

AS/NZS 2699.2:2000

Australian/New Zealand Standard™

**Built-in components for masonry
construction**

Part2: Connectors and accessories



This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee BD/28, Masonry Wall Ties and Accessories. It was approved on behalf of the Council of Standards Australia on 22 December 1999 and on behalf of the Council of Standards New Zealand on 20 December 1999. It was published on 28 February 2000.

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Australian Paint Manufacturers Federation
Australian Stainless Steel Development Association
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Australian/New Zealand Standard™

Built-in components for masonry construction

Part 2: Connectors and accessories

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee BD/28, Masonry Wall Ties and Accessories, to supersede AS 2975—1987, *Accessories for masonry construction* and, in part, NZS 4210:1989, *Code of practice for masonry construction: materials and workmanship*.

This Standard is the second of a three-part series on masonry wall ties, connectors and accessories, and lintels and shelf angles. The series comprises the following:

AS/NZS

2699 Built-in components for masonry construction

2699.1 Part 1: Wall ties

2699.2 Part 2: Connectors and accessories

2699.3 Part 3: Lintels and shelf angles (Durability requirements)

The types and spacings of connectors and accessories necessary to meet design requirements are specified in AS 3700, *Masonry structures*, NZS 4210, *Code of practice for masonry construction: materials and workmanship*, and NZS 4230, *Code of practice for the design of masonry structures*.

The objective of this Standard is to provide manufacturers with specifications for corrosion resistance and tests for structural serviceability of connectors and accessories when built into masonry.

The terms ‘normative’ and ‘informative’ have been used in this Standard to define the application of the appendices to which they apply. A ‘normative’ appendix is an integral part of a Standard, whereas an ‘informative’ appendix is only for information and guidance.

Notes to clauses in this Standard are for information and guidance only and compliance with them is not a requirement of the Standard.

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STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard**Built-in components for masonry construction****Part 2: Connectors and accessories**

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE AND APPLICATION This Standard specifies performance requirements for connectors and accessories built into masonry, including—

- (a) masonry anchors;
- (b) masonry connectors;
- (c) masonry ties other than wall ties;
- (d) tie-downs in masonry;
- (e) bolts and fixings in masonry;
- (f) bed-joint mesh in masonry; and
- (g) all accessories for masonry construction other than—
 - (i) wall ties that are covered by AS/NZS 2699.1;
 - (ii) damp-proof courses and flashings that are covered by AS/NZS 2904;
 - (iii) termite protection that is covered by AS 3660; and
 - (iv) lintels and shelf angles that are covered by AS/NZS 2699.3.

NOTES:

- 1 Bed-joint mesh is fabric laid in masonry bed joints as a tying material. This item does not include structural reinforcement in the bed joints of reinforced masonry.
- 2 The design and installation of connectors and accessories are specified in AS 3700, NZS 4210 and NZS 4230.1 and NZS 4230.2.

The requirements for connectors and accessories specified in this Standard cover—

- (A) durability—materials specifications and test methods; and
- (B) structural—test methods only.

NOTE: The durability classifications employed in this Standard are compatible with the environments specified in AS 3700, NZS 3604 and AS/NZS 2312.

Because of the wide variety of connectors and accessories and their diverse applications, it is not possible to provide specifications for structural performance parameters; however, test methods for these parameters are given for the guidance of manufacturers, designers and purchasers.

NOTE: Specifications for structural performance of components may be nominated by manufacturers, or, negotiated between manufacturers, designers and purchasers.

This Standard applies to connectors and accessories used in masonry described in AS 3700, NZS 4210, NZS 4230.1 and NZS 4230.2.

