# INTERNATIONAL STANDARD

# ISO 15614-14

First edition 2013-06-15

# Specification and qualification of welding procedures for metallic materials — Welding procedure test —

Part 14: Laser-arc hybrid welding of steels, nickel and nickel alloys iTeh STANDARD PREVIEW

> S Descriptif et qualification d'un mode opératoire de soudage pour les matériaux métalliques — Épreuve de qualification d'un mode opératoire de soudage —

https://standards.itehPartie\_J4: Soudage hybride laser-arc\_des aciers, du nickel et des 7@lliages\_lde nickel 14-14-2013



Reference number ISO 15614-14:2013(E)

# iTeh STANDARD PREVIEW (standards.iteh.ai)

<u>ISO 15614-14:2013</u> https://standards.iteh.ai/catalog/standards/sist/1d8fda45-fc7c-46fd-8f77-79e926eb81c9/iso-15614-14-2013



# **COPYRIGHT PROTECTED DOCUMENT**

© ISO 2013

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office Case postale 56 • CH-1211 Geneva 20 Tel. + 41 22 749 01 11 Fax + 41 22 749 09 47 E-mail copyright@iso.org Web www.iso.org

Published in Switzerland

# Contents

Introductionv1Scope12Normative references13Terms and definitions24Preliminary welding procedure specification25Welding procedure test36Test piece36.1General36.2Shape and dimensions of test pieces36.3Welding of test pieces47Examination and testing87.1Extent of examination and testing87.2Location and taking of test specimens97.3Non-destructive testing147.4Destructive testing147.5Quality levels167.6Re-testing178.1General(standards.iteh.ai)7.6Related to the manufacturer178.1General(standards.iteh.ai)178.2Related to the garent material scite-tide stretesting147.8Related to the garent material scite-tide stretesting178.4Related to the garent material scite-tide stretesting178.5Related to unwher of layers218.6Related to type of joint or weld218.7Related to probacting and interpass temperature218.8Related to probacting and interpass temperature218.9Welding procedure qualification record (WPQR)229Welding procedure qualification record template (WPQR)238Bibliography <t< th=""><th>Forev</th><th>vord</th><th></th><th>iv</th></t<>	Forev	vord		iv
1 Scope 1   2 Normative references 1   3 Terms and definitions 2   4 Preliminary welding procedure specification 2   5 Welding procedure test 3   6 Test piece 3   6.1 General 3   6.2 Shape and dimensions of test pieces 3   6.3 Welding of test pieces 4   7 Examination and testing 8   7.1 Extent of examination and testing 8   7.2 Location and taking of test specimens 9   7.3 Non-destructive testing 14   7.4 Destructive testing 14   7.5 Quality levels 16   7.6 Re-testing 17   8 Range of qualification 17   8.1 General 17   8.2 Related to the manufacturer 17   8.3 Related to the manufacturer 17   8.4 Related to welding procesting standards stations of test 164-142013 17   8.4 Related to to type	Introduction			v
2 Normative references. 1   3 Terms and definitions. 2   4 Preliminary welding procedure specification 2   5 Welding procedure test. 3   6 Test piece 3   6.1 General 3   6.2 Shape and dimensions of test pieces 3   6.3 Welding of test pieces 4   7 Examination and testing 8   7.1 Extent of examination and testing 8   7.2 Location and taking of test specimens 9   7.3 Non-destructive testing 14   7.4 Destructive testing 14   7.5 Quality levels 16   7.6 Re-testing of the st pieces superimens 17   8.1 General (Standards.iteh.ai) 17   8.1 General 17 17   8.2 Related to the manufacturer 17   8.3 Related to the manufacturer 17   8.4 Related to welding process and structures structur	1	Scope		
3 Terms and definitions 2   4 Preliminary welding procedure specification 2   5 Welding procedure test 3   6 Test piece 3   6.1 General 3   6.2 Shape and dimensions of test pieces 3   6.3 Welding of test pieces 4   7 Examination and testing 8   7.1 Extent of examination and testing 8   7.2 Location and taking of test specimens 9   7.3 Non-destructive testing 14   7.4 Destructive testing 14   7.5 Quality levels 16   7.6 Re-testing the STANDARD PREVIEW 17   8 Range of qualification 17   8.1 General 17   8.2 Related to the parent material. 56(4-14-2013) 17   8.3 Related to the parent material. 56(4-14-2013) 17   8.4 Related to upposition. 4(-9) fool of the 9 (-9) fool o	2	Norm	ative references	1
