AS 2741—2002
(Incorporating Amendment No. 1)

Australian Standard™

Shackles

Standards Australia

This Australian Standard was prepared by Committee ME-025, Lifting Tackle. It was approved on behalf of the Council of Standards Australia on 29 March 2002 and published on 2 May 2002.

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AS 2741—2002
(Incorporating Amendment No. 1)

Australian Standard™

Shackles

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PREFACE

This Standard was prepared by the Standards Australia Committee ME-025, Lifting Tackle, to supersede AS 2741—1992.

The purpose of this Standard is to promote the safety of shackles.

This Standard incorporates Amendment No. 1 (July 2002). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

This edition includes the following technical changes:

(a) In Clause 2, the list of referenced documents has been brought up to date.

(b) In Clause 3, the definitions for ‘production batch’ and ‘safe working load’ have been deleted, and definitions for ‘competent person’ and ‘nominal size’ have been added. The term ‘safe working load (SWL)’ is not used, to align with international practice.

(c) In Clause 4, Quality Grades L, P and T have been deleted.

(d) In Clauses 6, 8 and 9, the requirements for mechanical properties and proof testing are set out in a new format, including the deletion of production destructive tests.

(e) Requirements for quality control have been included in Clause 9.

(f) The note in Clause 9.4 recommends that the original test certificate be retained for 10 years.

(g) In Appendix D, the dimension ‘*E*’ was changed from lower case to upper case.

(h) Previous Figures 7 to 10 for pins for Quality Grade P shackles have been deleted.

(i) Appendix F specifies conditions for application of test forces.

CONTENTS

FOREWORD

Shackles are used in lifting, tensioning and staying systems as removable links to interconnect other components.

In any lifting, tensioning or staying system, the working load of each component has to take account of the conditions (such as the classification of load application as specified by AS 1418.1) and be compatible with any loads inherent in and applied to the system, and each component has to readily connect with each adjacent component. Therefore, it is important that components of lifting, tensioning or staying systems be quickly and positively identified in service for size, lifting capacity and quality grade.

The same quality grading system is used by other Australian Standards covering components in lifting, tensioning and staying systems. It allows for positive identification and easy selection and matching, and relates to the mechanical properties of the finished product and not simply to the strength of the material.

STANDARDS AUSTRALIA

Australian Standard
Shackles

1 SCOPE

This Standard specifies requirements for forged shackles of Quality Grades M or 4 and S or 6.

NOTES:

1 Guidance on information that should be supplied with inquiries and orders is given in Appendix A.

2 Guidance on the care and use of shackles is given in Appendix B.

3 Standards for components used in lifting systems are listed in Appendix C.

2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS	
1065	Non-destructive testing—Ultrasonic testing of carbon and low alloy steel forgings
1171	Non-destructive testing — Magnetic particle testing of ferromagnetic products, components and structures
1199	Sampling procedures and tables for inspection by attributes
1399	Guide to AS 1199—Sampling procedures and tables for inspection by attributes
1418	Cranes, hoists and winches
1418.1	Part 1: General requirements
1442	Carbon steels and carbon-manganese steels—Hot-rolled bars and semifinished products
1444	Wrought alloy steels—Standard, hardenability (H) series and hardened and tempered to designated mechanical properties
1627	Metal finishing—Preparation and pretreatment of surfaces
1627.6	Part 6: Chemical conversion treatment of metals
1721	General purpose metric screw threads
1789	Electroplated coatings—Zinc on iron or steel
1816	Metallic materials—Brinell hardness test
2062	Non-destructive testing — Penetrant testing of products and components
2193	Methods for calibration and grading of force-measuring systems of testing machines
B199	Undercuts and runouts for screw threads
ISO/IEC 17025	General requirements for the competence of testing and calibration laboratories
AS/NZS	
4680	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles

AS/NZS		
ISO 9001	Quality management systems—Requirements	
ISO 9004	Quality management systems — Guidelines for performance improvements	
HB	[Standards Australia Handbook]	
18	Guidelines for third-party certification and accreditation	
18.28	Guide 28:	General rules for a model third-party certification system for products

3 DEFINITIONS

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

3.1 Competent person

A person having practical and theoretical knowledge and relevant experience, sufficient to enable that person to detect and evaluate any defects and any weaknesses that may affect the intended performance of the equipment.

3.2 Finished condition

The condition after completion of processing and proof loading.

3.3 Nominal size

The nominal diameter of the shackle body.

3.4 Processing

Any treatment subsequent to forging, including heat treatment and application of surface finish coatings, but excluding proof loading and application of temporary protective coatings for storage purposes.

3.5 Self-coloured

A surface finish arising from essential manufacturing processes, without additional surface treatment.

3.6 Shackle

An assembly for interconnecting components in lifting, tensioning and staying systems, consisting of a body, a removable pin and any applicable locking devices.

3.7 Shall

Indicates a statement is mandatory.

3.8 Should

Indicates a recommendation.

3.9 Working load limit (WLL)

The maximum load that may be applied to the shackle, which may be re-rated for particular conditions of use.

4 MATERIAL

Shackles shall be of—

(a) heat-treated fully killed fine-grained steel complying with the relevant requirements of Table 1;

(b) suitable materials complying with AS 1442 or AS 1444; or

(c) steels not complying with AS 1442 or AS 1444, provided they meet the intent of this Standard.

Tramp elements such as tin, antimony and arsenic can increase the susceptibility of steel to temper embrittlement. Care should be taken to ensure temper embrittlement has not occurred.

To protect against strain-age embrittlement during service, the steel shall contain sufficient aluminium, subject to a minimum of 0.025%.

TABLE 1

MATERIAL AND HEAT TREATMENT

Quality Grade	Product analysis of elements, maximum allowable percentage			Heat treatment (see Clause 5.5)
	Carbon	Phosphorus	Sulfur	
M	0.45	0.045	0.045	Either harden and temper or normalize
S	0.45	0.030	0.030	Harden and temper

5 DESIGN AND MANUFACTURE

5.1 Type

Shackles shall be of the following types, each of which is illustrated in Appendix D:

(a) Quality Grade M or 4 dee.

(b) Quality Grade S or 6 dee.

(c) Quality Grade S or 6 bow.

5.2 Dimensions and tolerances

5.2.1 *Dimensions*

Shackles shall conform to the relevant dimensions specified in Appendix D, within the tolerances and clearances specified in Clause 5.2.

5.2.2 *Tolerances*

Dimensions *B*, *D*, *d*, *E*, *L* and *W*, as specified in Appendix D, shall be within a tolerance of +8% –5% of the specified dimension.

NOTE: Only indicative values are given for the other dimensions in Appendix E.

5.2.3 *Clearances between pin and body*

The diameter of unthreaded holes in the body of each shackle shall not exceed the following relevant values:

Actual pin diameter (*D*) mm	Maximum hole diameter mm
≤ 20	The greater of $(1.07 \times D)$ and $(D + 1)$
$> 20 \leq 45$	The greater of $(1.07 \times D)$ and $(D + 1.5)$
> 45	The greater of $(1.07 \times D)$ and $(D + 2)$

5.2.4 *Geometry*

Pin holes and bolt holes in the shackle body should be central to the outside shape of the eye and in axial alignment.

5.2.5 *Threads*

The screwed portion of shackle pins shall be concentric with the plain portion.

Metric threads shall comply with AS 1721, with a tolerance class of 6G/6e.

The tolerance for threads other than metric threads shall be similar to the tolerances for metric threads.

Where required, the shank of the shackle pin shall have an undercut and fillet at the end of the threaded portion conforming to Form A Tolerance Grade 1 as specified by AS B199.

For bolts and nuts, the length of the plain portion of the bolt should be such that its nut will lock on the inner end of the thread or undercut and not on the face of the shackle body. When in this position, bolts shall be cross-drilled for the split cotter pin.

5.3 Shackle body

The shackle body shall be cleanly forged in one piece and, prior to machining, shall be free from apparent defects.

Where holes are machined, the diameter of any hot-pierced holes shall be not more than two-thirds of the finished diameter of the machined hole.

