
**Dentistry — Endodontic
instruments —**

**Part 1:
General requirements**

*Médecine bucco-dentaire — Instruments d'endodontie —
Partie 1: Exigences générales*



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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 on 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 the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 106, *Dentistry*, Subcommittee SC 4, *Dental instruments*.

This third edition cancels and replaces the second edition (ISO 3630-1:2008), which has been technically revised.

The main changes compared to the previous edition are as follows:

- reorganization with the intention of presenting the requirements and test methods for endodontic instruments in an orderly manner;
- change of the main element of the title of the ISO 3630 series to "Endodontic instruments";
- addition of requirements for the current use of Nickel-Titanium;
- clarification of the option for the handle shape for the manufacturer;
- addition of the new identification symbols in [Figure 10](#).

A list of all parts in the ISO 3630 series can be found on the ISO website.

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

This document specifies general requirements and test methods for endodontic instruments. Other parts of the ISO 3630 series provide the specific requirements and test methods for six areas of endodontics (enlargers, compactors, auxiliary instruments, shaping and cleaning instruments, numeric coding system and ultrasonic inserts).

With current use of Nickel-Titanium alloys for manufacture of endodontic instruments a need for adequate expertise in their safe use is recommended. This document does not attempt to provide information for proper use of any instruments.

The sizes of the endodontic obturating points (cones) specified in ISO 6877 should be aligned with the corresponding sizes for endodontic instruments specified in all parts of the ISO 3630 series.

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Dentistry — Endodontic instruments —

Part 1: General requirements

1 Scope

This document specifies general requirements and test methods for endodontic instruments used for endodontic purposes, e.g. enlargers, compactors, accessory instruments, shaping and cleaning instruments, and a numeric coding system. In addition, it covers general size designations, color-coding, packaging, and identification symbols.

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 554, *Standard atmospheres for conditioning and/or testing — Specifications*

ISO 1797, *Dentistry — Shanks for rotary and oscillating instruments*

ISO 1942, *Dentistry — Vocabulary*

ISO 3630-2, *Endodontic instruments — Part 2: Enlargers*

ISO 3630-3, *Endodontic instruments — Part 3: Compactors: pluggers and spreaders*

ISO 3630-4, *Root canal instruments — Part 4: Auxiliary instruments*

ISO 3630-5, *Endodontic instruments — Part 5: Shaping and cleaning instruments*

ISO 8601, *Data elements and interchange formats — Information interchange — Representation of dates and times*

ISO 15223-1:2016, *Medical devices — Symbols to be used with medical device labels, labelling and information to be supplied — Part 1: General requirements*

ISO 17664, *Processing of health care products — Information to be provided by the medical device manufacturer for the processing of medical devices*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 1942 and the following apply.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1 Terms and definitions

3.1.1

endodontic instrument

dental instrument designed to explore, shape, clean and/or help filling a root canal system

3.1.2

standard instrument

endodontic instrument (3.1.1) having a uniform taper of 0,02 mm per millimetre of length of the working part throughout the range of available sizes

Note 1 to entry: The nominal sizes of endodontic instruments are listed in [Table 1](#).

Note 2 to entry: Some manufacturers may designate taper as a 2-digit number, e.g. '02' or as a percentage, e.g. '2 %'.

3.1.3

non-standard instrument

endodontic instrument (3.1.1), which has a tip diameter and/or shape other than that of a *endodontic standard instrument* (3.1.2)

3.1.4

taper instrument

endodontic instrument (3.1.1) of which the sizes are determined by the tip sizes and have uniform tapers of the working part other than 0,02 mm per millimetre of length

3.1.5

non-taper instrument

endodontic instrument (3.1.1) having a cylindrical shape along its long axis

3.1.6

non-uniform taper instrument

endodontic instrument (3.1.1) having more than one taper along the working part

3.1.7

shape instrument

endodontic instrument (3.1.1) having a contoured working part with continuously varying profile

3.1.8

tip

part of the *endodontic instrument* (3.1.1), which is intended as the point, the shape of which is at the discretion of the manufacturer

3.1.9

working part

section of an *endodontic instrument* (3.1.1) which has a cutting surface

3.1.10

shaft

part of the *endodontic instrument* (3.1.1) between the handle or shank and the working part

3.1.11

handle

part of the *endodontic instrument* (3.1.1) which is held by the user's fingers for manipulation of the instrument in the root canal

3.1.12

shank

part of a rotary, oscillating or reciprocating *endodontic instrument* (3.1.1) which is designed to fit into the chuck of a handpiece

3.1.13**operative part**

part of the *endodontic instrument* (3.1.1) from the tip to the handle or shank

3.2 Symbols

For the purposes of this document, the following symbols apply.

