European Welding Standards

John Dyson

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European Standards

Harmonised Standards

Not all EN Standards are Harmonised, only those that are considered to satisfy relevant ESRs in product directives. Harmonised standards contain an appendix Z, which defines which directives and ESRs the standard meets. For example: EN ISO 15614 will be harmonised, but other routes for weld procedure approval may not be, such as EN ISO 15610, EN ISO 15611, EN ISO 15612 etc.

ISO Standards

There is a Gentleman’s agreement that attempts to make all EN standards into ISO standards and vice versa, but this does not work for all standards.
Application Standards

EN 13445 : Pressure Vessels ( BS 5500)

EN 12952 : Water Tube Boilers ( BS 1113)

EN 12953 : Shell Boilers ( BS 2790)

EN 13480 : Piping ( BS 806, Not BS 2640, BS 2971)
## Specifications & Approval of Welding Procedures

### Summary of EN ISO Specifications

Details of the standards dealing with specification and approval of welding procedures

<table>
<thead>
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<td><strong>General rules</strong></td>
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<td></td>
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<td>Guidelines for a grouping system</td>
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<td>CR ISO/TR 15608</td>
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<td>Approved consumables</td>
<td>EN ISO 15610</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>EN ISO 15620</td>
</tr>
<tr>
<td>Previous welding experience</td>
<td>EN ISO 15611</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>EN ISO 15611</td>
</tr>
<tr>
<td>Standard procedure</td>
<td>EN ISO 15612</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>EN ISO 15611</td>
</tr>
<tr>
<td>Pre-production test</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>EN ISO 15611</td>
</tr>
</tbody>
</table>
Specifications & Approval of Welding Procedures

Introduction to The Specification & Approval of Welding Procedures
EN 288 Part 1 Will Become EN ISO 15607

Material Grouping for both Procedures and Welder Approval
CR ISO 15608 this standard has no current EN equivalent

Contents of a WPS
EN 288 Part 2 Will Become EN ISO 15609 (Part 1 Arc, Part 2 for Gas welding)

Welding Procedure Test
EN 288 Part 3 will become EN ISO 15614 Part 1 (Steel and Nickel Alloys)
EN 288 Part 4 will become EN ISO 15614 Part 2 (aluminium and its alloys)

Other routes for procedure approval, such as previous experience, approved consumables etc. Are unlikely to become harmonised for use with the PED
Specifications & Approval of Welding Procedures

Mechanical Testing

EN ISO 15614-1 adopts the same mechanical test as EN288-3, except that the bend test minimum former angle has been increased from 120° to 180° and fillet welds require a minimum of 4 macros. When impact testing is required the minimum thickness has been reduced from 12mm to 6mm.

HARDNESS TESTING

EN ISO 15614-1 Makes no distinction between multi-pass and single pass welds. The maximum values for material in group 1 and 2, is the same as that stated in EN288-3 for single run welds ( non-heat treated 380Hv₁₀ max, heat treated 320Hv₁₀ max)

All groups now have maximum hardness specified, except :-

- Group 6, Cr-Mo-V steels, non- heat –treated condition

Hardness Survey is not required for :-
- Steels in Sub-group 1.1 (yield strength of 275N/mm² or less)
- Stainless Steels in Group 8
- Nickel Alloys in Groups 41 to 48
## Specifications & Approval of Welding Procedures

