# British Standard

**BRITISH STANDARD**

**BS 1453:1972**

*Incorporating Amendments Nos. 1 and 2 and Corrigendum No. 1*

## Specification for

# Filler materials for gas welding

ICS 25.160.20

# Co-operating organizations

The Welding Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:

Aluminium Federation*
Associated Offices Technical Committee*
Association of Consulting Engineers
British Constructional Steelwork Association
British Electrical and Allied Manufacturers' Association*
British Railways Board*
British Steel Industry*
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Society of British Aerospace Companies Limited
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The Government department and scientific and industrial organizations marked with an asterisk in the above list, together with the following were directly represented on the committee entrusted with the preparation of this British Standard:

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British Compressed Gases Association
British Non-ferrous Metals Federation
Copper Development Association
Electricity Council, the Central Electricity Generating Board and the Area Boards in England and Wales
Institute of Iron and Steel Wire Manufacturers
Magnesium Industry Council
Oil Companies' Materials Association
Society of Motor Manufacturers and Traders Ltd.
Stainless Steel Development Association
Individual firms

This British Standard, having been approved by the Welding Industry Standards Committee, was published under the authority of the Executive Board on 30 March 1972



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The following BSI references relate to the work on this standard:
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**Amendments issued since publication**

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| 5363 | May 1987 | |
| 10840 | June 2000 | |
| 13107<br>Corrigendum No. 1 | March 2001 | Correction to Table 4, heading of column 2 |
| | | |

# Contents

# Foreword

This standard makes reference to the following British Standards:

BS 1728, *Methods for the analysis of aluminium and aluminium alloys.*
BS 1748, *Methods for the analysis of copper alloys.*

BS 2901, *Specification for filler rods and wires for gas-shielded arc welding.*
BS 3907, *Methods for the analysis of magnesium and magnesium alloys.*
BS 6200, *Sampling and analysis of iron, steel and other ferrous metals.*
BS EN 12536, *Welding consumables — Rods for gas welding of non alloy and creep resisting steels — Classification.*

This standard has been revised to take account of the technical developments that have occurred since the previous edition, in respect of both usage of gas welding and chemical compositions of filler materials. As a result most groups of materials have been altered by way of additions, deletions or composition changes. The austenitic stainless steel filler materials have undergone the greatest revision with regard to composition, coupled with a new method of designation. Throughout the standard relevant chemical compositions have been aligned with those specified in BS 2901, "*Filler rods and wires for gas-shielded arc welding*". For guidance on filler materials to be used for gas welding when not specified in this standard, reference may be made to BS 2901.

Sizes of filler materials are now only given in terms of nominal values as tolerances depend on the particular material and size, but this is not a factor that affects the welding process.

In accordance with current practice, this standard uses metric units and in deciding on the dimensions of the filler materials account has been taken of appropriate ISO Standards.

The material designations for aluminium and aluminium alloys have been changed to those used in the International Alloy Designation System for Wrought Aluminium and Wrought Aluminium Alloys, which has been adopted in the UK and is now used in other British Standards. This system is administered by the Aluminium Association Inc., who issued the "Registration Record of International Alloy Designations and Chemical Composition Limits for Wrought Aluminium and Wrought Aluminium Alloys". Some consequential minor amendments to composition limits have resulted.

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**Summary of pages**

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 8, an inside back cover and a back cover.

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## 1 Scope

This British Standard specifies requirements and chemical compositions, for filler materials for gas welding of cast iron, austenitic stainless steels, copper and copper alloys and aluminium and aluminium alloys. Filler materials for gas welding of ferritic steels are specified in BS EN 12536.

NOTE The titles of the British Standards referred to in this standard are listed on page ii.

## 2 Chemical compositions

The materials shall have a chemical composition in accordance with the requirements specified in Table 2, Table 3, Table 4 or Table 5 for the particular type ordered.

In cases of dispute regarding the chemical composition of the materials, sampling and check analysis shall be carried out in accordance with BS 1748, BS 1728, BS 3907 or BS 6200, or by a mutually agreed alternative method of comparable accuracy.

## 3 Sizes

For materials supplied as rods or wires, the sizes shall be selected from the following nominal diameters:

0.8[1)], 1.2, 1.6, 2.4, 3.2, 4.0, 5.0 and 6.0 mm.

For cast iron materials, which are supplied in square section, the sizes shall be selected from the following nominal values of the side of the square:

3.2, 5, 6, 8, 10 and 12 mm.

## 4 Condition

**4.1 Finish.** The filler material shall have a smooth finish, free from surface imperfections, corrosion products, grease or other foreign matter that would adversely affect the quality of the weld.

**4.2 Copper coating on ferritic steels.** Unless otherwise agreed, ferritic steel filler materials shall be supplied with a protective copper coating, it being a uniform, well-bonded, smooth coating applied over a clean surface. The copper content of the coated filler material expressed as a percentage of the filler material plus the coating shall not exceed 0.4 % by weight.

**4.3 Condition of aluminium, aluminium alloy and magnesium alloy filler materials.** Aluminium, aluminium alloy and magnesium alloy filler materials shall be supplied in the as manufactured (M) condition.

