

Australian Standard™

**Founding—Patterns, pattern equipment
and coreboxes for the production of
sand moulds and sand cores**

This Australian Standard was prepared by Committee MT-001, Iron and Steel. It was approved on behalf of the Council of Standards Australia on 30 May 2005. This Standard was published on 15 June 2005.

The following are represented on Committee MT-001:

- Australian Railway Associations
- Australian Building Codes Board
- Australian Foundry Institute
- Australian Industry Group
- Australian Steel Institute
- Bureau of Steel Manufacturers of Australia
- Institute of Material Engineering Australia

Keeping Standards up-to-date

Standards are living documents which reflect progress in science, technology and systems. To maintain their currency, all Standards are periodically reviewed, and new editions are published. Between editions, amendments may be issued. Standards may also be withdrawn. It is important that readers assure themselves they are using a current Standard, which should include any amendments which may have been published since the Standard was purchased.

Detailed information about Standards can be found by visiting the Standards Web Shop at www.standards.com.au and looking up the relevant Standard in the on-line catalogue.

Alternatively, the printed Catalogue provides information current at 1 January each year, and the monthly magazine, *The Global Standard*, has a full listing of revisions and amendments published each month.

Australian Standards™ and other products and services developed by Standards Australia are published and distributed under contract by SAI Global, which operates the Standards Web Shop.

We also welcome suggestions for improvement in our Standards, and especially encourage readers to notify us immediately of any apparent inaccuracies or ambiguities. Contact us via email at mail@standards.org.au, or write to the Chief Executive, Standards Australia, GPO Box 5420, Sydney, NSW 2001.

This Standard was issued in draft form for comment as DR 05100.

Australian Standard™

**Founding—Patterns, pattern equipment
and coreboxes for the production of
sand moulds and sand cores**

First published as AS 4314—2005.

COPYRIGHT

© Standards Australia

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher.

Published by Standards Australia, GPO Box 5420, Sydney, NSW 2001, Australia

ISBN 0 7337 6776 1

PREFACE

This Standard was prepared by the Australian members of the Joint Standards Australia/Standards New Zealand Committee MT-001, Iron and Steel. After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this Standard as an Australian, rather than an Australian/New Zealand Standard.

The objective of this Standard is to specify the general technical delivery requirements for patterns to be used for iron, steel and non-ferrous castings.

This Standard is intended for purchasers, manufacturers (patternmakers) and founders. It is also intended to ensure the correct interpretation of casting and tooling drawings/numerical data and to ensure that pattern equipment will produce sand moulds and/or sand cores, suitable for use, and to assist in determining the usually undefined limits of good workmanship. This Standard stresses the need for consultation between the purchaser, manufacturer (patternmaker) and founder before work commences.

This Standard not only specifies the usual features of design, construction, materials, tolerances, contractions and required machining allowances but also specifies other features such as usage, classification, quality control, marking, packaging and storage.

During the preparation of this Standard, cognizance was taken of the following European Standard:

EN

12890 Founding—Patterns, pattern equipment and coreboxes for the production of sand moulds and sand cores

This Standard is one of a series of Standards covering the range of cast irons and steels. The series comprises the following:

AS

1830 Grey cast iron

1831 Ductile cast iron

1832 Malleable cast iron

1833 Austenitic cast iron

2027 Wear-resistant white cast iron

2074 Cast steels

4314 Founding—Patterns, pattern equipment and coreboxes for the production of sand moulds and sand cores (this Standard)

4738 Metal castings

4738.1 Part 1: Ferrous sand moulded

5049 Cast iron—Designation of microstructure of graphite

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, where an ‘informative’ appendix is only information and guidance

CONTENTS

	<i>Page</i>
1 SCOPE.....	4
2 REFERENCE DOCUMENTS.....	4
3 DEFINITIONS.....	4
4 ORDER INFORMATION AND DELIVERY CONDITIONS	6
5 CONTRACTION ALLOWANCE.....	7
6 CLASSIFICATION	7
7 SPECIFICATIONS	7
8 MANUFACTURING REQUIREMENTS.....	16
9 QUALITY CONTROL	20
10 USAGE	21

APPENDICES

A	GUIDELINES ON THE USE OF THE TABLES IN THIS STANDARD	23
B	MEANS FOR DEMONSTRATING COMPLIANCE WITH THIS STANDARD	24
C	REFERENCE VALUES FOR LINEAR CASTING CONTRACTIONS.....	26

STANDARDS AUSTRALIA

Australian Standard**Founding—Patterns, pattern equipment and coreboxes for the
production of sand moulds and sand cores**

1 SCOPE

This Standard specifies the requirements for patterns, pattern equipment and coreboxes for the production of sand moulds and/or sand cores.

This Standard does not specify equipment for the production of lost wax patterns, permanent moulds and die casting dies or ancillary items used in the manufacture of pattern equipment (such as screws and dowels).

2 REFERENCE DOCUMENTS

The following documents are referred to in this Standard:

AS

- | | |
|----------|--|
| 1100 | Technical drawing |
| 1100.201 | Part 201: Mechanical engineering drawing |
| 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 acceptable quality limit (AQL) for lot-by-lot inspection |
| 1654 | ISO system of limits and fits |
| 1654.1 | Part 1: Bases of tolerance, deviations and fits |
| 4738 | Metal castings |
| 4738.1 | Part 1: Ferrous sand moulded |

AS/NZS

- | | |
|--------|---|
| 1604 | Specifications for preservative treatment |
| 1604.3 | Part 3: Plywood |

ISO 9001 Quality management systems—Requirements

ISO 9004 Quality management systems—Guidelines for performance improvements

HB 18 Guidelines for third-party certification and accreditation

HB 18.28 Guide 28 General rules for a model third-party certification scheme for products

3 DEFINITIONS

For the purposes of this Standard, the definitions below apply:

3.1 Purchaser

Person or body responsible for the ordering of the patterns, pattern equipment and coreboxes.

