



International Standard

ISO 16840-10

Wheelchair seating —

Part 10:

Resistance to ignition of postural support devices — Requirements and test method

**AMENDMENT 1: Amended with
additional Annexes and test method**

Sièges de fauteuils roulants —

*Partie 10: Résistance à l'inflammation des dispositifs de soutien
postural — Exigences et méthode d'essai*

AMENDEMENT 1: Annexes et méthode d'essai supplémentaires

**Second edition
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**AMENDMENT 1
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This document was prepared by Technical Committee ISO/TC 173, *Assistive products* Sub-committee SC1, *Wheelchairs*.

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Wheelchair seating —

Part 10:

Resistance to ignition of postural support devices — Requirements and test method

AMENDMENT 1: Amended with additional Annexes and test method

Clause 4

Replace the first paragraph with the following:

Test materials used in integrated and non-integrated seat and back supports, and other postural support devices as used in wheelchairs are assembled in either horizontal or vertical samples and subjected to a heat source that is equivalent to a smouldering cigarette. The resulting effects on the test materials are observed and measured.

6.4

Change NOTE 4 to read:

NOTE 4 Other means, such as a NiCr coil, that achieve the same heat transfer to the test sample, can be used as an alternative heat source (see [Annexes D](#) and [E](#)).

6.5

Replace the first paragraph with the following:

Prior to conditioning described in this subclause, any removable covering materials which have been subjected to water-soluble flame retardants shall be subjected to the washing and drying procedures described in Annex B.

Clause 9

Add the following NOTE after list item j):

NOTE A report template which can be used to meet this Clause is provided in [Annex F](#).

Annex D, E, and F

Add the new annexes after Annex C.

Annex D (informative)

Test method using a NiCr wire coil as a heat source

D.1 Principle

A NiCr wire coil heat source as described in this Annex has been designed and validated to approximate the heat output and thermal mass of a burning cigarette as determined by observing the ignition behaviour and resulting burn patterns from a variety of cigarettes. The repeatability of the ignition behaviour and resulting burn pattern from the device has been validated through interlaboratory testing^[10].

D.2 Test environment

The test environment shall have a temperature between 10 °C and 30 °C and a relative humidity between 15 % and 80 %.

D.3 Test enclosure

For the protection of the lab technician the test enclosure shall consist of either a room or a smaller enclosure designed to extract smoke and fumes. In absence of such conditions, the technician shall take other precautions against smoke inhalation. The enclosure shall be capable of controlled air flow between 0,0 m/s and 0,2 m/s when measured at $25 \text{ mm} \pm 5 \text{ mm}$ from the heat source.

D.4 Test apparatus

D.4.1 General

The test apparatus shall be a heat source that shall consist of a wire coil of NiCr alloy resistance wire, heated by a DC power supply that has a constant current output mode.

NOTE 1 The means to create the test apparatus is contained in [Annex E](#).

NOTE 2 By adjusting the current, this apparatus can be utilized to simulate a 'match' or other heat sources.

D.4.2 Wire coil

The wire shall be made from an alloy of 60 % nickel, 16 % chromium, and 24 % iron (known as "Nichrome 60" or "Chromel C"). The diameter of the wire shall be 0,39 mm to 0,41 mm (commonly sold as 26 AWG).

NOTE 1 Nichrome 70 or 80 wire can be substituted since the paper strip calibration will account for small differences in resistance.

The wire shall be wound to produce a wire coil with the specifications shown in [Figure D.1](#).

NOTE 2 A method for winding the wire coil to these specifications is provided in [Annex E](#).

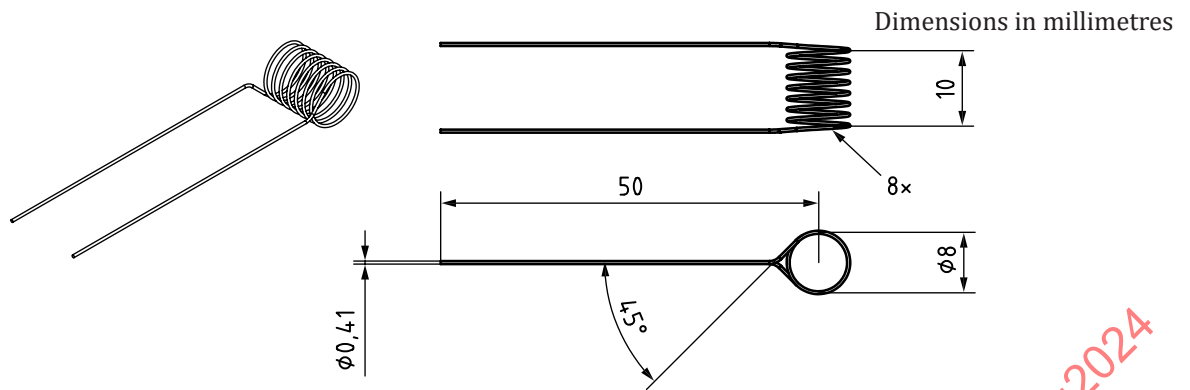


Figure D.1 — Dimensions of wire coil

D.4.3 Power supply and connection to the wire coil

The power supply shall be capable of producing a constant current between 1 A and 5 A with adjustments in 0,10 A increments. The wire coil shall be connected to the power supply by a means to ensure good electrical conductivity.