Where holes are produced by methods other than drilling, the resulting cut thread shall extend through the full depth of the eye.

Where plain punched holes are provided, the clearances between the body and the pin shall not exceed the limits specified in Clause 5.2.3.

Rounding of edges caused by punching shall be not more than 5% of the body diameter.

The screw thread shall be cleanly formed and free from imperfections.

5.4 Shackle pin

The shackle pin shall be either—

(a) cleanly forged in one piece and threaded;

(b) forged in one piece and machined;

(c) machined from an appropriate grade of bar.

The finished pin shall be free from imperfections that are deleterious to the use of the product.

NOTE: Typical shackle pins are illustrated in Appendix E, in which the dimensions for pinheads are provided for guidance and may be varied.

5.5 Heat treatment

Shackles shall be heat treated in a manner that will achieve the mechanical properties required by Clause 6.

The body and the pin shall have a hardness of not more than 300 Brinell (equivalent to Rockwell 32RC), as well as complying with the requirements of Table 1.

5.6 Surface finish

Shackles should have a surface finish of one of the following:

(a) Self-coloured.

(b) Hot-dipped galvanized coating complying with AS/NZS 4680.

(c) Class A1, Class A2 or Class B phosphate coating complying with AS 1627.6.

(d) Fe/Zn 12c electroplated zinc coating complying with AS 1789.

(e) Painted.

(f) Mechanical plating.

NOTE: Hydrogen embrittlement can occur in shackles that had their thread rolled after being heat treated. It results from the absorption of atomic hydrogen generated at the steel surface by processes such as acid pickling or cathodic cleaning.

5.7 Visual examination

Shackles should be visually examined by a competent person, to look for faults, including the following:

(a) Faults arising from the forging process, including overlaps, cavities and cracks.

(b) Faults arising from the machining process.

(c) Faults arising from the heat treatment process.

(d) Faults arising from the surface finish or the surface finishing process.

(e) Any indication of a possible crack.

(f) The fit of the pin.

Visual defects are not permitted in areas of the shackle that may be subjected to tensile stresses under service conditions.

NOTE: Visual examinations may be performed on the finished shackle or progressively at the most convenient stages of the manufacturing process, by one or more competent persons, provided that all relevant features are examined.

6 MECHANICAL PROPERTIES

6.1 Quality control

Each shackle shall be subjected to a quality control process complying with Clause 9.

6.2 Strength

6.2.1 *General*

Except where Clause 6.2.2(b) is applied, each shackle shall be capable of supporting a test load of 6 times the working load limit of the shackle under the conditions specified in Appendix F.

6.2.2 *WLL of more than 166 t*

Shackles with a WLL of more than 166 t (which would require a test load of more than 1000 t to comply with Clause 6.2.1) shall be either—

(a) tested in accordance with Clause 6.2.1; or

(b) tested with a test load of not less than 1000 t in conjunction with other appropriate engineering verifications.

6.3 Ductility

6.3.1 *General*

Where Clause 6.2.1 is applied, shackles shall be sufficiently ductile so that, in the event of being loaded to failure, the fractured member will show a permanent distortion before breaking. If the pin fractures, it shall show a permanent bend of not less than 20 degrees. If the body fractures, it shall show a permanent mid-shackle set of not less than 15% of the original width between the bows or legs (*B* or *W* in Appendix D).

6.3.2 *WLL of more than 166 t*

Where Clause 6.2.2 is applied, the permanent distortion required by Clause 6.3.1 need not be demonstrated.

7 MARKING

7.1 General

Shackle bodies shall be permanently and legibly marked with the information required by Clause 7.2, the marking being either raised or indented. Where the marking is indented, the marks shall not have sharp edges nor reduce the strength of the shackle. The marking should be located in accordance with Figure 1.

7.2 Information

The following information shall be marked:

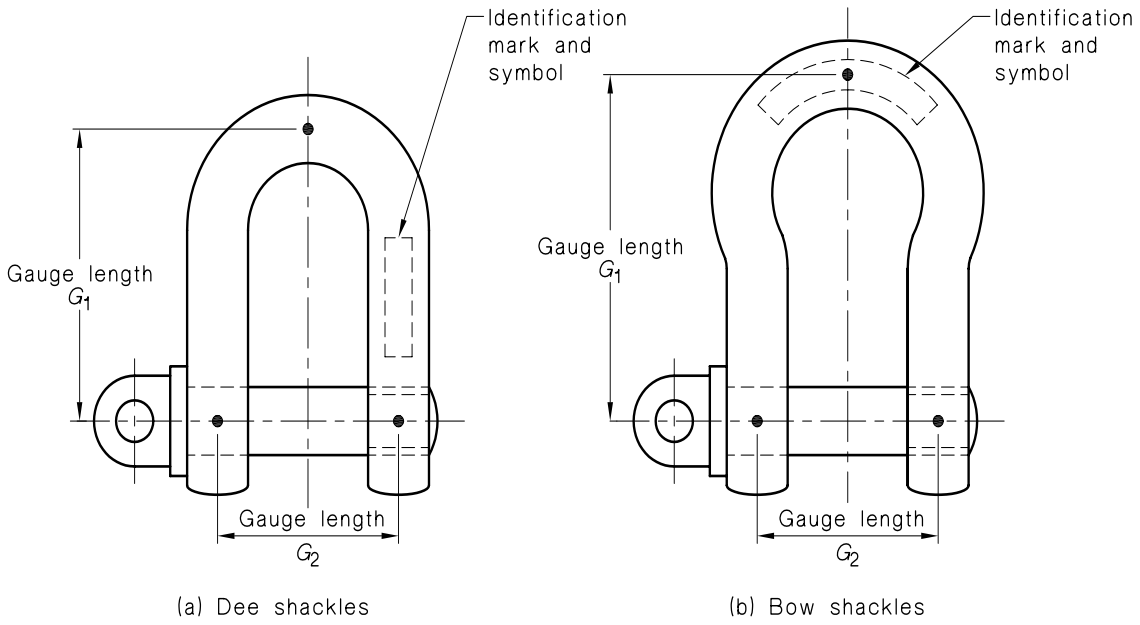
(a) Manufacturer's identification.

(b) Quality Grade, as M or 4, or S or 6.

(c) WLL.

(d) Identification marking to correlate the shackle to the test certificate.

NOTE: Manufacturers making a statement of compliance with this Australian Standard on a product, packaging or promotional material related to that product are advised to ensure that such compliance is capable of being verified.



NOTE: These gauge lengths are referred to in Clause 9.2.3(b)(ii).

FIGURE 1 TYPICAL POSITIONS FOR MARKING SHACKLES

8 TESTING OF MECHANICAL PROPERTIES

Compliance of each design and each batch with the requirements of Clause 6 shall be demonstrated.

The test of each design is known as the type test, which determines the adequacy of the design for achieving the required performance.

Each change in manufacturing process (including heat treatment), grade of material, design and size shall necessitate separate type testing, to demonstrate compliance with the requirements of Clause 6.

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

9 QUALITY CONTROL DURING MANUFACTURING

9.1 General

During manufacturing, the quality of shackles shall be controlled by either—

(a) proof testing every shackle in accordance with Clause 9.2; or

(b) a quality control system complying with Clause 9.3.

NOTES:

1 Proof testing of every shackle may be required by the purchaser, the regulatory authority or the user.

2 Figure 2 (which is located after Clause 9.4) illustrates the options given in Clause 9.

9.2 Proof testing

9.2.1 *Application*

Clause 9.2 applies where option (a) in Clause 9.1 is chosen and where otherwise required.

9.2.2 *Method*

Each shackle is subjected to a proof force (see Appendix D), applied under the conditions specified in Appendix F, of—

(a) for shackles with a WLL of not more than 55 t, [(WLL in tonnes) × 2 × 9.81] kN; and

(b) for shackles with a WLL of more than 55 t, [(WLL in tonnes + 50) × 9.81] kN.