3.2 Manufacturer (patternmaker)

Person or body responsible for the production of the patterns, pattern equipment and coreboxes.

3.3 Founder

Person or body responsible for the manufacture of castings from the moulds made from patterns, pattern equipment and coreboxes supplied to it by the manufacturer (pattern maker) or the purchaser.

3.4 Sand mould

Part or assembly of parts, made of heat resistant sand (such as silica sand and zircon sand), which usually forms the external surfaces of a casting and is not re-usable after pouring.

3.5 Sand core

Part or assembly of parts, made of heat resistant sand (such as silica sand and zircon sand), which usually forms the inner surfaces of a casting and is not re-usable after pouring.

3.6 Pattern

Model which forms part or all of a subsequent mould or core assembly.

3.7 Corebox

Model which forms all of a core or part or all of a subsequent core assembly.

3.8 Pattern equipment

All the components which make up all the necessary pieces to ensure the correct manufacture of a mould.

3.9 Quality class

Classification system which enables the parties concerned with the manufacture and use of patterns, pattern equipment and core boxes to be aware of their properties (such as fitness for purpose, quality and expected usage).

3.10 Contract review

Analysis and/or check of the order details carried out by the parties concerned, both before and during the processing of the order.

3.11 Core print

Projection either attached to a pattern to form recesses in the mould or attached to a core at points where cores are to be supported.

3.12 Required machining allowance (RMA)

Material deliberately added to certain surfaces of patterns, pattern equipment and coreboxes which is removed, partially or wholly, from the casting during subsequent machining.

3.13 Contraction allowance

The dimensional variation or allowance added to the pattern in order to compensate for shrinkage of the casting during cooling from the pouring temperature.

3.14 Taper

Slope or angle deliberately given to certain pattern or corebox surfaces to aid the stripping of the pattern from the mould or the core from the corebox.

NOTE: Taper is sometimes referred to as draft or draft angle.

3.15 Clearance

Space deliberately built into certain pattern or corebox surfaces to aid the assembly of the mould and/or core.

4 ORDER INFORMATION AND DELIVERY CONDITIONS

4.1 General

Clause 4 details the technical order information and delivery condition requirements to be agreed between the purchaser and the manufacturer (patternmaker). These requirements shall be in accordance with AS 4738.1.

The patterns, pattern equipment and coreboxes may be ordered either by the purchaser or by the founder. If the founder does not order directly, then consultation between the purchaser and founder is required.

As applicable, an agreement and an exchange of information carried out between the purchaser, the manufacturer (patternmaker), and the founder by the time of the acceptance of the order, is required to ensure a full understanding of the respective requirements of the parties concerned.

NOTE: The production of castings requires the use of patterns and/or coreboxes. The starting point in their manufacture is the drawing/numerical data of the as-cast casting and/or the machined part as agreed with the purchaser who can either—

- (a) order the castings and pattern equipment together from the founder who can sub-contract the pattern equipment manufacture to a patternmaker; or
- (b) order the castings from the founder and the patterns, pattern equipment and coreboxes from the manufacturer (patternmaker) separately.

4.2 Pre-production requirements

The following items shall be the subjects of agreement at the time of enquiry and before placing the order:

- (a) Cast material(s) and its (their) identification.
- (b) Moulding and/or coremaking techniques.
- (c) Dimensional tolerances.
- (d) Mould and core joint lines.
- (e) Pattern equipment identification.
- (f) Pattern surface coating.
- (g) Contractions.
- (h) Clearances.
- (i) Tapers.
- (j) Required machining allowances.
- (k) Pattern material(s).
- (l) Pattern material quality class(es).
- (m) Extent and type of quality inspection.
- (n) Protection and packaging for transportation and storage.

4.3 Mandatory information

The order shall include information on:

- (a) Designation of material to be cast (symbol and/or number).
- (b) Number of castings to be produced.
- (c) Number of sets of pattern equipment to be supplied.
- (d) Delivery time.

- (e) Relevant drawing(s) or numerical data.
- (f) Quality class(es) required.
- (g) Inspection(s) and documentation required.
- (h) Specification of the pattern and/or corebox materials to be used.
- (i) Moulding joint(s) and core print configuration.
- (j) Sizes and positions of gates and risers if required.
- (k) Contractions allowance to be used.
- (l) Type of protection and packaging.
NOTE: Transport arrangements may be included.
- (m) Repair and refurbishment.
- (n) Storage arrangement.
- (o) Approval procedure.
- (p) Any other requirements.
- (q) Core print configuration.
NOTE: Example size and shape of core prints or checks to prevent reversal.

5 CONTRACTION ALLOWANCE

The contraction allowance (see Appendix C) for patterns may vary as a result of material specification, various grades within a material specification the process of manufacture and the shape of the casting to be produced. Contraction rates may also vary within an individual pattern. For this reason the patternmaker shall discuss contraction rates with the casting supplier prior to manufacture of the pattern.

6 CLASSIFICATION

Patterns, pattern equipment and coreboxes shall be classified in accordance with the quality classes given in Table 1. In Table 1, reference is made to Tables 2 to 5 in which the applicability of the material is specified (see also Appendix A).

TABLE 1
QUALITY CLASSES FOR PATTERNS, PATTERN EQUIPMENT
AND COREBOXES

Material type	Quality classes	For further details
Wood	H1, H2, H3	See Tables 2 and 5
Metal	M1, M2	See Tables 3 and 5
Plastics	K1, K2	See Tables 4 and 5

7 SPECIFICATIONS

7.1 General

Drawings/numerical data, design and specifications shall be in accordance with the requirements of AS 4738.1, as applicable.