1.2 REFERENCED DOCUMENTS The following documents are referred to in this Standard:

AS	
1170	Minimum design loads on structures (known as the SAA Loading Code)
1170.2	Part 2: Wind loads
1199	Sampling procedures and tables for inspection by attributes
1397	Steel sheet and strip—Hot-dipped zinc-coated or aluminium/zinc-coated
1399	Guide to AS 1199—Sampling procedures and tables for inspection by attributes
1449	Wrought alloy steels—Stainless and heat-resisting steel plate, sheet and strip
1580	Paints and related materials—Methods of test
1580.481	Coatings
1580.481.3	Method 481.3: Exposed to weathering—Degree of corrosion of coated metal substrates
2193	Methods for calibration and grading of force-measuring systems of testing machines
2331	Methods of test for metallic and related coatings
2331.2.1	Method 2.1: Average thickness tests—Dissolution methods—Strip and weigh, and analytical
2331.3.1	Method 3.1: Corrosion and related property tests—Neutral salt spray (NSS) test
3660	Protection of buildings from subterranean termites—Prevention, detection and treatment of infestation
3700	Masonry structures
3894	Site testing of protective coatings
3894.3	Method 3: Determination of dry film thickness
3942	Quality control—Variables chart—Guide
AS/NZS	
1580.481.1.9	Method 481.1.9: Exposed to weathering—Degree of blistering
1580.481.1.10	Method 481.1.10: Exposed to weathering—Degree of flaking and peeling
2312	Guide to the protection of iron and steel against exterior atmospheric corrosion
2699	Built-in components for masonry construction
2699.1	Part 1: Wall ties
2699.3	Part 3: Lintels and shelf angles (Durability requirements)
2904	Damp-proof courses and flashings
4455	Masonry units and segmental pavers
4534	Zinc and zinc/aluminium-alloy coatings on steel wire
4680	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
ISO 9000	Quality management and quality assurance standards
ISO 9000.1	Part 1: Guidelines for selection and use
ISO 9004	Quality management and quality system elements
ISO 9004.1	Part 1: Guidelines

NZS	
3604	Timber framed buildings
4203	General structural design and design loadings for buildings
4210	Code of practice for masonry construction: materials and workmanship
4230	Code of practice for the design of masonry structures
4230.1	Part 1: Structures
4230.2	Part 2: Commentary
ASTM	
G1	Standard practice for preparing, cleaning and evaluating corrosion test specimens
SAA/SANZ	
HB18	Guidelines for third-party certification and accreditation
HB18.28	Guide 28—General rules for a model third-party certification system for products

1.3 NEW TECHNOLOGIES This Standard shall not be interpreted as preventing the use of materials or methods of manufacture not specifically referred to herein, provided the specified performance criteria are met.

1.4 DEFINITIONS For the purpose of this Standard, the definitions below apply.

1.4.1 Capacity design procedure—design method in which elements of the primary lateral earthquake-force-resisting system are chosen, suitably designed and detailed for energy dissipation under severe deformations; all other structural elements are then provided with sufficient strength such that the chosen means of energy dissipation can be maintained.

1.4.2 Characteristic strength—the strength of a connector or accessory, installed in substrate, as determined by the various tests prescribed in Appendix A.

1.4.3 Characteristic value—the value that is exceeded by at least 95% of the components in the lot.

1.4.4 Connectors and accessories—any components other than wall ties, lintels and shelf angles (also see Clause 1.1) used in masonry construction to aid the structural integrity of the building or to provide support or stability to building finishes.

NOTE: Connectors and accessories are frequently referred to as ‘components’ in this Standard.

1.4.5 Ductility—the ability of a structural element to sustain its load-carrying capacity when subjected to cyclic inelastic displacements during seismic activity.

1.4.6 Duplex coating—a coating system that provides corrosion protection through the combination of an organic barrier coating applied to galvanized steel.

NOTE: A film of organic matter, such as paint or plastic, is not an automatic indication of a duplex coating. Such films may have been applied simply to identify the durability classification (see Clause 4.1).

1.4.7 Durability classification (R)—identifies the level of corrosion protection provided to a connector or accessory to meet the performance condition for the design life of a structure.

NOTE: The classifications, R0 to R5, are individually defined by reference to exposure conditions given in AS 3700.

1.4.8 Galvanized coating—a protective zinc coating alloyed to the steel substrate and applied by hot-dip immersion in molten zinc of at least 98% purity.

1.4.9 Lot—a group of connectors or accessories of a single type with specific characteristics and dimensions, presented for sampling at the same time.

