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Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 8: Welding of tube to tube-plate joints

Descriptif et qualification d'un mode opératoire de soudage sur les matériaux métalliques — Epreuve de qualification d'un mode opératoire de soudage — Partie 8: Soudage de tubes sur plaques tubulaires

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 15614-8 was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 10, and by Technical Committee CEN/TC 121, *Welding* in collaboration.

This second/third/... edition cancels and replaces the first/second/... edition (EN ISO 15614-8:2002), [clause(s) / subclause(s) / table(s) / figure(s) / annex(es)] of which [has / have] been technically revised.

ISO 15614 consists of the following parts, under the general title *Specification and qualification of welding procedures for metallic materials — Welding procedure test*:

- *Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys*
- *Part 2: Arc welding of aluminium and its alloys*
- *Part 3: Arc welding of cast irons*
- *Part 4: Finishing welding of aluminium castings*
- *Part 5: Arc welding of titanium, zirconium and their alloys*
- *Part 6: Arc welding of copper and its alloys*
- *Part 7: Overlay welding*
- *Part 8: Welding of tubes to tube-plate joints*
- *Part 9: Underwater hyperbaric wet welding*
- *Part 10: Hyperbaric dry welding*
- *Part 11: Electron and laser beam welding*
- *Part 12: Spot, seam and projection welding*
- *Part 13: Flash and butt welding*

Introduction

This standard is part of a series of standards, details of this series are given in ISO 15607, Annex A.

Consideration of previous procedure qualifications to former national standards or specifications should be at the time of the enquiry or contract stage and agreed between the contracting parties.

Requests for official interpretations of any aspect of this standard should be directed to the secretariat if ISO/TC 44/SC10 via your national standards body, a complete listing which can be found at www.iso.org.

Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 8: Welding of tube to tube-plate joints

1 Scope

This **International** Standard specifies requirements for the qualification testing of welding procedures for the arc welding of tube to tube-plate joints in metallic materials by manual, **partly mechanized**, mechanized or automatic processes.

This standard is a part of a series of standards. Details of this series are given in ISO 15607, Annex A.

Qualification by tube to tube-plate joint tests can be used for all joints even if they are fully loaded or only seal welded as required in application standards.

In such cases, one or more special test pieces should be made to simulate the production joint in all essential features, e.g. dimensions, restraint, heat sink effects. The test should be carried out prior to and under the conditions to be used in production.

This standard applies to fusion welding of metallic materials for tube to tube-plate joints with **a gap between the tube and the tube plate for some length of the tube plate thickness**. This standard does not apply to tube-sheets with forged end connections with welded tubes (external/internal bore welds).

For welding of tube to tube-plate joints **with mechanical expansion which is load bearing** welding procedure test should be defined in the specification.

For other applications and/or requirements the standard can be used if required by the specification.

Repair welding should be considered in the welding procedure test.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 9606-1 EN 287-1, *Qualification test of welders — Fusion welding — Part 1: Steels*

ISO 3452-1 EN 571-1, *Non destructive testing — Penetrant testing — Part 1: General principles*

ISO 17639 EN 1321, *Destructive tests on welds in metallic materials — Macroscopic and microscopic examination of welds*

ISO 14732, *Welding personnel — Approval testing of welding operators for fusion welding and resistance weld setters for fully mechanized and automatic welding of metallic materials*

ISO 17636 EN 1435, *Non destructive examination of welds — Radiographic examination of welded joints*

EN 1708-1, *Welding — Basic weld joint details in steels — Part 1: Pressurized components*

ISO 4063, *Welding and allied processes — Nomenclature of processes and reference numbers*

ISO 6520-1, *Welding and allied processes — Classification of geometric imperfections in metallic materials — Part 1: Fusion welding*

ISO 9015-1, *Destructive tests on welds in metallic materials — Hardness testing — Part 1: Hardness test on arc welded joints*

ISO 9606-2, *Qualification test of welders — Fusion welding — Part 2: Aluminium and aluminium alloys*

ISO 9606-3, *Approval testing of welders — Fusion welding — Part 3: Copper and copper alloys*

ISO 9606-4, *Approval testing of welders — Fusion welding — Part 4: Nickel and nickel alloys*