**MATERIAL GROUPING CR ISO 15608**

<table>
<thead>
<tr>
<th>Material Group</th>
<th>EN ISO 15614-1</th>
<th>EN288-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Re ≤ 460N/mm²</td>
<td>Re ≤ 360N/mm²</td>
</tr>
<tr>
<td>2</td>
<td>TMCP &gt;360N/mm²</td>
<td>TMCP &gt;360N/mm²</td>
</tr>
<tr>
<td>3</td>
<td>Q+T and PHd steels</td>
<td>Q+T and PHd steels</td>
</tr>
<tr>
<td>4</td>
<td>1.5Ni,0.7Cr,0.7Mo,0.1V max</td>
<td>0.75Cr,0.6Mo,0.3V max</td>
</tr>
<tr>
<td>5</td>
<td>0.35C,10Cr,1.2Mo max</td>
<td>10Cr, 1.2Mo max</td>
</tr>
<tr>
<td>6</td>
<td>12.5Cr,1.2Mo,0.35V max</td>
<td>12.2Cr, 1.2Mo, 0.5V max</td>
</tr>
<tr>
<td>7</td>
<td>0.35C,30Cr</td>
<td>10 Ni max</td>
</tr>
<tr>
<td>8</td>
<td>Austenitic</td>
<td>10.5 ≤ Cr ≤ 30</td>
</tr>
<tr>
<td>9</td>
<td>Ni ≤ 10 (Cryogenic Steels)</td>
<td>Austenitic</td>
</tr>
<tr>
<td>10</td>
<td>Duplex</td>
<td>Duplex</td>
</tr>
<tr>
<td>11</td>
<td>0.25&lt; C ≤ 0.5</td>
<td>0.25&lt; C ≤ 0.5</td>
</tr>
<tr>
<td>41 to 48</td>
<td>Ni based alloys (Identical To ASME )</td>
<td></td>
</tr>
</tbody>
</table>
Specifications & Approval of Welding Procedures

MATERIAL GROUPING
CR ISO 15608

Main Groups are sub-divided into sub groups

• Based on yield strength for carbon steel in groups 1, 2 and 3. However these sub groups are not considered for material grouping in EN ISO 15614-1, the grouping is based on same specified yield strength or less in the main group (the same as EN288-3).

• Based on Alloy content for materials in all the other groups. EN ISO 15614-1, may approve the steels in the same sub-group or all the lower sub groups in the main group, depending on the suffix in EN ISO 15614-1 table 3:- (b) or (c)

• For example :- Group 8:-
  sub-group 8.1 Chrome \leq 19\%
  sub-group 8.2 Chrome > 19\%
  sub-group 8.3 Austenitic with 4< Mn \leq 12
A test in one sub group within group 8, approve all other steels in the same sub group ONLY (therefore a test in 304 approves 316, 347 and 321, but not 309 or 310)

Note :- Impact requirements do not affect the sub grouping approval range as they do in the ASME code.
### Specifications & Approval of Welding Procedures

**Table 3 — Range of qualification for steel groups and sub-groups**

<table>
<thead>
<tr>
<th>Material group(s) of test joint</th>
<th>Range of qualification</th>
<th>Additional range of qualification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 welded to 1</td>
<td>1 ^a</td>
<td>and also</td>
</tr>
<tr>
<td>2 welded to 2</td>
<td>2 ^a or 1</td>
<td>and also 2 ^a welded to 1</td>
</tr>
<tr>
<td>3 welded to 3</td>
<td>3 ^a or 2 or 1</td>
<td>and also 3 ^a welded to 2 or 1</td>
</tr>
<tr>
<td>4 welded to 4</td>
<td>4 ^b</td>
<td>and also 4 ^b welded to 2 or 1</td>
</tr>
<tr>
<td>5 welded to 5</td>
<td>5 ^b</td>
<td>and also 5 ^b welded to 2 or 1</td>
</tr>
<tr>
<td>6 welded to 6</td>
<td>6 ^b</td>
<td>and also 6 ^b welded to 2 or 1</td>
</tr>
<tr>
<td>7 welded to 7</td>
<td>7 ^c</td>
<td>and also</td>
</tr>
<tr>
<td>7 welded to 3</td>
<td>7 ^c welded to 3 ^a</td>
<td>and also 7 ^c welded to 2 or 1</td>
</tr>
<tr>
<td>7 welded to 2</td>
<td>7 ^c welded to 2 ^a</td>
<td>and also 7 ^c welded to 1</td>
</tr>
<tr>
<td>8 welded to 8</td>
<td>8 ^c</td>
<td>and also</td>
</tr>
<tr>
<td>8 welded to 6</td>
<td>8 ^c welded to 6 ^b</td>
<td>and also 8 ^c welded to 4 or 2 or 1</td>
</tr>
<tr>
<td>8 welded to 5</td>
<td>8 ^c welded to 5 ^b</td>
<td>and also 8 ^c welded to 6.2 or 6.1 or 4 or 2 or 1</td>
</tr>
<tr>
<td>8 welded to 3</td>
<td>8 ^c welded to 3 ^a</td>
<td>and also 8 ^c welded to 2 or 1</td>
</tr>
<tr>
<td>8 welded to 2</td>
<td>8 ^c welded to 2 ^a</td>
<td>and also 8 ^c welded to 1</td>
</tr>
</tbody>
</table>

a) Covers the equal or lower specified yield strength steels of the same group

b) Covers steels in the same sub-group and any lower sub-group within the same group

c) Covers steels in the same sub-group.
Specifications & Approval of Welding Procedures