The quality class of patterns, pattern equipment and coreboxes shall be stated on the order (see Tables 2 to 5).

7.2 Designation

The designation of the quality class on relevant documents shall contain the following:

- (a) The number of this Australian Standard (AS 4314).
- (b) The quality class.

EXAMPLE: AS 4314-H3

TABLE 2A
QUALITY CLASSES—PATTERNS, PATTERN EQUIPMENT AND
COREBOXES MADE OF WOOD

Feature	Quality class		
	H1	H2	H3
Use	For large quantities in hand and machine moulding shops when very high standards are required	For small quantities and recurring single castings in hand and machine moulding shops.	For single castings in hand moulding shops.
Number of moulds*:			
Large pattern sizes†	Up to 200	5 up to 20	Up to 10
Intermediate patterns sizes†	200 up to 5000	20 up to 100	10 up to 20
Small pattern sizes†	1000 up to 10 000	100 up to 200	20 up to 50
Material type‡	Plywood panels, composite boards, hardwood or softwood shall be used	Veneered panels or soft sawn timber	Soft sawn timber or particleboards
Joints	Framing shall be box-jointed, connections e.g. segments, shall be glued and additionally bolted or screwed according to stress conditions	Framing shall be box-jointed $\frac{1}{2}$ or $\frac{2}{3}$ rebate-jointed as required. Bolting and/or screwed and/or nailing shall be used.	Framing shall be rebate-jointed. Bolting and/or screwed or otherwise nailing shall be used.
Pattern, pattern equipment and corebox distortion	Shall not distort either during compaction or stripping	As for H1	As for H1 NOTE: Additional strengthening can be necessary to prevent distortion when laminated or particle board is used in its construction.
Wood grain direction	Preferably in the lifting direction	Preferably in the lifting direction but can be crosswise when sides are steeply sloping' change between long timber and end-grain wood shall be avoided.	No special instructions.

(continued)

TABLE 2A (continued)

Feature	Quality class		
	H1	H2	H3
Guides	Interchangeable metal dowels shall be used for machine moulding patterns and pattern equipment, dowels of sufficient size shall be used.	Dowels that can be driven in shall be used.	As for H2.
Fillets	Compression strength and abrasion resistance of fillets shall correspond to that of the pattern material	As for H1.	No special instruction.
Loose pieces	No loose pieces shall be used with automated moulding, dovetailed guides shall be used for hand mounting patterns. Material: light metal, synthetic resin, hardwood or hard wood veneered panels with veneer thickness < 1 mm.	No loose pieces shall be used with automated machine moulding, dovetailed guides shall be used for hand moulding patterns. Material: as for H1 but no light metal.	Wooden dovetailed guides with dowels or screws shall be used.
Lifting arrangements	Shall be provided to conform to the relevant occupational health and safety guidelines.	As for H1.	As for H1.
Core print design	Shall be appropriately sized and providing protection against distortion shifting mispositioning and counter balancing as necessary.	As for H1.	As for H1.
Corebox design	Corebox design shall meet the requirements specified in AS 4738.1	Coreboxes shall be dowelled or bolted.	As for H2.

* Reference value for number of moulds dependent upon batch size, serviceable life and moulding process with appropriate maintenance (for guidance only)

† Pattern sizes can be considered to be:

Large, with a volume over 30 dm³;

Intermediate, with a volume more than 10 dm³ and up to 30 dm³;

Small, with a volume up to 10 dm³.

‡ Wood should be dry having a moisture content of between 8% and 12% by mass.

TABLE 2B
QUALITY CLASSES—PATTERNS, PATTERN EQUIPMENT AND
COREBOXES MADE OF WOOD

Range of dimension (basic size, see AS 1654.1†)		Tolerances or dimensions* measured at (20 ± 5)°C		
mm		mm		
Over	Up to and including	H1	H2	H3
	30	±0.2	± 0.2	± 0.4
30	50	± 0.3	± 0.3	± 0.5
50	80	± 0.3	± 0.3	± 0.6
80	120	± 0.4	± 0.4	± 0.7
120	180	± 0.5	± 0.5	± 0.8
180	250	± 0.6	± 0.6	± 0.9
250	315	± 0.6	± 0.6	± 1.0
315	400	± 0.7	± 0.7	± 1.1
400	500	± 0.8	± 0.8	± 1.2
500	630	± 0.9	± 0.9	± 1.4
630	800	± 1.0	± 1.0	± 1.6
800	1000	± 1.1	± 1.1	± 1.8
1000	1250	± 1.3	± 1.3	± 2.1
1250	1600	± 1.5	± 1.5	± 2.5
1600	2000	± 1.8	± 1.8	± 3.0
2000	2500	± 2.2	± 2.2	± 3.5
2500	3150	± 2.7	± 2.7	± 4.3
3150	4000	± 3.2	± 3.2	± 5.0

* When specifying the tolerances, the parties concerned should verify whether the required casting dimension tolerances can be achieved with these figures.

† Tolerances on dimensions (basic sizes) over 4000 mm are subject to agreement between the parties concerned.

