

**AS/NZS 4389:2015**



Australian/New Zealand Standard

## **Roof safety mesh**

Superseding AS/NZS 4389:1996

**AS/NZS 4389:2015**



This joint Australian/New Zealand standard was prepared by joint Technical Committee BD-092, Housing Construction—Working Practices. It was approved on behalf of the Council of Standards Australia on 15 June 2015 and on behalf of the Council of Standards New Zealand on 11 June 2015.

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**The following are represented on Committee BD-092:**

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Australian Institute of Building Surveyors  
Housing Industry Association  
Master Builders Australia  
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## Roof safety mesh

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## PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee BD-092, Housing Construction—Working Practices, to supersede AS/NZS 4389:1996, *Safety mesh*.

The objective of this Standard is to provide manufacturers and users of roof safety mesh with specifications covering the manufacture and performance of roof safety mesh for use in building applications.

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

*This Standard incorporates a Commentary on some Clauses. The Commentary directly follows the relevant clause, is designated by ‘C’ preceding the clause number and is printed in italics in a panel. The Commentary is intended to help readers understand the background to the clause but does not form part of the clause.*

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## STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

**Australian/New Zealand Standard****Roof safety mesh****1 SCOPE**

This Standard specifies minimum requirements for the design, construction, testing and installation of roof safety mesh as a primary means for fall protection when working at heights in domestic, commercial and industrial building applications that use metal or timber purlins, or a tested supporting member.

NOTE: Means for demonstrating compliance with this Standard are given in Appendix B.

**2 NORMATIVE REFERENCE**

The following is the normative document referenced in this Standard:

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

AS/NZS

4534 Zinc and zinc/aluminium-alloy coatings on steel wire

**3 DEFINITIONS**

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

**3.1 Fastener**

A ring fastener (or 'hog ring') used for joining side laps of roof safety mesh.

**3.2 Fixing**

Connections between the roof safety mesh and the roof member.

**3.3 Joints**

Connections between rolls or sections of roof safety mesh.

**3.4 Lapping**

Where the sides of roof safety mesh are overlayed to prevent a gap forming between the two.

**3.5 Longitudinal wires**

Wires of roof safety mesh that span between purlins and are welded to transverse wires; *also* known as line wires.

**3.6 Mesh sag**

A measurement of downward deflection of roof safety mesh between two roof members.

**3.7 Purlin**

Beam, parallel to the eaves, that is supported by rafters and gives support to roof cladding.

**3.8 Roof member**

A supporting member to which the roof safety mesh is attached, and which has the structural capacity to ensure the performance requirements of Clause 8 and Appendix A can be met.

NOTE: Typically purlins or rafters, but may include bridge bars or other members.



### 3.9 Roof safety mesh

Steel wire mesh, comprising longitudinal and transverse wires, fixed to an appropriate roof member to prevent persons from falling during installation of roofing materials and support insulation materials.

*C3.9 Roof safety mesh is intended to control the risk of fall hazards over the entire roof area, including penetrations, both during construction and after the building enters service.*

### 3.10 Staples

Component used for fixing the ends of longitudinal wires to appropriate timber roof members.

### 3.11 Transverse wires

Wires of roof safety mesh that are parallel to the purlins and are welded to the longitudinal wires; *also* known as cross-wires.

### 3.12 Ultraviolet (UV) protection

The stabilization process applied to materials susceptible to deterioration from UV radiation.

## 4 NEW DESIGNS, INNOVATIONS AND MATERIALS

This Standard shall not be interpreted as preventing the use of materials that meet the performance requirements set out in this Standard, or are not specifically referred to herein. Any alternative materials, designs, methods of assembly, procedures, or the like, that do not comply with specific requirements of this Standard, but give equivalent results to those specified are not necessarily precluded, provided equivalent performance is demonstrated.

## 5 ROOF SAFETY MESH COVERAGE

Roof safety mesh shall be installed over the entire roof area, including penetrations, and remain in place for fall protection.

## 6 GENERAL REQUIREMENTS

### 6.1 Corrosion protection of steel wire

Steel wire mesh shall be galvanized, in accordance with Clause 7.1.1(b).

NOTE: For durability requirements for New Zealand, see Clause 10.2.

### 6.2 Corrosive exposure conditions

When installed in conditions having a high risk of corrosion adversely affecting the performance within its service life, roof safety mesh shall be protected by the application of a suitable protective coating.

NOTE: For guidance on external climatic conditions that can cause a high risk of corrosion, see AS/NZS 4534. Internal conditions e.g. from manufacturing/production processes, chemical exposure, etc., may also need to be considered.

### 6.3 Ultraviolet (UV) protection

Where a roof safety mesh or a coating material is susceptible to UV degradation, it shall be UV stabilized.

### 6.4 Injury

Apart from the cut ends, roof safety mesh shall be free of defects, sharp edges, burrs and similar imperfections that may cause injury to the handler or installer.

## 6.5 Longitudinal wires

Longitudinal wires shall comply with the following requirements:

- (a) Longitudinal wires shall have sufficient strength to withstand the loads imposed by the test criteria in Appendix A.
- (b) Longitudinal wires connected to the appropriate roof members shall not develop cracks or other potential structural defects when wrapped around or otherwise connected to appropriate roof members.

## 7 WIRE AND MESH REQUIREMENTS

### 7.1 Materials

#### 7.1.1 Wire

The wire for mesh shall comply with the following:

- (a) The wire shall be clean, smooth and free from defects detrimental to its subsequent processing and end use.
- (b) The wire shall be galvanized in accordance with AS/NZS 4534, Class W02.
- (c) The wire shall have the following minimum tensile strengths:
  - (i) Transverse wire ..... 450 MPa.
  - (ii) Longitudinal wire ..... 500 MPa.