ISO 9606-5, *Approval testing of welders — Fusion welding — Part 5: Titanium and titanium alloys, zirconium and zirconium alloys*

ISO 9692-1, *Welding and allied processes — Recommendations for joint preparation — Part 1: Manual metal-arc welding, gas-shielded metal-arc welding, gas welding, TIG welding and beam welding of steels*

ISO 14175, *Welding consumables — Gases and gas mixtures for fusion welding and allied processes*

ISO 15607:2003, *Specification and qualification of welding procedures for metallic materials — General rules*

ISO/TR 15608, *Welding — Guidelines for a metallic materials grouping system*

ISO 15609-1:2004, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 1: Arc welding*

ISO 15614-1:2004, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 15607 apply.

4 Symbols and abbreviated terms

For the purposes of this standard, the following symbols apply and are shown in Figures 1, 2 and 3:

- a throat thickness (mm) (in this case, the minimal distance between root point and weld surface)
- d_p pore size (mm)
- d_a tube-outside diameter (mm)
- d_l minimum distance between two pipes (mm), see Figure 2
- g gap between tube and tube plate
- s_p starting point of the root run
- t tube-wall thickness (mm)
- t_1 cladding thickness (mm)

t_2 tube-plate thickness (mm)

x overlap (mm)

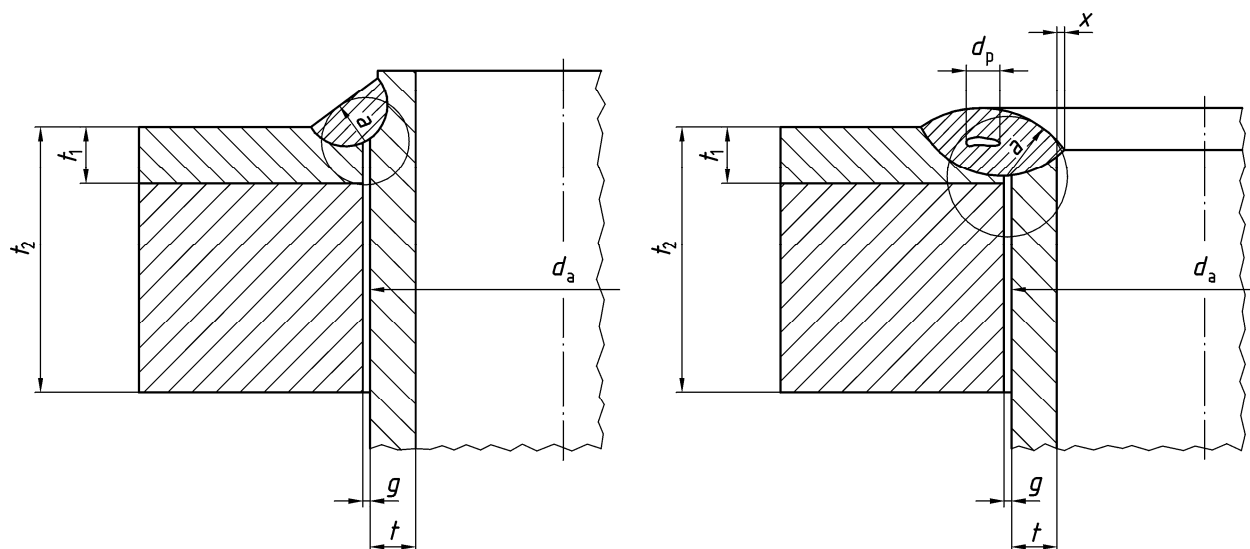


Figure 1 — Presentation of symbols in an example

5 Preliminary Welding Procedure Specification (pWPS)

5.1 General

The qualification for tube to tube-plate welding tests shall be based on a pWPS in accordance with ISO 15609-1:2004. It shall specify the relevant parameters listed in 5.2 and 5.3.

