AS 2699.3:2020

Australian STANDARD®

Built-in components for masonry construction

Part 3: Lintels and shelf angles (durability requirements)

STANDARDS Australia

This Australian Standard® was prepared by BD-028, Masonry Wall Ties and Accessories. It was approved on behalf of the Council of Standards Australia on 2 June 2020.

This Standard was published on 12 June 2020.

The following are represented on Committee BD-028:

Australasian Corrosion Association
Australian Building Codes Board
Australian Industry Group
Australian Institute of Building Surveyors
Australian Stainless Steel Development Association
Australian Steel Institute
Bureau of Steel Manufacturers of Australia
Concrete Masonry Association of Australia
Galvanizers Association of Australia
Housing Industry Association
Materials Australia
Think Brick Australia
University of Newcastle

This Standard was issued in draft form for comment as DR AS 2699.3:2019.

Keeping Standards up-to-date

Ensure you have the latest versions of our publications and keep up-to-date about Amendments, Rulings, Withdrawals, and new projects by visiting:
www.standards.org.au

ISBN 978 1 76072 873 1

Australian STANDARD®

Built-in components for masonry construction

Part 3: Lintels and shelf angles (durability requirements)

First published as AS/NZS 2699.3:2000.
Second edition 2002.
AS/NZS 2699.3:2002 revised and redesignated AS 2699.3:2020.

Preface

This Standard was prepared by the Standards Australia Committee BD-028, Masonry Wall Ties and Accessories, to supersede AS/NZS 2699.3—2002.

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

AS 2699.1, *Built-in components for masonry construction, Part 1: Wall ties*

AS 2699.2, *Built-in components for masonry construction, Part 2: Connectors and accessories*

AS 2699.3, *Built-in components for masonry construction, Part 3: Lintels and shelf angles (durability requirements)*

The objective of this Standard is to provide manufacturers of lintels and shelf angles with specifications to achieve durability requirements, and methods for testing corrosion resistance.

Durability requirements for lintels and shelf angles are specified in AS 3700, *Masonry structures* and AS 4773.1, *Masonry in small buildings,* Part 1*: Design,* and AS 4773.2, *Masonry in small buildings,* Part 2: *Construction*.

The terms "normative" and "informative" are used in Standards 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 conformance with them is not a requirement of the Standard.

This Standard includes a commentary on some of the clauses and tables. The commentary directly follows the relevant clause or table, is designated by "C" preceding the clause/table number and is printed in italics in a box. The commentary is for information and guidance and does not form part of the Standard.

Contents

NOTES

Australian Standard®

Built-in components for masonry construction

Part 3: Lintels and shelf angles (durability requirements)

Section 1 Scope and general

1.1 Scope

This Standard specifies requirements for the durability performance of steel lintels and shelf angles to be built into masonry.

This Standard applies to lintels and shelf angles used in masonry construction described in AS 3700, AS 4773.1 and AS 4773.2.

NOTE 1 AS 2699.1 specifies the durability performance and test procedures for structural performance of wall ties used in masonry construction.

NOTE 2 AS 2699.2 specifies the durability performance and test procedures for structural performance of connectors and accessories used in masonry construction.

NOTE 3 Throughout this Standard, lintel signifies lintel or shelf angle, unless stated otherwise.

NOTE 4 The durability classifications employed in this Standard are compatible with the environments specified in ISO 9223, AS 4312—2008, AS 3700, AS 4773.1 and AS 4773.2.

NOTE 5 This Standard does not cover requirements for structural design or the method of its determination. Details for these are given by AS 3700, AS 4773.1, AS 4100, and AS/NZS 4600.

NOTE 6 Design and installation requirements for lintels and shelf angles are specified in AS 3700, AS 4773.1 (design) and AS 4773.2 (construction).

1.2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitute requirements of this document:

NOTE Documents referenced for informative purposes are listed in the Bibliography.

AS 1627.4, *Metal finishing—Preparation and pretreatment of surfaces, Part 4: Abrasive blast cleaning of steel*

AS 2331.1.4, *Methods of test for metallic and related coatings, Method 1.4: Local thickness tests—Magnetic induction and eddy current methods*

AS 3700, *Masonry structures*

AS 3894.3, *Site testing of protective coatings, Method 3: Determination of dry film thickness*

AS 4773.1, *Masonry in small buildings, Part 1: Design*

AS 4773.2, *Masonry in small buildings, Part 2: Construction*

AS/NZS 3750.6, *Paints for steel structures, Part 6: Full gloss polyurethane (two-pack)*

AS/NZS 3750.9, *Paints for steel structures, Part 9: Organic zinc-rich primer*

AS/NZS 3750.9, *Paints for steel structures, Part 14: High-build epoxy (two-pack)*

AS/NZS 4680, *Hot-dip galvanized (zinc) coatings on fabricated ferrous articles*

AS/NZS 4791, *Hot-dip galvanized (zinc) coatings on ferrous open sections, applied by an in-line process*

AS 4848.1, *Application specifications for coating systems, Part 1: Single coat inorganic (ethyl) zinc silicate—Solvent-borne*

ISO 2178, *Non-magnetic coatings on magnetic substrates — Measurement of coating thickness — Magnetic method*

ISO 19840, *Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Measurement of, and acceptance criteria for, the thickness of dry films on rough surfaces*

AS ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

ASTM A240/A240M, *Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications*

1.3 Terms and definitions

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

1.3.1
batch
clearly identifiable collection of units, manufactured consecutively or continuously under the same conditions, using material or compound to the same specification

1.3.2
corrosivity category
C
standardized rating of corrosivity of atmosphere in relation to the one-year corrosion effect on steel and zinc

Note 1 to entry: The classifications C1 to C5 and CX are individually defined by reference to corrosivity of the atmosphere according to ISO 9223 and AS 4312—2008.

Note 2 to entry: A method for estimating corrosivity category is given in Appendix D.

1.3.3
design life
period for which the lintel is expected to fulfil its intended function

Note 1 to entry: See Clause 1.3.10.

1.3.4
distributor
any business entity that provides a point/source of supply of a lintel to the market

1.3.5
duplex coating
coating system that provides corrosion protection through the addition of an organic barrier coating applied over galvanized steel

1.3.6
durability class
R
identifies the level of corrosion protection provided to a lintel to meet the performance condition for the design life of a structure

Note 1 to entry: The classifications R1 to R5 are individually defined by reference to exposure conditions given in AS 3700, AS 4773.1 and AS 4773.2.

