

AS 1796:2022



STANDARDS  
Australia



# Pressure equipment — Qualification of welders, welding supervisors and welding inspectors



AS 1796:2022

This Australian Standard ® was prepared by ME-001, Pressure Equipment. It was approved on behalf of the Council of Standards Australia on 6 June 2022.

This Standard was published on 24 June 2022.

The following are represented on Committee ME-001:

- Australasian Institute of Engineer Surveyors
- Australian Aluminium Council
- Australian Industry Group
- Australian Institute for Non-Destructive Testing
- Australian Institute for the Certification of Inspection Personnel
- Australian Institute of Petroleum
- Better Regulation Division (Fair Trading, SafeWork NSW, TestSafe)
- Bureau of Steel Manufacturers of Australia
- Compressed Air Association of Australasia
- Energy Networks Australia
- Engineers Australia
- Gas Energy Australia
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- Materials Australia
- Office of Industrial Relations, Qld
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This Standard was issued in draft form for comment as DR AS 1796:2022.

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ISBN 978 1 76113 848 5

# **Pressure equipment — Qualification of welders, welding supervisors and welding inspectors**

Originated as AS CB14.1—1947, AS CB14.2—1950, AS CB14.3—1959, AS CB14.4—1966, AS CB14.5—1969 and AS CB14.6—1971.  
Previous edition AS 1796—2001.  
Fifth edition AS 1796:2022.

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## Preface

This Standard was prepared by the Australian members of Joint Standards Australia/Standards New Zealand Committee ME-001, Pressure Equipment, to supersede AS 1796—2001, *Certification of welders and welding supervisors*.

After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this document as an Australian Standard, rather than an Australian/New Zealand Standard.

The objective of this document is to specify the requirements for the qualification of welders, welding supervisors and welding inspectors engaged in welding processes used in the manufacture of pressure equipment, including requirements for the syllabus for the practical and/or theory components of each qualification.

The major changes in this edition are as follows:

- (a) Requirements for a welding inspector qualification, sourced from AS/NZS 4481, have been added as Certificate No. 11.
- (b) Test plate thickness for butt welds has been modified to permit maximization of the range of welder qualification where joint qualification to AS/NZS ISO 9606.1 is sought.
- (c) Minimum requirements for Certificates No. 3 and No. 3E aligned with other qualifications.
- (d) Reference to cellulosic consumables has been removed.
- (e) Weld testing requirements, including minimum test plate width, have been aligned with those of AS/NZS ISO 9606.1, and requirements for free bend tests removed.
- (f) Editorial changes have been made, including the following:
  - (i) Clarification of the meanings of several clauses.
  - (ii) Revision of normative references and addition of Bibliography, which includes informative references and an updated list of further reading, and revision of normative references.
  - (iii) Replacement of references to “certification” consistent with Standards Australia requirements.
  - (iv) Alignment with current Standards Australia style and wording, including removal of roles and responsibilities.
- (g) The syllabi have been moved into the appendices and expanded to account for a clearer content, learning outcomes and assessment criteria.

It is not intended that the publication of this edition will invalidate certificates that were issued in respect of previous editions of this document.

The terms “normative” and “informative” are used in Standards 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.

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## NOTES

# Australian Standard®

## Pressure equipment — Qualification of welders, welding supervisors and welding inspectors

### Section 1 Scope and general

#### 1.1 Scope

This document sets out the requirements for the qualification of welders, welding supervisors and welding inspectors engaged in welding processes used in the manufacture of pressure equipment, such as boilers, pressure vessels and associated piping, as defined in AS/NZS 1200, as well as other applications requiring a prescribed standard in the theory and practice of welding.

Qualification in welding is related primarily to welding techniques and processes and not to the parent metal of the joint.

The welder qualification comprises the following:

- (a) Preparation of test plates conforming to the requirements of this document.
- (b) Following designated weld procedure(s).
- (c) Qualifying welded test plates conforming to this document, and as appropriate, to AS/NZS ISO 9606.1.

NOTE 1 Unless otherwise specified, welders qualified to this document are required to undertake additional qualification tests as specified in the appropriate application standards (e.g. AS 3992) prior to the commencement of welding.

Requirements for the syllabus for the practical and theory component of the welder qualification are set out in [Section 2](#) and [Appendix A](#).

In addition, this document sets out requirements for the qualification of pressure equipment welding supervisors, which provide for a high degree of knowledge of the theory and practice of welding needed to supervise welders in accordance with AS/NZS 1200.

NOTE 2 The requirements are consistent with the requirements of AS/NZS ISO 14731 for the supervision of welding and welding-related activities on pressure equipment.

Requirements for the syllabus for the theory component of the welding supervisor qualification are set out in [Section 3](#) and [Appendix B](#).

This document also sets out requirements for the qualification of pressure equipment welding inspectors, which build on the knowledge of the theory and practice of welding in the welding supervisor qualification with a specific focus on inspection requirements.

NOTE 3 The syllabus items for welding inspector have been sourced from AS/NZS 4481.

Requirements for the syllabus for the practical and theory component of the welding inspector qualification are set out in [Section 4](#) and [Appendix C](#).

This document may be used when specified for applications to AS/NZS 2885.2.

This document excludes requirements for the qualification of personnel for the welding of non-metallic materials and for the certification of personnel.

## 1.2 Application

Qualification shall be in accordance with the general requirements of [Section 1](#) and the following, as applicable:

- (a) For pressure equipment welders — Certificate Nos. 1 to 9 inclusive (see [Section 2](#)).
- (b) For pressure equipment welding supervisors — Certificate No. 10 (see [Section 3](#)).
- (c) For pressure equipment welding inspectors — Certificate No. 11 (see [Section 4](#)).

## 1.3 Normative references

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

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

AS 1101.3, *Graphic symbols for general engineering, Part 3: Welding and non-destructive examination*

AS 1210, *Pressure vessels*

AS 1228, *Pressure equipment—Boilers*

AS 2177, *Non-destructive testing — Radiography of welding butt joints in metal*

AS 2205.2 (all parts), *Methods of destructive testing of welds in metal*

AS 2205.3 (all parts), *Methods of destructive testing of welds in metal*

AS 2205.6.1, *Methods for destructive testing of welds in metal, Method 6.1: Weld joint hardness test*

AS 2205.7.1, *Methods of destructive testing of welds in metal, Method 7.1: Charpy V-notch impact for fracture toughness test*

AS 2207, *Non-destructive testing—Ultrasonic testing of fusion welded joints in carbon and low alloy steel*

AS 2812, *Welding, brazing and cutting of metals — Glossary of terms*

AS 3992, *Pressure equipment—Welding and brazing qualification*

AS 4037, *Pressure equipment—Examination and testing*

AS 4942, *Pressure equipment—Glossary of terms*

AS ISO 3452 (all parts), *Non-destructive testing — Penetrant testing*

AS ISO 9712, *Non-destructive testing—Qualification and certification of NDT personnel*