5.2 Items for all welding process

Details relating to the following items shall be recorded for all welding processes :

- welding process, or processes when more than one is used in making a complete joint ;
- tube-plate specification and thickness and details of any cladding and its thickness ;
- tube specification, thickness and outside diameter ;
- pitch type (square or triangular) and distance between pipes ;
- joint geometry, actual borehole diameter and fit-up tolerances (sketch) in accordance with ISO 9692-1;
- cleaning and degreasing (time during the fabrication steps and type) ;
- jigging or tacking, tacking position and expansion;
- tube-plate and welding position ;
- type and/or trade name of welding consumables ;
- size (diameter) and wire lengths per run ;
- pre-heating and interpass temperature, including method of control ;

- l) welding speed (mechanized welding) ;
- m) number and arrangement of runs, starting points of runs and weld dimensions (sketch) ;
- n) welding sequence ;
- o) post-weld heat treatment, including method of control ;
- p) if necessary, the temperature and time recommended for drying/backing of welding consumables before use ;
- q) any special features, including heat **input** control requirements, any heat sinks effects or post-weld tube expansion.

5.3 Items for particular welding processes

Details relating to the items given in 5.3 a) to 5.3 d) shall be recorded for these particular processes, in addition to the items given in 5.2. The reference numbers of welding processes relate to ISO 4063.

- a) Manual metal arc welding (111)
 - alternating or direct current and polarity ;
 - current.
- b) MIG welding, MAG welding, solid wire or cored wire, with or without separate gas shield (114), (131), (135), (136), (137)
 - shielding gas designation in accordance with ISO 14175 and flow rate ;
 - arc voltage ;
 - wire feed speed or current ;
 - for pulsed welding : the pulse time and frequency, pulsed current and background current.
- c) TIG welding (141)
 - shielding gas designation in accordance with ISO 14175 and flow rate ;
 - alternating current (AC) or direct current (DC) and polarity ;
 - current in ampere ;
 - for pulsed welding : the pulse time and frequency, pulsed current and background current ;
 - whether filler metal is used.
- d) Mechanized or automatic welding
 - all items detailed in b) or c) and the following items if necessary :
 - arc length or arc voltage ;
 - where filler metal is used its rate of addition or wire feed speed relating to the wire diameter (see 5.2j));
 - other pre-programmed welding variables such as :

- pre- and post-gas purge times ;
- changes in current level ;
- current slope up and down rates ;
- welding travel speed and degree of overlap ;
- when considering front face welding, the following additional information :
 - radius of electrode rotation ;
 - electrode angle relative to the tube axis ;

For all other welding processes, the welding parameters shall be specified.

6 Qualification of welding procedure

The qualification of welding procedure for the tube to tube-plate welding shall be carried out by an examiner or examining body related to the appropriate application standard or specification.

7 Welding of test pieces

7.1 General

Procedure test pieces shall be produced in accordance with 7.2 and shall simulate the joint geometry to be used in production or a similar geometry within the requirements of clause 5. Welders shall be qualified in accordance with ISO 9606-1, ISO 9606-2, ISO 9606-3, ISO 9606-4 or ISO 9606-5. For welding operators and weld setters, the qualification can be carried out during the tests in accordance with ISO 14732.

7.2 Type of test piece

7.2.1 Joint preparation and joint construction

Examples of joint preparation according to ISO 9692 and joint construction are given in EN 1708-1.

7.2.2 Tube ends welded on triangular pitch

Where tube end welds are involved on a triangular pitch, a minimum of 10 tube ends with an outside diameter smaller than 40 mm (< 40 mm) or a minimum of 7 tube ends (area A) with an outside diameter greater than or equal to 40 mm (≥ 40 mm), shall be welded as shown in Figure 2.