3 Terms and definitions 2   4 Preliminary welding procedure specification 2   5 Welding procedure test 3   6 Test piece 3   6.1 General 3   6.2 Shape and dimensions of test pieces 3   6.3 Welding of test pieces 3   7 Examination and testing 8   7.1 Extent of examination and testing 8   7.2 Location and taking of test specimens 9   7.3 Non-destructive testing 14   7.5 Quality levels 16   7.6 Re-testing tent STANDARD PREVIEW 17   8 Range of qualification 17   8.1 General (standards.iteh.ai) 17   8.2 Related to the parent material.sight.442013 17   8.3 Related to the parent material.sight.442013 17   8.4 Related to the parent material.sight.442013 17   8.5 Related to mulfacturer 17   8.6 Related to the parent material.sight.442013 21   8.7 <t< th=""><th>2</th><th>Torm</th><th>a and definitions</th><th> າ</th></t<>	2	Torm	a and definitions	 າ
4 Preliminary welding procedure specification 2   5 Welding procedure test 3   6 Test piece 3   6.1 General 3   6.2 Shape and dimensions of test pieces 3   6.3 Welding of test pieces 4   7 Examination and testing 8   7.1 Extent of examination and testing 8   7.2 Location and taking of test specimens 9   7.3 Non-destructive testing 14   7.4 Destructive testing 14   7.5 Quality levels 16   7.6 Re-testing 14   7.5 Quality levels 16   7.6 Re-testing 17   8.1 General (standards.iteh.ai) 17   8.2 Related to the parent material. 564±14±2013 17   8.4 Related to welding process test and set 1d8145±67c=4661±877 21   8.5 Related to number of layers. 21 21   8.6 Related to type of joint or weld 21 21   8.7	3	Term	s and definitions	Z
5 Welding procedure test 3   6 Test piece 3   6.1 General 3   6.2 Shape and dimensions of test pieces 3   6.3 Welding of test pieces 3   6.3 Welding of test pieces 4   7 Examination and testing 8   7.1 Extent of examination and testing 8   7.2 Location and taking of test specimens 9   7.3 Non-destructive testing 14   7.4 Destructive testing 14   7.5 Quality levels 16   7.6 Re-testing 17   8 Range of qualification 17   8.1 General (standards.iteh.ai) 17   8.2 Related to the manufacturer 17   8.3 Related to welding process togstantards str/1081445-£7c-46EI-8f7- 21   8.6 Related to welding process togstantards str/1081445-£7c-46EI-8f7- 21   8.6 Related to fuller material 21 21   8.6 Related to fuller material 21 3   8.7 <th>4</th> <th>Preli</th> <th>ninary welding procedure specification</th> <th>2</th>	4	Preli	ninary welding procedure specification	2
6 Test piece 3   6.1 General 3   6.2 Shape and dimensions of test pieces 3   6.3 Welding of test pieces 4   7 Examination and testing 8   7.1 Extent of examination and testing 8   7.2 Location and taking of test specimens 9   7.3 Non-destructive testing 14   7.5 Quality levels 16   7.6 Re-testing 16   7.6 Re-testing 17   8 Range of qualification 17   8.1 General (standards.iteh.ai) 17   8.2 Related to the manufacturer 17   8.3 Related to the manufacturer 17   8.4 Related to the manufacturer 17   8.5 Related to the up arent material 5614-14-2013 17   8.4 Related to the up of process opstandardsstr/d8tla45-67c-46tl-8t/7 21   8.5 Related to tuple of joint or weld 21   8.6 Related to number of layers 21   8.7 Related to tippe of current <th>5</th> <th>Weld</th> <th>ing procedure test</th> <th></th>	5	Weld	ing procedure test	
6.1 General 3   6.2 Shape and dimensions of test pieces 3   6.3 Welding of test pieces 3   6.3 Welding of test pieces 3   7 Examination and testing 8   7.1 Extent of examination and testing 8   7.2 Location and taking of test specimens 9   7.3 Non-destructive testing 14   7.4 Destructive testing 14   7.5 Quality levels 16   7.6 Re-testing the STANDARD PREVIEW 17   8 Range of qualification 17   8.1 General (Standards.iteh.ai) 17   8.2 Related to the manufacturer 17   8.3 Related to the manufacturer 17   8.4 Related to welding process of stantards/stat/168/ta45-t-7c-46/61-8/77 21   8.6 Related to welding process of stantards/stat/168/ta45-t-7c-46/61-8/77 21   8.6 Related to uppe of joint or weld 21   8.7 Related to inpute of layers 21   8.8 Related to preheating and interpass temperature	6	Test piece		