AS ISO 9934 (all parts), *Non-destructive testing — Magnetic particle testing*

AS/NZS 1167.2, *Welding and brazing—Filler metals, Part 2: Filler metal for welding*

AS/NZS 1200, *Pressure equipment*

AS/NZS 2205.3.1, *Destructive tests on welds in metallic materials, Method 3.1: Bend tests*

AS/NZS 2205.4.1, *Methods for destructive testing of welds in metal, Method 4.1: Fracture test*

AS/NZS 2205.5.1, *Methods of destructive testing of welds in metal, Method 5.1: Macroscopic and microscopic examination of welds*

AS/NZS 2214, *Certification of welding supervisors — Structural steel welding*

AS/NZS 3545, *Welding and allied processes — Welding positions*

AS/NZS 4855, *Welding consumables—Covered electrodes for manual metal arc welding of non-alloy and fine grain steels—Classification*

AS/NZS 4856, *Welding consumables—Covered electrodes for manual metal arc welding of creep resistant steels—Classification*

AS/NZS 14341, *Welding consumables—Wire electrodes and weld deposits for gas shielded metal arc welding of non-alloy and fine grain steels—Classification (ISO 14341:2010, MOD)*

AS/NZS 16834, *Welding consumables—Wire electrodes, wires, rods and deposits for gas shielded arc welding of high strength steels—Classification (ISO 16834:2012, MOD)*

AS/NZS 21952, *Welding consumables—Wire electrodes, wires, rods and deposits for gas shielded arc welding of creep-resisting steels— Classification (ISO 21952:2012, MOD)*

AS/NZS ISO 9606.1, *Qualification testing of welders—Fusion welding, Part 1: Steels*

AS/NZS ISO 14171, *Welding consumables—Solid wire electrodes, tubular cored electrodes and electrode/flux combinations for submerged arc welding of non-alloy and fine grain steels—Classification*

AS/NZS ISO 14731, *Welding coordination — Tasks and responsibilities*

AS/NZS ISO 17632, *Welding consumables—Tubular cored electrodes for gas shielded and non-gas shielded metal arc welding of non-alloy and fine grain steels—Classification (ISO 17632:2004, MOD)*

AS/NZS ISO 17634, *Welding consumables—Tubular cored electrodes for gas shielded and non-gas shielded metal arc welding of creep-resisting steels—Classification (ISO 17634:2004, MOD)*

AS/NZS ISO 17637, *Non-destructive testing of welds—Visual testing of fusion welded joints*

AS/NZS ISO 18276, *Welding consumables—Tubular cored electrodes for gas shielded and non-gas shielded metal arc welding of high strength steels—Classification (ISO 18276:2005, MOD)*

AS/NZS ISO 24598, *Welding consumables—Solid wire electrodes, tubular cored electrodes and electrode-flux combinations for submerged arc welding of creep-resisting steels—Classification*

AS/NZS ISO 26304, *Welding consumables—Solid wire electrodes, tubular cored electrodes and electrode-flux combinations for submerged arc welding of high strength steels—Classification*

AS/NZS ISO/IEC 17024, *Conformity assessment—General requirements for bodies operating certification of persons*

## 1.4 Terms and definitions

For the purposes of this document, the terms and definitions in AS 2812, AS 4942 and the following apply. Weld positions are defined in AS/NZS 3545.

### 1.4.1

#### **acceptable trade**

trade in which the welding of plate or pipe or both using the welding process specified for the required test forms an integral part of that trade

Note 1 to entry: For example, pressure equipment, heavy steel structures, shipbuilding and the like where fusion welding and metal fabrication forms a significant component of the trade.

### 1.4.2

#### **certificate**

notification of attainment by the examining body when all qualification requirements have been satisfied

**1.4.3****competent person**

person who has acquired, through education, training, qualification or experience, or a combination of these, the knowledge and skill enabling that person to perform the task required

**1.4.4****examination**

mechanism that is part of the assessment which measures a candidate's competence by one or more means, such as written, oral, practical and observational

[SOURCE: AS/NZS ISO/IEC 17024:2013, 3.9, modified – reference to “certification scheme” omitted]

**1.4.5****examining body**

entity, organization or institution that carries out testing for qualification of welders, welding supervisors and welding inspectors

**1.4.6****examiner**

person competent to conduct and score an examination where the examination requires judgement

[SOURCE: AS/NZS ISO/IEC 17024:2013, 3.10, modified – “professional judgement” replaced with “judgement”]

**1.4.7****inspection and test plan****ITP**

document that systematically outlines the inspection activities required to be controlled during the manufacture of pressure equipment to assure product conformity

**1.4.8****manufacturer's data report****MDR**

compilation of essential documents produced during the manufacture of pressure equipment

**1.4.9****may**

indicates the existence of an option

**1.4.10****moderator**

competent person who reviews examination papers to ensure consistency

**1.4.11****preliminary welding procedure specification****pWPS**

document containing the required variables of the welding procedure which is intended to be qualified

**1.4.12****shall**

indicates that a statement is mandatory

**1.4.13****should**

indicates a recommendation

#### **1.4.14 welder qualification**

where a welder has passed theory and practical examinations which indicate a high degree of knowledge of the theory and practice of safe welding, and demonstrated ability to make welds on plate or pipe or both by using the welding process specified

Note 1 to entry: See [Section 2](#) for Certificate Nos. 1 to 9 requirements.

#### **1.4.15 welding inspector qualification**

where a welding inspector has passed theory and practical examinations which indicate a high degree of knowledge of the theory and practice of welding inspection needed to inspect welded pressure equipment

Note 1 to entry: See [Section 4](#) for Certificate No. 11 requirements.

#### **1.4.16 welding supervisor qualification**

where a welding supervisor has passed theory examination which indicates a high degree of knowledge of the theory and practice of welding needed to supervise welders engaged in the welding of pressure equipment

Note 1 to entry: See [Section 3](#) for Certificate No. 10 requirements.

### **1.5 Examination and assessment process**

#### **1.5.1 General**

The examination and assessment process shall conform to the requirements of this document and AS/NZS ISO/IEC 17024. The process shall include the following:

- (a) Impartiality.
- (b) Quality system incorporating checking and monitoring, auditing and record keeping.
- (c) Theory examination and practical tests based on a syllabus with criteria, and that involve moderation and invigilation processes as well as processes for when and where examinations are held.
- (d) Location, conditions and criteria of the examinations.
- (e) Assessment of practical tests.

#### **1.5.2 Impartiality**

A competent person who is involved in the final decision on the marking of an examination and assessment of a candidate shall not be involved in the teaching and training of that candidate.