**Governing Thickness For Approval Range**

The controlling thickness that determines the approval range in EN288-3 is dependant on the joint type; for example:- the controlling thickness is that of the thicker part, for a branch weld it’s the thickness containing the joint preparation. However in EN ISO 15614 both thicknesses in the joint are given independent approval ranges if they differ.

The thickness range also applies to the deposit thickness of multiple process welds. It is reasonable to consider a single run deposit in a multiple process weld to be a multiple run weld in determining its individual approval range.

Note the different plate thickness approval range for fillet welds.
# Specifications & Approval of Welding Procedures

## Range of Approval

**Butt and branch weld thickness and weld deposit**

<table>
<thead>
<tr>
<th>Test Piece Thickness (t) and also Deposit Thickness for multiple process welds</th>
<th>EN ISO15614-1</th>
<th>EN 288-3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Single run</td>
<td>Multiple run</td>
</tr>
<tr>
<td>≤ 3mm</td>
<td>0.7t- 1.3t</td>
<td>0.7t - 2t</td>
</tr>
<tr>
<td>&lt;3 ≤ 12mm</td>
<td>0.5t (3min) -1.3t</td>
<td>3mm - 2t</td>
</tr>
<tr>
<td>&gt;12 ≤ 100mm</td>
<td>0.5t-1.1t</td>
<td>0.5t - 2t</td>
</tr>
<tr>
<td>&gt;100mm</td>
<td>Not Applicable</td>
<td>50mm - 2t</td>
</tr>
</tbody>
</table>

Note:- The upper range of approval is 12mm if there is an impact requirement and impact testing has not been carried out
## Specifications & Approval of Welding Procedures

### Range of Approval

*Fillet weld thickness and Throat Thickness EN ISO15614-1*

<table>
<thead>
<tr>
<th>Test Piece Thickness (t)</th>
<th>Plate Thickness</th>
<th>Throat Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Single and Multiple Run</td>
<td>Single run</td>
</tr>
<tr>
<td>t ≤ 3mm</td>
<td>0.7t- 2t</td>
<td>0.75 a - 1.5 a</td>
</tr>
<tr>
<td>3 &lt; t &lt; 30mm</td>
<td>0.5t (3min) - 1.2t</td>
<td>0.75 a - 1.5 a</td>
</tr>
<tr>
<td>t ≥ 30mm</td>
<td>≥ 5mm</td>
<td>Throat thickness welded, No approval range</td>
</tr>
</tbody>
</table>

Fillet welds Qualified by butt welds:- The throat thickness approval range is based on the deposit thickness and the plate thickness range will have to be modified to that stated above.
## Specifications & Approval of Welding Procedures

### Range of Approval

**On Diameter**

<table>
<thead>
<tr>
<th>EN ISO 15614-1</th>
<th>EN 288-3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Test Piece</strong></td>
<td><strong>Approval</strong></td>
</tr>
<tr>
<td>&lt; 25mm OD</td>
<td>0.5D-2D</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;25mm OD</td>
<td>≥0.5D</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Plate</td>
<td>Pipe &gt;150mm in PA or PC</td>
</tr>
<tr>
<td></td>
<td>Pipe &gt; 500mm All Positions</td>
</tr>
</tbody>
</table>

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Range of Approval

Welding Position

The range of approval in EN ISO 15614-1 is exactly the same as EN 288-3.

If there is No impact or hardness survey requirement, one position covers all positions.

If Impact tests are required, the weld procedure approves other positions requiring the same or less heat input.

If a Hardness survey is required, the weld procedure approves other positions requiring the same or higher heat input.

If a test includes both a high and low heat input position, then all intermediate heat input positions are approved, refer to EN ISO 15614-1 figure 6

Note:- EN ISO 15614-1 requires heat input to be measured.