6.2 Shape and dimensions of test pieces 3   6.3 Welding of test pieces 4   7 Examination and testing 8   7.1 Extent of examination and testing 8   7.2 Location and taking of test specimens 9   7.3 Non-destructive testing 14   7.4 Destructive testing 14   7.5 Quality levels 16   7.6 Re-testing the STANDARD PREVIEW 17   8 Range of qualification 17   8.1 General (standards.iteh.al) 17   8.2 Related to the manufacturer 17   8.3 Related to the parent material 5614-14-2013 17   8.4 Related to welding process best and dista 56-670-4661-8677- 21   8.5 Related to welding process best and dista 56-670-4661-8677- 21   8.6 Related to uppe of joint or weld 21   8.7 Related to type of current 21   8.6 Related to type of current 21   8.7 Related to type of current 21   8.8 Related to proheating and interpass te		6.1	General	
6.3 Welding of test pieces 4   7 Examination and testing 8   7.1 Extent of examination and testing 8   7.2 Location and taking of test specimens 9   7.3 Non-destructive testing 14   7.4 Destructive testing 14   7.5 Quality levels 16   7.6 Re-testing 17   8 Range of qualification 17   8.1 General (standards.iteh.ai) 17   8.2 Related to the manufacturer 17 17   8.3 Related to the parent material. 56(14-14-2013) 17   8.4 Related to welding process. bestandards/sist/148/1415-670-46ft-8177- 21   8.5 Related to welding process. bestandards/sist/148/1415-670-46ft-8177- 21   8.6 Related to type of joint or weld 21   8.7 Related to used in position.81(-9/150+144-2013) 21   8.6 Related to type of current 21   8.7 Related to type of current 21   8.8 Related to preheating and interpass temperature 21   8.10<		6.2	Shape and dimensions of test pieces	
7 Examination and testing 8   7.1 Extent of examination and testing 8   7.2 Location and taking of test specimens 9   7.3 Non-destructive testing 14   7.4 Destructive testing 14   7.5 Quality levels 16   7.6 Re-testing 16   7.6 Re-testing 17   8 Range of qualification 17   8.1 General (standards.iteh.al) 17   8.2 Related to the manufacturer 17   8.3 Related to the parent material.sisticidation sisticidation sisticidatin sisticidatin sisticidatin sisticidation sisticidation		6.3	Welding of test pieces	4
7.1Extent of examination and testing87.2Location and taking of test specimens97.3Non-destructive testing147.4Destructive testing147.5Quality levels167.6Re-testing178Range of qualification178.1General(standards.iteh.ai)7.2Related to the manufacturer178.2Related to the parent material. 56:14-14-20:13178.3Related to the parent material. 56:14-14-20:13178.4Related to welding processing standards/sist/1d8fda45-£7c-46ft-8f77218.5Related to velding position.8ft-0/score156f4-14-20:13218.6Related to inper of joint or weld218.7Related to filler material218.8Related to filler material218.9Related to proheating and interpass temperature218.10Related to post-weld heat treatment218.11Related to post-weld heat treatment218.12Nominal heat input229Welding procedure qualification record (WPQR)229Welding procedure qualification record template (WPQR)23Bibliography24	7	Examination and testing		
7.2Location and taking of test specimens97.3Non-destructive testing147.4Destructive testing147.5Quality levels167.6Re-testing178Range of qualification178.1General(standards.iteh.ai)8.2Related to the manufacturer178.3Related to the parent material.178.4Related to welding processiogistandards/sist/1d8fda45-fc7c-46fl-8f77-218.5Related to wyle of joint or weld218.6Related to type of layers.218.7Related to type of layers.218.8Related to type of current218.9Related to preheating and interpass temperature218.10Related to preheating and interpass temperature218.13Duration of validity229Welding procedure qualification record (WPQR)23Bibliography24		7.1	Extent of examination and testing	