TABLE 3A
QUALITY CLASSES—PATTERNS, PATTERN EQUIPMENT AND
COREBOXES MADE OF METAL

Feature	Quality class		
	M1	M2	M3
Use	Long run production when very high standards are required	Long run production	Cast plates medium production
Material type	Copper-tin-zinc alloys, copper-zinc alloys, aluminium alloys, cast iron or tool steel	As for M1	Any M1 or M2
Surface finish	Shall be machined all over and ground, roughness depth $R_a = 3.2 \mu\text{m}$, average peak-to-valley height, according to AS 1100.201	Only parting and guiding surfaces shall be machined. Pattern surface shall be smoothed and ground by hand, roughness depth $R_a = 12.5 \mu\text{m}$, average peak-to-valley height, according to AS 1100.201	Cast or hand clean up
Fillets	Shall be integral with equipment	As for M1	Shall be integrated with equipment
Loose pieces	Shall only be used with coreboxes	As for M1	As for M1
Wearing areas	Replaceable inserts shall be made of abrasion-resistant material	As for M1	—
Core print design	With sand traps (see Figure 1). Shall be appropriately sized and providing protection against distortion shifting mispositioning and counter balancing as necessary.	As for M1 Shall be appropriately sized and providing protection against distortion shifting mispositioning and counter balancing as necessary.	—
Core print material	With sand traps (see Figure 1) Shall be appropriately sized and providing protection against distortion shifting mispositioning and counter balancing as necessary	As for M1 Shall be appropriately sized and providing protection against distortion shifting mispositioning and counter balancing as necessary	—
Core print material	Metal	Metal	Metal or pattern plate material

TABLE 3B
QUALITY CLASSES—PATTERNS, PATTERN EQUIPMENT AND
COREBOXES MADE OF METAL

Range of dimensions (basic size see AS 1654.1†) mm		Tolerances on dimensions* measure at (20 ± 5)°C mm		
Over	Up to and including	M1	M2	M3
	30	± 0.10	± 0.15	± 0.30
30	50	± 0.15	± 0.20	± 0.45
50	80	± 0.15	± 0.25	± 0.45
80	120	± 0.20	± 0.30	± 0.60
120	180	± 0.20	± 0.30	± 0.75
180	250	± 0.25	± 0.35	± 0.90
250	315	± 0.25	± 0.40	± 0.90
315	400	± 0.30	± 0.45	± 1.05
400	500	± 0.30	± 0.50	± 1.20
500	630	± 0.4	± 0.6	± 1.35
630	800	± 0.4	± 0.6	± 1.50
800	1000	± 0.5	± 0.7	± 1.65
1000	1250	± 0.5	± 0.8	± 1.95
1250	1600	± 0.6	± 1.0	± 2.25
1600	2000	± 0.7	± 1.1	± 2.70
2000	2500	± 0.8	± 1.4	± 3.30
2500	3150	± 1.0	± 1.6	± 4.05
3150	4000	± 1.3	± 2.0	± 4.80

* When specifying the tolerances, the parties concerned should verify whether the required casting dimension tolerances can be achieved with these figures.

† Tolerances on dimensions (basic sizes) over 4000 mm are subject to the agreement between the parties concerned.

NOTE: It is common practice to adjust the dimensions of the patterns after sample pattern runs.

TABLE 4A
QUALITY CLASSES—PATTERNS, PATTERN EQUIPMENT AND
COREBOXES MADE OF PLASTIC

Features	Quality class	
	K1	K2
Use	When very high standards are required. Appropriate resistance to pressure shall be ensured for high-pressure moulding machines	Large sized patterns and coreboxes for hand moulding as well as small to medium series production.
Material type	Plastics with high dimensional stability and resistance to abrasion shall be used, e.g. epoxy resins or polyurethanes with metallic or inert fillers taking into account the process temperature. The plastics shall be compatible with the materials that are to be processed (binders, stripping agents etc) with the subsequent coating systems.	As for K1.
Manufacture		
Plastic shell process (surface casting process)	The plastic coating shall be cast onto a metallic base element, the coating thickness shall be at least 5 mm.	The plastic coating shall be cast on an element strengthened with ribbing or veneered or sandwich panels. The coating can be cast resins with filters or fast cycling resins.
Laminating process	Successive layering shall be carried out with epoxy resins and fibres, depending upon the equipment size and moulding process. Shells shall be backed with metallic or inert filters.	As for K1.
Solid material	The equipment shall be machined from solid material, e.g. polypropylene milled or copy milled.	Timber or other strengthening mechanism.
Cast to size	Cast to size with appropriate resins and/or fillers.	As for K1.
Parting surface finish	Parting surface shall be machined or smooth surfaced as a result of the casting process.	As for K1.
Loose pieces and assembly guide	Guides shall be located on both sides. The guides shall be permanently linked with the plastic material, e.g. dovetailed guides.	No special instructions.
Core print design	Shall be appropriately sized and providing protection against distortion shifting mispositioning and counter balancing as necessary.	As for K1.
Corebox design	Core box design shall be designed to meet the requirements of AS 4738.1.	As for K1.

TABLE 4B
QUALITY CLASSES—PATTERNS, PATTERN EQUIPMENT AND COREBOXES
MADE OF PLASTIC

Range of dimension (basic size, see AS 1654†) mm		Tolerances on dimensions* measured at (20 ± 5)°C mm	
Over	Up to and including	K1	K2
	30	± 0.15	± 0.25
30	50	± 0.20	± 0.30
50	80	± 0.25	± 0.35
80	120	± 0.30	± 0.45
120	180	± 0.30	± 0.50
180	250	± 0.35	± 0.60
250	315	± 0.40	± 0.65
315	400	± 0.45	± 0.70
400	500	± 0.50	± 0.80
500	630	± 0.6	± 0.9
630	800	± 0.6	± 1.0
800	1000	± 0.7	± 1.1
1000	1250	± 0.8	± 1.3
1250	1600	± 1.0	± 1.5
1600	2000	± 1.1	± 1.8
2000	2500	± 1.4	± 2.2
2500	3150	± 1.6	± 2.7
3150	4000	± 2.0	± 3.2

* When specifying the tolerances, the parties concerned should verify whether the required casting dimension tolerance can be achieved with these figures.

