

# Welder Qualification



**Bruce Cannon**

Principal Welding Engineer & Technical Publications Manager

Chair, Committee WD-003

# Overview

Topics to be covered –

- AS/NZS 1554.1 – A history of welder qualification
- AS/NZS 2980 – A history
  - ❖ Questions arising
- AS/NZS ISO 9606-1 – The Journey
  - ❖ Questions arising
- Welder qualification – The future
  
- WD-003 work program

# *Disclaimer*



The information presented is the personal opinion of the presenter.

It may not be indicative of the views or opinions of either Standards Australia or Weld Australia.

Should you require an official interpretation relating to any Australian or ISO standard, please contact Standards Australia directly.

# AS/NZS 1554.1 Welder qualification: 1



- Pre 2000 – “Welders shall be qualified”
  - Detail of how to qualify limited
    - Implied to test to a WPS, qualify via a macro
  - AS 1796 welders – qualified for life
  - Use of AS 2980 option limited or unclear
  - Clarification requested

# AS/NZS 1554.1 Welder qualification: 2



## ➤ Post 2000 – Amended and clarified

- Ongoing demonstration of capability required (6 monthly)
- Extension of weld position added (from ISO 9606-1)
- Qualify to WPS test & macro, or qualification standard
- In 2014, UT or RT (+ bends for GMAW & metal core FCAW) allowed in lieu of macro

# AS 2980: 1987

- Originally developed in 1987
  - Based on AWS D1.1 methods of welder qualification
  - Butt welds did not qualify fillet welds
  - Plug weld provisions included
  - Positions qualified similar to those currently in AS/NZS ISO 9606-1
  - Provision for mechanised processes
  - Hierarchy of consumable qualifications and parent material qualifications
  - Qualification valid for life
- Known limitations—
  - Did not consider materials less than 10mm thickness
  - Not suitable for GTAW

# Terminology

## ➤ *Confirmation*

- The process whereby the person responsible for welding confirms (on the welder's certificate of test) that the welder has worked within the range of qualification, and this extends the period of validity for an additional 6 months.
- Required every 6 months

## ➤ *Prolongation/Validation*

- The process whereby an examiner reviews the results of two welds made in the previous 6 months via RT or UT, or by destructive tests. If satisfactory, the welder's certificate of test is validated and reissued for an additional 2 years provided that ongoing *Confirmation* is conducted on a 6 monthly basis.

# AS/NZS 2980: 2004 & 2007

- Major revision in 2004
  - Based on ISO 9606-1 requirements and test methods (similar to AS 2980:1987).
  - Allowed for thin materials
  - Suitable for GTAW, mechanised processes included but not part of ISO
  - Butt welds qualified welder for fillet welds, plug weld provisions retained
  - Positions qualified similar to those currently in AS/NZS 1554.1
  - Provision for mechanised processes
  - Hierarchy of consumable qualifications and parent material qualifications
  - Other minor variations from ISO e.g. transfer mode an essential variable
  - Defect acceptance based on AWS D1.1. Alternative options available.
  - Valid for 2 years, prolongation option available, 6 monthly confirmation required.
- Co-joined with NZ in 2007, appendix for NZ dairy industry added & allowed for 2 NZ standards to be retired.



# AS/NZS 2980: 2018

## ➤ Major revision in 2018

- Not permitted to revise and reprint as per 2007 edition for copyright reasons – required to produce a “variations edition” which referenced AS/NZS ISO 9606-1.
  - Aligned with ISO 9606-1:2012 requirements other than test method standards and default acceptance criteria.
  - Does not cater for mechanised welding processes but can be used.
  - Butt welds do not qualify for fillet welds, but both can be qualified at the same time
  - Plug weld provisions not mentioned but would be a “special test” if required.
  - Additional backing options available
  - Positions qualified modified, now similar to those in old AS 2980 and AWS D1.1.
  - Qualification based on consumable used, not parent material
  - Defect acceptance still based on AWS D1.1. Alternative options available.
  - 3 options now available for validation period.
- WD-003 intend to withdraw AS/NZS 2980 in the future (no date set).