9.2.3 *Requirements*

The shackle shall—

(a) withstand the application of the proof force, without sustaining damage that may affect its operation, intended function or safety; and

(b) after proof loading—

  (i) be free from any deleterious permanent set or defects that can be detected by visual inspection; and

  (ii) for gauge lengths G_1 and G_2, as defined in Figure 1, of—

    (A) more than 25 mm, not be deformed by more than 2% of the initial dimension; and

    (B) not more than 25 mm, not be deformed by more than 0.5 mm.

Any shackles that fail this test shall be rejected.

A competent person (see Clause 3.1) shall be satisfied that these requirements have been met.

9.3 Using a quality control system

9.3.1 *Application*

Clause 9.3 applies where option (b) in Clause 9.1 is used.

Clause 9.3.2 applies to shackles with a WLL of not more than 25 t.

Clause 9.3.3 applies to shackles with a WLL of more than 25 t.

9.3.2 *WLL of not more than 25 t*

For shackles with a WLL of not more than 25 t, if a quality control system is used, the quality control system shall be undertaken by a testing laboratory that is accredited to AS ISO/IEC 17025, and the following apply:

(a) A sampling plan shall be applied with a random sample size complying with Table 2. The selected samples shall be submitted to proof testing in accordance with Clause 9.2.

If the number of shackles failing the proof test exceeds the maximum number specified in Table 2, every shackle in the batch from which the samples were selected shall be proof tested in accordance with Clause 9.2.

TABLE 2

SAMPLING PLAN FOR PROOF TESTING

A1

Batch size	Minimum sample size	Maximum number of samples not conforming for acceptance of the batch
2 to 15	2	0
16 to 25	3	0
26 to 90	5	0
91 to 150	8	1
151 to 500	13	1
501 to 1200	20	2
1201 to 10 000	32	3
10 001 to 35 000	50	5
More than 35 000	80	7

(b) A mechanical properties sampling plan shall be applied with a sampling frequency complying with Table 3. The batch shall be accepted if during the first sampling all the samples conform. The batch shall be rejected if during the first sampling there are two or more samples that do not conform. A second sampling shall be submitted if there is only one sample that does not conform.

For a second sampling, the batch shall be accepted if all of the second samplings conform. The batch shall be rejected if any one of the second samplings does not conform.

TABLE 3

SAMPLING PLAN FOR MECHANICAL PROPERTIES

A1

Batch size	Sample size
16 to 150	2
151 to 1200	3
1201 to 35 000	5
More than 35 000	8

9.3.3 *WLL of more than 25 t*

For shackles with a WLL of more than 25 t, any quality control system being used shall comply with the following:

(a) *Choice of quality-assurance system* The manufacturing test procedure that is used depends on whether or not the manufacturer has a quality assurance system conforming to AS/NZS ISO 9001 for the manufacture of shackles and is certified by a relevant nationally recognized certification body. For shackles with a WLL of more than 25 t, where such a system is in place and operating, the manufacturer shall comply with Item (b) below. Where such a system is not in place and operating, the manufacturer shall comply with Item (c) below.

(b) *Using a certified quality assurance system* Where a certified quality assurance system is operating, the manufacturer shall have the choice of either of the following procedures:

(i) Visual examination of all of the shackles, in accordance with Clause 5.7, plus application of a manufacturing proof test to 3% of the batch of shackles, in accordance with Clause 9.2.

(ii) Application of a non-destructive test to all shackles with zero defects, in accordance with nationally recognized Standards for inspection via a magnetic-particle test or a dye-penetrant test, plus application of the manufacturing proof test to 3% of the batch of shackles, in accordance with Clause 9.2.

In the event of a shackle failing to pass a manufacturing proof test, every shackle in that batch shall be subjected to and pass this test. Any shackle failing the manufacturing proof test shall not be deemed to comply with this Standard.

(c) *Without a certified quality assurance system* Where a certified quality assurance system is not operating, the manufacturer shall test one sample per batch, to demonstrate compliance with the requirements of Clause 6.

In the event of the sample failing this test, two further samples shall be taken from the same batch. Both of these samples shall pass the test.

In the event of any of these further samples failing to pass this test, the entire batch shall be deemed to have failed the test.

In addition, the manufacturer shall carry out manufacturing proof testing and visual examination in accordance with Clause 9.1 on all of the shackles. Any shackle failing the manufacturing proof test or the visual examination shall be deemed to not comply with this Standard.

If all of these requirements are achieved, the batch shall be deemed to comply with this Standard.

Where it is prohibitive to undertake testing to demonstrate compliance with Clause 6 (for example, where the batch consists of a small quantity of large and expensive shackles, where testing facilities are unavailable), the quality of the product may be assured by requesting quality plans, inspection and testing plans and manufacturer's data reports associated with the manufacture of shackles. These details are to be acceptable to the purchaser.

9.4 Test certificate

Proof testing of shackles shall be recorded on a test certificate, which shall bear the following information:

(a) Type (i.e., dee or bow, body and type of pin).

(b) Quality Grade.

(c) Nominal size.

(d) Surface finish.

(e) WLL.

(f) Proof force.

(g) Date of proof test.

(h) Quantity in batch.

(i) Number tested.

(j) Batch identification.

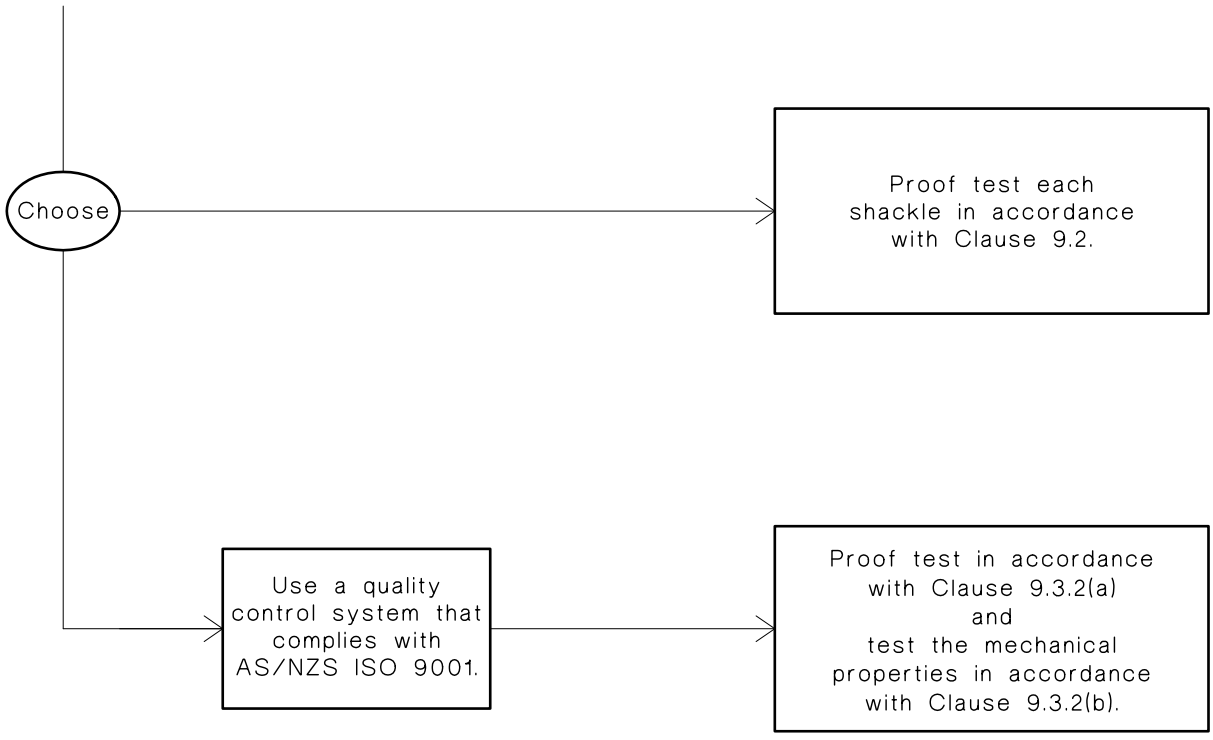
(k) A declaration that the shackles comply with this Standard.

(l) The name and address of the manufacturer or supplier.

(m) The name and address of the testing establishment.