1.3.7
factory production control
FPC
comprises operational techniques and all measures necessary to regulate and maintain the conformity of the product to the requirements of a Standard

1.3.8
galvanized coating
protective zinc coating alloyed to the steel substrate and applied by hot-dip immersion in molten zinc of at least 98 % purity

1.3.9
inorganic zinc silicate
coating consisting essentially of a dispersion of metallic zinc powder in an inorganic silicate medium

1.3.10
lintel
loadbearing beam that provides structural support for the masonry and other loads above a window, door or other opening of a building

1.3.11
lot
group of lintels of a single type with specific characteristics and dimensions, presented for sampling at the same time

1.3.12
manufacturer
business entity providing the total, substantive or final production/assembly process of the lintel

1.3.13
manufacturing lot
manufacturing batch
quantity of lintels of a single type with specific characteristics and dimensions, processed through the same or similar steps at the same time or over a continuous time period from a process with FPC

1.3.14
manufacturing lot number
unique alphanumeric code assigned by the lintel manufacturer to a manufacturing lot enabling its traceability throughout the entire production operation, including incoming materials control and all processes defined in the FPC

1.3.15
organic coating
protective coating, based on one or more organic resins, in liquid or powder form, applied to the substrate

1.3.16
purchaser
organization or person who buys lintels, but is not necessarily the user

1.3.17
sample
one of more units of product drawn from a batch or lot, selected at random without regard to quality

Note 1 to entry: The number of units of product in the sample is the sample size.

1.3.18
shall
indicates that a statement is mandatory

1.3.19
shelf angle
structural angle fixed to a supporting wall and used to support a vertical masonry veneer

1.3.20
should
indicates a recommendation

1.3.21
specimen
specially prepared item for testing, consisting of a lintel embedded in masonry, to simulate the design service condition or, where more than one type of service condition applies, the most demanding

1.3.22
statistical process control
SPC
application of statistical methods to the monitoring and control of a process to ensure that it operates at its full potential to produce conforming product

1.3.23
supplier
organization that provides lintels

Note 1 to entry: The supplier may be the manufacturer, an importer or a distributor.

1.3.24
trace lot number
unique alphanumeric code assigned by a lintel manufacturer or distributor, which identifies the original manufacturing lot number in an unequivocal manner

1.3.25
type testing
testing performed to prove that the lintel is capable of conforming to the requirements of this Standard

1.4 Product conformity evaluation

Product conformity to this Australian Standard shall be evaluated in accordance with Appendix B.

If the evaluation of the product conformity is not completed, or the product does not fulfil the requirements stated in this Standard, claims shall not be made that products meet the requirements of this Standard.

1.5 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.

Section 2 Performance criteria

2.1 Scope of section

This Section sets out specific requirements for the manufacture of lintels.

2.2 Aim

The performance criteria set out in this Section are intended to ensure that —

(a) the lintels are durable and serviceable, and thus retain adequate strength; and

(b) there is no loss of function of the lintels, or adverse effect on the masonry, over a design life of not less than 50 years.

NOTE It is essential that lintels attached to supporting walls be installed so that they do not permit water transfer across the cavity to the supporting frame. For example, flashing or a drip mechanism may be used to shed water into the cavity.

2.3 Safety

Features that present a safety hazard, e.g. sharp edges and burrs, shall be removed. In the case of coated lintels, these features shall be removed prior to coating.

2.4 Durability

2.4.1 General

Materials for the manufacture of lintels shall be either inherently corrosion resistant or suitably treated to ensure sufficient durability to achieve design life.

2.4.2 Damage

All cut ends and any damaged areas on coated lintels shall be repaired prior to installation to ensure that the durability criteria are met. The minimum acceptable repair requirements and methods shall be in accordance with Appendix F.

2.4.3 Classification of materials

Lintels manufactured from any material shall be identified as durability classes R1 to R5, as defined in AS 3700, AS 4773.1, and AS 4773.2, by application of the acceptance criteria in Clause 2.4.4.

2.4.4 Durability criteria for lintels

Lintels shall suffer no loss in serviceability over the design life of the structure (see Clause 2.2) when subjected to the following in-service conditions:

(a) *R1 and R2* —

(i) all interior locations;

(ii) exterior locations more than 1 km from a non-surf coast and not classed as industrial;

(iii) exterior locations more than 10 km from a surf coast and not classed as industrial;

(iv) protected exterior locations with a coating above the damp proof course (DPC) or a membrane below the DPC in any atmospheric environment; or

(v) locations not subject to wetting or soil exposure.

(b) *R3* —

(i) exterior locations 100 m to 1 km from a non-surf coast;

(ii) exterior location 1 km to 10 km from a surf coast; or

(iii) exterior locations subject to non-saline wetting and drying.

(c) *R4* —

(i) exterior locations less than 100 m from a non-surf coast;

(ii) exterior locations less than 1 km from a surf coast; or

(iii) exterior locations subject to saline wetting and drying or aggressive soil.

(d) *R5:* Locations outside the above criteria which show severe corrosion (see Note 2).

The design solutions for the durability criteria of this Clause shall be as specified in Table 3.1.

NOTE 1 Appendix D relates the durability classifications R1 to R5 to the ISO 9223 corrosivity categories and locations described in AS 4312—2008.

NOTE 2 Examples of R5 durability class are CX atmospheric environments, acid sulfate soils, enclosed swimming pools, fertilizer sheds, tanneries, chemical plants, piggeries, poultry sheds and similar environments, which may require special materials or coatings

2.4.5 Alternative materials

Where alternative material are used in the production of lintels, conformance to the durability criteria set out in this Standard shall be demonstrated as specified in Clause 3.2.

2.5 Impact resistance

Coatings on lintels shall have sufficient impact resistance to ensure that they remain intact under normal handling conditions expected during manufacture, transportation and installation.

Any damage shall be repaired (see Clause 2.4.2).

Section 3 Materials

3.1 Material selection

Materials for lintels shall be in accordance with Table 3.1.

Determination of the coating thickness of hot-dip galvanized lintels shall be in accordance with Appendix A.

NOTE 1 The method set out in Appendix A for hot-dip galvanized lintels may be used for site inspection of an individual article or for inspection of a batch lot, such as supplied to a distributor, or for house lots. It may also be used to demonstrate the galvanized coating thickness for alternative solutions.

NOTE 2 The methods set out in Clause E.2 and Clause E.3 for identifying 304 and 316 stainless steel lintels may be used for site inspection of an individual article or for inspection of a batch lot, such as supplied to a distributor, or for house lots. If there is any doubt, the stainless steel lintels should be assessed by examination of the supplier's test report or a laboratory as described in Clause E.5.

Additional decorative coats may be applied to a lintel. The additional coating shall be compatible with the substrate material, but shall not be considered for durability calculations.

NOTE 3 Information on painting hot dip galvanized steel is available in AS/NZS 2312.2. Information on suitable top coats for inorganic zinc silicate coatings is available in AS 2312.1. Information on painting stainless steel can be obtained from paint suppliers.

C3.1 *(Clause) The corrosivity of the atmospheric environment affects the durability of lintels used in masonry. Appendix D sets out methods that may be used to develop a reasonable estimation of the atmospheric exposure for lintels. If the location of the structure has been defined according to AS 4312—2008, then the required durability class for lintels may be determined using Appendix D, subject to the in-service conditions described in Clause 2.4.4 being met.*

Galvanized (zinc) steel is resistant to mild alkaline conditions, such as exists in the mortar used in masonry construction. Uncured mortar does attack galvanized steel, although this attack slows once the mortar is cured, and experience has shown the durability is not significantly compromised. The coating types in AS 1397 include the "AZ" and "AM" coatings, which contain significant amounts of aluminium. These aluminium-rich products are susceptible to ongoing rapid corrosion in mortar due to their high aluminium content and are not suitable for use when lintels are embedded in fresh mortar.