NOTE 1 Crocodile (alligator) clips on high-temperature silicone insulated wire leads are an effective means of connection.

NOTE 2 Setting the centre of the wire coil 25 mm from the crocodile clips results in a predictable length of wire through which current flows actively. This provides calibration by paper strip ignition at approximately 2,2 A to 2,3 A.

D.4.4 Conditioning the wire coil

Before the wire coil can be used for testing, it shall be conditioned for use to relax stress from the winding process and burn off any residual oil. To condition the wire, set the power supply to run at a constant current set to 12 V (to ensure adequate power) and adjust the current to 4 A for $10 \text{ s} \pm 1 \text{ s}$.

NOTE The wire coil will glow red hot, and, after cooling, will relax, increasing the width of the wire coil from 10 mm to (12–14) mm, with no significant change in the diameter.

D.4.5 Paper calibration strip

A paper calibration strip shall be made from 80 g/m^2 white bond copier paper cut to $5 \text{ mm} \pm 1 \text{ mm} \times 40 \text{ mm} \pm 5 \text{ mm}$ and folded, as shown in [Figure D.2](#).

NOTE This paper is equivalent to 20 lb paper.

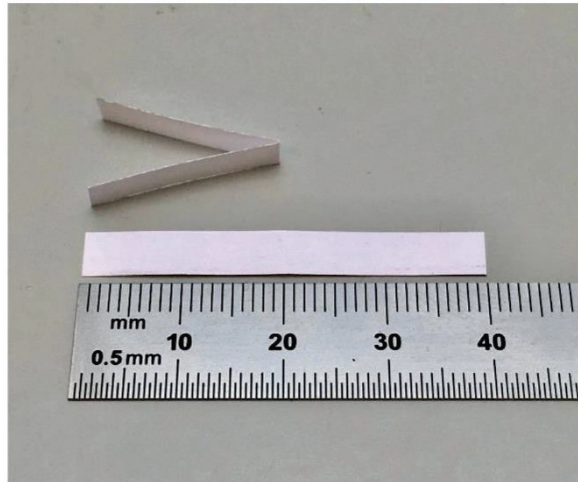


Figure D.2 — A paper calibration strip, folded in half

D.5 Heat source calibration

Calibration is required after conditioning a new wire coil, or if any other changes have been made to the connections or power supply. Calibration shall be done with the wire coil placed in the position which will be used for subsequent testing to ensure effects of air flow passing over the heat source are consistent. Calibration shall be conducted without a test sample in place, as the presence of a test sample can affect the local airflow around the wire coil.

The following process shall be followed.

- a) Place a folded paper calibration strip between middle coils ([Figure D.3](#)), with the power turned off (cold).

NOTE 1 The middle coils will be hottest.



Figure D.3 — Paper calibration strip placed between middle coils

- b) Ensure the current setting results in the paper exhibiting a visible red glowing ignition within 10 s to 14 s after turning on power.
- c) If ignition occurs after 14 s, or does not occur at all, raise the current and repeat.

d) If ignition occurs before 10 s, decrease the current and repeat.

NOTE 2 To aid in seeing ignition, you can dim the lights.

NOTE 3 Based on interlaboratory experiments, 2,2 A to 2,3 A is likely to achieve this result.

NOTE 4 Variations in positioning and wire connections can contribute to variations in the current needed to achieve the paper ignition specification.

D.6 Wire coil cleaning between tests

Ensure that there is no carbon build up on the wire coil. If present, turn the power supply up to 4 A to burn off any deposits.

WARNING — Do not exceed 5 amps. A current of 5 A will heat the coil wire to a temperature of over 1 000 °C. Until the power is removed and the coil cools, this is a burn and fire hazard.

D.7 Test methods

D.7.1 Sample size

Because this test is intended to test for ignition of composite PSD samples, and not the component level materials, there is no minimal sample size requirement. Samples are tested in the orientation and configuration in which they are used. Burn area is not a pass/fail requirement, hence a minimal sample size specification is not necessary.