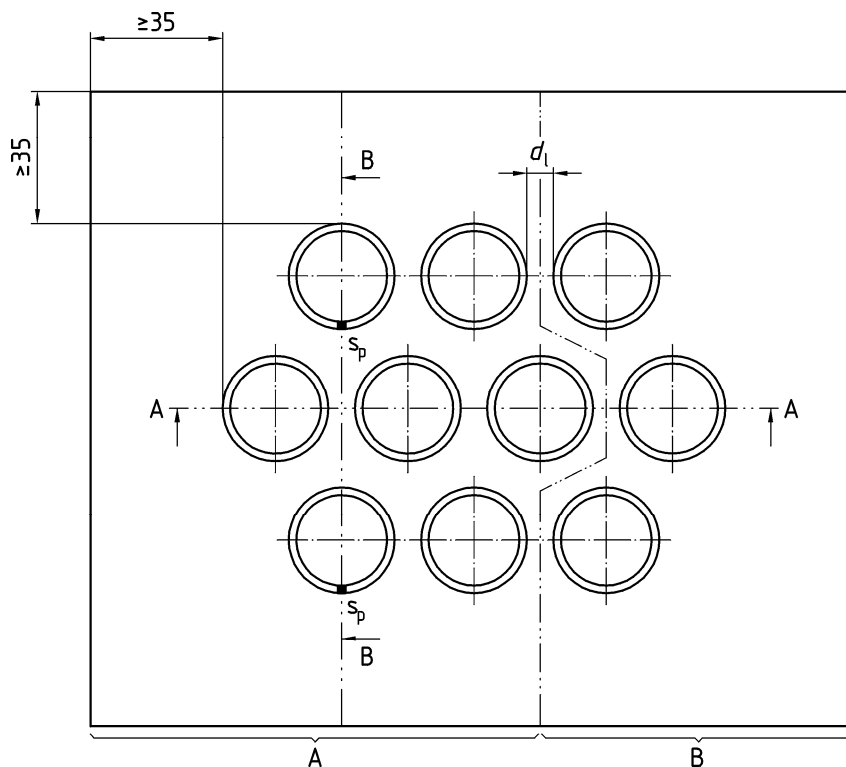


Figure 2 — Test piece for tube ends on triangular pitch

Key

d_l Minimum distance between two pipes

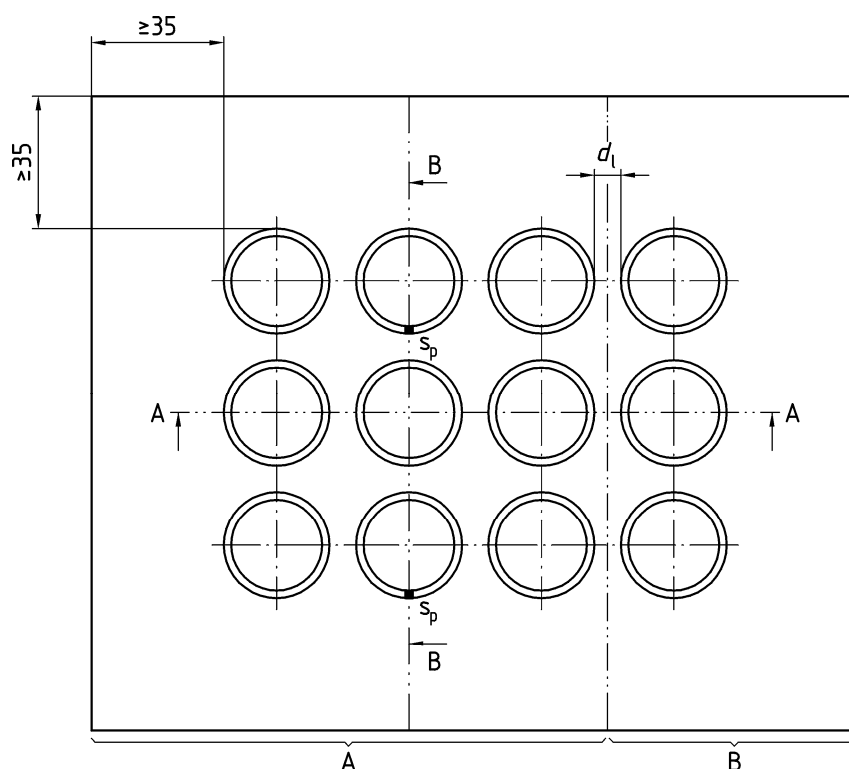
s_p Starting point of the root run

A-A/B-B Ground sections of a test specimen (examples for the location of the cut lines)

7.2.3 Tube ends welded on square pitch

Where tube end welds are involved on a square pitch, a minimum of 12 tube ends with an outside diameter smaller than 40 mm (< 40 mm) or a minimum of nine tube ends (area A) with an outside diameter greater than or equal to 40 mm (≥ 40 mm) shall be welded as shown in Figure 3.

