
International Standard



3630

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Dental root canal instruments

Instruments pour canaux radiculaires utilisés en art dentaire

First edition — 1984-02-15

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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 developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been authorized 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 3630 was developed by Technical Committee ISO/TC 106, *Dentistry*, and was circulated to the member bodies in August 1982.

It has been approved by the member bodies of the following countries:

Belgium	New Zealand	Switzerland
China	Norway	United Kingdom
Czechoslovakia	Romania	USA
Germany, F.R.	South Africa, Rep. of	USSR
Japan	Sweden	

The member bodies of the following countries expressed disapproval of the document on technical grounds:

Australia
France
India

Dental root canal instruments

0 Introduction

This International Standard covers significant features of hand- and power-operated dental root canal instruments which are used by the dentist for the mechanical preparation of root canals for treatment.

Attention is drawn to the International Standard on a number coding system, ISO 6360, which specifies a 15 digit number for the identification of dental rotary instruments of all types.

1 Scope and field of application

This International Standard specifies requirements, test methods, coding and identification for hand- and power-operated dental root canal instruments. It covers root canal instruments of the following types (see ISO 1942):

- a) files types H and K;
- b) reamers types K and B2;
- c) barbed broaches; ✕
- d) rasps; ✕
- e) paste carriers; ✕
- f) explorers and cotton broaches (probes and applicators).

NOTE — Additional types of instruments will form the subject of future International Standards.

2 References

ISO 1797, *Dental rotary instruments — Fitting dimensions.*¹⁾

ISO 1942, *Dental vocabulary.*

ISO 6360, *Dental rotary instruments — Number coding system.*²⁾

3 Material

The instruments shall be made of stainless steel or carbon steel. The type of steel and the treatment shall be at the discretion of the manufacturer.

4 Dimensional requirements

The dimensions are given in millimetres. The dimensional requirements of the instruments shall be as given in the respective tables and figures. Compliance shall be tested in accordance with 7.1.

NOTE — The dimensional requirements for files, types H and K and reamers, type K are very similar. Recent developments however might lead to more divergencies. Therefore in 4.2.1 to 4.2.3 these three types of instrument are laid down separately.

4.1 Nominal sizes, designation and nominal diameters

Table 1 gives the series of nominal diameters for the working part and the corresponding designations to be used for all dental root canal instruments regardless of the type of instrument.

The designation of the nominal sizes are given by 3 digits corresponding to the value of the nominal diameter, in hundredths of a millimetre.

Table 1 — Nominal diameters and nominal size designation

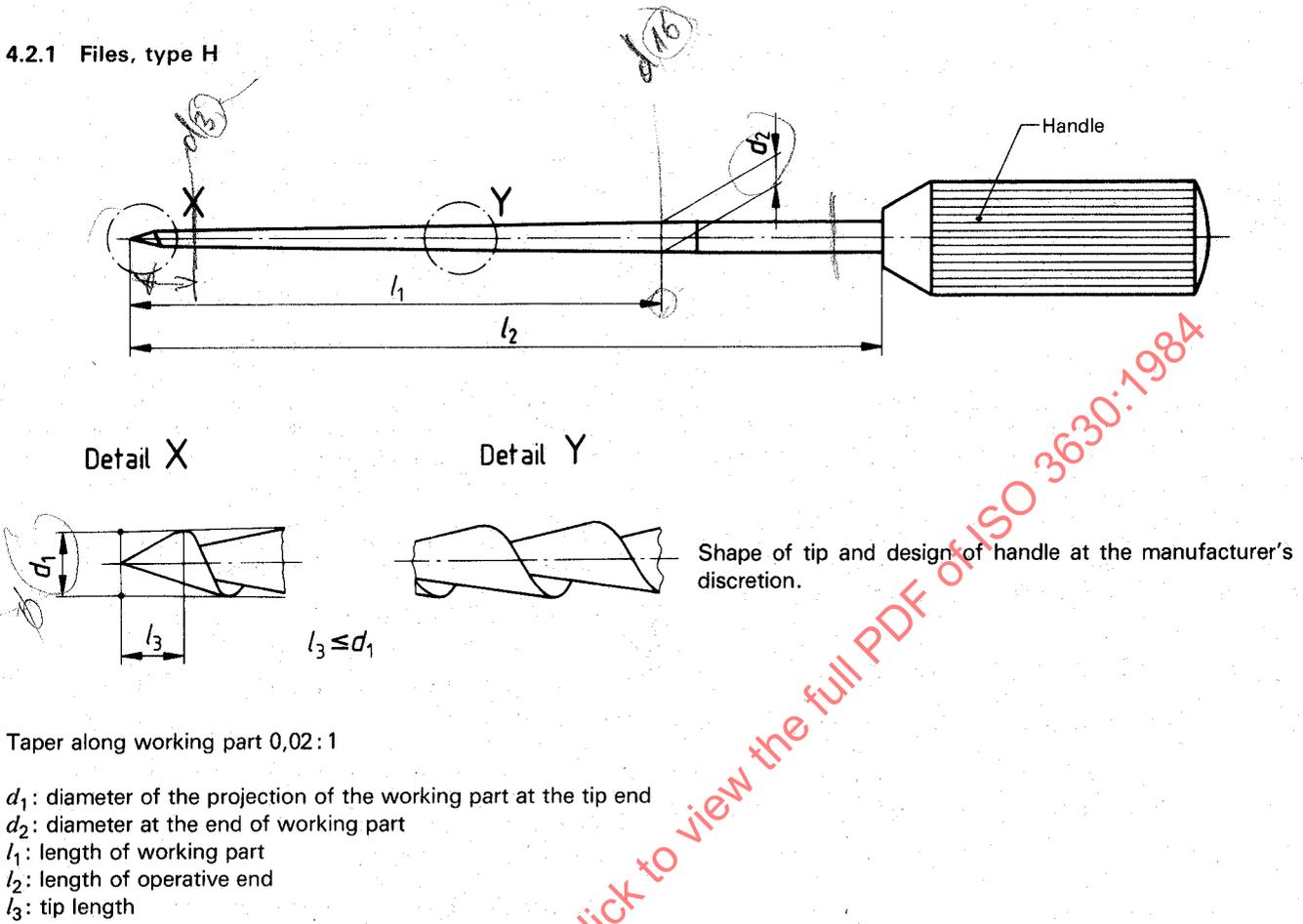
Nominal diameter	Nominal size designation
0,10	010
0,12	012
0,15	015
0,17	017
0,20	020
0,25	025
0,30	030
0,35	035
0,40	040
0,45	045
0,50	050
0,55	055
0,60	060
0,70	070
0,75	075
0,80	080
0,90	090
1,00	100
1,05	105
1,10	110
1,20	120
1,30	130
1,40	140