Inorganic zinc silicate paints, as described in AS 2312.1, are considered an acceptable design solution in environments up to and including R3 when applied to suitably prepared surfaces.

Stainless steel grade 304 may exhibit rust spotting (tea staining) and crevice corrosion over time, specially in environments where the lintel is exposed to chlorides such as in marine locations and where it remains unwashed. If appearance is critical, the lintel may be coated, a smoother finish may be specified or grade 316/316L may be specified.

Table 3.1 — Material selection for lintels of various durability classes

Durability class	Material or protective coating specification
R1 and R2	Hot dip galvanized to AS/NZS 4791 ILG300 (minimum average coating thickness ≥ 42 µm)
	Hot dip galvanized to AS/NZS 4680 HDG300 (minimum average coating thickness ≥ 42 µm)
	Painted with inorganic zinc silicate paint to AS 4848.1 (except minimum average coating thickness ≥ 75 µm)
R3	Hot dip galvanized to AS/NZS 4680 HDG600 (minimum average coating thickness ≥ 85 µm)
	Painted with inorganic zinc silicate paint to AS 4848.1 (except minimum average coating thickness ≥ 125 µm)
	Stainless steel ASTM A240 304L (UNS S30403)
R4	Duplex coating (hot dip galvanized plus paint coating) consisting of AS/NZS 4680 HDG 600 (minimum average coating thickness ≥ 85 µm) followed by sweep blast cleaning and a paint coating consisting of either — (a) 350 µm of high build epoxy paint to AS/NZS 3750.14; or (b) 250 µm of high build epoxy paint to AS/NZS 3750.14 followed by 100 µm of polyurethane to AS/NZS 3750.6 or 100 µm of acrylic gloss to AS/NZS 3750.5
	Stainless steel ASTM A240 316L (UNS S31603)
R5	See Note 2

Painted, hot-dip galvanized and duplex coated lintels shall have all surfaces fully coated, including ends. Any damaged areas shall be repaired using the methods described in Appendix F.

NOTE 1 Durability class is defined in Clause 2.4.4.

NOTE 2 The design solution for R5 will depend on the environment to which the lintel is exposed and will require specialist advice for design solutions.

NOTE 3 304 (UNS S30400) and 316 (UNS S31600) stainless steel grades are considered accepted alternatives for 304L (UNS S30403) and 316L (UNS S31603) respectively.

NOTE 4 A material for a particular durability class is also considered suitable material for lower durability classes. For example, R3 material may be used in durability classes R1 and R2.

C3.1 *(Table) The successful application of paint coatings (including duplex systems) requires adherence to the paint supplier's guidelines including surface preparation, weather conditions and overcoating times. It is strongly recommended that any painted or duplex coated lintel follow the recommendations in AS 2312.1 (paint) and AS/NZS 2312.2 (duplex coatings).*

Guidelines for the selection and application of inorganic zinc silicate paint systems specified in this Standard are described in AS 2312.1. These are denoted AS 2312.1 IZS1 (75 µm coating thickness) and AS 2312.1 IZS 4 (125 µm coating thickness).

Guidelines for the selection and application of duplex systems (paint applied over galvanized coatings) specified in this Standard are described in AS/NZS 2312.2. These are denoted AS/NZS 2312.2 4I and AS/NZS 2312.2 4D.

3.2 Alternative materials

Lintels manufactured from alternative materials or using alternative coating systems shall be deemed acceptable materials for the durability criteria of Clause 2.4.4 of this Standard if evidence to support the

use of an alternative material is provided. Documentary evidence shall be a complete copy of the report or document. This evidence shall include:

(a) The method used to determine the durability of the material or coating system, which sets out the basis on which it is given and the extent to which relevant Standards, specifications, rules, codes of practice and other publications have been relied upon.

(b) A report prepared by a testing authority as required in Clause 5.2, showing that the material or coating system has been submitted to the tests listed in the report, and setting out the results of those tests. The report shall include all the information required in Clause 5.2.

(c) Any information that demonstrates the material's suitability for use in the building.

Results obtained from salt spray tests (e.g. ASTM B117, ISO 9227 and AS 2331.3.1) shall not be regarded as indicating the relative corrosion resistance of different zinc coatings.

C3.2 *The results obtained from salt spray tests seldom correlate to real life performance in natural environments and cannot be used to accurately test zinc-coated steel because the test accelerates a different failure mechanism. Without a proper wet/dry cycle, the zinc coating cannot form patina layers. The absence of a patina layer allows constant attack of the zinc metal and gives a very low prediction of the zinc coating lifetime.*

Section 4 Identification markings

4.1 Lintel marking

Each lintel shall be permanently marked to indicate the following:

(a) The number of this Standard, i.e. AS 2699.3.

(b) The durability class (as specified in Table 4.1 and this Clause).

(c) The manufacturer or supplier name or trademark.

NOTE 1 For an example of lintel marking, see Figure 4.1

The marking used shall indicate the highest durability class applicable for the lintel.

Each lintel shall be colour coded, as specified in Table 4.1, or otherwise marked with the appropriate durability classification so that the identification is readable from a distance of 1 m. The colour of the mark used shall be either black or the durability class colour code.

If the mark is applied by metal stamping, any protective coating shall not be damaged in the process.

All identification marks (including colour codes) shall be placed on a face that is readily visible after installation.

NOTE 2 The marking is not required to be visible after the lintel is built into the structure.

Table 4.1 — Durability class marking for lintels

Durability class	Colour code
R1	Green
R2	Yellow
R3	Red
R4	Blue
Lintels of durability class R5 shall be labelled or otherwise identified as agreed between manufacturer and purchaser.	

