British Standard

BRITISH STANDARD

BS 2901-4: 1990

Filler rods and wires for gas-shielded arc welding —

Part 4: Specification for aluminium and aluminium alloys and magnesium alloys

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Welding Standards Policy Committee (WEE/-) to Technical Committee WEE/39, upon which the following bodies were represented:

Aluminium Federation
Association of Welding Distributors
British Association for Brazing and Soldering
British Compressed Gases Association
British Constructional Steelwork Association Ltd.
British Shipbuilders
British Steel Industry
Electricity Supply Industry in England and Wales
Engineering Equipment and Materials Users ' Association
Power Generation Contractors' Association (BEAMA Ltd.)
Process Plant Association
Welding Institute
Welding Manufacturers' Association (BEAMA Ltd.)
Coopted members

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

British Non-ferrous Metals Federation
British Nuclear Fuels Limited
British Railways Board
British Steel Industry (Wire Section)
Stainless Steel Wire Industry Association
United Kingdom Atomic Energy Authority

This British Standard, having been prepared under the direction of the Welding Standards Policy Committee, was published under the authority of the Board of BSI and comes into effect on 30 September 1990

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Fourth edition September 1990

The following BSI references relate to the work on this standard:
Committee reference WEE/39
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Amendments issued since publication

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Contents

Foreword

This revision of this Part of BS 2901 has been prepared under the direction of the Welding Standards Policy Committee. BS 2901 is published in Parts covering the following types of consumables.

a) Part 1: covers ferritic steels.

b) Part 2: covers stainless steels.

c) Part 3: covers copper and copper alloys.

d) Part 4: covers aluminium and aluminium alloys and magnesium alloys.

e) Part 5: covers nickel and nickel alloys.

This Part of BS 2901 supersedes BS 2901-4:1983 which is withdrawn.

In accordance with current practice, in deciding on the dimensions of wires and reels, account has been taken of appropriate ISO (International Organization for Standardization) specifications.

The chemical composition of the deposited weld metal is not specified because this depends on the particular welding conditions. Advice on the selection of filler metals is included in BS 3019-1 and BS 3571-1.

Product certification. Users of this British Standard are advised to consider the desirability of third party certification of product conformity with this British Standard based on testing and continuing surveillance, which may be coupled with assessment of a supplier's quality systems against the appropriate Part of BS 5750.

Enquiries as to the availability of third party certification schemes will be forwarded by BSI to the Association of Certification Bodies. If a third party certification scheme does not already exist, users should consider approaching an appropriate body from the list of Association members.

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 6, 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 BS 2901 specifies requirements and chemical compositions for aluminium and aluminium alloy filler rods and wires and magnesium alloy filler rods for gas-shielded arc welding, i.e. TIG-welding or MIG-welding.

NOTE The titles of the publications referred to in this Part of BS 2901 are listed on the inside back cover.

2 Chemical composition

The rods and wires shall have a chemical composition in accordance with Table 1 or Table 2 for the particular type ordered.

In cases of dispute regarding the chemical composition of the rods and wires, check analysis shall be carried out.

NOTE 1 Some suitable methods are given in BS 1728 and BS 3907.

For the purposes of determining compliance with composition limits, any value obtained from the analysis shall be rounded to the same number of decimal places as used in this standard in expressing the specified limit. The following rules shall be used for rounding.

a) When the figure immediately after the last figure to be retained is less than five, then the last figure to be retained shall be kept unchanged.

b) When the figure immediately after the last figure to be retained is either:

1) greater than five; or

2) equal to five and followed by at least one figure other than zero;

then the last figure to be retained shall be increased by one.

c) When the figure immediately after the last figure to be retained is equal to five, and followed by zeros only, then the last figure to be retained shall be left unchanged if even, and increased by one if odd.

NOTE 2 The purchaser should indicate whether a test certificate for the chemical analysis of rods and wires is required.

3 Diameters and tolerances

The diameters of rods and wires shall be selected from the values given in Table 3 with tolerances appropriate to the specified diameters.

4 Condition of rods and wires

4.1 Finish

Rods and wires shall have a smooth finish, free from surface imperfections, corrosion products, grease or other foreign matter which would adversely affect the quality of the weld or the operation of the welding equipment.

4.2 Temper of rods

Rods shall be supplied in the as manufactured (M) temper.

4.3 Temper, cast and helix of wire

The temper and cast of wires shall be such as to assist smooth feeding of the wire.

NOTE 1 This is normally the subject of agreement between the purchaser and the supplier.