† Tolerances on dimensions (basic sizes) over 4000 mm are subject to agreement between the parties concerned.

TABLE 5
CHARACTERISTICS OF COREBOXES

Features	Quality class									
	B	D1	D2	E1	E2	F1	F2	G	H	I
Corresponding pattern quality class	H1 and H2	H1 and H2	H1 and H2	H1 and H2			K2	K1 and M2	M1	M3
Maximum number of cores										
Easy to make	20	300		750			3000	10000	30000	10000
Difficult to make	10	150		300			1000	2000	30000	1000
Main material	Soft wood and plywood (AS/NZS 1604.3)	Hard wood		Plywood (AS/NZS 1604.3) or plastic			Plastic and/or light metal	Metal	Iron or steel	Metal
Other materials	No requirement	Metal or plastic		Metal or plastic			Wooden or metal frame	No requirement	No requirement	No requirements
Type of corebox	No requirements	No requirement		In two parts with machined impression			In two parts with machined impression	Manually operated or mechanised metal corebox	Mechanised metal corebox	No requirements
Type of core production	Manual	Manual	Core shooter	Manual	Core shooter	Manual	Core shooter	Core shooter	Core shooter	Manual or core shooter
Corebox assembly guide	Wood	Metal or plastic	Metal or plastic	Metal or plastic	Metal or plastic	Metal or plastic	Metal or plastic	Metal	Metal	Metal

NOTE: Provisions for the removal of gases (venting) is required for core making process using pressurized gas.

8 MANUFACTURING REQUIREMENTS

8.1 Materials

Unless otherwise agreed, patterns, pattern equipment and coreboxes shall be made of one or more of the material types shown in Table 1.

8.2 Manufacture

Unless otherwise agreed, patterns, pattern equipment and coreboxes shall be manufactured in accordance with the requirements detailed in Tables 2 to 5, as applicable. By agreement between the parties concerned, parts of the patterns, pattern equipment and coreboxes may be manufactured of other materials and to other quality classes than those specified in Table 1.

8.3 Contraction allowance

Unless otherwise specified, the reference values for linear casting contractions given in Appendix C shall apply.

NOTES:

- 1 The contractions and contraction ranges in certain castings can differ from the values given in Appendix C and can vary across the three axes of the casting. Therefore it is recommended that there is consultation between the manufacturer (patternmaker) and the founder.
- 2 The casting design can often lead to distortion or initiate defects on solidification. Therefore it is recommended that there be consultation between the parties concerned to make provision for these possibilities before deciding upon the construction and shape of the patterns, pattern equipment and coreboxes.

8.4 Tapers

Unless otherwise specified, the tapers given in Table 6 and/or AS 4738.1 shall be used.

TABLE 6
TAPERS

Height (<i>H</i>)	Taper (<i>T</i>) [†]						millimetres
	Shallow surfaces (<i>H</i> / <i>W</i> ≤ 1)*			Deep surface (<i>H</i> / <i>W</i> ≥ 1)*			
	Handmoulding		Machine moulding	Handmoulding		Machine moulding	
	Claybonded sand	Chemically bonded sand		Claybonded sand	Chemically bonded sand		
Up to and including 30	<1.0	<1.0	<1.0	<1.5	<1.0	<1.0	
Over 30 up to and including 80	2.0	2.0	2.0	2.5	2.0	2.0	
Over 80 up to and including 180	3.0	2.5	2.5	3.0	3.0	3.0	
Over 180 up to and including 250	3.5	3.0	3.0	4.0	4.0	4.0	
Over 250 up to and including 1000	± 1.0 per 250 mm step	± 1.0 per 250 mm step	± 1.0 per 250 mm step	± 1.0 per 250 mm step	± 1.0 per 250 mm step	± 1.0 per 250 mm step	
Over 1000 up to and including 4000	± 2.0 per 1000 mm step	± 2.0 per 1000-mm step	± 2.0 per 1000 mm step	± 2.0 per 1000 mm step	± 2.0 per 1000 mm step	± 2.0 per 1000 mm step	