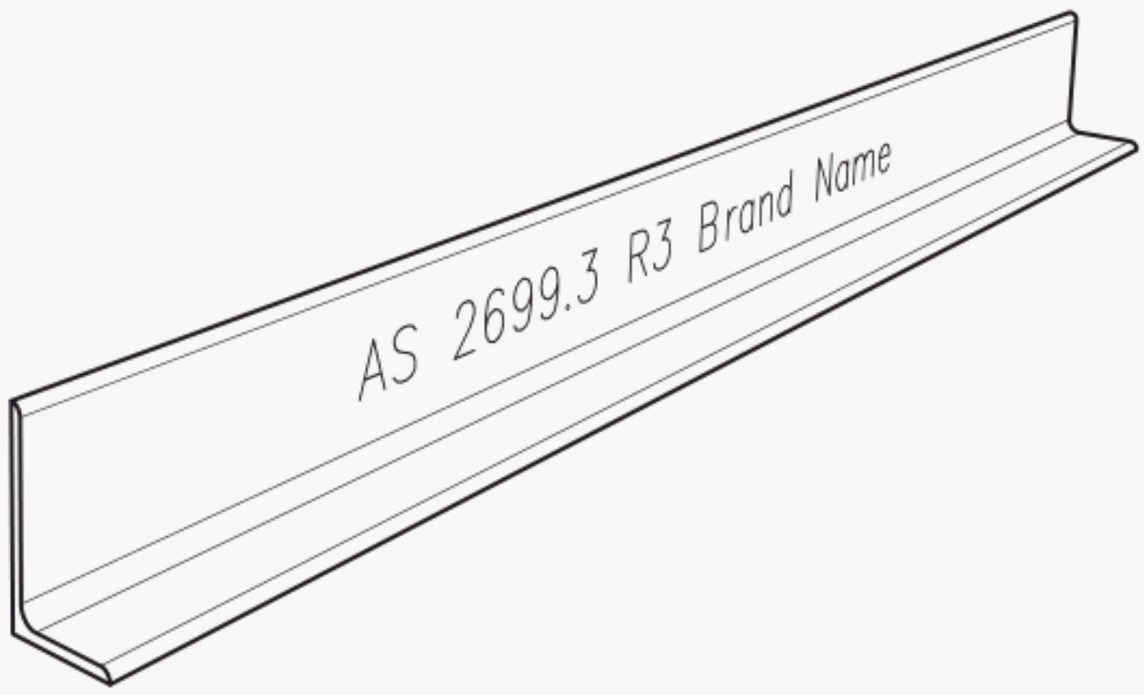

Figure 4.1 — Example of acceptable marking

4.2 Package marking

The following information shall be marked on each lintel, or on a label securely attached thereto:

(a) Reference to this Standard, i.e. AS 2699.3.

(b) Name or registered trade name or mark and address of the manufacturer or supplier.

(c) Durability classification.

(d) Any limitations on the use of the lintel, including those not specifically identified in this Standard.

Where a protective coating applied to a lintel may be susceptible to damage through impact or similar incident, an easily read warning shall be firmly placed on each lintel, advising of the necessity for due care in transporting, handling and installing the lintel, and for the need to repair any damage to the coating.

NOTE This warning applies particularly to the use of wire rope slings for the lifting of lintels that have a paint or duplex coating. Such slings should be sleeved to minimize abrasion damage.

Section 5 Testing

5.1 General

A test report shall be available for all products manufactured to this Standard. The tests shall be performed by a laboratory accredited to AS ISO/IEC 17025.

NOTE Accreditation bodies that are signatories to the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Arrangement (MRA) for testing laboratories are able to offer accreditation to AS ISO/IEC 17025. A listing of ILAC signatories is available from the ILAC website (www.ilac.org). In Australia and New Zealand, the National Association of Testing Authorities (NATA) is signatory to the ILAC MRA.

5.2 Test reports — Minimum requirements

Test reports shall be in English alphanumeric characters, issued by the manufacturer or supplier, and include the following:

(a) The name and address of the lintel manufacturer or supplier who establishes the inspection document.

(b) The report number.

NOTE The report number is a unique identification allocated by the testing authority for its own traceability to test/inspection results.

(c) Type of lintel, including manufacturer's or supplier's drawing identification number.

(d) Batch and manufacturing lot number (or trace lot number) for each manufacturing lot.

(e) Size of the manufacturing lot.

(f) The lintel marking (see Clause 4.1).

(g) The manufacturer identification (trade) mark of the labelling, if any.

(h) Identification and address of the test authority and accreditation details of the test authority and the test identification number(s) for the measured values [see Item (j)] date of issue, page number and total number of pages on each page.

(i) Measured values in comparison to specified values for each of the properties required to be reported in this Standard.

(j) Reference to the test Standard and specific test method used.

(k) Reference to this Standard, i.e. AS 2699.3.

NOTE The test report should be accompanied by a declaration of conformity that the products supplied conform to the requirements of this Standard.

5.3 Testing of lintels

Testing for lintels shall be as specified in Table 5.1.

Table 5.1 — Tests for lintels

Critical characteristic	Accuracy	Method
Durability class — Local average coating thickness, µm	±2 µm	Measurement
The coating thickness tests shall apply to galvanized and coated components. Stainless steel component durability classification shall be determined from the original material supplier's test report.		

Appendix A
(normative)

Method for determining the coating thickness of hot dip galvanized, painted and duplex coated lintels

A.1 Scope

This Appendix provides methods to measure the coating thickness of lintels that are hot dip galvanized, painted or duplex coated.

The methods specified in this Appendix are intended for site inspection of an individual article or for inspection of a batch lot, such as supplied to a distributor or for house lots.

The methods specified in this Appendix may also be used to demonstrate the galvanized coating thickness of alternative materials (see Clause 3.2).

A.2 Coating thickness inspection method

Coating thickness inspection of galvanized or duplex coated articles shall be by a method given in AS 2331.1.4 or ISO 2178. Coating thickness of painted articles shall be by a method given in AS 3894.3 or ISO 19840. The gauge used shall be suitable for the article being measured. The gauge shall be calibrated and adjusted to the manufacturer's instructions prior to sample inspection.

A.3 Hot dip galvanized coating thickness

A.3.1 Acceptance inspection and sampling

A control sample for thickness testing shall be taken randomly from each inspection lot selected for testing. The random selection method shall ensure there is no bias, whether positive or negative, which would skew the coating thickness measurement.

NOTE For example, articles selected should not all be from the top of a row of packed articles, nor should the reading be taken from a part of the lintel that is not representative of the overall coating thickness

The minimum number of articles from each inspection lot that forms the control sample shall be in accordance with Table A.1.

Table A.1 — Control sample size related to lot size

Number of articles in lot	Minimum number of articles in the control sample
1 to 3	All
4 to 500	3
501 to 1200	5
1201 to 3200	8

A.3.2 Thickness readings

The location of the thickness readings shall be chosen with regard to the shape and size of the lintel to be measured to obtain a result as representative as possible of mean coating thickness.

The thickness measurements shall not be taken on areas less than 10 mm from edges or corners and not less than 100 mm from the ends of lintels as the coating may build up or reduce in these areas providing misleading results. Where practicable, the locations measured shall comprise the whole cross-section of the lintels.

For lintels under 3 m in length, the local average coating thickness on a lintel shall be taken as the average of at least 5 thickness readings performed randomly over the lintel. The control sample's average coating thickness shall be calculated from the average of all the sample local coating thicknesses.

For lintels 3 m and over in length, the local average coating thickness on a lintel shall be taken as the average of at least 15 thickness readings performed randomly over the lintel. The control sample's average coating thickness shall be calculated from the average of all the sample local coating thicknesses.

The average coating thickness for each lintel in the control sample shall be equal to or greater than the minimum average coating thickness values specified in Table A.2. An individual reading may be lower than the local average coating thickness value specified in Table A.2, provided the average is greater than or equal to the minimum local coating thickness.