1) At present at the stage of draft. (Revision of ISO 1797-1976.)

2) At present at the stage of draft.

4.2 Files and reamers

4.2.1 Files, type H



Taper along working part 0,02:1

- d_1 : diameter of the projection of the working part at the tip end
- d_2 : diameter at the end of working part
- l_1 : length of working part
- l_2 : length of operative end
- l_3 : tip length

Figure 1 – Files, type H

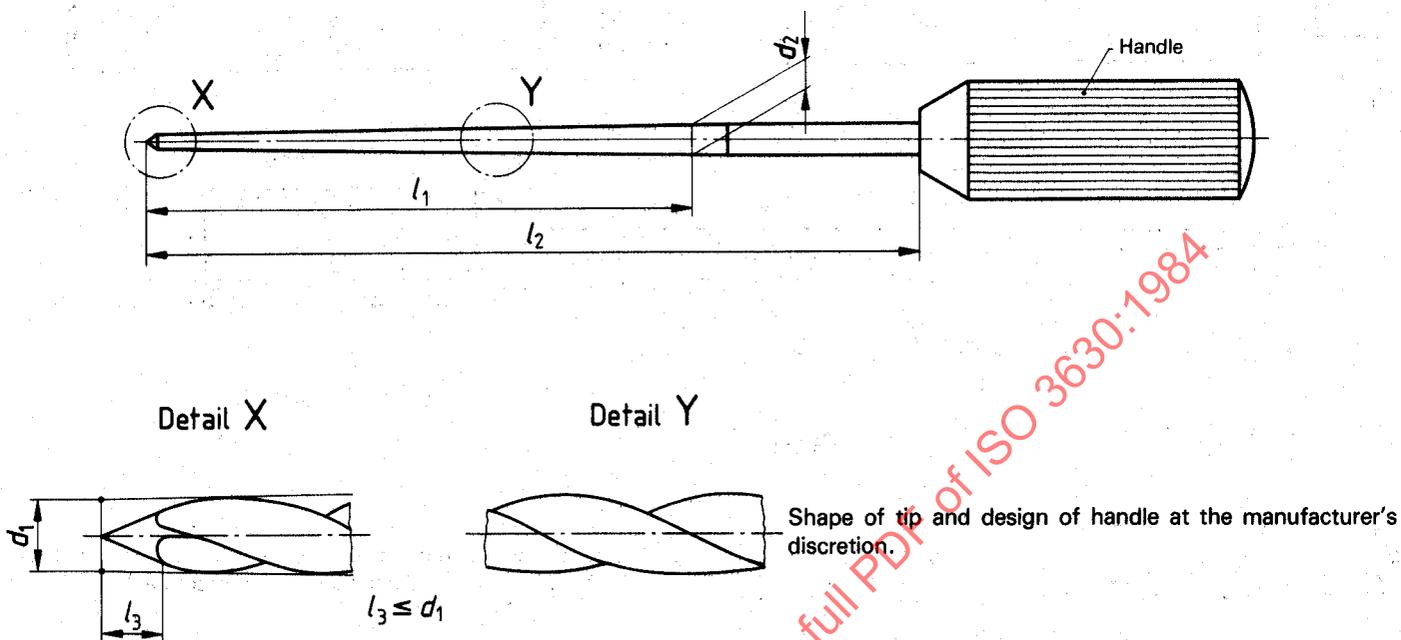
Table 2 – Dimensions and designation

Nominal sizes	d_1 $\pm 0,02$	d_2 $\pm 0,02$	l_1 min.	Colour designation
015	0,15	0,47	16	white
020	0,20	0,52		yellow
025	0,25	0,57		red
030	0,30	0,62		blue
035	0,35	0,67		green
040	0,40	0,72		black
045	0,45	0,77		white
050	0,50	0,82		yellow
055	0,55	0,87		red
060	0,60	0,92		blue
070	0,70	1,02		green
080	0,80	1,12		black
090	0,90	1,22		white
100	1,00	1,32		yellow
110	1,10	1,42		red
120	1,20	1,52		blue
130	1,30	1,62	green	
140	1,40	1,72	black	

Table 3 – Length l_2

l_2 $\pm 0,5$
21
25
28
31

4.2.2 Files, type K



Taper along working part 0,02 : 1

- d_1 : diameter of the projection of the working part at the tip end
- d_2 : diameter at the end of working part
- l_1 : length of working part
- l_2 : length of operative end
- l_3 : tip length