- D diameter of the projection of the working part at the tip end (reference size)
- d_s diameter of the shank (the subscript indicates the location on the shank in s mm from the tip)
- d_n diameter of the *endodontic instrument* (3.1.1) at the subscripted millimetre distance from the tip indicated by $[n]$
 EXAMPLE d_3 is the diameter at 3 mm from the tip.
- l_n length of the *endodontic instrument* (3.1.1) at the subscripted millimetre distance from the tip indicated by $[n]$ and l_t .
 EXAMPLE l_3 is the length 3 mm away from the tip.
- l_s minimum length of the shank
- l_t length of operative part, measured from the tip

4 Classification

For the purposes of this document, endodontic instruments are classified as follows:

Standard instrument

- Type 1: standard instrument (taper = 02);

Non-standard instrument

- Type 2: taper instrument (taper other than 02);
 Some manufacturers can designate taper as a percentage, e.g. '2 %'.
- Type 3: non-taper instrument (zero taper);
- Type 4: non-uniform taper instrument (more than one taper); and
- Type 5: shape instrument (arc shape).

5 Requirements**5.1 General**

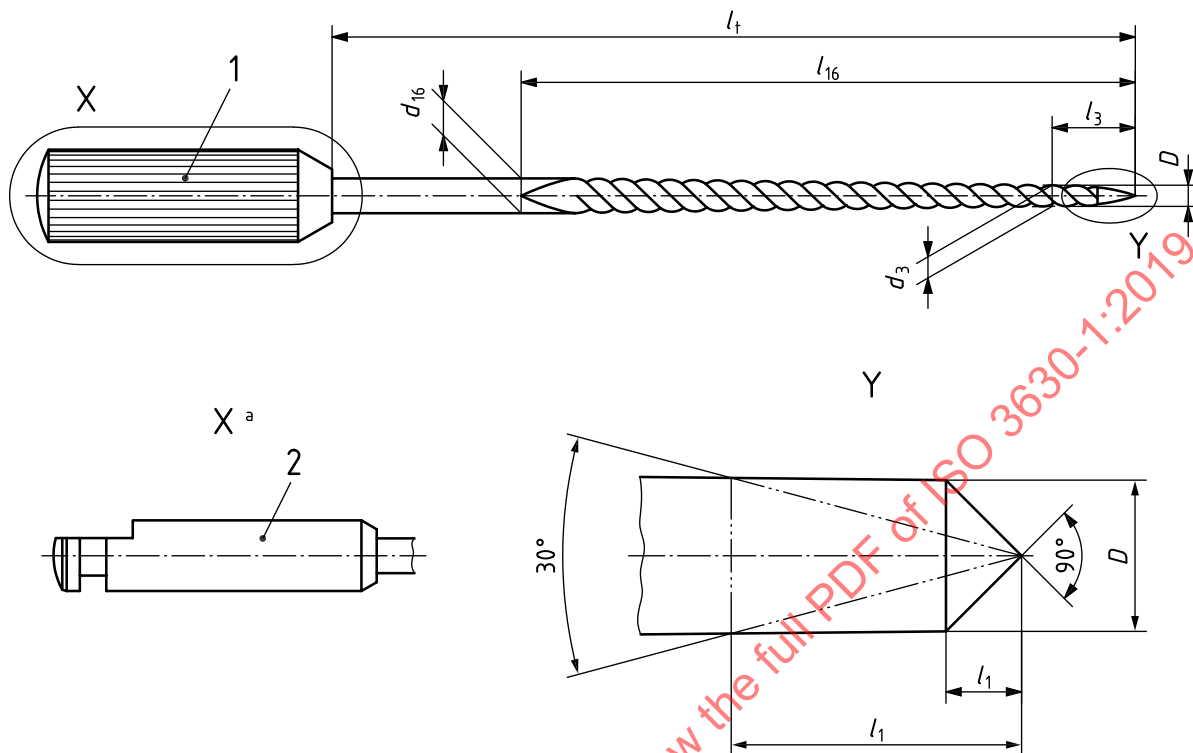
Specific endodontic instrument types, such as enlargers, compactors and auxiliary instruments, have unique shapes, which are not included in this document. These instruments are covered in separate parts of the ISO 3630 series.

5.2 Type 1: Standard instruments**5.2.1 Length**

The length of the working part, l_{16} , shall be a minimum of 16 mm unless otherwise specified by the manufacturer (see [Figure 1](#)).

The length of the working part and length of the operative part shall be specified by the manufacturer, and shall be within $\pm 0,5$ mm of the specified length.

Test in accordance with 7.3.



Key

- 1 handle
- 2 shank
- ^a Shape option for manufacturer.

Figure 1 — Dimensions and locations for Type 1

5.2.2 Size designation and diameters

Table 1 gives the nominal sizes and dimensions for the working part to be used for Type 1 (standard instruments). Tip sizes (D) other than those listed in Table 1 are permitted. Figure 1 shows the position of the diameters and lengths for all Type 1 endodontic instruments. The nominal sizes shall correspond to the values of the extended diameters at the tip of the working part in hundredths of a millimetre.