# AS/NZS 2980: 2018

Variable	AS/NZS 2980:2007	AS/NZS ISO 9606-1 & AS/NZS 2980:2018
Welding process	Processes include: <ul style="list-style-type: none"> <li>• GMAW, GTAW, MMAW, FCAW, PAW, OW</li> <li>• Mechanised SAW</li> <li>• ESW, EGW</li> </ul>	Changes are: <ul style="list-style-type: none"> <li>• FCAW (metal core) added, additional GTAW variants</li> <li>• Part mechanised SAW only</li> <li>• ESW, EGW removed</li> </ul>
Arc transfer characteristics	Change in arc transfer mode	Short arc qualifies other modes but not vice versa
Multi process joint	<ul style="list-style-type: none"> <li>• Root process qualifies, root process and fill/cap process qualifies as ssmb; both in combination and singly</li> <li>• Two single process as per above qualify in combination</li> </ul>	No change
Product type	Plate & pipe (tube)	No change
Type of weld	<ul style="list-style-type: none"> <li>• Butt welds qualify all types except branch welds</li> <li>• Butt welds qualify butt and fillet welds</li> <li>• Fillet welds qualify fillet welds</li> <li>• Special welds option</li> </ul>	<ul style="list-style-type: none"> <li>• Butt welds qualify all butt welds except branch welds</li> <li>• Options to qualify butt and fillet welds at the same time</li> <li>• Fillet welds qualify fillet welds</li> <li>• Special weld option</li> </ul>
Material groups	<ul style="list-style-type: none"> <li>• Qualification linked to material groups</li> <li>• 11 basic groups based on ISO/TR 15608</li> </ul>	<ul style="list-style-type: none"> <li>• Not essential variable</li> <li>• Record details of material welded on certificate of test</li> </ul>
Filler material group	Not an essential variable	<ul style="list-style-type: none"> <li>• Six groups FM1 to FM6, based on composition</li> <li>• Groups with similar or better useability qualifies for similar or more useable types</li> </ul>
Filler material type	<ul style="list-style-type: none"> <li>• MMAW – cellulosic qualifies cellulosic only</li> <li>• Basic types qualifies basic, rutile and variants</li> <li>• Rutile and variants qualifies rutile and variants</li> <li>• Solid wire and metal core qualifies solid wire and metal core</li> </ul>	No change
Dimensions	<p>Butt joints – plate thickness</p> <ul style="list-style-type: none"> <li>• &lt;3mm qualifies <math>t</math> to <math>2t</math></li> <li>• 3 to 12mm qualifies 3 to <math>2t</math></li> <li>• <math>\geq 12</math>mm qualifies <math>\geq 3</math>mm</li> </ul> <p>Pipe</p> <ul style="list-style-type: none"> <li>• <math>\leq 25\emptyset</math> qualifies <math>D</math> to <math>2D</math></li> <li>• <math>&gt; 25\emptyset</math> qualifies <math>\geq 0.5D</math> (25mm minimum)</li> </ul> <p>Fillet welds (plate thickness)</p> <ul style="list-style-type: none"> <li>• &lt;3mm qualifies <math>t</math> to <math>2t</math></li> <li>• <math>\geq 3</math>mm qualifies <math>\geq 3</math>mm</li> </ul>	<p>Butt joints – deposited metal thickness</p> <ul style="list-style-type: none"> <li>• &lt;3mm qualifies greater of <math>s</math> to 3mm or <math>s</math> to <math>2s</math></li> <li>• 3 to 12mm qualifies 3 to <math>2s</math></li> <li>• <math>\geq 12</math>mm qualifies <math>\geq 3</math>mm</li> </ul> <p>Pipe</p> <ul style="list-style-type: none"> <li>• <math>\leq 25\emptyset</math> qualifies <math>D</math> to <math>2D</math></li> <li>• <math>&gt; 25\emptyset</math> qualifies <math>\geq 0.5D</math> (25mm minimum)</li> </ul> <p>Fillet welds (plate thickness)</p> <ul style="list-style-type: none"> <li>• &lt;3mm qualifies <math>t</math> to <math>2t</math></li> <li>• <math>\geq 3</math>mm qualifies <math>\geq 3</math>mm</li> </ul>

