BSI Standards Publication

Qualification testing of welders — Fusion welding
焊工资格考试—熔焊

Part 1: Steels

第一部分：钢

本标准译文难免有不妥之处，欢迎各位批评指正

bsi.

National foreword

This British Standard is the UK implementation of EN ISO 9606-1:2017. It is identical to ISO 9606-1:2012, incorporating corrigendum September 2012. It supersedes BS EN ISO 9606-1:2013, which is withdrawn.

Please note that ISO corrigendum 2:2013 only affects the French edition and has therefore not been incorporated in this version.

During the development of this standard a new option (option c) was introduced to clause 9.3 to revalidate a welder's qualification. It is the opinion of the UK committee that options a) and b) are the preferred methods for the periodic verification of a welder's ability/skill to reproduce and meet the acceptance levels of the original test conditions.

Attention is drawn to clause 9.3 and which option/s may or may not be relevant or allowed in application standards or specific contract requirements. For the relationship with EU directives 2014/68/EU (PED) and 2014/29/EU (SPVD), see informative Annex ZA and ZB, respectively.

The UK participation in its preparation was entrusted to Technical Committee WEE/36, Qualification of welding personnel and welding procedures.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Compliance with a British Standard cannot confer immunity from legal obligations.

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Qualification testing of welders - Fusion welding - Part 1: Steels (ISO 9606-1:2012 including Cor 1:2012 and Cor 2:2013)

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Épreuve de qualification des soudeurs - Soudage par fusion - Partie 1 : Aciers (ISO 9606-1:2012, y compris Cor 1:2012 et Cor 2:2013)

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This European Standard was approved by CEN on 16 July 2017. 该欧洲标准于2017年7月16日获得CEN的批准。

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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European foreword 欧洲前言

The text of ISO 9606-1:2012 including Cor 1:2012 and Cor 2:2013 has been prepared by Technical Committee ISO/TC 44 "Welding and allied processes" of the International Organization for Standardization (ISO) and has been taken over as EN ISO 9606-1:2017 by Technical Committee CEN/TC 121 "Welding and allied processes" the secretariat of which is held by DIN. ISO 9606-1：2012的文本（包括Cor 1：2012和Cor 2：2013）已由国际标准化组织（ISO）的ISO / TC 44技术委员会"焊接和相关工艺"编写，并已被接管为 技术委员会CEN / TC 121的EN ISO 9606-1：2017"焊接及相关工艺"，其秘书处由DIN负责。

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 2018, and conflicting national standards shall be withdrawn at the latest by February 2018. 最迟应在2018年2月之前通过发布相同文本或通过认可使本欧洲标准成为国家标准，并且最迟应于2018年2月取消有冲突的国家标准。

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This document supersedes EN ISO 9606-1:2013. 本文档取代了EN ISO 9606-1：2013

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directives 2014/68/EU and 2014/29/EU. 本文件是根据欧洲委员会和欧洲自由贸易协会赋予CEN的授权编写的，并支持欧盟指令2014/68 / EU和2014/29 / EU的基本要求

For relationship with EU Directives, see informative Annex ZA and ZB, which is an integral part of this document. 有关与欧盟指令的关系，请参阅内容丰富的附录ZA和ZB，这是本文档的组成部分

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.
根据CEN-CENELEC内部规定，以下国家/地区的国家标准组织必须执行此欧洲标准：奥地利，比利时，保加利亚，克罗地亚，塞浦路斯，捷克共和国，丹麦，爱沙尼亚，芬兰，前南斯拉夫的马其顿共和国，法国，德国，希腊，匈牙利，冰岛，爱尔兰，意大利，拉脱维亚，立陶宛，卢森堡，马耳他，荷兰，挪威，波兰，葡萄牙，罗马尼亚，塞尔维亚，斯洛伐克，斯洛文尼亚，西班牙，瑞典，瑞士，土耳其和英国。

Endorsement notice 背书通知

The text of ISO 9606-1:2012 including Cor.1:2012 and Cor 2:2013 has been approved by CEN as EN ISO 9606-1:2017 without any modification. ISO 9606-1：2012的文本（包括Cor.1：2012和Cor 2：2013）已由CEN批准为EN ISO 9606-1：2017，未经任何修改。

Annex ZA
(informative)

Relationship between this European Standard and the essential requirements of EU Directive 2014/68/EU [2014 OJ L 189] (PED) aimed to be covered

This European Standard has been prepared under a Commission's standardization request M/071 "Mandate to CEN for standardization in the field of pressure equipment" to provide one voluntary means of conforming to essential requirements of Directive 2014/68/EU (PED) on the harmonisation of the laws of the Member States relating to the making available on the market of pressure equipment [2014 OJ L 189].

Once this standard is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding essential requirements of that Directive, and associated EFTA regulations.

Table ZA.1 — Correspondence between this European Standard and Directive 2014/68/EU (PED) [2014 OJ L 189]

Essential Requirements of Directive 2014/68/EU (PED)	Clause(s)/sub-clause(s) of this EN	Remarks/Notes
Annex I, 3.1.2	Clauses 5, 6.2 to 6.6, 7, 8, 10, 11	Qualification testing
	Clauses 6.1, 9.1, 9.3 a), 9.3 b)	For pressure equipment in categories II, III and IV the examiner/examining body (according to 3.3 and 3.4) is a competent third party – a notified body or a recognized third party organization.
	Clause 9.3 c)	Not permitted for categories II, III and IV products.

WARNING 1 — Presumption of conformity stays valid only as long as a reference to this European Standard is maintained in the list published in the Official Journal of the European Union. Users of this standard should consult frequently the latest list published in the Official Journal of the European Union.

WARNING 2 — Other Union legislation may be applicable to the product(s) and services falling within the scope of this standard.

Annex ZB
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 2014/29/EU (SPVD) [2014 OJ L96]

This European Standard has been prepared under a Commission's standardization request M/071 "Mandate to CEN for standardization in the field of pressure equipment" to provide one voluntary means of conforming to essential requirements of Directive 2014/29/EU (SPVD) on the harmonisation of the laws of the Member States relating to the making available on the market of simple pressure vessels [2014 OJ L96].

Once this standard is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of this standard given in Table ZB.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding essential requirements of that Directive, and associated EFTA regulations.

Table ZB.1 — Correspondence between this European Standard and Directive 2014/29/EU (SPVD) [2014 OJ L96]

Essential Requirements of Directive 2014/29/EU (SPVD)	Clause(s)/sub-clause(s) of this EN	Remarks/Notes
Annex I, 3.2	Clauses 5, 6, 7, 8, 9.1, 9.3 a), 9.3 b), 10, 11	For welds on pressurised parts of simple pressure vessels the examiner/examining body (according to 3.3 and 3.4) is a notified body.

WARNING 1 — Presumption of conformity stays valid only as long as a reference to this European Standard is maintained in the list published in the Official Journal of the European Union. Users of this standard should consult frequently the latest list published in the Official Journal of the European Union.

WARNING 2 — Other Union legislation may be applicable to the product(s) and services falling within the scope of this standard.

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Introduction 说明

The ability of a welder to follow verbal or written instructions and verification of a person's skills are important factors in ensuring the quality of the welded product.
焊工遵循口头或书面指示以及对人员技能进行验证的能力是确保焊接产品质量的重要因素

The testing of a welder's skill in accordance with this International Standard depends on the welding techniques and conditions used, in which uniform rules are complied with and standard test pieces are used.
根据本国际标准对焊工的技能进行测试取决于所使用的焊接技术和条件，其中应遵守统一的规则并使用标准试件

The principle of this International Standard is that a qualification test qualifies a welder not only for the conditions used in the test, but also for all other conditions which are considered easier to weld in accordance with this International Standard. It is presumed that the welder has received training and/or has industrial practice within the range of qualification.
该国际标准的原则是，资格考试不仅使焊工符合测试中使用的条件，而且还符合根据本国际标准被认为更易于焊接的所有其他条件。假定焊工已经在资格范围内接受了培训和/或具有工业实践。

The qualification test can be used to qualify a welding procedure and a welder provided that all the relevant requirements, e.g. test piece dimensions and testing requirements are satisfied (see ISO 15614-1[11]).
鉴定测试可用于鉴定焊接程序和焊工，但前提是必须满足所有相关要求，例如 满足试件尺寸和测试要求（请参阅ISO 15614-1 [11]）。

All new qualifications shall be in accordance with each part of this International Standard from its date of issue.
自发布之日起，所有新资格应符合本国际标准的每个部分

At the end of its period of validity, existing qualification tests of welders in accordance with the requirement of a national standard may be revalidated according to this International Standard. This is providing that the technical intent of this International Standard is satisfied. It is necessary for the new range of qualification to be interpreted in accordance with the requirements of this International Standard.
在有效期结束时，可以根据本国际标准重新验证符合国家标准要求的现有焊工资格考试。这是为了满足本国际标准的技术意图。有必要根据本国际标准的要求来解释新的资格范围。

Qualification testing of welders — Fusion welding —
焊工资格考试—熔焊 Part 1: **Steels** 钢

1 Scope 范围

This part of ISO 9606 specifies the requirements for qualification testing of welders for fusion welding of steels. 本标准ISO 9606规定了用于钢的熔焊的焊工资格测试的要求

It provides a set of technical rules for a systematic qualification test of the welder, and enables such qualifications to be uniformly accepted independently of the type of product, location and examiner or examining body.
本标准提供了一套系统的焊工认可的技术规则，适合不同的产品类型、地区和考官/考试机构

When qualifying welders, the emphasis is placed on the welder's ability manually to manipulate the electrode, welding torch or welding blowpipe, thereby producing a weld of acceptable quality.
对焊工进行资格认可时，重点于考核焊工手工操作焊钳、焊枪、焊炬，焊接合格焊缝的技能。

The welding processes referred to in this part of ISO 9606 include those fusion-welding processes which are designated as manual or partly mechanized welding. It does not cover fully mechanized and automated welding processes.
本标准所指的焊接方法包括手工或半自动熔化焊接方法。不适用于全机械化和自动化焊接方法

NOTE For such processes, 这些方法见see ISO 14732[10].