5.2.3 Colour designation

The colour of the handle or shank of Type 1 instruments shall be in accordance with the requirements of Table 1.

NOTE The handle or shank colours of instrument sizes not included in Table 1 are at the discretion of the manufacturer.

5.2.4 Tip shape

The shape of the tip is at the discretion of the manufacturer. The angles shall be within 30° and 90° , as shown in the Figure 1.

Table 1 — Dimensions, size designation, and colour designation for Type 1 (standard instruments)

Dimensions in millimetres

Nominal size	D	d_3	Tolerance	d_{16}	Tolerance	l_3	l_{16}	Colour designation
6	0,06	0,12	±0,02	0,38	±0,02	3	16	pink
8	0,08	0,14		0,40				grey
10	0,10	0,16		0,42				purple
15	0,15	0,21		0,47				white
20	0,20	0,26		0,52				yellow
25	0,25	0,31		0,57				red
30	0,30	0,36		0,62				blue
35	0,35	0,41		0,67				green
40	0,40	0,46		0,72				black
45	0,45	0,51		0,77				white
50	0,50	0,56		0,82				yellow
55	0,55	0,61		0,87				red
60	0,60	0,66		0,92				blue
70	0,70	0,76	±0,04	1,02	±0,04		green	
80	0,80	0,86		1,12		black		
90	0,90	0,96		1,22		white		
100	1,00	1,06		1,32		yellow		
110	1,10	1,16		1,42		red		
120	1,20	1,26		1,52		blue		
130	1,30	1,36		1,62		green		
140	1,40	1,46		1,72		black		

5.2.5 Tip length

The tip length shall be specified by the manufacturer within the limits as shown in [Figure 1](#).

5.3 Type 2: Taper instruments

5.3.1 Length

The lengths of the working part and of the operative part shall be specified by the manufacturer, and shall be within $\pm 0,5$ mm of the specified lengths.

Test in accordance with [7.3](#).

5.3.2 Tip shape

The shape of the tip is at the discretion of the manufacturer. The angles shall be within 30° and 90° (see [Figure 1](#)).

The tip length is determined by the limits specified by the minimum and the maximum angle as shown in [Figure 1](#).

5.3.3 Size designation

The instrument size shall be designated in two parts; two or three digits for diameter identification ("xxx") and two or three digits ("yyy") for taper identification.

EXAMPLE A size 30 instrument with a 02 taper would be designated "030 002", however the leading zero for each part can be omitted; see 5.3.4 and 5.3.5.

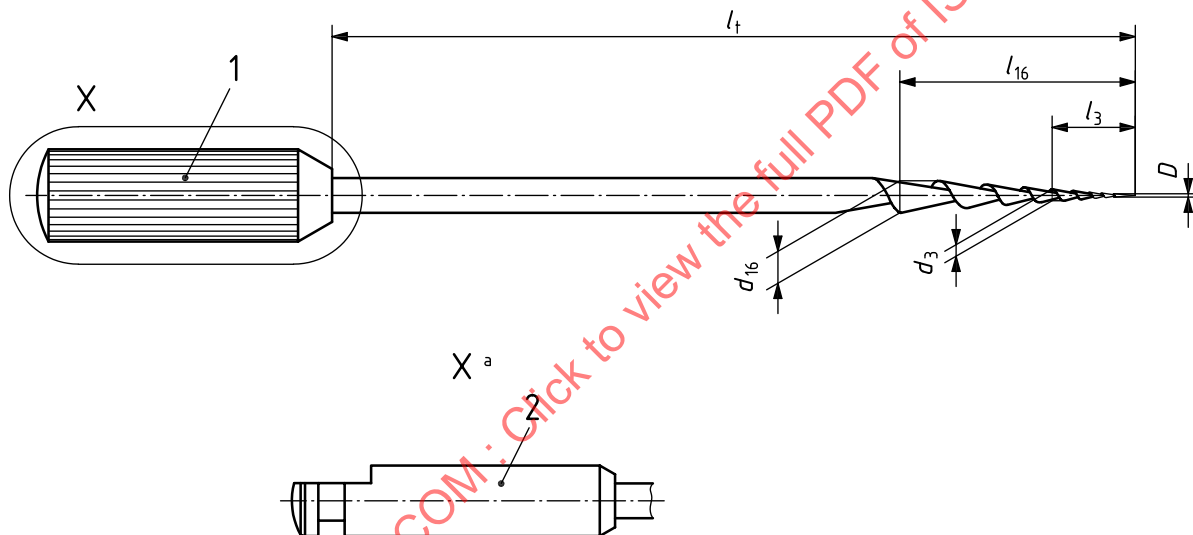
The diameter identification is described in 5.3.4 and the taper identification is described in 5.3.5.

5.3.4 Designation and diameters

The three digit diameter part of the size designation shall be D (see Figure 2) expressed in hundredths of a millimetre. For diameter sizes less than 1 mm, one digit may be omitted.