Dimensions in millimetres

**Key** d_l Minimum distance between two pipes s_p Starting point of the root run

A-A/B-B Ground sections of a test specimen (examples for the location of the cut lines)

Figure 3 — Test piece for tube ends on square pitch**8 Examination and testing****8.1 Performance****8.1.1 General**

For a welding procedure to be qualified the same test piece representing the welding procedure test shall comply with 8.1.2 to 8.1.6 and, when specified, with the push-out tests described in 8.1.7.

Table 1 — Examination and testing of the test pieces

Orientation of tubes in the tube plate	Number of welds and Type of test	Extent of testing
Triangular pitch, see Figure 2	- $D_a < 40$ mm (10 tube ends) - $D_a \geq 40$ mm (7 tube ends) - Visual testing - Penetrant testing - Radiographic testing ^a - Macroscopic examination - Hardness test (row) ^b - Push-out or pull-out test	100 % 100 % 100 % 6 specimen ($D_a < 40$ mm) 5 specimen ($D_a \geq 40$ mm) 1 specimen at the first tube end which was welded - if required by specification
Square pitch, see Figure 3	- $D_a < 40$ mm (12 tube ends) - $D_a \geq 40$ mm (9 tube ends) - Visual testing - Penetrant testing - Radiographic testing - Macroscopic examination - Hardness test (row) ^b - Push-out or pull-out test	100 % 100 % 100 % 7 specimen ($D_a < 40$ mm) 6 specimen ($D_a \geq 40$ mm) 1 specimen at the first tube end which was welded - if required by specification
^a Except those for push-out or pull-out test.		
^b For steel groups 2, 3, 4, 5, 6 and 7 and for dissimilar joints between austenitic and ferritic steels (except steel group 1).		

8.1.2 Visual testing

After appropriate cleaning and if required any post-weld heat treatment, and prior to the cutting of test specimens, the test piece shall be tested visually according to ISO 17637.

The welds shall show uniform contour without excessive reinforcement, with the bores of the tube free from any spatter and shall be in accordance with Table 2.

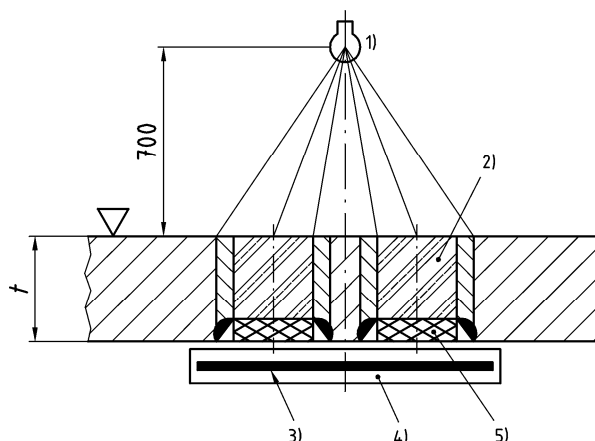
8.1.3 Penetrant testing

The external surfaces of all welds shall be subjected to penetrant examination in accordance with ISO 3452-1.

8.1.4 Radiographic testing

All test welds, except those for push-out tests, shall be radiographed in accordance with ISO 17636. An example is given in Figure 4. In this case, the tube-plate shall be reduced in thickness of 5 mm to 12 mm.

Dimensions in millimetres



Key

- 1) Ray source
- 2) Radiated marcassite (steel/lead)
- 3) Film
- 4) Film cassette
- 5) Stopper

Figure 4 — Performance of the radiographic examination

8.1.5 Macroscopic examination

After visual and non-destructive examination, the test piece shall be sectioned as shown in Figures 2 and 3, by sawing or machining and exposing two starting points of the root runs. The macroscopic examination specimens shall be prepared and examined in accordance with **ISO 17639**.

Macroscopic examinations of additional sections to assess compliance with the acceptance levels in 8.2 shall be carried out where radiography reveals imperfections other than gas pores.

8.1.6 Hardness test

A hardness row normally HV 10 in accordance with ISO 9015-1 shall be carried out only for the steel groups 2, 3, 4, 5, 6 and 7 in accordance with ISO/TR 15608 and for dissimilar metal joints between austenitic and ferritic steels.