2 Normative references 引用标准

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. 下面的参考标准是必不可少的。注明日期的，只能用引用的，没有注明日期的，依据最新标准（包括所有修正）。

ISO 857-1, *Welding and allied processes — Vocabulary — Part 1: Metal welding processes*

ISO 3834-2, *Quality requirements for fusion welding of metallic materials — Part 2: Comprehensive quality requirements*

ISO 3834-3, *Quality requirements for fusion welding of metallic materials — Part 3: Standard quality requirements*

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

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

ISO 5817, *Welding — Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) — Quality levels for imperfections*

ISO 6947, *Welding and allied processes — Welding positions*

ISO 9017, *Destructive tests on welds in metallic materials — Fracture test*

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

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

ISO 15609-2, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 2: Gas welding*

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/TR 25901:2007, *Welding and related processes — Vocabulary*

3 Terms and definitions 术语和定义

For the purposes of this part of ISO 9606, the following terms and definitions apply.
ISO 9606的本部分而言，以下术语和定义适用。

3.1
welder 焊工
person who holds and manipulates the electrode holder, welding torch or blowpipe by hand
用手操持焊钳、焊枪、焊炬进行焊接的人。
[ISO/TR 25901:2007, 2.428]

3.2
manufacturer 制造商
person or organization responsible for the welding production 生产焊接产品的个人或组织
[ISO 15607:2003,[12] 3.23]

3.3
examiner 考官
person appointed to verify compliance with the applicable standard 被任命核实是否符合适用标准的人员
NOTE [ISO/TR 25901:2007, 2.119]

3.4
examining body 考试机构
organization appointed to verify compliance with the applicable standard
被任命来验证是否符合适用标准的组织
NOTE In certain cases, an external independent examining body can be required.
在某些情况下，可能需要外部独立审查机构
[ISO/TR 25901:2007, 2.120]

3.5
material backing 衬垫材料
backing using material for the purpose of supporting molten weld metal
为保证接头根部焊透和焊缝背面成形，沿接头背面预置的一种衬托物。

3.6
gas backing 气体衬垫
backing using gas primarily for the purpose of preventing oxidation 气体衬垫主要是为了防止氧化

3.7
flux backing 焊剂衬垫
backing using flux primarily for the purpose of preventing oxidation
主要是为了防止氧化而使用助焊剂做背衬

NOTE In submerged arc welding, flux backing may also reduce the risk of a weld pool collapse.
在埋弧焊中，助焊剂衬里还可以降低焊缝塌陷的风险

3.8
consumable insert 熔化垫板
filler material that is placed at the root of the joint before welding to be completely fused into the root
填充材料，在焊接之前放置在接头的根部，以完全融合到根部

3.9
layer 焊层
stratum of weld metal consisting of one or more runs 由一个或多个焊道组成的焊缝金属层
[ISO/TR 25901:2007, 2.209]

3.10
root run 根部焊道
root pass 通过根部
〈multi-layer welding〉 run(s) of the first layer deposited in the root（多层焊接） 溶敷在根部的第一层
[ISO/TR 25901:2007, 2.310]

3.11
filling run 填充焊道
〈multi-layer welding〉 run(s) deposited after the root run(s) and before the capping run(s)
(在多层焊中)根部焊道之后顶层焊道之前熔敷的焊道
[ISO/TR 25901:2007, 2.132]

3.12
capping run 焊道余高
〈multi-layer welding〉 run(s) visible on the weld face(s) after completion of welding
(在多层焊中)焊接完成后在焊接面上可见
[ISO/TR 25901:2007, 2.57]

3.13
deposited thickness 熔敷厚度
thickness of the weld metal excluding any reinforcement 焊缝金属的厚度，不包括余高

3.14
leftward welding 左焊法
gas welding technique in which the filler rod is moved ahead of the blowpipe in relation to the welding direction 气焊时在焊缝前进方向上，焊丝在焊炬前面移动
[ISO/TR 25901:2007, 2.210]

3.15
rightward welding 右焊法
gas welding technique in which the filler rod is moved behind the blowpipe in relation to the welding direction
气焊时在焊缝前进方向上，焊丝在焊炬后面移动
[ISO/TR 25901:2007, 2.302]

3.16
branch joint 支管接头
joint of one or more tubular parts to the main pipe or to a shell 一个或多个管状部件与主管或壳体的连接

3.17
fillet weld 角焊缝
triangular weld in a square preparation for making a T-joint, corner joint or lap joint
T 型、角接或搭接接头中的正三角形焊缝
[ISO/TR 25901:2007, 2.131]

3.18
verification 验证
confirmation, through the provision of objective evidence, that specified requirements have been fulfilled
依据客观证据，确认符合相关要求
[ISO 9000:2005,[5] 3.8.4]

4 Reference numbers, symbols and abbreviated terms 参考编号，符号和缩写词

4.1 General 概述

The following abbreviations and reference numbers shall be used when completing the welder's qualification test certificate (see Annex A).
填写焊工资格测试证书时，应使用以下缩写和参考编号（见附件A）。

4.2 Reference numbers of welding processes 焊接工艺参考编号

This part of ISO 9606 covers the following manual or partly mechanized welding processes (reference numbers of welding processes for symbolic representations are listed in ISO 4063): 本标准包括手工或部分机械化焊接工艺（ISO 4063 列出了焊接工艺方法代号）：

111 manual metal arc welding 手工电弧焊（焊条电弧焊）；
114 self-shielded tubular cored arc welding 自保护药芯焊丝电弧焊；
121 submerged arc welding with solid wire electrode (partly mechanized) 带实心焊条的埋弧焊（部分机械化）
125 submerged arc welding with tubular cored electrode (partly mechanized) 带管状芯焊条的埋弧焊（部分机械化）
131 MIG welding with solid wire electrode
135 MAG welding with solid wire electrode
136 MAG welding with flux cored electrode 药芯焊丝活性气体保护
138 MAG welding with metal cored electrode
141 TIG welding with solid filler material (wire/rod) 钨极惰性气体保护电弧焊（TIG）
142 autogenous TIG welding 自熔性TIG 焊
143 TIG welding with tubular cored filler material (wire/rod)
145 TIG welding using reducing gas and solid filler material (wire/rod)
15 plasma arc welding
311 oxyacetylene welding

See ISO/TR 25901 and ISO 857-1 for the definition of manual and partly mechanized welding.
有关手动和部分机械化焊接的定义，请参见ISO / TR 25901和ISO 857-1。

NOTE The principles of this part of ISO 9606 can be applied to other fusion welding processes.
ISO 9606的这一部分的原理可以应用于其他熔焊工艺。

4.3 Symbols and abbreviated terms 符号和缩写词

4.3.1 For test pieces 对于试件

a design throat thickness 设计焊缝厚度
BW butt weld 对接焊缝
D outside pipe diameter 管外径
FW fillet weld 角焊缝
l_1 length of test piece 试件长度
l_2 half-width of test piece 试件半宽
l_f examination length 试验长度
P plate 板
s deposited thickness or fused metal thickness in butt welds对接焊缝中的沉积厚度或熔融金属厚度
t material thickness of test piece (plate or wall thickness) 试件的材料厚度（板或壁厚）

s_1 deposited thickness of test piece for welding process 1焊接方法 1 的试件溶敷厚度

s_2 deposited thickness of test piece for welding process 2 焊接方法 2 的试件溶敷厚度

T pipe[1] 管

z leg length of fillet weld 角焊缝的脚长

4.3.2 For filler materials用于填充材料

nm no filler material 无填充材料

The symbol for type of covering or core is based on those given in various International Standards on filler materials. 覆盖物或属芯类型的符号基于各种国际标准中有关填充材料的符号

03 rutile basic covering 金红石碱性药

10 cellulosic covering 纤维素药皮

11 cellulosic covering 纤维素药皮

12 rutile covering 金红石药皮

13 rutile covering 金红石药皮

14 rutile + iron powder covering 金红石金属粉末药皮

15 basic covering 碱性药皮

16 basic covering 碱性药皮

18 basic + iron powder covering 碱性金属粉末药皮

19 limenite covering 钛铁矿药皮

20 iron oxide covering 氧化铁药皮

24 rutile + iron powder covering 金红石金属粉末药皮

27 iron oxide + iron powder covering 氧化铁金属粉末药皮

28 basic + iron powder covering 碱性金属粉末药皮

45 basic covering 碱性药皮

48 basic covering 碱性药皮

A acid covering 酸性药皮

B basic covering or electrode core — basic 碱性药皮或药芯

C cellulosic covering 纤维素型药皮

R rutile covering or electrode core — rutile, slow-freezing slag 金红石型药皮或药芯，慢凝固型渣

RA rutile — acid covering 金红石酸性药皮

RB rutile — basic covering 金红石碱性药皮

RC rutile — cellulosic covering 金红石纤维素型药皮

RR rutile — thick covering 金红石型厚药皮

1) The word “pipe”, alone or in combination, is used to mean “pipe”, “tube” or “hollow section”.

M metal cored electrode or metal powder 药芯 - 金属粉末

P electrode core — rutile, fast-freezing slag.药芯-金红石，快凝固型渣

S solid wire electrode — solid rod .实芯焊丝/填充丝

V electrode core — rutile or basic/fluoride electrode.药芯-金红石或碱性/氟化物

W core — basic/fluoride, slow-freezing slag electrode.药芯-碱性/氟化物，慢凝固型渣

Y core — basic/fluoride, fast-freezing slag electrode.药芯-碱性/氟化物，快凝固型渣

Z core — other types .药芯-其他型

4.3.3 For other weld details 有关其他焊接细节

fb flux backing 焊剂衬垫

bs welding from both sides. 双面焊

ci consumable insert .熔化垫板

lw leftward welding .左焊法

mb material backing .焊接衬垫

gb gas backing .气体衬垫

ml multi-layer .多层

nb welding with no material backing.无衬垫焊接

rw rightward welding . 右焊法

sl single layer .单层

ss single side welding .单面焊

4.3.4 For bend tests 用于弯曲测试

A minimum tensile elongation after fracture required by the material材料规程要求的最低延伸率

d specification diameter of the former or the inner roller 前辊或内辊的规格直径

t_s thickness of the bend test specimen 弯曲试样的厚度

4.3.5 Types of arc welding 电弧焊的类型

MAG metal active gas 金属活性气体

MIG metal inert gas 金属惰性气体

TIG tungsten inert gas 钨极惰性气体

5 Essential variables and range of qualification 基本变数和资格范围

5.1 General 概述

The qualification of welders is based on essential variables. For each essential variable, a range of qualification is defined. If the welder has to weld outside the range of welder qualification, a new qualification test is required. The essential variables are:
焊工资格的确定基于基本变数。对于每个基本变数，定义了一个限定范围。如果焊工必须在焊工资格范围之外进行焊接，则需要进行新的资格测试。基本变数是：

— welding process(es);焊接方法

— product type (plate or pipe); 产品类型（板和管）；

— type of weld (butt or fillet); 焊缝种类（对接焊缝和角焊缝）；

— filler material group; 填充材料组别

— filler material type; 填充材料类型；

— dimension (material thickness and outside pipe diameter); 尺寸（材料厚度和管外径）；

— welding position; 焊接位置；

— weld detail(s) (material backing, gas backing, flux backing, consumable insert, single side welding, both side welding, single layer, multi-layer, leftward welding, rightward welding). 焊接细节（材料衬里，气体衬里，助焊剂衬里，易耗嵌件，单面焊接，双面焊接，单层，多层，向左焊接，向右焊接）。

The parent material group(s) and subgroup(s), in accordance with ISO/TR 15608, that are used in the test shall be recorded on the welder's qualification test certificate.
测试中使用的母材组和子组（根据ISO / TR 15608）应记录在焊工的资格测试证书上

5.2 Welding processes 焊接工艺

Welding processes are defined in ISO 857-1 and listed in 4.2. 焊接工艺在ISO 857-1中定义并在4.2中列出

Each test normally qualifies only one welding process. A change of welding process requires a new qualification test. 通常，每个测试仅合格一个焊接过程。 改变焊接工艺需要新的鉴定测试

Exceptions are as follows: 但以下情况除外：

— a change from solid wire electrode 135 to a metal cored electrode 138, or vice versa, does not require requalification (see Table 5);
从实心线电极135变为金属芯电极138，反之亦然，不需要重新资格认证（见表5）；

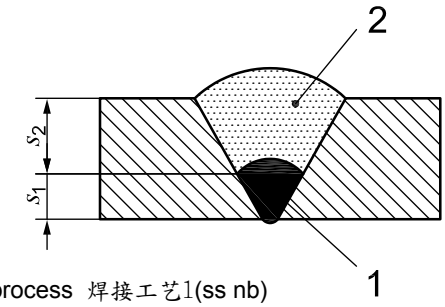
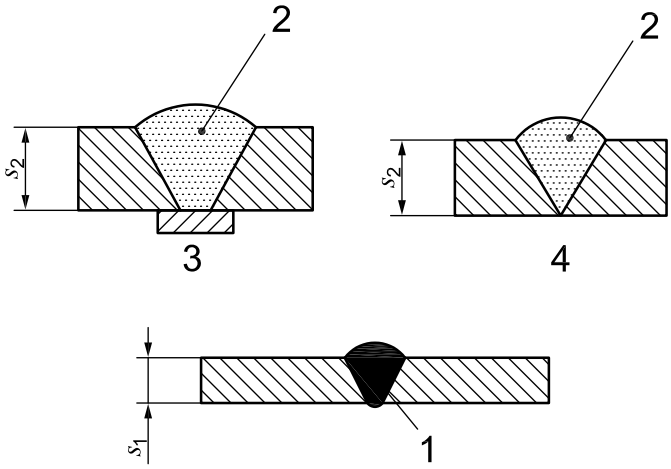
— a change from solid wire electrode 121 to a tubular cored electrode 125, or vice versa, does not require requalification (see Table 5);
从实心线电极121到管状芯电极125的改变，反之亦然，不需要重新鉴定（见表5）；