Figure 2 shows the position of the diameters and lengths for all Type 2 endodontic instruments. The nominal sizes shall correspond to the values of the extended diameters at the tip of the working part in hundredths of a millimetre.

NOTE The diameter and the tolerances shall be left at the discretion of the manufacturer.



Key

1 handle

2 shank

^a Shape option for manufacturer.

Figure 2 — Dimensions and locations for Type 2 (taper instrument: taper other than 02)

5.3.5 Taper designation

The taper part of the size designation shall be in number form.

Some manufacturers can designate taper as a percentage, e.g. '2 %'.

EXAMPLE The taper 03 designates 0,03 mm per millimetre of length or 3 %, and 12 designates 0,12 mm per millimetre of length or 12 %.

5.3.6 Diameter colour identification

When color-coding is used for diameter sizes, the colour sequence shall be the size designation, as shown in the Table 1.

5.3.7 Taper colour and ring identification

When color-coding is used for taper sizes, a second colour ring shall be present. The colour sequence shall be white, yellow, red, blue, green and black, representing increasing tapers. This sequence shall be repeated for sets with more than six tapers.

When rings or other marks are included for a brand's set of taper sizes, the number of rings or marks shall be in sequence, starting with one for the smallest percent taper.

5.4 Type 3: Non-taper instruments

5.4.1 Length

The lengths of the working part and of the operative part shall be specified by the manufacturer, and shall be within $\pm 0,5$ mm of the specified lengths.

Test in accordance with 7.3.

5.4.2 Size designation and diameters

Size designation and diameters shall follow the pattern of Table 1 but are not restricted to the sizes shown.

NOTE Since the working part is cylindrical in shape, the D tip diameter is the diameter of the working part. The zero taper shape shown in Figure 3 is an example of the non-tapered diameter.

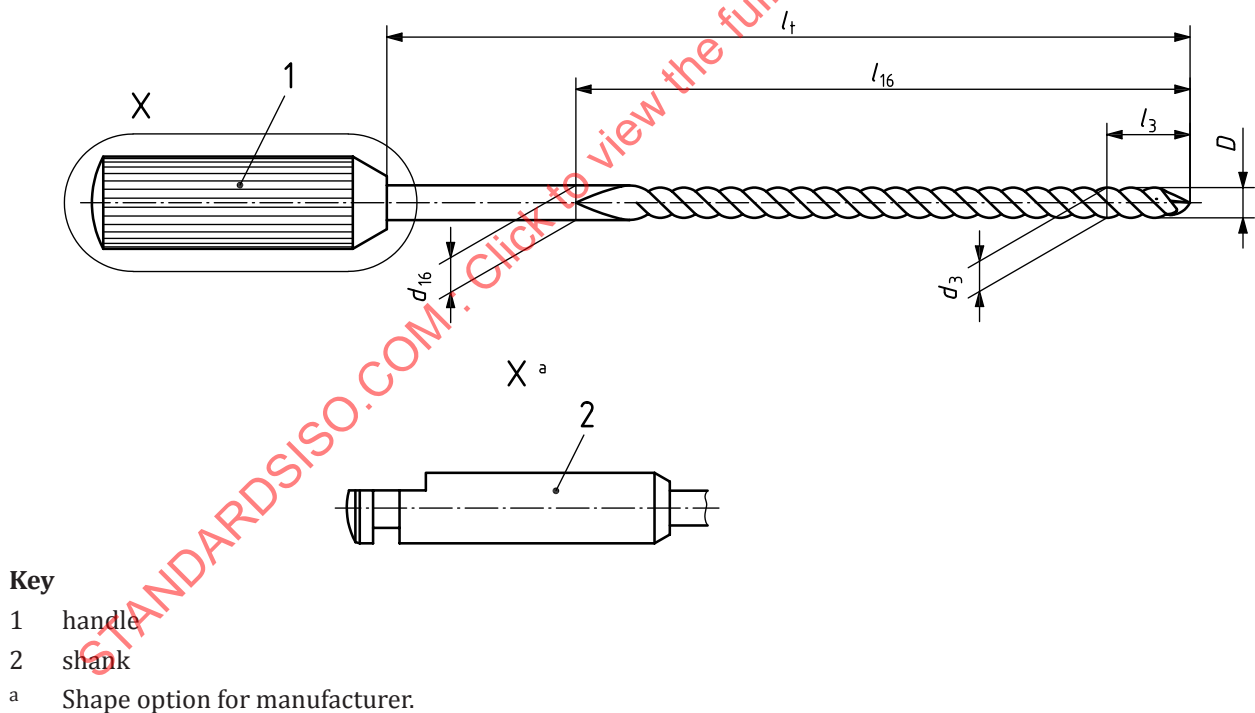


Figure 3 — Dimensions and locations for Type 3 (non-taper instrument: zero taper)

5.4.3 Colour designation

The colour of the handle or shank of Type 3 instruments shall be in accordance with the requirements of Table 1.