#### **1.5.3 Quality system**

##### **1.5.3.1 General**

A quality system for the examination and assessment process shall check and monitor the following:

- (a) Theory examination and practical test processes.
- (b) Assessment processes for theory examinations and practical tests.
- (c) Security of theory examination and practical test results.

- (d) Archival of records.

### 1.5.3.2 Audit

An audit of the quality system and the technical outcomes shall be conducted where the theory examinations and practical tests are carried out. An audit shall be conducted at least every three years. The audit shall be assessed and, where required, corrective action taken.

NOTE The audit process should follow the recommendations of AS/NZS ISO 19011.

### 1.5.3.3 Records

A record of the audit and all actions resulting from this audit shall be retained for a period of at least two audit cycles.

## 1.5.4 Examination

### 1.5.4.1 Application and supporting documentation

The application for examination and supporting documentation (see [Clauses 2.1.2](#), [3.1](#) and [4.1](#) as appropriate) shall be assessed and the applicant notified of the result of the assessment.

### 1.5.4.2 Theory examination

Examination shall be paper based (written) or in electronic format (computer or online), or a combination of both.

The following requirements also apply:

- (a) The examination questions shall be such as to determine the knowledge of the candidate on the items in the syllabus. Questions shall be reviewed on a regular basis to ensure the reliability and validity of the theory examination.
- (b) The theory examination shall be invigilated to ensure the correct conduct of the candidates undertaking the theory examination.
- (c) Completed examination papers shall be kept secure.
- (d) The examination papers and/or electronic documentation shall be marked as soon as practicable.
- (e) The marked papers and electronic documentation (where not automatically marked) shall be moderated and the appropriate mark agreed.
- (f) The candidate shall be notified of the result of the theory examination as soon as the marking process is complete.
- (g) Each candidate's theory examination paper shall be stored for a period of not less than one audit cycle.

### 1.5.4.3 Practical tests

The following requirements apply:

- (a) The practical test shall be carried out at a location that has appropriate welding equipment, welding consumables and test pieces.

NOTE 1 Work health and safety regulations may apply to the locations and surrounds of practical tests.

- (b) A competent person shall assess the conduct of the practical tests to ensure that each test is conducted in accordance with the requirements specified in this document.

NOTE 2 The competent person is usually referred to as the examiner.

- (c) Test pieces shall be permanently marked before the start of each test in accordance with AS/NZS ISO 9606.1.
- (d) Each test piece shall be visually examined. If the test piece passes the visual examination, it shall be prepared to provide test specimens for destructive testing, or alternatively for butt welds, a radiographic or ultrasonic examination (see [Clause 2.4.2.1](#)).
- (e) Each candidate shall be notified of the result of the practical tests as soon as is practicable.
- (f) The results of the visual examination, and destructive tests or radiographic examination or ultrasonic examination shall be recorded.
- (g) Each test piece shall be stored for a period of not less than four weeks after completion of the practical tests.

#### **1.5.4.4 Appeals**

Appeals in writing to the examining body regarding the results of any examination or test may be made. The appeal shall be registered within two weeks after receiving the results of any examination or test.

### **1.5.5 Assessment**

#### **1.5.5.1 Visual and destructive tests**

The visual and destructive tests shall be assessed by a competent person who shall —

- (a) be qualified as a welding supervisor (Certificate No. 10) or a welding inspector (Certificate No. 11) as specified in this document; or
- (b) have passed the examination as specified in AS/NZS 2214; or
- (c) have the equivalent to Item (a) or (b), or higher, conforming to the requirements of AS/NZS ISO 14731.

#### **1.5.5.2 Non-destructive examination**

A competent person shall assess the welded test plate utilizing the radiographic or ultrasonic examination method when implemented. The competent person shall be trained, qualified and experienced to carry out the assessment in accordance with this document.

NOTE An example of a competent person includes an assessor conforming to AS ISO 9712 level 2 or higher.

## Section 2 Welder qualification

### 2.1 Pre-examination requirements

#### 2.1.1 General

Pre-examination requirements for the welder qualification include the following:

- (a) Knowledge of the theory and safe practice of welding.
- (b) Ability to weld, and to thermal cut and gouge metal.

#### 2.1.2 Documentation

Documentation required before candidates attempt the qualification tests and theory examination shall include records of the following:

- (a) Attendance at one or more welding courses of instruction.
- (b) Experience gained in work that includes joints, materials and thicknesses not differing greatly from the practical tests for the required test as specified in this document.
- (c) The qualified weld procedures (WPS) (or pre-qualified procedure(s)) or pWPS that the candidate will follow during the practical tests (see [Clause 2.3.6.1](#)).

#### 2.1.3 Title and types of certificates

The qualification tests for welders shall be as specified for Certificate Nos. 1 to 9 inclusive.

[Clauses 2.1.4](#) to [2.1.13](#) specify criteria for the qualification tests listed below. A candidate for welder qualification shall demonstrate ability to make welds on plate or pipe or both by using the welding process specified in one or more of the following qualification tests:

- (a) Certificate No. 1 — Manual metal-arc welding (MMAW) of welds in carbon steel plate and carbon steel pipe over 600 mm outside diameter (single vee welded from both sides).
- (b) Certificate No. 1E — Manual metal-arc welding (MMAW) of welds in carbon steel plate and carbon steel pipe over 270 mm outside diameter (single vee welded from one side only).
- (c) Certificate No. 2 — Manual metal-arc welding (MMAW) of welds in carbon steel pipe (single vee weld from one side only).
- (d) Certificate No. 3 — Manual metal-arc welding (MMAW) of welds using hydrogen controlled electrodes in alloy steel plate and alloy steel pipe over 600 mm outside diameter (single vee welded from both sides).
- (e) Certificate No. 3E — Manual metal-arc welding (MMAW) of welds using hydrogen controlled electrodes in alloy steel plate and alloy steel pipe over 270 mm outside diameter (single vee welded from one side only).
- (f) Certificate No. 4 — Manual metal-arc welding (MMAW) of welds using hydrogen-controlled electrodes in alloy steel pipe (single vee welded from one side only).
- (g) Certificate No. 5 — Gas tungsten-arc welding (GTAW) root run and manual metal-arc welding (MMAW) of welds using hydrogen-controlled electrodes in alloy steel pipe (single vee welded from one side only).
- (h) Certificate No. 6 — Gas welding (GW) (single vee welded from one side only).
- (i) Certificate No. 7 — Gas tungsten-arc welding (GTAW) (single vee welded from one side only).

- (j) Certificate No. 8F — Flux-cored arc welding (FCAW) of plate and pipe.
- (k) Certificate No. 8G — Gas metal-arc welding (GMAW), of plate and pipe.
- (l) Certificate No. 9 — Automatic welding.

NOTE The suffix “E” indicates that a candidate elected to make a complete penetration single-sided butt weld on plate (see [Clause 2.3.2](#)).

