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AMENDMENT 1
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Approval testing of welders — Fusion welding —

Part 2: Aluminium and aluminium alloys

AMENDMENT 1

Qualification des soudeurs — Soudage par fusion —

Partie 2: Aluminium et ses alliages

AMENDEMENT 1



Reference number
ISO 9606-2:1994/Amd.1:1998(E)

Foreword

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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.

Amendment 1 to International Standard ISO 9606-2:1994 was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, subcommittee SC 11, *Approval requirements for welding and allied processes personnel*.

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Part 2: Aluminium and aluminium alloys

AMENDMENT 1

1 Scope

Delete the 5th paragraph and replace it by the following.

The welding processes referred to in this part of ISO 9606 include those fusion welding processes which are designated as manual or partly mechanized welding. This International Standard does not cover fully mechanized and automatic welding processes (see 5.2).

Delete the 7th paragraph and replace it by the following.

The certificate of approval testing is issued under the sole responsibility of the examiner or examining body.

2 Normative references

Add the following reference.

ISO 9017:—¹⁾, *Destructive tests on welds in metallic materials — Fracture test*.

3 Definitions

Delete 3.1.

3.1.1 manual welder

To be numbered 3.1 and amend title to "welder".

3.1.2 welding operator

To be numbered 3.2.

1) To be published.

3.2 examiner or test body

To be numbered 3.3.

Amend title to "examiner or examining body".

Delete definition and replace by the following:

A person or organization who verifies compliance with the applicable standard. The examiner/examining body shall be acceptable to any contracting party.

3.3 welding procedure specification (WPS)

To be numbered 3.4.

3.4 heat treatment

To be numbered 3.5.

3.5 range of approval

To be numbered 3.6.

3.6 test piece

To be numbered 3.7.

3.7 test specimen

To be numbered 3.8.

3.8 test

To be numbered 3.9.

4.4 Miscellaneous

Delete line 3 "gb welding with gas backing".

Footnote 4) to 5.3 — replace the last three words by "flat extruded bars."

5.4.2.1 Group W 21: Pure aluminium

Delete 5.4.2.1 and replace it by the following.

Pure aluminium and aluminium-manganese-alloys with $\leq 1,5$ % impurities or alloy content, e.g.

- Al 99,8 (A)
- Al 99,5
- Al Mn 1

5.4.2.2 Group W 22: Non-heat treatable alloys

Delete 5.4.2.2 and replace it by the following.

Non-heat treatable alloys (Aluminium-magnesium-alloys), e.g.

- Al Mg 1,5 (C)

- Al Mg 5
- Al Mg 3 Mn
- Al Mg 4,5 Mn 0,7
- Al Si alloys

5.4.2.3 Group W 23: Heat treatable alloys

Delete 5.4.2.3 and replace by it the following.

Heat treatable alloys, e.g.

- Al Mg 1 SiCu
- Al Si 1 MgMn
- Al SiMg (castings)
- Al SiCu (castings)
- Al Zn 4,5 Mg 1

5.5 Filler metal and shielding gas

Amend the title to "Consumables".

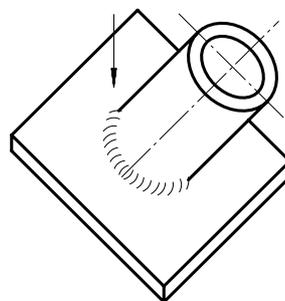
6.2 Welding process

Delete items a) and b) and replace them by the following.

- a) successful completion of an approval test simulating the multi-process joint, i.e. the root run welded by TIG (141) without backing, subsequent runs or layers welded by MIG (131) within the limits of the range of approval for each welding process;
- b) successful completion of separate relevant approval tests, one for TIG (141) without backing for the root run and a separate test for the fill by MIG (131) with backing or welded from both sides with or without gouging.

Figure 2

In b), add the following drawing.



PA Pipe: rotating
 Axis: inclined
 Weld: flat

6.3 Joint types

Delete item b) and replace it by the following.