The helix of spooled filler wire shall be such that when one complete loop or circle of wire taken from the spool is laid on a flat surface without restraint, the vertical separation between and part of the loop and the flat surface shall not exceed the value given in Table 4.

NOTE 2 Although helix has been specified it should be noted that other factors which can not be quantified also affect the feeding of wire.

5 Spools of wire

The size of spool on which the particular diameter of wire is to be supplied shall conform to the appropriate dimensions and mass given in Figure 1 and Table 5 and Table 6.

NOTE 1 It is necessary for the purchaser to designate the type and size at the time of placing the order.

The flanges of spools shall be sufficiently robust to avoid becoming deformed in normal usage.

NOTE 2 The barrel diameter for spools should be as large as possible to permit satisfactory feeding of the wire.

Table 1 — Chemical compositions for aluminium and aluminium alloys (percentage by mass)

Type	Silicon		Iron	Copper	Manganese		Manganesium		Chromium		Zinc	Titanium		Beryllium	Other elements			Aluminium
	min.	max.	max.	max.	min.	max.	min.	max.	min.	max.	max.	min.	max.	max.	Specified element	Maximum unspecified elements		
																Each	Total	
1080A	—	0.15[a]	0.15	0.03	—	0.02	—	0.02	—	—	0.06	—	0.02	0.0008	0.03 max. gallium	0.02	—	99.80 min.
1050A	—	0.25[a]	0.04	0.05	—	0.05	—	0.05	—	—	0.07	—	0.05	0.0008	—	0.03	—	99.05 min.
3103	—	0.50	0.7	0.10	0.9	1.5	—	0.30	—	0.10	2.20	—	—	0.0008	0.10 max. zirconium + titanium	0.05	0.15	Remainder
4043A	4.5	6.0	0.6	0.30	—	0.15	—	0.20	—	—	0.10	—	0.15	0.0008	—	0.05	0.15	Remainder
4047A	11.0	13.0	0.6	0.30	—	0.15	—	0.10	—	—	0.20	—	0.15	0.0008	—	0.05	0.15	Remainder
5154A	—	0.50	0.50	0.10	0.10	0.50	3.1	3.9	—	0.25	0.20	—	0.20	0.0008	0.10 to 0.50 manganese + chromium	0.05	0.15	Remainder
5554	—	0.25	0.40	0.10	0.50	1.0	2.4	3.0	0.05	0.20	0.25	0.05	0.20	0.0008	—	0.05	0.15	Remainder
5056A	—	0.40	0.50	0.10	0.10	0.6	4.5	5.6	—	0.20	0.20	—	0.20	0.0008	0.10 to 0.6 manganese + chromium	0.05	0.15	Remainder
5356	—	0.25	0.40	0.10	0.05	0.20	4.5	5.5	0.05	0.20	0.10	0.06	0.20	0.0008	—	0.05	0.15	Remainder
5556A	—	0.25	0.40	0.10	0.6	1.0	5.0	5.5	0.05	0.20	0.20	0.05	0.20	0.0008	—	0.05	0.15	Remainder
5183	—	0.40	0.40	0.10	0.50	1.0	4.3	5.2	0.05	0.25	0.25	—	0.15	0.0008	—	0.05	0.15	Remainder

[a] The silicon content should be less than that of iron.

Table 2 — Chemical compositions for magnesium alloys (percentage by mass)

Type	Aluminium		Zinc		Manganese		Zirconium		Rare earth metals		Thorium		Copper max.	Silicon max.	Iron max.	Nickel max.	Magnesium	Notes
	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.						
MAG 1	7.5	9.0	0.3	1.0	0.15	0.4	—	—	—	—	—	—	0.15	0.3	0.05	0.01	Remainder	Cu + Si + Fe + Ni 0.40 max.
MAG 3	9.0	10.5	0.3	1.0	0.15	0.4	—	—	—	—	—	—	0.15	0.3	0.05	0.01	Remainder	Cu + Si + Fe + Ni 0.40 max.
MAG 5	—	—	3.5	5.0	—	—	0.4	1.0	0.75	1.75	—	—	0.03	—	—	0.005	Remainder	—
MAG 6	—	—	0.8	3.0	—	—	0.4	1.0	2.5	4.0	—	—	0.03	—	—	0.005	Remainder	—
MAG 8	—	—	1.7	2.5	—	0.15	0.4	1.0	—	0.10	2.5	4.0	0.03	0.01	0.01	0.005	Remainder	—
MAG 9	—	—	5.0	6.0	—	0.15	0.4	1.0	—	0.20	1.5	2.3	0.03	0.01	0.01	0.005	Remainder	—
MAG 111	2.5	3.5	0.6	1.4	0.15	0.40	—	—	—	—	—	—	0.1	0.1	0.03	0.005	Remainder	Ca 0.04 max.
MAG 141	—	0.02	0.75	1.5	—	0.15	0.4	0.8	—	—	—	—	0.03	0.01	0.01	0.005	Remainder	—

