BRITISH STANDARD

BS 2901 :
Part 2 : 1990

Filler rods and wires for gas-shielded arc welding

Part 2. Specification for stainless steels

BSI STANDARDS

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 November 1990

First published, incorporated in BS 2901, Parts 1 and 2, September 1957 and April 1960
Second edition, as BS 2901, Part 2, November 1970
Third edition, May 1983
Fourth edition November 1990

The following BSI references relate to the work on this standard:
Committee reference WEE/39
Draft for comment 89/76926 DC

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Amendments issued since publication

Amd. No.	Date	Text affected

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This Part of BS 2901 supersedes BS 2901 : Part 2 : 1983 which is withdrawn.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.

Although the rods and wires specified in this Part of BS 2901 are all suitable for some form of gas-shielded arc welding, certain rods and wires are not suitable for use with particular shielding gases. The chemical composition of the deposited weld metal is not specified because this depends on the shielding gas used and the particular welding conditions. It is necessary, therefore, to ascertain from the supplier whether the rods or wires are suitable for use with a particular shielding gas. Also for some applications a particular chemical composition may need to be selected from the range specified for the appropriate type of rod or wire.

In this revision 14 new alloys have been introduced.

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 will 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.

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

Specification

1 Scope

This Part of BS 2901 specifies requirements and chemical compositions for austenitic and ferritic/martensitic stainless steel filler rods and wires for gas-shielded arc welding, i.e. TIG-welding and 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 for the particular type ordered. If the delta-ferrite content in the deposited weld metal is important, then the purchaser shall indicate that he requires this to be determined at the time of placing the order.

NOTE 1. The method to be used and the acceptable limits are to be the subject of agreement between the purchaser and the supplier.

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.

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

NOTE 2. Some suitable methods are given in BS Handbook No. 19.

NOTE 3. The purchaser should indicate whether a test certificate for the 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 2 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 Cast and helix of wire

The cast of spooled filler wire shall be such that one complete loop or circle of wire taken from the spool, when laid on a flat surface without restraint, shall form a circle or part thereof with maximum and minimum diameters as given in table 3.

The vertical separation between any part of the loop used to determine the cast and the flat surface on which it is laid shall not exceed the value for helix given in table 3.

NOTE. Although cast and helix have been specified it should be noted that other factors which cannot be quantified also affect the feeding of a wire.

5 Reels of wire

The size and type of reel (spool, rim or coil) on which the particular diameter of wire is to be supplied shall conform to the appropriate dimensions and mass given in figure 1 and tables 4 and 5, figure 2 and tables 6 and 7 or figure 3 and tables 8 and 9. For wire baskets the dimensions shall be as given in figure 4 and table 10 and the maximum mass shall be 18 kg.

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 state.

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

6 Reeling conditions

The wire shall be wound on the reel 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 than 3 mm to the flange periphery on spools having a flange diameter of 100 mm and not closer than 10 mm to the flange periphery on spools having other flange diameters.

Table 1. Chemical compositions (percentage by mass)