- b) approval for butt welds in plates in all relevant positions covers butt welds on pipes having an outside diameter greater than or equal to 500 mm, except item c) also applies;

6.5 Filler metal and shielding gas

Amend the title to "Welding consumables".

7.1 Supervision

Delete the first sentence and replace it by the following.

The welding and testing of test pieces shall be witnessed by an examiner or examining body.

7.3 Welding conditions

Replace "WPS" by "WPS or pWPS" in the first and second sentence and in items k) and l).

Delete items e) and g) and reletter items f) and h) to n) accordingly.

Replace the last part of item c) by "cleaning and degreasing is necessary".

Table 6

Add one row and one column indicated below.

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Table 6 — Range of approval according to welding position

Welding position of approval test piece			Range of approval																						
			Plates										Pipes												
			Butt welds					Fillet welds					Butt welds				Fillet welds								
			Pipe-axis and angle																						
			Rotating		Fixed		Rotating		Fixed		Rotating		Fixed		Rotating		Fixed								
0°		90°		45°		0°		90°		45°		0°		90°											
PA	PC	PG	PF	PE	PA	PB	PG	PF	PD	PA	PG	PF	PC	H-L045	PA	PB	PG	PF	PD ²⁾						
Plates	Butt welds	PA	*	—	—	—	x	x	—	—	x	—	—	—	x	x	—	—	—						
		PC	x	*	—	—	x	x	—	—	x	—	—	x	—	x	x	—	—	—					
		PG	—	—	*	—	—	x	—	—	—	—	—	—	—	—	—	—	—	—					
		PF	x	—	—	*	x	x	—	x	x	—	—	—	—	x	x	—	x	—					
		PE	x	x	—	x	*	x	x	—	x	x	x	—	—	x	x	—	x	x					
	Fillet welds	PA	—	—	—	—	*	—	—	—	—	—	—	—	—	x	—	—	—	—					
		PB	—	—	—	—	x	*	—	—	—	—	—	—	—	x	x	—	—	—					
		PG	—	—	—	—	—	—	*	—	—	—	—	—	—	—	—	—	—	—					
		PF	—	—	—	—	x	x	—	*	—	—	—	—	—	x	x	—	—	—					
		PD	—	—	—	—	x	x	—	x	*	—	—	—	—	x	x	—	—	x					
Pipes	Butt welds Pipe-axis and angle	Rotating	0°	PA	x	—	—	—	—	x	x	—	—	—	*	—	—	—	—	x	x	—	—	—	
			PG	—	—	x	—	—	—	x	—	—	—	*	—	—	—	—	—	—	x	—	—	—	
		Fixed	90°	PC	x	x	—	—	x	x	—	—	x	—	—	*	—	x	x	—	—	—	—	—	—
				H-L045	x	x	—	x	x	x	—	x	x	x	—	x	x	*	x	x	—	x	x	—	—
			45°	PA	—	—	—	—	x	—	—	—	—	—	—	—	—	*	—	—	—	—	—	—	—
	Fillet welds Pipe-axis and angle	Rotating	1)	PB	—	—	—	—	x	x	—	—	—	—	—	—	x	*	—	—	—	—	—	—	
		Fixed	0°	PG	—	—	—	—	—	—	x	—	—	—	—	—	—	—	—	*	—	—	—	—	
				PF	—	—	—	—	x	x	—	x	x	—	—	—	—	x	x	—	*	x	—	—	

Key
 * indicates the welding position for which the welder is approved in the approval test
 x indicates those welding positions for which the welder is also approved
 — indicates those welding positions for which the welder is not approved

1) PB for pipes may be welded in two versions
 a) pipe: rotating, axis: horizontal, weld: vertical
 b) pipe: fixed, axis: vertical weld: horizontal vertical

2) This is an approved position and is covered by the other related tests.

7.4 Test methods

Delete the first paragraph and replace it by the following.

Each completed weld shall be examined visually in the as-welded condition. When required (see table 7), visual examination can be supplemented by penetrant (see ISO 3452) or other test methods, and macro tests on butt welds.

Table 7

Delete table 7 and replace it by the following.