Table 3 — Diameters and tolerances

From	Diameter	Tolerance	
		Wire	Rod
	mm	mm	mm
Wire	0.8 1.0	± 0.02	—
Wire or rod	1.2 1.6 2.4	+ 0.02 − 0.04	± 0.03
Rod	3.2 4.0 5.0 6.0	—	± 0.05

6 Spooling conditions

The wire shall be wound on the spool in one continuous length and shall be free from kinks, waves, sharp bends or twists, so that it is free to unwind without restriction.

The outer layer of wire shall be not closer to the flange periphery than the value given in Table 7 for the appropriate flange diameter.

7 Lengths of rods[1)]

The length of rod supplied shall be one of the following:

a) 500 mm or 1 000 mm for rods of less than 2.5 mm diameter;

b) 1 000 mm for rods of 2.5 mm diameter and larger;

c) a length as stated at the time of placing the order.

NOTE Options 7 a) and 7 b) are the preferred lengths.

The tolerance on each length shall be ± 5 mm.

8 Packing

Rods and spools of wire shall be suitably packed to guard against damage, contamination or deterioration during storage and transportation. Spools shall be packed in cartons of suitable construction and shall be heat sealed in plastics bags.

NOTE If special conditions apply, e.g. transportation to a tropical region, the purchaser should state them at the time of placing the order.

Table 4 — Helix of wire

Diameter of spool	Helix
mm	mm
100	12
300	25
435	25

9 Marking

Each package of rods and each spool of wire and its outer packing shall be clearly marked with the following information.

a) The name of the supplier.

b) The designation of type of rod or wire.

NOTE If individual identification of rods is required this is to be agreed between the purchaser and supplier at the time of placing the order.

c) The size and quantity or mass of rod or wire.

d) The identification number for traceability.

e) A health warning (see Appendix A) consisting of the general warning sign (**A.2.9** of BS 5378-1:1980) accompanied by the following.

FUMES AND GASES CAN BE DANGEROUS TO YOUR HEALTH. ARC RAYS CAN INJURE EYES AND BURN SKIN. ELECTRIC SHOCK CAN KILL.

READ AND UNDERSTAND THE MANUFACTURER'S INSTRUCTIONS AND YOUR EMPLOYER'S SAFETY PRACTICES.

10 Supplier's certificate

If required, the supplier shall provide a certificate stating that the rods or wires comply with BS 2901-4:1990[2)].

[1)] The lengths specified in 7 a) and 7 b) are in accordance with ISO 544:1989.

[2)] Marking BS 2901-4:1990 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is therefore solely the responsibility of the person making the claim. Such a declaration is not to be confused with third party certification of conformity, which may also be desirable.