#### 7.1.2 Mesh

Mesh shall comply with the following:

- (a) *Mesh construction* Mesh construction shall be formed by welding of wires using electric resistance techniques under pressure, and shall comply with the requirements of Tables 1, 2 and 3.
- (b) *Freedom from defects* The mesh shall be clean, smooth and free from sharp edges, burrs and similar defects.

**TABLE 1**  
**REQUIREMENTS FOR**  
**ROOF SAFETY MESH**

Minimum nominal diameter of wire mesh mm	Spacing of longitudinal wires mm	Spacing of transverse wires mm	Minimum mass of zinc coating g/m <sup>2</sup>
2.00	150 ±5	300 ±5	35

**TABLE 2**  
**REQUIREMENTS FOR ROOF SAFETY MESH STAPLES**

Minimum mass of zinc coating g/m <sup>2</sup>	Minimum nominal diameter of staple wire mm	Minimum length of staple		Maximum spacing of staples mm
		Stapling onto side of timber rafter mm	Staples on top of timber rafter mm	
35	3.15	30	40	155

**TABLE 3**  
**REQUIREMENTS FOR ROOF SAFETY MESH FASTENERS**

Crown width of fastener mm	Opening width of fastener mm	Coating type	Fastener size mm
22	16	Galvanized	1.90 diameter or equivalent strip

## 7.2 Product documentation

### 7.2.1 Documented information

Appropriate documented information, written in plain English and adopting SI units, shall be provided with the roof safety mesh.

The documentation information shall include the following:

- (a) The supplier and country of manufacture.
- (b) The diameters of the roof safety mesh wires.
- (c) The minimum tensile strengths of the roof safety mesh wires.
- (d) The dimensions of the mesh aperture, in millimetres.
- (e) The width of the mesh in the roll, in metres.
- (f) The nominal weight of the mesh roll, in kilograms.
- (g) Information on the coating procedure of the steel wires of the mesh.
- (h) If plasticized materials are used, the UV stabilization rating.
- (i) The safety procedures applicable when opening a roll of mesh.
- (j) Installation instructions.
- (k) Statement of compliance with this Standard, i.e. AS/NZS 4389.

### 7.2.2 Labelled information

Each roll shall be labelled with the following:

- (a) The length of mesh in the roll, in metres.
- (b) The width of mesh in the roll, in metres.
- (c) The weight of mesh in the roll or weight/metre.
- (d) The diameters of the roof safety mesh wires, in millimetres.
- (e) The dimensions of the mesh aperture, in millimetres.
- (f) The manufacturer's/supplier's details and country of manufacture.
- (g) Installation instructions, including tautness requirements.
- (h) Statement of compliance with this Standard, i.e. AS/NZS 4389.

## 8 PERFORMANCE REQUIREMENTS

When tested in accordance with Appendix A, the test probe shall not pass through the roof safety mesh or side lap.

## 9 INSTALLATION REQUIREMENTS

### 9.1 General

The installation of roof safety mesh shall comply with the requirements of Clauses 9.2 and 9.3.

### 9.2 Position of roof safety mesh

Roof safety mesh shall be positioned in accordance with the following:

- (a) *Position of mesh* Where roof safety mesh is required, it shall be fitted under the roof sheeting so that it is supported by metal and/or timber purlins/rafters or roof members that are part of the roof structure.
- (b) *Natural sag of roof safety mesh* Roof safety mesh shall be pulled taut to ensure only a natural sag between each purlin or roof member. This natural sag shall not be modified to create artificial sag.
- (c) *Relevant positions of longitudinal and transverse wires* Where applicable, wires parallel to the direction of the corrugations of the roof sheeting (longitudinal wires) shall be in contact with the tops of the immediate supports of the sheeting; transverse wires (cross-wires) shall be on top of the longitudinal wires.

**C9.2(b)** *Test methods and performance requirements in this Standard have been set for roof safety mesh that is to be installed with a natural sag midspan between each purlin or roof member.*

*Evaluation of roof safety mesh has shown that if initially installed with a midspan sag greater than a natural sag prior to the installation of bulk insulation, there is a risk of a side lap opening increasing in the event that a person falls on the roof safety mesh during the installation of roofing material. This opening increase has been borne out during the drop test.*

*Excessive initial sags means the initial sag in the incident bay can take up sags from the roof safety mesh between bays supported by adjoining purlins or roof members, resulting in an increased side gap that could permit a person to fall from the resulting gap between runs of the roof safety mesh.*

*Intentionally increasing sag is beyond the scope of this Standard. Where such practice is utilized, there may be additional safety risks not covered by this Standard.*

### 9.3 Fixing of roof safety mesh

All longitudinal wires of roof safety mesh shall be fixed to the roof members in one of the following ways, as applicable to the construction of the roof members:

- (a) *Steel construction* Where the roof members are of metal construction, the longitudinal wires, including lapped wires, of the roof safety mesh shall be attached in one of the following methods:
  - (i) The wires shall be passed through a hole drilled at a spacing of  $150 \pm 5$  mm in the top of the purlin and tied off with at least four full turns around the same wire, as shown in Figure 1(a).
  - (ii) The wires shall be passed once completely around the roof member, the tail of every wire being twisted four times around the main portion of the same wire, as shown in Figure 1(b).
  - (iii) The wires shall be attached to predrilled supporting member where all longitudinal wires (including lapped wires) shall be passed through the predrilled holes in the projecting half of the metal strip with the tail wire being twisted 4 times around the main portion of the wire as shown in Figure 1(d). Attachment of the supporting member to the roof structure shall be in accordance with manufacturer's installation specification.

