INTERNATIONAL STANDARD

ISO 7711-1

Second edition
2021-11

Dentistry — Diamond rotary instruments —

Part 1: General requirements

Médecine bucco-dentaire — Instruments rotatifs diamantés —

Partie 1: Exigences générales

Reference number
ISO 7711-1:2021(E)

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Published in Switzerland

Contents

Page

Foreword

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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).

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For an explanation of 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 106, *Dentistry*, Subcommittee SC 4, *Dental instruments,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 55, *Dentistry,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition of ISO 7711-1 cancels and replaces ISO 7711-1:1997 and ISO 7711-3:2004, which have been technically revised. It also incorporates the Amendment ISO 7711-1:1997/Amd.1:2009.

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

— the entire content of ISO 7711-3 has been included;

— definitions have been added to Clause 3;

— blank materials have been added in 5.1;

— tables for force values were removed;

— figures and tables describing bur shapes and dimensions have been removed.

A list of all parts in the ISO 7711 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.

Dentistry — Diamond rotary instruments —

Part 1: General requirements

1 Scope

This document specifies the general requirements and test methods for diamond rotary instruments used in dentistry, including designation, colour code and grit sizes and a quality control for these instruments.

It applies to all types of diamond rotary instruments independent of type and shape with exception to diamond discs, which are specified in ISO 7711-2.

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 1797:2017, *Dentistry — Shanks for rotary and oscillating instruments*

ISO 1942, *Dentistry — Vocabulary*

ISO 2157, *Dentistry — Nominal diameters and designation code numbers for rotary instruments*

ISO 3696, *Water for analytical laboratory use — Specification and test methods*

ISO 8325:2004, *Dentistry — Test methods for rotary instruments*

ISO 6106, *Abrasive products — Checking the grain size of superabrasives*

ISO 14457, *Dentistry — Handpieces and motors*

ISO 21850-1, *Dentistry — Materials for dental instruments — Part 1: Stainless steel*

3 Terms and definitions

For the purposes of this document, the following terms and definitions given in ISO 1942 and ISO 14457 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 https://www.electropedia.org/

3.1
blank
supporting material for a rotary instrument consisting of a *shank* (3.5), neck (optional) and an uncoated *working part* (3.6)

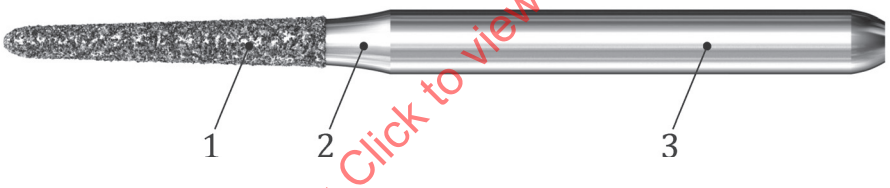
Note 1 to entry: See Figure 1.

Key
1 working part
2 neck
3 shank

Figure 1 — Blank

3.2
diamond rotary instrument
rotary instrument consisting of a *blank* (3.1) and a *working part* (3.6) coated with diamond grit

Note 1 to entry: See Figure 2.



Key
1 working part
2 neck
3 shank

Figure 2 — Diamond rotary instrument

3.3
macrogrit
grit with grit size distribution which is determined by sieving

3.4
microgrit
grit with grit size distribution which is determined by sedimentation

3.5
shank
part of the diamond instrument to be connected to a dental handpiece

3.6
working part
part of the diamond instrument with an active grinding surface

4 Symbols

The following symbols are used in this document:

d_1 diameter of the working part at the first measurement on the circumference

d_2 diameter of the working part at the second measurement on the circumference

d_3 diameter of working part at third measurement on the circumference

D minimum of neck diameter

F_1 test force for run-out

F_2 test force for breaking test

L length from the tip of the working part to the minimum of the neck diameter

L_2 overall length of the instrument

NOTE The overall length of the instrument, L_2, is the sum of the fitting length of the shank, the length of the neck and the length of the working part.

5 Requirements

5.1 Material

5.1.1 Blank

The stainless steel material for the blank of the diamond rotary instrument shall be in accordance with ISO 21850-1.