# AS/NZS 2980: 2018

Variable	AS/NZS 2980:2007	AS/NZS ISO 9606-1 & AS/NZS 2980:2018
Welding position	<ul style="list-style-type: none"> <li>OH (PE) qualifies all except VD (PG)</li> <li>Other positions provided including pipe, fixed and rotated <i>Note: Positions as per AS 3545</i></li> </ul>	<ul style="list-style-type: none"> <li>OH (PE) + VU (PF) or H-L045 qualifies all butt position</li> <li>OH (PD or PE) fillet qualifies all fillets except VU (PF) &amp; VD (PG)</li> <li>VU (PF) fillet qualifies F (PA), HV (PB) and VU (PF) fillets</li> <li>VD (PG) fillet qualifies VD (PG) fillet only</li> <li>Pipe positions simplified</li> </ul>
Weld details	<ul style="list-style-type: none"> <li>Backing options limited to single sides and material backing</li> <li>Single layer fillet only qualifies single layer fillet. Multilayer qualifies multilayer and single layer</li> </ul>	<ul style="list-style-type: none"> <li>Backing options expanded to include ceramic, flux, gas backings and consumable inserts.</li> <li>Single layer fillet only qualifies single layer fillet. Multilayer qualifies multilayer and single layer</li> </ul>
Test method options	Based on ISO options but uses AS 2205 and Australian RT and UT methods	<ul style="list-style-type: none"> <li>Both standards use same options as AS/NZS 2980:2007</li> <li>AS/NZS ISO 9606-1 test methods ISO based. Australian RT and UT methods used if Australian acceptance criteria specified.</li> <li>AS/NZS 2980:2018 uses AS 2205 and Australian RT and UT methods</li> </ul>
Acceptance criteria	Based on AWS D1.1 unless otherwise specified	<ul style="list-style-type: none"> <li>AS/NZS ISO 9606-1 – ISO unless specified otherwise</li> <li>AS/NZS 2980:2018 as per AS/NZS 2980:2007 unless specified otherwise</li> </ul>
Retests	Not considered	Retest once without additional training if failed
Period of validity	<ul style="list-style-type: none"> <li>2 years – validity prolonged based on 2 tests reproducing original conditions other than position, thickness and pipe OD.</li> <li>Requires confirmation every 6 months</li> <li>Welder may change employer</li> </ul>	<p>3 options:</p> <ul style="list-style-type: none"> <li>3 years – retest required</li> <li>2 years - validity prolonged based on 2 tests reproducing original conditions other than thickness and pipe OD</li> <li>Indefinite if employer's quality program verified to AS/NZS ISO 3834 2 or AS/NZS ISO 3834 3</li> <li>All options require confirmation every six months</li> <li>Welder may change employer other than for indefinite option</li> </ul>

# AS/NZS 2980: 2018

## Key differences with AS/NZS ISO 9606-1

### ➤ Test method standards

- Visual examination – AS 3978 v/s ISO 17636 *Note: AS/NZS ISO 17636 now available*
- Bend tests – AS 2205.3.1 v/s ISO 5173
- Nick-break & Fillet-break tests (i.e. Fracture tests)  
AS 2205.4.1 & AS 2205.4.2 v/s ISO 9017 *Note: ISO 9017 adopted as AS/NZS 2205.4.1*
- Macro test – AS 2205.5.1 v/s ISO 17639 *Note: ISO 17639 adopted as AS/NZS 2205.5.1*
- Radiography – AS 2177 v/s ISO 17636
- Ultrasonics – AS 2207 v/s ISO 17640