- (b) *Timber construction* Where the roof members are of timber, the longitudinal wires of the roof safety mesh shall be attached using either one of the following methods:
- (i) The wires shall be bent over and down, and fixed to the sides of the purlins by means of galvanized steel staples of not less than the gauges, lengths and spacing specified in Table 2, as shown in Figure 1(c).
  - (ii) The wires shall be fixed to the tops of the roof members by means of galvanized steel staples of not less than the gauges, lengths and spacing given in Table 2.

All staples shall be driven in such manner that a transverse wire is between the end of the wire and the staple, or the end of the wire is bent back and twisted four times around the same wire so that individual wires cannot be drawn from a staple, as shown in Figure 1(c).

- (c) *Fixing of the longitudinal wires when the method in Item (a) or (b) is not possible* Longitudinal wires shall be secured to the roof member by means of galvanized steel wire loops of not less than 3.15 mm diameter by placing the centre of the tying wire around the longitudinal wire at a point of intersection of a transverse wire, so that a transverse wire is between that point and the end of the longitudinal wire, and next passing both ends of the tying wire once completely around the roof members, and then drawing the two tails of the tying wire in opposite directions over the two strands of the tying wire and twisting together with at least three complete turns, as shown in Figure 1(e).
- (d) *Joints between adjacent lengths of roof safety mesh* The following shall apply:
- (i) For purlin spacing less than 1200 mm, the runs of mesh shall be side-lapped by a minimum of one mesh spacing.
  - (ii) For purlin spacing between 1200–2200 mm, the runs of mesh shall be side-lapped by a minimum of one mesh spacing (150 mm). Side laps shall be secured with ring fasteners fabricated from minimum 1.90 mm diameter wire, or equivalent, fitted at maximum 900 mm centres between each purlin on one side of the lap.
  - (iii) For purlin spacing greater than 2200 mm, the runs of mesh shall be side-lapped by a minimum of two-mesh spacing (300 mm). Side laps shall be secured with ring fasteners fabricated from minimum 1.90 mm diameter wire, or equivalent, fitted at maximum 600 mm centres between each purlin on both sides of the lap.

NOTES:

- 1 Fastening of the mesh laps should be carried out from underneath.
- 2 For side lapping of mesh, see Figure 3.

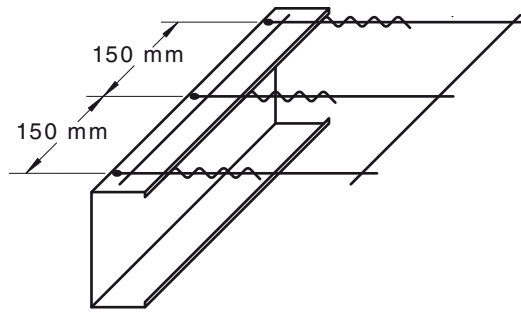
#### 9.4 Joining rolls or sections

Roof safety mesh may be joined at roof members, provided the following method is used:

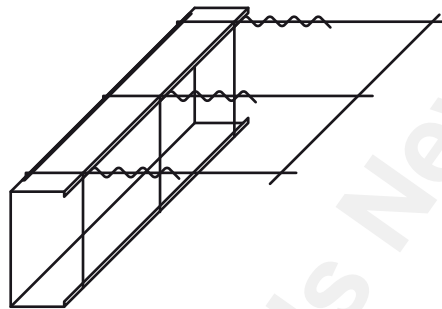
- (a) Place the two transverse wires together and twist the longitudinal tail wires around each other.
- (b) Twist one longitudinal tail wire four times around the main portion of the same wire.
- (c) Twist the other longitudinal tail wire once around the main portion of the same wire and then four times around the two transverse wires, as shown in Figure 2.

Joints in longitudinal wires shall—

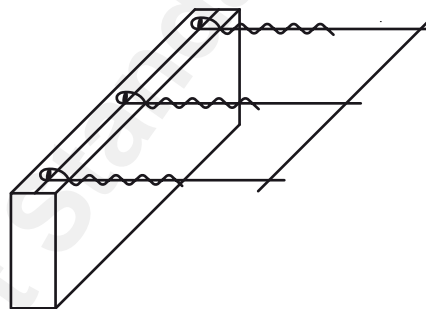
- (i) result in apertures not larger than those of the mesh; and
- (ii) have the same orientation.



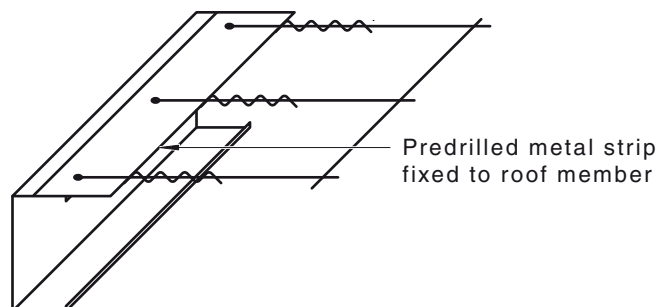
(a) Longitudinal wires passed through holes drilled in purlins.  
Lapped wires also passed through the drilled holes.



