
Specification for
**Approval testing of welders
working to approved welding procedures**
Part 2. TIG or MIG welding of aluminium
and its alloys

Spécification pour essai d'agrément des soudeurs qualifiés
pour les procédés de soudage agréés
Partie 2. Soudage à l'arc en atmosphère inerte avec électrode fusible
ou de tungstène de l'aluminium et des alliages d'aluminium

Spezifikation für Schweißerprüfung mit Verfahrensprüfung
Teil 2. WIG- und MIG-Schweißen von Aluminium und seinen Legierungen

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Foreword

This British Standard, which has been prepared under the direction of the Welding Standards Committee, is one of a series of standards on the approval testing of welders and welding procedures, the latter having a bearing on the former for certain applications. This link has been used as a means of arranging the series of standards into:

- (a) approval testing of welding procedures (see BS 4870 : Part 2);
- (b) welder approval when approval of the welding procedure is required;
- (c) welder approval when approval of the welding procedure is not required (for either technical or contract reasons) (see BS 4872 : Part 2).

For the purposes of this Part of this standard, a welder working to an approved procedure or a procedure being approved is considered to be sufficiently experienced in the appropriate welding process for aluminium and its alloys and hence already capable of passing tests such as those given in BS 4872 : Part 2.

To indicate the philosophy behind this series of standards, it is considered useful to give details of the practices relating to welding procedure approval. Depending upon the emphasis placed on quality control in the production of welded components, the approval of welding procedures

covered in this series of standards may be administered in one of several ways which should be stipulated at the enquiry and/or order stage. The alternatives currently employed are the following:

- (1) each individual contractor (or sub-contractor) may have proved by actual test pieces every weld form he wishes to use, in every thickness and material; or
- (2) each individual contractor (or sub-contractor) may have proved by actual test pieces; a set of welds representative on a group basis of all the various thicknesses and materials to be used in production; or
- (3) each individual contractor (or sub-contractor) need not make procedure test pieces provided he can prove by appropriate authentic documentation of an independent nature that he has previously satisfactorily welded the type of joint and material in question.

In respect of (1) and (2) it should be appreciated that once the welding procedure tests have been approved, they need never be repeated unless there is a change in certain variables. As an extension beyond (3), it may be possible by agreement between the contracting parties for fully documented welding procedures, developed independently of the particular contractor, to be employed without the need for further approval tests.

British Standard Specification for

Approval testing of welders working to approved welding procedures

Part 2. TIG or MIG welding of aluminium and its alloys

1. Scope

This Part of this British Standard specifies requirements for the approval testing of welders to be engaged on the manual or mechanized TIG or MIG welding of wrought aluminium and its alloys, for which an approved welding procedure has to be employed. If it is required to make approval tests for welding castings, the principles given in this standard may be applied, subject to agreement between the contracting parties.

Where the approval of a welder and a welding procedure are to be covered in one test, then BS 4870 : Part 2 applies.

2. References

The titles of the standards publications referred to in this Part of this standard are listed on the inside back cover.

3. Definitions

For the purposes of this Part of this British Standard the following definitions apply.

3.1 welding procedure. A specified course of action followed in welding including a list of materials and, where necessary, tools to be used*.

3.2 welding procedure test. The making and testing of a welded joint representative of that to be used in production in order to prove the feasibility of a welding procedure.

NOTE. This term is not usually applied to any tests that may have been made during the development of a welding procedure.

3.3 approved welding procedure. A documented welding procedure that has been approved by an inspecting authority either by means of a welding procedure test or as a result of authentic documented experience gained with the welding of joints similar to that to which the welding procedure applies.

3.4 welder approval test. A documented test, which has been approved by an inspecting authority, carried out by a welder working to an approved welding procedure.

3.5 test piece. Components welded together in accordance with a specified welding procedure, or a portion of a welded joint detached from a structure, for test*.

3.6 test specimen. A portion detached from a test piece and prepared as required for testing*.

3.7 inspecting authority. That competent independent body or association which verifies compliance with this standard.

4. Information to be given to the welder

The welder shall be provided with full written details according to clause 4 of BS 4870 : Part 2 : 1982 of the approved welding procedure which he shall follow in making his test weld (see also clause 8 of this standard).

5. Items to be recorded

The items given in appendix B shall be recorded for each welder approval test.

NOTE. Details of the welding procedure used should have been recorded previously by approval testing in accordance with BS 4870 : Part 2.