NOTE The handle or shank colours of instrument sizes not included in Table 1 are at the discretion of the manufacturer.

5.5 Type 4: Non-uniform taper instruments

5.5.1 Length

The lengths of the working part and of the operative part shall be specified by the manufacturer, and shall be within $\pm 0,5$ mm of the specified lengths.

If the manufacturer specifies the total length, it shall be within $\pm 1,0$ mm of the specified length.

Test in accordance with [7.3](#).

5.5.2 Tip length and angle

The tip length and angle shall be at the discretion of the manufacturer, however the angle shall not exceed 90° .

5.5.3 Size designation

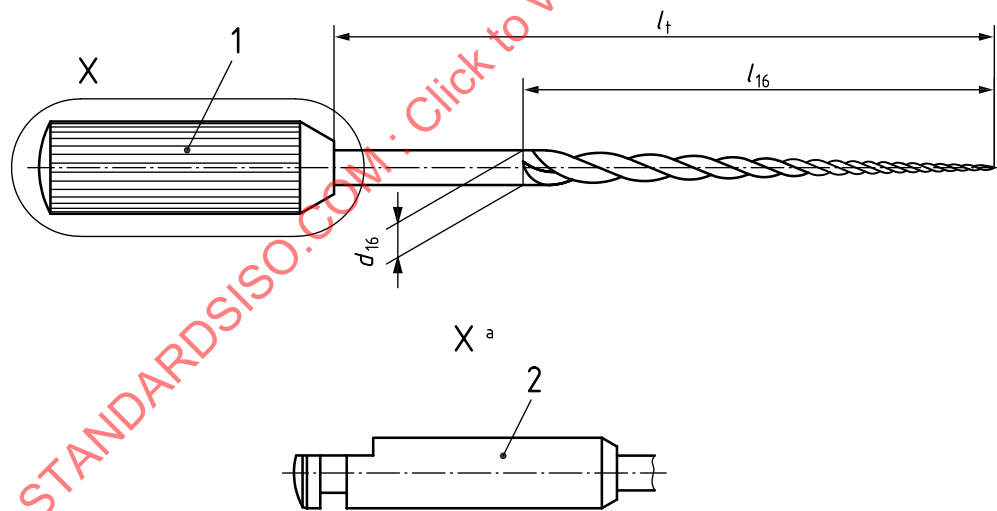
The instrument size shall be designated as "xxx yyy", where "xxx" is the diameter identification ([5.3.4](#)) and "yyy" is taper identification ([5.3.5](#)).

5.5.4 Diameter designation and diameters

The diameter part of the size designation shall be D in [Table 1](#). The position of the diameters and lengths for all Type 4 endodontic instruments shall be as identified by the manufacturer (see [Figure 4](#)).

NOTE The diameter and the tolerances shall be left at the discretion of the manufacturer.

NOTE This requirement does not preclude other sizes.



Key

1 handle

2 shank

^a Shape option for manufacturer.

Figure 4 — Dimensions and locations for Type 4

5.5.5 Diameter colour identification

When color-coding is used for diameter sizes, the colour sequence shall be white, yellow, red, blue, green, and black. This sequence shall be repeated for endodontic instruments with more than six sizes.

NOTE For taper sizes less than .01, one digit may be omitted. The third space is for a letter to indicate a non-uniform taper.

5.5.6 Taper colour and ring identification

When color-coding for a brand's set of taper sizes is used, a second colour shall be used in the sequence white, yellow, red, blue, green, black. This sequence is repeated for sets with more than six tapers. The colour shall represent the first (most distal) taper of the instrument.

When rings or other marks are included for a brand's set of taper sizes, number of rings or marks shall be in sequence, starting with one for the smallest percent taper. The ring or mark shall represent the first taper of the instrument.

5.6 Type 5: Shape instruments

5.6.1 Length

The lengths of the working part and of the operative part shall be specified by the manufacturer, and shall be within $\pm 0,5$ mm of the specified lengths.

If the manufacturer specifies the total length, it shall be within $\pm 1,0$ mm of the specified length.

NOTE Shape instruments are defined in ISO 3630-2.

Test in accordance with 7.3.

5.6.2 Size designation and diameters

The size designation shall be in accordance with dimension D in Table 1, such that D is the maximum diameter of the working part. This requirement shall not preclude other sizes.

NOTE 1 The arc-shape type shown in Figure 5 is an example of the maximum diameter D .

NOTE 2 The shape of the working part is at the discretion of the manufacturer.

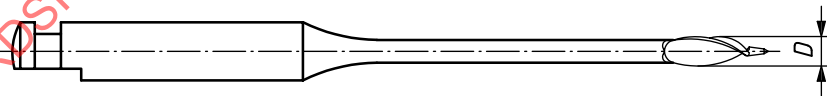


Figure 5 — Dimensions and locations for Type 5 (shape instrument: arc shape)

5.6.3 Colour designation

The colour of the handle or shank of Type 5 instruments shall be in accordance with the requirements of Table 1.