A.3.3 Acceptance criteria

When a control sample is tested, the coating thickness shall be not less than the values specified in Table A.2.

If the control sample does not conform to the coating thickness requirements of the relevant Standard, twice the original number of articles (or all the articles if that is the lesser number) may be taken from the lot and tested. If this larger control sample passes, the whole inspection lot shall be accepted (but not any failed parts). If the larger control sample does not pass, the articles that do not conform to the requirements shall be discarded.

NOTE The customer may authorize for the articles to be re-galvanized. See Appendix C for purchasing guidelines.

Table A.2 — Coating thickness acceptance criteria for acceptable design solutions

Specification	Minimum local coating thickness µm	Minimum average coating thickness µm
AS/NZS 4791 ILG300	34	42
AS/NZS 4680 HDG300		
AS/NZS 4680 HDG600	70	85

A.4 Paint coating thickness

A.4.1 General

AS 4848.1 describes the steps necessary to prepare the steel for painting. These are not covered in this Standard.

NOTE 1 The purchaser should ensure that the supplier or manufacturer of the lintel has the skills and equipment necessary to properly apply the paint coating to the requirements of AS 4848.1. For purchasing guidelines, see Appendix C.

NOTE 2 The methods specified in this Appendix are a simplified form of the methods and procedures for checking the thickness of dry paint films on abrasively blasted surfaces described in AS 3894.3. In case of dispute, the full requirements of AS 3894.3 should be used.

NOTE 3 For inorganic zinc silicate coatings there is normally a critical maximum dry coating thickness, which will vary by paint manufacturer. Information should be provided on this aspect in the paint manufacturer's technical data sheet. In cases where the actual dry coating thickness is greater than the maximum allowable, additional checks should be carried out to ensure the coating is otherwise sound.

A.4.2 Acceptance inspection and sampling

A control sample for thickness testing shall be taken randomly from each inspection lot selected for testing. The random selection method shall ensure there is no bias, whether positive or negative, which would skew the coating thickness measurement.

NOTE For example, articles selected should not all be from the top of a row of packed articles

The minimum number of articles from each inspection lot that forms the control sample shall be as specified in Table A.3.

The dry film thickness shall be measured at least once on each flat face for every metre of length, so that a minimum of 5 point readings are taken for each lintel.

The average of the 5 or more point readings for each control sample shall not be outside the coating thickness range specified in Table A.4. No single point reading in any control sample shall be less than 80 % of the specified minimum coating thickness. Where three readings are averaged to produce a point reading, an individual reading may be less than 80 % of the minimum coating thickness.

Table A.3 — Sampling plan for inspection with AQL = 1.5 %

Lot size	Sample size	AQL = 1.5 %	
		Accept	Reject
2 to 8	2	0	1
9 to 15	3	0	1
16 to 25	5	0	1
26 to 50	8	0	1
51 to 90	13	0	1
91 to 150	20	1	2
151 to 280	32	1	2
281 to 500	50	2	3
501 to 1200	80	3	4
1201 to 3200	125	5	6
The lot size shall be determined and then read off the sample size. NOTE For example, a lot size of 300 parts would need a sample size of 50 pieces and from these 50 pieces two samples may be rejected for under-thickness, and the lot is deemed to pass. The entire lot would fail with three rejected samples, and the lot is either rejected in total or a decision made to double the sample size and the new samples are to be tested.			

A.4.3 Acceptance criteria

When a control sample is tested, the coating thickness shall be not less than the values specified in Table A.4.

If the control sample does not conform to the coating thickness requirements of the relevant coating, twice the original number of articles (or all the articles if that is the lesser number) shall be taken from the lot and tested. If this larger control sample passes, the whole inspection lot shall be accepted (but not any failed parts). If the larger control sample does not pass, either the articles that do not conform to the requirements shall be discarded or they shall be repainted if required.

Table A.4 — Coating thickness acceptance criteria for acceptable design solutions

Specification	Minimum single point reading coating thickness µm	Minimum average coating thickness µm
AS 4848.1 (except 75 µm coating thickness)	60	75
AS 4848.1 (except 125 µm coating thickness)	100	125

A.5 Duplex coating thickness

Duplex coatings (the combination of a hot dip galvanized steel article with a paint coating) cannot be assessed on site for conformance of the coating type, or whether the substrate is hot dip galvanized, or thickness of the individual coatings, without a destructive test.

Coating thickness and assessment of coating type and galvanizing condition (if required) shall be determined at the manufacturing facility.

Coating thickness, sample size and acceptance criteria of duplex coating systems shall be determined by the method described for inspection of the coating thickness for paint coatings (see Clause A.4).

A.6 Test report

The following information shall be reported:

(a) Identification of the test method.

(b) Name of testing authority and the person responsible for the test.

(c) Date and location of test.

(d) Lot size.

(e) Identification of the lot of lintels, including —

  (i) manufacturer;

  (ii) lintel description, including the specification and drawing identification number(s) provided by the lintel manufacturer or supplier; and

  (iii) source of the lot.

(f) For the sample lot —

  (i) minimum local average coating thickness; and

  (ii) minimum average coating thickness.

(g) Any variation from the test procedure.

(h) Comments, if necessary.

(i) Summary of results giving durability class of tested item.

(j) Reference to this Standard, i.e. AS 2699.3.

Appendix B
(normative)

Product conformity

B.1 Scope

This Appendix sets out the minimum requirements for evaluating product conformity to this Standard through —

(a) initial type testing (ITT); and

(b) a minimum sampling and testing frequency plan.

Lintels for test shall be chosen to ensure they are representative of the condition of the manufacturing lot.

Product conformity requirements enable conformity assessment to be undertaken by a manufacturer or supplier (first party), a user or purchaser (second party), or an independent body (third party).

NOTE For guidance on sampling and inspection, see ISO 2859-1 and ISO 3951series.

B.2 Initial type testing

An initial type testing program comprises intensive routine testing to establish the capabilities of the manufacturing process to produce product(s) and component(s).

Initial type testing requirements shall be as detailed in Table B.1.

Table B.1 — Minimum sampling and testing frequency plan for initial type testing

Characteristic	Reference	Sample size
Local average coating thickness, µm	Table 3.1	In accordance with Clause A.3.1 (galvanized lintels) and Clause A.4.2 (painted or duplex coated lintels)[a, b]
[a] Only galvanized, painted and duplex coated lintels shall be tested for coating thickness. [b] Stainless steel lintels durability classification shall be determined from the original material supplier's test report.		

B.3 Sampling and testing frequency

The minimum sampling and testing frequency plan shall be as detailed in Table B.2.

NOTE 1 A factory production control (FPC)system should be in place, which consists of procedures, regular inspections and tests and/or assessments and the use of the results to control raw and other incoming material or components, equipment, the production process and the product.

NOTE 2 A documentation and maintenance protocol of the factory production control (FPC) system should be established to ensure that the process of production is capable of consistently fulfilling the requirements of this Standard.