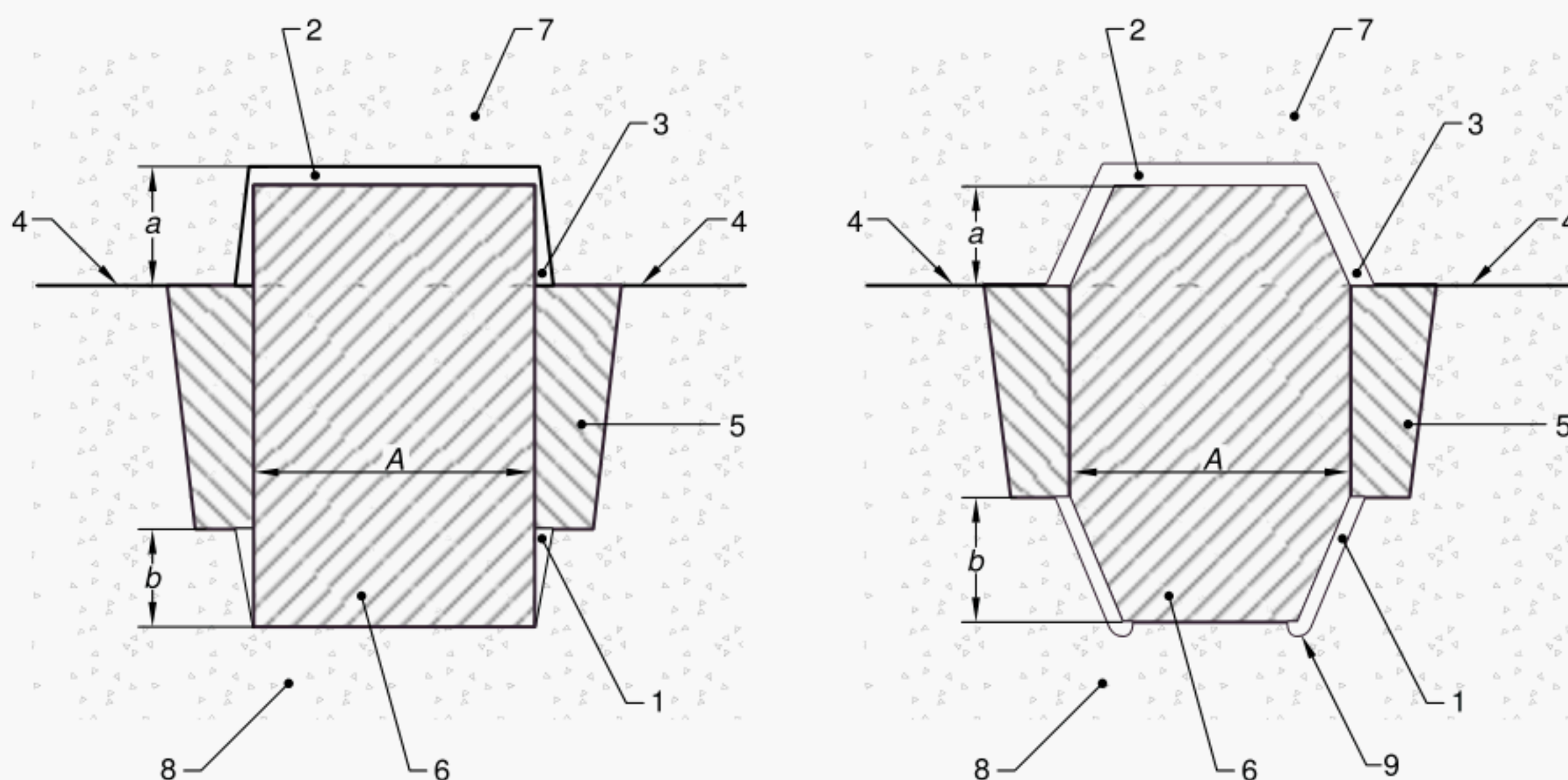
* *W* = internal width

[†] See AS 4738.1—2004 Appendix C, Paragraph C7.

NOTE: Moulding taper is usually in addition to the casting dimension unless otherwise specified.

8.5 Clearances

Closing, covering and mould assembly clearances are subject to agreement between the manufacturer (patternmaker) and the founder, see Figures 1 to 3.