5.1.2 Shank hardness

The hardness of the shank shall comply with ISO 1797.

5.1.3 Working part

The working part shall be coated with diamond grit, bound in either metal or other suitable material at the discretion of the manufacturer.

The diamond grit may consist of natural or synthetic origin.

5.2 Designation, colour code, grit sizes

5.2.1 Designation

The fineness of the diamond grit used shall comply with the requirements in Table 1.

5.2.2 Colour code

The colour code complements the designation. Usage of the colour code for mean grit size is optional and at the discretion of the manufacturer. If colour coding is used, the colours shall be those specified in Table 1.

The location on the diamond instrument where the colour is applied may be on the shank or neck and is left at the discretion of the manufacturer.

5.2.3 Grit size distribution

5.2.3.1 Macrogrits

The method for determining or verifying the grit size distribution of macrogrits for diamonds used in the manufacture of industrial products (e.g. grinding wheels, saws) as specified in ISO 6106, for grit sizes between 1 180 µm and 41 µm, shall be used.

The series of diamond grit sizes is designated as D series (D 1 181 to D 46), where “D” denotes diamond.

NOTE Further information is given in References [13] and [15].

5.2.3.2 Microgrits

Currently no internationally accepted method for determining or verifying the grit size distribution of microgrits diamonds is available. Therefore, methods from regional standards or national standards are used.

The series of diamond grit sizes is designated as M series, where “M” denotes microgrit.

NOTE Further information is given in References [12] and [14].

5.2.4 Grit sizes

The grit sizes as specified in Table 1 shall be used for all types of diamond instruments.

The grit sizes and their classification in regard to their fineness are selected according to Table 1.

Because of the difficulty in separating grit sizes, overlapping areas are unavoidable and commonly accepted.

In Table 1, columns 3 and 4 indicate colour codes and their equivalent grit size ranges, respectively.

Table 1 — Designation, colour code, grit sizes for diamond grits

Designation	Abbreviation	Colour code	Grit designation	Mean grit size[a] µm
ultra-fine	UF	white	M 4 to M 14	8
extra fine	EF	yellow	M 10 to M 36	25
fine	F	red	M 27 to D 76	46
medium	M	blue	D 64 to D 126	107
coarse	C	green	D 107 to D 181	151
very coarse	VC	black	D 151 to D 213	181

[a] Mean grit size, in µm, is used for information in the communication to the dentist or dental technician.

NOTE Grit sizes >D 213 are acceptable in extraoral or laboratory use. Designation 'very coarse' can also be designated as 'extra coarse' or 'super coarse'.

Overlapping of grit sizes may be allowed as dictated by the intended use of the instruments.

5.3 Dimensions

5.3.1 Designated dimensions of overall length

The overall length of the diamond rotary instrument, L_2, is the sum of the fitting length of the shank, the neck and the length of the working part. "Standard" refers to instruments with standard fitting lengths of shank. For instruments with longer or shorter shank lengths, the overall length, L_2, will vary accordingly. See ISO 1797 for fitting lengths of shanks.

The dimensions for Type 1 shall be according to ISO 1797:2017, Table 1.

If the manufacturer deviates from the overall length specified in Tables 2 to 5, it shall be ensured that the minimum fitting length of ISO 1797 is observed.

Table 2 — Overall length L_2 for instruments with working part length up to 5 mm

Dimensions in millimetres

Designation	**Overall length L_2**		
Shank type	Type 1	Type 2	Type 3
Tolerance	±0,5	$L_2 \leq 50$: ±0,5 $L_2 > 50$: ±1	±0,5
short	$L_2 \leq 18,5$	—	$L_2 \leq 16,5$
standard	$18,5 < L_2 \leq 22,0$	$L_2 \leq 44,5$	$16,5 < L_2 \leq 19,0$
long	$22,0 < L_2 \leq 26,0$	$44,5 < L_2 \leq 64,5$	$19,0 < L_2 \leq 21,0$
extra long	$26,0 < L_2 \leq 34,0$	$64,5 < L_2 \leq 70,0$	$21,0 < L_2 \leq 25,0$