D.7.2 Preparation

- a) Identify the PSD.
- b) Select the surface(s) that the manufacturer assesses to be at risk from a fire source (see Annex C). These shall be identified as the test surfaces.
- c) If testing items that are intended to be used only in the range of the horizontal plane $\pm 30^\circ$, use the horizontal test, and for all other items, use the vertical test. If the item is intended for use in either plane, then only the vertical test is necessary.
- d) Place the test sample in the test environment for a minimum of 12 h to condition it for testing.

D.7.3 Horizontal test

- a) Set up the test sample in the same location used for calibration of the wire coil. The test sample shall be positioned such that the surface to be tested is horizontal $\pm 3^\circ$. A suitable test rig may be used to hold the test sample in position.

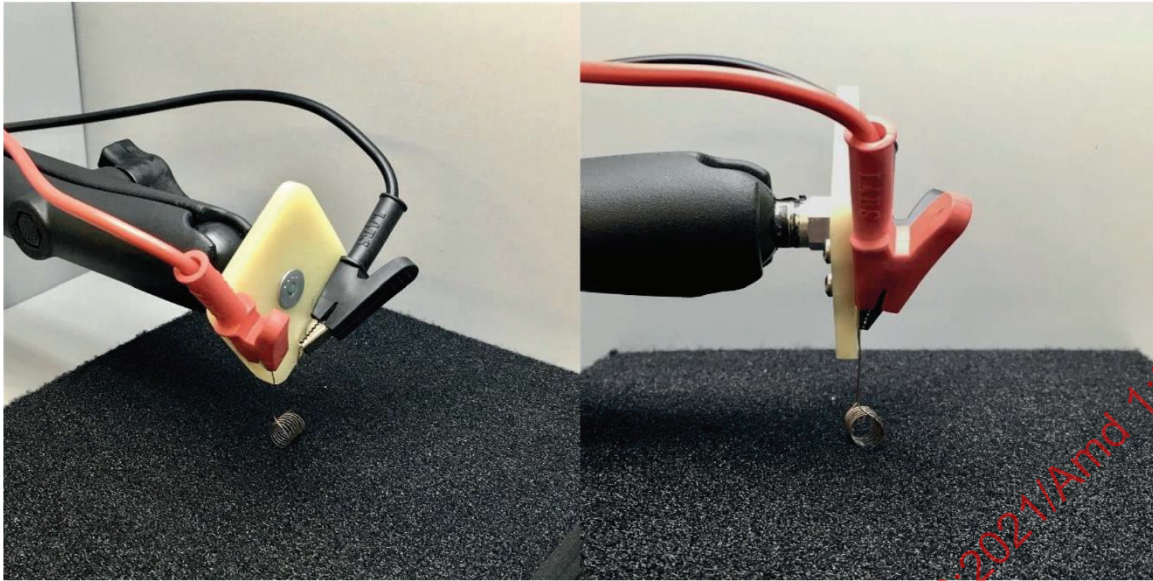


Figure D.4 — Placement position of wire coil heat source on a horizontal surface

- b) Apply the side of the wire coil to the test surface, pressing lightly, with some visible deflection of the surface. (see [Figure D.4](#)).
- c) Photograph the sample, with the hot wire coil in position, prior to testing.
- d) Switch on the power to heat the wire coil for $60 \text{ s} \pm 1 \text{ s}$. Observe the subsequent progress of ignition and record any flaming that occurs. Remove the heat source at the end of 60 s. Record any evidence of smouldering that continues after an additional 120 s.
- e) Photograph the sample, with the wire coil removed, to record results.
- f) Clean wire coil per [Clause D.6](#).
- g) Repeat [D.7.3 a\)](#) to f) once in an unaffected area of the same test surface, for a total of two tests. If there is insufficient material to conduct a second test on the same surface, a new sample shall be used and noted on the test report.
- h) If the manufacturer has determined more than one surface is at risk, repeat [D.7.3 a\)](#) to g) on each surface to be tested.

NOTE 1 If flaming occurs in the interior and/or surface during the test, the sample has failed.

NOTE 2 Testing can be stopped and the flames extinguished by suffocating them with a fireproof cover to prevent the spread of fire within the test enclosure.

D.7.4 Vertical test

- a) Set up the test sample in the same location used for calibration of the wire coil. The test sample shall be positioned such that the surface to be tested is vertical $\pm 3^\circ$. A suitable test rig may be used to hold the test sample in position.