Figure 2 — Files, type K

Table 4 — Dimensions and designation

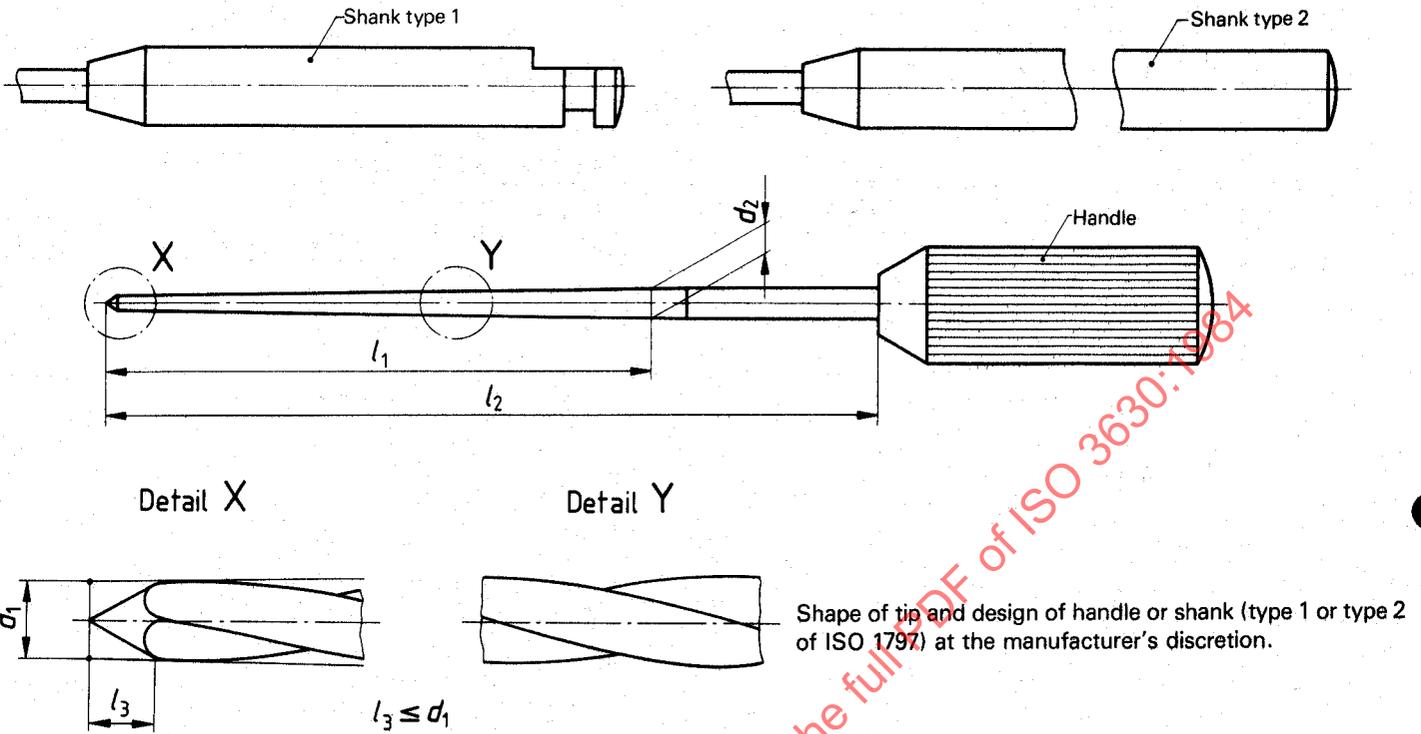
Nominal sizes	d_1 $\pm 0,02$	d_2 $\pm 0,02$	l_1 min.	Colour designation
010*	0,10	0,42	16	purple
015	0,15	0,47		white
020	0,20	0,52		yellow
025	0,25	0,57		red
030	0,30	0,62		blue
035	0,35	0,67		green
040	0,40	0,72		black
045	0,45	0,77		white
050	0,50	0,82		yellow
055	0,55	0,87		red
060	0,60	0,92		blue
070	0,70	1,02		green
080	0,80	1,12		black
090	0,90	1,22		white
100	1,00	1,32	yellow	
110	1,10	1,42	red	
120	1,20	1,52	blue	
130	1,30	1,62	green	
140	1,40	1,72	black	

Table 5 — Length l_2

l_2 $\pm 0,5$
21
25
28
31

* The size 010 is a super fine size and has therefore an individual colour which is purple.

4.2.3 Reamers, type K



Taper along working part 0,02 : 1

- d_1 : diameter of the projection of the working part at the tip end
- d_2 : diameter at the end of working part
- l_1 : length of working part
- l_2 : length of operative end
- l_3 : tip length

Figure 3 — Reamers, type K

Table 6 — Dimensions and designation

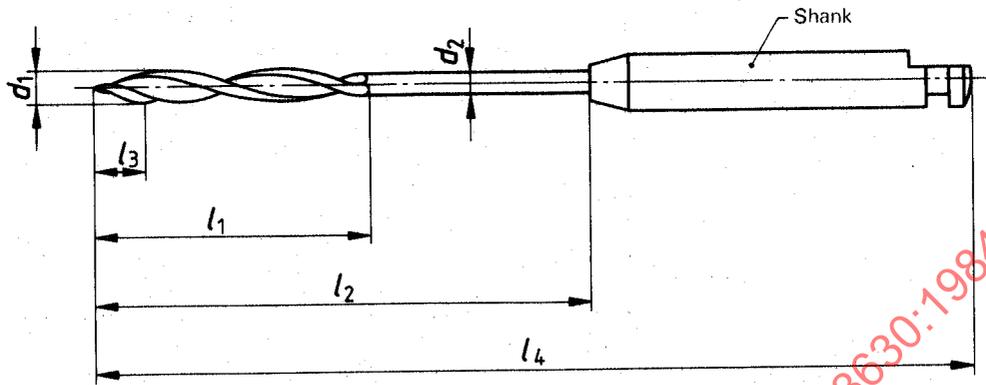
Nominal sizes	d_1 $\pm 0,02$	d_2 $\pm 0,02$	l_1 min.	Colour designation
010*	0,10	0,42	16	purple
015	0,15	0,47		white
020	0,20	0,52		yellow
025	0,25	0,57		red
030	0,30	0,62		blue
035	0,35	0,67		green
040	0,40	0,72		black
045	0,45	0,77		white
050	0,50	0,82		yellow
055	0,55	0,87		red
060	0,60	0,92		blue
070	0,70	1,02		green
080	0,80	1,12		black
090	0,90	1,22		white
100	1,00	1,32		yellow
110	1,10	1,42		red
120	1,20	1,52	blue	
130	1,30	1,62	green	
140	1,40	1,72	black	