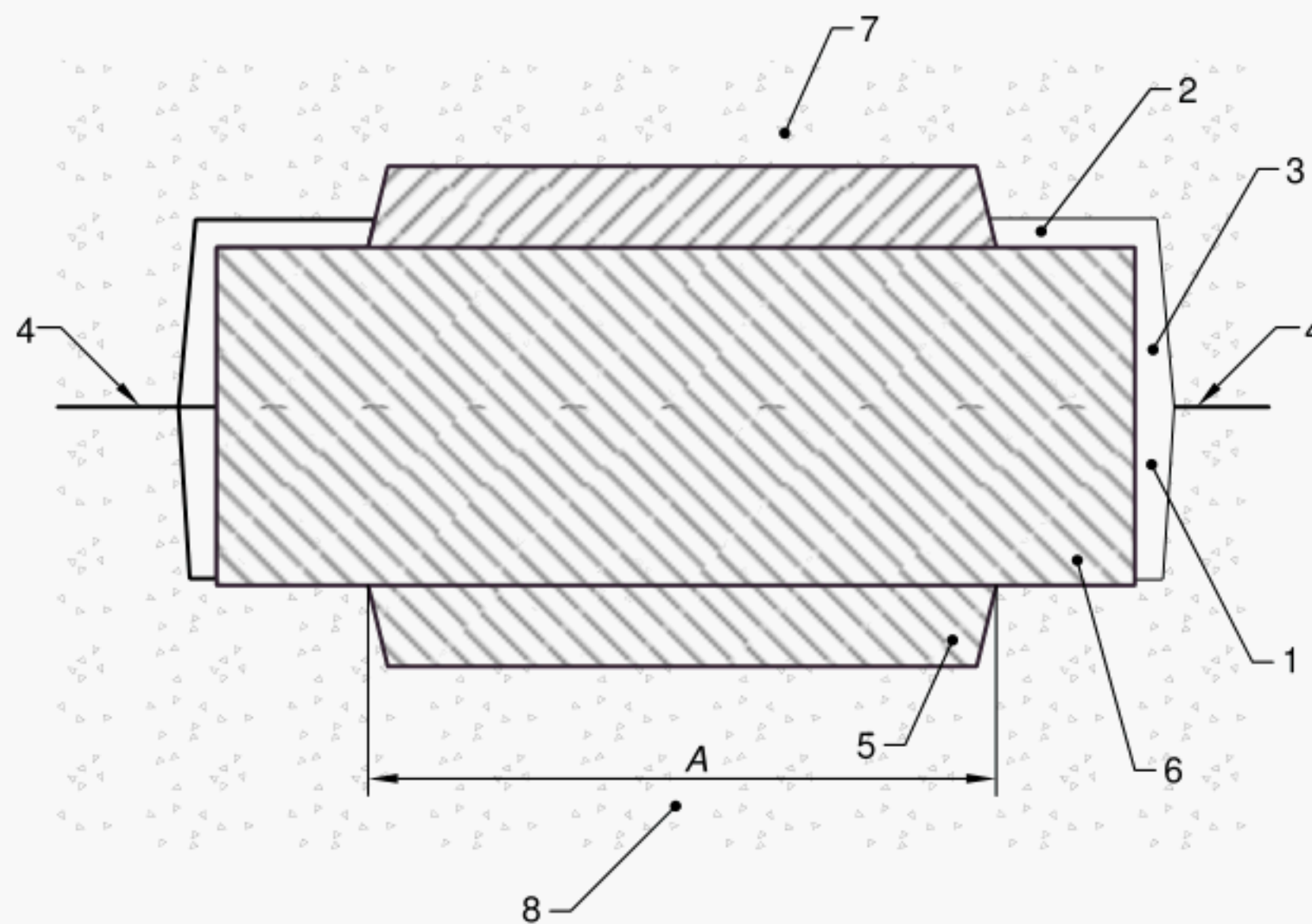


LEGEND:

- 1 Mould assembly clearance
- 2 Closing clearance
- 3 Covering clearance
- 4 Joint line
- 5 Casting
- 6 Core

- 7 Cope
- 8 Drag
- 9 Sand trap
- a 10 mm to 15 mm
- b 15 mm to 30 mm

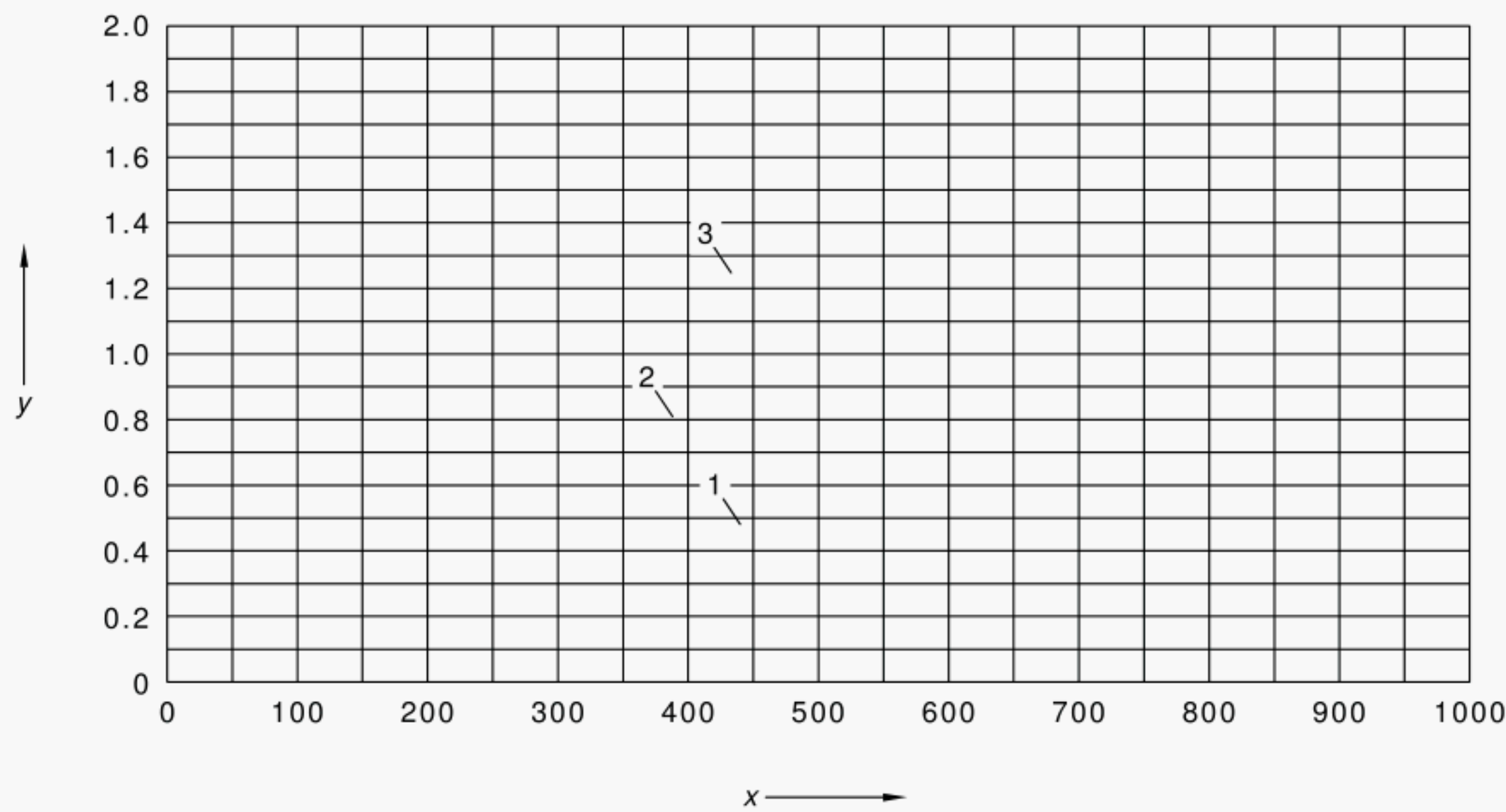
FIGURE 1 EXAMPLES OF CLEARANCES OF CORE PRINTS (VERTICAL CORE)
(FOR VALUES OF A SEE FIGURE 3)



LEGEND:

1	Mould assembly clearance	5	Casting
2	Closing clearance	6	Core
3	Covering clearance	7	Cope
4	Joint line	8	Drag

FIGURE 2 EXAMPLE OF CLEARANCES OF CORE PRINTS (HORIZONTAL CORE),
(FOR VALUES OF A, SEE FIGURE 3)



- LEGEND:
- x Dimensions A in millimetres
 - y Clearance in millimetres
 - 1 Closing clearance
 - 2 Covering clearance
 - 3 Mould-assembly clearance

FIGURE 3 VALUES FOR CLEARANCES OF CORE PRINTS (FOR MOULDING WITH HORIZONTAL JOINT SURFACE)

8.6 Required machining allowances (RMA)

Any required machining allowance (RMA) to be added to the patterns, pattern equipment and coreboxes are subject to agreement between the parties concerned (see Clause 4). For the selection of machining allowances (RMA) see AS 4738.1—2004, Appendix C.

