

Specification for

Approval testing of welding procedures —

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

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- British Gas Corporation
- Electricity Supply Industry in England and Wales
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- Heating and Ventilating Contractors' Association
- National Coal Board
- Power Generation Association (BEAMA)
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- United Kingdom Atomic Energy Authority

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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;
- b) welder approval when approval of the welding procedure is required (see BS 4871-2);
- c) welder approval when approval of the welding procedure is not required (for either technical or contract reasons) (see BS 4872-2).

For the purposes of this Part of this standard, the welder who makes the manual welding procedure test 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 4872-2.

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.

The need for a welding procedure to be approved in accordance with the requirements of this Part of this standard should be specified in the application standard or be agreed between the contracting parties. Although a welding procedure may already have been approved, each manufacturer should accept responsibility for the procedure used on a contract and for the ability of the welders to apply the procedure.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 14, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This Part of this British Standard specifies requirements for the approval testing of welding procedures for the TIG or MIG welding of wrought aluminium and its alloys.

Approval of a welding procedure to this Part of this standard does not imply that the procedure is suitable for all conceivable conditions of service; supplementary tests may be required for particular applications. If the procedure is required for welding castings, the principles given in this standard may be applied, subject to agreement between the contracting parties.

2 References

The titles of the 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 used¹⁾

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

NOTE 2 Sometimes an additional joint of a different type is welded in order to obtain relevant test data.

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

test piece

components welded together in accordance with a specified welding procedure, or a portion of a welded joint detached from a structure, for test¹⁾

3.5

test specimen

a portion detached from a test piece and prepared as required for testing¹⁾

3.6

inspecting authority

that competent independent body or association which verifies compliance with this standard

4 Items in a welding procedure test

4.1 General. All the items listed in 4.2 and the items in 4.3 relevant to the particular welding process shall be recorded for each welding procedure test.

NOTE Not all of these items need be included in the approved welding procedure documentation.

4.2 Items for both welding processes. Details relating to the following items shall be recorded for both welding processes:

- a) welding process or processes when more than one is used in making a complete joint;
- b) parent metal specification, thickness and for pipe²⁾ the outside diameter or dimension;
- c) whether shop or in situ welding;
- d) weld preparation (sketch);
- e) pre-weld cleaning, degreasing;
- f) fit-up (sketch);
- g) jiggling or tacking;
- h) permanent or temporary backing with details of groove;
- i) welding position (including direction for vertical position);
- j) filler metal specification and size;
- k) pre-heating and interpass temperature, if required, including method and control;
- l) welding speed (mechanized welding);
- m) shielding gas composition and flow rate;
- n) nozzle diameter;
- o) for pulsed welding, the pulse and background times, currents and voltages;
- p) welding head position and torch angle (mechanized welding);
- q) approximate number and arrangement of runs and weld dimensions (sketch);
- r) welding sequence;
- s) details of oscillation or weaving, if any;
- t) back gouging;

¹⁾ This definition is taken from BS 499-1.

²⁾ 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.

u) post-weld heat treatment if required, including method and control;

v) any special features.

4.3 Items specific to the welding process.

Details relating to the items given in 4.3 a) and 4.3 b) shall be recorded for TIG welding and MIG welding respectively, in addition to the items given in 4.2.

a) TIG welding

- 1) current range;
- 2) for mechanized welding, arc length or voltage;
- 3) a.c. or d.c. and polarity;
- 4) tungsten electrode diameter and type;
- 5) power source type and special features, e.g. use of d.c. suppressors, h.f. initiation or arc stabilization;
- 6) single or double welder technique.

b) MIG welding

- 1) current range or wire feed speed;
- 2) arc voltage range;
- 3) electrode extension (mechanized welding);
- 4) power source characteristic, e.g. constant voltage or constant current.

5 Changes affecting approval

A welding procedure test shall be carried out when any of the following changes are made to an approved welding procedure:

- a) any change in welding process³⁾ or combination of processes;
- b) any change in parent metal, thickness or pipe outside diameter or dimension, subject to the extent of approval given in clause 6;
- c) any change in joint detail (gap, root face or backing) or a significant change in joint configuration, e.g. from a butt to a fillet;
- d) any change in fundamental welding position (flat, horizontal-vertical, vertical, overhead; see BS 499-1 for definitions). For sheet or plate these positions are directly applicable to the test weld.

Approval on welds made in all four fundamental positions includes approval for all intermediate positions.

For pipe it is more convenient to define the pipe position and movement during the test as given in Table 1.

Table 1 — 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
Horizontal	Fixed	Flat, vertical, overhead
45°	Fixed	All

e) any change in welding technique (e.g. a change from the vertical-upward method to the vertical-downward method, double or single welder);

f) any change in the use of filler material (change from or to autogenous welding);

g) any change in the specification of filler material or in the type of shielding gas;

h) any change of more than 25 % of the diameter of the filler rod or wire;

i) any change in arc voltage range for MIG welding;

j) any change in the range or type of welding current (e.g. from a.c. to d.c., or change in polarity);

k) any change in pre-heating temperature, if used;

l) any change in post-weld heat treatment, if used.

6 Extent of approval

6.1 Parent metal. The approval of a welding procedure for pipe is valid for plate in the same thickness and fundamental position but the converse shall not apply. For thickness approval, see 6.2. For positional approval for pipe, see Table 1.

For the purposes of this standard, parent metals have been grouped as shown in Table 2. The approval of a procedure to weld a particular type of material shall include approval only for all the other materials in the same group⁴⁾. When it is required to join together alloys from different groups, procedure approval shall be obtained for the particular combination of materials.

³⁾ This includes consideration of changes in the mode of transfer, arc characteristics or other welding parameters listed in clause 4. For these reasons a welding procedure test may be required. A change in the number of runs without changing other variables does not require reapproval.

⁴⁾ For this purpose group 3(a) and 3(b) are regarded as separate groups.