Table 7 — Length l_2

l_2 $\pm 0,5$
21
25
28
31

* The size 010 is a super fine size and has therefore an individual colour which is purple.

4.2.4 Reamers, type B2



Shank type 1 or 2 of ISO 1797 at the manufacturer's discretion

- d_1 : diameter of working part
- d_2 : neck diameter
- l_1 : length of working part
- l_2 : length of operative end
- l_3 : tip length
- l_4 : overall length

Figure 4 — Reamers, type B2

Table 8 — Dimensions and designation

Nominal sizes	d_1 $\pm 0,02$	d_2 min.	l_1 max.	l_3 max.	Designation ¹⁾	
					Colour	Ring marking on shank
030	0,30	0,20	7,5	0,5	purple	—
035	0,35	0,25	8	0,5	white	I
045	0,45	0,35	8	0,5	yellow	II
060	0,60	0,45	8	0,7	red	III
075	0,75	0,55	9	0,8	blue	III I
090	0,90	0,65	9	1	green	III II
105	1,05	0,75	10	1,1	black	III III

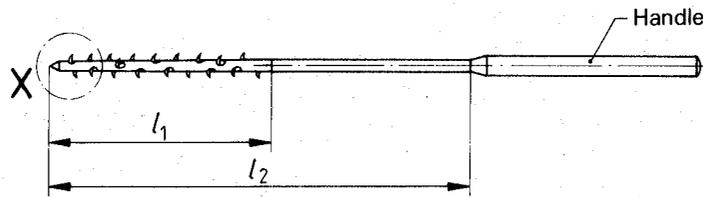
1) See clause 8.

Table 9 — Lengths l_2 and l_4

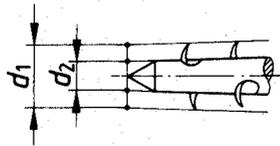
l_2		l_4 min.	
for shank type 1 $\pm 0,5$	for shank type 2 min.	for shank type 1	for shank type 2
18	25	33	61

4.3 Barbed broaches

Tip end at the manufacturer's discretion



Detail X



Hand use: design of handle at the manufacturer's discretion

Machine use (for reciprocating hand piece only): shank type 1 of ISO 1797.

Taper along working part 0,007 : 1 with a tolerance of $\begin{matrix} +0,003 \\ 0 \end{matrix}$

d_1 : diameter of the projection of the working part at the tip end

d_2 : diameter of core

l_1 : length of working part

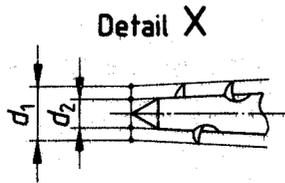
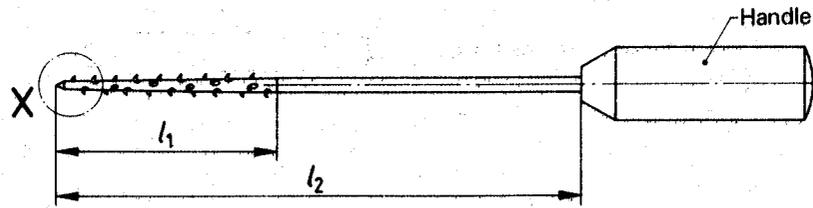
l_2 : length of operative end

Figure 5 – Barbed broaches

Table 10 – Dimensions and designation

Nominal sizes	d_1 +0,04 0	d_2 +0,02 0	l_1 $\pm 1,5$	l_2 min.	Height of barbs	Number of barbs min.	Designation	
							Colour	Numbers
025	0,24	0,12	10,5	20	0,5 d_2	36	white	1
030	0,28	0,14					yellow	2
035	0,34	0,17					red	3
040	0,40	0,20					blue	4
050	0,50	0,25					green	5
060	0,60	0,30					black	6

4.4 Rasps



Shape of tip and design of handle at the manufacturer's discretion.