#### **2.1.4 Certificates No. 1 and No. 1E**

The criteria for Certificates No. 1 and No. 1E shall be one of the following:

- (a) One year's welding experience, subsequent to or during an apprenticeship to an acceptable trade, including 40 h training in the use of manual metal-arc welding of plate.
- (b) Two years' welding experience and documentary evidence of the successful completion of one or more welding programs, which includes at least 300 h training in the theory and practice of welding, including the welding of plate using the manual metal-arc welding process.
- (c) Three years' welding experience and, during or subsequent to this period, 40 h training in the welding of plate using the manual metal-arc welding process.

#### **2.1.5 Certificate No. 2**

The criteria for Certificate No. 2 shall be one of the following:

- (a) One year's welding experience, subsequent to or during an apprenticeship to an acceptable trade, including 40 h training in the welding of pipe using the manual metal-arc welding process.
- (b) Two years' welding experience and documentary evidence of the successful completion of one or more welding programs, which includes at least 300 h training in the theory and practice of welding and, during or subsequent to this period, 40 h training in the welding of pipe using the manual metal-arc welding process.
- (c) Three years' welding experience and, during or subsequent to this period, 40 h training in the welding of pipe using the manual metal-arc welding process.

#### **2.1.6 Certificates No. 3 and No. 3E**

The criteria for Certificates No. 3 and No. 3E shall be one of the following:

- (a) One year's welding experience, subsequent to or during an apprenticeship to an acceptable trade, including 40 h training in the welding of plate using the manual metal-arc welding process with hydrogen-controlled electrodes.
- (b) Two years' welding experience and documentary evidence of the successful completion of one or more welding programs, which includes at least 300 h training in the theory and practice of welding and, during or subsequent to this period, 40 h training in the welding of plate using the manual metal-arc welding process with hydrogen-controlled electrodes.
- (c) Three years' welding experience and, during or subsequent to this period, 40 h training in the welding of plate using hydrogen-controlled electrodes.

### 2.1.7 Certificate No. 4

The criteria for Certificate No. 4 shall be one of the following:

- (a) One year's welding experience, subsequent to or during an apprenticeship to an acceptable trade, including 40 h training in the welding of pipe using the manual metal-arc welding process with hydrogen-controlled electrodes.
- (b) Two years' welding experience and documentary evidence of the successful completion of one or more welding programs, which includes at least 300 h training in the theory and practice of welding and, during or subsequent to this period, 40 h training in the welding of pipe using both the manual metal-arc welding, welding process with hydrogen-controlled electrodes and gas tungsten-arc welding process.
- (c) Three years' welding experience and, during or subsequent to this period, 40 h training in the welding of pipes using hydrogen-controlled electrodes.

### 2.1.8 Certificate No. 5

The criteria for Certificate No. 5 shall be one of the following:

- (a) One year's welding experience, subsequent to or during an apprenticeship to an acceptable trade, including 80 h training in the welding of pipe using both the manual metal-arc welding process with hydrogen-controlled electrodes and gas tungsten-arc welding process. Forty hours training shall be allocated to the use of hydrogen-controlled electrodes and 40 h to gas tungsten-arc welding.
- (b) Two years' welding experience and documentary evidence of the successful completion of one or more welding programs, which includes at least 300 h training in the theory and practice of welding and, during or subsequent to this period, 80 h training in the welding of pipe using both the manual metal-arc welding process with hydrogen controlled electrodes and gas tungsten-arc welding process. Forty hours training shall be allocated to the use of hydrogen-controlled electrodes and 40 h to gas tungsten-arc welding.
- (c) Three years' welding experience and, during or subsequent to this period, 80 h training in the welding of pipe using both the manual metal-arc welding process with hydrogen-controlled electrodes and gas tungsten-arc welding process. Forty hours' training shall be allocated to the use of hydrogen-controlled electrodes and 40 h to gas tungsten-arc welding.

### 2.1.9 Certificate No. 6

The criteria for Certificate No. 6 shall be one of the following:

- (a) One year's welding experience, subsequent to or during an apprenticeship to an acceptable trade, including 40 h training in the welding of pipe using the gas welding process.
- (b) Two years' welding experience and documentary evidence of the successful completion of one or more welding programs, which includes at least 300 h training in the theory and practice of welding and, during or subsequent to this period, 40 h training in the welding of pipe using the gas welding process.
- (c) Three years' welding experience and, during or subsequent to this period, 40 h training in the welding of pipe using the gas welding process.

### 2.1.10 Certificate No. 7

The criteria for Certificate No. 7 shall be one of the following:

- (a) One year's welding experience, subsequent to or during an apprenticeship to an acceptable trade, including 40 h training in the welding of pipe using the gas tungsten-arc welding process.

- (b) Two years' welding experience and documentary evidence of the successful completion of one or more welding programs, which includes at least 300 h training, in the theory and practice of welding and, during or subsequent to this period, 40 h training in the welding of pipe using the gas tungsten-arc welding process.
- (c) Three years' welding experience and, during or subsequent to this period, 40 h training in the welding of pipe using the gas tungsten-arc welding process.

#### **2.1.11 Certificate No. 8F**

The criteria for Certificate No. 8F shall be one of the following:

- (a) One year's welding experience, subsequent to or during an apprenticeship to an acceptable trade, including 40 h training in the welding of plate and pipe using flux cored-arc welding process.
- (b) Two years' welding experience and documentary evidence of the successful completion of one or more welding programs, which includes at least 300 h training in the theory and practice of welding and, during or subsequent to this period, 40 h training in the welding of plate and pipe using flux cored-arc welding process.
- (c) Three years' welding experience and, during or subsequent to this period, 40 h training in the welding of plate and pipe using flux cored-arc welding process.

#### **2.1.12 Certificate No. 8G**

The criteria for Certificate No. 8G shall be one of the following:

- (a) One year's welding experience, subsequent to or during an apprenticeship to an acceptable trade, including 40 h training in the welding of plate and pipe using the gas metal-arc welding process.
- (b) Two years' welding experience and documentary evidence of the successful completion of one or more welding programs, which includes at least 300 h training in the theory and practice of welding and, during or subsequent to this period, 40 h training in the welding of plate and pipe using the gas metal-arc welding process.
- (c) Three years' welding experience and, during or subsequent to this period, 40 h training in the welding of plate and pipe using the gas metal-arc welding process.

#### **2.1.13 Certificate No. 9**

The criteria for Certificate No. 9 shall be one of the following:

- (a) One year's welding experience, subsequent to or during an apprenticeship to an acceptable trade, including 40 h training in the welding of plate using an automatic welding process.
- (b) Two years' welding experience and documentary evidence of the successful completion of one or more welding programs, which includes at least 300 h training in the theory and practice of welding and, during or subsequent to this period, 40 h training in the welding of plate using an automatic welding process.
- (c) Three years' welding experience and, during or subsequent to this period, 40 h training in the welding of plate using an automatic welding process.

