

# SVENSK STANDARD

## SS-ISO 24394:2009/Amd 1:2012



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**Svetsning för flyg- och rymdteknik – Svetsarprovning och  
provning av svetsoperatörer – Svetsning av metalliska material –  
Tillägg 1 (ISO 24394:2008/Amd 1:2012, IDT)**

**Welding for aerospace applications – Qualification test for  
welders and welding operators – Fusion welding of metallic  
components –  
Amendment 1 (ISO 24394:2008/Amd 1:2012, IDT)**

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Den internationella standarden ISO 24394:2008/Amd 1:2012 gäller som svensk standard. Detta dokument innehåller den officiella engelska versionen av ISO 24394:2008/Amd 1:2012.

The International Standard ISO 24394:2008/Amd 1:2012 has the status of a Swedish Standard. This document contains the official version of ISO 24394:2008/Amd 1:2012.

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*Information about the content of the standard is available from the Swedish Standards Institute (SIS), telephone +46 8 555 520 00. Standards may be ordered from SIS Förlag AB, who can also provide general information about Swedish and foreign standards.*

Denna standard är framtagen av kommittén för Kvalifikationskrav vid svetsning, SIS/TK 134/AGS 445.

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

Amendment 1 to ISO 24394:2008 was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*.

Requests for official interpretations of any aspect of this amendment should be directed to the Secretariat of ISO/TC 44 via your national standards body. A complete listing of these bodies can be found at [www.iso.org](http://www.iso.org).

**SS-ISO 24394:2009/Amd 1:2012 (E)**

# Welding for aerospace applications — Qualification test for welders and welding operators — Fusion welding of metallic components

## AMENDMENT 1

### *Page 1, Clause 2*

Delete footnotes 1) and 2) and their citations from ISO 4063 and ISO 6947.

### *Page 3, 4.1.1*

Add the following paragraph at the end of the subclause.

The welding coordinator of the plant or the fabricator shall select from Table 2 the test piece as required for the production work on which the welder is to be employed. Two complementary specific test pieces (TP5 and TP6) may also be chosen as defined in 4.4 and 4.8.1.

### *Page 3, 4.1.3*

Delete this subclause.

### *Page 5, Table 1*

Replace the existing table with that on p. 3.

### *Page 6, 4.8.2*

Delete “.”, add “;” at the end of “g)” and add h).

- h) qualification for welding positions that are not covered by Table 1.

### *Page 8, 5.1*

Replace the first paragraph with the following:

The candidate shall provide documented evidence of satisfactory vision in accordance with the following requirements.

- a) Near-vision acuity shall permit reading of Times New Roman N5 maximum size or equivalent font types (Times New Roman of 5 points vertical height where 1 point =  $1/72$  in  $\equiv$  0,35 mm) at not less than 30 cm with at least one eye, corrected or uncorrected. This test shall be conducted with a minimum of six single spaced random capital characters.
- b) Colour perception shall be examined, e.g. according to the Ishihara test.

## SS-ISO 24394:2009/Amd 1:2012 (E)

### Page 8, 5.2

Replace the second and third sentences and the note with the following:

The welding coordinator shall have knowledge and experience relevant to the welding process, and be acceptable to the responsible design authority or recognized examining body. The welding coordinator may authorize another person to administer the welder or welding operator qualification test.

NOTE 1 Example of relevant knowledge is International Welding Engineer (IWE) according to IIW IAB-252-11.<sup>[5]</sup>

NOTE 2 The person responsible for welder and welding operator qualification tests can differ from the person responsible for implementing 4.1.1

### Page 10, Table 2

In column 2, row “TP1”, add the following at the end of footnote <sup>a</sup>.

— for materials susceptible to cracking, the welding sequence may be altered.

### Page 15, Clause 9

Replace the fourth paragraph with the following.

The person authorized to conduct the welder’s qualification test shall decide if and when a new test can be taken. If the welder or welding operator fails the test, the candidate shall have additional training and/or practice.

### Page 15, Clause 11

Add the following final paragraph.

Qualifications to previous revisions of this International Standard remain valid within the limits given in the preceding.

### Page 16, clause 12

Replace the third paragraph with the following.

For requalification tests, actual production parts may be used to replace test pieces, if they are consistent with the requirements of the welding process, the material group and testing as identified in the respective initial qualification test, e.g. requirements given in Table 1 and Table 3.

### Page 17–18, Table A.1

Replace the existing Table with that on pp. 4–5.

### Pages 19–20, Table A.2

In the “**Unacceptable imperfections**” column, row 8, “Spatter”, add a superscript <sup>e</sup>, Insert the following footnote at the bottom of the footer row.



<sup>e</sup> Spatter may be acceptable on welding processes or materials where it cannot be avoided. In such cases, the acceptability is at the discretion of the welding coordinator.