Taper along working part 0,015 : 1 with a tolerance of $^{+0,005}_0$

d_1 : diameter of the projection of the working part at the tip end

d_2 : diameter of core

l_1 : length of working part

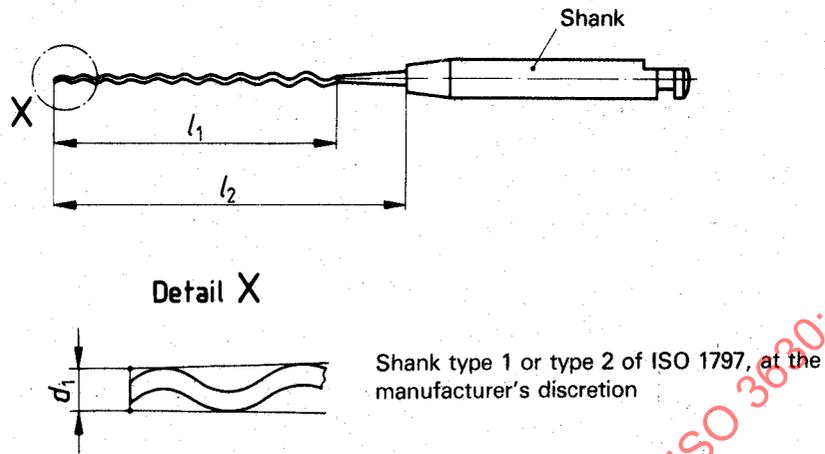
l_2 : length of operative end

Figure 6 — Rasps

Table 11 — Dimensions and designation

Nominal sizes	d_1 +0,03 0	d_2 +0,02 0	l_1 min.	l_2 $\pm 0,5$	Height of barbs	Number of barbs min.	Designation	
							Colour	Numbers
025	0,25	0,15	10,5	25,5	$1/3 \times d_2$	50	white	1
030	0,30	0,18					yellow	2
035	0,35	0,21					red	3
040	0,40	0,24					blue	4
045	0,45	0,27					green	5
050	0,50	0,30					black	6

4.5 Paste carriers



Working part tapered or cylindrical and winding of spiral at the manufacturer's discretion. The winding of the spiral shall be such as to convey the material to the tip of the instrument when rotated in a clockwise direction.

Taper, if applicable, along working part 0,02 : 1.

d_1 : diameter of the projection of the working part at the tip end
 l_1 : length of working part
 l_2 : length of operative end

Figure 7 — Paste carriers

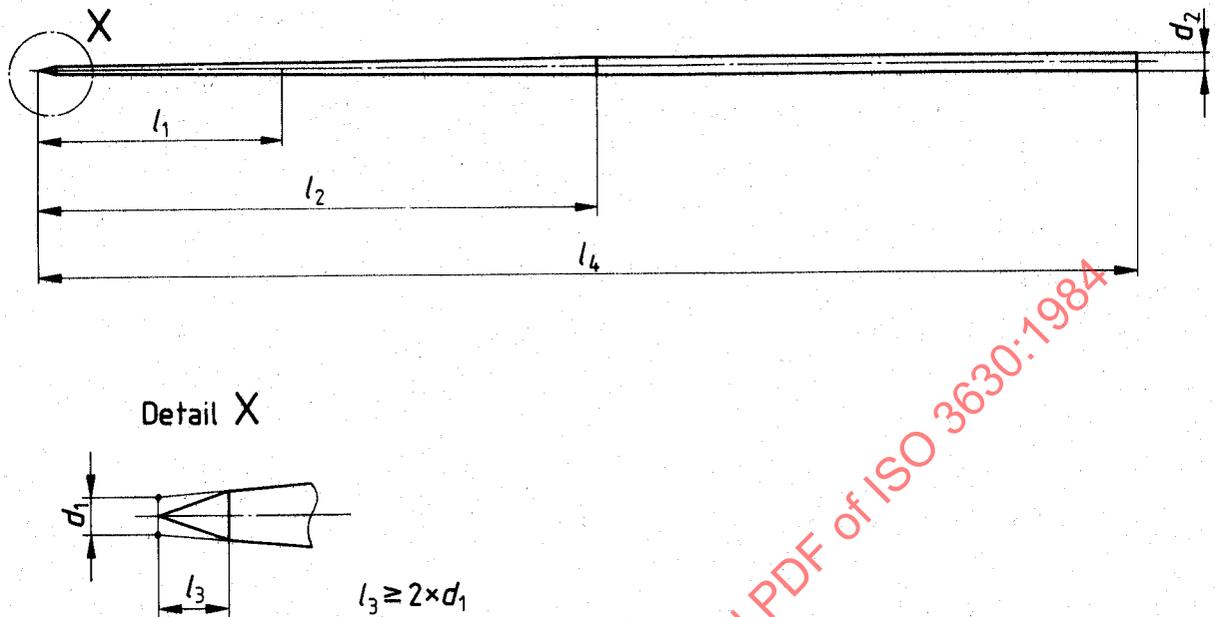
Table 12 — Dimensions and designation

Nominal sizes	d_1 0 -0,05	l_1 min.	Designation	
			Colour	Ring marking on shank
025	0,25	16	red	I
030	0,30		blue	II
035	0,35		green	III
040	0,40		black	IIII

Table 13 — Length l_2

l_2 $\pm 0,5$	
for shank type 1	for shank type 2
21	21
25	25
29	—

4.6 Explorers and cotton broaches



Cross-section along operative end: round or polygonal at the manufacturer's discretion.

Taper along operative end 0,007 : 1, with a tolerance of $\begin{matrix} +0,003 \\ 0 \end{matrix}$.

- d_1 : diameter of the projection of the working part at the tip end
- d_2 : diameter of the handle
- l_1 : length of working part
- l_2 : length of operative end
- l_3 : tip length
- l_4 : overall length

Figure 8 – Explorers and cotton broaches

Table 14 – Dimensions and designation

Nominal sizes	d_1 $\pm 0,02$	d_2 max.	l_1 $\pm 1,5$	l_2 $\pm 0,5$	l_4 $\pm 1,5$	Designation	
						Colour	Numbers
012	0,12	0,8	10,5	25	50	white	1
015	0,14					yellow	2
017	0,17					red	3
020	0,20					blue	4
025	0,25					green	5
030	0,30					black	6

Table 15 — Resistance to fracture in torque and angular deflection

Nominal sizes	Resistance to fracture (torque) g · cm min.			Angular deflection degrees min.	
	Files type K	Files type H	Reamers type K	Files and reamers type K	Files type H
010	6	5	6	360	180
015	8	8	8		
020	18	12	12		
025	30	20	20		
030	45	35	35		
035	65	50	50		
040	100	65	70		120
045	120	90	95		
050	170	120	120		
055	1)	160	1)	1)	90
060		250			
070		350			

1) The values for sizes in excess of 050 are not given as all instruments of sizes greater than 050 can be assumed to have more than adequate resistance to fracture.