Table B.2 — Lintels — Minimum sampling and testing frequency plan

Characteristic	Applicable clause	Sample size
Durability class	3.1	In accordance with Clause A.3.1 (galvanized lintels) and Clause A.4.2 (painted or duplex coated lintels)[a, b]
Identification marking	4	One piece per shift

[a] The coating thickness tests are required only for galvanized, painted and duplex coated lintels.

[b] Stainless steel lintel durability classification shall be determined from the original material supplier's test report.

B.4 Retesting — Non-conforming product

B.4.1 Further samples

In the event of a test failure, the products manufactured since the previous test(s) conforming to the requirements outlined in Table B.1 shall be quarantined as a batch. A further set of samples shall be selected randomly from the quarantined batch and twice the number of products originally selected as specified in Table B.1 shall be tested.

B.4.2 Successful retest

Provided the retest requirements are met, the batch shall be released and conformance to this Standard for the quarantined batch claimed.

B.4.3 Rejection after retest

Should a failure on retesting occur, the quarantined batch shall be rejected and claims and/or marking indicating conformance to the Standard(s) shall be suspended until the cause of the failure has been identified and corrected.

In the event of a quarantined batch being rejected after retesting, it may be 100 % retested for the failed requirement(s).Only those items found to conform to this Standard shall be claimed and/or marked as conforming.

B.5 Documentation

The results of the initial type testing program shall be recorded. The records shall be maintained and made available for inspection for a period of at least 10 years after the date when that last product to which the test program refers was delivered.

Documentation shall include information to be supplied to the purchaser, plus manufacturing process, physical and mechanical properties, inspection and testing, and test procedures.

Appendix C
(informative)

Purchasing guidelines

C.1 General

Australian Standards are intended to include the technical provisions necessary for the supply of materials referred to in the particular Standard, but do not purport to comprise all the necessary provisions of a contract. In a number of cases, the purchaser is asked to state the requirements or is given a choice of optional requirements. These are contractual matters to be agreed upon between the purchaser and the manufacturer or supplier.

This Appendix contains detailed explanations, advice and recommendations on the information to be supplied by the purchaser at the time of enquiry and order. Its aims are to avoid misunderstandings and to result in the purchaser receiving satisfactory products and services.

C.2 Information to be supplied by the purchaser

The purchaser should consider and supply the following information at the time of enquiry and order, after making due reference to the explanation, advice and recommendations contained in this Appendix and the requirements of this Standard:

(a) Quantity, type of lintel, durability class and length of each lintel.

(b) Delivery instructions (dates, schedules and delivery point).

(c) Whether a test report is required.

(d) Any information concerning processing or end use that the purchaser considers of assistance to the manufacturer or supplier.

(e) Whether any special testing conditions and procedures are necessary or required, and if there are any supplementary requirements.

NOTE 1 Any special or supplementary requirements additional to the requirements of this Standard are subject to agreement between the purchaser and the manufacturer, or the supplier at the time of enquiry and order, and should be stated on the order.

NOTE 2 Special testing conditions and procedures may be required for durability class R5.

C.3 Inspection

If it is the purchaser's intention to undertake any of the following functions at the manufacturer's works or at the supplier's works, the manufacturer or supplier should be notified at the time of enquiry and order, and the functions should be accomplished in a manner that will not interfere with the operation of the works.

The functions are as follows:

(a) Inspect the product during manufacture.

(b) Select and identify the test samples.

(c) Witness the tests being made.

The manufacturer or supplier should provide all reasonable facilities to enable the purchaser to be satisfied that the product conforms to this Standard.

NOTE Any special or supplementary inspection requirements additional to the requirements of this Standard are subject to agreement between the purchaser and the manufacturer, or the supplier at the time of enquiry and order, and should be stated on the order.

Appendix D
(informative)

Typical relationship of durability class to atmospheric corrosivity category

D.1 General

The corrosivity of the atmospheric environment affects the durability of components used in masonry. This Appendix sets out methods that may be used to develop a reasonable estimation of the atmospheric exposure for those locations where actual corrosivity measurements have not been carried out.

Estimates of the corrosivity of the atmospheric environment may be developed from historical data; by observation of long-term performance of similar structures in the local environment; or by direct determination. However, other than for locations exposed to severe salt spray or strong chemical pollution, estimation of the location corrosivity using the techniques described in this Appendix is satisfactory. If a more comprehensive determination of the corrosivity category (C) is required, the method described in ISO 9223 may be used.

D.2 The relationship between atmospheric corrosivity categories and durability class of lintels

External atmospheric environments are classified in ISO 9223 into six corrosivity categories based on corrosion rates of metals. This Clause (D.2) relates these categories to conditions in Australia as described in AS 4312—2008. If there is any doubt as to the corrosivity category (C), professional advice should be sought. Categories are as follows:

(a) *Category C1 (Very low)* — The only external environments in Australia are some alpine regions although generally these environments will extend into Category C2. Category C1 is normally associated with internal spaces with air conditioning such as offices and public buildings.

(b) *Category C2 (Low)* — External environments in this category include dry, rural areas as well as other regions remote from the coast or sources of pollution. Most areas of Australia beyond at least 50 km from the sea are in this category, which can however extend as close as 1 km from seas that are relatively sheltered and quiet. Typical areas occur in arid and rural inland regions, most inland cities and towns such as Canberra, Ballarat, Toowoomba, Alice Springs, and suburbs of cities on sheltered bays, such as Melbourne and Hobart. Proximity to the coast is an important factor.

(c) *Category C3 (Medium*) — This category mainly covers coastal areas with low salinity. The extent of the affected area varies significantly with factors such as winds, topography and vegetation. Around sheltered seas, such as Port Philip Bay, Category C3 extends beyond about 50 m from the shoreline to a distance of about 1 km inland. For a less sheltered bay or gulf, such as near Adelaide, this category extends from 100 m from the shoreline to about 3 km to 6 km inland. Along ocean front areas with breaking surf and significant salt spray, it extends from about 1 km inland to between 10 km to 50 km inland, depending on the strength of prevailing winds and topography. Much of the metropolitan areas of Wollongong, Sydney, Newcastle, and the Gold Coast are in this category. In South Australia, the whole of the Yorke Peninsula falls within this or a more severe category, and in the southeast of the state, from Victor Harbour to the Victorian border, this category extends between 30 km and 70 km inland. Such regions are also found in urban and industrial areas with low pollution levels and, although uncommon in Australia, exist for several kilometres around major industries,

such as smelters and steel works. Micro-environmental effects, such as result from proximity to airports and sewage treatment works, may also place a site into this category.

(d) *Category C4 (High)* — This category occurs mainly on the coast. Around sheltered bays, Category C4 extends up to 50 m inland from the shoreline. In areas with rough seas and surf, it extends from about 200 m inland to about 1 km inland. As with Categories C2 and C3, the extent depends on winds, wave action and topography. Industrial regions may also be in this category, but in Australia these are only likely to be found within 1.5 km of the plant.