— welding with 141, 143 or 145 qualifies for 141, 142, 143 and 145, but 142 only qualifies for 142;
采用焊接方法 141、143 或 145 可以覆盖 141、142、143、145，但是 142 仅能覆盖 142

— qualifying the welder for dip (short-circuit) transfer mode (131, 135 and 138) shall qualify him for other transfer modes, but not vice versa. 对于焊接方法 131，135 和 138 使用实芯或金属芯焊丝短路过渡形式可以覆盖采用脉冲，喷射或颗粒过渡的形式，反之则不行

However, it is permitted for a welder to be qualified for two or more welding processes by welding a single test piece (multi-process joint) or by two or more separate qualification tests. The ranges of qualification concerning the deposited thickness for each welding process used and for the multi-process joint for butt welds are given in Tables 1 and 6. 然而，允许焊工通过焊接单个试件（多工艺接头）或通过两个或多个单独的鉴定测试来对两个或多个焊接过程进行鉴定。表1和表6给出了有关所使用的每种焊接工艺和对接焊的多工艺接头的熔敷厚度的合格范围。

Table 1 — Deposited thickness range of weld metal for single and multi-process joints for butt welds
单一或多种焊接方法对接焊缝接头焊缝金属熔敷厚度范围

Welding process used for test piece 试件的焊接工艺	Deposited thickness range qualified according to Table 6 溶敷厚度范围符合表6	
	Single process joint 单工艺接头	Multi-process joint 多工艺接头
 1 welding process 焊接工艺1(ss nb) 2 welding process 焊接工艺 2 (ss mb)	for welding process 1: $s = s_1$ for welding process 2: $s = s_2$	$s = s_1 + s_2$
 1 welding process 1 2 welding process 2 3 welding with backing 有衬垫焊接(ss mb) 4 welding without backing 无衬垫焊接(ss nb)	for welding process 1: s_1 for welding process 2: s_2	for $s = s_1 + s_2$ welding process 1 only for welding of the root area 焊接工艺1仅用于根部区域的焊接
NOTE See 4.3.1 for definitions of the variables. 有关变量的定义，见4.3.1		

5.3 Product type 产品类别

The qualification test shall be carried out on plate, pipe or other suitable product form. The following criteria are applicable: 资格测试应在板，管或其他合适的产品形式上进行。 适用以下条件：

a) test piece welds with outside pipe diameter $D > 25$ mm cover welds in plates;
外管直径D> 25 mm的试件焊缝在板中的覆盖焊缝;

b) test piece welds in plates cover welds in fixed pipe of outside pipe diameter $D \geq 500$ mm; in accordance with Tables 9 and 10. 外径D≥500 mm的固定管中的平板槽焊中的试件焊缝; 根据表9和表10。

c) test piece welds in plates cover welds in rotating pipes of outside pipe diameter $D \geq 75$ mm for welding positions PA, PB, PC, and PD; in accordance with Tables 9 and 10.
外径为D≥75 mm的旋转管中板孔焊接中的试件焊缝，焊接位置为PA，PB，PC和PD； 根据表9和表10

5.4 Type of weld 焊缝种类

The qualification test shall be carried out as butt or fillet welding. The following criteria are applicable.
考试应采用对接焊缝或角焊缝。采用下列准则：

a) Butt welds cover butt welds in any type of joint except branch connections [see also c)].
对接焊缝适合于任何接头类型上的对接焊缝，支管连接除外[另见c）]。

b) Butt welds do not qualify fillet welds or vice versa. It is, however, permissible to qualify a fillet weld in combination with a butt weld, e.g. single bevel joint preparation with permanent material backing (a minimum test piece thickness of 10 mm shall be used). See Annex C.
对接不能覆盖角接，反之亦然。 但是允许通过使用一个组合对接接头试板，例如带永久垫板的 HV 接头（试板厚度最小 10mm），补焊一个角焊缝，来认定角焊缝资质，见附录 C。
For this combination test, all testing requirements specified in this part of ISO 9606 shall be fulfilled and associated ranges of qualification shall be given based on the test conditions.
这个组合试验，必须满足本标准的所有试验要求。相关范围依据试验条件来决定。

c) Butt welds in pipes qualify branch joints with an angle ≥60° and the same range of qualification as in Tables 1 to 12. For a branch weld, the range of qualification is based on the outside diameter of the branch.管子对接焊缝(不带垫板)适合于角度≥60°的支管及表 1～表 12 所示的相同范围。对支管焊缝而言，其认可范围以支管的外径为依据。

d) For applications where the type of weld cannot be qualified by means of either a butt or fillet or for branch connections of less than 60°, a specific test piece should be used to qualify the welder, when specified (e.g. by the product standard).）如果无法采用对接焊或角焊或角度<60°的支管等焊缝种类对焊工进行评定，如果有特殊要求时，例如产品规范，应使用特殊试件评定。

e) Butt welds may qualify fillet welds if a supplementary fillet weld test piece (see Figure 3) is welded with each process, filler material (FM) group and electrode covering/core, in accordance with Tables 3, 4, and 5. The test piece shall be at least 10 mm thick, or the thickness of the butt weld test piece if the thickness is less, and completed using a single layer in the PB position. For this supplementary test, the welder shall be qualified for all fillet welds as given for the butt weld qualification variables related to the range of qualification for fillet welds (e.g. Tables 7, 8, 9, 10 and 12). Fillet weld positions PA and PB are qualified by this test. 如果按照表3、4和5的要求，对每个过程，填充材料（FM）组和电极覆盖层/焊芯焊接了辅助角焊缝测试件（参见图3），则对接焊缝可能合格角焊缝。 厚度应至少为10 mm，如果厚度较小，则应为对接焊试件的厚度，并在PB位置使用单层完成。 对于此补充试验，焊工应具有与角焊缝合格范围有关的对接焊缝合格变量所规定的所有角焊缝合格的资格（例如表7、8、9、10和12）。 角焊缝位置PA和PB通过此测试合格。

5.5 Filler material grouping 填充材料组别

5.5.1 General 概述

The qualification test shall be carried out with filler material from one of the groups listed in Table 2. When welding with filler materials outside the filler material grouping in Table 2, a separate test is required.
应使用表2中所列组中的一种填充材料进行资格测试。当与表2中填充材料组以外的填充材料进行焊接时，需要进行单独的测试。
The parent material used in a qualification test should be from any suitable material from ISO/TR 15608, material groups 1 to 11. 资格测试中使用的母材应来自ISO / TR 15608第1至11组的任何合适材料

5.5.2 Range of qualification 资格范围

Filler material groups are defined in Table 2. 填充材料组在表2中定义

Table 2 — Filler material grouping 填充材料组别

Group	Filler material for welding of 用于焊接的填充材料	Examples of applicable standards 相关标准
FM1	Non-alloy and fine grain steels 非合金和细晶粒钢	ISO 2560,[2] ISO 14341,[8] ISO 636,[1] ISO 14171,[6] ISO 17632[14]
FM2	High-strength steels 高强度钢	ISO 18275,[21] ISO 16834,[13] ISO 26304,[25] ISO 18276[22]
FM3	Creep-resisting steels抗蠕变钢 Cr < 3,75 %	ISO 3580,[3] ISO 21952,[23] ISO 24598,[24] ISO 17634[16]
FM4	Creep-resisting steels 3,75 ≤ Cr ≤ 12 %	ISO 3580,[3] ISO 21952,[23] ISO 24598,[24] ISO 17634[16]
FM5	Stainless and heat-resisting steels 不锈钢和耐热钢	ISO 3581,[4] ISO 14343,[9] ISO 17633[15]
FM6	Nickel and nickel alloys 镍和镍合金	ISO 14172,[7] ISO 18274[20]

Welding with a filler material in one group qualifies the welder for welding with all other filler materials within the same group, as well as other groups, listed in Table 3, and welding on parent materials from groups 1 to 11. 焊工获得某组别中任何一种填充材料的焊接资格，也就获得该组别中所有其他填充材料及按表 3 规定的其他组别填充的焊接资格，母组别为1 到11。

Table 3 — Range of qualification for filler material 填充材料的资格范围

Filler material 填充材料	Range of qualification 资格范围					
	FM1	FM2	FM3	FM4	FM5	FM6
FM1	×	×	—	—	—	—
FM2	×	×	—	—	—	—
FM3	×	×	×	—	—	—
FM4	×	×	×	×	—	—
FM5	—	—	—	—	×	—
FM6	—	—	—	—	×	×

× indicates those filler materials for which the welder is qualified. 表示焊工合格的填充材料
— indicates those filler materials for which the welder is not qualified. 表示那些焊工不合格的填充材料

5.6 Filler material type 填充材料类型

Welding with filler material qualifies for welding without filler material, but not vice versa.
带填充材料的焊接覆盖无填充材料的焊接，反之不行。

NOTE For processes 142 and 311 (without filler material), the parent material group used in the test is the material group that the welder is qualified for.
对于工艺142和311（无填充材料），测试中使用的母材组是焊工合格的材料组。

The ranges of qualification for filler material type are given in Tables 4 and 5.
表 4 和表5 给出了填充材料的覆盖范围

Table 4 — Range of qualification for covered electrodes[a] 焊条药坡覆盖范围

Welding process 焊接工艺	Type of covering used in the test[b] 考试采用覆盖物类型	Range of qualification 资格范围		
		A, RA, RB, RC, RR, R 03, 13, 14, 19, 20, 24, 27	B 15, 16, 18, 28, 45, 48	C 10, 11
111	A, RA, RB, RC, RR, R 03, 13, 14, 19, 20, 24, 27	×	—	—
	B 15, 16, 18, 28, 45, 48	×	×	—
	C 10, 11	—	—	×

× indicates those filler materials for which the welder is qualified. 表示焊工合格的填充材料
— indicates those filler materials for which the welder is not qualified. 表示那些焊工不合格的填充材料

[a] For abbreviations, 对于缩写see 4.3.2.
[b] The type of covering used in the qualification test of welders for root run welding without backing (ss nb) is the type of covering qualified for root run welding in production with no backing (ss nb).
焊工资格考试中没有背衬的根部焊接类型的覆盖物类型（ss nb）是生产中没有背衬的根部焊接合格的覆盖物类型（ss nb）。

Table 5 — Range of qualification for filler material types[a,b] 填充材料类型的资格范围

Filler material types used in test piece 试件中使用的填充材料类型	Range of qualification 资格范围			
	S	M	B	R, P, V, W, Y, Z
Solid wire electrode, rod 实心焊条，棒(S)	×	×	—	—
Metal cored electrode, rod金属芯焊条，棒 (M)	×	×	—	—
Flux cored electrode, rod 药芯焊丝，棒(B)	—	—	×	×
Flux cored electrode, rod (R, P, V, W, Y, Z)	—	—	—	×