The hardness shall be recorded for the weld metal, both parent metals and the heat-affected zones.

8.1.7 Push-out or pull-out test

If required by the specification, push-out or pull-out tests can be required.

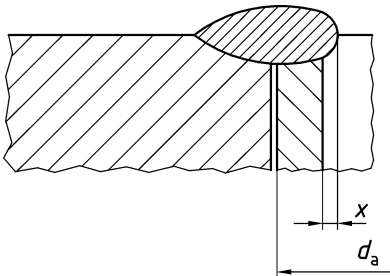
8.2 Acceptance levels

8.2.1 General

It should be appreciated that the following details are being used for the qualification testing of welding procedures and as such may be different from those specified for a particular application.

8.2.2 Visual testing

Table 2 — Visual examination

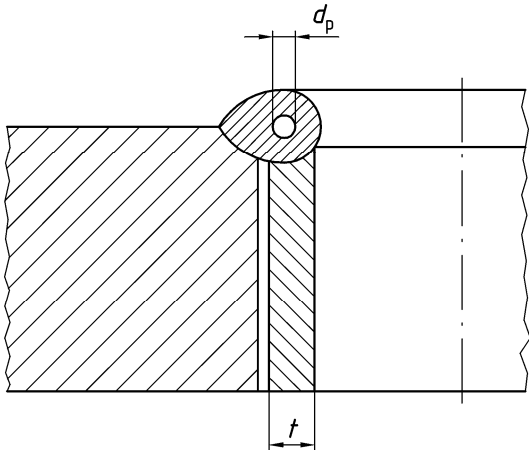
N°	Imperfection/ designation	ISO 6520-1 reference N°	Remarks	Limits for imperfections
1	Cracks	100	all types of cracks	not permitted
2	Crater crack	104		not permitted
3	Surface pore open end crater pipe	2017 2024	all types of pores, they are visible on the surface	not permitted
4	Burn through of tube wall			not permitted
5	Overlap	506		$x \leq 0,5 \text{ mm}$ for tubes, $d_a \leq 25 \text{ mm}$ outside diameter and $x \leq 1 \text{ mm}$ for tubes, $d_a > 25 \text{ mm}$ outside diameter
6	Burn down of tube end (only fillet welds)			not permitted; where it reduces the weld below its required dimensions
7	Undercut	5011		0,1 t

8.2.3 Penetrant testing

Any indication of dimensions in the weld metal or heat-affected zone is not acceptable.

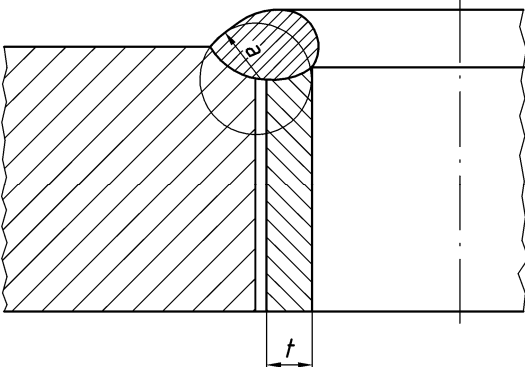
8.2.4 Radiographic testing

Table 2 — Radiographic testing

N°	Imperfection/ designation	ISO 6520-1 reference N°	Remarks	Limits for imperfections
8	Cracks	100	all types of cracks	not permitted
9	Elongated cavities, wormholes	2015 2016		not permitted
10	Clustered (localized) cavities	2013		not permitted
11	Gas pores uniformly distributed, porosity, linear porosity	2011 2012 2014	 - per tube joint max. two pores with pore size d_p permitted as measured on the image - distance between two pores min. distance $2 \times d_p$ in direction of circumference	$d_p \leq 0,25 t$ max. 1 mm
12	Solid inclusions	300		not permitted
13	Lack of fusion	401		not permitted
14	Lack of penetration	402		not permitted

8.2.5 Macroscopic examination

Table 3 — Macroscopic examination

N°	Imperfection/ designation	ISO 6520-1 reference N°	Remarks	Limits for imperfections
8 to 14	see Table 2			
15	Weld thickness		 The throat dimension a is equal to the radius of the largest circle totally inscribed in the weld whose centre is situated in the root of weld	$a \geq 0,9 t$

8.2.6 Hardness values

The results from the hardness test shall meet the requirements given in ISO 15614-1.:2004, Table 2.