### ➤ Default acceptance criteria

- Based on AWS D1.1 v/s ISO 5817 but in both cases, alternatives are available  
*Note: AS/NZS ISO 5817 now available*

# AS/NZS 2980: 2018

## Examination & testing options (no change from 2007):

<b>Plate butt welds</b>			
Visual <i>plus:</i>			
Radiography <i>or</i> →	Bend tests <i>or</i> →	Fracture tests <i>or</i> → <i>(i.e. Nick-break test)</i>	Ultrasonic (≥8mm ferritic steel only)
<i>plus</i> Additional bends <i>or</i> fracture tests for all GMAW <sup>131, 135</sup> , FCAW <sup>138</sup> (metal core) and oxyacetylene <sup>311</sup> welding only. One of these tests to come from stop start region			
<b>Pipe butt welds</b>			
Visual <i>plus:</i>			
Radiography <i>or</i> →	Bend tests <i>or</i> →	Fracture tests <i>or</i> →	Ultrasonic (≥8mm ferritic steel only)
<i>plus</i> Additional bends <i>or</i> fracture tests for all GMAW <sup>131, 135</sup> , FCAW <sup>138</sup> (metal core) and oxyacetylene <sup>311</sup> welding only. One of these tests to come from stop start region	For OD ≤ 25mm, notched tensile optional in lieu of bends	For OD ≤ 25mm, notched tensile optional in lieu of nick-break	
<b>Fillet weld</b>			
Visual <i>plus:</i>			
Fracture test <i>or</i> → <i>(i.e. Fillet- break test)</i>	2 macros One macro to come from stop start region		
<b>Branch pipe joint</b>			
Visual <i>plus:</i>			
Fracture test <i>or</i> → <i>(i.e. Fillet- break test)</i>	2 macros <i>or</i> → One macro to come from stop start region	Radiography	

# AS/NZS 2980: 2018 – Period of Validity

- Qualification valid from date of testing (no change)
- Validity of all qualifications must be confirmed every 6 months by person responsible for welding (or an examiner). Welder must weld within the limits of qualification (no change).
- Three options for period of validity:
  1. Welder to be retested after 3 years *(new)*
  2. Every 2 years two welds made in previous 6 months to be assessed. If OK, qualification is revalidated for a further 2 years (no change)
  3. No expiry but qualifications must be confirmed, welder must be employed by same manufacturer and manufacturer must have a validated ISO 3834 quality program *(new)*
- ❖ Qualification can be revoked where doubt exists as to the welders ability



# AS/NZS 2980 – Further reading

- See Appendix A of AS/NZS 2980
- See Weld Australia's Technical Guidance Note TGN-SG03 – a free download at <https://wtia.com.au/resources/technical-guidance-notes/>
- Examiner's test option's helper – a free download available at <http://awcr.org.au/resources/manuals>

# AS/NZS 2980 – Fabricator questions Q1



1. Why do we need two standards and not one?

A. The Committee was not permitted to revise and reprint as per 2004 or 2007 edition for copyright reasons – required to produce a “variations edition” which referenced AS/NZS ISO 9606-1



# AS/NZS 2980 – Fabricator questions Q2



2. Why do I need to retest my welders every 6 months?

A. You don't, unless the welders have not used the welding process in the previous 6 months within the range of essential variables. This requirement is consistent with AS/NZS 1554.1 and other standards.

# AS/NZS 2980 – Fabricator questions Q3



3. Why isn't AS/NZS 1554.1 fit for purpose for welder qualification?

A. It is. The fabricator is free to qualify their welders to specific weld procedures. Unless otherwise specified in contract documents, whatever method the fabricator chooses to qualify their welders is usually a commercial consideration.

# AS/NZS 2980 – Fabricator questions Q4



4. You need to qualify butt welds and fillet welds separately. Why?

A. It is known that 70% of welders (both in Australia and internationally) cannot successfully pass a HV (PB or 2F) fillet weld test – they usually struggle to obtain acceptable root penetration.