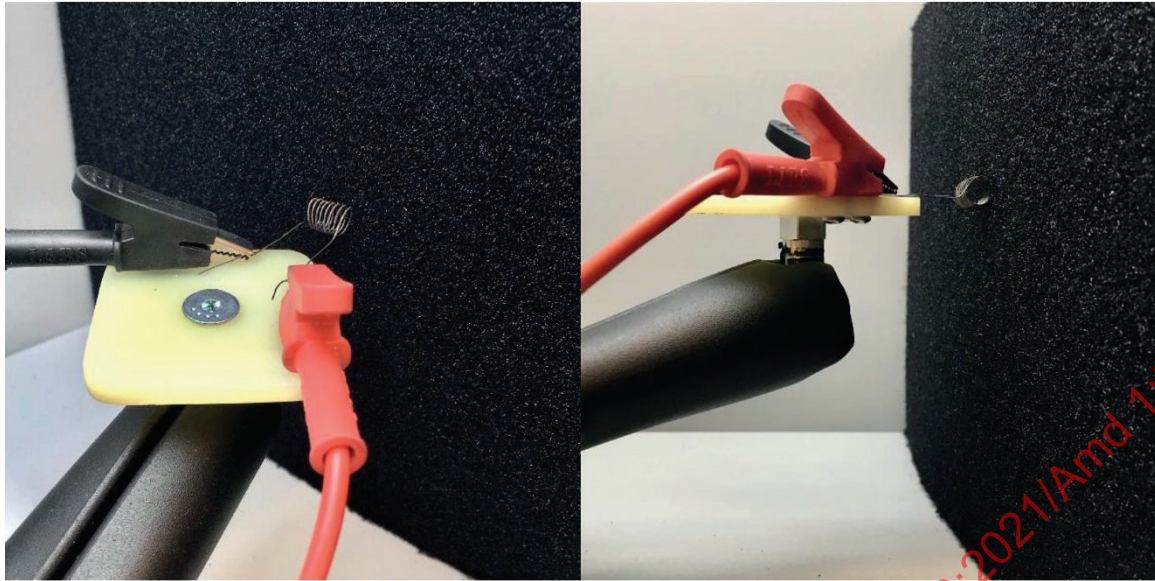


Figure D.5 — Placement position of wire coil heat source on a vertical surface

- b) Apply the side of the wire coil to the test surface, pressing lightly, with some visible deflection of the surface (see [Figure D.5](#)).
- c) Photograph the sample, with the wire coil in position, prior to testing.
- d) Switch on the power to heat the wire coil for $60 \text{ s} \pm 1 \text{ s}$. Observe the subsequent progress of ignition and record any flaming that occurs. Remove the heat source at the end of 60 s. Record any evidence of smouldering that continues after an additional 120 s.
- e) Photograph the sample, with the wire coil removed, to record results.
- f) Clean wire coil per [Clause D.6](#).
- g) Repeat [D.7.4 a\)](#) to f) once in an unaffected area of the same test surface, for a total of two tests. If there is insufficient material to conduct a second test on the same surface, a new sample shall be used and noted on the test report.
- h) If the manufacturer has determined more than one surface is at risk, repeat [D.7.4 a\)](#) to g) on each surface to be tested.

NOTE 1 If flaming occurs in the interior and/or surface during the test, the sample has failed.

NOTE 2 Testing can be stopped and the flames extinguished by suffocating them with a fireproof cover to prevent the spread of fire within the test enclosure.

D.8 Requirements

In horizontal and vertical orientations, when subjected to the heat source specified in [Annex D](#), PSDs used in a wheelchair shall:

- a) show no evidence of flaming in the interior and/or surface during or after the test;
- b) show no evidence of progressive smouldering $120 \text{ s} \pm 1 \text{ s}$ after the end of the maximum temperature plateau of the temperature heating curve.

NOTE Testing can be stopped and the flames extinguished by suffocating them with a fireproof cover to prevent the spread of fire within the test enclosure.

D.9 Test report

The test report shall include the following:

- a) date of the test report;
- b) name and address, and accreditation status, if any, of the test institution;
- c) a statement confirming that prior to testing, equipment was calibrated or verified against measurement standards traceable to international or national measurement standards (when no such standards exist, the basis used for calibration or verification shall be recorded);
- d) a statement verifying the following requirements were met:
 - 1) temperature in the test area was between 10 °C and 30 °C;
 - 2) relative humidity in the test area was between 15 % and 80 %;
 - 3) during calibration, the airflow at 25 mm $\pm$ 5 mm from the wire coil was between 0,0 m/s and 0,2 m/s;
 - 4) heat source had been calibrated using paper strip to ignition in 12 s $\pm$ 2 s;
 - 5) the test sample was in new or unused condition;
 - 6) the test sample was held in the test environment for a minimum of 12 h prior to testing;
 - 7) the tests were conducted by trained laboratory personnel;
- e) a statement that “The following test results relate only to the ignitability of the combination of materials under the particular conditions of the test. They are not intended as a means of assessing the full potential hazard of a complete wheelchair”;
- f) identification and construction of the test samples;
- g) description of the surface(s) tested, and whether a horizontal or vertical test was conducted;
- h) name and address of the manufacturer of the test sample;
- i) photographs of the sample and setup, before and after testing;
- j) results of the tests carried out and a statement as to whether the PSD met the minimum performance requirements of this standard;
- k) a unique test report reference;
- l) any deviation from the procedure.