• When impacts are required the heat input is limited to + 25% of test value
• When Hardness is required the heat input is limited to - 25% of test value
Specifications & Approval of Welding Procedures

Range of Approval
Joint Type

The approval range for joint type in EN ISO 15614-1 and EN 288-3 are essentially the same

For Example:-
Butt welds approve fillet welds
Single sided welds approve backed, double sided and back gouged welds
Butt welds approve T-butt welds
Butt welds in pipe approve branch connections With angles between 60° - 90°
Backed welds approve double sided welds

N.B. a fillet weld approves a fillet weld only BUT if mechanical properties are important supplement with a butt weld

Shielding and backing gasses
Range of approval restricted to the EN439 gas symbol Or Restricted to Nominal composition Used in test if no EN439 code exists. A weld made without a backing gas also approves welding with a backing gas.

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Specifications & Approval of Welding Procedures

Range of Approval

Filler Metal EN ISO 15614-1

Filler Materials Cover Other materials subject to :-

- Equivalent mechanical properties
- Same type of covering, core or flux
- Same nominal composition
- Same or lower hydrogen content

If impact there is an impact requirement then the filler metal can not be changed from the brand used in the procedure test. This does not apply to solid wires of the same designation and nominal composition.

The size of the filler metal can be changed providing the heat input requirements, if required, are met.

Weld with a filler metal does no approve welds made without filler, or vice versa.

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EN ISO 15614 Part 8  Tube to tube-plate joints
EN ISO 15614 Part 8  Tube to tube-plate joints

Requirements similar to BS4870 Part 3

Welder Approvals to : EN ISO 9606 Part 1- 5 / EN1418 (Mechanised)

Size Of Test piece :-

Tube D < 40mm  10 tubes for Triangular Pitch, 12 for square

Tube D >= 40mm  7 tubes for Triangular Pitch, 9 for square

One pitch type approves all pitch types with the same or greater ligament dimension (d1)
EN ISO 15614 Part 8  Tube to tube-plate joints
EN ISO 15614 Part 8 Tube to tube-plate joints

Testing Requirements

Visual

- Penetrant
- Radiography to EN1435
- Macro 2 off full width and length of test piece (Along A and B)
- Hardness survey for materials in group 2,3,4,5,6,7
- Push Out Test Optional

The standard has its own acceptance criterion similar to EN ISO 5817
### EN ISO 15614 Part 8  Tube to tube-plate joints

#### Table 4 — Range of qualification for geometrical details

<table>
<thead>
<tr>
<th>Designation</th>
<th>Test piece in mm</th>
<th>Range of approval in mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cladding thickness</td>
<td>$t_1 &lt; 3$</td>
<td>$\geq t_1$</td>
</tr>
<tr>
<td></td>
<td>$t_1 \geq 3$</td>
<td>$\geq 3$</td>
</tr>
<tr>
<td>Tube-plate thickness</td>
<td>$t_2 &lt; 35$</td>
<td>$\geq t_2$</td>
</tr>
<tr>
<td></td>
<td>$t_2 \geq 35$</td>
<td>$\geq 35$</td>
</tr>
<tr>
<td>Tube-wall thickness, manual welding</td>
<td>$t$</td>
<td>$0.5 \cdot t$ to $2 \cdot t$</td>
</tr>
<tr>
<td>Tube-wall thickness, mechanized or automatic welding</td>
<td>$t$</td>
<td>$t \pm 0.2 \cdot t$</td>
</tr>
<tr>
<td>Tube-outside diameter</td>
<td>$d_a$</td>
<td>$\geq d_a$</td>
</tr>
</tbody>
</table>
EN ISO 9606    Welder Approval Testing

Note, the proposed revision to ISO 9606 Part 1 has not been agreed. Therefore EN287 Part 1 will continue, and all references in this document to ISO9606 Part 1 should read the latest version of EN287 Part 1

This does not affect the other parts of ISO 9606
EN ISO 9606     Welder Approval Testing

Note:- this standard should not be confused with ISO 9606 which currently exists, only the EN version is harmonised.