5 Mechanical requirements

5.1 Resistance to fracture in torque and angular deflection

5.1.1 Files and reamers

When tested in accordance with 7.2 the test piece shall not fracture and the minimum value for the resistance to fracture in torque and the minimum value for the angular deflection given in table 15 shall be reached.

5.1.2 Other root canal instruments

NOTE — For barbed broaches, rasps, paste carriers, explorers and cotton broaches (probes and applicators) requirements will be added as soon as data are available.

5.2 Resistance to bending

5.2.1 Files and reamers

When tested in accordance with 7.3 the values for the resistance to bending given in table 16 shall not be exceeded.

5.2.2 Other root canal instruments

NOTE — For barbed broaches, rasps, paste carriers, explorers and cotton broaches (probes and applicators) requirements will be added as soon as data are available.

6 Chemical requirements

When tested in accordance with one of the tests described in 7.4 the root canal instruments made out of stainless steel shall not show evidence of corrosion.

Table 16 — Resistance to bending

Nominal sizes	Bending moment g · cm max.		
	Files type K	Files type H	Reamers type K
010	25	20	25
015	50	35	50
020	80	65	80
025	120	100	120
030	150	135	150
035	190	170	220
040	250	220	320
045	360	320	375
050	450	520	410
055	1)	720	1)
060		920	
070		1 120	

1) The values for sizes in excess of 050 are not given as all instruments of sizes greater than 050 can be assumed to have adequate resistance to bending.

7 Sampling and methods of test

7.1 Measurement of dimensions

The lengths and diameters are measured or calculated with a shadowgraph or other equipment of equivalent accuracy, for example dial gauges. The diameter, d_2 , of instruments specified in 4.2.1, 4.2.2 and 4.2.3 shall be measured 16 mm from the tip.

The tapers of the tapered instruments are measured with a shadowgraph or an equivalent apparatus as shown in figure 9.

The taper diameter at the tip shall be determined by a suitable measuring device, for example a displacement gauge or a shadowgraph. The actual values are detracted from diameters measured by the device shown in figure 9 and calculated taking into account the taper decrease of the respective instrument.

All dimensions in millimetres with a tolerance of $\pm 0,5$ mm

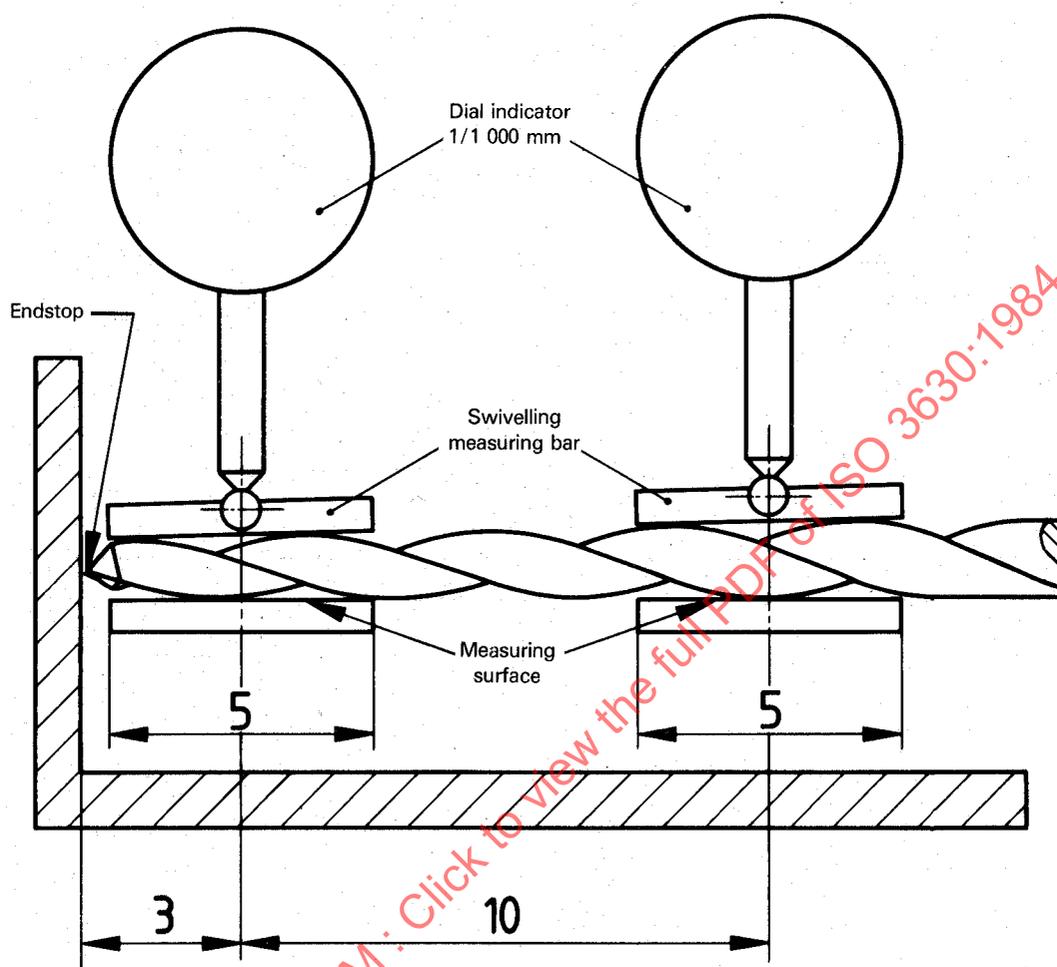


Figure 9 – Apparatus for measurement of taper

7.2 Resistance to fracture in torque and angular deflection

7.2.1 Test apparatus (see figure 10)

7.2.1.1 Low speed reversible geared motor capable of revolving the test piece at 2 min^{-1} .

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

7.2.1.3 Chuck, with jaws made from soft brass (70 % copper and 30 % zinc) for clamping the test piece at the tip along a length of 3 mm and coaxially with the torque axis.