NOTE The handle or shank colours of instrument sizes not included in Table 1 are at the discretion of the manufacturer.

5.7 Material

The operative part and the handle or shank, if one piece, shall be made of any material which allows the instruments to meet the requirements of this document.

The type of material is left at the discretion of the manufacturer.

If the requirements of [5.9](#) to [5.10](#) are fulfilled, the endodontic instruments are considered also to be in accordance with the requirements of [5.7](#).

5.8 Dimensions

5.8.1 General

The dimensions are given in millimetres.

The dimensions designated D and l shall be in accordance with the requirements of the specific instrument's respective tables and figures. Variations in shape and design are permitted.

Test in accordance with [7.1](#), [7.2](#), and [7.3](#).

5.8.2 Length

The length of the operative part of the instrument shall be in accordance with the requirements of the specific instrument's tables and figures.

Test in accordance with [7.1](#), [7.2](#), and [7.3](#).

5.8.3 Handle and shank

5.8.3.1 Handle

The diameter of the handle is at the discretion of the manufacturer.

5.8.3.2 Shank

The shank shall be in accordance with the dimensions shown in [Figure 6](#) and [Table 2](#). The shank shall be Type 1 as specified in ISO 1797, and shall be operated with handpieces of the maximum revolutions per minute of the instrument.

NOTE The tolerance of the diameter d_s is based upon the maximum revolutions per minute of the instrument and the material of the shank. This clause differs from ISO 1797.

The minimum length l_s of the shank is shown in [Table 2](#).

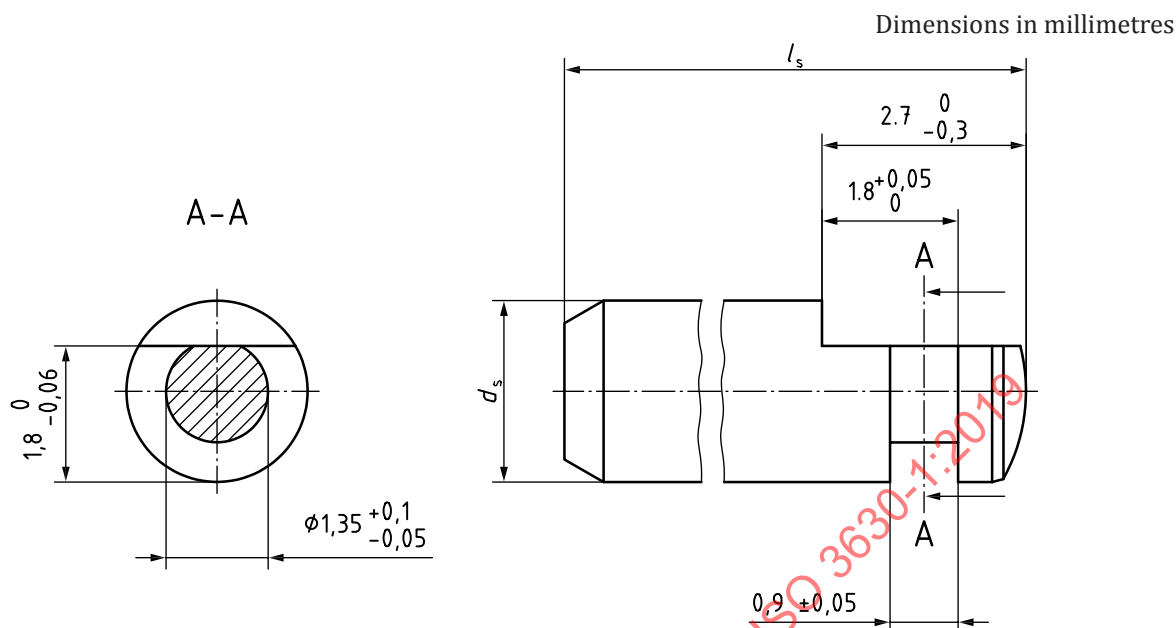


Figure 6 — Shank dimensions

Table 2 — Shank tolerances

Material	Manufacturer's recommended speed r/min	Shank diameter d_s	Length l_s (minimum)
Metal	>1 000	$2,35 + 0/-0,016$	12,5
Metal	$\leq 1\ 000$	$2,35 + 0/-0,03$	11
Plastics	$\leq 1\ 000$	$2,35 + 0/-0,05$	11

5.9 Mechanical requirements

5.9.1 Resistance to fracture by twisting and angular deflection

An endodontic instrument shall be in accordance with the requirements specified in ISO 3630-2 to ISO 3630-5.

Test in accordance with 7.4.