NOTE A report template which can be used to meet this Clause is provided in [Annex F](#).

Annex E (informative)

Guidance on fabrication of NiCr wire coil test apparatus

E.1 General

This annex provides practical guidance on procurement of and building a test apparatus suitable for application for carrying the test methods in [Annex D](#).

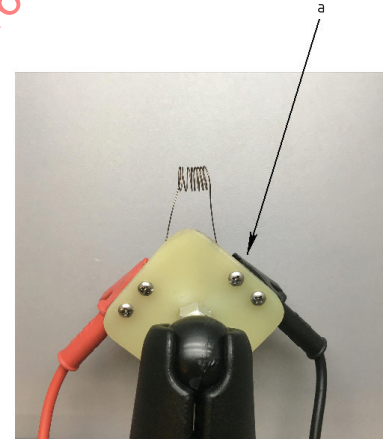
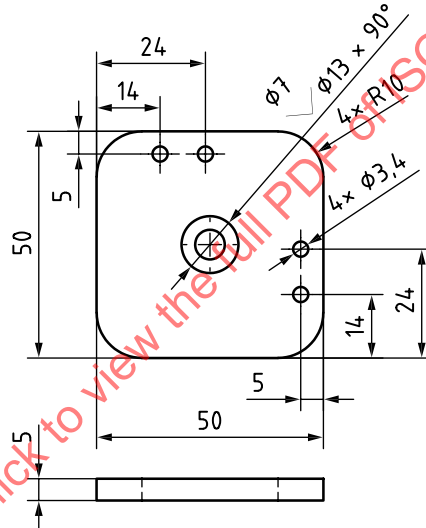
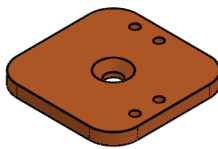
E.2 Apparatus

Table E.1 — Parts list

Item No.	Element	Description
	Power supply/Electrical	
1	Resistance wire	Alloy of 60 % nickel, 16 % chromium, and 24 % iron, known as “Nichrome 60” or “Chromel C”. The diameter of the wire is 26 AWG (a range from Ø 0,39 mm to 0,41 mm). Winding instructions below (Nichrome 80 wire may be substituted).
2	Test leads	Wire leads with crocodile (alligator) clips for gripping wire coil
3	Mounting plate (see Figure E.2)	Heat resistant base to anchor crocodile (alligator) clips at a fixed spacing
4	DC power supply (5A)	Shall have “constant current” output mode. By controlling the current, not the voltage, effects of small variations in resistance between coils and imperfect connections are eliminated.
5	Coil holder/Adjustable arm (Figure E.1)	
		Arkon 65 mm diameter round heavy-duty magnet base w/ 25 mm (1”) ball (SP1420MAG25)
		Ram Mounts double socket arm, size B (RAM-B-201U-C)
		Ram Mounts double ball adapter, size B (RAM-B-230U)
		Ram Mounts ball adapter with M6 female threaded hole and hex post, size B (RAM-B-273-M6U)
		Flame retardant G-10/FR4 epoxy composite sheet, 5 mm thick
		Self-tapping sheet metal screw, M3 x 10 mm long to mount crocodile (alligator) clips to epoxy composite board
6	Wire coil winder	
		Screw, M8 x 1,25 x 40 mm Long
		Coupling Nut, M8 x 1,25 X 24 mm Long
		Alternative option – Nut, M8 x 1,25
7	Enclosure/Smoke exhaust	
	Test enclosure + smoke exhaust	Paasche Hobby Spray Booth, 560 mm x 406 mm (HSSB-22-16)
	Odour removal air filter	25 mm thick, MERV-7 Charcoal
This is an example of a suitable assembly with commercially available components. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of these products.		



Figure E.1 — Example apparatus



Fabricate from Flame-Retardant Garolite G-10/FR4 Sheet, 5 mm thick

- ^a Fasten crocodile clips to plate using M3 × 10 thread-forming screws.

Figure E.2 — Wire coil mounting plate

E.3 Heat source construction

E.3.1 General

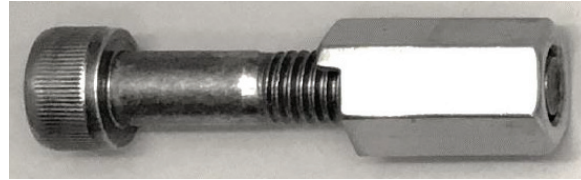
The heat source is to be constructed using the resistance wire specified in [Annex D](#) and [E.1](#). The “wire coil winder” components shown in [Table E.1](#) and [Figure E.3](#) can be used as wire winding tools.