1.4.10 Masonry couplet—two stack-bonded masonry units joined by a bed of mortar, or adhesive, as appropriate.

1.4.11 Monotonic test—test procedure in which the applied load is gradually increased until failure occurs.

1.4.12 Organic coating—a protective coating, based on one or more organic resins, in liquid or powder form, applied to the substrate.

1.4.13 Overstrength factor—the factor to be applied to the characteristic residual strength, to estimate the maximum probable strength of a connector or accessory, installed in substrate, where required for capacity design.

1.4.14 Residual load—the load resisted by a specimen after several cycles of displacement applied during the seismic loading test as prescribed in Appendix A.

1.4.15 Specimen—specially prepared item for testing, consisting of single or multiple connectors or accessories embedded in a masonry unit or a masonry couplet, possibly affixed to a length of timber or metal stud, or embedded in another masonry unit or couplet, to simulate the appropriate service condition or, where more than one type of service condition applies, the most demanding.

1.4.16 Substrate—either of the following, as appropriate:

- (a) The masonry, timber or metal assembly of a building, in or to which a connector or accessory is installed, embedded or affixed, as appropriate.
- (b) Basis metal to which a non-metallic coating, or component of a coating, is applied.

SECTION 2 PERFORMANCE CRITERIA

2.1 SCOPE OF SECTION This Section sets out specific requirements for the design and manufacture of connectors and accessories.

2.2 AIM The performance criteria set out in this Section are designed to ensure that—

- (a) connectors and accessories are durable and serviceable, and fulfil their intended function; and
- (b) there is no loss of function of the connectors or accessories, or adverse effect on the masonry, over a design life of not less than 50 years, except for those components intended for durability classification R5, which require the use of specifically designed connectors and accessories.

2.3 SAFETY All items shall be manufactured without sharp features, such as points or corners, that could injure site workers.

2.4 DURABILITY

2.4.1 General Materials for the manufacture of connectors and accessories shall be either inherently corrosion resistant or suitably coated to impart adequate corrosion resistance to achieve design life.

2.4.2 Damage Each connector or accessory shall be free from fracture or surface cracks. Where connectors or accessories are fabricated from coated sheet, wire or bar, the manufacturing process shall not materially damage the corrosion-resistant coating, except at cut edges or ends.

2.4.3 Classification of materials Connectors and accessories manufactured from any material shall be identified as durability classifications R0 to R5 by application of the acceptance criteria in Clause 2.4.4.

2.4.4 Durability criteria for connectors and accessories Connectors or accessories shall suffer no loss in serviceability or performance over the design life of the structure (see Clause 2.2) when subjected to the following in-service conditions:

- (a) Elevated temperatures with a maximum of 55°C, where the connector or accessory is exposed on the external face of the masonry, or 40°C, where the connector or accessory is embedded within mortar.
- (b) A cyclic temperature variation of 40°C over any 24 h period.
- (c) The mortar bed having an initial alkalinity with a pH of up to 10, but carbonating over time to a pH of not less than 7.
- (d) Being wet and remaining wet for a period of three months every year.
- (e) Exposure to UV radiation (global radiation of 20 MJ/m²) for a period of up to four weeks (the construction period).
- (f) Aerosol penetration, with the highest level of airborne salt deposited at the exterior of the masonry, as follows:
 - (i) R0 nil g/m²/day.
 - (ii) R1 10 g/m²/day.
 - (iii) R2 20 g/m²/day.
 - (iv) R3 60 g/m²/day.
 - (v) R4 300 g/m²/day.
 - (vi) R5 see Note 2.

NOTES:

- 1 The extent of aerosol salt penetration depends largely on the distance from the coast; however, in practice, microclimatic effects may distort otherwise normal climatic patterns by many kilometres and should always be taken into account. The salt deposition in the wall cavity would normally be half that experienced on the exterior face of the wall. The values used in Appendix B reflect this situation.
- 2 The R5 durability classification refers to specific environments outside the above criteria. Where industrial fall-out, bacteria, chemicals or other environmental conditions exist, it is necessary for the manufacturer to test all unique coatings and materials to confirm their resistance to the particular environment for the expected life of the structure. Because that environment cannot be specified in this document, suitable coating systems cannot be recommended.

