AS 2528—1982

Australian Standard®

# Bolts, studbolts and nuts for flanges and other high and low temperature applications

The following scientific, industrial and governmental organizations and departments were officially represented on the committee entrusted with the preparation of this standard:

Australian Institute of Steel Construction Ltd

Bureau of Steel Manufacturers of Australia

Confederation of Australian Industry

Department of Defence

Department of Industrial Relations, N.S.W.

Electricity Supply Association of Australia

Engineering and Water Supply Department, S.A.

Fasteners Institute of Australia

Federal Chamber of Automotive Industries

Institution of Production Engineers

Metal Trades Industry Association of Australia

Metropolitan Water Sewerage & Drainage Board, Sydney

Petroleum Refinery Engineers Advisory Committee

Railways of Australia Committee

Society of Automotive Engineers—Australasia

Telecom Australia

Tractor and Machinery Association of Australia

University of New South Wales

University of Sydney

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This standard, prepared by Committee ME/29, Fasteners, was approved on behalf of the Council of the Standards Association of Australia on 10 December 1981, and was published on 15 March 1982.

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*This standard was issued in draft form for comment as DR 81159.*

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First published . . . . . 1982

PUBLISHED BY STANDARDS AUSTRALIA
(STANDARDS ASSOCIATION OF AUSTRALIA)
1 THE CRESCENT, HOMEBUSH, NSW 2140

ISBN 0 7262 2465 0

# PREFACE

This standard was prepared jointly by the Association's Committee on Fasteners and Committee on Flanges as a part of the revision of AS 2129—1978, Flanges and Bolting for Pipes, Valves and Fittings. It supersedes the corresponding portion of AS 2129—1978.

During the preparation of this standard it was noted that while AS 2129 covered quite a large proportion of Australian requirements for bolting for flanges there were major sections of industry, most notably the petroleum, chemical and petrochemical industries, which were heavily committed to the use of flanges to ANSI B16.5, Steel Pipe Flanges and Flanged Fittings, Including Ratings for Class 150, 300, 400, 600, 900, 1500 and 2500, which require an inch series of stud bolts with associated nuts. It was recognised that while the ultimate object is to establish a single series of metric pipe flanges and associated bolting to cover all requirements, nevertheless the ANSI B16.5 flanges will continue to be used for some considerable period.

It was also noted that AS 2129 was in effect a soft metric conversion of imperial flanges and bolting and included a series of metric bolting intended for use in the cryogenic and elevated temperature ranges; in reality most fasteners used in these applications were still inch series manufactured in accordance with ASTM A193, Specification for Alloy-steel and Stainless Steel Bolting Materials for High-temperature Service, ASTM A 194, Specification for Carbon and Alloy Steel Nuts for Bolts for High-pressure and High-temperature Service, and ASTM A 320, Specification for Alloy-steel Bolting Materials for Low-temperature Service. To achieve an overall rationalized system of flange bolting, and recognizing current requirements, the committee agreed that the standard would include the following sections:

(a) A section giving a metric series of bolts, studbolts and nuts used in the temperature range -50°C to +300°C, covering the bulk of requirements of AS 2129.

(b) A section giving all inch series of studbolts and nuts covering the bolting requirement of flanges to ANSI B16.5 and other flanges and which are also suitable for bolting flanges to AS 2129 in the temperature ranges -200°C to -50°C and +300°C to +525°C.

The metric series of bolting is, with respect to dimensions, materials and properties, in line with ISO standards (where applicable) and it should be noted that the physical properties are specified in such a manner as to make testing in full size possible. This follows the approach used in all Australian metric fastener standards. Conversely, for the inch series bolting, the grades have been selected from ASTM A 193, ASTM A 194 or ASTM A 320 and have been rationalized to suit Australian requirements, but owing to the manner in which the physical properties are specified in those standards it is not possible to test the fasteners in full size. This accounts for the different approach to the test requirements between the inch and the metric fasteners.