## 5 Lengths of rods[2)]

Rods less than 2.5 mm in diameter should preferably be supplied in lengths of 500 mm or 1 000 mm. Rods 2.5 mm in diameter and larger should preferably be supplied in lengths of 1 000 mm. Lengths other than the above preferred lengths may be supplied by agreement between the purchaser and the supplier.

The tolerance on each length shall be ± 5 mm.

## 6 Packing

The filler material 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 ordering.

[1)] Because of wire-drawing problems, not all of the wire compositions can be supplied in this size.

[2)] *Deleted.*

## 7 Marking

**7.1 Packages.** Each package shall be clearly marked with the following information:

1) Name of supplier.

2) The number of this British Standard, i.e., BS 1453[3)], and the type designation of the filler material.

3) Trade designation of filler material.

4) Size and quantity or weight of filler material.

5) Batch number.

6) Health warning (see Appendix A), i.e. the following general warning sign and accompanying text:

WARNING

PROTECT YOURSELF AND OTHERS — READ AND UNDERSTAND THIS LABEL. TAKE PRECAUTIONS WHEN WELDING. ASK FOR YOUR EMPLOYER'S SAFETY PRACTICES WHICH SHOULD BE BASED ON MANUFACTURER'S HAZARD DATA.

Fumes and gases can be dangerous to your health.

Read and understand the manufacturer's instructions and your employer's safety practices.

Keep your head out of the fumes.

Use enough ventilation, exhaust at source, or both, to keep fumes and gases from your breathing zone, and the general area.

Wear correct eye, ear and body protection.

See WMA Publication 236 "*Hazards from Welding Fume*", available from the manufacturer.

DO NOT REMOVE THIS LABEL.

NOTE This warning is only suitable for gas welding filler materials and if the supplier intends the filler material to be used for other welding processes the warning should be suitably modified in accordance with the appropriate British Standard, e.g. BS 2901.

**7.2 Filler materials.** The identification marking of individual rods, wires or sections, including the method of marking, shall be a matter for agreement between the purchaser and the supplier. When such marking is to be applied, it shall include the number of this British Standard, BS 1453[3)], and the type designation of the filler material.

## 8 Supplier's certificate

When requested, the supplier shall certify that the filler material complies with the requirements of this standard.

At the time of placing the order, the purchaser shall indicate whether he requires a chemical analysis to be taken for each batch of filler material supplied.

[3)] Marking with the number BS 1453 signifies the manufacturer's claim that the filler material complies with the requirements of this standard.

**Table 1 —** *Deleted*

**Table 2 — Chemical compositions: cast iron**

All values in this table are expressed as percentages by mass.

| Type | Carbon | | Silicon | | Manganese | | Nickel | | Sulphur | Phosphorus |
|---|---|---|---|---|---|---|---|---|---|---|
| | min. | max. | min. | max. | min. | max. | min. | max. | max. | max. |
| B2 | 3.0 | 3.6 | 2.0 | 2.5 | 0.5 | 1.0 | | | 0.15[a] | 1.5 |

[a] The sulphur content should be kept as low as possible.

## Table 3 — Chemical compositions: austenitic stainless steels

All values in this table are expressed as percentages by mass.

| Type | Carbon | | Silicon | | Manganese | | Phosphorus | Sulphur | Chromium | | Molybdenum | | Nickel | | Copper | Niobium | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | min. | max. | min. | max. | min. | max. | max. | max. | min. | max. | min. | max. | min. | max. | max.[a] | min. | max. |
| 308S92 | — | 0.03 | 0.25 | 0.65 | 1.0 | 2.5 | 0.030 | 0.030 | 19.5 | 22.0 | — | 0.5[a] | 9.0 | 11.0 | 0.5 | | |
| 347S96 | — | 0.08 | 0.25 | 0.65 | 1.0 | 2.5 | 0.030 | 0.030 | 19.0 | 21.5 | — | 0.5[a] | 9.0 | 11.0 | 0.5 | 10 × C | 1.0 |
| 309S92 | — | 0.03 | 0.25 | 0.65 | 1.0 | 2.5 | 0.030 | 0.030 | 23.0 | 25.0 | — | 0.5[a] | 12.0 | 14.0 | 0.5 | | |
| 309S94 | — | 0.12 | 0.25 | 0.65 | 1.0 | 2.5 | 0.030 | 0.030 | 23.0 | 25.0 | — | 0.5[a] | 12.0 | 14.0 | 0.5 | | |
| 310S94 | 0.08 | 0.15 | 0.25 | 0.65 | 1.0 | 2.5 | 0.030 | 0.030 | 25.0 | 28.0 | — | 0.5[a] | 20.0 | 22.5 | 0.5 | | |
| 312S94 | — | 0.15 | 0.25 | 0.65 | 1.0 | 2.5 | 0.030 | 0.030 | 28.0 | 32.0 | — | 0.5[a] | 8.0 | 10.5 | 0.5 | | |
| 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 | | |
| 316S96 | — | 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 | | |
| 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 | 10 × C | 1.0 |

NOTE With the considerable progress of gas-shielded arc welding processes for stainless steel it is now recommended that gas welding should not be used unless absolutely necessary. Gas welding can lead to deterioration of properties and corrosion resistance in the weld area.