E.3.2 Preparation of wire winding tool

Machine an M8 nut to remove material while leaving a ‘lip’ that can capture the wire when wound around an M8 screw (see [Figures E.3](#) and [E.4](#)).



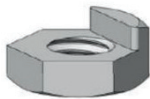
a) M8 × 1,25 × 40 mm cap screw and coil winder nut (short)



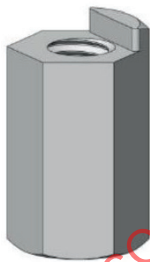
b) Cap screw and coil winder nut (long)

Figure E.3 — Tools for winding wire coil

Dimensions in millimetres



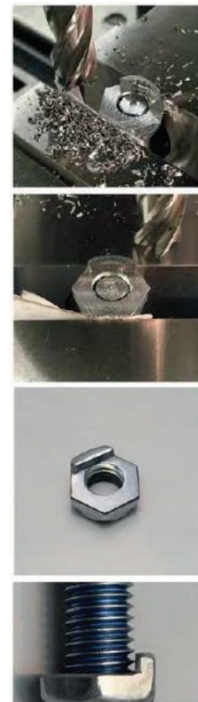
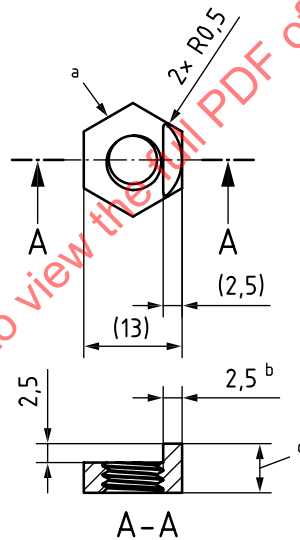
Modified standard hex nut, M8 X 1,25
(6,5 mm tall)



Modified hex coupling nut,
M8 X 1,25 (24 mm tall)

Can be made from any standard or tall M8 X 1,25 hex nut

- a) Deburr all edges to prevent scratching wire during bending.
- b) Cut surface is vertically aligned with thread diameter.
- c) Variable height.



For step-by-step photos of coil bending, see [E.3.3](#).

Figure E.4 — Machining wire coil winder nut

E.3.3 Winding the coil

- Cut a piece of NiCr wire to $300 \text{ mm} \pm 5 \text{ mm}$.
- Mark one end at $50 \text{ mm} \pm 3 \text{ mm}$.
- Grip the bolt in a vice and thread the nut 10 turns onto the end.
- Insert the wire up to the 50 mm mark between the threads on the bolt and capture it under the lip of the coil winder nut. 50 mm of wire will remain exposed (see [Figure E.5](#)).

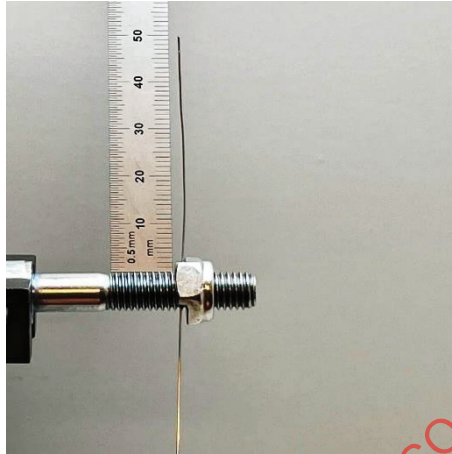


Figure E.5 — Positioning of wire for winding

- Hold the short end (50 mm) of the wire and rotate the nut anticlockwise, 8,5 turns, winding the coil as the nut unthreads from the bolt (see [Figure E.6](#)).

NOTE 1 To form eight complete coils, the extra half turn is added to account for spring-back in the wire.