(b) Longitudinal wires wrapped around steel or wood purlins

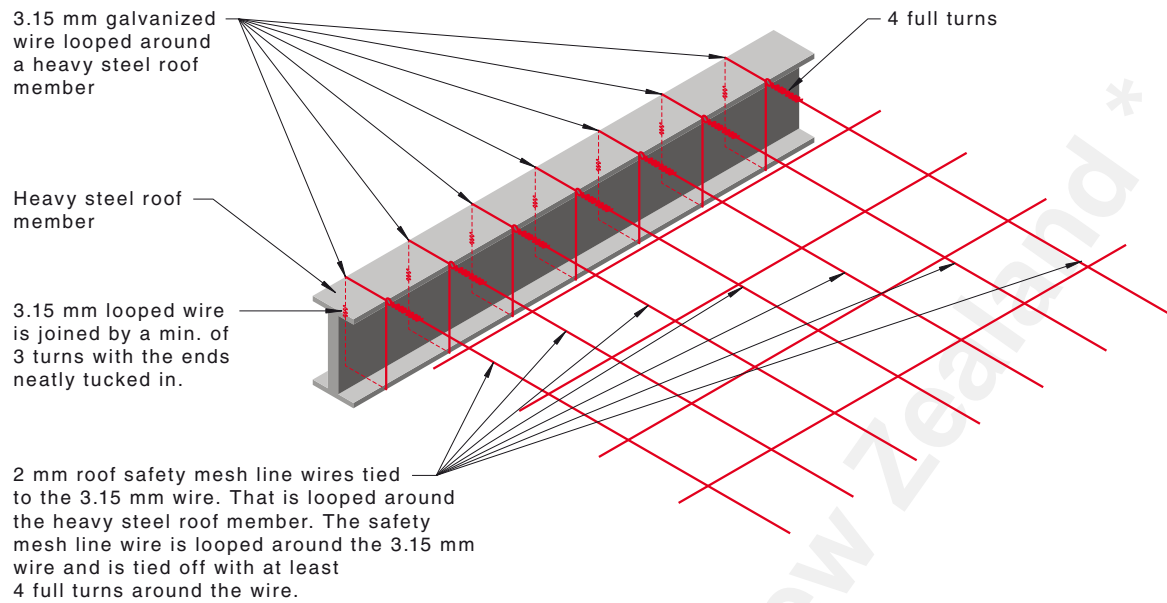


(c) Longitudinal wires passed through 40 mm long x Ø 3.15 mm staples



(d) Longitudinal wires passed through holes in predrilled strip