7.3Non-destructive testing147.4Destructive testing147.5Quality levels167.6Re-testing178Range of qualification178.1General(standards.iteh.ai)8.2Related to the manufacturer178.3Related to the parent material.5614-14-2013178.4Related to the parent material.5614-14-2013178.5Related to welding processionstandards/sist/1d8fla45-£7c-46fd-8f77218.6Related to type of joint or weld218.7Related to number of layers218.8Related to type of current218.9Related to type of current218.10Related to post-weld heat treatment218.11Related to post-weld heat treatment218.12Nominal heat input229Welding procedure qualification record (WPQR)229Welding procedure qualification record template (WPQR)23Bibliography24		7.2	Location and taking of test specimens	9
7.4Destructive testing147.5Quality levels167.6Re-testing178Range of qualification178.1General(standards.iteh.ai)8.2Related to the manufacturer178.3Related to the parent material.5614-14-2013178.4Related to welding processionstandards/sist/148fda45-fc?c-46fd-8f7?-218.5Related to velding position at correst of the parent material.218.6Related to velding position at correst of the parent material.218.7Related to type of joint or weld218.8Related to type of layers218.9Related to type of current.218.10Related to type of current.218.11Related to preheating and interpass temperature218.12Nominal heat input.229Welding procedure qualification record (WPQR)229Welding procedure qualification record template (WPQR)23Bibliography24		7.3	Non-destructive testing	
7.5Quality levels167.6Re-testing ten STANDARD PREVIEW178Range of qualification178.1General(standards.iteh.ai)8.2Related to the manufacturer178.3Related to the parent material 56(4+14:2013)178.4Related to welding processiogstandards/sist/id8fla45-£7c-46fl-8f77218.5Related to welding positions (strong positions)218.6Related to type of joint or weld218.7Related to fuller material218.8Related to fuller material218.9Related to type of current.218.10Related to processing and interpass temperature218.11Related to post-weld heat treatment218.12Nominal heat input229Welding procedure qualification record (WPQR)228Bibliography24		7.4	Destructive testing	
7.6Re-testing ch STANDARD PREVIEW178Range of qualification178.1General(standards.iteh.ai)8.2Related to the manufacturer178.3Related to the parent material.5614-14-2013178.4Related to welding processiogstandards/sist/1d8fla45-fc7c-46fl-8f77-218.5Related to welding position streptsor15614-14-2013178.6Related to type of joint or weld218.7Related to filler material218.8Related to filler material218.9Related to type of current218.10Related to preheating and interpass temperature218.11Related to post-weld heat treatment218.12Nominal heat input228.13Duration of validity229Welding procedure qualification record (WPQR)23Bibliography24		7.5	Quality levels	
8Range of qualification178.1General(standards.iteh.ai)8.2Related to the manufacturer178.3Related to the parent material.5614-14-2013178.4Related to welding process by standards sist/1d8fla45-fc7c-46ft-8f77-218.5Related to welding position.81-97so-15614-14-2013218.6Related to type of joint or weld218.7Related to filler material218.8Related to type of current218.9Related to type of current218.10Related to preheating and interpass temperature218.11Related to post-weld heat treatment218.12Nominal heat input228.13Duration of validity229Welding procedure qualification record (WPQR)23Bibliography24		7.6	Re-testing	
8.1General178.2Related to the manufacturer178.3Related to the parent material 5614-14-2013178.4Related to welding process log/standards/sist/1d8fda45-fc7c-46fd-8f77-218.5Related to welding position or weld218.6Related to number of layers218.7Related to type of current218.8Related to type of current218.9Related to type of current218.10Related to preheating and interpass temperature218.11Related to post-weld heat treatment218.12Nominal heat input228.13Duration of validity229Welding procedure qualification record (WPQR)23Bibliography24	8	Range of qualification		