6. Extent of approval

6.1 General. The extent of approval for a welder shall be the same as that for the approved welding procedure. Although a change in the welding procedure according to clause 5 of BS 4870 : Part 2 : 1982 requires a new welding procedure test, this shall **not** entail reapproval of the welder in the following cases:

- (a) a change in parent metal from group 3(a) to group 3(b) or vice versa (see table 1);
- (b) a change from one filler metal group to any other group (see table 2);
- (c) a change of 50 % or less in the diameter of the filler rod or wire;
- (d) a change from single sided welding to double sided welding, but not the converse;
- (e) a change in pre-heating temperature;
- (f) a change in post-weld heat treatment.

Table 1. Grouping of parent metals

Group	Alloys*
1	1080A, 1050A, 1200, 3103, 3105
2	6063, 6061, 6082
3(a)	5005, 5251, 5154A, 5454
3(b)	5083
4	7020

* Alloy designations in accordance with BS 1470 to BS 1475 and the BS 4300 series. A comparison between the new and old designations is given in appendix A, together with the nearest equivalent ISO designations.

*This definition is taken from BS 499 : Part 1.

Table 2. Grouping of filler metals

Filler metal group	Filler metal types* in accordance with BS 2901 : Part 4
F1	G1A, G1B, NG3
F2	NG 21
F3	NG 5, NG 52, NG 6, NG 61

*A comparison between the new and old designations is given in appendix A together with the nearest equivalent ISO designations.

6.2 Position. The approval of a welder on a test joint in sheet or plate welded in one of the fundamental welding positions shall give approval for welding in the following positions:

- (a) a test in the flat position gives approval only for that position;
- (b) a test in the horizontal-vertical position includes approval for the horizontal-vertical and flat positions;
- (c) a test in the overhead position includes approval for the overhead, horizontal-vertical and flat positions;
- (d) a test in the vertical-up position includes approval for the vertical-up and flat positions;
- (e) a test in the vertical-down position gives approval only for that position;
- (f) a test joint inclined at 45° to the horizontal involving the overhead position, includes approval for all welding positions.

Approval for all four fundamental positions includes approval for all intermediate positions.

In the case of pipe welds, the extent of approval shall be as given in table 3.

Table 3. Positional approval for pipe

Pipe position during test	Pipe movement during test	Welding positions for which approval is given
Horizontal	Rotated	Flat
Vertical	Rotated or fixed	Horizontal-vertical, flat
Horizontal 45°	Fixed	Flat, vertical, overhead
	Fixed	All

6.3 Thickness. The approval of a welder on material of thickness t shall include approval for thicknesses in the range $0.75t$ to $2t$, except that a test made on material 20 mm thick or over shall give approval for welding material 15 mm thick and above.

6.4 Pipe† outside diameter or dimension. The approval of a welder on pipe of outside diameter or dimension D shall include approval for diameters or dimensions in the range $0.5D$ to $2D$, except that a test made on pipe of outside diameter or dimension 168.3 mm or larger shall give

approval for welding outside diameters or dimensions 88.9 mm and above. For rectangular structural hollow sections D shall be the dimension of the smaller side. For branch connections D shall be the diameter or dimension of the branch.

6.5 Pipe covering for plate. The approval of a welder on a test butt joint in pipe shall include approval for a butt joint in sheet or plate for the same test conditions, but the converse shall not apply.

6.6 More than one welder. When more than one welder is employed on making a complete test weld, the satisfactory testing of the test weld shall approve each welder only for his respective portion.

7. Test pieces

The welder shall weld a test piece or pieces representative of each type of joint to which the welding procedure will relate in production, preferably selected from the following.

- (a) A butt joint (sheet or plate and/or pipe). (See figures 1(a), 1(b), 2(a), 2(b), and 2(c).)
- (b) A fillet weld (sheet or plate). (See figure 3.)
- (c) A branch connection (pipes) forming the minimum angle, θ , likely to be involved in production. (See figure 4.)

The root run of the test weld shall be stopped and restarted within the central 50 mm of the length of the test piece as shown in figure 1(a) and at about 75 mm from one end of the test piece as shown in figure 3. The test piece shall be marked so that the stop/start position is identifiable after the test weld has been completed.

If the production joint design or application is such that none of the above types of test piece could be regarded as representative, e.g. attachment welds to thin pipes, then the welder shall make a special test piece which simulates the production joint in all essential features, e.g. dimensions, restraint, access, heat-sink effects, any special surface protection. The type of special test piece to be welded, and the tests to be carried out shall be agreed between the contracting parties at the time of placing an order.