FIGURE 1 (in part) FIXING



(e) Fixing of the longitudinal wires when the method in Clause 9.3(a) or (b) is not possible

FIGURE 1 (in part) FIXING

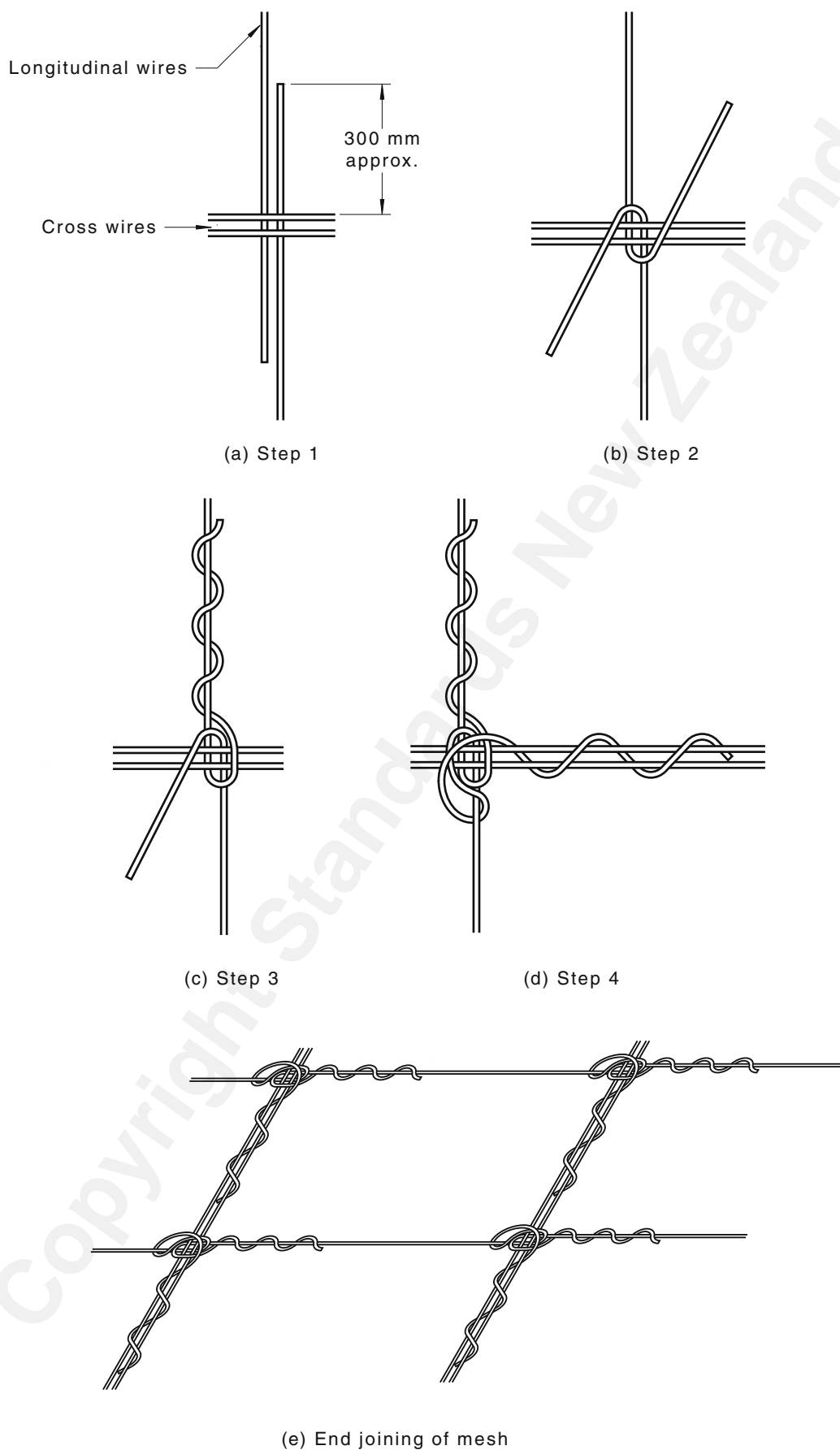
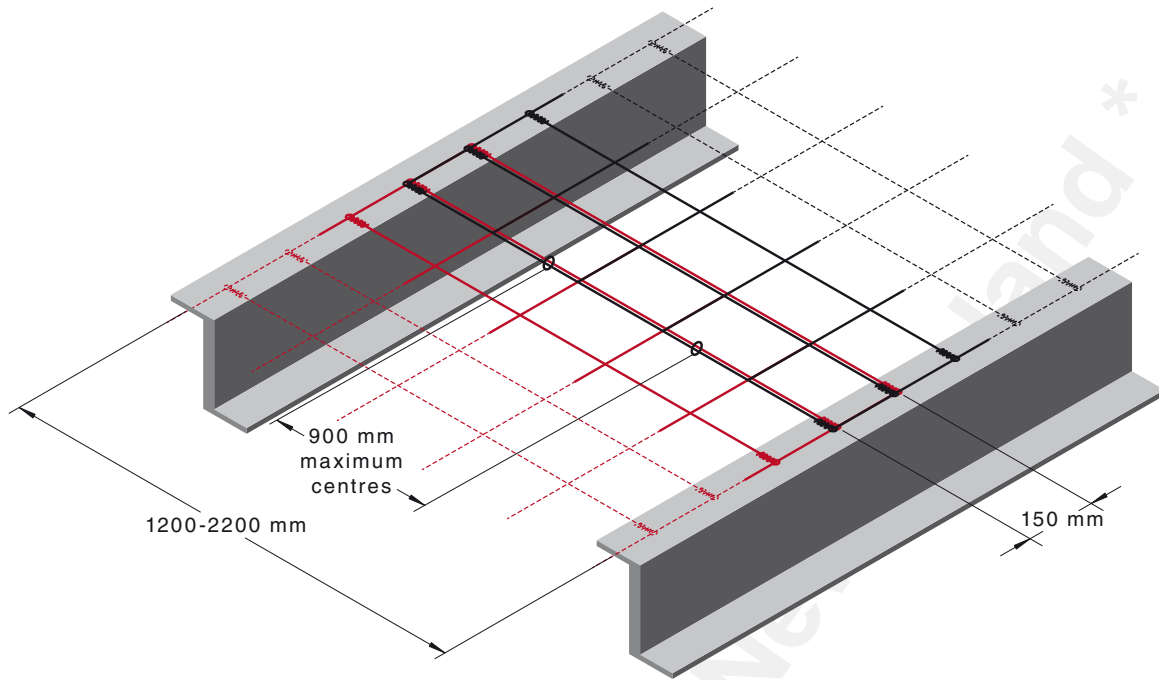


