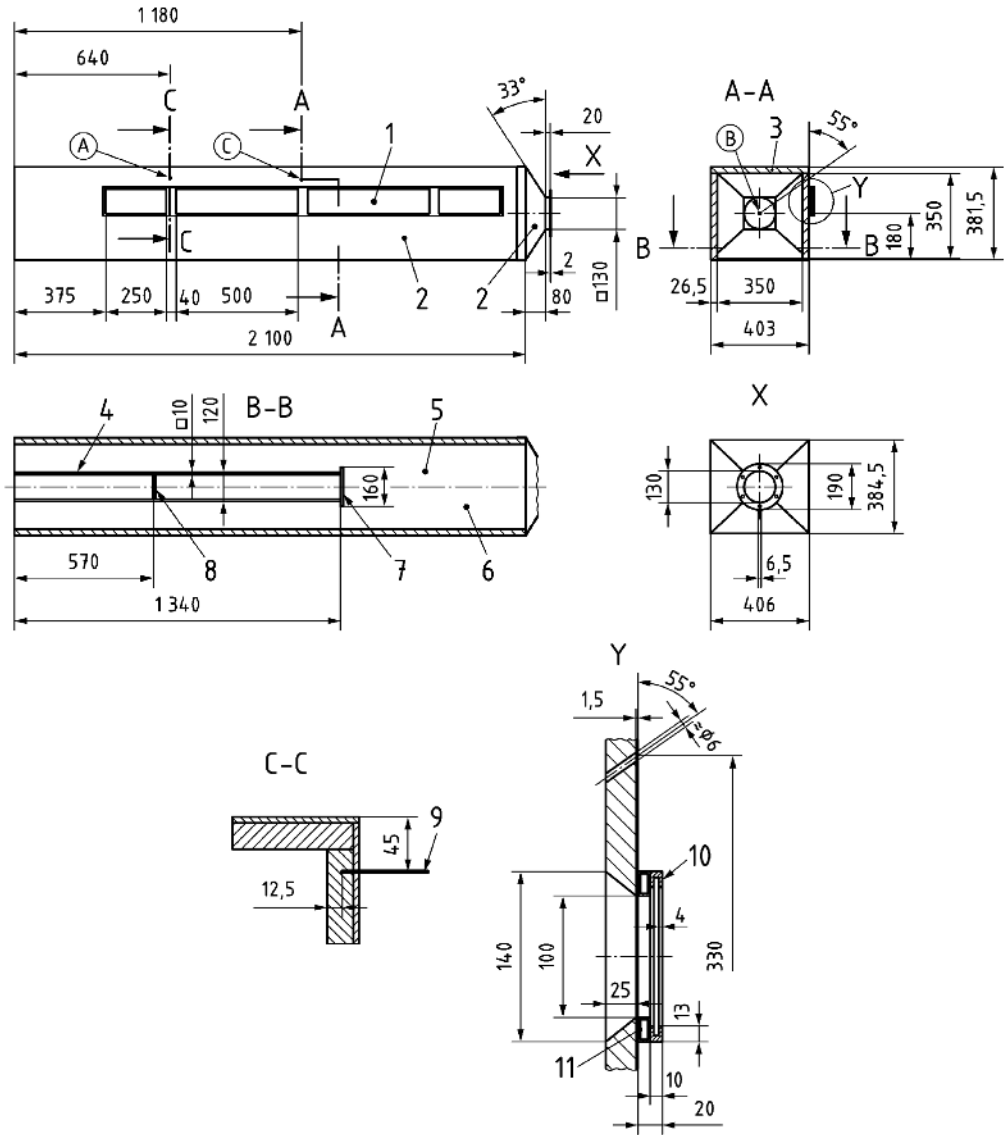
g) the mean length undamaged from the five tests;

h) signature and name of person responsible for the test;

i) any deviations from the procedure, including whether any test was terminated prematurely;

j) the following statement: “The test results relate only to the behaviour of the test pieces of a product under the particular conditions of test; they are not intended to be the sole criterion for assessing the potential fire hazard of the product in use”.