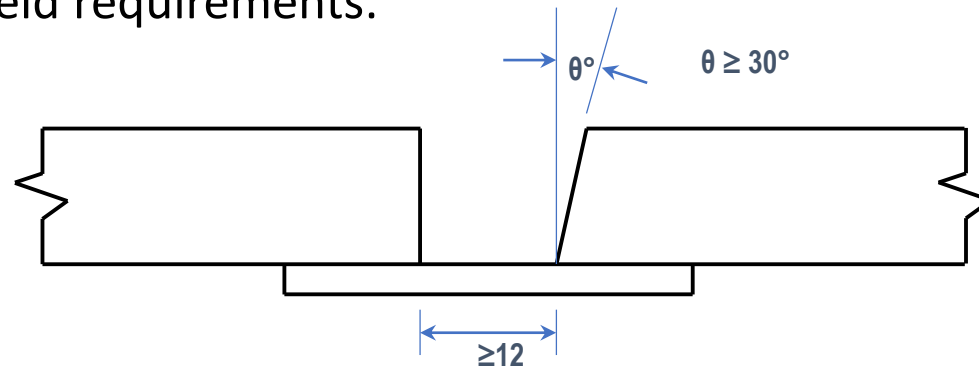
**Note:** *The standard provides two methods to qualify welders for butt and fillet joints at the same time.*

# AS/NZS 2980 – Fabricator questions Q4 *cont'd*

## 4. Qualifying butt welds and fillet welds at the same time – 2 methods:

### A. Method 1 – see Clause 5.4(b) of AS/NZS ISO 9606-1

- I. Weld the joint from Appendix C (joint similar to B-C4(b) from Table E1 of AS/NZS 1554.1)
- II. Use a root gap of 12mm to provide root access – details missing or incorrect in the standard
- III. Weld a single or multipass fillet as required and visually examine. If OK, complete the butt joint
- IV. Test as per butt weld requirements.



### B. Method 2 – see Clause 5.4(e) of AS/NZS ISO 9606-1

- I. Weld the required butt joints (e.g. VU & OH to qualify all positions).
- II. Weld supplementary fillet test in HV position.
- III. If fillet test passes, welder also qualifies as per butt joint positions.

# AS/NZS 2980 – Fabricator questions Q5



5. Acceptance criteria confusing.

A. Acceptance criteria offers two options – a default option (similar to AWS D1.1 and AS/NZS 1554.1 SP), or other criteria specified, if required e.g. AS/NZS 1554.5 FP.

# AS/NZS 2980 – Fabricator questions Q6



6. Is there a transition period from the 2007 edition of the standard?

A. Yes – see Clause 2, paragraph 4. Qualifications issued under the 2007 edition of AS/NZS 2980 remain valid until prolongation is required. The 2018 edition is then used to prolong (revalidate) the qualification. Essential variables of the 2018 edition apply after prolongation/revalidation.

*See also the Introduction to AS/NZS ISO 9606-1.*

# AS/NZS 2980 – Fabricator questions Q8



7. AS/NZS 1554.1 allows for welders to be qualified to AS/NZS 1554.1 or AS/NZS 2980 or ISO 9606-1. That no longer appears to be the case as AS/NZS 2980 is linked to ISO 9606-1. Why?
- A. There is no change to requirements within AS/NZS 1554.1. Fabricators are free to qualify welders to AS/NZS 1554.1, AS/NZS 2980 or AS/NZS ISO 9606-1.  
Note that AS/NZS 2980 will be withdrawn in the medium term (no time frame set).