2.4.5 Test methods Connectors produced from materials not meeting the deemed-to-comply provisions (see Section 3) shall be tested and assessed for compliance in accordance with Appendix B or Appendix C, as appropriate.

2.5 RESISTANCE TO WATER TRANSFER Connectors and accessories shall be manufactured such that, when tested in accordance with Appendix D, no connector or accessory permits water transfer across the cavity.

2.6 EMBEDMENT, MOVEMENT AND TOLERANCE Any part of a masonry connector or accessory that, in service, is built into a mortar bed in masonry shall be designed to have an overall height, including any crimping or bending, not exceeding 70% of the design bed thickness. This limitation shall not apply to connectors and accessories used with autoclaved aerated concrete blocks, but provision shall be made to accommodate the thickness of the connector or accessory.

2.7 STRUCTURAL PERFORMANCE The manufacturer shall state the minimum characteristic property or properties of the connector or accessory and shall provide evidence of its structural performance based on the test procedures specified in Appendix A and in accordance with the following criteria:

- (a) Tests on the connector or accessory shall simulate the most demanding in-service conditions for its intended use, and shall include its fixings and substrates.
- (b) Tests shall evaluate the strength, stiffness and potential movement of the connector or accessory in the three orthogonal directions, with the loading regime chosen to simulate the intended use of the connector or accessory.

SECTION 3 DEEMED - TO - COMPLY PROVISIONS FOR MATERIAL SELECTION

Bare connectors and accessories or connectors and accessories with metallic coating shall be deemed to comply with Clause 2.4.4 by compliance with Table 1 (for sheet) or Table 2 (for wire).

TABLE 1
DURABILITY CLASSIFICATIONS FOR CONNECTORS AND ACCESSORIES
MANUFACTURED FROM STEEL SHEET

Durability classification	Material requirement
R0, R1, R2	(a) Connectors and accessories manufactured from galvanized steel sheet complying with AS 1397 and with a galvanized coating of at least grade Z600 (b) Connectors and accessories galvanized after manufacture from bare steel sheet and complying with AS/NZS 4680 except that the coating mass shall be at least 300 g/m ² on each side
R3	Connectors and accessories galvanized after manufacture from bare steel sheet and complying with AS/NZS 4680 except that the coating mass shall be at least 470 g/m ² on each side
R4	Stainless steel Grade AS 1449/316 or AS 1449/316L (UNS S31600 or S31603) (see Table 2, Note 1)

NOTES:

- 1 See Table 2, Notes 2 and 5.
- 2 For ties of durability classification R5, see Clause 2.4.4, Note 2.

TABLE 2
DURABILITY CLASSIFICATIONS FOR CONNECTORS AND ACCESSORIES
MANUFACTURED FROM STEEL WIRE (OR BAR)

Durability classification	Material requirement
R0, R1, R2, R3	(a) Connectors and accessories manufactured from galvanized steel wire (or bar) shall comply with AS/NZS 4534, except that the galvanized coating mass shall be at least 470 g/m² (b) Connectors and accessories galvanized after manufacture from bare steel wire (or bar) and complying with AS/NZS 4680 except that the coating mass shall be at least 470 g/m²
R4	Stainless steel Grade AS 1449/316 or AS 1449/316L (UNS S31600 or S31603)

NOTES:

- 1 A chemical procedure is described in Appendix E for the identification of Grade AS 1449/316 or AS 1449/316L stainless steel.
- 2 Hot-dip-galvanized coatings may not be suitable for the manufacture of some connectors or accessories. For these components electrodeposited zinc coatings may be employed; in such cases, the zinc coatings shall meet all other requirements of this Standard.
- 3 For ties of durability classification R5, see Clause 2.4.4, Note 2.
- 4 Galvanized steel wire employed for the manufacture of connectors and accessories is normally supplied to a tensile strength specification of 550 MPa max.
- 5 Feedstock for connectors and accessories, already appropriately coloured for durability classification identification, may be available from materials suppliers.