8.2.7 Push-out or pull-out load

The requirements should be defined in the specification.

8.3 Re-test

If the test piece fails to comply with any of the requirements for examination specified in 8.1, one further test piece shall be welded and subjected to the same examination. If this additional test piece does not comply with the requirements, the welding procedure test has failed.

9 Range of qualification

9.1 General

All the conditions of validity stated below shall be met independently of each other. Changes outside of the ranges specified shall require a new welding procedure test.

9.2 Related to the manufacturer

A qualification of a WPS obtained by a manufacturer is valid for welding in workshops and sites under the same technical conditions and quality control of that manufacturer.

9.3 Related to the material

9.3.1 Parent metal

For the purposed of this standard, the groups of materials listed in ISO/TR 15608 shall apply. For the range of qualification the relevant part of ISO 15614¹⁾ shall be used.

9.3.2 Tube-plate and tube dimensions

For all geometrical details the ranges of qualification are given in Table 4.

Table 4 — Range of qualification for geometrical details

Designation	Test piece in mm	Range of approval in mm
Cladding thickness	$t_1 < 3$ $t_1 \geq 3$	$\geq t_1$ ≥ 3
Tube-plate thickness	$t_2 < 35$ $t_2 \geq 35$	$\leq t_2$ ≥ 35
Tube-wall thickness	t	0,5 t to 2 t
Tube-outside diameter	d_a	$\geq d_a$

9.3.3 Tube pitch

The qualification of a welding procedure using a particular pitch of tubes shall include qualification for any other type of pitch provided that the minimum distance between two pipes d_1 (see Figures 2 and 3) is not reduced to below that used in the qualified welding procedure.

9.4 Common to all welding procedures

9.4.1 Welding process

The qualification is valid only for the welding process used in the welding procedure test. In a multi-process procedure test the qualification is only valid for the order used during the qualification test.

9.4.2 Welding position of tube-plate

The qualification is only valid for the welding position used in the welding procedure test.

¹⁾ As long as relevant parts are under preparation the range of qualification should be in accordance with the specification.

9.4.3 Type of joint

The qualification is only valid for the type of welded joints used in the welding procedure test.

9.4.4 Filler metal, classification

The qualification range of filler metals covers other filler metals as long as they are :

- either in the same group of tensile properties. Change in the type of coating will entail new qualification of the welding procedure;
- or within the same nominal chemical composition.

9.4.5 Filler metal, dimensions

The qualification given is for the diameters of electrodes or for the diameters of wires or for special consumables, e.g. inserts, used in the welding procedure test.

9.4.6 Type of current

The qualification given is for the type of current (alternating, direct or pulsed current) and polarity used in the welding procedure test.

9.4.7 Heat input

The requirements of this clause only apply when the control of heat input is specified.

When hardness requirements apply, the lowest limit of heat input is that used in welding procedure test or may be 25 % greater than that used in welding the test piece.

9.4.8 Pre-heat temperature

The lower limit of qualification is the pre-heat temperature used at the start of the welding procedure test.

9.4.9 Interpass temperature

The upper limit of qualification is the nominal interpass temperature reached in the welding procedure test.

9.4.10 Post-weld heat treatment

Welding procedure test with heat treatment does not include welding procedure test without heat treatment and vice versa. The temperature range used for the welding procedure test is the range qualified. Where required, heating rates, cooling rates and holding time shall be related to the production component.

9.4.11 Shielding gas

The qualification given to the shielding gas is restricted to the type of gas (nominal composition) in accordance with ISO 14175 used in the welding procedure test.

10 Welding, Procedure Qualification Record form (WPQR)

A Welding Procedure Qualification Record (WPQR) is a statement of the results of assessment of each test piece including re-tests. The relevant items listed for the WPS in clause 5 of this standard shall be included, together with details of any features that would be rejectable by the requirements of clause 8.

