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Resistance welding — Embossed projection welding — Projections for resistance welding

Soudage par résistance — Soudage par bossage embouti — Bossages pour le soudage par résistance

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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 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 44, *Welding and allied processes*, Subcommittee SC 6, *Resistance welding and allied mechanical joining*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 121, *Welding and allied processes*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 8167:1989), which has been technically revised.

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

— Clause 3 has been updated;

— Annexes B and C have been revised;

— the document has been technically revised to the state of the art.

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.

Official interpretations of ISO/TC 44 documents, where they exist, are available from this page: https://committee.iso.org/sites/tc44/home/interpretation.html.

Resistance welding — Embossed projection welding — Projections for resistance welding

1 Scope

This document specifies the geometries and dimensions of projections for embossed projection welding. Tools to make the projections are also included in Annex B.

The projections are used on hot-rolled, cold-rolled, uncoated and coated steels, stainless steels and nickel alloys for conventional welding quality up to 3 mm thickness, as single projections, in multiples or as a group of multiples.

Any solid projections are not included in this document.

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 17677-1, *Resistance welding — Vocabulary — Part 1: Spot, projection and seam welding*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 17677-1 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
spherical projection
projection with circular protrusion (see Figure 1)

Note 1 to entry: The type code for spherical projection is SP.

3.2
ring-shaped projection
annular projection
projection with ring-shaped protrusion (see Figure 2)

Note 1 to entry: The type code for ring-shaped projection is RP.

Note 2 to entry: In the United States, a kind of solid projection is called “annular projection”.

3.3
elongated projection
projection with oval protrusion (see Figure 3)

Note 1 to entry: The type code for elongated projection is EP.

3.4
projection diameter
d_1
outer diameter of the projection in the embossed side surface of the sheet for spherical and ring-shaped projections (see Figure 1 and Figure 2)

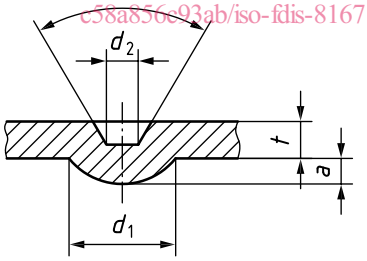
3.5
projection height
a
maximum height of the projection (see Figures 1 to 3)

3.6
projection width
b_1
maximum width of the elongated projection in the embossed side surface of the sheet (see Figure 3)

3.7
projection length
l_1
bottom length of the elongated projection in the embossed side surface of the sheet (see Figure 3)

4 Types of projections

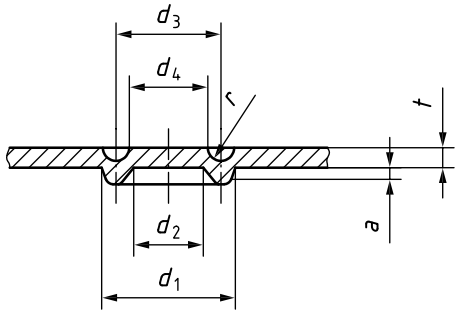
The projection shape shall be selected from three types of projections shown in Figures 1 to 3 based on the design requirements of the welds or welding procedure specification (WPS) for the projection welding. Spherical projections are recommended for sheets thicknesses of 1 mm or greater. Ring-shaped projections and multiple spherical projections (e.g. a set of three projections) are usually used for sheets thinner than 1 mm. Elongated projections can be used to replace a set of two ring-shaped or spherical projections.



Key

a	nominal height
d_1	projection diameter
d_2	nominal dimeter
t	sheet thickness
ϕ	indentation angle

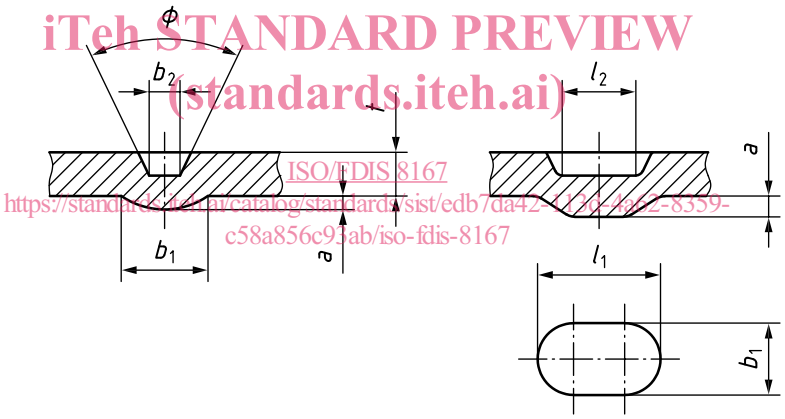
Figure 1 — Spherical projection



Key

a nominal height
d_1 outer diameter of projection ring
d_2 inner diameter of projection ring
d_3 centre line diameter of projection ring
d_4 blind hole diameter for upper punch
r radius
t sheet thickness

Figure 2 — Ring-shaped projection



Key

a nominal height
b_1 nominal width
b_2 short side width of the indentation bottom
l_1 nominal length
l_2 long side length of the indentation bottom
ϕ indentation angle
t sheet thickness

Figure 3 — Elongated projection

5 Dimensions of projections

The dimensions shall be as specified in Tables 1 to 3 for spherical, elongated and ring-shaped projections, respectively. The tolerance on the projection diameter, d_1, projection width, b_1, and projection height, a, shall be equal or less than the values specified in Tables 1 to 3.

In the case of multiple projection welding with spherical and ring-shaped projections in one operation, more severe tolerance control for the projection height is required. The height of the individual projections on any of the components comprising the assembly shall not vary by more than 5 % from one another.

The projection should be made in the thicker sheet with the dimensions determined according to the thinner sheet thickness.