[a] Residual element.

## Table 4 — Chemical compositions: copper and copper alloys

All values in this table are expressed as percentages by mass.

| Type | Copper | | Zinc | Lead | Aluminium | Iron | | Nickel | | Manganese | | Silicon | | Tin | | Arsenic | Antimony | Bismuth | Phosphorus | | Tellurium | Total impurities (excl. silver, nickel, arsenic, phosphorus) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | min. | max. | | max. | max. | min. | max. | min. | max. | min. | max. | min. | max. | min. | max. | max. | max. | max. | min. | max. | max. | max. |
| C1 | 99.85[a] | — | | 0.010 | | — | 0.030 | — | 0.10 | | | | | — | 0.01 | 0.05 | 0.005 | 0.0030 | 0.015 | 0.08 | 0.010[b] | 0.060 |
| C2 | 58.5 | 61.5 | rem. | 0.03 | 0.03 | | | | | | | 0.2 | 0.5 | — | 0.5 | | | | | | | |
| C2B | 56.0 | 60.0 | rem. | 0.05 | 0.01 | 0.25 | 1.2 | 0.2 | 0.8 | 0.01 | 0.50 | 0.04 | 0.15 | 0.8 | 1.1 | | | | | | | 0.50 incl. Pb & Al |
| C2C | 56.0 | 60.0 | rem. | 0.05 | 0.01 | 0.25 | 1.2 | | | 0.01 | 0.50 | 0.04 | 0.15 | 0.8 | 1.1 | | | | | | | 0.50 incl. Pb & Al |
| C4 | 58.5 | 61.5 | rem. | 0.03 | 0.03 | | 0.5 | | | 0.05 | 0.25 | 0.15 | 0.3 | — | 0.5 | | | | | | | |
| C5 | 46.0 | 50.0 | rem. | 0.03 | 0.03 | — | 0.5 | 8.0 | 11.0 | — | 0.5 | 0.15 | 0.5 | — | 0.5 | | | | | | | |

[a] Includes silver 0.5 % min., 1.2 % max.
[b] Selenium plus tellurium, 0.020 % max.

## Table 5 — Chemical compositions: aluminium and aluminium alloys

All values in this table are expressed as percentages by mass.

| Type[a] | Silicon | | Iron | Copper | Manganese | | Magnesium | | Chromium | | Zinc | Titanium | | Beryllium | Other elements | | | Aluminium | Former designation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | min. | max. | max. | max. | min. | max. | min. | max. | min. | max. | max. | min. | max. | max. | Specified elements | Unspecified elements | | | |
| | | | | | | | | | | | | | | | | Each max. | Total max. | | |
| 1 100<br>1 260<br>1 050A | — | 0.95[b] | 0.40 | 0.20 | — | 0.05 | — | 0.05 | | | 0.10 | — | 0.05 | 0.0008 | | 0.05 | — | 99.0 min. | G1B |
| 3 103 | — | 0.50 | 0.7 | 0.10 | 0.9 | 1.5 | — | 0.30 | — | 0.10 | 0.20 | | | 0.0008 | 0.10 max. zirconium + titanium | 0.05 | 0.15 | Remainder | NG 3 |
| 4 043<br>4 043A | 4.5 | 6.0 | 0.8 | 0.30 | — | 0.15 | — | 0.20 | | | 0.10 | — | 0.20 | 0.0008 | | 0.05 | 0.15 | Remainder | NG 21 |
| 4 047<br>4 047A | 11.0 | 13.0 | 0.8 | 0.30 | — | 0.15 | — | 0.10 | | | 0.20 | — | 0.15 | 0.0008 | | 0.05 | 0.15 | Remainder | NG 2 |
| 5 154 A | — | 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 | NG 5 |
| 5 554 | — | 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 | NG 52 |
| 5 356 | — | 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 | |

[a] The registered compositions fall within the specifications given in this table.
[b] Silicon content should be less than that of iron.

## Appendix A Safety references

The following publications about health and safety are available.

The Facts About Fume. The Welding Institute, Abington 1976.

Welding Fume. The Welding Institute, Abington 1981.

Health and Safety in Welding and Allied Processes. 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 49.1 “Safety in Cutting and Welding”.

American Welding Society 1973.

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

WMA Publication 236 “Hazards from welding fume”.

WMA Publication 237 “The arc welder at work”.

BS EN 169 Specification for filters for personal eye-protection equipment used in welding and similar operations.

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## British Standards

The following are available on application:

YEARBOOK

Including subject index and numerical list of British Standards

SECTIONAL LISTS. Gratis

Acoustics (SL 10)
Aerospace materials and components (SL 25)
Automobile (SL 34)
British Standard Handbooks (SL 27)
Building (SL 16)
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Furniture, bedding and furnishings (SL 11)
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