Dimensions in millimetres



Key

1	heat-resistant glass	7	limitation for trestle
2	stainless steel t = 1,5	8	limitation for burner
3	refractory material	9	thermocouple
4	guidance rail for burner and trestle	10	sealing cord heat resistant
5	stainless steel t = 5	11	hollow profile
6	floor sheet		

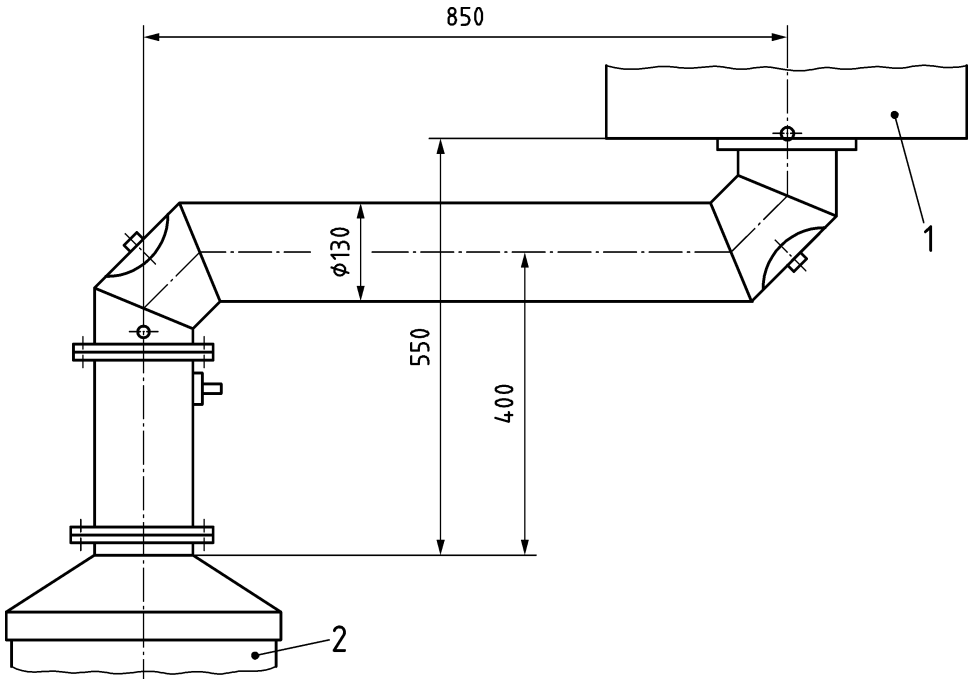
(A) measuring point for pre-heat temperature