# AS/NZS 2980 – Fabricator questions Q8



8. I would like to qualify my welders in-house to AS/NZS 2980 or AS/NZS ISO 9606-1. Do I need to ensure that all tests are conducted by a NATA lab or independent examiner?
- A. No. If the fabricator employs a suitably qualified and competent welding supervisor or inspector, and has in-house testing facilities available then they are free to conduct their own tests. Some clients may prefer the tests to be conducted by an independent examiner and/or tested in a NATA lab, but this is a commercial issue.
- Notes:**
1. *AS/NZS ISO 9606-1 warns that an independent examiner may be required.*
  2. *UT or RT should be conducted by someone compliant with AS ISO 9712.*



# AS/NZS ISO 9606-1 – A history



- Originally published as EN 287, cloned by ISO as ISO 9606-1 in 1994 to provide for standardisation of welder qualifications
- Revised by ISO –
  - ❖ Original revision draft in 2004 seen as too European centric & rejected
    - Pacific Rim Countries tend to follow North American practices, not European
  - ❖ Later drafts considered & incorporated comments by Australia, Canada, Japan and USA becoming more truly internationalised
  - ❖ Second edition published in 2012, usage growing
- **Note:** *Australia considered the contents of the drafts and incorporated key items within the revision of AS 2980 in 2004, later updated in 2007 as AS/NZS 2980.*

# AS/NZS ISO 9606-1 Recognition



- ISO 9606-1 was drafted to provide for the qualification of welders of both pressure equipment and non-pressure (e.g. structural, bridge, defence etc.) applications. It is not product specific.
- ISO 9606-1:2012 is recognised in:
  - ✓ ASME IX
  - ✓ AS/NZS 1554 series
  - ✓ AS 1988
  - ✓ AS/NZS 3992 (2015)
  - ✓ AS 5100 series
  - ✓ Accepted by Europe and has superceded EN 287
  - ✓ AS/NZS 2980 revised to align with ISO 9606-1 requirements (March 2018)
  - ✓ ISO 9606-1 adopted in Australia and New Zealand as AS/NZS ISO 9606-1 (December 2017)

# AS/NZS ISO 9606-1 – The approach

- Uses methodology similar to many other standards
- Test methods similar to AS/NZS 2980, AS/NZS 3992, ASME IX
  - ❖ Welder is tested to a qualified WPS –
    - Option to utilise a draft WPS when being qualified at the same time
- Acceptance criteria for mechanical testing:
  - ❖ Similar to AS/NZS 3992 (AS 4037 Class 1) & AS 1796
  - ❖ A little more restrictive than AS/NZS 1554.1 and AWS D1.1
- Acceptance criteria for NDE
  - ❖ Uses methodology of ISO unless otherwise specified
  - ❖ More restrictive treatment of adjacent imperfections
- Alternative acceptance criteria acceptable when specified
- Welder qualification is transportable across employers but expires unless reconfirmed

# AS/NZS ISO 9606-1 – Essential variables

Eight essential variables (Cl 5.1):

- Welding process (Cl 5.2)
- Product type (Cl 5.3)
- Type of weld (Cl 5.4)
- Filler material group (Cl 5.5)
- Filler material type (Cl 5.6)
- Dimensions (Cl 5.7)
- Welding position (Cl 5.8)
- Weld details (Cl 5.9)

**Note:** *Parent materials (see ISO/TR 15608) are not an essential variable*

# AS/NZS ISO 9606-1 – Filler materials

## Key points:

- Six groups FM1 to FM6 ( Cl 5.5, Table 3)
  - ❖ FM1 – non-alloy and fine grained steels
  - ❖ FM2 – high strength steels
  - ❖ FM3, FM4 – creep-resisting steels
  - ❖ FM5 – stainless & heat-resisting steels
  - ❖ FM6 – nickel & nickel alloys
- Range of qualification based on filler metal group used in the test

If consumable does not have ISO type classification, still use above groups  
e.g. *AWS E70 T-1 FCAW consumable would be a FM1 type consumable*

# AS/NZS ISO 9606-1 – Test methods

## Test methods:

- Visual examination – use AS/NZS ISO 17637
- Fracture test – use AS/NZS 2205.4.1 (ISO 9017)
- Macro test – use AS/NZS 2205.5.1 (ISO 17639)
- Bend test – ISO 5173 (similar to AS 2205.3.1)
- NDT (RT and UT) must use the test methods consistent with specified acceptance criteria and WPS.