5.9.2 Stiffness (Resistance to bending)

The stiffness of an endodontic instrument is tested as resistance to bending and shall be in accordance with the requirements specified in ISO 3630-2 to ISO 3630-5.

Test in accordance with 7.5.

5.9.3 Handle and shank security

If the handle or shank and the operative part are not in one piece, the handle or shank shall be securely and permanently affixed to the shaft. The shaft shall have no axial movement greater than 0,02 mm from the handle or shank after an axial force of 20 N is applied. If the handle or shank is composed of plastics, the shaft shall not twist within the handle or shank when a torque of 35 mN·m is applied. If the handle or shank is composed of metal, the shaft shall not twist within the handle or shank when a torque of 70 mN·m is applied.

Test in accordance with [7.6](#).

5.10 Reprocessing

Endodontic instruments which the manufacturer claims can be reprocessed shall not be affected by the reprocessing cycle[s].

NOTE [Clause 10](#) e) requires the manufacturer to state the reprocessing instructions; the requirements for such instructions are embodied in ISO 17664.

The manufacturer shall state the maximum number of cycles for which the instrument may be reprocessed.

After the maximum number of reprocessing cycles, the instrument shall be free from surface defects and corrosion, and be in accordance with the requirements of [5.9](#).

Test in accordance with [7.7](#).

6 Sampling

Test 10 instruments of each size. If all 10 samples pass, the product passes. If eight or fewer samples pass, the product fails. If nine samples pass, test 10 additional samples. When 10 additional samples are required to be tested, all 10 shall pass for the product to comply.

7 Measurement and test methods

7.1 Visual inspection

Carry out visual inspection at normal visual acuity without magnification, unless otherwise specified.

7.2 Test conditions

Condition the apparatus and the endodontic instruments to be tested, in accordance with ISO 554 at $(23 \pm 2) ^\circ\text{C}$ for a period of at least 1 h prior to testing. Maintain these conditions during testing.

7.3 Measurement of dimensions

7.3.1 Principle

The measurement of dimensions of endodontic instruments includes diameters, tapers, lengths, and angles.

7.3.2 Measuring device

Use a measuring device with an accuracy of $\pm 0,002$ mm, such as an optical comparator, shadowgraph, measuring microscope, dial gauge, or other suitable device.

7.3.3 Procedure

Insert the endodontic instrument to be measured into the measuring device. Measure the length l_{16} and the diameters D and d_{16} . If the working part length l_{16} is less than 16 mm measure the second diameter 1 mm from the end of the working part.

As an alternative to measuring the D diameter the d_3 diameter can be measured at a location 3,0 mm from the tip.

Calculate the tip dimension from the projection of the taper of the working part onto a plane at the tip of the instrument (datum line), which is perpendicular to the long axis (centre-line) of the instrument.

NOTE The configuration of the tip is left at the discretion of the manufacturer.

7.3.4 Taper calculation

Calculate the taper by subtracting the diameter d_3 from the diameter d_{16} and dividing by 13.

EXAMPLE For a standard instrument size 10 (see [Table 1](#)), $d_3 = 0,16$ mm, $d_{16} = 0,42$ mm, taper = $(0,42 - 0,16) / 13 = 0,02$.

NOTE Taper tolerance is controlled solely by the tolerance of the specified diameters.

7.4 Resistance to fracture by twisting and angular deflection

7.4.1 Principle

The test of resistance to fracture of endodontic instruments is performed by measuring the maximum torque and angular deflection for each size.

7.4.2 Apparatus

7.4.2.1 Apparatus for torque test, such as shown in [Figure 7](#) or other suitable device, consisting of the following parts:

7.4.2.1.1 Low-speed reversible geared motor capable of revolving the test piece at 2 r/min.

7.4.2.1.2 Torque-measuring device fixed on two linear ball bearings mounted on the shaft of the device.

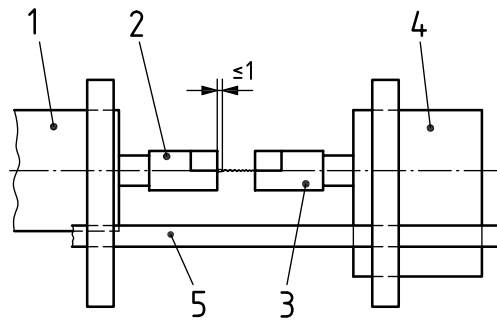
7.4.2.2 Chuck with jaws made from metallic materials used to clamp the test piece 3,0 mm from the tip and coaxial with the torque axis (see [Figure 8](#)).