## 2.2 Theory examination

### 2.2.1 Syllabus

The welder's theory examination content shall include the items specified in [Appendix A](#) unless otherwise specified (see [Clause 2.2.2](#)).

NOTE 1 The syllabus items in [Appendix A](#) are consistent with the syllabus items in AS/NZS ISO 9606.1.

NOTE 2 The order in which the syllabus items are listed is not intended to suggest their relative importance.

NOTE 3 The Bibliography lists some standards which may be used to prepare for the examination. This list is not exhaustive.

### 2.2.2 Modification of the syllabus

The syllabus may be modified as needed to take into account changes in government legislation or regulations, or changes in relevant standards and relevant technology.

Modifications to the syllabus shall be recorded in the records for auditing (see [Clause 1.5.3.2](#)).

### 2.2.3 Type of examination

The theory examination shall be given by a written or electronic examination (computer or online), or any combination of these methods.

The examination shall be as follows:

- (a) For Certificates No. 1, No. 1E or No. 2, knowledge of syllabus Items 1 to 12 specified in [Appendix A](#) shall be demonstrated by undertaking an examination that consists of one part, designated Part A — General.
- (b) For Certificates No. 3, No. 3E, No. 4, No. 5, No. 6, No. 7, No. 8F, No. 8G or No. 9, knowledge of syllabus Items 1 to 18 specified in [Appendix A](#) shall be demonstrated by undertaking an examination that consists of two parts, one designated Part A — General and the other designated Part B — Welding Processes and Materials. Part A shall comprise questions selected from Items 1 to 12 and Part B from Items 13 to 18.

Each item may be assessed individually, as a group or in total.

### 2.2.4 Evidence of prior learning

Part B of the examination shall be required to be undertaken where documentary evidence of holding Certificates No. 1, No. 1E or No. 2 is produced, but documentary evidence of having passed Part B for Certificates No. 3, No. 3E, No. 4, No. 5, No. 6, No. 7, No. 8F, No. 8G or No. 9 cannot be produced.

### 2.2.5 Duration of examination

The minimum duration of the theory examination for Part A shall be two hours and for Part B, one hour.

### 2.2.6 Criteria for examination marking

Marks shall be allocated to each part. The pass mark for any part shall be not less than 65 %.

## 2.3 Practical tests

### 2.3.1 Types of practical tests

The types of practical tests shall be appropriate to the relevant certificate as shown in [Table 2.1](#). The welding position shall be specified on the pWPS or WPS.

NOTE Weld positions are defined in AS/NZS 3545.

### 2.3.2 Elective tests

A practical examination for Certificates No. 1E or No. 3E may be elected. If complete penetration from one side cannot be obtained, gouging the back of the weld, making backing runs and otherwise completing the practical test for Certificates No. 1 or No. 3, as relevant, may be elected.

### 2.3.3 Test pieces

#### 2.3.3.1 Type and dimensions of test piece

The types and dimensions of test pieces shall be as follows:

- (a) For butt welds in plate, as shown in [Table 2.2](#).
- (b) For butt welds in pipe, as shown in [Table 2.2](#).
- (c) For fillet welds, as shown in [Table 2.2](#).
- (d) For thermal cutting, as shown in [Table 2.3](#).
- (e) For gouging, as shown in [Table 2.3](#).

All dimensions are approximate but shall not be less than the length of weld specified.

#### 2.3.3.2 Material for test piece

The test pieces for Certificates No. 1, No. 1E, No. 2, No. 3, No. 3E, No. 4, No. 5, No. 6, No. 7, No. 8F, No. 8G and No. 9 should be of weldable quality carbon steel. The carbon content should not exceed 0.26 %.

NOTE 1 For Certificates No. 3, No. 3E, No. 4 and No. 5, the material used may be the alloy material that is specified for the welder qualification test specified in the application standard.

NOTE 2 For Certificates No. 7, No. 8F, No. 8G and No. 9, test pieces of other alloy materials listed in AS 3992 may be used.

#### 2.3.3.3 Supply of test pieces

The test pieces in conformance with this document may be provided by others.

#### 2.3.3.4 Weld preparations for test pieces

The test pieces shall be prepared for welding before the start of the test.

The weld preparation shall be as shown in [Table 2.4](#).

Table 2.1 — Types and applicability of practical tests

| Certificate No.                                                                                                          | Type of test                  |                |                |                               |               |               |                               |               |                         |                         |                         |  | Flame, plasma or air-arc gouging |
|--------------------------------------------------------------------------------------------------------------------------|-------------------------------|----------------|----------------|-------------------------------|---------------|---------------|-------------------------------|---------------|-------------------------|-------------------------|-------------------------|--|----------------------------------|
|                                                                                                                          | Butt weld                     |                |                |                               |               |               | Fillet weld                   |               |                         |                         |                         |  |                                  |
|                                                                                                                          | Plate                         |                |                | Pipe                          |               |               | Plate                         |               |                         | Flame or plasma cutting |                         |  |                                  |
|                                                                                                                          | Welding position <sup>c</sup> |                |                | Welding position <sup>c</sup> |               |               | Welding position <sup>c</sup> |               |                         | Flame or plasma cutting |                         |  |                                  |
|                                                                                                                          | PA (1G)                       | PC (2G)        | PE (4G)        | PA (1G)                       | PC (2G)       | PH (5G)       | PB (2F)                       | PF (3F)       | Flame or plasma cutting |                         |                         |  |                                  |
|                                                                                                                          | Figure 2.1(a)                 | Figure 2.1(b)  | Figure 2.1(c)  | Figure 2.2(a)                 | Figure 2.2(b) | Figure 2.2(a) | Figure 2.3(a)                 | Figure 2.3(b) | Flame or plasma cutting |                         |                         |  |                                  |
|                                                                                                                          | Weld axis                     |                |                | Pipe axis                     |               |               | Weld axis                     |               |                         | Flame or plasma cutting |                         |  |                                  |
| Horizontal                                                                                                               | Horizontal                    | Horizontal     | Horizontal     | Vertical                      | Horizontal    | Horizontal    | Horizontal                    | Vertical      | Horizontal              | Vertical                | Flame or plasma cutting |  |                                  |
| 1                                                                                                                        | —                             | X <sup>a</sup> | X <sup>a</sup> | —                             | —             | —             | X                             | X             | X                       | X                       | X                       |  |                                  |
| 1E                                                                                                                       | —                             | X              | X              | —                             | —             | —             | X                             | X             | X                       | X                       | X                       |  |                                  |
| 2                                                                                                                        | —                             | —              | —              | —                             | X             | X             | —                             | —             | —                       | —                       | X                       |  |                                  |
| 3                                                                                                                        | —                             | X <sup>a</sup> | X <sup>a</sup> | —                             | —             | —             | X                             | X             | X                       | X                       | X                       |  |                                  |
| 3E                                                                                                                       | —                             | X              | X              | —                             | —             | —             | X                             | X             | X                       | X                       | X                       |  |                                  |
| 4                                                                                                                        | —                             | —              | —              | —                             | X             | X             | —                             | —             | —                       | —                       | X                       |  |                                  |
| 5                                                                                                                        | —                             | —              | —              | —                             | X             | X             | —                             | —             | —                       | —                       | X                       |  |                                  |
| 6                                                                                                                        | —                             | —              | —              | —                             | X             | X             | —                             | —             | —                       | —                       | X                       |  |                                  |
| 7                                                                                                                        | —                             | —              | —              | —                             | X             | X             | —                             | —             | —                       | —                       | X                       |  |                                  |
| 8F                                                                                                                       | —                             | X <sup>a</sup> | —              | X <sup>b</sup>                | —             | —             | X                             | X             | X                       | X                       | X                       |  |                                  |
| 8G                                                                                                                       | —                             | X <sup>a</sup> | —              | X <sup>b</sup>                | —             | —             | X                             | X             | X                       | X                       | X                       |  |                                  |
| 9                                                                                                                        | X                             | —              | —              | —                             | —             | —             | —                             | —             | —                       | —                       | X                       |  |                                  |
| Welded from both sides if complete penetration is not obtained (all other welds are complete penetration from one side). |                               |                |                |                               |               |               |                               |               |                         |                         |                         |  |                                  |
| Pipe rotated.                                                                                                            |                               |                |                |                               |               |               |                               |               |                         |                         |                         |  |                                  |
| See Clause 2.3.1.                                                                                                        |                               |                |                |                               |               |               |                               |               |                         |                         |                         |  |                                  |