7.2.1.4 Separate amplifier and digital display for controlling the operation of the motor and recording the torque and angular deflection.

7.2.1.5 Chuck with jaws made from hardened steel for clamping the test piece at the shank.

7.2.2 Sampling and procedure

Take as the sample and for each test, 10 instruments of each size. Remove the handles with a suitable wire cutter at the point at which the handle is attached to the instrument shaft. 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 (7.2.1.1) leaving a maximum of 1 mm of the unground portion of the shank out of the chuck. Tighten the chuck. Slowly slide the torque-measuring device (7.2.1.2) along the linear bearing until the tip of the test piece enters 3 mm into the brass jaws. Check to ensure that the test piece is straight and centred into the jaws (see figure 10). Tighten the chuck (7.2.1.3). Since clamping will probably induce a prestress of the test piece, the geared motor (7.2.1.1) must be activated in steps until the torque digital display (7.2.1.4) or the strip chart recorder shows a zero reading. After ensuring that the geared motor is set for clockwise rotation as viewed from the test piece shank end, activate the device. The test device will cease operation when the test piece fails. The maximum torque and angular deflection shall be recorded for each piece tested.

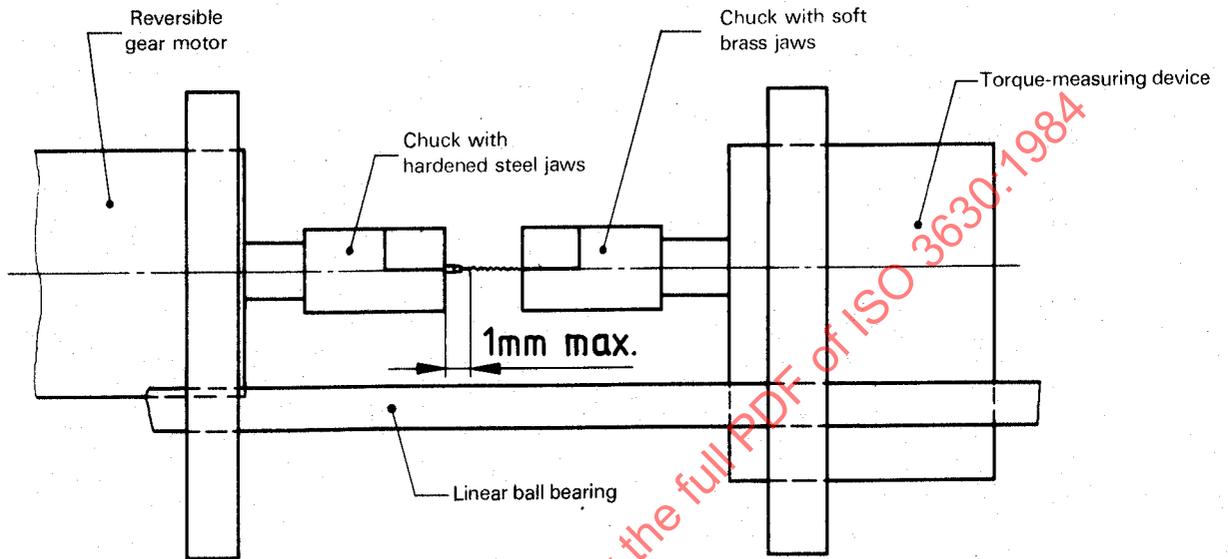


Figure 10 — Apparatus for torque test

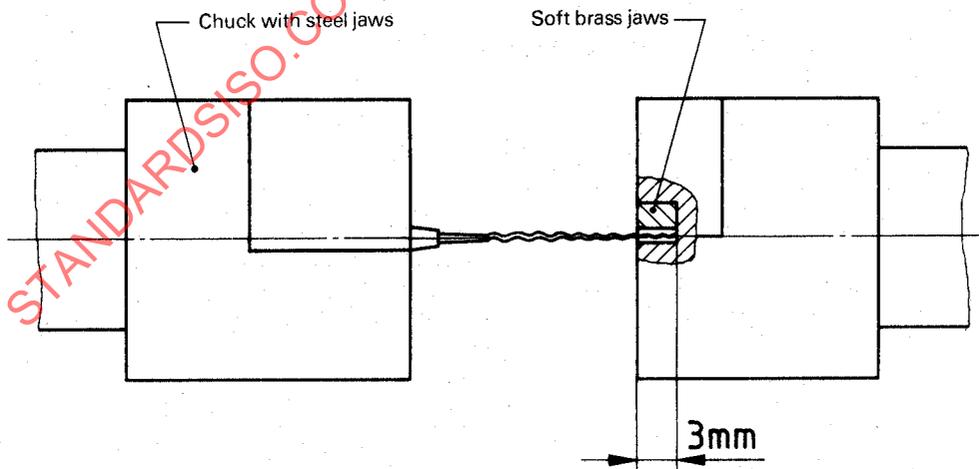


Figure 11 — Test chuck detail

7.3 Resistance to bending

7.3.1 Test apparatus

The equipment as described in 7.2.1 is used with the modification of the clamping jaws and the bending device or catch pin as shown in figure 12. The amplifier shall be capable of being set to a pre-selected angular deflection of 45° at which point the test stops.