Type	Carbon		Silicon		Manganese		Phosphorus max.	Sulphur max.	Chromium		Molybdenum		Nickel		Copper		Niobium		Nitrogen	
	min.	max.	min.	max.	min.	max.			min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
(a) Austenitic steels																				
307S94	—	0.20	0.25	0.65	5.5	7.5	0.035	0.030	17.0	20.0	—	0.5[1)]	7.5	9.5	—	0.5[1)]	—	—	—	—
307S98	—	0.20	0.65	1.00	5.5	7.5	0.035	0.030	17.0	20.0	—	0.5[1)]	7.5	9.5	—	0.5[1)]	—	—	—	—
308S92	—	0.03	0.25	0.65	1.0	2.5	0.030	0.030	19.5	22.0	—	0.5[1)]	9.0	11.0	—	0.5[1)]	—	—	—	—
308S96	0.04	0.08	0.25	0.65	1.0	2.5	0.030	0.030	19.5	22.0	—	0.5[1)]	9.0	11.0	—	0.5[1)]	—	—	—	—
308S93	—	0.03	0.65	1.00	1.5	2.5	0.030	0.030	19.5	21.0	—	0.5[1)]	9.5	11.0	—	0.5[1)]	—	—	—	—
347S96	—	0.08	0.25	0.65	1.0	2.5	0.030	0.030	19.0	21.5	—	0.5[1)]	9.0	11.0	—	0.5[1)]	10C	1.0	—	—
347S97	—	0.07	0.65	1.00	1.0	2.0	0.030	0.030	19.0	21.0	—	0.5[1)]	9.0	11.0	—	0.5[1)]	12C	1.0	—	—
309S92	—	0.03	0.25	0.65	1.0	2.5	0.030	0.030	23.0	25.0	—	0.5[1)]	12.0	14.0	—	0.5[1)]	—	—	—	—
309S93	—	0.03	0.65	1.00	1.0	2.5	0.030	0.030	22.0	25.0	—	0.5[1)]	12.0	14.0	—	0.5[1)]	—	—	—	—
309S94	0.04	0.12	0.25	0.65	1.0	2.5	0.030	0.030	23.0	25.0	—	0.5[1)]	12.0	14.0	—	0.5[1)]	—	—	—	—
309S95	—	0.03	0.25	0.65	1.0	2.5	0.030	0.030	21.0	24.0	2.0	3.0	12.0	14.0	—	0.5[1)]	—	—	—	—
310S91	—	0.03	—	0.20	4.0	5.0	0.020	0.020	24.0	26.0	1.5	2.5	21.0	23.0	—	0.1[1)]	—	—	0.10	0.17
310S94	0.08	0.15	0.25	0.65	1.0	2.5	0.030	0.030	25.0	28.0	—	0.5[1)]	20.0	22.5	—	0.5[1)]	—	—	—	—
310S98	0.35	0.45	0.80	1.30	1.0	2.5	0.030	0.030	25.0	28.0	—	0.5[1)]	20.0	22.5	—	0.5[1)]	—	—	—	—
311S94	—	0.12	0.25	0.65	1.0	2.5	0.030	0.030	23.0	25.0	—	0.5[1)]	12.0	14.0	—	0.5[1)]	10C	1.3	—	—
312S94	—	0.15	0.25	0.65	1.0	2.5	0.030	0.030	28.0	32.0	—	0.5[1)]	8.0	10.5	—	0.5[1)]	—	—	—	—
313S94	0.06	0.13	0.25	0.65	1.0	2.5	0.030	0.030	25.0	28.0	—	0.5[1)]	20.0	22.5	—	0.5[1)]	10C	1.3	—	—
316S92	—	0.03	0.25	0.65	1.0	2.5	0.030	0.030	18.0	20.0	2.0	3.0	11.0	14.0	—	0.5[1)]	—	—	—	—
316S96	0.04	0.08	0.25	0.65	1.0	2.5	0.030	0.030	18.0	20.0	2.0	3.0	11.0	14.0	—	0.5[1)]	—	—	—	—
316S93	—	0.03	0.65	1.00	1.5	2.5	0.030	0.030	18.0	20.0	2.5	3.0	10.0	13.5	—	0.5[1)]	—	—	—	—
317S92	—	0.03	0.25	0.65	1.0	2.5	0.030	0.030	18.5	20.5	3.0	4.0	13.0	15.0	—	0.5[1)]	—	—	—	—
317S96	0.04	0.08	0.25	0.65	1.0	2.5	0.030	0.030	18.5	20.5	3.0	4.0	13.0	15.0	—	0.5[1)]	—	—	—	—
318S96	—	0.08	0.25	0.65	1.0	2.5	0.030	0.030	18.0	20.0	2.0	3.0	11.0	14.0	—	0.5[1)]	10C	1.0	—	—
318S97	—	0.07	0.65	1.00	1.0	2.0	0.030	0.025	18.5	21.0	2.5	3.0	11.0	13.0	—	0.5[1)]	12C	1.0	—	—
904S92	—	0.03	0.25	1.00	1.0	2.5	0.030	0.020	19.5	21.5	4.2	5.2	24.0	26.0	1.2	2.0	—	—	—	0.060
22.8.3S92	—	0.03	0.25	0.80	1.0	2.0	0.030	0.030	21.0	23.5	2.5	3.5	7.5	9.5	—	0.5[1)]	—	—	0.12	0.20
27.31.4S91	—	0.02	—	0.20	1.0	2.5	0.015	0.015	26.0	28.0	3.0	4.0	30.0	32.0	—	1.5	—	—	—	0.060
(b) Ferritic/martensitic stainless steels																				
409S96	—	0.05	0.35	0.75	0.4	1.0	0.030	0.030	11.0	12.0	0.5[1)]		—	0.6	—	—	10C	0.6	—	—
410S94	0.09	0.15	0.25	0.80	—	1.0	0.030	0.030	11.5	13.5	0.5[1)]		—	0.6	—	—	—	—	—	—
430S94	—	0.10	0.25	0.80	—	1.0	0.030	0.030	16.0	18.0	0.5[1)]		—	0.6	—	—	—	—	—	—

[1)] Residual element.