If no rejectable features or unacceptable test results are found, a WPQR detailing the welding procedure test piece results is qualified and shall be signed and dated by the examiner or examining body.

A WPQR format shall be used to record details for the welding procedure and the test results, in order to facilitate uniform presentation and assessment of the parameters.

An example of the WPQR-form is shown in annex A.

Annex A (informative)

Welding Procedure Qualification Record form for tube to tube-plate joints (WPQR)

Welding procedure qualification - Test certificate

Manufacturer's welding procedure
Reference N° :

Examiner or examining body
Reference N° :

Manufacturer :

Address :

Code/Testing standard :

Date of welding :

Extent of qualification

Welding process :

Joint type :

Parent metal (s) : tube-plate : Cladding : Tube :

Thickness of tube-plate (mm) : Cladding (mm) : Tube (mm) :

Tube-outside diameter (mm) : Gap (g) (mm) :

Filler metal type :

Shielding gas :

Type of welding current :

Welding positions :

Pre-heat :

Post-weld heat treatment :

Other information :

.....

.....

Certified that test welds prepared, welded and tested satisfactorily in accordance with the requirements of the code/testing standard indicated above

.....
Location Date of issued Examiner or examining body

Name, date and signature

Details of tube to tube-plate joint tests

Location:
 Manufacturer's welding procedure
 Reference N°.:
 WPQR N°.:

Examiner or examining body:

Method of preparation and cleaning:

Parent material specification: - tube-plate:
 - cladding:
 - tube:
 Material thickness (mm): - tube-plate :
 - cladding:
 - tube:

Manufacturer:

Welder's name:

Welding process:

Joint type:

Tube-outside diameter (mm):

Welding position:

Sketch of test piece in accordance with clause 6	Sketch of the joint preparation

Welding details

Run	Process	Size of filler metal mm	Current A	Voltage V	Type of current/polarity	Wire feed speed m/min	Travel speed *) cm/min	Heat input *) Kj/cm

Cleaning and degreasing :

Filler metal classification and trade name :

Any special baking or drying :

Gas shielding :

Gas flow rate - shielding :

Tungsten electrode type/size :

Details of fastening of tubes before welding :

Preheat temperature :

Interpass temperature :

Post-weld heat treatment and/or ageing :

Time, temperature, method :

Heating and cooling rates *):

Remarks :

Further information *):

(see on a separate sheet)

Manufacturer

Examiner or examining body

.....

.....

Name, date and signature

Name, date and signature

*) If required

Further information

Oscillation (amplitude, frequency) :

Distance contact tube/ workpiece::

Torche angle :

Current increase (A) from : to : in : (s)

Pool formation (A) : Time (s) :

Wire rate (mm/s) :

..... for 1st run **) : for 2nd run **) :

Min. current (A) :

..... for 1st run **) : for 2nd run **) :

Max. current (A) :

..... for 1st run **) : for 2nd run **) :

Pulse frequency :

Circulation time (s) :

..... for 1st run **) : for 2nd run **) :

Current decrease (A) from : to : in : (s)

Pulse, wire : yes no

Pulse, rotary : yes no

Manufacturer of weld machine : **)

.....

.....

.....

Current : **)

Polarity : **)

**) Welding data for automatic welding

Test results

Manufacturer's welding procedure

Examiner or examining body

Reference N° :

Reference N° :

Visual testing

without objections	with objections	Remarks
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Penetrant testing

without objections	with objections	Remarks
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Radiographic testing

without objections	with objections	Remarks
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Macroscopic examination

Weld thickness			Assessment	Remarks
required	measured		without objections with objections	
		min. (mm)		
		max. (mm)		
acceptable	yes	no		

Hardness test *)**

Type/load :

Parent metal :

HAZ :

Weld metal :

Push-out or pull-out test *)**

	R _e (N/mm ²)	R _m (N/mm ²)	Fracture location	Remarks
Requirements				

***) If required.

Other tests :

Remarks :

.....

.....

Tests carried out in accordance with the requirements of :

Laboratory report reference N° :

The test results are - acceptable not acceptable

Test carried out in the presence of

Examiner or examining body

.....

Name, date and signature