When welding sheets of dissimilar materials, the projection should be made in the material with the lower heat conductivity and/or higher strength.

Alternative projection dimensions can be found in Annex C.

NOTE 1 The height, a, is determined by the punch stroke when using open bottom die.

NOTE 2 Annex A indicates the relationship between sheet thickness, t, and projection diameter, d_1, for spherical projections.

Table 1 — Dimensions for spherical projection

Dimensions in millimetres

Projection diameter		Projection height		Bottom diameter of the indentation part
Nominal diameter d_1[a]	Tolerance	Nominal height a	Tolerance[b]	d_2[c]
1,4	+0,1 −0,1	0,38	+0,05 −0,05	0,45
1,6		0,4		0,5
2,0		0,5		0,63
2,5		0,63		0,8
3,2		0,8		1,0
4,0	+0,15 −0,15	1,0	+0,05 −0,10	1,25
5,0		1,25		1,6
6,3		1,6		2,0
8,0		2,0		2,5

NOTE The indentation angle, ϕ, and bottom diameter of the indentation part, d_2, vary depending to the forming tool geometry used to make the projection. The indentation angle between 45° and 90° can be selected in accordance with the design requirements or WPS.

[a] The rod diameter d_6 of the forming tool (e.g. punch) shall be greater than d_1. An example of the forming tool is given in Figures B.1 and B.2.

[b] In the case of welding with single projection, ±10 % is acceptable as the tolerance of projection height.

[c] The diameter values indicated in this table are only informative. The values are effective only to prepare the forming tool with a truncated cone tip geometry in which the tool tip angle is 60°.

Table 2 — Dimensions for ring-shaped projection

Dimensions in millimetres

Outer diameter of projection ring		Projection height		Inner diameter of projection ring		Centre line diameter of projection ring	Blind hole diameter	Radius
Nominal diameter d_1	Tolerance	Nominal height a	Tolerance	Nominal dimeter d_2	Tolerance	d_3	d_4	r
3,0	+0,1 −0,0	0,4	+0,05 −0,05	1,6	+0,0 −0,1	2,3	1,7	0,3
4,0		0,5		2,0		3,0	2,2	0,4
4,5		0,5		2,0		3,25	2,25	0,5

NOTE Tolerances of d_3 and d_4 are +0.0 / -0.1 mm, respectively.

[a] This is only informative. The indentation geometry varies depending on the stamp tip shape.

Table 3 — Dimensions for elongated projection

Dimensions in millimetres

Projection width		Projection height		Short side width of the indentation bottom	Projection length
Nominal width b_1	Tolerance	Nominal height a	Tolerance	b_2[a]	l_1
1,4	+0,1 −0,1	0,38	+0,05 −0,05	0,45	2,8 to 4,5
1,6		0,4		0,5	3,2 to 5,1
2,0		0,5		0,63	4,0 to 6,4
2,5		0,63		0,8	5,0 to 8,0
3,2		0,8		1,0	6,4 to 10,2
4,0	+0,15 −0,15	1,0	+0,05 −0,10	1,25	8,0 to 12,8
5,0		1,25		1,6	10,0 to 16,0
6,3		1,6		2,0	12,6 to 20,2
8,0		2,0		2,5	16,0 to 25,6

NOTE The indentation angle, ϕ, and the indentation geometry vary depending to the forming tool shape and geometry used to make the projection. The indentation angle between 45° and 90° can be selected in accordance with the design requirements or WPS.

[a] The short side width values indicated in this table are only informative. The values are effective only to prepare the forming tool with a truncated cone tip geometry in which the tool tip angle is 60°.

6 Designation

Projections covered by this document shall be designated using the following information in the order given:

a) the description (i.e. “Projection”);

b) a reference to this document (i.e. ISO 8167:2021);

c) the type code of projection (SP, EP or RP);

d) the projection diameter, d_1, or projection width, b_1, in millimetres.

EXAMPLE A spherical projection with a diameter, d_1, of 2,5 mm is designated as follows:

Projection ISO 8167—SP2,5

Annex A
(informative)

Relationship between sheet thickness and projection size

For the various applications and the required strength determined by weld strength and material properties, it is recommended that, according to the sheet thickness, the following three different groups of projection diameters (see Table A.1) be adopted when selecting the spherical and elongated projections.

Group A Comprises small size projections for applications where space is limited or minimum marking is required.

Group B Projections for standard applications which usually need more space and leave larger marks than Group A projections.

Group C large size projections for high strength applications, where space or shape limits the application or use of multi-projections; normally used with high strength steels.

For easy designation, it can be convenient to reach agreement on the groups in national or company standards.

Table A.1 — Groups of projection diameters for spherical and elongated projections

Dimensions in millimetres

Sheet thickness t	Projection diameter, d_1, or projection width, b_1		
	Group A	Group B	Group C
$t \leq 0{,}4$	1,4	1,6	2,0
$0{,}4 < t \leq 0{,}5$	1,6	2,0	2,5
$0{,}5 < t \leq 0{,}63$	2,0	2,5	3,2
$0{,}63 < t \leq 1$	2,5	3,2	4,0
$1 < t \leq 1{,}6$	3,2	4,0	5,0
$1{,}6 < t \leq 2{,}5$	4,0	5,0	6,3
$2{,}5 < t \leq 3$	5,0	6,3	8,0

Ring-shaped projections are recommended for thin sheets materials. The relationship recommended is indicated in Table A.2.

Table A.2 — Projection size for ring-shaped projections

Dimensions in millimetres

Sheet thickness t	Projection diameter d_1
$0{,}5 < t \leq 0{,}8$	3,0
$0{,}8 < t < 1{,}0$	4,0
$t = 1{,}0$	4,5