**Table 2.2 — Nominal dimensions of test pieces for welds<sup>a,b,c,d</sup>**

Dimensions in millimetres

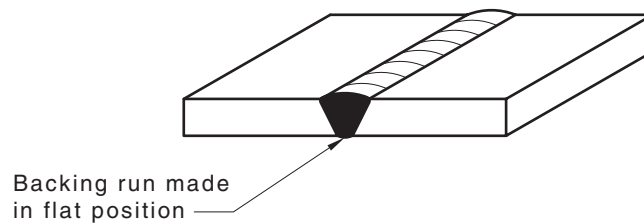
| Certificate No.          | Butt weld in plate                                                                                |          |          | Butt weld in pipe |                 |           | Fillet weld in plate |          |          |
|--------------------------|---------------------------------------------------------------------------------------------------|----------|----------|-------------------|-----------------|-----------|----------------------|----------|----------|
|                          | <i>l</i>                                                                                          | <i>w</i> | <i>t</i> | <i>l</i>          | <i>d</i>        | <i>t</i>  | <i>l</i>             | <i>w</i> | <i>t</i> |
| 1, 1E, 3, 3E, 8F and 8G  | 300                                                                                               | ≥ 125    | 10 to 12 | —                 | —               | —         | 225                  | ≥ 125    | 12       |
| 2, 4, 5, 6, 7, 8F and 8G | —                                                                                                 | —        | —        | 100 min           | DN 80 to DN 150 | 4.8 to 12 | —                    | —        | —        |
| 9                        | As specified in the welding procedure, for continuous wire processes, a minimum length of 450 mm. |          |          |                   |                 |           |                      |          |          |

**Key***l* = Length of test piece*w* = Width of test piece*t* = Thickness of test piece*d* = Outside diameter of test piece<sup>a</sup> For illustrations of butt and fillet welds, see [Figures 2.2, 2.3 and 2.4](#).<sup>b</sup> Test piece thickness for butt welds is at the discretion of the candidate.<sup>c</sup> Welder qualification range is maximized for 12 mm test plate thickness (refer to AS/NZS ISO 9606.1).<sup>d</sup> It is not intended that these dimensions should be measured precisely, but rather the general philosophy behind the values given in this table should be applied.**Table 2.3 — Nominal dimensions of test pieces for thermal cutting and gouging**

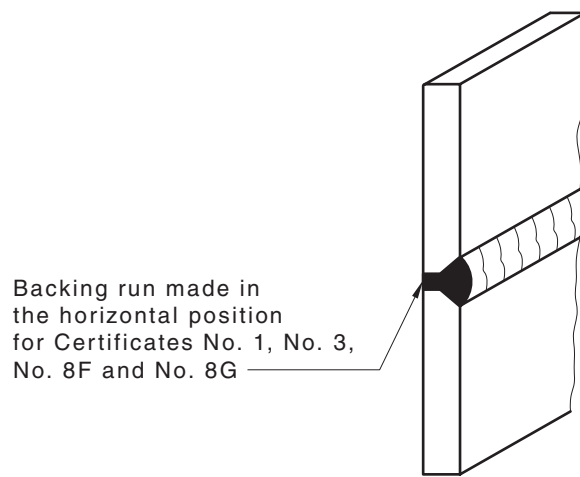
Dimensions in millimetres

| Certificate No.                           | Flame or plasma cutting |          |          |                 |           | Flame, plasma or air-arc gouging <sup>a</sup> |          |          |
|-------------------------------------------|-------------------------|----------|----------|-----------------|-----------|-----------------------------------------------|----------|----------|
|                                           | Plate <sup>a</sup>      |          |          | Pipe            |           |                                               |          |          |
|                                           | <i>l</i>                | <i>w</i> | <i>t</i> | <i>d</i>        | <i>t</i>  | <i>l</i>                                      | <i>w</i> | <i>t</i> |
| 1, 1E, 2, 3, 3E, 4, 5, 6, 7, 8F, 8G and 9 | 200                     | 100      | 12       | DN 80 to DN 150 | 4.8 to 12 | 200                                           | 100      | 10–12    |

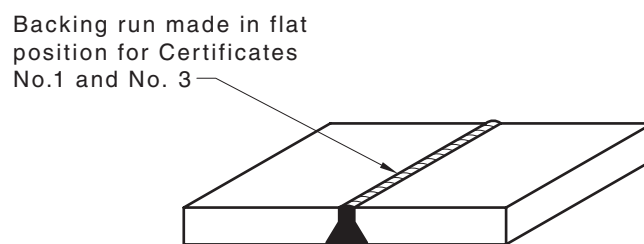
**Key***l* = Length of test piece*w* = Width of test piece*t* = Thickness of test piece*d* = Outside diameter of test piece<sup>a</sup> As an alternative, butt weld test pieces or fillet weld test pieces of dimensions specified in [Table 2.2](#) for use with Certificates No. 1, No. 1E, No. 3, No. 3E and No. 9 may be used.