FIGURE 2 LONGITUDINAL WIRE JOINING





NOTE: For purlin spacing 1200–2200 mm, fasteners to be fitted at maximum of 900 mm centres and minimum single lap [Clause 9.3(d)(ii)]. For purlin spacing greater than 2200 mm, fasteners to be fitted at maximum 600 mm centres and minimum double lap [Clause 9.3(d)(iii)].

FIGURE 3 SIDE LAPPING OF MESH

## 10 DURABILITY

### 10.1 General

If the wire mesh or fasteners show signs of red rust, they shall not be used.

NOTE: This requirement does not apply to the cut ends of the mesh.

### 10.2 New Zealand durability requirements

The total roof safety mesh system, including fastenings, shall be durable for the lengths of time specified in the New Zealand Building Code.

NOTE: This may be demonstrated by history of performance, laboratory-ageing experiments or by expert opinion.

## APPENDIX A

### ROOF SAFETY MESH—LOAD TEST

(Normative)

#### A1 SCOPE

This Appendix sets out the methods for determining the strength of roof safety mesh, end fixings and the laps.

#### A2 PRINCIPLE

Roof safety mesh is fixed to purlins and or supporting members in a rectangular frame and subjected to dynamic loading.

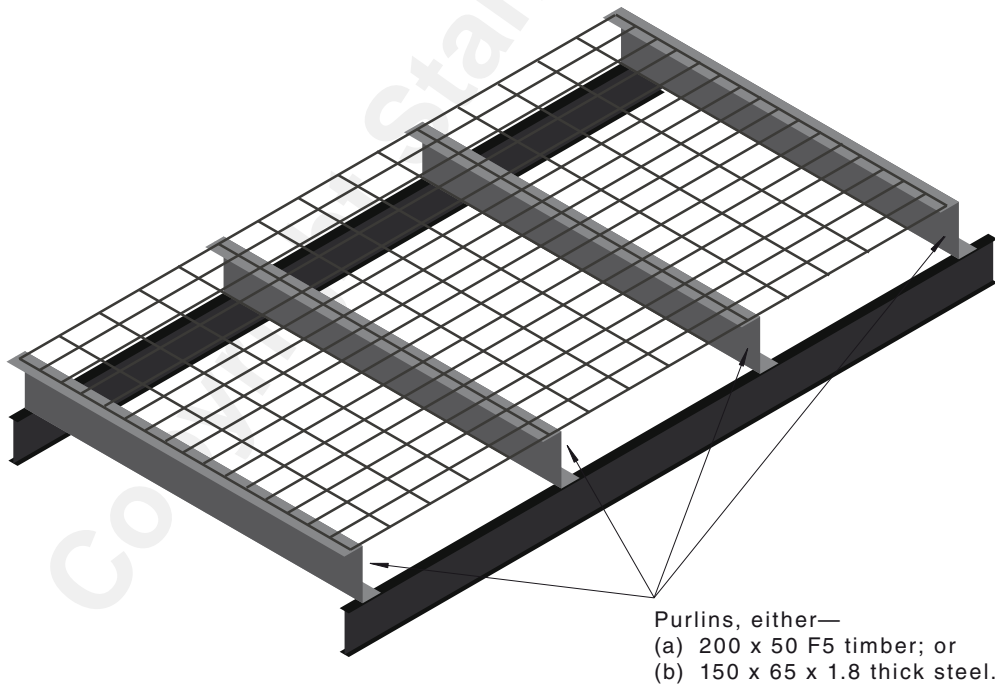
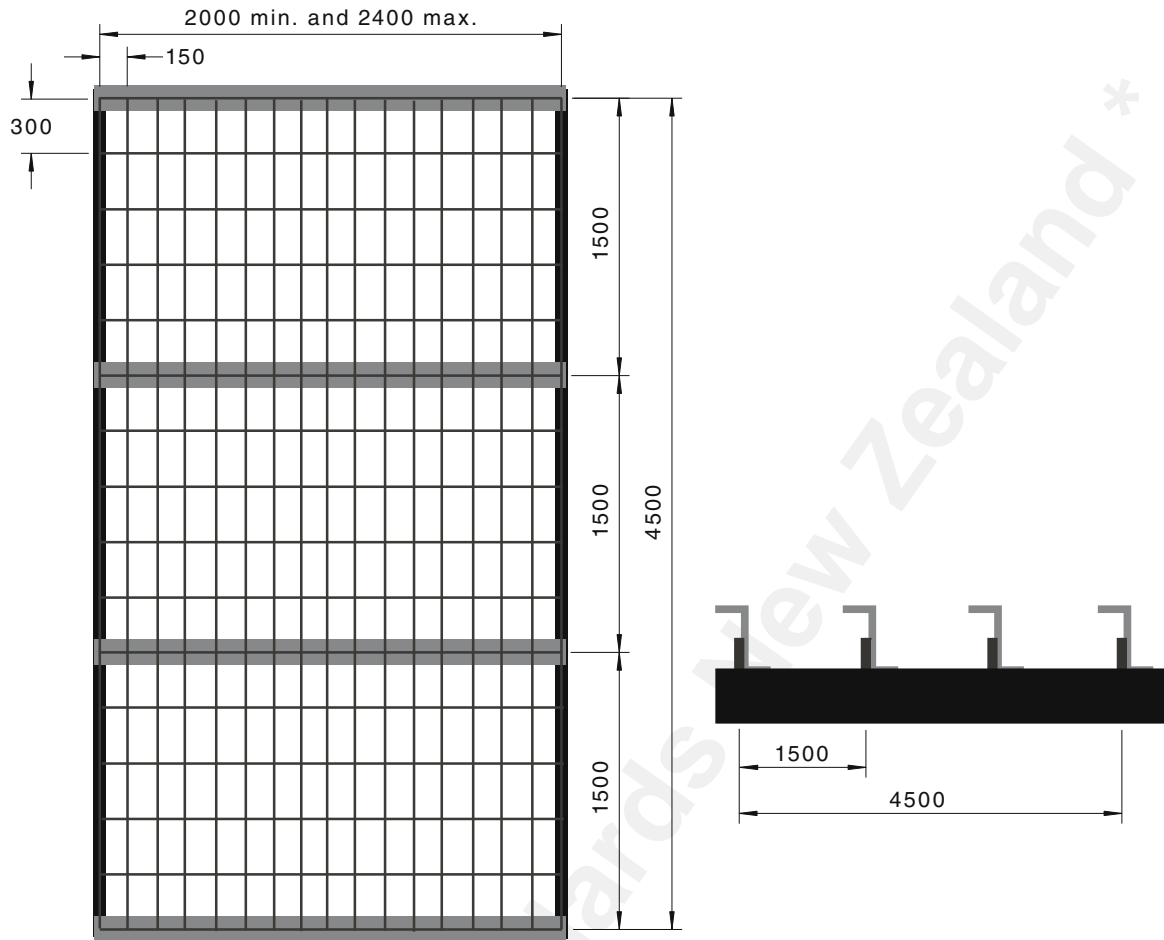
#### A3 APPARATUS

##### A3.1 Test frame

The test frame shall be capable of accepting steel or timber purlins as required. The width shall be minimum 2 m and maximum of 2.4 m and the length shall be 4.5 m, intended to simulate purlins in a normal roof construction, and shall comprise three bays formed by purlin cross-members.

NOTE: Figure A1 gives details of the spacing and size of the test frame and purlins for both the timber and steel frames.

The test frame shall be set a minimum of 1.5 m clear of the supporting surface.



DIMENSIONS IN MILLIMETRES

FIGURE A1 TEST FRAME

### A3.2 Test load

The test load shall consist of dry sand in a bag approximately 1500 mm long by 350 mm diameter and having a mass of  $165 \pm 5, - 0$  kg. The bag shall be constructed so as to not rupture during testing.

### A3.3 Test probe

The test probe shall consist of a rigid sphere of 350 mm nominal diameter and nominal weight of 5.1 kg.

## A4 TEST SPECIMEN

The test specimen shall be a minimum of 1800 mm wide.

NOTE: The test sample of mesh is fixed to the test frame.