(B) measuring point for air velocity

(C) opening for air velocity meter

Figure 13 — Test Gallery

Dimensions in millimetres



Key

1 ventilator

2 test gallery

Figure 14 — Exhaust Pipe

Dimensions in millimetres

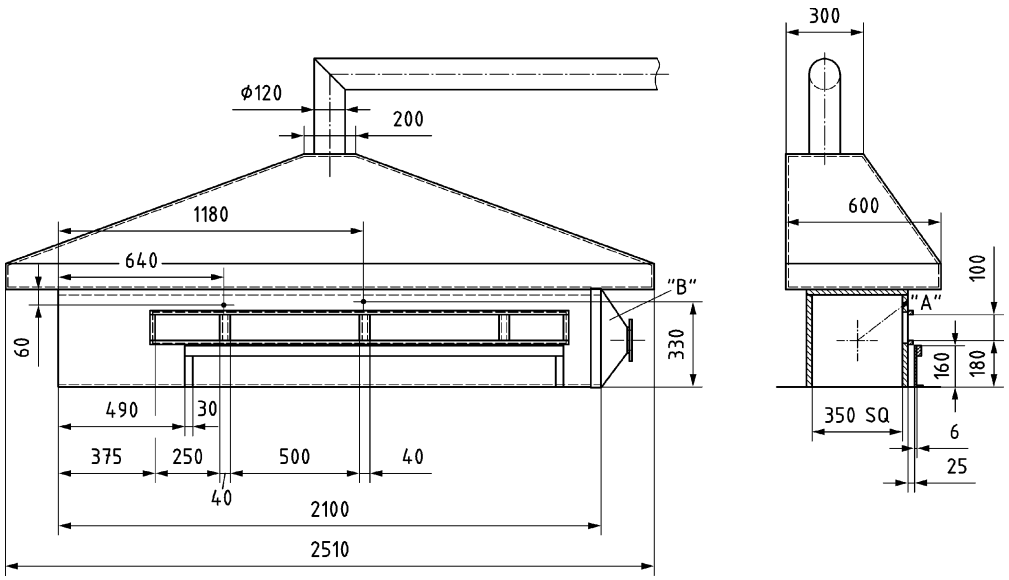
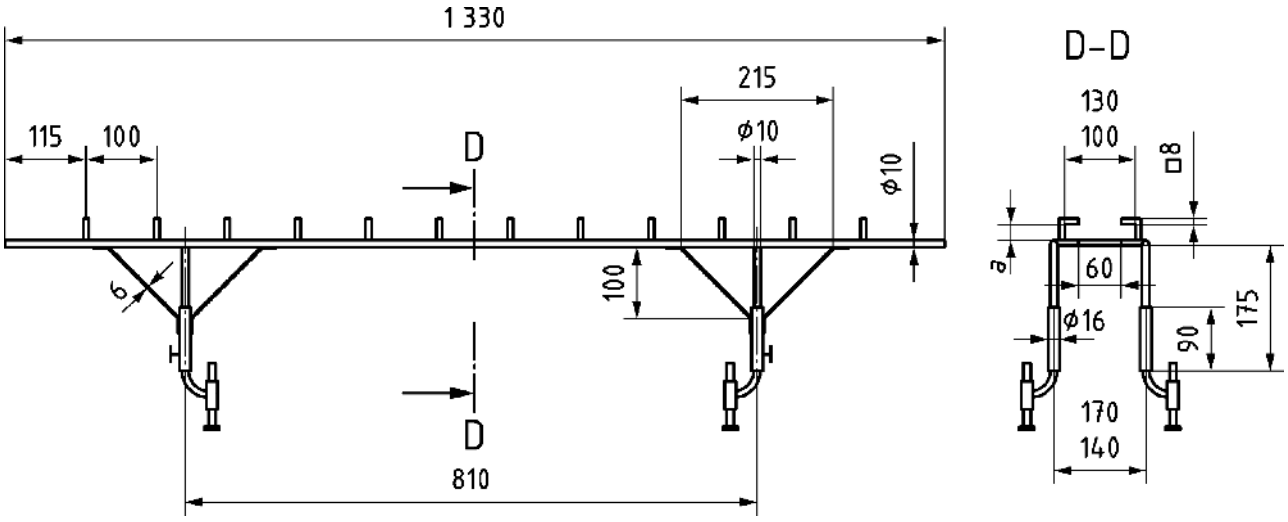


Figure 15 — Exhaust Hood

Dimensions in millimetres

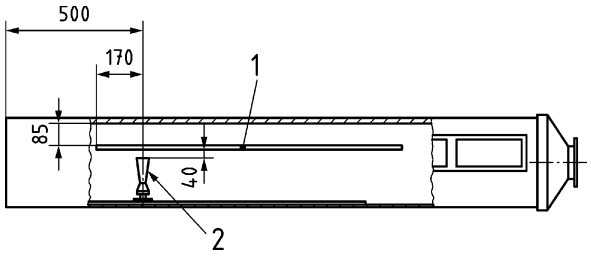


Key

a height (see 7.1.4)