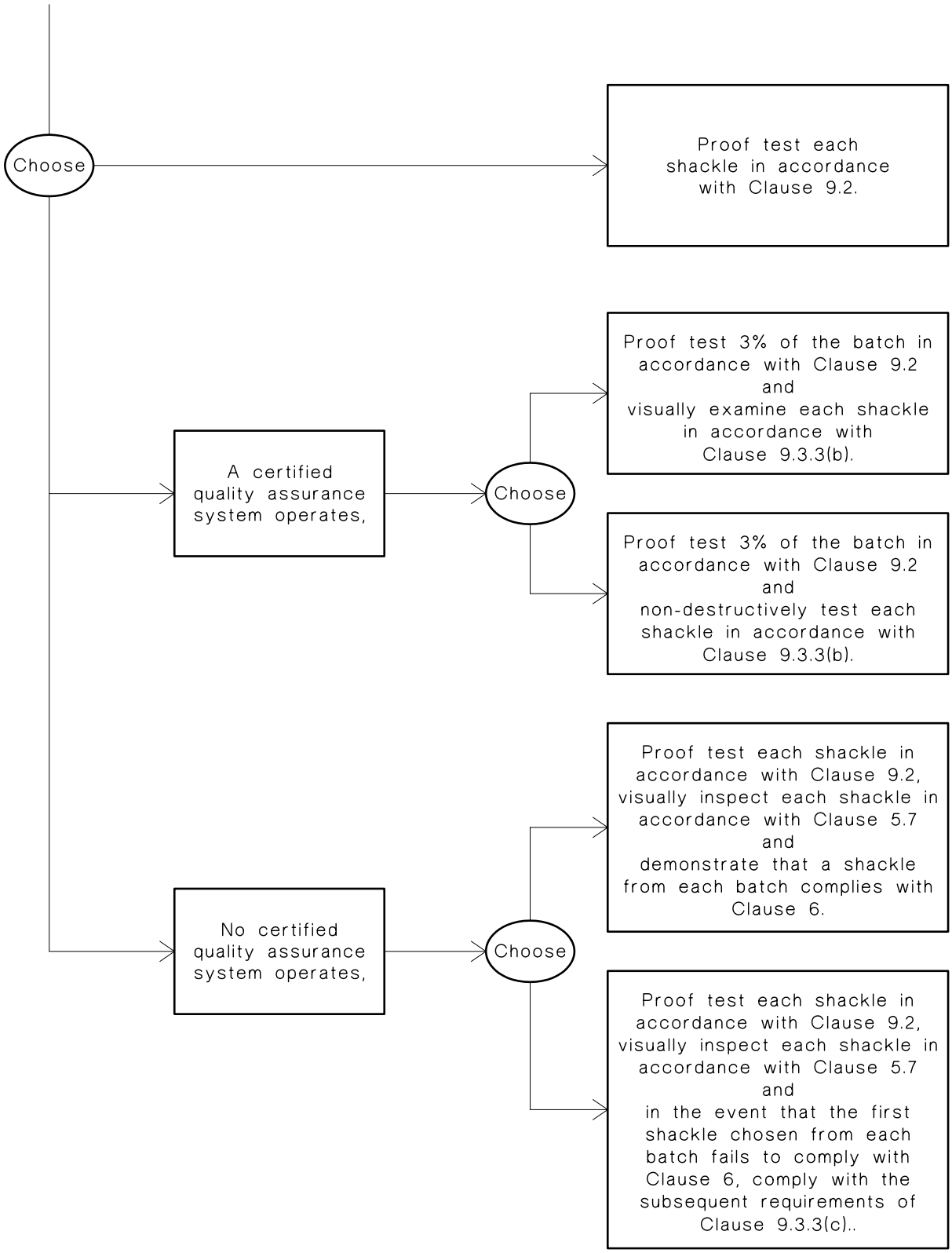
(n) The name and signature of the signatory.

NOTE: The manufacturer or supplier should retain a copy of the test certificate for not less than 10 years.



(a) For shackles with a WLL of not more than 25 t

FIGURE 2 (in part) QUALITY CONTROL OPTIONS DURING MANUFACTURE



(b) For shackles with a WLL of more than 25 t

FIGURE 2 (in part) QUALITY CONTROL OPTIONS DURING MANUFACTURE

APPENDIX A

INFORMATION THAT SHOULD BE SUPPLIED WITH INQUIRIES AND ORDERS

(Informative)

The following information should be supplied with inquiries and orders for shackles:

(a) Type (i.e., dee or bow, body and type of pin).

(b) Nominal size.

(c) Quality Grade, as M or 4, or S or 6.

(d) Surface finish.

(e) WLL.

(f) Applications, including temperature.

(g) Whether individual identification is required.

(h) Whether a copy of the test certificate is to be supplied.

(i) Whether additional tests such as analysis of material, production destructive tests or proof testing are required.

NOTE: Ultrasonic testing, magnetic particle testing, dye penetrant testing and Brinell hardness testing should comply with AS 1065, AS 1171, AS 2062 and AS 1816, respectively.

APPENDIX B

CARE AND USE

(Informative)

B1 INSPECTION

B1.1 Before use

Before use, shackles should be inspected to ensure the following apply:

(a) The markings are legible.

(b) The pin is of the correct type.

(c) The threads of the pin and the body are undamaged.

(d) The body and the pin are not distorted.

(e) The body and the pin are not unduly worn.

(f) The body and the pin are free from nicks, gouges, cracks and corrosion.

B1.2 Periodic

Shackles in use should be subject to periodic thorough examination by a competent person. The period between such examinations will depend upon the amount of use.

B2 SELECTION

B2.1 Type

Select the correct type of shackle for a particular application from the information given in Paragraph B4.

B2.2 Working load limit (WLL)

For applications involving two or more attachments to a shackle (which would apply non-linear forces), the WLL should be determined in consultation with the manufacturer.

The WLL for each application of a shackle shall be derived as follows:

(a) *Maximum load* The maximum load that may be supported by a shackle under general conditions of use.

(b) *General conditions of use* General conditions of use are equivalent to a group classification of crane mechanisms of M3, as specified in AS 1418.1.

(c) *Non-general-use value* Under other than general conditions of use (e.g., severe conditions, hazardous conditions, conditions directly involving the safety of personnel), the WLL shall be derived to conform to the group classification of crane mechanisms as specified in AS 1418.1 for the conditions of use that apply.

NOTES:

1 Under specified or unusual conditions of use (e.g., a high temperature environment, handling dangerous substances), the regulatory body may require the use of a derating that is greater than that specified in AS 1418.1.

2 Where the shackle is an integral part of a crane, the derating for the shackle shall be the same as that used for the crane.

B3 ASSEMBLY

When assembling a shackle, the following requirements apply:

(a) Ensure that the pin is of the correct length, so that it penetrates the full depth of the screwed eye and allows the collar of the pin to bed on the surface of the drilled eye.

(b) Ensure that the pin is screwed securely into the shackle body, so that the collar of the pin is seated on the shackle body.

(c) Incorrect seating of a pin may be due to a bent pin, a tightly fitting thread or misalignment of the pin holes. Such a shackle shall be withdrawn from service.

(d) Never replace a shackle pin with one of a different grade or specification, as it may not be suitable for the loads imposed.

(e) Shackles permanently attached to a lifting device shall have their pins secured, to prevent unintended release, such as by seizing or mousing. Bolt and nut type pins, such as those shown in Figures E5 and E8, are commonly used for this purpose.

B4 USAGE

When using a shackle, the following requirements apply:

(a) The strength of shackles is adversely affected by excessively elevated temperatures. Do not use shackles outside the temperature range of −10°C to 200°C without consulting with the manufacturer.

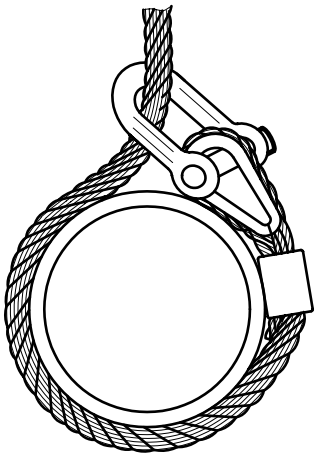
(b) Avoid applications where movement of the load or the rope can roll and possibly unscrew the shackle pin (see Figures B1 and B2).