8.2Related to the manufacturer178.3Related to the parent material 5614-14-2013178.4Related to welding process by standards/sist/1d8fda45-fc7c-46fd-8f77-218.5Related to welding position or weld218.6Related to type of joint or weld218.7Related to filler material218.8Related to filler material218.9Related to type of current218.10Related to preheating and interpass temperature218.11Related to post-weld heat treatment218.12Nominal heat input229Welding procedure qualification record (WPQR)22Annex A (informative) Welding procedure qualification record template (WPQR)238ibliography24		8.1	General (standards.iteh.ai)	
8.3Related to the parent material 5614-14-2013178.4Related to welding process logistandards/sist/1d8fda45-fc7c-46fd-8f77-218.5Related to welding position stored by signal stored st		8.2	Related to the manufacturer	
8.4Related to welding process by standards/sist/148fla45-fc7c-46fl-8f77-218.5Related to welding position are systematic system		8.3	Related to the parent material 5614-14-2013	
8.5Related to welding position are or solution are or solution and the solution of the solution are or solution and the solution are or solution and the solution are or solution are or solution and the solution are or solution and the solution are or solution and the solution are or solution		8.4	Related to welding process og/standards/sist/1d8fda45=fc7c=46fd=8f77=	
8.6Related to type of joint or weld218.7Related to number of layers218.8Related to filler material218.9Related to type of current218.10Related to preheating and interpass temperature218.11Related to post-weld heat treatment218.12Nominal heat input228.13Duration of validity229Welding procedure qualification record (WPQR)22Annex A (informative) Welding procedure qualification record template (WPQR)23Bibliography24		8.5	Related to welding position 81c9/iso-15614-14-2013	
8.7Related to number of layers218.8Related to filler material218.9Related to type of current218.10Related to preheating and interpass temperature218.11Related to post-weld heat treatment218.12Nominal heat input228.13Duration of validity229Welding procedure qualification record (WPQR)22Annex A (informative) Welding procedure qualification record template (WPQR)23Bibliography24		8.6	Related to type of joint or weld	
8.8Related to filler material218.9Related to type of current218.10Related to preheating and interpass temperature218.11Related to post-weld heat treatment218.12Nominal heat input228.13Duration of validity229Welding procedure qualification record (WPQR)22Annex A (informative) Welding procedure qualification record template (WPQR)23Bibliography24		8.7	Related to number of layers	
8.9Related to type of current218.10Related to preheating and interpass temperature218.11Related to post-weld heat treatment218.12Nominal heat input228.13Duration of validity229Welding procedure qualification record (WPQR)22Annex A (informative) Welding procedure qualification record template (WPQR)23Bibliography24		8.8	Related to filler material	
8.10Related to preheating and interpass temperature218.11Related to post-weld heat treatment218.12Nominal heat input228.13Duration of validity229Welding procedure qualification record (WPQR)22Annex A (informative) Welding procedure qualification record template (WPQR)23Bibliography24		8.9	Related to type of current	21
8.11 Related to post-weld heat treatment 21   8.12 Nominal heat input 22   8.13 Duration of validity 22   9 Welding procedure qualification record (WPQR) 22   Annex A (informative) Welding procedure qualification record template (WPQR) 23   Bibliography 24		8.10	Related to preheating and interpass temperature	
8.12 Nominal heat input		8.11	Related to post-weld heat treatment	
8.13 Duration of validity 22   9 Welding procedure qualification record (WPQR) 22   Annex A (informative) Welding procedure qualification record template (WPQR) 23   Bibliography 24		8.12	Nominal heat input	
9Welding procedure qualification record (WPQR)22Annex A (informative) Welding procedure qualification record template (WPQR)23Bibliography24		8.13	Duration of validity	
Annex A (informative) Welding procedure qualification record template (WPQR)23Bibliography24	9	Weld	ing procedure qualification record (WPQR)	
Bibliography 24	Annex A (informative) Welding procedure qualification record template (WPQR)			