7.3.2 Sampling and procedure

Take as the sample and for each test, 10 instruments of each size. Remove the handles with a suitable wire cutter at

the point at which the handle is attached to the instrument shaft.

Set the apparatus (7.2.1.4) to stop the angular deflection at 45° . Set the chuck (7.2.1.3) 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. When the angular deflection has reached 45° the test will stop. Record the applied force at the display for each piece tested.

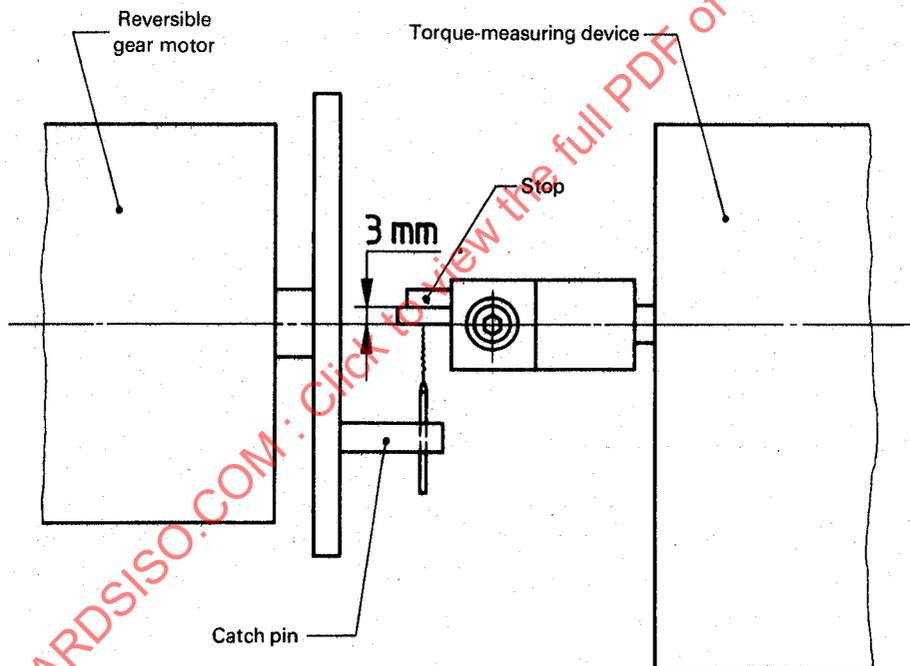


Figure 12 — Apparatus for bending test

7.4 Resistance to corrosion

7.4.1 Sampling and preparation of the sample

Take as the sample and for each test, five instruments of each size. Scrub the test pieces with soap and water, rinse in hot water, dip in 95 % (V/V) ethanol or isopropyl alcohol (isopropanol; propan-2-ol), and dry.

7.4.2 Procedure

Test pieces are subjected to one of the tests described in 7.4.2.1. and 7.4.2.2.

7.4.2.1 Copper sulphate test

Prepare copper sulphate solution as follows:

- copper sulphate pentahydrate (CuSO₄·5H₂O) : 4,0 g ;
- sulphuric acid (H₂SO₄, ρ 1,84 g/ml) : 10,0 g ;
- water (H₂O) : 90 ml.

Immerse the test pieces in the copper sulphate solution at 20 °C for 6 min, then wipe off with a cloth saturated with fresh water. Examine the test pieces under a magnification of at least × 5 for the presence of brown stains indicating corrosion.

7.4.2.2 Agar ion test

Prepare an agar ion gel as follows:

- potassium hexacyanoferrate(III) [K₃Fe(CN)₆] : 0,2 g ;
- sodium chloride (NaCl) : 1,0 g ;
- water (H₂O) : 100 ml ;
- agar-agar : 1,5 g.

Pour the agar gel into a transparent container. Insert the test pieces into the gel at 37 ± 2 °C, at intervals of not less than 10 min and a distance of 10 mm from the periphery of the container. Insert the test pieces to a depth of about 20 mm. Examine the test pieces while in the gel for the presence of blue precipitates on the surface indicating corrosion.

8 Designation, marking and identification

8.1 Code for colour designation

The handles or shanks of root canal instruments shall be designated with colours according to table 17 or the respective abbreviation specified in table 18.

NOTE — The colour designation is based on six colours from white to black i.e. from light to dark. This sequence is repeated for instruments with more than six sizes.

Due to the different series and types of instruments it is not possible to apply one specific colour generally to a certain diameter of a root canal instrument.

Table 17 — Colour designation

Nominal sizes	Colour designation for					
	files and reamers, types H and K	paste carriers	barbed broaches	rasps	reamers type B2	explorers and cotton broaches
010	purple	—	—	—	—	—
012	—	—	—	—	—	white
015	white	—	—	—	—	yellow
017	—	—	—	—	—	red
020	yellow	—	—	—	—	blue
025	red	red	white	white	—	green
030	blue	blue	yellow	yellow	—	black
035	green	green	red	red	white	—
040	black	black	blue	blue	—	—
045	white	—	—	green	yellow	—
050	yellow	—	green	black	—	—
055	red	—	—	—	—	—
060	blue	—	black	—	red	—
070	green	—	—	—	—	—
075	—	—	—	—	blue	—
080	black	—	—	—	—	—
090	white	—	—	—	green	—
100	yellow	—	—	—	—	—
105	—	—	—	—	black	—
110	red	—	—	—	—	—
120	blue	—	—	—	—	—
130	green	—	—	—	—	—
140	black	—	—	—	—	—

NOTE — The size 010 has the special colour purple.