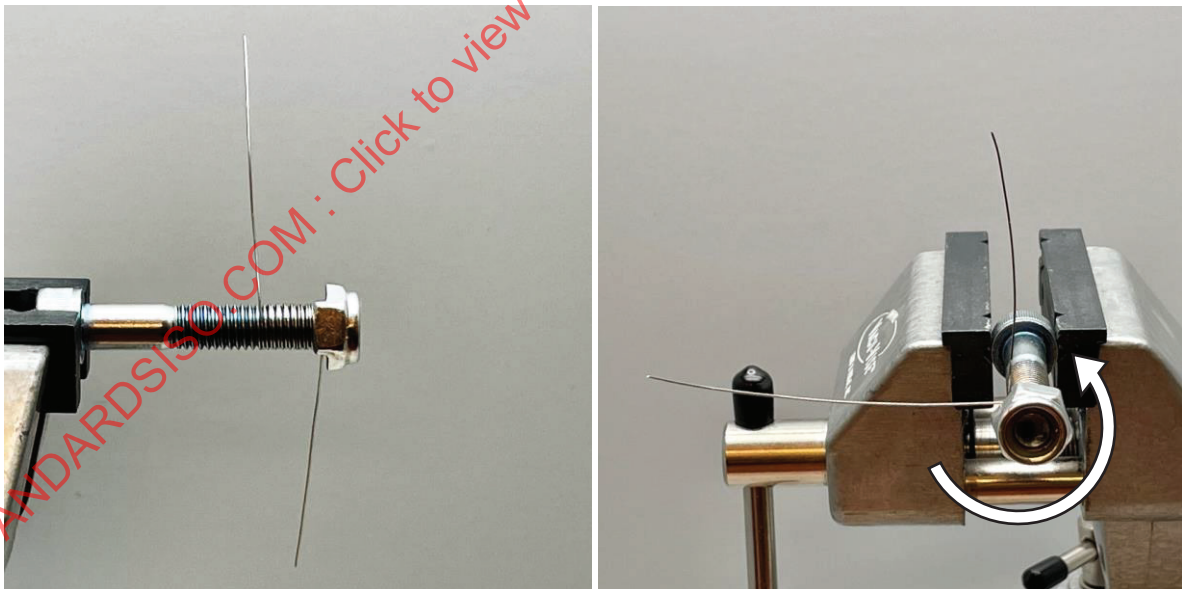


Figure E.6 — Winding the wire

- Straighten the ends of the wire and bend them to align the ends so that they are roughly parallel ([Figure E.7](#)) Make small bends to align the wire ends ([Figure E.8](#)).

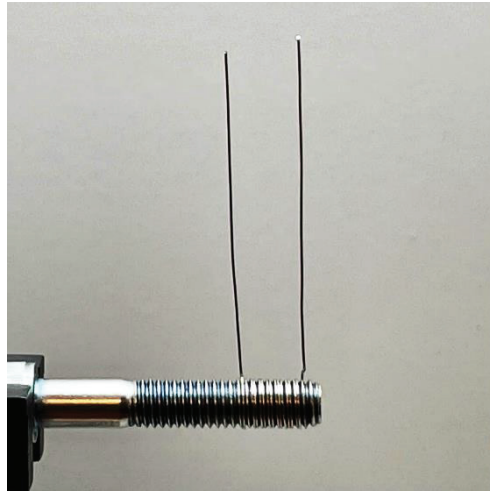


Figure E.7 — Straightened ends of wire



Figure E.8 — Wire bent to align ends

- g) Unwind the coil from the bolt.
- h) Verify results.
 - Coil outside diameter should be $8,0 \text{ mm} \pm 1 \text{ mm}$.
 - There should be eight coils, having an overall width of $10 \text{ mm} \pm 1 \text{ mm}$. Small adjustments can be made by pressing or pulling the coils apart.

NOTE 2 If properly wound, with consistent wire tension, the resulting coils will be evenly spaced. This can be verified with a thread pitch gauge ([Figure E.9](#)).

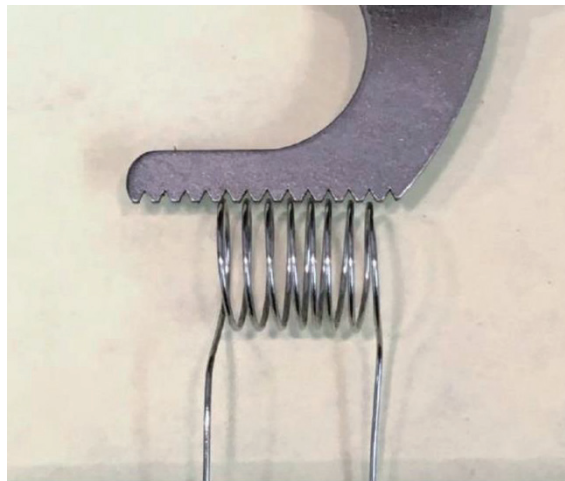


Figure E.9 — Checking even coil spacing using a thread pitch gauge

E.3.4 Installation in adjustable hot wire coil holder

Install the ends of the wire into the adjustable hot wire coil holder using the crocodile (alligator) clips. Setting the centre of the wire coil 25 mm from the crocodile (alligator) clips results in a predictable length of wire through which current flows. This can provide the facility for calibration by paper strip ignition at approximately 2,2 A to 2,3 A ([Figure E.10](#)).