- EN 287 Part 1 : 2004 {was to have be replaced by EN ISO 9606 Part 1 but agreement could not be reached} : Published
  Fusion Welding Of Steel Materials

- EN ISO 9606 Part 2 {Replaces EN287 Part 2} : Not Published
  Fusion Welding Of Aluminium and its Alloys

- EN ISO 9606 Part 3 :1999 {No EN Equivalent} : Published
  Fusion Welding Of Copper and Copper Alloys

- EN ISO 9606 Part 4 :1999 {No EN Equivalent} : Published
  Fusion Welding Of Nickel and Nickel Alloys

- EN ISO 9606 Part 5 :2000 {No EN Equivalent} : Published
  Fusion Welding Titanium and Titanium Alloys, Zirconium and zirconium alloys
EN 287-1:2004 Welder Approval Testing

Test pieces for butt, fillet, pipe, fillet to pipe are identical to old EN 287-1

Each process in a multi process weld an be used separately with the range of thickness dictated by the deposit thickness attributed to that process, $t = s$.

**Range of Approval for Butt Welds**
Same as the old version of EN 287-1

**Range of Approval For Fillet Welds**
- Plate thickness, $t < 3$mm, Approves a range = $t$ to 3mm
- Plate thickness, $t \geq 3$mm, Approves all thicknesses from 3mm
- Single layer fillet weld approves single layer only
- Multi layer fillet weld approves single and multi layer

**Branch Welds**
Qualified by pipe butt welds for branch angles $\geq 60^\circ$

- Set on: Branch diameter and branch thickness considered in approval
- Set in: Main pipe thickness and branch diameter considered in approval
**EN 287-1:2004 Welder Approval Testing**

**Diameters**

The approval range for pipe diameters according to EN ISO 9606-1 :-

- Pipe Diameter < 25mm  \(D \text{ to } 2D\)
- Pipe Diameter > 25mm  \(0.5D \text{ (25mm Min) and above } + \text{ Plates}\)

Note:-
The testing of small bore pipes require a minimum circumference of 150mm, or additional test pieces must be welded to a maximum of 3.
<table>
<thead>
<tr>
<th>Group</th>
<th>Approval Range</th>
<th>Grade</th>
<th>Old EN 287-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1, 1.2, 1.4</td>
<td>1.1, 1.2, 1.4</td>
<td>C steel ≤460 Re</td>
<td>WO1</td>
</tr>
<tr>
<td>2 + 1.3</td>
<td>1, 2, 3, 9.1, 11</td>
<td>TMCP steel &gt;360 Re</td>
<td>WO3</td>
</tr>
<tr>
<td>3</td>
<td>1, 2, 3, 9.1, 11</td>
<td>Q+T, PH steels &gt;360 Re</td>
<td>WO2</td>
</tr>
<tr>
<td>4</td>
<td>1, 2, 3, 9.1, 4, 5, 6, 7, 11</td>
<td>Low V CrMo steels</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1, 2, 3, 9.1, 4, 5, 6, 7, 11</td>
<td>C ≤ 0.35 CrMo, noV steel</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>1, 2, 3, 9.1, 4, 5, 6, 7, 11</td>
<td>High V CrMo(Ni) steel</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>1, 2, 3, 9.1, 4, 5, 6, 7, 11</td>
<td>10.5 ≤ Cr ≤ 30 steel</td>
<td>WO4</td>
</tr>
<tr>
<td>8</td>
<td>8, 9.2, 9.3, 10</td>
<td>Austenitic steel</td>
<td>W11</td>
</tr>
<tr>
<td>9.1</td>
<td>1, 2, 3, 9.1, 11</td>
<td>Ni steels &lt; 3% max</td>
<td></td>
</tr>
<tr>
<td>9.2, 9.3</td>
<td>9.2, 9.3, 1.1, 1.2, 1.4</td>
<td>Ni steels 10% max</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>8, 9.2, 9.3, 10</td>
<td>Duplex stainless steel</td>
<td>W11</td>
</tr>
<tr>
<td>11</td>
<td>1.1, 1.2, 1.3, 1.4, 11</td>
<td>C steels 0.25&lt;C ≤0.5</td>
<td></td>
</tr>
</tbody>
</table>
EN 287-1:2004 Welder Approval Testing

Range of Approval for Electrode Coating

The approval range for EN 287-1:2004 is similar to the old EN287-1.