Table 2. Diameters and tolerances[1)]

Form	Diameter	Tolerance
Wire	mm **0.5** 0.6	mm +0.01 −0.03
	0.8 0.9 **1.0**	+0.01 −0.04
	1.2 **1.6**	
Wire or rod	2.0 **2.4** 2.5 **3.2**	+0.03 −0.07
Rod	4.0 5.0	

NOTE. The values printed in bold type are the sizes normally manufactured.

[1)] The diameters and tolerances specified in table 3 are in accordance with ISO 864 : 1988 except for the positive tolerance on diameters of 2 mm and above.

7 Lengths of rods[1)]

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

(a) 500 mm or 1000 mm for rods of less than 2.5 mm in diameter;

(b) 1000 mm for rods of 2.5 mm in 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 reels of wire shall be suitably packed to guard against damage, contamination or deterioration during storage and transportation.

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 3. Cast and helix of wire

Diameter of spool	Wire diameter	Cast		Helix
		max.	min.	
mm	mm	mm	mm	mm
300	0.50 - 2.40	1250	600	25
200	0.50 - 1.20	1000	380	15
100	0.50 - 1.20	500	100	12

9 Marking

Each package of rods and each reel 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 : Part 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 : Part 2 : 1990[2)].

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

[2)] Marking BS 2901 : Part 2 : 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.

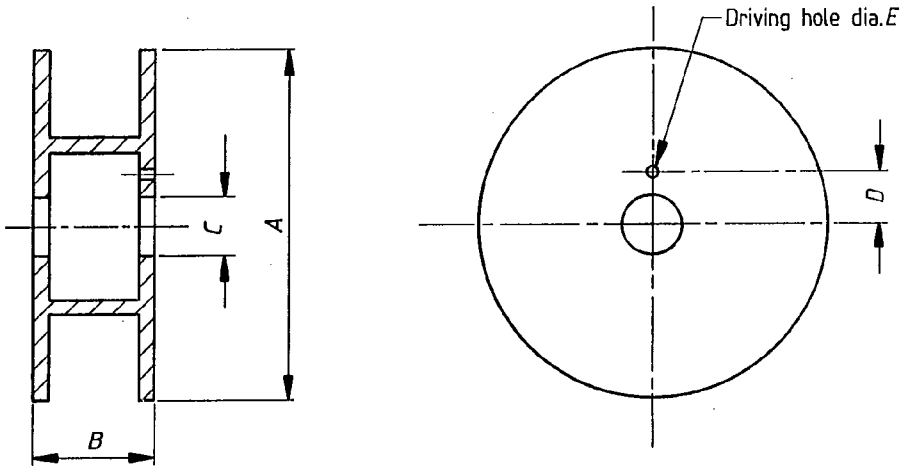

Figure 1. Spool

Table 4. Dimensions of spools (see figure 1)

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	—	—	—	—
200	+3 −3	55	0 −3	50.5	+2.5 0	44.5	+0.5 −0.5	10	+1 0
300	+5 −5	103	0 −3	50.5	+2.5 0	44.5	+0.5 −0.5	10	+1 0
350	+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 dimensions specified are in accordance with ISO 864 : 1988.

Table 5. Maximum masses for wire on spools

Wire diameters	**Masses for wire on spools having flange diameters of**				
	100 mm	**200 mm**	**300 mm**	**350 mm**	**435 mm**
	kg	kg	kg	kg	kg
All	1.0	6.0	18.0	25	25

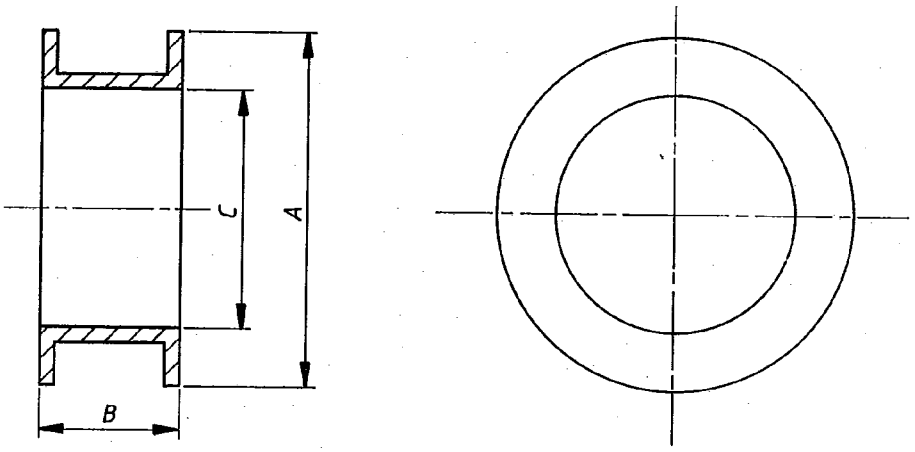

Figure 2. Rim

Table 6. Dimensions of rims (see figure 2)

A		*B*		*C*	
Diameter	**Tolerance**	**Width**	**Tolerance**	**Diameter**	**Tolerance**
mm	mm	mm	mm	mm	mm
300	±5	90	0 −15	200	+10 0
		120	0 −20		
350	±5	90	0 −15	300	+15 0
		120	0 −20		
435	±5	90	0 −15	300	+15 0
		120	0 −20		

NOTE. The dimensions specified are in accordance with ISO 864 : 1988.