(c) To avoid eccentric loading of a shackle, a loose spacer may be used on either end of the shackle pin (see Figure B3), or a shackle with a small jaw width may be used. Do not reduce the width between the shackle jaws by welding washers or spacers to the inside faces of the eyes, or by closing the jaws, as this will have an adverse effect on the properties of the shackle.

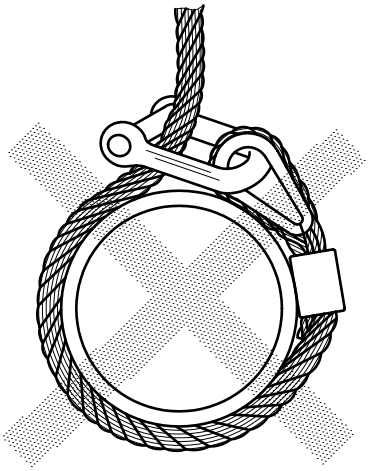
(d) Where a shackle is used to connect two slings to the hook of a lifting machine, it should be a bow-type shackle, assembled with the slings in the shackle body and the hook engaged with the shackle pin (see Figure B2(a)). A deration shall apply where the included angle exceeds 60° and advice should be sought from the manufacturer.

(e) Shackles should not be used in a manner that imposes a side loading, unless specifically permitted by the manufacturer. In general, this means that the shackle body should take the load along the axis of its centre-line (see Figures B3 and B4). For those makes of shackle that do permit side loading, the manufacturer's instructions should be followed.

(f) Where using shackles in conjunction with multi-leg slings, due consideration should be given to the effect of the angle between the legs of the sling. As this angle increases, so does the load in the sling leg and consequently in any shackle attached to the leg.



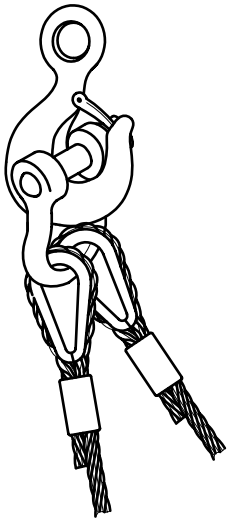
(a) Correct method



NOTE: The rope could unscrew the pin.

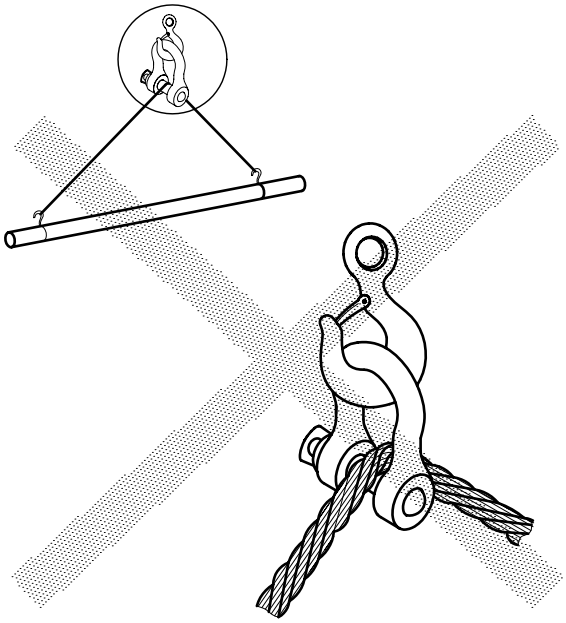
(b) Incorrect method

FIGURE B1 AVOIDING UNSCREWING THE PIN WITH A CHOCKED WRAPPING



NOTE: Using two ropes with eyes.

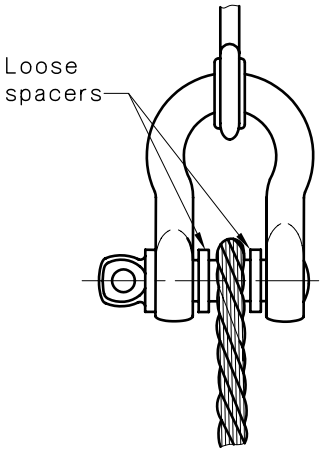
(a) Correct method



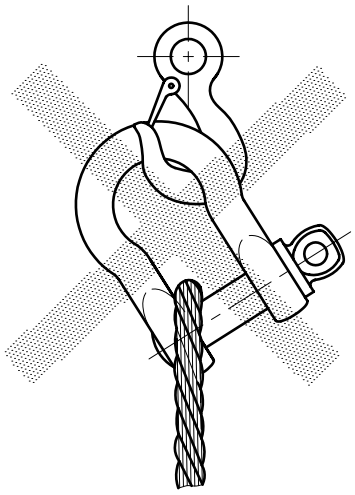
NOTE: If the load shifts, the sling could unscrew the shackle pin.

(b) Incorrect method

FIGURE B2 AVOIDING UNSCREWING THE PIN BY USING TWO SINGLE-LEG SLINGS WITH EYES



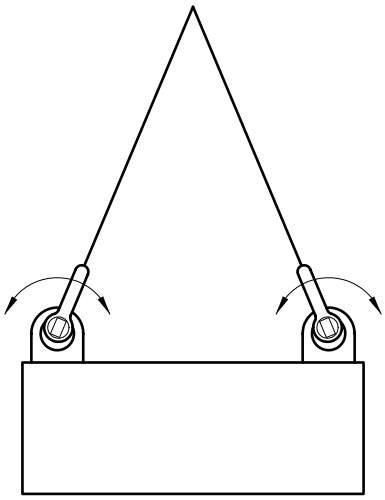
(a) Correct method



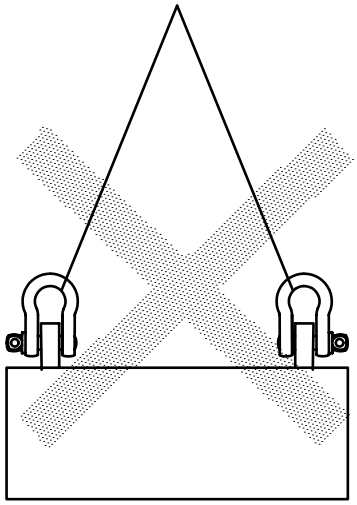
NOTE: Spaces are required, to keep the sling on the centre-line of the shackle.

(b) Incorrect method

FIGURE B3 AXIAL LOADING



(a) Correct method



NOTE: Shackles are being twisted sidewards

(b) Incorrect method

FIGURE B4 TYPICAL USE OF SHACKLES TO SLING A LOAD

APPENDIX C

STANDARDS FOR COMPONENTS USED IN LIFTING SYSTEMS

(Informative)

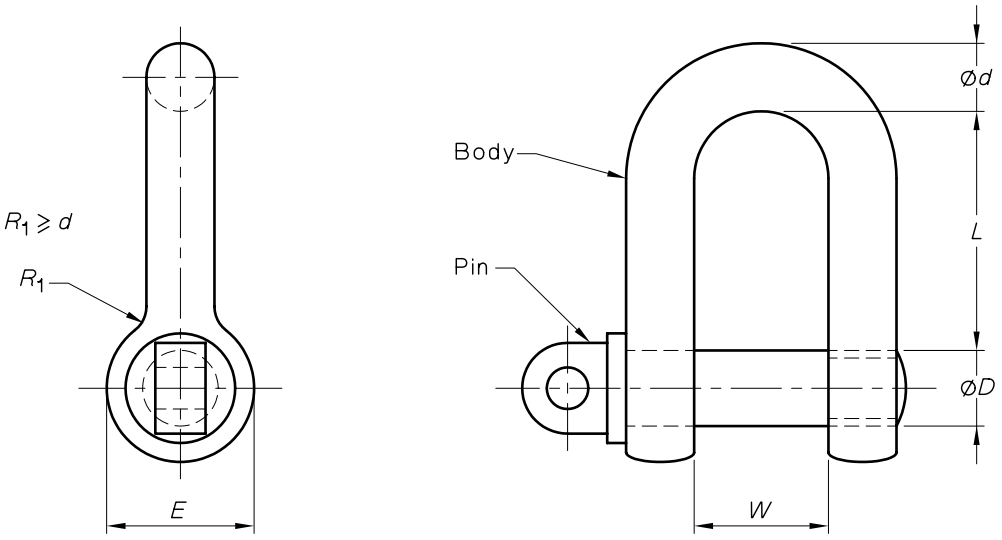
The following is list of Australian Standards for components used in lifting systems:

AS	
1138	Thimbles for wire rope
1353	Flat synthetic-webbing slings
1353.1	Part 1: Product specification
1353.2	Part 2: Care and use
1380	Fibre-rope slings
1380.1	Part 1: Product specification
1380.2	Part 2: Care and use
1438	Wire-coil flat slings
1438.1	Part 1: Product specification
1438.2	Part 2: Care and use
1666	Wire-rope slings
1666.1	Part 1: Product specification
1666.2	Part 2: Care and use
2076	Wire-rope grips for non-lifting applications
2089	Sheave blocks for lifting purposes
2317	Collared eyebolts
2318	Swivels for hoists
2319	Rigging screws and turnbuckles
2321	Short-link chain for lifting purposes
2740	Wedge-type sockets
2741	Shackles
2759	Steel wire rope—Application guide
2841	Galvanized steel wire strand
3569	Steel wire ropes
3585	End fittings for flat-webbing slings
3775	Chain slings—Grade T
3776	Lifting components for Grade T chain slings
3777	Shank hooks and large-eye hooks—Maximum 25 t
4142	Fibre ropes
4142.2	Part 2: Three-strand hawser-laid and eight-strand plaited
4497	Roundslings—Synthetic fibre
4497.1	Part 1: Product specification
4497.2	Part 2: Care and use

APPENDIX D

DETAILS OF SHACKLE BODIES

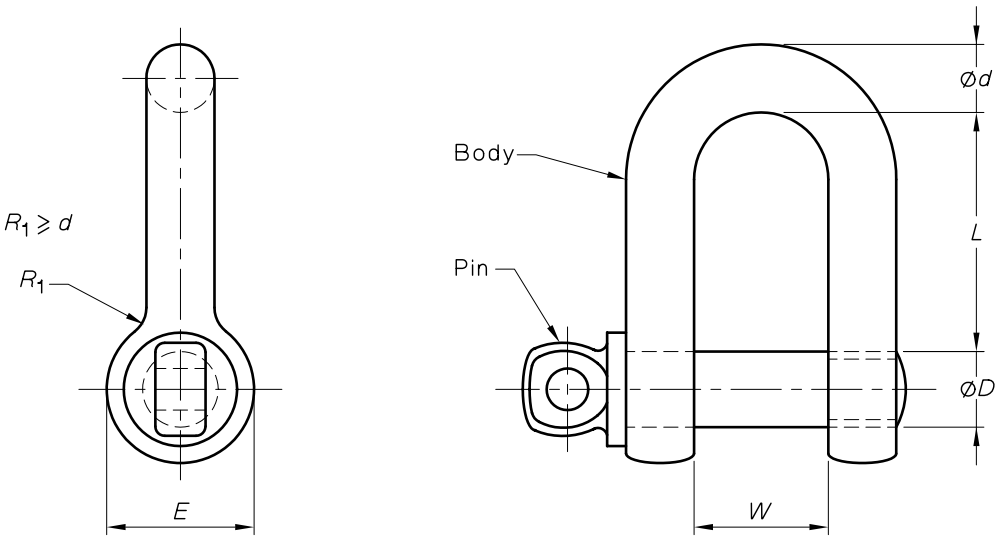
(Normative)



Shown with a Figure E1 type pin. Typical types of pin are shown in Figures E1 to E6 of Appendix E.

1	2	3	4	5	6	7	8	9
Nominal size mm	**Dimension, mm (Tolerance +8%, –5%)**					**WLL t**	**Test force, kN**	
	d	***D***	***W***	***L***	***E***		**Destructive test**	**Proof test**
6	6	10	13	25	19	0.25	14.8	5.0
10	10	13	19	38	25	0.50	29.5	9.9
13	13	16	28	54	32	0.75	44.2	14.8
16	16	19	32	63	38	1.5	88.3	29.5
19	19	22	38	73	44	2.0	118	39.3
22	22	25	44	83	51	3.0	177	58.9
25	25	29	51	95	57	3.8	224	74.6
29	29	32	54	105	63	5.0	295	98.1
32	32	35	60	114	70	6.0	354	118
35	35	38	67	127	67	7.0	413	138
38	38	44	70	137	89	9.5	560	187
41	41	48	76	146	95	11	648	216
44	44	51	83	156	102	13	766	256
48	48	54	92	178	108	14	825	275
51	51	57	98	187	114	16	942	314
54	54	60	105	197	121	18	1060	354
57	57	63	108	210	127	20	1180	393
63	63	73	121	235	146	25	1480	491
70	70	79	133	260	159	30	1770	589
76	76	86	146	279	171	35	2070	687
79	79	89	149	292	178	40	2360	785
89	89	102	171	330	203	50	2950	981
102	102	114	191	375	229	65	3830	1130
114	114	127	219	419	254	80	4710	1280

FIGURE D1 QUALITY GRADE M OR 4 DEE SHACKLES



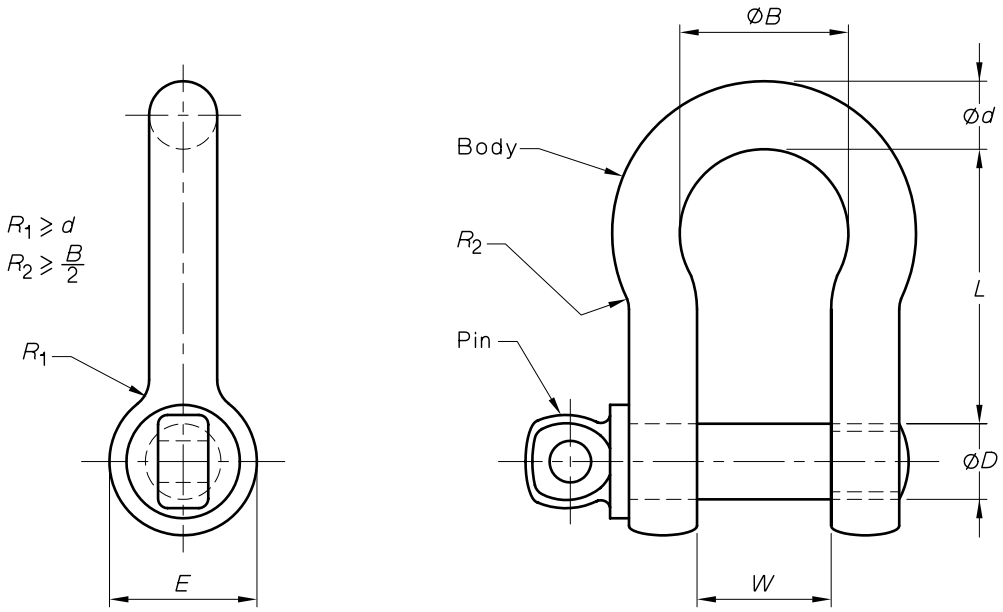
Shown with a Figure E7 type pin. Typical types of pin are shown in the following figures of Appendix E:

(a) For shackle sizes of less than 12 mm, Figure E7.

(b) For shackle sizes of not less than 12 mm, Figures E7 and E8.