## A5 TEST PROCEDURE

### A5.1 Drop test—Single run of mesh

The procedure shall be as follows:

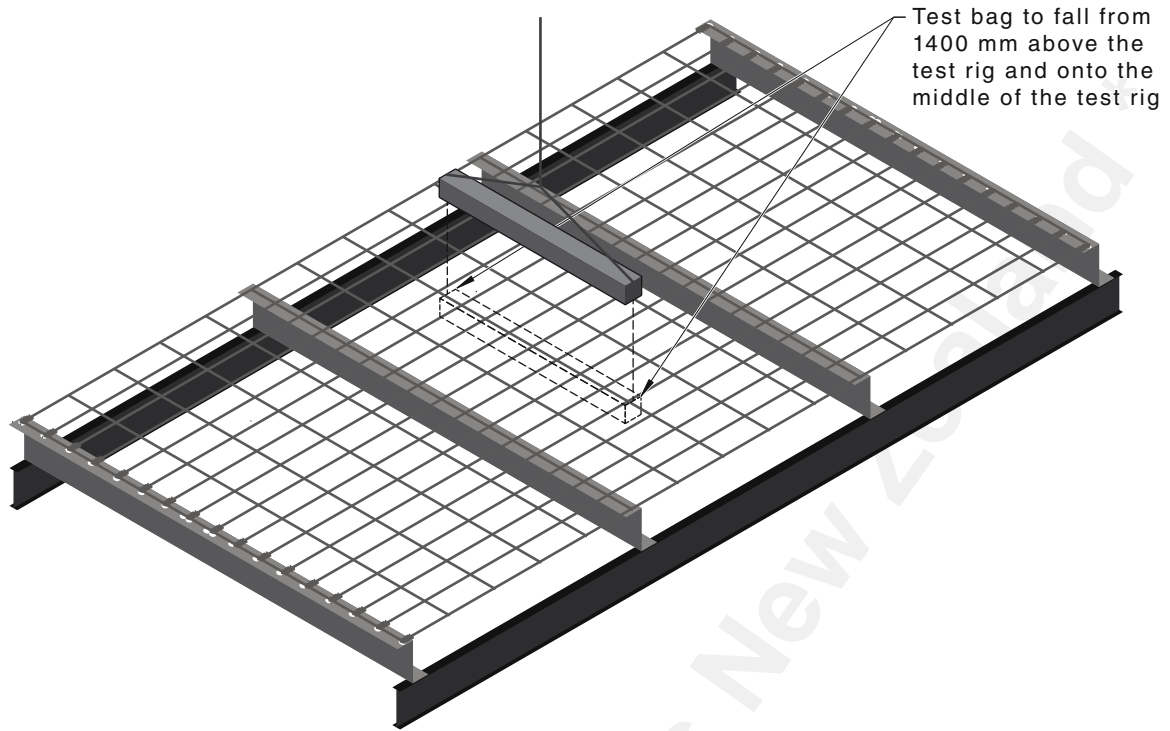
- (a) Fasten the mesh to the steel purlin frame in accordance with Clause 9.3.
- (b) With the test load positioned as indicated in Figures A2, as appropriate, drop the test load once in the middle bay from a height of 1400 mm, measured from the lowest point of the test load.
- (c) Record if penetration of the roof safety mesh by the test load bag occurred.
- (d) Remove the test load bag.
- (e) Place the test probe, without any vertical force, centrally on an opening in the mesh and record if the test probe passes through the opening.
- (f) Record any failure of weld, wire, joint or termination.
- (g) Repeat Steps (a) to (f) for the timber purlin frame.

### A5.2 Drop test—Double run of mesh with side lap

The procedure shall be as follows:

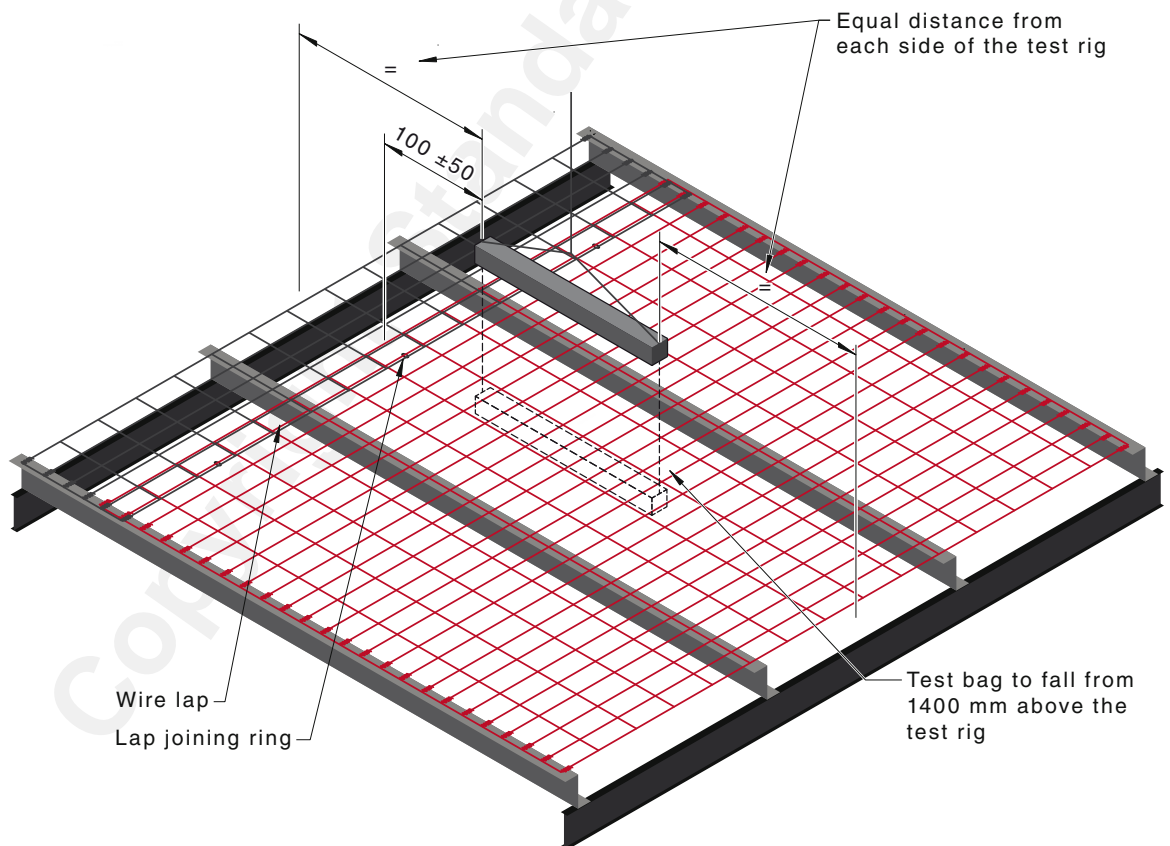
- (a) Fasten each run of the mesh to the steel purlin frame and side lap in accordance with Clause 9.3.
- (b) With the test load positioned as indicated in Figures A3, drop the test load once in the middle bay nominally 100 mm from the nearer edge of the lap, from a height of 1400 mm measured from the lowest point of the test load.
- (c) Record if penetration of the roof safety mesh by the test load bag occurred.
- (d) Remove the test load bag.
- (e) Place the test probe, without any vertical force, centrally on a side lap opening in the mesh and record if the test probe passes through the opening.
- (f) Record any failure of weld, wire, joint or termination.
- (g) Repeat Steps (a) to (f) for the timber purlin frame.