Figure 16 — Trestle

Dimensions in millimetres



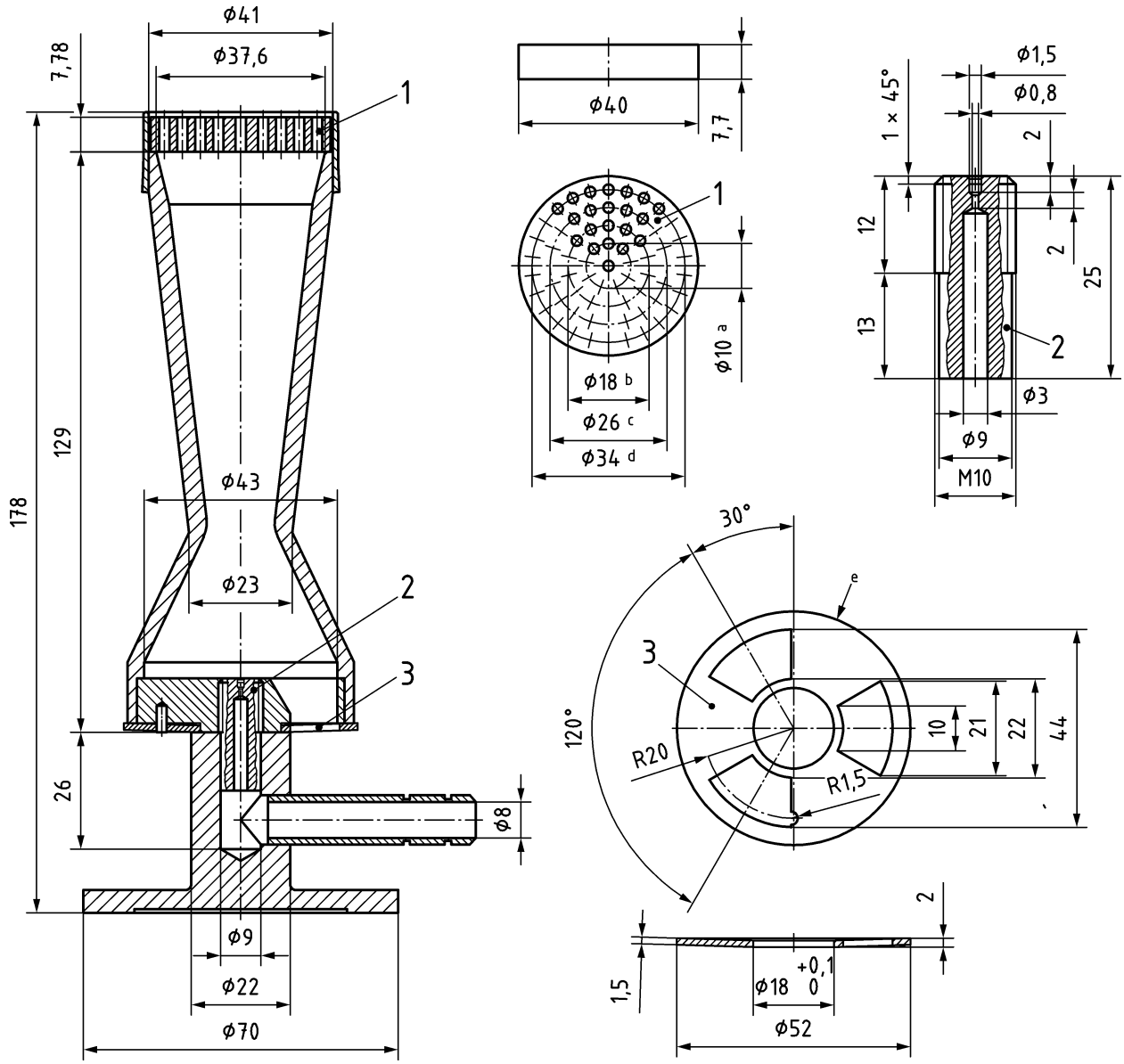
Key

1 sample

2 burner

Figure 17 — Test arrangement

Dimensions in millimetres



Key

1	ceramic sieve	2	nozzle
3	adjusting disc		
a	9 drill holes (ø 2,3)	b	14 drill holes (ø 2,3)
c	20 drill holes (ø 2,3)	d	26 drill holes (ø 2,3)
e	knurled		

Figure 18 — Gas Burner

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide one means of conforming to Essential Requirements of the New Approach Directive for machinery, 2006/42/EC.

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard confers, within the limits of the scope of this standard, a presumption of conformity with the Essential Requirement

1.5.6 Fire

of that Directive and associated EFTA regulations.

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

Bibliography

[1] EN 12882, *Conveyor belts for general purpose use — Electrical and flammability safety requirements*

[2] EN 14973, *Conveyor belts for use in underground installations — Electrical and flammability safety requirements*

[3] EN 22768-2:1993, *General tolerances — Part 2: Geometrical tolerances for features without individual tolerance indications (ISO 2768-2:1989)*

[4] EN 60584-1:1995, *Thermocouples — Part 1: Reference tables (IEC 60584-1:1995)*

[5] EN ISO 12100, *Safety of machinery — General principles for design — Risk assessment and risk reduction (ISO 12100)*

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