# 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 15614-14 was prepared by Technical Committee ISO/TC 44, Welding and allied processes, Subcommittee SC 10, Unification of requirements in the field of metal welding.

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

- 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: Fusion welding of non-alloyed and low-alloyed casts irons.
- Part 4: Finishing welding of aluminium castings<sup>1</sup>c9/iso-15614-14-2013
- Part 5: Arc welding of titanium, zirconium and their alloys
- Part 6: Arc and gas welding of copper and its alloys
- Part 7: Overlay welding
- Part 8: Welding of tubes to tube-plate joints
- Part 10: Hyperbaric dry welding:
- Part 11: Electron and laser beam welding
- Part 12: Spot, seam and projection welding
- Part 13: Upset (resistance butt) and flash welding
- Part 14: Laser-arc hybrid welding of steels, nickel and nickel alloys

Requests for official interpretations of any aspect of this part of ISO 15614 should be directed to the Secretariat of ISO/TC 44/SC 10 via your national standards body. A complete listing of these bodies can be found at www.iso.org.

# Introduction

It is intended that all new welding procedure tests be carried out in accordance with this part of ISO 15614 from the date of its issue.

However, this part of ISO 15614 does not invalidate previous welding procedure tests made to former national standards or specifications.

Also, where additional tests shall be carried out to make the qualification technically equivalent, it is only necessary to do the additional tests on a test piece made in accordance with this part of ISO 15614.

# iTeh STANDARD PREVIEW (standards.iteh.ai)

<u>ISO 15614-14:2013</u> https://standards.iteh.ai/catalog/standards/sist/1d8fda45-fc7c-46fd-8f77-79e926eb81c9/iso-15614-14-2013

# iTeh STANDARD PREVIEW (standards.iteh.ai)

<u>ISO 15614-14:2013</u> https://standards.iteh.ai/catalog/standards/sist/1d8fda45-fc7c-46fd-8f77-79e926eb81c9/iso-15614-14-2013

# Specification and qualification of welding procedures for metallic materials — Welding procedure test —

# Part 14: Laser-arc hybrid welding of steels, nickel and nickel alloys

# 1 Scope

This part of ISO 15614 specifies how a preliminary welding procedure specification is qualified by welding procedure tests.

This part of ISO 15614 defines the conditions for the execution of welding procedure tests and the range of qualification for welding procedures for all practical welding operations within the range of variables listed in <u>Clause 8</u>.

NOTE 1 It is possible that additional tests are required by applications standards.

The various parts of ISO 15614 comprise, in their turn, a series of International Standards on welding, NOTE 2 details of which are given in ISO 15607:2003, Annex A. ITeh STANDARD PREVIEW

#### Normative references (standards.iteh.ai) 2

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

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

ISO 4136, Destructive tests on welds in metallic materials — Transverse tensile test

ISO 5173, Destructive tests on welds in metallic materials — Bend tests

ISO 6947, Welding and allied processes — Welding positions

ISO 9016, Destructive tests on welds in metallic materials — Impact tests — Test specimen location, notch orientation and examination

ISO 12932, Welding — Laser-arc hybrid welding of steels, nickel and nickel alloys — Quality levels for imperfections

ISO 14732, Welding personnel — Qualification testing of welding operators and weld setters for mechanized and automatic welding of metallic materials

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 15609-6, Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 6: Laser-arc hybrid welding

ISO 15613, Specification and qualification of welding procedures for metallic materials — Qualification based on pre-production welding test

ISO 17636 (all parts), Non-destructive testing of welds — Radiographic testing

ISO 17637, Non-destructive testing of welds — Visual testing of fusion-welded joints

ISO 17638, Non-destructive testing of welds — Magnetic particle testing

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

ISO 17640, Non-destructive testing of welds — Ultrasonic testing — Techniques, testing levels, and assessment

# 3 Terms and definitions

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

#### 3.1

### hybrid welding

welding in which two or more welding processes are used simultaneously in the same weld pool

Note 1 to entry: Hybrid welding is different than combinations of processes where at least two melt pools exist which are completely separated by a solid component in the solidification phases. Examples of a combined process (a) and a laser-arc hybrid welding process (b) are given in Figure 1 by using a laser beam and the additional energy source of an arc.



b) Hybrid process

### Кеу

- 1 laser beam
- 2 torch

Figure 1 — Combination of welding processes

# 4 Preliminary welding procedure specification

The preliminary welding procedure specification (pWPS) shall be prepared in accordance with ISO 15609-6.