Page 30, before the bibliography





Insert Annex F, which appears on p. 6.

Page 30, Bibliography

Add the following entry:

- [1] IAB-252-11, *IIW guideline for international welding engineers, technologists, specialists and practitioners — Personnel with qualification for welding coordination — Minimum requirements for the education, examination and qualification*. Available (viewed 2012-10-11) at: [http://www.iiwelding.org/WorkingUnits/QCMB\\_IAB/Documents/IAB-252r1-11-SV00-Guideline-for-Personnel-with-Qualification-for-Welding-Coordination-SV.pdf](http://www.iiwelding.org/WorkingUnits/QCMB_IAB/Documents/IAB-252r1-11-SV00-Guideline-for-Personnel-with-Qualification-for-Welding-Coordination-SV.pdf)

Table 1 — Range of qualification for welding positions

Test piece (see Table 2)	Welding position of test piece according to ISO 6947:2011	Qualified welding position														
		Plate or tube $D > 26$ mm										Tube $D \leq 26$ mm				
		Butt weld					Fillet weld					Butt weld			Fillet weld	
		PA	PC	PE	PF	PA	PB	PC	PD	PF	PA	PC	PF	PB	PD	PF
 TP1	PA	x	—	—	—	—	—	—	—	—	x <sup>a</sup>	—	—	—	—	—
	PC	x	x	—	—	—	—	—	—	—	—	x <sup>a</sup>	—	—	—	—
	PE	x	x	x	—	—	—	—	—	—	—	—	—	—	—	—
	PF	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
 TP2	PA	—	—	—	—	x	—	—	—	—	—	—	—	—	—	—
	PB	—	—	—	—	x	x	—	—	—	—	—	—	—	—	—
	PC	—	—	—	—	x	x	x	—	—	—	—	—	—	—	—
	PD	—	—	—	—	x	x	—	x	—	—	—	—	—	—	—
	PF	—	—	—	—	x	x	—	—	—	—	—	—	—	—	—
 TP3	PA	—	—	—	—	—	—	—	—	—	x <sup>bc</sup>	—	—	—	—	—
	PC	x	x	—	—	—	—	—	—	—	—	x <sup>c</sup>	—	—	—	—
	PF	—	—	—	—	—	—	—	—	—	x <sup>c</sup>	—	x <sup>c</sup>	—	—	—
 TP4	PB	—	—	—	—	(x)	(x)	—	—	—	—	—	—	x <sup>c</sup>	—	—
	PD	—	—	—	—	(x)	(x)	—	(x)	—	—	—	—	x <sup>c</sup>	x <sup>c</sup>	—
	PF	—	—	—	—	(x)	(x)	—	—	(x)	—	—	—	x <sup>c</sup>	—	x <sup>c</sup>

x indicates those welding positions for which the welder is qualified.

(x) indicates those welding positions for which the welder is qualified for welding on tube  $D > 26$  mm, but not on plate.

— indicates those welding positions for which the welder is not qualified.

NOTE 1 Plate or sheet qualification in the PA position also qualifies for welding tubing with  $D > 26$  mm in the PA position.

NOTE 2 Test pieces on tube do not qualify for sheet/plate. Tube welds do not contain weld start and stop points that are required for sheet or plate welds.

<sup>a</sup> Only applicable for longitudinal weld on a tube.

<sup>b</sup> Only applicable for a rotating tube with the torch in welding position PA.

<sup>c</sup> The qualification is valid for any tube of outer diameter equal to or larger than the outer diameter of the test piece.