For a single sided root run with no backing, no change of flux type is permitted. The following approval range is permitted for the fill and capping runs:

• Basic approves basic (B), rutile (R), acid (A) and combinations
• Cellulosic (C) approves cellulosic only
• Rutile approves R, RR, RA, RB, RC

EN 287-1:2004 also differentiates between solid and cored wires
A solid wire approves metal cored and vice versa, but not Flux cored wires.
Basic FCAW approves all FCAW wires
Rutile approves rutile and basic wires only

General: The filler material must be compatible with the parent material used for the test weld.
EN 287-1:2004 Welder Approval Testing

Range of Approval on Position

EN 287-1: 2004 Has a similar positional approval range to the old EN287-1

Generally more difficult position approves for easier positions

- e.g. fixed inclined pipe approves all except V-down (PG)
- Overhead (PE) approves all except V-down (PG)

JL045 Approves all positions except HL045 and PF

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EN 287-1:2004 Welder Approval Testing

Validity Of Approval

The prolongation rules are the same for both EN 287-1:2004 and EN 287-1:1992

EN 287-1:2004

Valid for 2 years, providing that the welder's supervisor can confirm that at every six month period the welder has been working within his range of qualification.

Prolonged for periods of 2 years by examining the body, on the basis of satisfactory evidence from volumetric testing on at least two items of production work or test welds, produced in the previous six month period. They must be traceable to the welder, satisfy the acceptance requirements of EN ISO 5817 and reproduce the original test conditions. The evidence of these tests must be retained for 2 years.
EN ISO 9606    Welder Approval Testing

EN ISO 9606-3:1999    Copper and Copper Alloys

W 31: Pure copper
W 32: Copper-zinc alloys
W 33: Copper-tin alloys
W 34: Copper-nickel alloys
W 35: Copper-aluminium alloys
W 36: Copper-nickel-zinc alloys

Thickness range is 0.5t to 1.5t for all thicknesses

Acceptance is EN 30042 all level B except for the defects permitted by EN287-1 as level C.
EN ISO 9606 - 4: 1999 Nickel and Nickel Alloys

W 41: Pure nickel
W 42: Nickel-copper alloys
W 43: Nickel-chromium alloys
W 44: Nickel-molybdenum alloys
W 45: Nickel-iron-chromium alloys
W 46: Nickel-chromium-cobalt alloys
W 47: Nickel-iron-chromium-copper

A test in W41 approves W41 to W47 not vice versa
A test in any group W42 to W47 approves all of the groups
A test in any group W41 to W47 approves 8 {Austenitic Stainless Steel}

Acceptance is the same as EN 287-1:2004 EN ISO 5817

Thickness and diameter approval ranges are basically the same as EN287-1:2004

Note:- The alloy content for W41 to W47 is based on CR12187 which has now been superseded by CR15608. This reduces the qualifying Nickel content for group 44 from a minimum of 45% to 30%
EN 1418 Approval of welding operators

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EN 1418  Approval of welding operators :-
Fusion and Resistance Welding

Definitions

• Mechanised welding :- Adjustment during welding possible
• Automatic Welding :- Adjustment during welding not required

Welding Operators/ Resistance weld setters

• Set up equipment and/or adjust it during welding: Testing Required
• Operators that can’t adjust the equipment. i.e. Button pushers, don’t need testing

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EN 1418 Approval of welding operators: -
Fusion and Resistance Welding

APPROVALS

4.21 Adopt EN288 Part 3 or 4 for testing, but approval range for thickness and diameter based on capacity of equipment used. A WPS must be followed.

4.22 Pre Production test to EN 288 Part 8 or equivalent. Must follow a WPS and approval range same as 4.21.

4.23 Production sampling, Set up equipment and sample test production welds. Test method subject to agreement between contracting parties.

4.24 Function Test, On the job Job Knowledge test: -

- Knowledge of welding
- Parameters V welding results
- Setting up equipment to WPS
- Test equipment to WPS
- Knowledge of malfunctions (SAFED knowledge test in preparation)
EN 729 Quality requirements for fusion welding

This standard can be used either as part of an ISO 9000 Quality system, or to define quality requirements where a formal quality system is not required.