× indicates those filler materials for which the welder is qualified. 表示焊工合格的填充材料
— indicates those filler materials for which the welder is not qualified. 表示那些焊工不合格的填充材料

a For abbreviations,对于缩写 see 4.3.2.
b The type of flux cored wire used in the qualification test of welders for root run welding without backing (ss, nb) is the type of flux cored wire qualified for root run welding in production with no backing (ss, nb).
焊工资格考试中没有背衬（ss，nb）的药芯焊丝的类型是指生产中没有背衬（ss，nb）的有根焊合格的药芯焊丝的类型。

5.7 Dimensions 尺寸

The welder qualification test of butt welds is based on the deposited thickness and outside pipe diameters. The ranges of qualification are specified in Tables 6 and 7.
对接焊缝的焊工考试以材料厚度或管子外径为基础。表 6 及表7 规定了认可范围

It is not intended that deposited thickness or outside pipe diameters should be measured precisely, but rather the general philosophy behind the values given in Tables 6 and 7 should be applied. 精确测量焊缝金属厚度或管子外径的尺寸实际上并不重要，而应遵循的则是表 6 和表 7 中数值背后的基本原则。

For fillet welds, the range of qualification for material thicknesses is specified in Table 8.
对于角焊，材料厚度的合格范围在表8中指定

For test pieces of different outside pipe diameters and deposited thicknesses, the welder is qualified for:
对于管径和焊缝金属厚度不同的焊缝，焊工考试按照

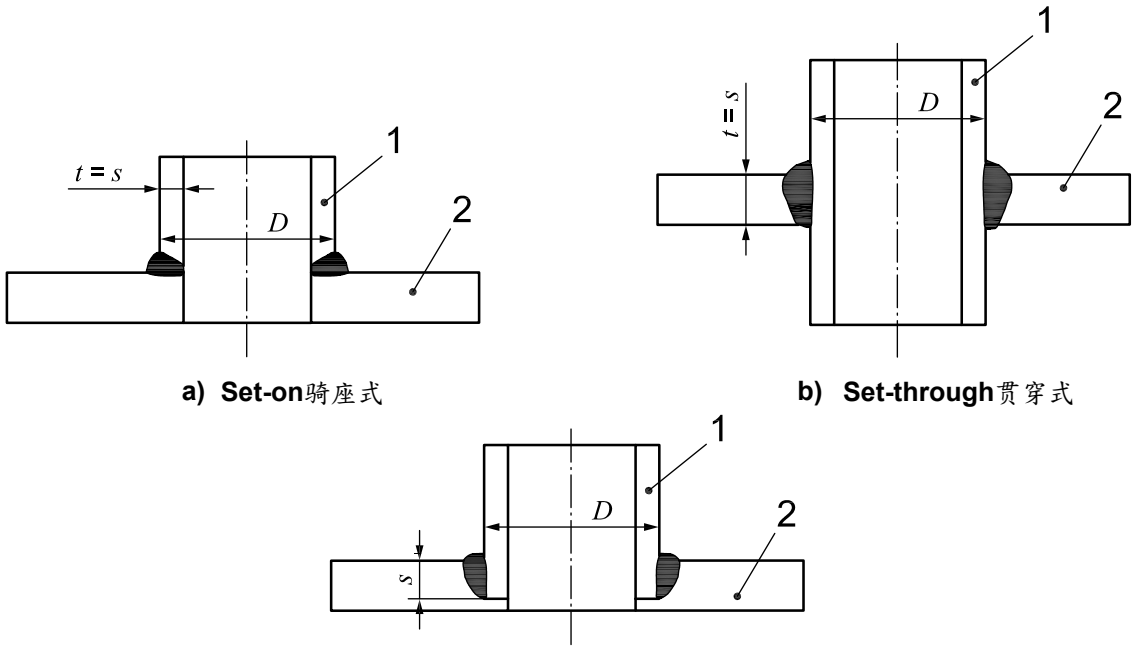
— the thinnest through to the thickest deposited and/or parent metal thickness qualified; and
从最薄到最厚的溶金和/或母金属厚度合格； 和
— the smallest through to the largest diameter qualified (refer to Tables 6 and 7).
覆盖最小和最大的管子外径，详见表 6 和表 7。

Table 6 — Range of qualification of deposited thickness for butt welds
对接焊缝熔敷厚度合格范围

Dimensions in millimetres
尺寸单位：毫米

Deposited thickness of test piece 试板焊缝金属厚度 *s*	Range of qualification 资格范围[a,b]
$s < 3$	*s* to 3[c] or *s* to 2*s*[c] whichever is greater 取较大者
$3 \leq s < 12$	3 to 2*s*[d]
$s \geq 12$[e,f]	≧3[f]

a For single process and the same type of filler material, *s*, is equal to parent material *t*.
对于单一焊接方法和相同类型的填充材料，s 等于母材厚度 t.
b For branch joints, the range of qualification for deposited thickness is: 支管焊接，焊缝金属厚度覆盖范围如下：
— for set-on branch, see, for example, Figure 1 a), the deposited thickness of the branch;
分支机构(骑座式)（见图 1a）：支管的焊缝金属厚度及外径；
— for set-through and set-in branches, see, for example, Figure1 b) and c), the deposited thickness of the main pipe or shell.
插入式或贯穿式（见图 1b 和 1c）：主管或壳体的焊缝金属厚度
c For oxyacetylene welding氧乙炔焊 (311): *s* to 1,5*s*
d For oxyacetylene welding 氧乙炔焊(311): 3 to 1,5*s*
e The test piece has to be welded in at least 3 layers 试板至少应焊接 3 层
f For multi-processes, *s* is the deposited thickness for each process. 对多种焊接焊接方法，s 是每种方法的焊缝金属厚度。



Key

D outside pipe diameter 管外直径

s deposited thickness or fused metal thickness in butt welds对接焊缝金属厚度和熔敷金属厚度

t material thickness of test piece (plate or wall thickness)试以材料厚度（板或壁厚）

1 branch 支管

2 main pipe or shell 主管或壳体

Figure 1 — Branch types 支管类型

Table 7 — Range of qualification for outside pipe diameter 管外径覆盖范围

Dimensions in millimetres
尺寸单位：毫米

Outside pipe diameter of test piece[a] 试件外径 *D*	**Range of qualification** 资格范围
$D \leq 25$	*D* to 2*D*
$D > 25$	≥ 0,5*D* (25 mm min.)

[a] For non-circular hollow sections, *D* is the dimension of the smaller side.
对于非圆形空心部分，D是较小边的尺寸

Table 8 — Range of qualification of material thickness for fillet welds
角焊缝材料厚度覆盖范围

Dimensions in millimetres
尺寸单位：毫米

Material thickness of test piece 试件材料厚度 *t*	**Range of qualification** 资格范围
$t < 3$	*t* to 2*t*, or 3, whichever is greater 取较大者
$t \geq 3$	≥ 3

In the case of branch welding, the deposited thickness criteria to which Table 6 applies and the outside pipe diameter criteria to which Table 7 applies are as follows:
对于支管焊接，焊缝金属厚度标准依据表 6，管外径标准依据表 7，覆盖范围如下：

— set-on: the deposited thickness and outside pipe diameter of the branch [see Figure 1 a)];
骑座式[见图1a）]：支管的焊缝金属厚度及外径；

— set-in or set-through: the deposited thickness of the main pipe or shell and the outside pipe diameter of the branch [see Figure 1 b) and c)].
插入式或贯穿式[见图 1b）和 c）]：主管或壳体的沉积厚度和分支的外径

5.8 Welding positions 焊接位置

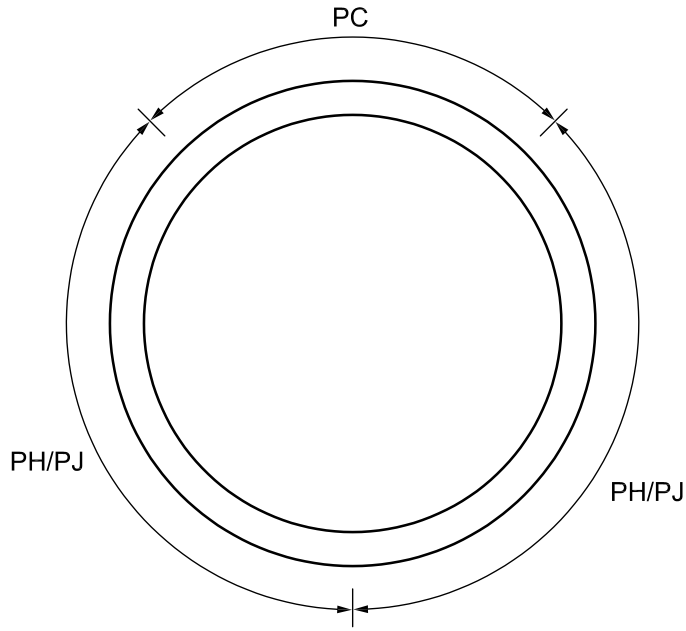
The range of qualification for each welding position is given in Tables 9 and 10. The welding positions and symbols refer to ISO 6947. 表9和表10中显示每个焊接位置的合格范围。焊接位置和符号参考ISO 6947。

The test pieces shall be welded in accordance with the testing positions specified in ISO 6947.
考试件应按照ISO 6947规定的测试位置进行焊接

Welding two pipes with the same outside pipe diameter, one in welding position PH and one in welding position PC, also covers the range of qualification of a pipe welded in welding position H-L045 using upward welding. 焊接两根外径相同的管，一根在焊接位置PH，另一根在焊接位置PC，也覆盖了使用向上焊接在焊接位置H-L045中焊接的管的合格范围。

Welding two pipes with the same outside pipe diameter, one in welding position PJ and one in welding position PC, also covers the range of qualification of a pipe welded in welding position J-L045 using downward welding. 焊接两根外径相同的管，一根在焊接位置PJ，一根在焊接位置PC，也涵盖了通过向下焊接在焊接位置J-L045中焊接的管的合格范围

Outside pipe diameters $D \geq 150$ mm can be welded in two welding positions (PH or PJ 2/3 of circumference, PC 1/3 of circumference) using only one test piece. This test covers all positions for the direction of welding used in the test. 仅使用一块试件就可以在两个焊接位置（圆周的PH或PJ 2/3，圆周的PC 1/3）焊接外径D >= 150 mm的管道。 该测试涵盖了测试中所用焊接方向的所有位置。



NOTE For welding position symbols, refer to ISO 6947.
焊接位置代号参见 ISO 6947。

Figure 2 — Outside pipe diameter $D \geq 150$ mm, positions
外径 D≥150mm 的管子焊接位置

Table 9 — Range of qualification for welding positions for butt welds 对接焊缝焊接资格范围

Testing position 考试位置	Range of qualification 资格范围				
	PA Flat	PC Horizontal	PE Overhead	PF Vertical up	PG Vertical down
PA	×	—	—	—	—
PC	×	×	—	—	—
PE (plate)	×	×	×	—	—
PF (plate)	×	—	—	×	—
PH (pipe)	×	—	×	×	—
PG (plate)	—	—	—	—	×
PJ (pipe)	×	—	×	—	×
H-L045	×	×	×	×	—
J-L045	×	×	×	—	×

NOTE See also 5.3.

× indicates those welding positions for which the welder is qualified. 表示焊工那些焊接位置合格

— indicates those welding positions for which the welder is not qualified. 表示焊工那些焊接位置不合格

Table 10 — Range of qualification for welding positions for fillet welds 角焊缝焊接位置的资格范围

Testing position 考试位置	Range of qualification 资格范围						
	PA Flat	PB Horizontal	PC Horizontal	PD Overhead	PE Overhead	PF Vertical up	PG Vertical down
PA	×	—	—	—	—	—	—
PB	×	×	—	—	—	—	—
PC	×	×	×	—	—	—	—
PD	×	×	×	×	×	—	—
PE (plate)	×	×	×	×	×	—	—
PF (plate)	×	×	—	—	—	×	—
PH (pipe)	×	×	×	×	×	×	—
PG (plate)	—	—	—	—	—	—	×
PJ (pipe)	×	×	—	×	×	—	×

NOTE See also 5.3.