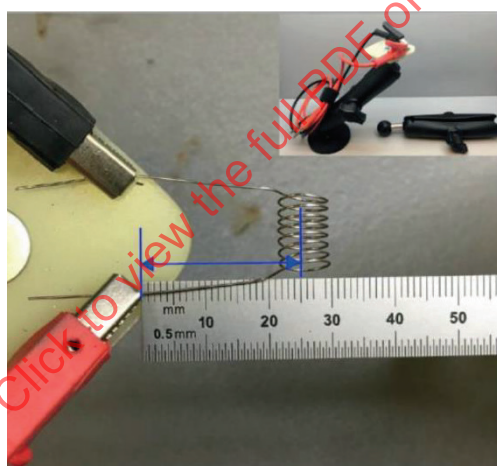
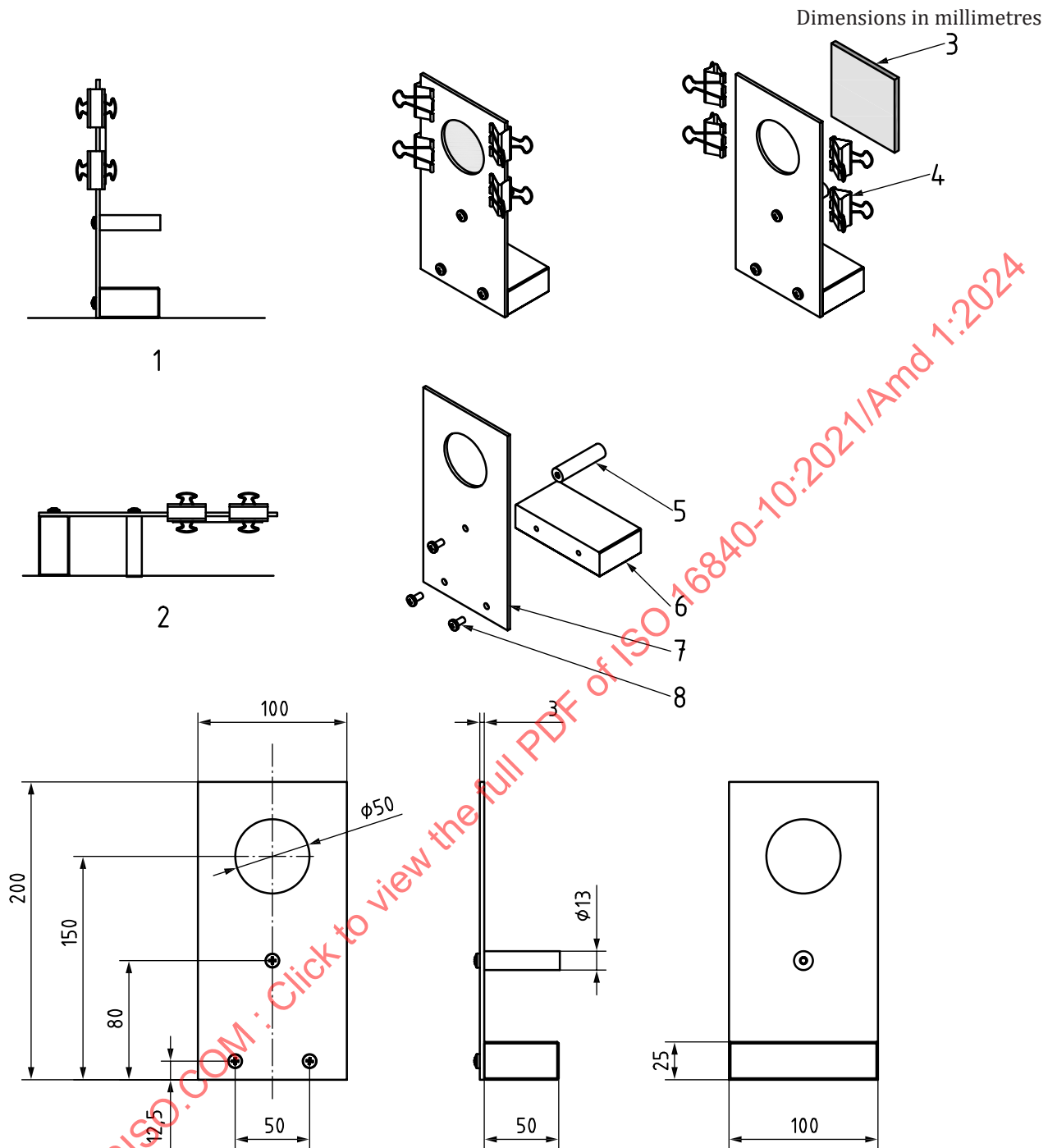


Figure E.10 — Wire coil test set up

E.4 Test sample holder

For the testing of small PSDs as well as for experimental tests of individual materials, a test sample holder has been found useful. [Figure E.11](#) provides guidance on a test sample holder which can be used for both horizontal and vertical tests.



Key

- 1 vertical test
- 2 horizontal test
- 3 test sample
- 4 binder clips
- 5 aluminium standoff
- 6 steel base block
- 7 aluminium plate
- 8 M5 X 10 panhead screws

Figure E.11 — Test sample holder