Table 7. Maximum masses for wire on rims

Wire diameters	**Masses for wire on rims having outside diameters of**		
	300 mm	**350 mm**	**435 mm**
mm	kg	kg	kg
0.5 to 1.0	16	16	25
1.2 to 3.2	25	25	25

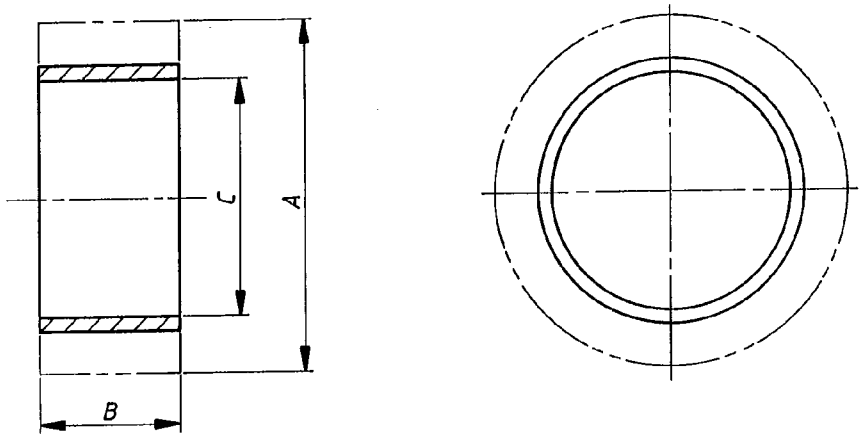

Figure 3. Coil

Table 8. Dimensions of coils with formers (see figure 3)

A	*B*		*C*	
Diameter max.	**Width**	**Tolerance**	**Diameter**	**Tolerance**
mm	mm	mm	mm	mm
300	90	0 −15	200	+10 0
	120	0 −20		
350	90	0 −15	300	+15 0
	120	0 −20		
435	90	0 −15	300	+15 0
	120	0 −20		

NOTE 1. For dimension *A*, the values given in this table are the preferred sizes.

NOTE 2. The dimensions specified are in accordance with ISO 864 : 1988.

Table 9. Maximum masses for wire on coils

Wire diameters	**Masses for wire on coils having outside diameters of**		
	300 mm	**350 mm**	**435 mm**
mm	kg	kg	kg
0.5 to 1.0	16	16	25
1.2 to 3.2	25	25	25

Table 10. Dimensions of wire baskets (see figure 4)

A	*B*	*C*	*D*
Diameter	**Width**	**Diameter**	**Diameter**
mm	mm	mm	mm
300	98	180	52

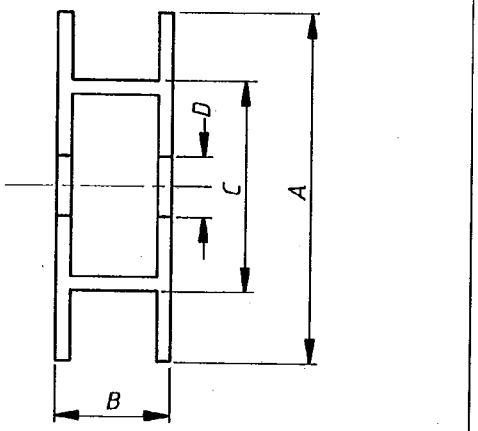

Figure 4. Wire basket

Appendix

Appendix A. References to health and safety publications

The following references relating to 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 MS15 *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 2901[1)] Filler rods and wires for gas-shielded arc welding
Part 1 Ferritic steels
Part 3 Specification for copper and copper alloys
Part 4 Specification for aluminium and aluminium alloys and magnesium alloys
Part 5 Specification for nickel and nickel alloys

BS 5378 Safety signs and colours
Part 1 Specification for colour and design

BS 5750 Quality systems

BS Handbook No. 19 Methods for the sampling and analysis of iron, steel and other ferrous metals

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, 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 Note EH 40 *Occupational Exposure Limits*

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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*

[1)] Referred to in the foreword only.

BS 2901 : Part 2 : 1990

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British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

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