(e) *Category C5 (Very High)* — This category is common on the beachfront in regions of rough seas and surf beaches. The region can extend inland for about 200 m. (In some areas of Newcastle, for example, it extends more than half a kilometre from the coast.) This category may also be found in aggressive industrial areas, where the environment may be acidic with a pH of less than 5.5.

(f) *Category CX (Extreme)* — These regions are found at some surf beach shoreline regions with very high salt deposition. Such corrosion rates would also be found in severe acidic industrial environments, which are included under C5 category for the purposes of this Standard.

NOTE CX is not covered in AS 4312—2008 and should be considered special (R5) for the purposes of AS 3700 and AS 4773.1 and AS 4773.2.

If a site is considered to be in more than one category, for example an industry on the coast in a tropical region, then the material or coating should be capable of resisting the most severe of the environments involved.

The exposure locations for the durability classes R1 to R5 given in this Standard are similar to the ISO corrosivity categories but there are slight differences. Figure D.1 shows simplified corrosivity category locations in Australia and Table D.1 shows the relationship between atmospheric corrosivity categories and durability class of lintels as they relate to distance from the coast.

Provided the location of the structure has been defined according to AS 4312—2008, the required durability class for fixtures may be determined using Table D.1 subject to the in-service conditions described in Clause 2.4.4 being met.

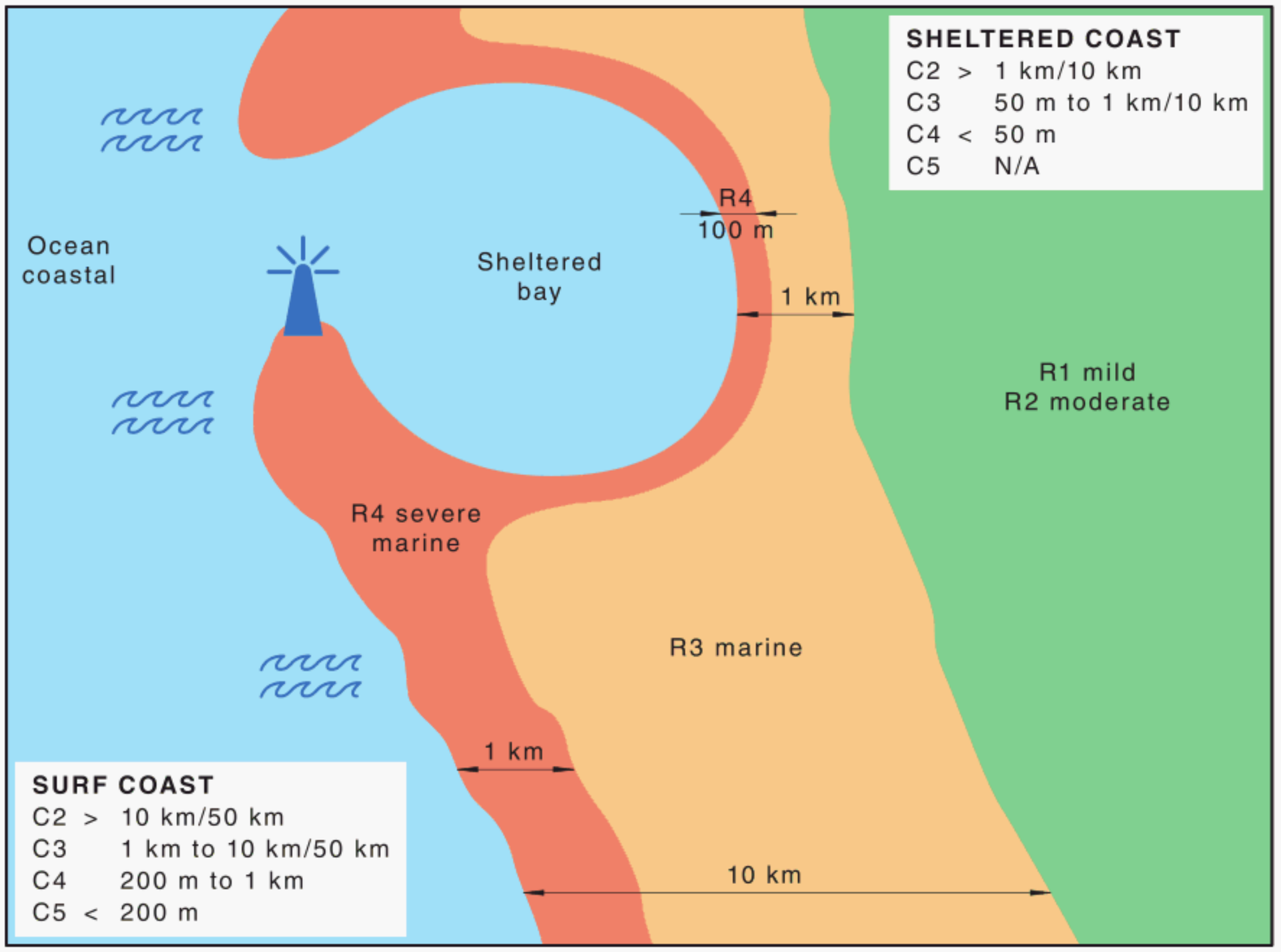

Figure D.1 — Simplified corrosivity category locations in Australia

Table D.1 — Typical relationship of durability class of lintels to atmospheric corrosivity category

AS 2699.3			AS 4312—2008		
Durability class	Typical distance		Corrosivity category (C)	Typical distance	
	Surf coast	Sheltered coast		Surf coast	Sheltered coast
R1 and R2	> 10 km	> 1 km	C2	> 50 km	> 10 km
				10 km to 50 km	1 km to 10 km
R3	1 km to 10 km	100 m to 1 km	C3	10 km to 50 km	1 km to 10 km
				1 km to 10 km	50 m to 1 km
R4	< 1 km	< 100 m	C4	200 m to 1 km	< 50 m
			C5	< 200 m	N/A

NOTE 1 A region of 10 km to 50 km from a surf coast (or 1 km to 10 km from a sheltered coast) may be in AS 4312—2008 C2 or C3 category, but R3 durability fixtures should normally be selected.

NOTE 2 Durability class R4 covers both C4 and C5 corrosivity categories for marine exposure. Categories C4 and C5 may also be categorized by increasing levels of pollution. There are very few polluted sites in Australia and specialist advice should be sought in these cases.

NOTE 3 Durability class R5 will need specialist advice for materials.

Appendix E
(informative)

Tests to identify stainless steel grades

E.1 General

Stainless steel 304 and 316 grades are visually indistinguishable, although various field tests are available to help distinguish between these grades and other stainless steels.

Lintels manufactured with the chemical and mechanical properties of stainless steel grade ASTM A240 316L have been selected for corrosion classification R4 because of the superior resistance to attack by airborne salt-laden moisture, while stainless steel grade ASTM A240 304L has relatively lower chloride resistance and is suitable only for R3 classification. Incorrect use of stainless steel 304 lintels in R4 classification areas may lead to premature failure of the connection.