During the preparation of the standard it was also noted that the methods of defining the overall length and length of thread were different for the metric and inch series of studbolts. For metric studbolts these lengths include the chamfer on the threaded end, whereas for inch studbolts these lengths do not include the chamfer on the threaded end. The committee gave serious consideration to the rationalization of these practices, but concluded that both methods were so deeply entrenched in the different sections of industry that any change from current practices was not warranted and could cause confusion.

An appendix has been included giving notes on bolting strength and performance at elevated temperatures. The appendix represents material given in BS 4882, Bolting for Flanges and Pressure Containing Purposes, with minor editorial amendments. Acknowledgement is made to the British Standards Institution for the use of this material.

In most sectors of industry, metric conversion is now at an advanced stage and it is anticipated that this rate of conversion will increase during the next few years. As a consequence, measuring capability in imperial units will decline. To meet this situation, an appendix has been provided which gives the approximate metric equivalent of all dimensions, tolerances and mechanical properties given in Section 3 of this standard. The inch designation, however, has been retained because it is currently well entrenched in Australian industry; furthermore, the cost to industry of amending drawings, specifications, and the like to introduce a different designation could not be justified.

Although at present there are no international standards dealing specifically with bolting for flanges, account has been taken where possible of standards prepared by ISO/TC 2, Bolts, Nuts, Fasteners and Accessories, and the provision of the following ISO standards have been incorporated in this standard:

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| ISO 225 | Bolts, Screws and Studs—Dimensioning |
| ISO 272 | Fasteners—Hexagon Products—Widths Across Flats |
| ISO 885 | General Purpose Bolts and Screws—Metric Series—Radii Under the Head |
| ISO 888 | Bolts, Screws and Studs—Nominal Lengths, and Thread Lengths for General Purpose Bolts |
| ISO 898/1 | Mechanical Properties of Fasteners Part 1—Bolts, Screws and Studs |
| ISO 4759/1 | Tolerances for Fasteners Part 1—Bolts, Screws and Nuts with Thread Diameters Between 1.6 (inclusive) and 150 mm (inclusive) and Product Grades A, B and C |

In addition, for inch bolting account was also taken of ANSI B16.5, ASTM A 193, ASTM A 194, ASTM A 320, and BS 4882.

This standard may require reference to the following Australian standards:

AS 1014 Gauging of Metric Screw Threads

AS 1110 ISO Metric Hexagon Precision Bolts and Screws

AS 1111 ISO Metric Hexagon Commercial Bolts and Screws

AS 1112 ISO Metric Hexagon Nuts, Including Thin Nuts, Slotted Nuts and Castle Nuts

AS 1214 Hot-dip Galvanized Coatings on Threaded Fasteners (ISO Metric Coarse Thread Series)

AS 1252 General Grade High-strength Steel Bolts With Associated Nuts and Washers for Structural Engineering (ISO Metric Series)

AS 1275 Metric Screw Threads for Fasteners (Based on ISO Recommendations)

AS 1391 Methods for Tensile Testing of Metals

AS 1442 Carbon Steels and Carbon-manganese Steels— Hot-rolled Bars and Semi-finished Products

AS 1443 Carbon Steels and Carbon-manganese Steels—Bright Bars

AS 1444 Wrought Alloy Steels—AISI-SAE Standard, Hardenability (H) and Stainless Series

AS 1544 Methods for Impact Tests on Metals
Part 2—Charpy V-notch
Part 3—Charpy U-notch and Keyhole Notch

AS 1654 Limits and Fits for Engineering

AS 1721 General Purpose Metric Screw Threads

AS 1815 Method for Rockwell Hardness Test
Part 1—Testing of Metals

AS 1816 Method for Brinell Hardness Test
Part 1—Testing of Metals

AS 1817 Method for Vickers Hardness Test
Part 1—Testing of Metals

AS 1823 Suppliers Quality Control System—Level 3

AS 1897 Electroplated Coatings on Threaded Components (Metric Coarse Series)

AS 2129 Flanges and Bolting for Pipes, Valves and Fittings

AS B133 Unified Screw Threads

AS B193 Hot-dip Galvanized Coating on Fasteners (BSW and UNC Threads)

AS K132 Electroplated Coatings on Threaded Components
Part 1—Cadmium on Steel
Part 2—Zinc on Steel

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STANDARDS ASSOCIATION OF AUSTRALIA

# Australian Standard

# for

# BOLTS, STUDBOLTS AND NUTS FOR FLANGES AND OTHER HIGH AND LOW TEMPERATURE APPLICATIONS

## SECTION 1. SCOPE AND DEFINITIONS

**1.1 SCOPE.** This standard specifies requirements for bolts, studbolts and nuts, mainly intended for bolting for flanges and other pressure-containing purposes. It covers both a metric series and an inch series of fasteners.