## Acceptance criteria:

- Acceptance requirements to be assessed in accordance with AS/NZS ISO 5817 unless otherwise specified
- Alternative acceptance criteria can be applied when specified

# AS/NZS ISO 9606-1 – Questions Q1



1. Do I have need to qualify weld procedures to ISO standards to use AS/NZS ISO 9606-1?

A. No, but WPS used must contain the information set out in ISO 15609-1.

# AS/NZS ISO 9606-1 – Questions Q2



2. Do I have to use ISO testing standards to use AS/NZS ISO 9606-1?

A. Some Australian destructive tests are similar (or identical) and will present a similar or identical outcome to the ISO methods (e.g. bend tests, fracture tests, macro tests), however, RT and UT processes are not compatible with Australian methods.

Notes:

1. Australia is updating some of its weld test methods and adopting the relevant ISO methods. This does not currently include RT or UT.
2. Australian RT or UT must be used when specified on the WPS.



# AS/NZS ISO 9606-1 – Questions Q3



3. Will AS/NZS ISO 9606-1 replace AS 1796?

A. No. AS/NZS ISO 9606-1 complements rather than replaces AS 1796, and both standards have different functions within Australian industry.

# AS/NZS ISO 9606-1 – Questions Q4

4. Can I qualify to AS 1796 and AS/NZS ISO 9606-1 at the same time?
- A. Yes, however the choice of test method is limited. Specifically,
- For fillet weld tests, use the fracture test (Fillet-break test).
  - For butt weld tests, use the RT evaluation option to evaluate the test piece to both standards. For the 8G certificate, supplementary bend tests are also required to qualify to AS/NZS ISO 9606-1.

# Welder qualification – Future considerations



- ISO 9606-1 is gaining importance and traction throughout the world
  - ❖ Is referenced in AS/NZS 3992 and the AS/NZS 1554 series of standards
- Adopted in Australia and New Zealand as AS/NZS ISO 9606-1
- Defence and road & rail transport industry groups reference ISO 9606-1 (AS/NZS ISO 9606-1) as the basis for welder qualifications
- Referenced standards within ISO 9606-1 are being adopted in Australia
- AS/NZS 2980 will be withdrawn in the medium term future
- ISO 9606-1 will be amended to better align with Australian industry requirements

# AS/NZS ISO 9606-1 – Further reading



- Weld Australia's Technical Guidance Notes TGN-SG01 and TGN-SG02 – a free download at <https://wtia.com.au/resources/technical-guidance-notes/>
- Guidance on the application and understanding of AS/NZS ISO 9606-1 See presentation entitled *Using AS-NZS ISO 9606-1 with WeldQ* – available at <http://awcr.org.au/resources/manuals>
- Examiner's test option's helper available at <http://awcr.org.au/resources/manuals>

# WD-003 Work program

- Revision of AS/NZS 1554.2 (Stud welding)
- Correction to AS/NZS 2980 Appendix B, Table B3.6.3
- Revision of AS/NZS 1665 (Welding of aluminium) – late 2019?
- Adoption relevant ISO standards e.g.
  - ❖ ISO 6947 (To be AS 3545 – Weld positions)
  - ❖ ISO 5173 (To be AS/NZS 2205.3.? – Bend tests)
  - ❖ ISO 3821 (To be AS/NZS 1335? – Hoses for welding)Above adoptions delayed due to ISO revisions
- Revision of the AS/NZS 1554 series (2020 start?)
- Input to ISO committees TC44, TC44/SC10 and TC44/SC11
  - ❖ Revision of ISO 9606 series
  - ❖ Revision of ISO 17660 (Welding of reinforcing)

*Any questions?*