7.4.2.3 Separate amplifier for controlling the operation of the motor.

7.4.2.4 Digital display or strip chart recorder for recording the torque and angular deflection.

7.4.2.5 Wire cutter, suitable for cutting an endodontic instrument.

Dimensions in millimetres

**Key**

- 1 reversible gear motor
- 2 chuck with hardened steel jaws
- 3 chuck with metallic jaws
- 4 torque measuring device
- 5 linear ball-bearing

Figure 7 — Apparatus for torque test**7.4.3 Procedure**

If necessary, remove the handle or shank with a suitable wire cutter at the point at which it is attached to the shaft of the endodontic instrument. Calibrate the torque-measuring device for the torque range of the sample to be tested. Set the test piece into the chuck of the geared motor end leaving a maximum of 1 mm from the working part of the instrument. Tighten the chuck and slowly slide the torque-measuring device along the linear bearing until the tip of the test piece enters 3 mm into the jaws of the chuck. Check to ensure that the test piece is straight and centered into the jaws (see [Figure 7](#)). Tighten the chuck, ensuring that the instrument has not been distorted or damaged.

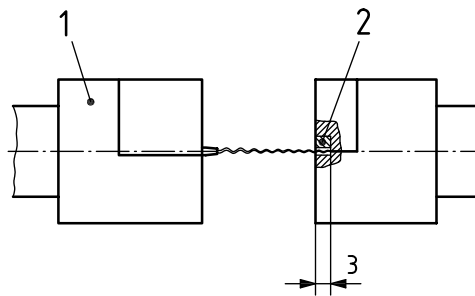
Activate the geared motor in steps until the torque digital display or the strip chart recorder shows a zero reading.

This is necessary as clamping may induce a pre-stress in the test piece from the handle or shank.

Ensure that the geared motor is set for the same rotation direction as instrument normal operating, viewed from the test piece shank end, activate the device. Record the maximum torque and angular deflection at failure for each instrument tested.

NOTE The device shown is designed to stop the operation when the test piece fails.

Dimensions in millimetres

**Key**

- 1 chuck with hardened steel jaws
- 2 chuck with metallic jaws
- 3 millimetre distance

Figure 8 — Details of test chuck**7.4.4 Expression of results**

Express the maximum torque in millinewton metre (mN·m) and the angular deflection in degrees.

7.5 Stiffness**7.5.1 Principle**

The determination of stiffness is performed by bending the endodontic instruments through 45 degrees.

7.5.2 Apparatus

7.5.2.1 Apparatus as described in 7.4.2, with the modification of the clamping jaws and the bending device or catch pin as shown in Figure 9.

7.5.2.2 Separate amplifier for controlling the operation of the motor.

7.5.2.3 Digital display or strip chart recorder for recording the torque.

7.5.2.4 Wire cutter, suitable for cutting an endodontic instrument.

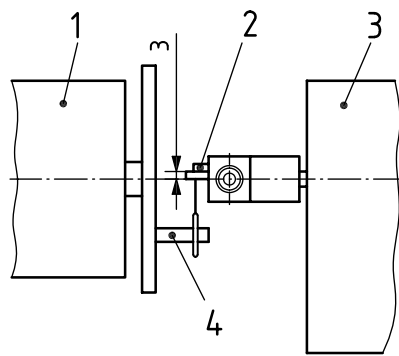
7.5.3 Procedure

Remove the handle or shank from the endodontic instrument with a wire cutter at the point at which the handle or shank is attached to the operative part of the endodontic instrument.

Set the amplifier (7.5.2.2) to stop at a pre-selected angular deflection of 45°.

Set the chuck onto the shaft of the torque-measuring device. Set the tip of the test piece into the jaws of the chuck perpendicular to the axis of the motor to a depth of 3 mm. Tighten the chuck. Mount the catch pin onto the motor shaft. Slide the torque-measuring device along the linear ball bearing until the test piece is located above the rotating pin. Rotate the motor in the correct direction in stages until the catch pin is lightly touching the test piece. Ensure that the display shows zero. Activate the torque-measuring device.

Record the applied torque for each instrument tested.

**Key**

- 1 reversible gear motor
- 2 stop
- 3 torque measuring device
- 4 catch pin

Figure 9 — Apparatus for bending test**7.5.4 Expression of results**

Express the stiffness in millinewton metre (mN·m).

7.6 Handle or shank security**7.6.1 Principle**

The determination of the handle or shank security includes tests of the axial movement or twist strength.

7.6.2 Apparatus

7.6.2.1 Apparatus as described in [7.4.2.1](#) or other suitable normal laboratory device.

7.6.2.2 Torquemeter**7.6.3 Preparation of test sample**

Select five endodontic instruments of each type and size and test for axial movement.

Select a further five endodontic instruments of each type and size and test for twist strength.

7.6.4 Procedure**7.6.4.1 Axial movement**

Measure and record the length of the operative part. Grasp the operative part within 1 mm of the handle or shank. Support the handle or shank to prevent axial movement without applying any restriction to the operative part. Apply the force axially for 30 seconds. Measure the length of the operative part to determine evidence of axial movement.

NOTE Excluded from this test are paste carriers with a spiral between the working part and the shank, which are designed to fracture at this point if safe torque limit is exceeded.