1	2	3	4	5	6	7	8	9	10
Nominal size mm	**Dimension, mm (Tolerance +8%, −5%)**					**WLL t**	**Test force, kN**		**Pin type**
	d	***D***	***W***	***L***	***E***		**Destructive test**	**Proof test**	
6	6	8	12	22	17	0.5	29.5	9.9	Figure E7
8	8	10	13	26	21	0.75	44.2	14.8	
10	10	11	17	32	25	1.0	58.9	19.7	
11	11	13	18	37	27	1.5	88.3	29.5	
13	13	16	21	41	33	2.0	118	39.3	Figures E7 and E8
16	16	19	27	51	40	3.2	189	62.8	
19	19	22	32	60	48	4.7	277	92.3	
22	22	25	37	71	54	6.5	383	128	
25	25	29	43	81	60	8.5	501	167	
29	29	32	46	90	67	9.5	560	187	
32	32	35	52	100	76	12	707	236	
35	35	38	57	113	84	13.5	795	265	
38	38	41	60	124	92	17	1010	334	
44	44	51	73	146	110	25	1480	491	
51	51	57	83	171	127	35	2070	687	
57	57	63	95	181	143	42.5	2510	834	
63	63	70	105	203	152	55	3240	1080	
76	76	83	127	229	165	85	5010	1330	
89	89	95	146	267	203	120	7070	1670	
102	102	108	165	318	229	150	8830	1970	

FIGURE D2 QUALITY GRADE S OR 6 DEE SHACKLES



Shown with a Figure E7 type pin. Typical types of pin are shown in the following figures of Appendix E:

(a) For shackle sizes of less than 12 mm, Figure E7.

(b) For shackle sizes of not less than 12 mm, Figures E7 and E8.

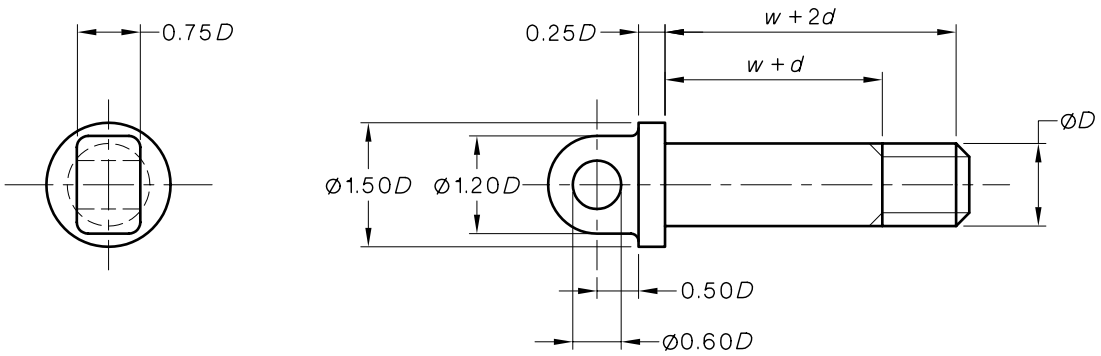
1	2	3	4	5	6	7	8	9	10	11
Nominal size mm	**Dimension, mm (Tolerance +8%, −5%)**						**WLL t**	**Test force, kN**		**Pin type**
	d	***D***	***W***	***B***	***L***	***E***		**Destructive test**	**Proof test**	
5	5	6	10	15	22	14	0.33	19.5	6.5	Figure E7
6	6	8	12	20	29	17	0.50	29.5	9.9	
8	8	10	13	21	31	21	0.75	44.2	14.8	
10	10	11	17	26	37	25	1.0	58.9	19.7	
11	11	13	18	29	43	27	1.5	88.3	29.5	
13	13	16	21	33	48	33	2.0	118	39.3	Figures E7 and E8
16	16	19	27	43	61	40	3.2	189	62.8	
19	19	22	32	51	72	48	4.7	277	92.3	
22	22	25	37	58	84	54	6.5	383	128	
25	25	29	43	68	95	60	8.5	501	167	
29	29	32	46	74	108	67	9.5	560	187	
32	32	35	52	83	119	76	12	707	236	
35	35	38	57	92	133	84	13.5	795	265	
38	38	41	60	98	146	92	17	1010	334	
44	44	51	73	127	178	110	25	1480	491	
51	51	57	83	146	197	127	35	2070	687	
57	57	63	95	160	222	143	42.5	2510	834	
63	63	70	105	184	267	152	55	3240	1080	
76	76	83	127	200	330	165	85	5010	1330	
89	89	95	146	241	381	203	120	7070	1670	
102	102	108	165	279	432	229	150	8830	1970	

FIGURE D3 QUALITY GRADE S OR 6 BOW SHACKLES

APPENDIX E

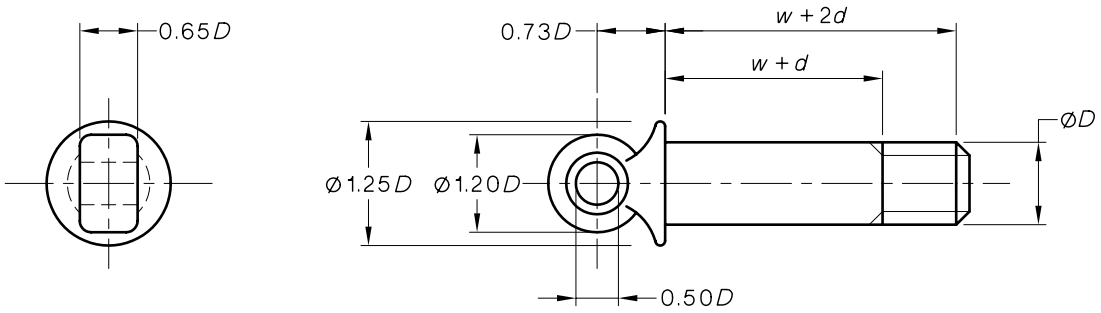
DETAILS OF TYPICAL SHACKLE PINS

(Informative)