(a) Flat butt welding position PA (1G), for Certificate No. 9

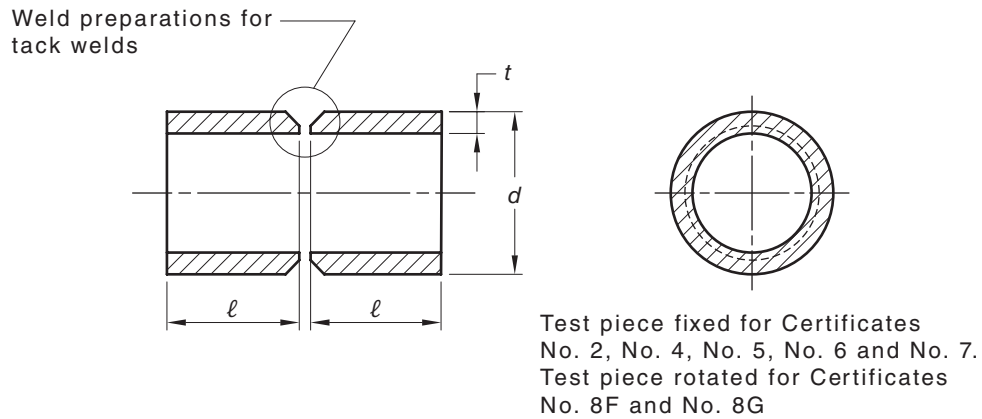


(b) Horizontal butt welding position PC (2G), for Certificates No. 1, No. 1E, No. 3E, No. 8F and No. 8G

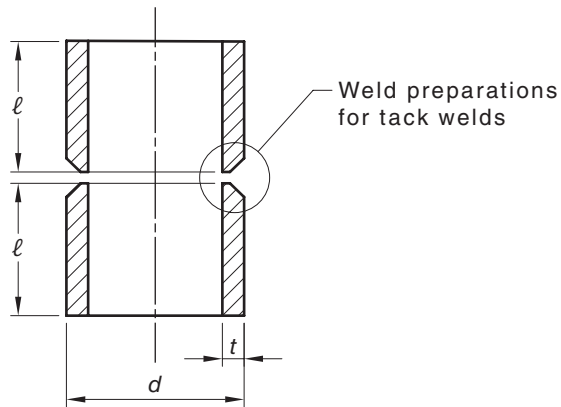


(c) Overhead butt welding position PE (4G), for Certificates No. 1, No. 1E, No. 3 and No. 3E

**Figure 2.1 — Positions for butt welds in plate**



- (a) Multiple position butt weld, welding position PH (5G), for Certificates No. 2 No. 4, No. 5, No. 6 and No. 7 and welding position PA (1G rotated) for Certificates No. 8F and No. 8G



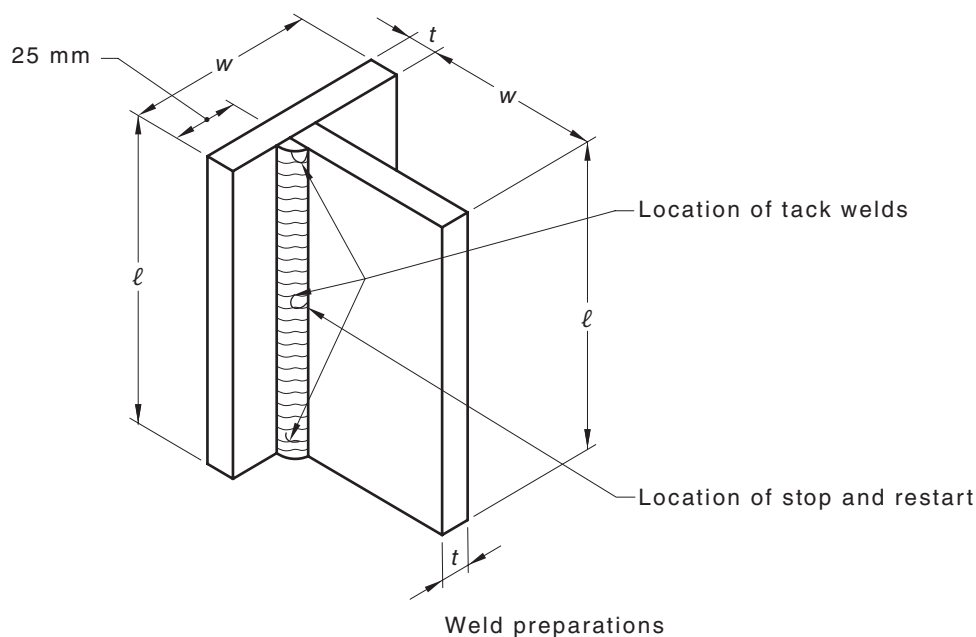
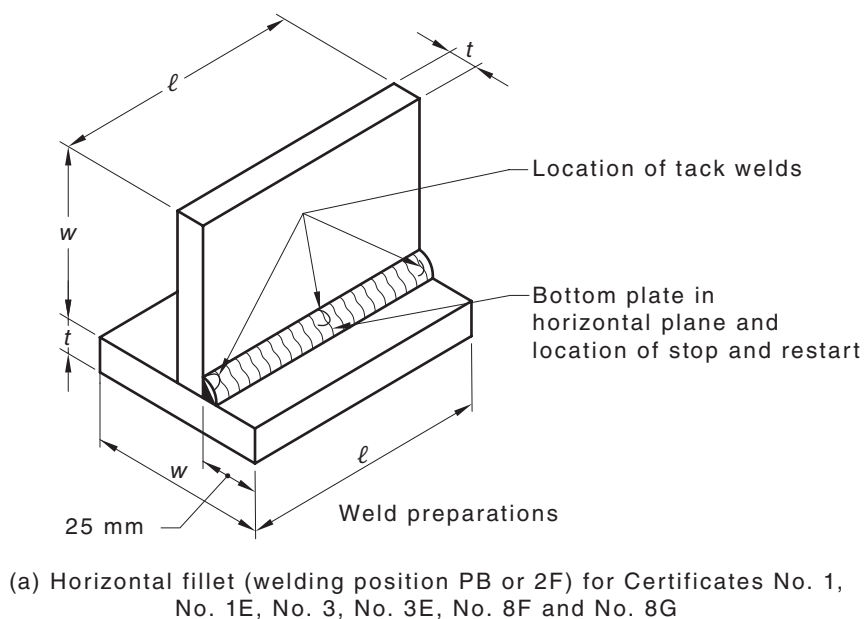
- (b) Horizontal butt welding position PC (2G), for Certificates No. 2, No. 4, No. 5, No. 6 and No. 7

#### Key

- $l$  = Length of test piece (see [Table 2.2](#))  
 $d$  = Diameter of test piece (see [Table 2.2](#))  
 $t$  = Thickness of test piece (see [Table 2.2](#))

NOTE For details of weld preparations, see [Table 2.4](#) and for tack welds, see [Clause 2.3.5.2](#).