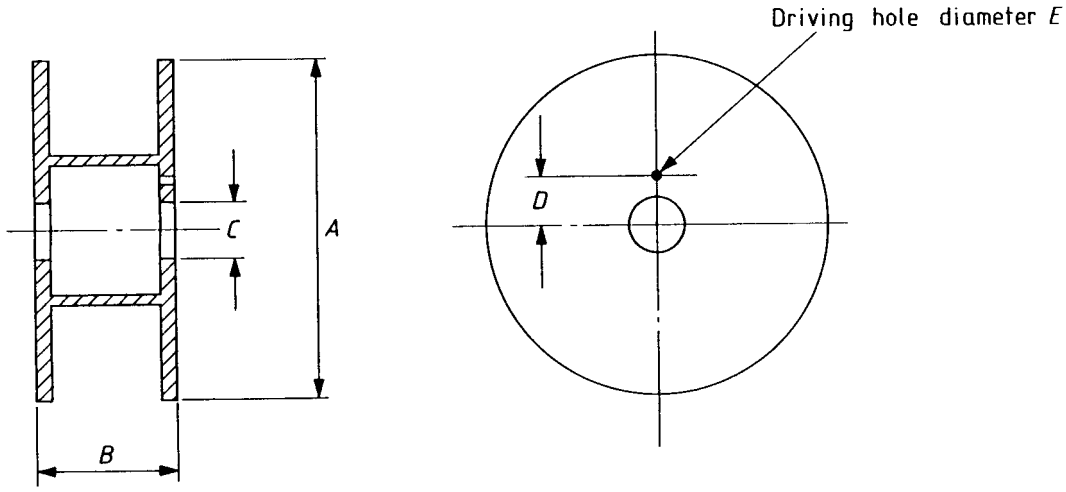

Figure 1 — Spool

Table 5 — Dimensions of spools

A		*B*		*C*		*D*		*E*	
Diameter	**Tolerance**	**Width**	**Tolerance**	**Diameter**	**Tolerance**	**Distance between axes**	**Tolerance**	**Diameter**	**Tolerance**
mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
100	+ 2 – 2	45	+ 0 – 2	16	+ 1 – 0	—	—	—	—
300	+ 5 – 5	103	+ 0 – 3	50.5	+ 2.5 – 0	44.5	+ 0.5 – 0.5	10	+ 1 – 0
435	+ 5 – 5	103	+ 0 – 3	50.5	+ 2.5 – 0	44.5	+ 0.5 – 0.5	10	+ 1 – 0

NOTE The Dimension specified are in accordance with ISO 864:1988 and shown in Figure 1.

Table 6 — Maximum masses for aluminium and aluminium alloy wire on spools

Wire diameters	**Masses for wire on spools having flange diameters of**		
	100 mm	**300 mm**	**435 mm**
mm	kg	kg	kg
0.8	0.5	5.0	
1.0	0.5	6.5	
1.2 and 1.6	0.5	6.5	15
2.4		6.5	15

NOTE Magnesium alloys are not normally supplied as filler wire for MIG-welding.

Table 7 — Distance between outer layer of wire and flange periphery

Flange diameter	**Minimum distance between outer layer of wire and flange periphery**
mm	mm
100	3
300	6
435	10

Appendix A References to health and safety publications

The following references about health and safety are available.

The Facts About Fume, The Welding Institute, Abington 1986

Welding Fume, The Welding Institute, Abington 1981

Health, and Safety in Welding, The Welding Institute, Abington, 1983

Health and Safety Executive Guidance Note EH 40 *Occupational Exposure Limits*

Department of Employment Guidance Note MS 15 *Welding*

American Standard ANSI Z 49.1 *Safety in Cutting and Welding*, American Welding Society 1973

Health Hazards of Welding, Dr H T Doig, British Safety Council

Welding Manufacturers' Association, Publication No. 237 *The Arc Welder at Work*

BS 679 *Specification for filters, cover lenses and backing lenses for use during welding and similar operations*

Publication(s) referred to

BS 679, *Specification for filters, cover lenses and backing lenses for use during welding and similar operations.*

BS 1728, *Methods for the analysis of aluminium and aluminium alloys.*

BS 2901, *Filler rods and wires for gas-shielded arc welding*[3)].

BS 2901-1, *Ferritic steels.*

BS 2901-2, *Specification for stainless steels.*

BS 2901-3, *Specification for copper and copper alloys.*

BS 2901-5, *Specification for nickel and nickel alloys.*

BS 3019, *TIG welding*[3)].

BS 3019-1, *Specification for TIG welding of aluminium, magnesium and their alloys.*

BS 3571, *MIG welding*[3)].

BS 3571-1, *Specification for MIG welding of aluminium and aluminium alloys.*

BS 3907, *Methods for the analysis of magnesium and magnesium alloys.*

BS 5378, *Safety signs and colours.*

BS 5378-1, *Specification for colour and design.*

BS 5750, *Quality systems.*

ISO 544, *Filler materials for manual welding — Size requirements.*

ISO 864, *Arc welding – Solid and tubular cored wires which deposit carbon and carbon manganese steel — Dimensions of wires, spools, rims and coils.*

The Facts About Fume, The Welding Institute, Abington 1986

Welding Fume, The Welding Institute, Abington 1981

Health and Safety in Welding, The Welding Institute, Abington 1983

Health and Safety Executive Guidance Notes EH 40 Occupational Exposure Limits

Department of Employment Guidance Note MS 15 Welding

American Standard ANSI Z 49.1 Safety in Cutting and Welding, American Welding Society 1973

Health Hazards of Welding, Dr H T Doig, British Safety Council

Welding Manufacturers' Association, Publication No. 237 The Arc Welder at Work

[3)] Referred to in the foreword only.

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