× indicates those welding positions for which the welder is qualified. 表示焊工那些焊接位置合格

— indicates those welding positions for which the welder is not qualified. 表示焊工那些焊接位置不合格

5.9 Weld details 焊缝细节

Depending on the weld details, the ranges of qualification are shown in Tables 11 and 12.
根据焊接细节，合格范围如表11和表12所示

When welding with process 311, a change from rightward welding to leftward welding, and vice versa, requires a new qualification test.
使用氧乙炔焊方法 311 进行焊接时，左焊法改成右焊法或反之均要求新的考试。

Table 11 — Range of qualification for backings and consumable inserts 垫板和耗材镶嵌覆盖范围

Test condition 测试条件	Range for qualification for backing and consumable inserts 衬背和耗材镶嵌的认证范围					
	No backing 无垫板 (ss,nb)	Material backing 带垫板 (ss,mb)	Welding from both sides 双面焊 (bs)	Gas backing 气体衬垫 (ss,gb)	Consumable insert 耗材镶嵌 (ci)	Flux backing 焊剂衬垫 (ss,fb)
No backing 无垫板(ss,nb)	×	×	×	×	—	×
Material backing带垫板(ss,mb)	—	×	×	—	—	—
Welding from both sides (bs) 双面焊	—	×	×	—	—	—
Gas backing 气体衬垫(ss,gb)	—	×	×	×	—	—
Consumable insert 耗材镶嵌(ci)	—	×	×	—	×	—
Flux backing 焊剂衬垫(ss,fb)	—	×	×	—	—	×

× indicates those conditions for which the welder is qualified.指出焊工合格的条件
— indicates those conditions for which the welder is not qualified. 指出焊工不合格的条件

Table 12 — Range of qualification of layer technique for fillet welds 角焊缝层技术鉴定的范围

Test piece 试件	Range of qualification 资格范围[b]	
	Single layer 单层 (sl)	Multi-layer 多层 (ml)
Single layer单层 (sl)	×	—
Multi-layer 多层 (ml)[a]	×	×

× indicates the layer technique for which the welder is qualified.表示焊工合格的层技术
— indicates the layer technique for which the welder is not qualified. 表示焊工不合格的层技术

[a] During the welding of the test piece, the examiner shall perform visual examination of the first layer in accordance with Clause 7.
在试件的焊接过程中，检查员应根据第7条对第一层进行目视检查

[b] When a welder has been qualified using a multi-layer butt weld and he or she makes the supplementary fillet weld test described in 5.4 e), he or she is qualified for both multi- and single layer fillet welds.如果一个焊工通过了对接焊缝多层焊接，并且按 5.4e)要求焊接了附加角焊缝试板，那么也就获得了相对应的角焊缝单层和多层焊接资质

6 Examination and testing 监考和检验

6.1 Examination 监考

The welding of test pieces shall be witnessed by the examiner or examining body. The testing shall be verified by the examiner or examining body.
试件的焊接应由检查员或检查机构见证。 测试应由审查员或审查机构进行验证。

The test pieces shall be marked with the identification of the examiner and the welder. Additionally, welding positions for all test pieces shall be marked on the test piece and, for fixed pipe welds, the 12 o'clock welding position shall also be marked. 试件上应标明检验员和焊工的身份。另外，所有试件的焊接位置应在试件上标出，对于固定管焊缝，还应标出12点钟的焊接位置

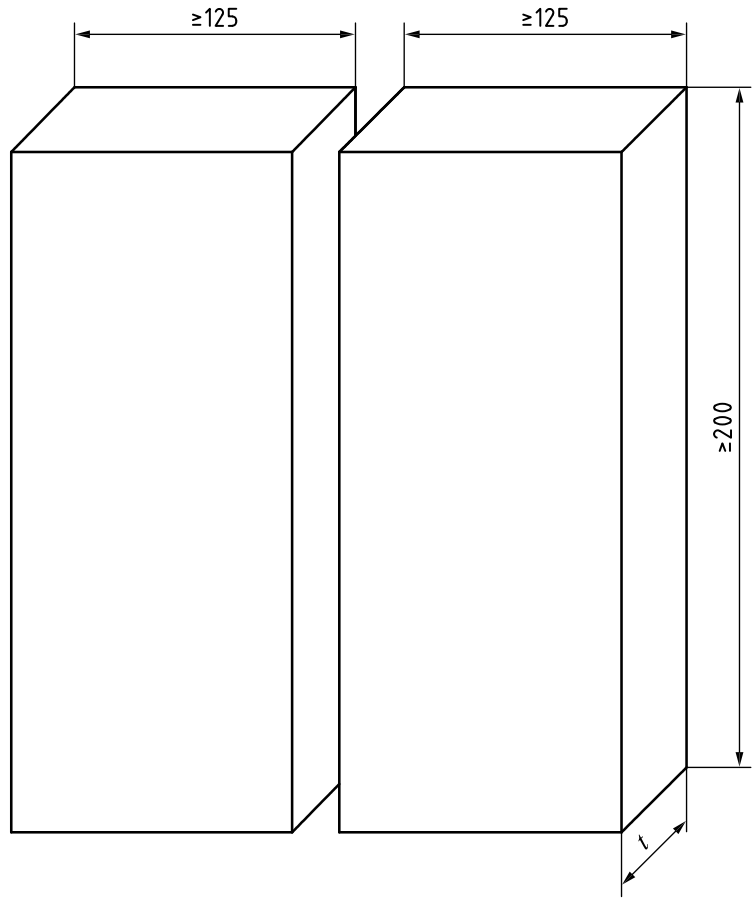
The examiner or examining body may stop the test if the welding conditions are not correct or if it appears that the welder does not have the skill to fulfil the requirements, e.g. where there are excessive and/or systematic repairs. 如果焊接条件不正确或焊工似乎不具备满足要求的技能，则检查者或检查机构可以停止测试。过多和/或系统维修的地方。

6.2 Test pieces 试件

The shape and dimension of test pieces required are shown in Figures 3 to 6.
所需试件的形状和尺寸如图3至6所示

A minimum test piece length for plates of 200 mm is required; the examination length is 150 mm. For pipe circumferences of less than 150 mm, additional test pieces will be required with a maximum of three test pieces. 板的最小试件长度要求为200 mm； 检查长度为150mm。 对于小于150 mm的管道周长，将需要额外的试件，最多三个

Dimensions in millimetres
单位：mm

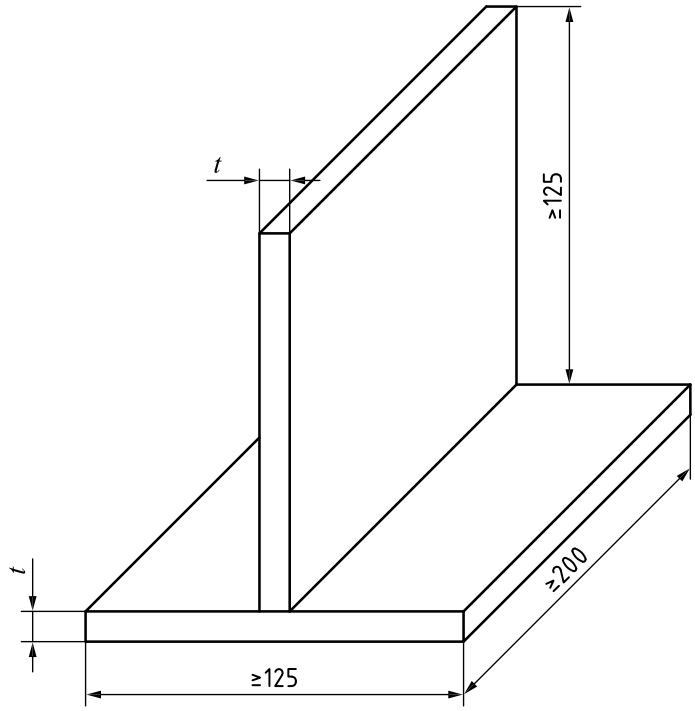


Key

t material thickness of test piece 试件材料厚度

Figure 3 — Dimensions of test piece for a butt weld in plate
板对接焊的试件尺寸

Dimensions in millimetres
单位：mm



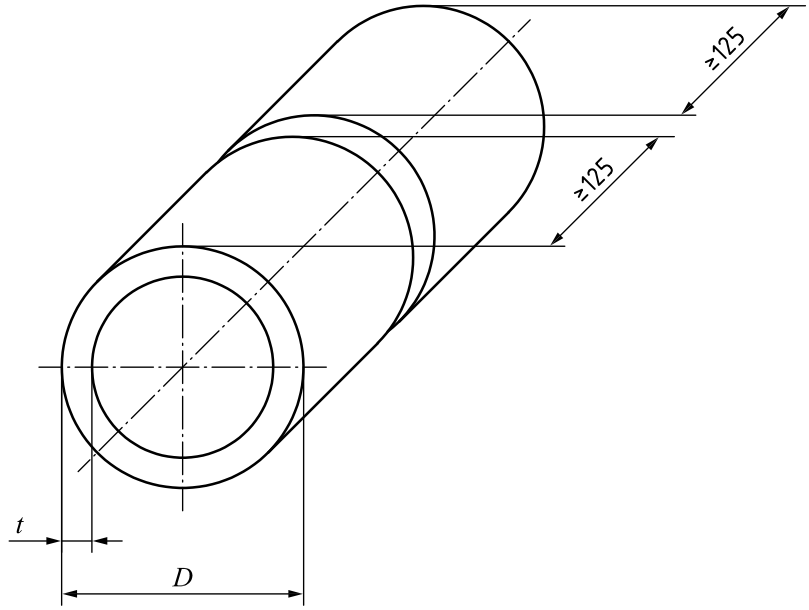
Key

t material thickness of test piece 试件材料厚度

NOTE The parent material can be of dissimilar thickness. 母材可以具有不同的厚度

Figure 4 — Dimensions of test piece for a fillet weld on plate 板上角焊缝的试件尺寸

Dimensions in millimetres
单位：mm



Key

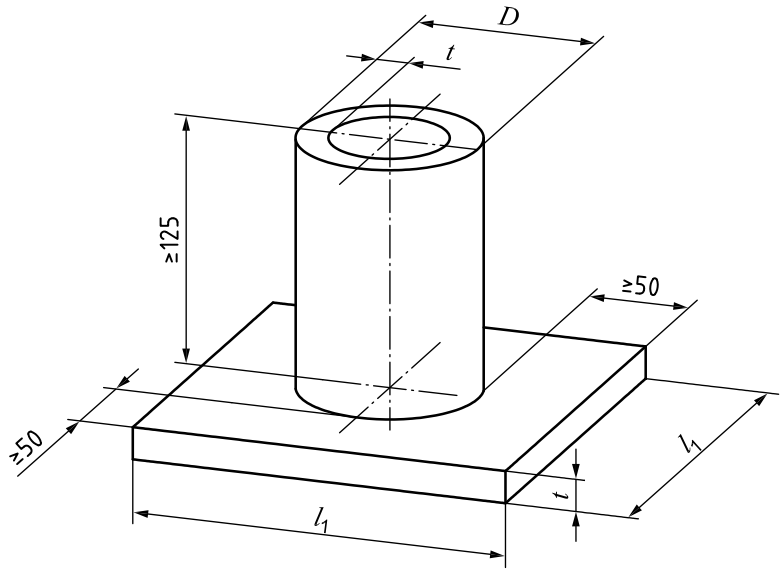
D outside pipe diameter 管外径

t material thickness of test piece (wall thickness) 试件材料厚度（壁厚）

Figure 5 — Dimensions of test piece for a butt weld in pipe 管道对接焊试件尺寸

Dimensions in millimetres

单位：mm



Key

D outside pipe diameter 管外径

l_1 length of test piece 试片长度

t material thickness of test piece (plate or wall thickness) 试件的材料厚度（板或壁厚）

NOTE The parent material can be of dissimilar thickness for the pipe and plate. 对于管道和板，母材的厚度可以不同