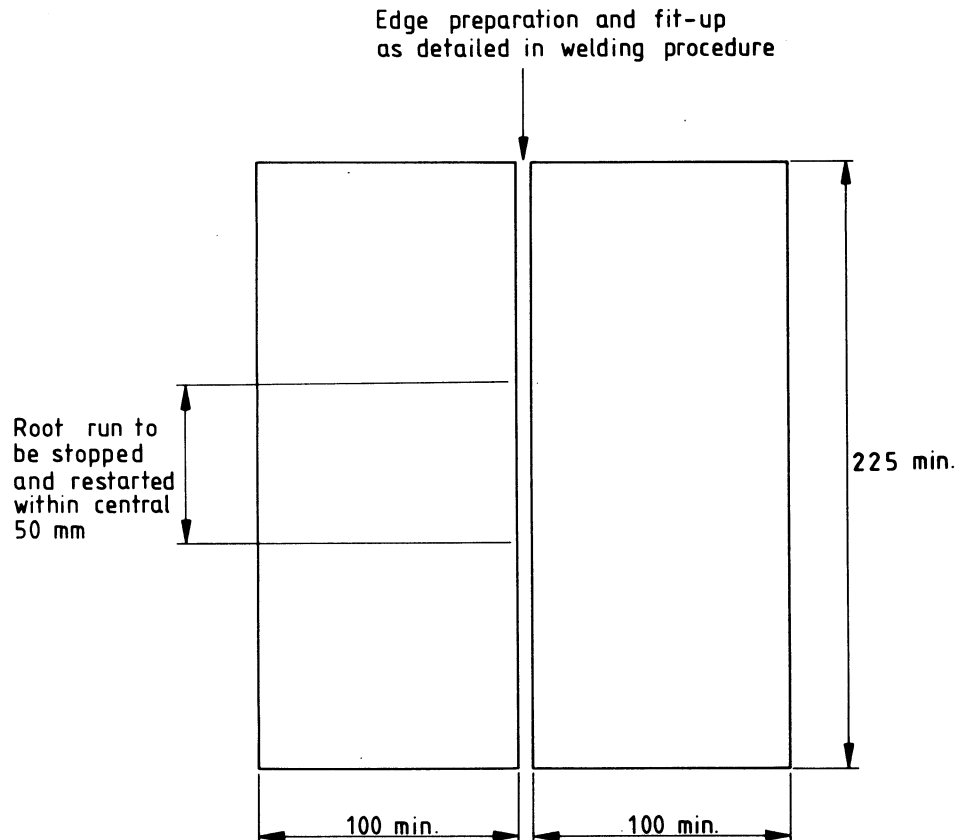
Tack welds to be incorporated in the final joint shall be made from the side to be welded and their location shall be identifiable after the test weld has been completed.

Subsurface defects that break the surface or which are revealed as the result of grinding specified in the welding procedure shall not be repaired. There shall be no repair welding of a completed test piece.

8. Submission of test weld

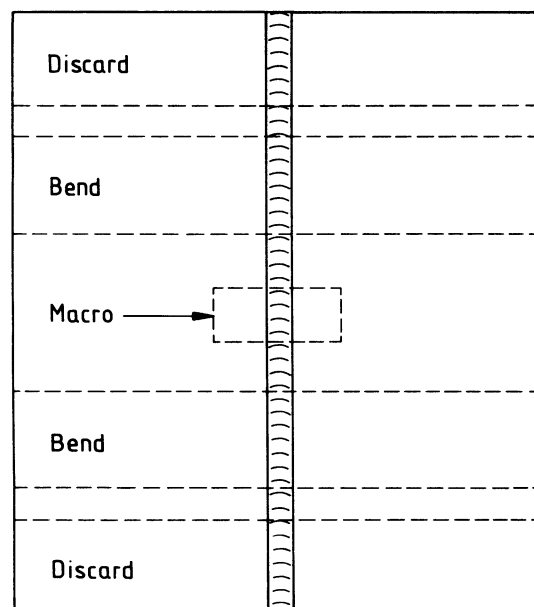
If the welder realises that for some reason the test weld he has made is likely to fail the subsequent examination and testing, he may withhold the test piece and make a second test weld. If the welder does choose to make a second test weld, it is the second test piece that shall be examined and tested, the first test piece being scrapped.

†In this standard the word 'pipe' alone or in combination is used to mean 'pipe' or 'tube' or 'structural hollow section' (circular or rectangular), although these terms are often used for different categories of product by different industries.



All dimensions are in millimetres.

(a) Test piece



(b) Location of specimens

Figure 1. Test piece and location of test specimens for butt weld in sheet or plate
(see clause 7)