**Figure 2.2 — Positions for butt welds in pipe**

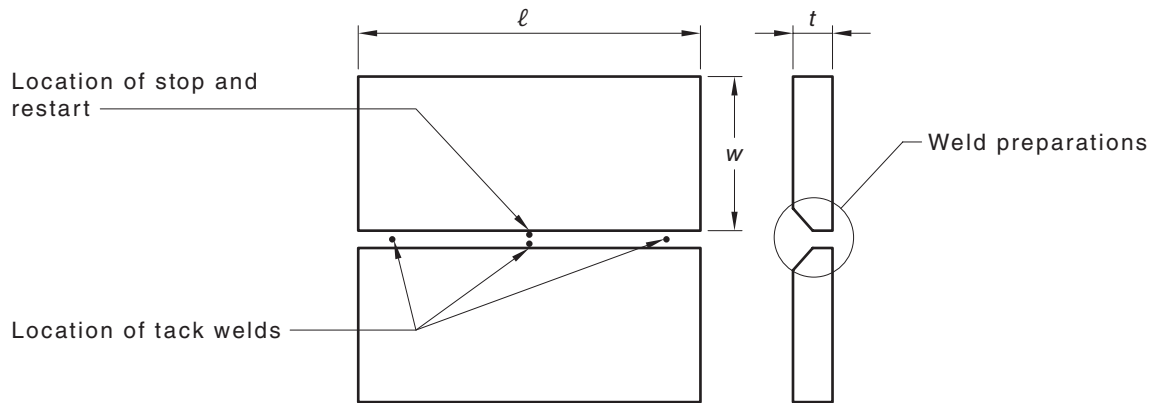


### Key

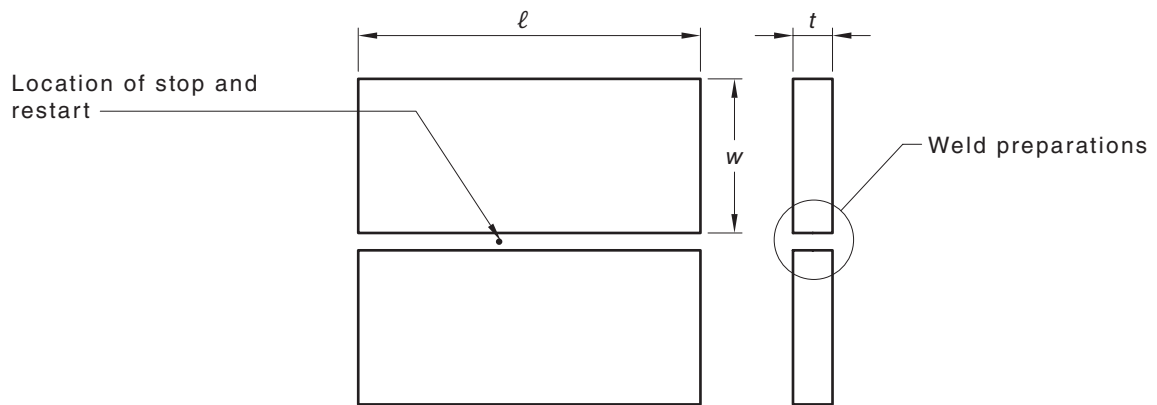
- $l$  = Length of test piece (see [Table 2.2](#))  
 $w$  = Width of test piece (see [Table 2.2](#))  
 $t$  = Thickness of test piece (see [Table 2.2](#))

NOTE For details of weld preparations, see [Table 2.4](#), for tack welds, see [Clause 2.3.5.2](#) and for stop and restart areas, see [Clause 2.3.6.4](#).

**Figure 2.3 — Positions, location of stop and restart and tack welds for fillet welds in plate**



(a) Butt weld for Certificates No. 1, No. 1E, No 3, No 3E, No. 8F and No. 8G



(b) Butt weld for Certificate No. 9

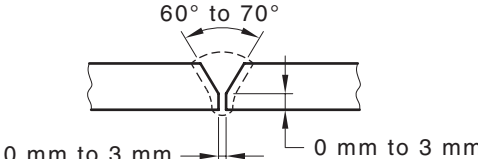
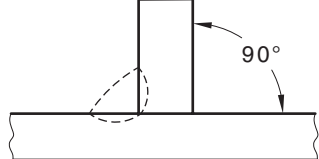
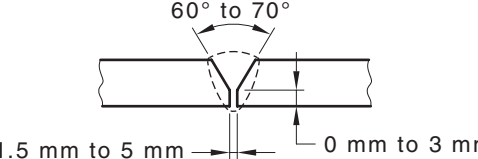
### Key

- $l$  = Length of test piece (see [Table 2.2](#))  
 $w$  = Width of test piece (see [Table 2.2](#))  
 $t$  = Thickness of test piece (see [Table 2.2](#))

NOTE For details of weld preparations, see [Table 2.4](#), for tack welds, see [Clause 2.3.5.2](#) and for stop and restart areas, see [Clause 2.3.6.2](#).

**Figure 2.4 — Location of stop and restart and tack welds for butt welds in plate**

**Table 2.4 — Weld preparations**

| Certificate No.          | Butt weld                                                                                                    | Fillet weld                                                                                         |
|--------------------------|--------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| 1,3, 8F and 8G           | Single V with root face<br> | Close square<br> |
| 1E, 2, 3E, 4, 5, 6 and 7 | Single V with root face<br> |                                                                                                     |
| 9                        | As specified in the qualified welding procedure.                                                             |                                                                                                     |

### 2.3.4 Welding consumables

#### 2.3.4.1 Types of consumables

Consumables shall be suitable for the welding process, be compatible with the material used for the test piece, and be selected from those listed in [Table 2.5](#).

#### 2.3.4.2 Use of electrode

For Certificates No. 1E or No. 2 or both, either the root run, or the complete weld may be made using electrodes as listed in [Table 2.5](#).

#### 2.3.4.3 Supply of consumables

The consumables in conformance with this document may be provided by others.

### 2.3.5 Assembly of test pieces for welding

#### 2.3.5.1 General

Test pieces for welding shall be assembled as follows:

- For Certificates No. 1, No. 1E, No. 2, No. 3, No. 3E, No. 4, No. 5, No. 6, No. 7, No. 8F and No. 8G — By tack welding.
- For Certificate No. 9 — By bracing or tack welding or both.

#### 2.3.5.2 Tack welds

Tack welds of the specified size shall be made from any position and be located as follows:

- Butt welds in plate* — Three tack welds shall be made on the side to be welded. Each shall be equal to or less than 25 mm in length. One shall be located within the central 50 mm. The others shall be approximately 50 mm from each end of the test piece (see [Figure 2.4](#)).
- Butt welds in pipe* — Three or four tack welds shall be made. Each shall be equal to or less than 12 mm in length, and be spaced equally around the test piece (see [Figure 2.2](#)).