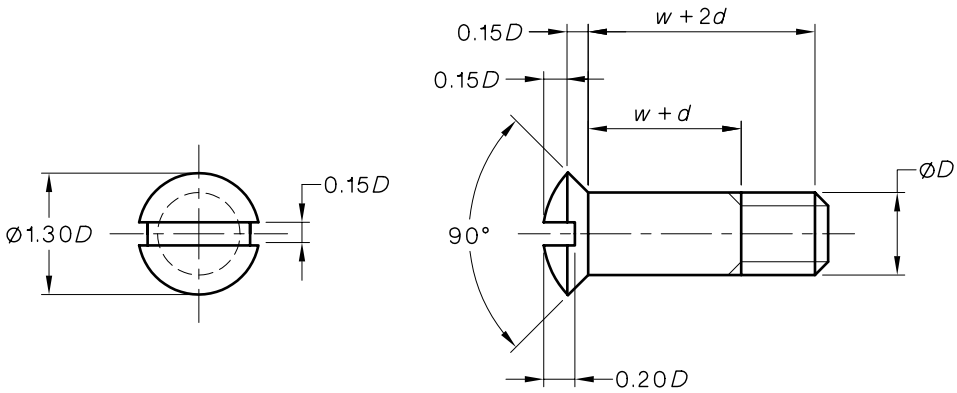
$D \leqslant 89$ mm

FIGURE E1 SCREWED AND COLLARED PIN WITH EYE IN RECTANGULAR HEAD FOR QUALITY GRADE M OR 4 SHACKLES



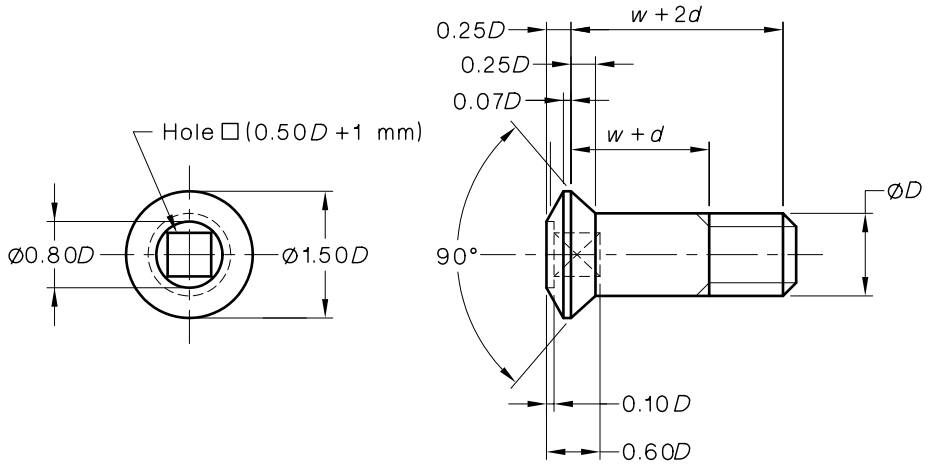
$D \leqslant 89$ mm

FIGURE E2 SCREWED AND COLLARED PIN WITH EYE IN ROUNDED HEAD FOR QUALITY GRADE M OR 4 SHACKLES



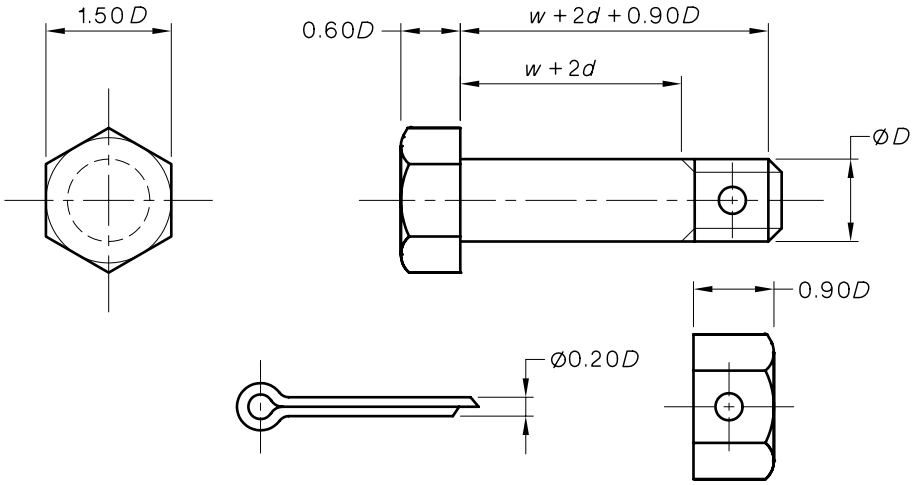
$D \leqslant 63$ mm

FIGURE E3 SCREWED PIN WITH SLOTTED COUNTERSUNK HEAD FOR QUALITY GRADE M OR 4 SHACKLES



$D \leqslant 63$ mm

FIGURE E4 SCREWED PIN WITH SOCKETED COUNTERSUNK HEAD FOR QUALITY GRADE M OR 4 SHACKLES



$D \leqslant 90$ mm

FIGURE E5 BOLT, NUT AND SPLIT PIN FOR QUALITY GRADE M OR 4 SHACKLES

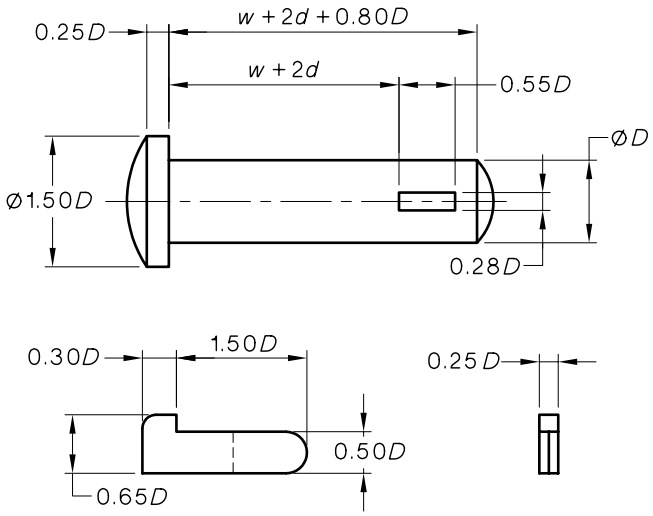


FIGURE E6 COLLARED PIN AND FORELOCK FOR QUALITY GRADE M OR 4 SHACKLES

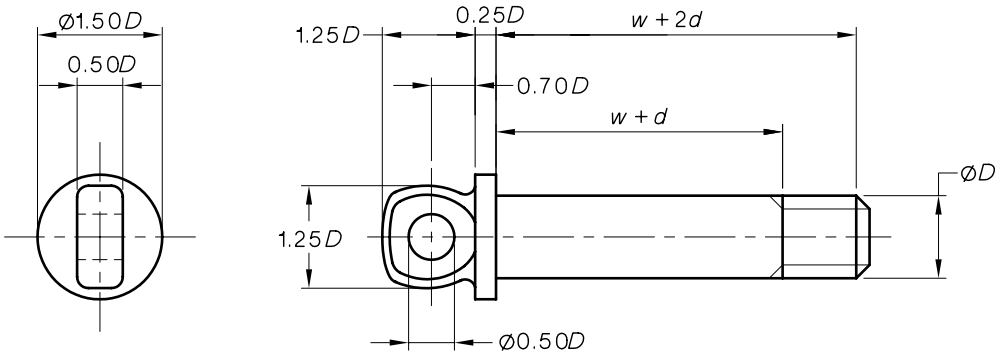


FIGURE E7 SCREWED AND COLLARED PIN WITH EYE FOR QUALITY GRADE S OR 6 SHACKLES

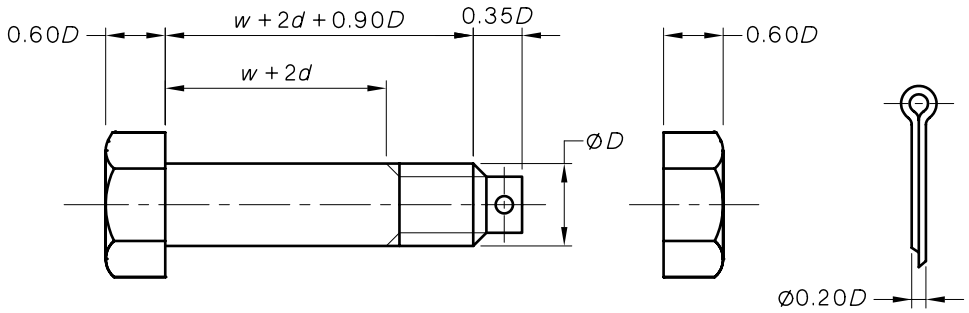


FIGURE E8 BOLT, NUT AND SPLIT PIN FOR QUALITY GRADE S OR 6 SHACKLES

APPENDIX F

CONDITIONS FOR APPLICATION OF TEST FORCES

(Normative)

The following conditions apply to the application of test forces to shackles:

(a) The testing machine shall be calibrated in accordance with AS 2193 and shall be capable of Grade A results when testing mechanical properties (see Clause 6) and Grade C results when proof testing (see Clause 9.2).

(b) Manufacturing processes, other than proof loading and any application of temporary protective coatings for storage purposes, shall be completed.

(c) The interface of the testing tooling shall be not more than two-thirds of the inside width *B* or *W* of a bow shackle or *W* of a dee shackle.

(d) The test force shall be applied to the shackle in tension along the centre-line that lies on the central plane of the body and the pin, is normal to the central axis of the pin and passes through the centre of the opening between the ends of the body.

APPENDIX G

MEANS OF DEMONSTRATING COMPLIANCE WITH THIS STANDARD

(Informative)

G1 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.

G2 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 on 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, guidance to which is given in AS 1399.

G3 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 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.

G4 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.

G5 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.

AMENDMENT CONTROL SHEET

AS 2741—2002

Amendment No. 1 (2002)

CORRECTION

SUMMARY: This Amendment applies to the History block and Tables 1 and 2.

Published on 12 July 2002.

NOTES

NOTES

Standards Australia

Standards Australia is an independent company, limited by guarantee, which prepares and publishes most of the voluntary technical and commercial standards used in Australia. 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 national standards body.

Australian Standards

Australian Standards are prepared by committees of experts from industry, governments, consumers and other relevant sectors. 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 that 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 ISO (The International Organization for Standardization) and the International Electrotechnical Commission (IEC).

Electronic Standards

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