# 5 Welding procedure test

The welding and testing of test pieces shall be in accordance with <u>Clauses 6</u> and <u>7</u>.

The welding operator who undertakes the welding procedure test satisfactorily in accordance with this part of ISO 15614 shall be qualified for the appropriate range of qualification in accordance with ISO 14732 provided the relevant testing requirements are met.

# 6 Test piece

### 6.1 General

The welded joint to which the welding procedure relates in production shall be represented by making a standardized test piece or pieces, as specified in <u>6.2</u>. Where the production joint geometry requirements do not represent the standardized test piece as shown in this part of ISO 15614, the use of ISO 15613 shall be required.

The length or number of test pieces shall be sufficient to allow all required tests to be carried out.

Additional test pieces, or longer test pieces than the minimum size, can be prepared in order to allow for extra or for re-testing specimens (see <u>7.6</u>). Application standards can require larger test pieces.

If required by the application standard, the direction of plate rolling shall be marked on the test piece when impact tests are required to be taken in the heat-affected zone (HAZ).

The plate thickness or pipe outside diameter and wall thickness of the test pieces shall be selected in accordance with <u>8.3.2.1</u> to <u>8.3.2.6</u> standards.iteh.ai)

### 6.2 Shape and dimensions of test pieces<sub>4-14:2013</sub>

https://standards.iteh.ai/catalog/standards/sist/1d8fda45-fc7c-46fd-8f77-

#### **6.2.1** Butt joint in plate 79e926eb81c9/iso-15614-14-2013

The test piece shall be prepared in accordance with Figure 2.

It may be used for fully and partially penetrated butt welds.

### 6.2.2 Butt joint in pipe

The test piece shall be prepared in accordance with Figure 3.

It may be used for fully and partially penetrated butt welds.

NOTE The word "pipe", alone or in combination, is used to mean "pipe", "tube" or "hollow section".

### 6.2.3 T-joint

The test piece shall be prepared in accordance with <u>Figure 4</u>.

It may be used for fully and partially penetrated butt welds or fillet welds.

### 6.2.4 Corner joint

The test piece shall be prepared in accordance with <u>Figure 5</u>.

It may be used for fully and partially penetrated butt welds or fillet welds.

## ISO 15614-14:2013(E)

#### 6.2.5 Branch connection

The pipe to pipe test piece shall be prepared in accordance with Figure 6. The angle  $\alpha$  is the minimum to be used in production.

It may be used for fully and partially penetrated joints (set-on or set-in or set-through joint) and for fillet welds.

The pipe to plate test piece shall be prepared in accordance with Figure 7. The angle  $\alpha$  is the minimum to be used in production.

It may be used for fully and partially penetrated joints (set-on or set-in or set-through joint) and for fillet welds.

### 6.3 Welding of test pieces

Preparation and welding of test pieces shall be carried out in accordance with the pWPS, and under the general conditions of welding in production which they shall represent. Welding positions and limitations for the angle of slope and rotation of the test piece shall be in accordance with ISO 6947. If tack welds are to be fused into the final joint, they shall be included in the test piece.

Welding and testing of the test pieces shall be witnessed by an examiner or an examining body.



#### Кеу

- 1 joint preparation and fit-up as detailed in the pWPS
- t material thickness
- <sup>a</sup> Minimum width 150 mm.
- <sup>b</sup> Minimum length 350 mm.

### Figure 2 — Test piece for a butt joint in plate



#### Кеу

- 1 joint preparation and fit-up as detailed in the pWPS
- *a* minimum length 150 mm
- *D* outside pipe diameter
- t material thickness





#### Кеу

- 1 joint preparation and fit-up as detailed in the pWPS
- $a_1, a_2$  minimum width 150 mm
- *b* minimum length 350 mm
- $t_1$  material thickness, plate 1
- *t*<sub>2</sub> material thickness, plate 2

### Figure 4 — Test piece for a T-joint



Figure 5 — Test piece for a corner joint