Figure 6 — Dimensions of test piece for a fillet weld on pipe 管板角焊缝试板尺寸

6.3 Welding conditions 焊接条件

The qualification test of welders shall follow a pWPS or WPS prepared in accordance with ISO 15609-1 or ISO 15609-2. The required throat thickness of the fillet weld test piece shall be defined in the pWPS or WPS used for the test. 焊工的资格测试应遵循按照ISO 15609-1或ISO 15609-2制备的pWPS或WPS。角焊缝试件的所需喉道厚度应在用于测试的pWPS或WPS中定义。

The following welding conditions shall apply. 应遵循以下焊接条件

— The test piece shall have at least one stop and restart in the root run and in the capping run. When more than one process is used, then at least one stop and restart shall be carried out for each process, this includes the root run and final run. The stop and restart areas shall be marked.
试件在打底焊道和盖面焊道上应至少有一次熄弧和再起弧。如果采用多种焊接方法焊接，每一种焊接方法应至少有一次熄弧和再起弧，包括打底焊道和最终焊道，并标记接头位置；

— The welder shall be allowed to remove minor imperfections by grinding, except for the capping run for which only the stop and restart may be ground. The permission of the examiner or examining body shall be obtained. 经考官或考试机构同意后，焊工在完成焊接后可以通过打磨的方法去除轻微的缺陷，但盖面层仅允许打磨接头处。

— Any post-weld heat treatment required in the pWPS or WPS may be omitted at the discretion of the manufacturer. pWPS 或 WPS 中要求的焊接后热处理，制造商可以省略不做

6.4 Test methods 检验方法

After welding the test piece shall be tested in accordance with Table 13. 焊接后，应按照表13进行测试

If the weld is accepted by visual testing, the remaining test(s) according to Table 13 shall be carried out. 如果焊缝通过目测接受，则应按照表13进行其余试验

When material backing is used in the qualification test, it shall be removed prior to destructive testing (except for macroscopic examination) and need not be removed before non-destructive testing (NDT). 考试采用永久垫板时，应在进行破坏性检验之前将其去除，但 NDT 前不必去除。

The test specimen for macroscopic examination shall be prepared and etched on one side to clearly reveal the weld. Polishing is not required. 为了清晰地显示焊缝，宏观试样应在一侧制备并腐蚀。一般不要求抛光

Table 13 — Test methods 检验方法

Test method 检验方法	**Butt weld (in plate or pipe)** 对接(板或管)	**Fillet weld and branch joint** 角焊缝或支管
Visual testing according外观检验 to ISO 17637	mandatory 强制	mandatory 强制
Radiographic testing according 射线检验to ISO 17636	mandatory强制[a,b,c]	not mandatory 非强制
Bend test according弯曲试验 to ISO 5173	mandatory强制[a,b,d]	not applicable 不适用
Fracture test according断裂试验 to ISO 9017	mandatory强制[a,b,d]	mandatory强制[e,f]

a Either radiographic testing or bend or fracture tests shall be used. 射线(RT)，弯曲，断裂试验任选其一

b When radiographic testing is used, then additional bend or fracture tests are mandatory for welding processes 131, 135, 138 and 311. 当使用射线照相测试时，则对于焊接工艺131、135、138和311必须进行附加的弯曲或断裂测试

c The radiographic testing may be replaced by ultrasonic testing according to ISO 17640[19] for thicknesses ≥8 mm on ferritic steels only. In this case, the additional tests mentioned in footnote b are not required.

8mm 以上的铁素体钢射线(RT)可用依据ISO17640 的UT 替代。这种情况下不要求b 中提到的附加试验。

d For outside pipe diameters $D \leq 25$ mm, the bend or fracture tests may be replaced by a notched tensile test of the complete test piece (an example is given in Figure 9). 外径D≯25mm 的管，弯曲或断裂可用缺口拉伸试验替代（见图9）。

e The fracture tests may be replaced by a macroscopic examination, performed according to ISO 17639[18], of at least two sections,at least one of which shall be taken from the stop/start location.

断裂试验可以用根据ISO 17639 [18]对至少两个部分进行的宏观检查代替，其中至少两个部分应从停止/开始位置进行。

f The fracture tests on pipes may be replaced by radiographic testing. 管的断裂试验可以用射线照相试验代替

6.5 Test piece and test specimen 试件和试样

6.5.1 General 概述

In 6.5.2 and 6.5.3, details of the type, dimensions, and preparation of the test pieces and test specimens are given. In addition, the requirements for destructive tests are indicated. For root, face or side bend, or fracture tests, one specimen shall be taken from the start and stop area in the examination length.
在6.5.2和6.5.3中，给出了试件和试样的类型，尺寸和制备的详细信息。此外，还指出了破坏性测试的要求。对于根部，表面或侧面弯曲或断裂测试，应在检查长度的起点和终点截取一个样品。

6.5.2 Butt weld in plate and pipe 板和管的对接焊缝

6.5.2.1 General 一般要求

When radiographic testing is used, the examination length of the weld (see Figures 7 and 8) in the test piece shall be radiographed. 当使用射线照相测试时，应对试件中焊缝的检查长度（见图7和8）进行射线照相。

When fracture testing is used, test specimens may be longitudinally notched in the centre of the weld of the side in tension in order to achieve a fracture in the weld. All notch preparations according to ISO 9017 are permitted. 当使用断裂测试时，为了使焊缝断裂，可以在受拉侧焊缝的中心纵向开槽。 允许按照ISO 9017进行所有缺口准备。

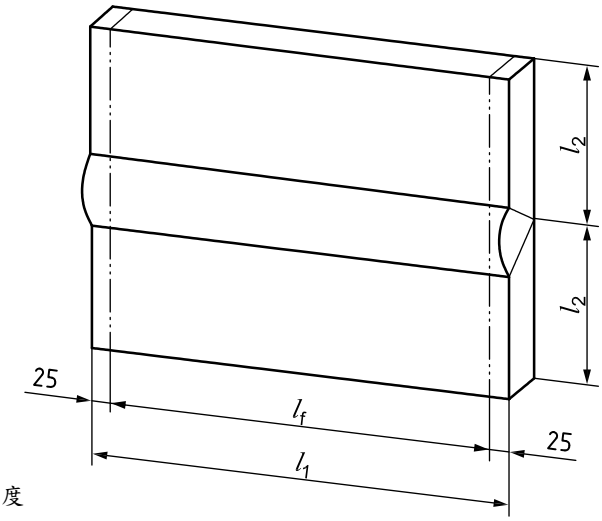
All test specimens shall be tested in such a manner that fracture is reached and the specimen examined after fracture. 所有试样应以达到断裂的方式进行试验，并在断裂后检查试样

6.5.2.2 Fracture testing only 仅做断裂试验

For butt welds in plate, the test piece examination length (Figure 7) shall be cut into four test specimens of equal width in accordance with the dimensions given in Table 14.
对于板对接焊缝，应按照表14中给出的尺寸将试件检查长度（图7）切成四个等宽的试样。

For butt welds in pipe, the test piece examination length (Figure 8) shall be cut into four test specimens of equal width in accordance with the dimensions given in Table 14.
对于管道中的对接焊缝，应按照表14中给出的尺寸将试件检查长度（图8）切成四个等宽的试样。

Dimensions in millimetres



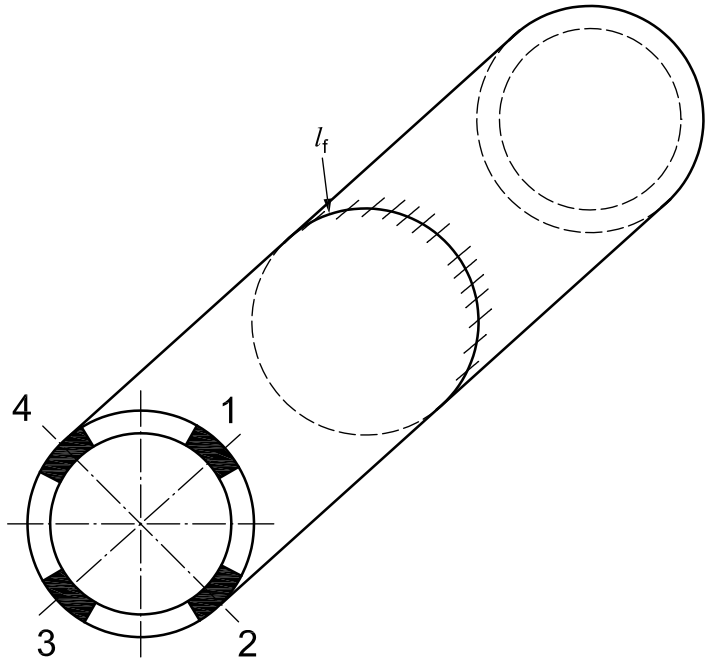
Key

l_1 length of test piece 试验长度

l_2 half-width of test piece试件宽一半

l_f examination length 检验长度

Figure 7 — Examination length for fracture test specimens for a butt weld in plate
板对接焊缝断裂试样的检验长度



Key

l_f examination length 检验长度

1 one root fracture or one root transverse bend or one side-bend test specimen 一个根面断裂或根面横弯或侧弯试样

2 one face fracture or one face transverse bend or one side-bend test specimen 一个正面断裂或正面横弯或侧弯试样

3 one root fracture or one root transverse bend or one side-bend test specimen 一个根面断裂或根面横弯或侧弯试样

4 one face fracture or one face transverse bend or one side-bend test specimen 一个正面断裂或正面横弯或侧弯试样

Figure 8 — Examination length and locations for fracture or bend test specimens for a butt weld in pipe 管对接焊缝的断裂或弯曲试样的检验长度和位置

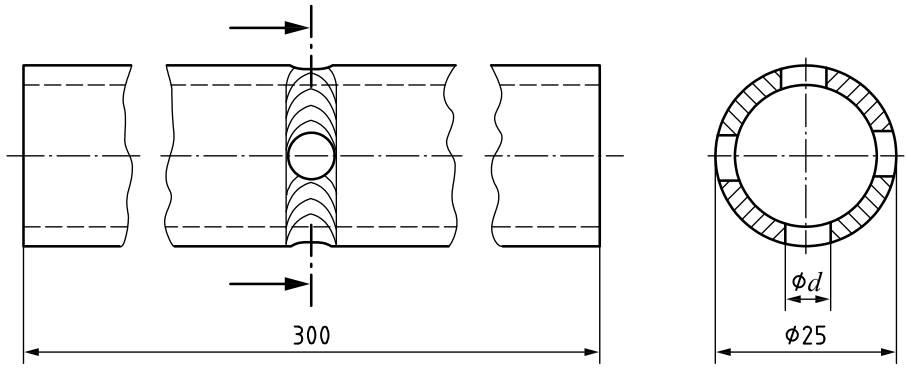
Table 14 — Width of fracture test specimens 断裂试样的宽度