This Appendix provides several methods of test if a supplier or purchaser is concerned that the material grade is wrongly identified. In cases of ongoing dispute, an analysis by a laboratory accredited to AS ISO/IEC 17025 should test the chemical and mechanical properties of the material (see Clause E.5).

NOTE Accreditation to AS ISO/IEC 17025 is a requirement by a signatory member of the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Agreement (MRA), with a relevant scope of accreditation to cover the tests being performed. In Australia, the National Association of Testing Authorities (NATA) and in New Zealand, International Accreditation New Zealand (IANZ) are signatories (ILAC) (MRA).

E.2 Magnetic test

304 and 316 stainless steels are non-magnetic or, in the cold worked condition, sometimes slightly magnetic. The application of a strong magnet to the surface may be used as a first step to identifying the grade.

If there is no response or a very weak response, the material may be 304 or 316 stainless steel or may be a 200 series austenitic alloy.

NOTE 200 series high manganese stainless steels are never affected by a magnet. Typically, they have less corrosion resistance than the 300 series grades, i.e. 304 and 316. A spot test for manganese (see Clause E.3) is strong evidence of a 200 series alloy.

E.3 Chemical test

304 and 316 stainless steels will respond differently to a test for molybdenum (Mo). This is commonly known as the “Moly-drop” test and proprietary kits are readily available and relatively inexpensive. Alternative proprietary test kits are available, which use less aggressive chemicals in a paper square together with a small battery. Both are suitable for field testing.

In the Moly-drop test, a suitable liquid is dropped onto the surface of the steel, which will change colour after a few minutes if Mo is present (such as in stainless steel 316). The test will also give a positive result to some other molybdenum containing grades of stainless steel.

Grades with high manganese (200 series) are sometimes supplied but frequently have lower corrosion resistance than 304 or 316. There is a similar battery plus proprietary chemical test for manganese.

E.4 X-Ray fluorescence (XRF) test

XRF equipment is capable of distinguishing between 304 and 316 stainless steels to the level of accuracy required. Portable XRF devices are widely available, although the cost of the equipment usually precludes this test being conducted by other than specialist contractors. The XRF equipment is difficult to use for wire products.

E.5 Laboratory test

Destructive testing by accredited laboratories will normally only be required if there is a dispute over the material after examination of the supplier test report or initial on-site testing.

Appendix F
(normative)

Site repair of damaged areas on coated lintels

F.1 Scope

This Appendix specifies procedures for the site repair of minor coating damage to galvanized and zinc-rich paint coated lintels to restore the original corrosion protection before installation.

NOTE 1 Site repair damage is normally due to transport or handling.

NOTE 2 Achieving acceptable durability by repairing major damage, such as arises from on-site welding, drilling or slotting and damage to duplex coatings is difficult and advice should be sought before commencing on-site repair (see AS 2312.1). Repair at the original factory is generally a superior method than on-site repair, and is preferred.

This Appendix does not cover repairs to lintels that show any red (iron) rust, such as those that have been in service for some time.

The methods specified in this Appendix are intended to be carried out by competent personnel, experienced in surface preparation and application of paint systems.

F.2 Site repair procedure

The repair procedure used depends on the extent of damage.

For R1 and R2 durability class items, a single pack zinc-rich primer to AS 3750.9 Type 1 shall be used. For R3 durability class items, a two-pack zinc-rich primer to AS 3750.9 Type 2 shall be used. Application shall be by brush or spray; rollers shall not be used.

The temperature of the substrate shall be at least 3 °C above the dew point. The paint shall not be applied if the substrate is —

(a) above 35 °C; or

(b) wet, or likely to become wet prior to curing.

The procedure shall be as follows:

(i) If the steel substrate is not exposed, roughen the surface using suitable abrasive paper, feathering edges to sound coating.

(ii) After removal of dust, apply the specified zinc-rich primer to at least the local coating film thickness of the original coating.

(iii) If the steel substrate is exposed, clean the substrate to the equivalent of AS 1627.4 class Sa2 or better using a bristle blaster, sanding disc or other suitable power tools. Ensure that the surface is roughened to produce a profile of at least 25 µm. Do not use power wire brushes or other tools which can burnish the surface for final cleaning.

(iv) Feather the damaged area into sound coating with an overlap of at least 50 mm.

(v) After cleaning the prepared regions to remove dust, apply the specified zinc-rich primer to the paint supplier's recommend dry film thickness. Apply all paint strictly in accordance with the paint supplier's recommendation, including overcoat time.

NOTE It is important to observe normal good painting practice with respect to weather and application conditions.

The lintel shall not be installed until the paint has fully cured.

Bibliography

AS 1397, *Continuous hot-dip metallic coated steel sheet and strip—Coatings of zinc and zinc alloyed with aluminium and magnesium*

AS 2312.1, *Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings, Part 1: Paint coatings*

AS 2331.3.1, *Methods of test for metallic and related coatings, Method 3.1: Corrosion and related property tests—Neutral salt spray (NSS) test*

AS 4312—2008, *Atmospheric corrosivity zones in Australia*

AS 2699.1, *Built-in components for masonry construction, Part 1: Wall ties*

AS 2699.2, *Built-in components for masonry construction, Part 2: Connectors and accessories*

AS 4100, *Steel structures*

AS/NZS 4600, *Cold-formed steel structures*

AS/NZS 2312.2, *Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings, Part 2: Hot dip galvanizing*

ISO 3951, *Sampling procedures for inspection by variables (series)*

ISO 9223, *Corrosion of metals and alloys — Corrosivity of atmospheres — Classification, determination and estimation*

ISO 9227, *Corrosion tests in artificial atmospheres — Salt spray tests*

ASTM B117, *Standard Practice for Operating Salt Spray (Fog) Apparatus*

Standards Australia
Standards Australia develops Australian Standards® and other documents of public benefit and national interest. These Standards are developed through an open process of consultation and consensus, in which all interested parties are invited to participate. Through a Memorandum of Understanding with the Commonwealth Government, Standards Australia is recognized as Australia's peak non-government national standards body.

For further information visit www.standards.org.au

Australian Standards®
Committees of experts from industry, governments, consumers and other relevant sectors prepare Australian Standards. The requirements or recommendations contained in published Standards are a consensus of the views of representative interests and also take account of comments received from other sources. They reflect the latest scientific and industry experience. Australian Standards are kept under continuous review after publication and are updated regularly to take account of changing technology.

International Involvement
Standards Australia is responsible for ensuring the Australian viewpoint is considered in the formulation of International Standards and that the latest international experience is incorporated in national Standards. This role is vital in assisting local industry to compete in international markets. Standards Australia represents Australia at both the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC).

For information regarding the development of Standards contact:
Standards Australia Limited
GPO Box 476
Sydney NSW 2001
Phone: 02 9237 6000
Email: mail@standards.org.au
www.standards.org.au

ISBN 978 1 76072 873 1