Table A.1 — Required dimensions and permissible deviations of form

Dimensions in millimetres

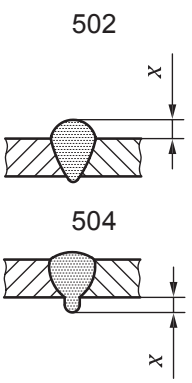
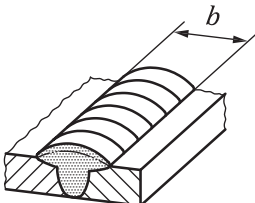
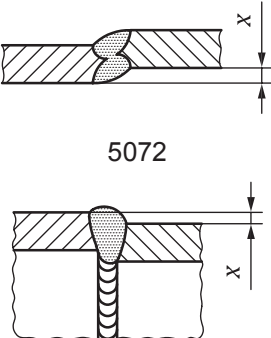
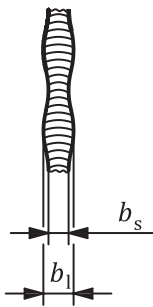
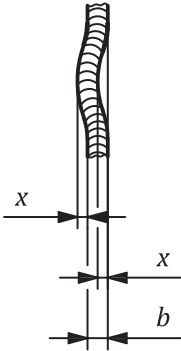
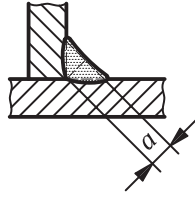
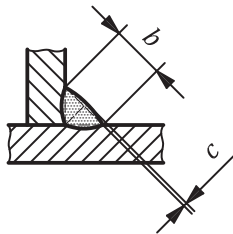
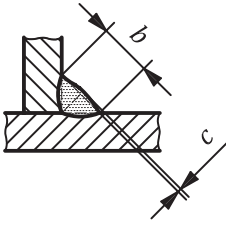
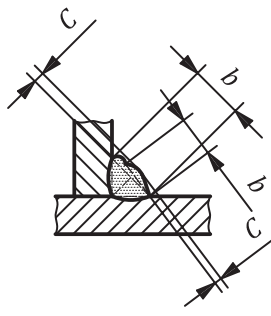
Imperfection <sup>a</sup>	Excess weld metal/ excess penetration		Weld width of face side		Linear misalignment
	502/504		5212		5071/5072
Illustration <sup>a</sup>					
Material group	A B C E	D	A B C E	D	A B C D E
Determination	$x = 0,6t + 0,6 \text{ mm}^b$	$x = 0,2t + 1,8 \text{ mm}^b$	$b = 1,8t + 5 \text{ mm}$	$b = 2t + 6 \text{ mm}$	$x = 0,1t + 0,3 \text{ mm}$ or $x = 0,5 \text{ mm}$ , whichever is less
Test piece thickness, $t^c$	max.	max.	max.	max.	max.
0,4	0,9	1,9	5,7	6,8	0,3
0,5	0,9	1,9	5,9	7,0	0,3
0,6	1,0	2,0	6,1	7,2	0,3
0,8	1,1	2,0	6,4	7,6	0,4
1,0	1,2	2,0	6,8	8,0	0,4
1,2	1,4	2,1	7,2	8,4	0,4
1,5	1,5	2,1	7,7	9,0	0,4
1,6	1,6	2,2	7,9	9,2	0,5
1,8	1,7	2,2	8,2	9,6	0,5
2,0	1,8	2,2	8,6	10,0	0,5
2,5	2,1	2,3	9,5	11,0	0,5
3,0	2,4	2,4	10,4	12,0	0,5

Table A.1 (continued)

Dimensions in millimetres

Imperfection <sup>a</sup>	Weld width deviation <sup>d</sup>	Weld track deviation	Throat thickness <sup>e</sup>			
Illustration <sup>a</sup>		 <p>Deviations from the intended weld track shall be smooth and uniform on the face side of the weld.</p>				
			desirable fillet weld profiles			
						
acceptable fillet weld profiles						
Material group	A B C D E	A B C E	D	A B C D E	A B C E	D
Determination	$x = [2(b_1 - b_2)] / (b_1 + b_2)$	$x = 0,25 b_{max}^f$		$a = 0,7 t$	$a = 0,4t + 2 \text{ mm}$	$a = 0,4 t + 3,1 \text{ mm}$
Test piece thickness, <sup>c</sup>	max.	max.	max.	min.	max.	max.
0,4	25 %	1,4	1,7	0,3	2,1	3,2
0,5		1,5	1,8	0,4	2,1	3,2
0,6		1,5	1,8	0,4	2,2	3,4
0,8		1,6	1,9	0,6	2,4	3,5
1,0		1,7	2,0	0,7	2,4	3,5
1,2		1,8	2,1	0,8	2,5	3,6
1,5		1,9	2,2	1,1	2,6	3,7
1,6		2,0	2,3	1,1	2,7	3,8
1,8		2,1	2,4	1,3	2,8	3,9
2,0		2,2	2,5	1,4	2,8	3,9
2,5		2,4	2,8	1,8	3,0	4,1
3,0		2,6	3,0	2,1	3,2	4,3
<sup>a</sup>	Ordinal number according to ISO 6520-1 given, where available.					
<sup>b</sup>	In case of misalignment, determination is to be made from the outermost surface.					
<sup>c</sup>	For fillet mating parts of non-uniform thicknesses, the smaller thickness shall be taken as reference.					
<sup>d</sup>	$b_1$ is the largest measured weld width and $b_2$ is smallest measured weld width.					
<sup>e</sup>	Convexity $C$ of a weld or individual surface bead $b$ shall not exceed the following value:					
	weld width of face side or individual surface bead, $b$			convexity, $C$		
	$b \leq 8 \text{ mm}$			$\leq 1,6 \text{ mm}$		
	$8 \text{ mm} < b < 25 \text{ mm}$			$\leq 3 \text{ mm}$		
	$b \geq 25 \text{ mm}$			$\leq 5 \text{ mm}$		
<sup>f</sup>	See column "Weld width of face side" for values of $b_{max}$ .					