Dimensions in millimetres 单位： mm

Plates 板**(P)**	**Product type** 产品类别 **Outside diameter** 外径, D, **of pipes** 管 **(T)**[a]	**Width of fracture test specimens** 断裂试样的宽度
×	≥100	≥35
—	$50 \leq D < 100$	≥20
—	$25 < D < 50$	≥10

[a] For pipes with outside diameter $D \leq 25$ mm, the notch tensile test piece according to Figure 9 is recommended.
外径D≯25mm 的管，缺口拉伸试验推荐按照图 9 进行。

Dimensions in millimetres 单位： mm



Key

d diameter of the former or the inner roller 内或外辊直径

Holes are not allowed in start and stop areas. 孔不允许开在接头处

For $t \geq 1{,}8$ mm: $d = 4{,}5$ mm

For $t < 1{,}8$ mm: $d = 3{,}5$ mm

NOTE Notch profiles s and q are also permitted in circumferential direction according to ISO 9017.
圆周方向上的缺口形状允许按 ISO 9017 规定采用尖（s）形和方（q）形。

Figure 9 — Example for notch tensile test for pipe test piece outside diameter ≤25 mm
外径<=25mm的管道试件的缺口拉伸试验示例

6.5.2.3 Bend testing only 仅弯曲测试

Bend tests shall be performed in accordance with ISO 5173. 根据 ISO 5173 来做弯曲试验。

When only bend testing is carried out, the following conditions shall apply.
仅进行弯曲试验时，应满足以下条件

For thicknesses $t < 12$ mm, a minimum of two root and two face bend test specimens shall be used, and the complete examination length shall be tested.
厚度 t<12 至少 2 个面弯和 2 个背弯试样，而且整个长度都要试验。

For thicknesses $t \geq 12$ mm, four side-bend test specimens shall be used approximately equally spaced along the examination length. 厚度 t≥12 等间距的在试验长度上取 4 个侧弯试样。

For pipe butt welds, the four specimens shall be equally spaced in accordance with Figure 8.
对于管对接焊缝，按表 8 等间距的取 4 个侧弯试样。

In all cases, at least one specimen shall be taken from a stop/start location. For this purpose, it is possible that a side-bend specimen can be substituted by a root-bend specimen. 做这些试验时，至少一个试样要取在起弧和收弧区域。为了这个目的，可能的话一个侧弯试样可以用一个背弯试样替代。

When transverse bend testing or side-bend testing is used, the diameter of the former or the inner roller shall be 4t and the bending angle 180° for parent metal with elongation $A \geq 20$ %. For parent metal with elongation $A < 20$ %, the following equation shall apply: 做横弯或侧弯试验时，对于延伸率 A≥20%的母材，弯头或内辊的直径应为4t，弯曲角度应为 180°。对延伸率 A＜20%的母材，应采用下列公式：

$$d = \frac{100 \times t_s}{A} - t_s$$

where 式中

d is the diameter of the former or the inner roller, in millimetres; 弯头或内辊的直径，mm；

t_s is the thickness of the bend-test specimen, in millimetres; 弯曲试样厚度，mm；

A is the minimum percentage elongation required by the material standard. 材料规范要求的最小延伸率，%

6.5.2.4 Additional bend or fracture test 附加弯曲或断裂试验

When additional bend or fracture tests are required (see Table 13, footnote b), in all cases, at least one specimen shall be taken from a stop/start location. For this purpose, it is possible that a side-bend specimen can be substituted by a root-bend specimen. 当需要附加弯曲或断裂试验时（见表 13 脚注 b），在这些情况下，至少一个试样要取在起弧和收弧区域。为了这个目的，可能的话一个侧弯试样可以用一个背弯试样替代。

— For all plate butt welds, one root and one face test specimen shall be tested or two side-bend test specimens if applicable.板对接焊缝，适用的话可以进行一个面弯和背弯试验，或 2 个侧弯试验

— For butt welds in pipe in PA or PC positions, one root and one face test specimen shall be tested or two side-bend test specimens, if applicable.
PA 和 PC 焊接位置的管对接焊缝，适用的话可以进行一个面弯和背弯试验，或 2 个侧弯试验；

— For butt welds in pipe welded in all other welding positions, one root-test specimen shall be taken from the PE (overhead) welding position and one face test specimen shall be taken from the PF (vertical up) position or the PG (vertical down) position, or two side-bend test specimens if applicable.
其它焊接位置的管对接焊缝，PE 位置取一个背弯，PF 或 PG 位置取一个面弯，或 2 个侧弯试验。

6.5.3 Fillet weld on plate and pipe 板和管角焊试板

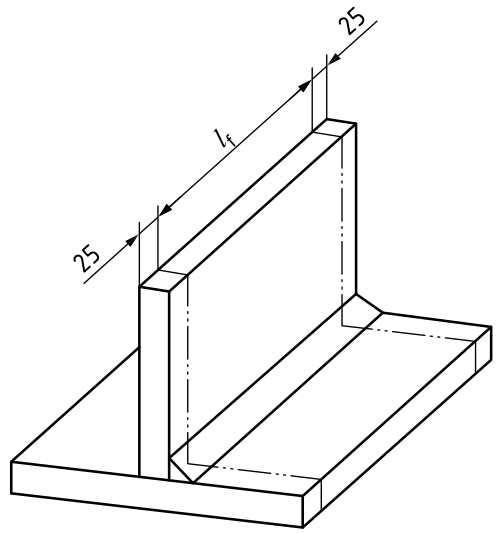
For fillet welds on plate, the test piece examination length (Figure 10) shall be fractured as one complete specimen. If necessary, the test piece can be cut into several test specimens of equal width. 对于板上的角焊缝试件，整个试验长度（见图 10）作为一个试样来进行断裂试验。有必要的话可以切成等宽的试样。

For fillet welds on pipe, the test piece shall be cut into four or more test specimens and fractured.
对于管道上的角焊缝，应将试件切成四个或更多的试样并弄

Fillet weld fracture tests on plate and pipe may be replaced by macroscopic examination. When macroscopic examination is used, at least two specimens shall be taken. One macroscopic specimen shall be taken at the stop/start location. 板和管的角焊缝断裂试验可以用宏观检查代替。当使用宏观检查时，至少应取两个样本。在起弧和收弧区域应取一个宏观样品

Fillet weld test specimens shall be positioned for breaking in accordance with ISO 9017.
角焊缝试样应按照ISO 9017的规定进行断裂定位

Dimensions in millimetres 单位：mm



Key
l_f examination length 检验长度

Figure 10 — Examination length for fracture testing for a fillet weld in plate 板角焊缝断裂试样长度

6.6 Test report 试验报告

The results of all testing shall be documented in accordance with the relevant test standard.
所有测试的结果均应按照相关的测试标准进行记录。

7 Acceptance requirements for test pieces 试件验收要求

Test pieces shall be evaluated according to the acceptance requirements specified for relevant types of imperfections. 应根据针对相关缺陷类型规定的验收要求对试件进行评估

Prior to any testing, the following shall be checked: 进行任何试验之前应做下列检查：

— all slag and spatters are removed; 清除所有的焊渣和飞溅

— no grinding on the root and the face side of the weld (according to 6.3);
焊缝正面和背面不得打磨（按 6.3）；

— stop and restart in the root run and in the capping run are identified (according to 6.3);
根部焊道和盖面焊道的熄弧点和起弧点应做标记（按 6.3）；

— profile and dimensions. 轮廓和尺寸

The acceptance requirements for imperfections found by test methods performed according to this part of ISO 9606 shall, unless otherwise specified, be assessed in accordance with ISO 5817. A welder is qualified if the imperfections are within ISO 5817, quality level B, except for the following imperfection types for which level C shall apply: excess weld metal (502); excessive convexity (503); excessive throat thickness (5214); excessive penetration (504); and undercut (501).
除非另有说明，否则，根据ISO 9606的本部分执行的测试方法所发现的缺陷的接受要求，应按照ISO 5817进行评估。如果缺陷在ISO 5817的B级范围内，则焊工合格。符合C级的以下缺陷类型,焊缝金属过多（502）、凸度过大（503）、焊缝厚度过大（5214）、塌陷（504）和咬边（501），

Bend-test specimens shall not reveal any discrete discontinuity ≥3 mm in any direction. Discontinuities appearing at the edges of a test specimen during testing shall be ignored in the evaluation unless there is evidence that cracking is due to incomplete penetration, slag or other discontinuity. The sum of the greatest discontinuities exceeding 1 mm but less than 3 mm in any one bend specimen shall not exceed 10 mm.
弯曲试样不应在任意方向上出现大于3mm 的单个裂纹。弯曲时出现在试样边缘处的裂纹应在评估时忽略，但由未焊透、焊渣或其它的缺陷所造成的裂纹除外。任何一个试样上最大不连续(超过1mm但小于3mm的不连续)的总和不允许超过10mm.

If the imperfections in the welder's test piece exceed the permitted maximum specified, then the welder fails the test. 如果焊工试件中的缺陷超过规定的最大允许值，则焊工将无法通过测试。

Reference should also be made to the corresponding acceptance criteria for non-destructive testing. Specified procedures shall be used for all destructive and non-destructive testing.
对于无损检测，还应参考相应的验收标准。 所有破坏性和非破坏性测试均应使用规定的程序

8 Re-tests 重新测试

If any test fails to comply with the requirements of this part of ISO 9606, the welder may be given the opportunity to repeat the qualification test once without further training. 如果任何测试不符合ISO 9606的本部分要求，则可以在无需进一步培训的情况下，使焊工有机会重复一次资格测试

9 Period of validity 有效期

9.1 Initial qualification 初始取证

The welder's qualification begins from the date of welding of the test piece(s), provided that the required testing has been carried out and the test results obtained were acceptable. The certificate needs to be confirmed every 6 months otherwise the certificate(s) become(s) invalid.
焊工的资格从试件的焊接日期开始，只要已进行了必需的测试并且所获得的测试结果是可接受的。需要每6个月对证书进行一次确认，否则证书将失效。

The validity of the certificate may be extended as specified in 9.3. The chosen method of the extension of qualification in accordance with 9.3, a) or b) or c), shall be stated on the certificate at the time of issue.
证书的有效性可以按照9.3的规定延长。根据9.3，a）或b）或c）选择的延长资格的方法，应在签发时在证书上说明

9.2 Confirmation of the validity 有效性确认

The qualifications of a welder for a process shall be confirmed every 6 months by the person responsible for welding activities or examiner/examining body. This is confirming that the welder has worked within the range of qualification and extends the validity of the qualification for a further 6 month period.
焊工的资格应每6个月由负责焊接活动的人员或检验人员/检查机构进行确认。这证实了焊工已经在认证范围内工作，并将认证的有效期再延长6个月。

This subclause is applicable to all options of revalidation specified in 9.3.
该条款选用于 9.3 中指定的所有可选择项。

9.3 Revalidation of welder qualification 重新验证焊工资格

Revalidation shall be carried out by an examiner/examining body. 重新验证应由审查员/审查机构进行

The skill of the welder shall be periodically verified by one of the following methods.
焊工的技能应通过以下方法之一定期验证

a) The welder shall be retested every 3 years.焊工每3年进行一次重新取证考试

b) Every 2 years, two welds made during the last 6 months of the validity period shall be tested by radiographic or ultrasonic testing or destructive testing and shall be recorded. The acceptance levels for imperfections shall be as specified in Clause 7. The weld tested shall reproduce the original test conditions except for thickness and outside diameter. These tests revalidate the welder's qualifications for an additional 2 years.在有效期的最后6个月中，每2年进行两次焊接，应通过射线照相或超声波检查或破坏性检查进行测试，并进行记录。缺陷的验收水平应按照第7条的规定进行。所测试的焊缝应复制原始的测试条件，但厚度和外径除外。这些测试使焊工的资格再次获得有效期2年。