Despite the versatility of this standard it has so far failed to generate any serious interest within the European fabrication industry.
EN 729 defines management quality requirements for fusion welding. This incorporates the following parts:

EN 729: Quality Requirements for Welding
- EN 729 Part 1: Guide to selection and use
- EN 729 Part 2: Comprehensive Quality Requirements
- EN 729 Part 3: Standard Quality Requirements
- EN 729 Part 4: Elementary Quality Requirements
- PDCR 13576: Implementation of EN 729

Parts 2 and 3 of these documents also make reference to EN 719 - Welding Co-ordination, Tasks and Responsibilities.

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EN729

Welding exerts a profound influence on the cost of fabrication and quality of the product. It is important, therefore, to ensure that welding is carried out in the most effective way and that appropriate control is exercised over all aspects of the operation.

Within the EN 29000 series of standards for quality systems, welding is to be treated as a 'Special Process' since welds cannot be fully verified by subsequent inspection and testing of the product to ensure that the required quality standards have been met.

Quality cannot be inspected into a product, it has to be built into it. Even the most extensive and sophisticated non-destructive testing does not improve the quality of welds.

Supervision needs to be implemented to ensure that the specified quality will be achieved. Responsibilities defined in EN 719.
# EN 729 Sample Of Requirements

<table>
<thead>
<tr>
<th>REQUIREMENT</th>
<th>COMPREHENSIVE</th>
<th>STANDARD</th>
<th>ELEMENTARY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Part 2</td>
<td>Part 3</td>
<td>Part 4</td>
</tr>
<tr>
<td>Contract Review</td>
<td>Full Documented Review</td>
<td>Less Extensive</td>
<td>Establish that capability and information is available</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Review</td>
<td></td>
</tr>
<tr>
<td>Design Review</td>
<td>Design for Welding to be confirmed</td>
<td>Design for Welding to be confirmed</td>
<td>As above</td>
</tr>
<tr>
<td>Sub-contractor</td>
<td></td>
<td>Treat like a main fabricator</td>
<td>Must comply to standard</td>
</tr>
<tr>
<td>Welders/ Operators</td>
<td></td>
<td>Approved to (EN 287)</td>
<td></td>
</tr>
<tr>
<td>Welding Co-ordination</td>
<td>European Welding Engineer, or persons with appropriate knowledge</td>
<td>European Welding Engineer, or persons with appropriate knowledge</td>
<td>Not demanded but personal responsibility of manufacturer</td>
</tr>
<tr>
<td>Inspection Personnel</td>
<td>Sufficient and competent personnel to be available</td>
<td></td>
<td>Sufficient and competent access for external inspectors, as needed</td>
</tr>
</tbody>
</table>

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## EN 729 Sample Of Requirements Continued

<table>
<thead>
<tr>
<th>REQUIREMENT</th>
<th>COMPREHENSIVE</th>
<th>STANDARD</th>
<th>ELEMENTARY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weld Procedure Approval</td>
<td>To EN 288 Part 2 - Approved as application standard or contract demands</td>
<td></td>
<td>No demands</td>
</tr>
<tr>
<td>Work Instructions</td>
<td>Welding Specification or dedicated Instructions to be available (WPS)</td>
<td></td>
<td>No demands</td>
</tr>
<tr>
<td>Documentation</td>
<td>Necessary</td>
<td>Not specified</td>
<td>No demands</td>
</tr>
<tr>
<td>Batch testing of consumables</td>
<td>Only if specified in contract</td>
<td>Not specified</td>
<td>No demands</td>
</tr>
<tr>
<td>Storage and treatment of welding consumables</td>
<td>As per supplier recommended as minimum</td>
<td></td>
<td>No demands</td>
</tr>
<tr>
<td>Storage of raw materials</td>
<td>Protection required from influence by the environment</td>
<td></td>
<td>No demands</td>
</tr>
<tr>
<td>Post Weld Heat Treatment</td>
<td>Specification and complete record</td>
<td>Confirmation to specification necessary</td>
<td>No demands</td>
</tr>
<tr>
<td>Inspection before - during - after welding</td>
<td>As required for specified operations</td>
<td></td>
<td>Responsibilities as specified in contract</td>
</tr>
<tr>
<td>Non-conformances</td>
<td>Procedures must be available</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>