Table 3 — Overall length L_2 for instruments with working part length exceeding 5 mm and up to 7,5 mm

Dimensions in millimetres

Designation	**Overall length L_2**		
Shank type	Type 1	Type 2	Type 3
Tolerance	±0,5	$L_2 \leq 50$: ±0,5 $L_2 > 50$: ±1	±0,5
short	$L_2 \leq 18,5$	—	$L_2 \leq 18,5$
standard	$18,5 < L_2 \leq 22,0$	$L_2 \leq 44,5$	$18,5 < L_2 \leq 21,0$
long	$22,0 < L_2 \leq 26,0$	$44,5 < L_2 \leq 64,5$	$21,0 < L_2 \leq 23,0$
extra long	$26,0 < L_2 \leq 34,0$	$64,5 < L_2 \leq 70,0$	$23,0 < L_2 \leq 25,0$

Table 4 — Overall length L_2 for instruments with working part length exceeding 7,5 mm and up to 9 mm

Dimensions in millimetres

Designation	**Overall length L_2**		
Shank type	Type 1	Type 2	Type 3
Tolerance	±0,5	$L_2 \leq 50$: ±0,5 $L_2 > 50$: ±1	±0,5
short	$L_2 \leq 19,5$	—	$L_2 \leq 19,5$
standard	$19,5 < L_2 \leq 24,0$	$L_2 \leq 44,5$	$19,5 < L_2 \leq 22,0$
long	$24,0 < L_2 \leq 28,0$	$44,5 < L_2 \leq 64,5$	$22,0 < L_2 \leq 24,0$
extra long	$28,0 < L_2 \leq 34,0$	$64,5 < L_2 \leq 70,0$	$24,0 < L_2 \leq 25,0$

Table 5 — Overall length L_2 for instruments with working part length exceeding 9 mm and up to 12 mm

Dimensions in millimetres

Designation	**Overall length L_2**		
Shank type	Type 1	Type 2	Type 3
Tolerance	±0,5	$L_2 \leq 50$: ±0,5 $L_2 > 50$: ±1	±0,5
short	$L_2 \leq 23{,}5$	—	$L_2 \leq 21{,}5$
standard	$23{,}5 < L_2 \leq 27{,}0$	$L_2 \leq 46{,}0$	$21{,}5 < L_2 \leq 24{,}0$
long	$27{,}0 < L_2 \leq 31{,}0$	$46{,}0 < L_2 \leq 64{,}5$	$24{,}0 < L_2 \leq 26{,}0$
extra long	$31{,}0 < L_2 \leq 34{,}0$	$64{,}5 < L_2 \leq 70{,}0$	$26{,}0 < L_2 \leq 30{,}0$

5.3.2 Designated dimensions of the shank

The shank shall be Type 1, 2 or 3 of ISO 1797:2017.

5.3.3 Dimensions of working part

5.3.3.1 Tolerances of nominal diameter

The nominal diameter is the largest diameter of the working part. The designation shall be in accordance with ISO 2157.

Tolerances of nominal diameter of working parts are shown in Table 6.

Table 6 — Tolerances of nominal diameter of working part

Designation	Ultra-fine to fine	Medium to very coarse
Tolerance	±0,08 mm	±0,10 mm

Testing shall be carried out in accordance with ISO 8325.

5.3.3.2 Tolerances of length of working part

If the manufacturer designates the length of the working part (coated length) the tolerance shall be ±0,5 mm.

5.3.3.3 Run-out of working part

The maximum total indicated run-out shall be as given in Table 7.

Table 7 — Run-out of working part

Designation	**Maximum run-out** mm
ultra-fine	0,07
extra fine	0,07
fine	0,08
medium	0,10
coarse	0,12
very coarse	0,14

The measurement location shall be as given in Table 8.

Table 8 — Measurement location in relation to the shape of the working part

Shape of working part	Measurement location
round head, spherical (with collar) inverted truncated, conical (with collar) wheel (with collar) hemispherical, inverted conical, truncated inverted conical, with convex end and rounded edge	largest diameter
cylindrical truncated conical inverted conical	1 mm from tip
hemispherical cylindrical truncated conical, domed cylindrical, with ogival end	2 mm from tip

5.4 Bending test to verify the instrument strength

5.4.1 General

Testing shall be carried out in accordance with ISO 8325:2004, 5.9.