Table 7 — Test methods

Test method	Butt weld plate	Butt weld pipe	Fillet weld
Visual	*	*	*
Radiography	*1)	*1)	—
Bend or tensile	*2)	*2)	—
Fracture	*1)	*1)	*3) 4)
Macro (without polishing)	—	—	4)
Penetrant	—	—	—
Key			
* indicates that the test method is mandatory.			
— indicates that the test method is not mandatory.			
1) Radiography or fracture test shall be used, but not both.			
2) Tensile test may be used instead of bend test, e.g. for heat-treated alloys which receive no post-weld heat treatment. Bend or tensile shall be used additionally to radiography for MIG-welding (131) only.			
3) The fracture test should be supported by macro examination and penetrant testing when required by the examiner or examining body.			
4) The fracture test may be replaced by a macro examination of at least four sections, one of which will be taken from the stop/start location.			

7.5.2 Butt weld in plate

Delete 7.5.2 and replace it by the following.

When radiography is used, the inspection length [see figure 7a)] of the weld in the test pieces shall be radiographed in the as-welded condition in accordance with ISO 2437 using class B technique.

When fracture testing according to ISO 9017 is used, the full test piece inspection length shall be tested and to do this, the test piece shall be cut into several test specimens [see figure 7a)]. The length of any fracture test specimen shall be approximately 50 mm. If necessary, the excess weld metal of the test specimen may be removed and additionally the weld edges may be notched to a depth of approximately 5 mm to facilitate fracture in the weld metal [see figure 7b)]. In the case of single-sided welding (ss) without backing (nb), half of the inspection length shall be tested against the face side and the other half against the root side [see figures 7c) and 7d)].

When transverse bend testing according to ISO 5173 is used, two root bend test specimens and two face bend test specimens shall be tested in accordance with ISO 9956-4.

During testing, the test specimens shall not reveal any one single flaw greater than 3 mm in any direction. Failures appearing at the corners of a test specimen during testing shall be ignored in the evaluation.

For plate thicknesses greater than or equal to 12 mm, the transverse bend tests may be substituted by four side bend tests.

7.5.3 Fillet weld on plate

Delete 7.5.3 and replace it by the following.

For fracture tests according to ISO 9017, the test piece may be cut, if necessary, into several test specimens [see figure 8a)]. Each test specimen shall be positioned for breaking as shown in figure 8b), and examined after fracture.

When macro examination is used, four test specimens shall be taken, equally spaced in the inspection length.

7.5.4 Butt weld in pipe

Delete 7.5.4 and replace it by the following.

When radiography is used, the inspection length of the weld in the test piece shall be radiographed in the as-welded condition using agreed procedures until International Standards covering these tests are available except where double wall technique is necessary.

When fracture testing according to ISO 9017 is used, the full test piece inspection length shall be tested and to do this the test piece shall be cut into at least four test specimens [see figure 9a)].

A minimum weld length of 150 mm is required for testing of pipes. If the circumference is less than 150 mm, additional weld test pieces, but a maximum of three test pieces, will be required.

The inspection length of any test specimen shall be approximately 40 mm. If necessary, the excess weld metal of the test specimen may be removed and additionally the weld edges may be notched to a depth of approximately 5 mm to facilitate fracture in the weld metal [see figure 9b)]. In the case of single-side welding (ss) without backing (nb), half of the inspection length [see figure 9a)] shall be tested against the face side and the other half against the root side [see figures 9c) and 9d)].

When transverse bend testing is used, two root bend test specimens and two face bend test specimens shall be tested under the conditions in accordance with ISO 9956-4.

For the sectioning of test pieces welded in position PF, PG, H-L045 [see figures 2 and 9a)], the test specimens shall be taken from different welding positions.

During testing, the test specimens shall not reveal any one single failure greater 3 mm in any direction. Failures appearing at the corners of a test specimen during testing shall be ignored in the evaluation.

For wall thicknesses greater than or equal to 12 mm, the transverse bend tests may be substituted by four side bend tests.

Figure 7b)

Replace ≈40 by ≈50

Figure 8a)

Amend upper caption to "Inspection length of fillet weld".