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DIMENSIONS IN MILLIMETRES

FIGURE A2 SET-UP FOR LOAD TEST FOR SINGLE RUN MESH



DIMENSIONS IN MILLIMETRES

FIGURE A3 SET-UP FOR LOAD TEST FOR DOUBLE RUN MESH WITH SIDE LAP

## A6 ACCEPTANCE CRITERIA

The acceptance criteria shall be in accordance with Clause 8.

## A7 REPORT

The following information shall be reported in plain English with dimensions stated in SI units:

- (a) Product label information as stated in Clause 7.2.2.
- (b) The date and location of the test.
- (c) The test frame dimensions, purlin material and spacing.
- (d) The fastening system and spacing.
- (e) Detailed description, drawing or photograph of the test apparatus.
- (f) Name, position and qualification of the person responsible for the test.
- (g) Whether each test complied with the acceptance criteria.
- (h) A reference to this test method, e.g. Appendix A, AS/NZS 4389.

The report shall be signed and dated by the person responsible for the test.

NOTE: When more than one set of tests is included in one report, the report as a whole need only be signed, not each set of tests.

**APPENDIX B**  
**MEANS FOR DEMONSTRATING COMPLIANCE WITH THIS STANDARD**  
(Informative)

**B1 SCOPE**

This Appendix sets out the following different means by which compliance with this Standard can be demonstrated by the manufacturer or supplier:

- (a) Evaluation by means of statistical sampling.
- (b) The use of a product certification scheme.
- (c) Assurance using the acceptability of the supplier's quality system.
- (d) Other such means proposed by the manufacturer or supplier and acceptable to the customer.

**B2 STATISTICAL SAMPLING**

Statistical sampling is a procedure which enables decisions to be made about the quality of batches of items after inspecting or testing only a portion of those items. This procedure will only be valid if the sampling plan has been determined on a statistical basis and the following requirements are met:

- (a) The sample needs to be drawn randomly from a population of product of known history. The history needs to enable verification that the product was made from known materials at essentially the same time, by essentially the same processes and under essentially the same system of control.
- (b) For each different situation, a suitable sampling plan needs to be defined. A sampling plan for one manufacturer of given capability and product throughput may not be relevant to another manufacturer producing the same items.

In order for statistical sampling to be meaningful to the customer, the manufacturer or supplier needs to demonstrate how the above conditions have been satisfied. Sampling and the establishment of a sampling plan should be carried out in accordance with AS 1199.1, guidance to which is given in AS 1199.0.

**B3 PRODUCT CERTIFICATION**

The purpose of product certification is to provide independent assurance of the claim by the manufacturer that products comply with the stated Standard.

The certification scheme should meet the criteria described in HB 18.28 (SANZ HB 18.28) in that, as well as full type testing from independently sampled production and subsequent verification of conformance, it requires the manufacturer to maintain effective quality planning to control production.

The certification scheme serves to indicate that the products consistently conform to the requirements of the Standard.

#### **B4 SUPPLIER'S QUALITY MANAGEMENT SYSTEM**

Where the manufacturer or supplier can demonstrate an audited and registered quality management system complying with the requirements of the appropriate or stipulated Australian or international Standard for a supplier's quality management system or systems, this may provide the necessary confidence that the specified requirements will be met. The quality assurance requirements need to be agreed between the customer and supplier and should include a quality or inspection and test plan to ensure product conformity.

Information on establishing a quality management system is set out in AS/NZS ISO 9001 and AS/NZS ISO 9004.

#### **B5 OTHER MEANS OF ASSESSMENT**

If the above methods are considered inappropriate, determination of compliance with the requirements of this Standard may be assessed from the results of testing coupled with the manufacturer's guarantee of product conformance.

Irrespective of acceptable quality levels (AQLs) or test frequencies, the responsibility remains with the manufacturer or supplier to supply products that conform to the full requirements of the Standard.



## BIBLIOGRAPHY

## AS

- 1199 Sampling procedures for inspection by attributes
- 1199.0 Part 0: Introduction to the ISO 2859 attribute sampling system
- 1199.1 Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection

## AS/NZS ISO

- 9001 Quality management systems—Requirements
- 9004 Quality management systems—Guidelines for performance improvements

## HB

- 18 Guidelines for third-party certification and accreditation
- 18.28 Guide 28: General rules for a model third-party certification scheme for products

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