Test forces are applied under an angle of inclination α (α = 22,5°) of the tested instrument at bending test.

5.4.2 Effect on run-out

Check that the direction of run-out complies with the requirement of ISO 8325:2004, 5.9.3 before the test force is applied. Adjust the instrument accordingly.

Apply a testing force F_1 of 2 N for at least 5 s. For burs with long working ends (e.g. 8 mm to 12 mm) and neck diameters in the range of 0,50 mm and 0,65 mm apply a testing force F_1 of 60 % of the breaking force shown in Table 9.

Measure the difference of the run-out in the middle of the working part length before and after F_1 has been applied.

To comply with the requirement, a difference of the run-out (before and after application of testing-force) shall be at the most 0,05 mm.

Exclusion: for long and pointed instruments which have an opening angle of the tip of maximum 30°, the resulting run out shall not exceed 0,15 mm.

5.4.3 Breaking test

Apply a test force F_2 as specified in Table 9 for at least 5 s.

NOTE The values in Table 9 are calculated from the formula:

$$F_2 = 81{,}8 \times D^3 / L$$

This formula is used only to obtain the numerical value of F_2, and the units of the left and right terms do not match.

To comply with the requirement, the instrument shall not break.

The test specimen shall not break neither in the area of the working part nor in the neck area. No exclusions are permitted for the breaking test.

Table 9 — Test force F_2 for selected values of L and D

Minimum of neck diameter D mm	Test force F_2 N — Length from the tip to the minimum of neck diameter L mm								
	1	**1,5**	**2**	**3**	**4**	**5**	**8**	**10**	**12**
0,50	10,2	6,8	5,1	3,4	2,6	2,0	1,3	1,0	—
0,55	13,6	9,1	6,8	4,5	3,4	2,8	1,7	1,3	1,1
0,60	17,7	11,7	8,8	5,9	4,4	3,6	2,2	1,7	1,4
0,65	22,5	14,9	11,2	7,5	5,6	4,5	2,8	2,2	1,8
0,70	28,0	18,7	14,0	9,3	7,1	5,6	3,5	2,8	2,4
0,75	34,5	23,0	17,3	11,5	8,6	6,9	4,3	3,5	2,9
0,80	41,9	27,9	20,9	14,0	10,4	8,4	5,2	4,2	3,5
0,85	50,1	33,5	25,1	16,8	12,6	10,0	6,2	5,0	4,2
0,90	—	39,7	29,8	19,8	14,9	12,0	7,5	5,9	5,0
0,95	—	46,7	35,0	23,4	17,5	14,0	8,8	7,1	5,8
1,00	—	—	40,9	27,3	20,4	16,3	10,2	8,2	6,8
1,1	—	—	54,3	36,3	27,2	21,8	13,6	10,8	9,1
1,2	—	—	—	47,1	35,3	28,2	17,7	14,1	11,7
1,4	—	—	—	—	56,1	44,8	28,0	22,5	18,7
1,8	—	—	—	—	—	—	59,5	47,7	39,7
2,0	—	—	—	—	—	—	—	—	54,4
EXAMPLE	Diamond rotary instrument with D = 0,8 mm, L = 5 mm, and F_2 = 8,4 N.								

Testing shall be carried out in accordance with ISO 8325:2004, 5.9.

5.5 Resistance to processing and reprocessing

If the manufacturer recommends processing or reprocessing of the diamond rotary instrument it shall show no signs of corrosion or functional deterioration after testing.

Testing shall be carried out in accordance with 6.4.

Other appropriate testing methods are left to the discretion of the manufacturer.

6 Measurement and test methods

6.1 Sampling

The tests are used as type tests and not in the series production.

Test 10 instruments against the test methods. All 10 instruments shall be in accordance with the general requirements.

6.2 Testing of the dimensions

Measure and/or determine the shapes and dimensions according to ISO 8325:2004, 5.1 to 5.7, as appropriate.