8.7 Dimensional tolerances

Dimensional tolerances shall be in accordance with the values given in Tables 2 to 4 for each quality class of pattern material, unless otherwise agreed by the time of acceptance of the order.

8.8 Surface coating

As applicable, the surfaces of patterns, pattern equipment and coreboxes shall be coated to provide for their protection and/or identification in accordance with the agreement made between the parties concerned (see Clause 4).

When a surface coating is specified, the materials used in the moulding/coremaking process and the surface coating shall be compatible.

9 QUALITY CONTROL

As applicable, the manufacturer (patternmaker) shall maintain written evidence that the following quality control procedures have been carried out before, during and after the manufacture of the equipment:

- (a) Pre-production planning.

- (b) Contract review.
- (c) Dimensional inspection and completion of dimension sheets.
- (d) Identification.
- (e) Jig/fixture inspection.
- (f) Jig location point inspection.

NOTE: See Appendix B for guidance on demonstrating compliance with the Standard.

10 USAGE

10.1 General

The materials used and the processing and handling employed in the manufacture and use of patterns, pattern equipment and core boxes shall meet the appropriate occupational health and safety environmental and safety requirements.

NOTE: The lifetime of patterns, pattern equipment and coreboxes depends upon the quality class and the conditions of use and of storage.

10.2 Identification

10.2.1 *Identification of the patterns, pattern equipment and coreboxes*

All parts of the patterns, pattern equipment and core boxes shall be durably and legibly marked and identified in accordance with either the drawing(s) or the agreement made between the parties concerned (see Clause 4).

NOTES:

- 1 The following list of possible identifying details is given for information only:
 - (a) Drawing number.
 - (b) Part number.
 - (c) Purchaser identity.
 - (d) Date or date code.
 - (e) Pattern and corebox identity and material specifications.
 - (f) Other references.
- 2 It is recommended that the parts of the patterns, pattern equipment and coreboxes be individually numbered.

10.2.2 *Identification of the casting*

The location of the agreed identification shall be such that any subsequent operation does not remove the casting identity details, unless an agreement to the contrary has been made between the parties concerned (see Clause 4 and AS 4738.1).

10.3 Modifications

Modifications to patterns, pattern equipment and coreboxes during or after their manufacture shall be carried out only after an agreement has been made between the parties concerned. Such agreements shall be included in the documentation concerned with the contract review (see Clause 8).

10.4 Repair and refurbishment

The responsibility for the repair and/or refurbishment of the equipment is subject to agreement between the parties concerned (see Clause 4).

NOTE: The need for repair and/or refurbishment can arise normally through the production process and repetitive use of the equipment or through damage in handling and transportation.

The requirement to re-approve the equipment after repair and/or refurbishment is subject to agreement between the parties concerned (see Clause 4).

NOTE: The requirement to re-approve the equipment after repair and/or refurbishment depends upon the degree and nature of that repair and/or refurbishment.

10.5 Protection and packaging for transportation and storage

Protection and packaging for transportation and storage are subject to agreement between the parties concerned (see Clause 4).

APPENDIX A
GUIDELINES ON THE USE OF THE TABLES IN THIS STANDARD
(Informative)

Patterns, pattern equipment and coreboxes can be produced in a variety of materials. For efficient usage it may be helpful for the purchaser to be aware of the characteristics of the range of materials available.

The purchaser may thus be in a better position to assess the possibility of proposals made to them by the founder and/or manufacturer (patternmaker).

For this purpose Tables 2 to 6 have been prepared. They give guidance on the characteristics of patterns, pattern equipment and coreboxes and should be read in conjunction with the main text and Appendix C of this Standard.

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 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.

APPENDIX C

REFERENCE VALUES FOR LINEAR CASTING CONTRACTIONS

(Normative)

Material	Contraction rate range, %	Commonly used contraction rate, %
Grey cast irons	0.8–1.3	1
White cast iron (Wear-resistant white cast iron)	1.7–2.4	2
Ductile iron	0–1	1
Whiteheart malleable cast iron	—	1.6
Blackheart malleable cast iron	—	0.5
Carbon steel	2–2.8	2
Stainless steel	2.4–2.6	2.5
High manganese steel	2.6	2.6
Copper based alloys	1.3–2.3	1.4
Aluminium	1.3	1.3
Lead	—	2.6
Magnesium alloys	1.6–2	1.6
Zinc based alloys	1.3–2.6	2.6
Cast nickel alloys	—	2.1

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. For further information on Standards Australia visit us at

www.standards.org.au

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

All Australian Standards are available in electronic editions, either downloaded individually from our web site, or via On-Line and DVD subscription services. For more information phone 1300 65 46 46 or visit Standards Web Shop at

www.standards.com.au



GPO Box 5420 Sydney NSW 2001

Administration Phone (02) 8206 6000 Fax (02) 8206 6001 Email mail@standards.com.au

Customer Service Phone 1300 65 46 46 Fax 1300 65 49 49 Email sales@standards.com.au

Internet www.standards.org.au

ISBN 0 7337 6776 1

Printed in Australia

This page has been left intentionally blank.