Materials have been selected for use in temperature conditions from –250°C to +575°C, and provision is also made for the supply of bolts, studbolts and nuts with hot-dip galvanized and other metallic coatings to provide improved corrosion resistance at essentially ambient temperatures.

The dimensional and marking requirements (except property class/strength grade marking) of this standard also apply to non-ferrous, stainless steel and weather-resistant steel fasteners.

NOTE: Appendix A gives information on bolting strength performance at elevated temperatures.

The specific requirements are given in the following Sections:

(a) Section 2—specifies a metric series of bolts, studbolts and associated nuts for use in the temperature range –50°C to +300°C.

NOTES:

1. This Section covers the bulk of the requirements of AS 2129.
2. Bolts and studbolts of property class 4.6 and nuts of property class 5, manufactured from free cutting steel, should not be used at temperatures in excess of +200°C.

(b) Section 3—specifies an inch series of studbolts and associated nuts with unified threads covering—

(i) bolting for flanges to ANSI B16.5 and other flanges as used in the petroleum, chemical, petrochemical industries and other applications in the temperature range –250°C to +575°C;

(ii) bolting suitable for flanges to AS 2129 in the cryogenic and elevated temperature ranges, i.e. –200°C to –50°C and +300°C to +525°C.

**1.2 DEFINITIONS.** For the purpose of this standard, the following definitions apply:

**1.2.1 Bolting.**

**1.2.1.1** *Metric series*—studbolts, bolts and nuts made in accordance with Section 2 of this standard.

**1.2.1.2** *Inch series*—studbolts and nuts made in accordance with Section 3 of this standard.

**1.2.2 Bolts.**

**1.2.2.1** *Bolt*—a fastener with a head integral with the shank and which is threaded at the opposite end.

**1.2.2.2** *Nominal length (l)*—the distance from the bearing surface of the head to the extreme end of the shank including any chamfer or radius.

**1.2.2.3** *Thread length (b)*—the difference between the nominal length of the bolt and the distance between the bearing surface of the head and the nearest face of a nut with no internal chamfer screwed as far as practicable onto the bolt by hand.

**1.2.3 Studbolts.**

**1.2.3.1** *Studbolt*—a fastener intended for flanges threaded at both ends, or threaded for the whole of its length intended for use with a nut at each end.

**1.2.3.2** *Nominal length (l).*

(a) *Metric series*—the length of a studbolt including the chamfer at each end (see Fig. 2.1).

(b) *Inch series*—the length of a studbolt excluding the chamfer at each end (see Fig. 3.1).

**1.2.3.3** *Thread length.*

(a) *Metric series*—the distance from the end of a studbolt including the chamfer, to the last full thread (see Fig. 2.1).

(b) *Inch series*—the distance from the end of a studbolt excluding the chamfer, to the last full thread (see Fig. 3.1).

**1.2.3.4** *Body*—the unthreaded centre portion of a studbolt.

NOTE: Type ‘a’ studbolts (see Clause 2.3.1) have no body.

**1.2.4 Thread runout.**

(a) *All bolts and Type ‘b’ studbolts with rolled thread*—the distance from the top of the extrusion cone to the nearest face of a nut with no internal chamfer screwed on to the bolt as far as practicable by hand.

(b) *All bolts and Type ‘b’ studbolts with cut threads (and also Type ‘e’ studbolts with rolled threads)*—the distance from the last witness of thread to the nearest face of a nut with no internal chamfer screwed on to the bolt as far as practicable by hand.