   A welder's qualifications for any certificate shall be valid as long as it is confirmed according to 9.2 and provided all the following conditions are fulfilled:
   只要符合9.2的规定并满足以下所有条件，则任何证书的焊工资格均应有效：

c) — the welder is working for the same manufacturer for whom he or she qualified, and who is responsible for the manufacture of the product; 焊工为同一家制造商工作，并且负责产品的制造

   — the manufacturer's quality programme has been verified in accordance with ISO 3834-2 or ISO 3834-3; 制造商的质量程序已通过ISO 3834-2或ISO 3834-3的验证

— the manufacturer has documented that the welder has produced welds of acceptable quality based on application standards; the welds examined shall confirm the following conditions: welding position(s), weld type (FW, BW), material backing (mb) or no material backing (nb).
制造商已证明焊工已根据应用标准生产出质量合格的焊缝；被检查的焊缝应确认以下条件：焊接位置，焊接类型（FW，BW），材料底衬（mb）或无材料底衬（nb）。

9.4 Revocation of qualification 资格失效

When there is a specific reason to question a welder's ability to make welds that meet the product standard quality requirements, the qualifications that support the welding he or she is doing shall be revoked. All other qualifications not questioned remain valid. 当有特定的原因，怀疑焊工的某项认证技能不能够满足产品标准质量要求，那么将撤回支持他从事此项焊接作业的证书。其它没有问题的证书继续有效。

10 Welder's qualification test certificate 焊工资格考试证书

It shall be verified that the welder has successfully passed the qualification test. All essential variables shall be recorded on the certificate. If the test piece(s) fail(s) any of the required tests, no certificate shall be issued.
焊工已成功地通过了技能考试，应授予证书。证书上应记录所有的焊接主要参数。如果试件可以通过所要求的试验，则不予提交证书

The certificate shall be issued under the sole responsibility of the examiner or examining body. A recommended format is detailed in Annex A. If any other form of welder's qualification test certificate is used, it shall contain the information required in Annex A. The examiner or examining body is responsible for verifying that all essential variables are addressed in this certificate. 证书应由审查员或审查机构全权负责。推荐的格式在附录A中有详细说明。如果使用任何其他形式的焊工资格考试证书，则应包含附录A中要求的信息。检验员或检验机构负责验证本证书中是否涉及所有基本变量。

The following non-essential variables shall be recorded on the certificate:
以下非焊接主要参数应该记录在证书内：

— type of current and polarity; 电流类型和极性

— parent material group/subgroup; 母材组别和分组别

— shielding gas. 保护气体

In general, for each test piece, a separate welder's qualification test certificate shall be issued.
通常，对于每个试件，应签发单独的焊工资格测试证书。

If more than one test piece is welded, a single welder's qualification test certificate can be issued that combines the ranges of qualification of the individual test pieces. All essential variables for all tests shall be recorded on the combined certificate. In this case, only one of the following essential variables is permitted to differ, except those given in 5.7. 如果焊接的试板为一个以上，可以单独颁发一个焊工资格考试证书，将各个试件的资格范围 进行合并。在这种情况下，只可以变更以下主要参数中的一个，5.7 给出的情况除外：

— type of weld, 焊缝类型；

— welding position, 焊接位置

— deposited thickness. 溶敷厚度

It is not permissible to change other essential variables. 不允许改变主要参数。

It is recommended that the welder's qualification test certificates be issued in the local language plus at least one of the following languages: English, French or German.
建议以当地语言加上以下至少一种语言颁发焊工的资格考试证书：英语，法语或德语。

The examination of job knowledge (see Annex B) shall be designated by “Accepted” or “Not tested”.
对工作知识的考试（见附件B）应指定为“接受”或“未测试”。

In accordance with 5.4 e) the supplementary fillet weld test shall be recorded on the certificate for the associated butt weld qualification.
按照5.4 e），补充角焊缝试验应记录在证书上，以取得相关的对接焊缝合格证书。

11 Designation 标记

The designation of a welder qualification shall comprise the following items in the order given (the system is arranged so that it can be used for computerization):
焊工考试标记应包括下列项目（这样安排便于电脑化处理）：

a) the number of this part of ISO 9606 (ISO 9606-1);ISO 9606（ISO 9606-1）此部分的编号

b) the essential variables: 基本变数

   1) welding processes: refer to 4.2, 5.2, and ISO 4063,焊接工艺：参考4.2、5.2和ISO 4063

   2) product type: plate (P), pipe (T), refer to 4.3.1 and 5.3,产品类型：板（P），管(T），请参阅4.3.1和5.3

   3) type of weld: butt weld (BW), fillet weld (FW), refer to 5.4,
   焊缝类型：对接焊缝（BW），角焊缝（FW），请参阅5.4，

   4) filler material group or parent material group (autogenous welding): refer to 5.5,
   填充材料组或母材组（自溶）：参见5.5

   5) filler material types: refer to 5.6,填充材料类型：参见5.6

   6) dimensions of test piece: deposited thickness, s, or material thickness, t, and outside pipe diameter, D, refer to 5.7,试件的尺寸：熔敷厚度s或材料厚度t以及管道外径D，参见5.7，

   7) welding positions: refer to 5.8 and ISO 6947,焊接位置：参考5.8和ISO 6947

   8) weld details: refer to 5.9. 焊接细节：参见5.9。

The type of shielding and backing gas shall not be incorporated in the designation, but shall be included in the welder's qualification test certificate (see Annex A).
防护和衬里气体的类型不应包含在名称中，而应包括在焊工的资格测试证书中（参见附录A）。

Annex A
(informative)
Welder's qualification test certificate焊工资格考试证书

Designation(s): .....
.....

WPS – Reference参考编号:
Welder's name焊工姓名:
Identification身份证号:
Method of identification识别方法:
Date and place of birth出生日期和地点:
Employer雇主:
Code/testing standard 规范/考试标准:
Job knowledge专业知识:
Acceptable/Not tested (delete as necessary) 合格/未考试（可按需要删除）

Examiner or examining body 监考员或监考机构– Reference No参考编号.:

Photograph相片
(if required如需要)

	Test piece 試件	Range of qualification 资格范围
Welding process(es)焊接工艺; Transfer mode 电弧过渡模式 Product type (plate or pipe) 试件类型(板或管) Type of weld 焊缝种类 Parent material group(s)/subgroups 母材组别 Filler material group(s) 焊材组别 Filler material (Designation) 焊材（标记） Shielding gas 保护气体 Auxiliaries / Flux:辅助材料/助焊剂 Type of current and polarity 电流类型和极性 Material thickness材料厚度 (mm) Deposited thickness 熔敷金属厚度(mm) Outside pipe diameter管外径 (mm) Welding position 焊接位置 Weld details 焊接细节 Multi-layer/single layer 多层/单层		---------- ----------

Supplementary fillet weld test (completed in conjunction with a butt weld qualification): acceptable/not acceptable)
附加角焊缝试验（与对接焊缝一起取证）：接受/不接受

Type of test 试验种类	Performed and accepted 执行并接受	Not tested 不试验
Visual testing 目视测试 Radiographic testing 射线测试 Fracture test 断裂试验 Bend test 弯曲试验 Notch tensile test 缺口拉伸试验 Macroscopic examination 宏观检验		

Name of examiner or examining body: 监考员或监考机构名称

Place, date and signature of examiner or examining body: 监考员或监考机构的地点，日期和签名

Date of issue发行日期: 2007-01-20

Revalidation 再次生效 9.3 a)		Valid until 有效期到 2010-01-20

Revalidation 9.3 b)		Valid until 2009-01-20

Revalidation 9.3 c)		Valid until 2007-07-20

Revalidation for qualification by examiner or examining body for the following 2 years [refer to 9.3 b)]
在两年中由审查员或审查机构重新进行资格认证[参见9.3 b）]

Date 日期	Signature 签名	Position or title 职务或职称

Confirmation of the validity by employer/welding coordinator/examiner or examining body for the following 6 months [refer to 9.2)] 由雇主/焊接协调员/审查员或检查机构在接下来的六个月内确认有效性[参见9.2）]

Date	Signature	Position or title

Annex B
(informative)

Job knowledge 专业知识

B.1 General 概述

The test of job knowledge is recommended, but it is not mandatory. 建议考试工作知识，但这不是强制性的

However, some countries may require that the welder undergo a test of job knowledge. If the job knowledge test is carried out, it should be recorded on the welder's qualification test certificate.
但是，某些国家/地区可能要求焊工进行工作知识考试。 如果进行了工作知识考试，则应将其记录在焊工的资格测试证书中。

This annex outlines the job knowledge that a welder should have in order to ensure that procedures are followed and common practices are complied with. The job knowledge indicated in this annex is only pitched at the most basic level. 本附件概述了焊工应具备的工作知识，以确保遵循相关程序并遵守常规做法。 本附件中指出的工作知识仅在最基本的层次上提出。

Owing to different training programmes in various countries, it is only proposed to standardize general objectives or categories of job knowledge. The actual question used should be drawn up in the individual country concerned, but should include questions on areas covered in B.2, relevant to the qualification test of welders. 由于各个国家/地区的培训计划不同，因此建议仅将一般目标或职业知识类别标准化。所使用的实际问题应在有关国家中提出，但应包括与焊工资格考试有关的B.2涵盖的问题。

The actual tests of a welder's job knowledge may be given by any of the following methods or combinations of these methods: 焊工专业知识的实际考试可以按以下任何一种方法或这些方法的组合进行：

a) written objective tests (multiple choice);书面考试（多项选择）；

b) oral questioning following a set of written questions;按一组书面问题进行口试

c) computer testing;电脑考试

d) demonstration/observation testing following a written set of criteria.
遵循书面标准进行的演示/观察测试

The test of job knowledge is limited to the matters related to the welding process used in the test.
专业知识的考试仅限于与考试中使用的焊接过程有关的事项。

B.2 Requirements 要求

B.2.1 Welding equipment 焊接设备

B.2.1.1 Oxyacetylene welding 乙炔焊

a) Identification of gas cylinders.气瓶的识别

b) Identification and assembly of essential components.主要的组件识别和组装

c) Selection of correct nozzles and welding blowpipes. 选择正确的喷嘴和焊炬

B.2.1.2 Arc welding电弧焊

a) Construction and maintenance of welding equipment and typical parameters.
焊接设备的保养和维护及典型参数

b) Type of welding current.焊接电流的类型

c) Correct connection of the welding return cable.正确连接焊接回路电缆

B.2.2 Welding process 焊接工艺 [2)]

B.2.2.1 Oxyacetylene welding 乙炔焊(311)

a) Gas pressure.气压

b) Selection of nozzle type.选择喷嘴类型

c) Type of gas flame.气体火焰的类型

d) Effect of overheating. 过热的影响

B.2.2.2 Manual metal-arc welding with covered electrode手工金属带焊条的电弧焊 (111)

a) Classification of electrodes.焊条分类

B.2.2.3 Gas and self-shielded metal-arc welding 气体保护和自保护电弧焊(114, 13, 14, 15)

a) Type and size of electrodes.电极的类型和尺寸

b) Identification of shielding gas and flow rate (without 114).识别保护气体和流速（无114）。

c) Type, size and maintenance of nozzles/contact tip.喷嘴/导电嘴的类型，尺寸和维护

d) Selection and limitations of transfer mode.传输模式的选择和限制

e) Protection of the welding arc from draughts. 保护焊接电弧不受气流影响

B.2.2.4 Submerged arc welding 埋弧焊 (121, 125)

a) Drying, feeding and correct recovery of flux.焊剂干燥，输送正确回收

b) Correct alignment and travel of welding head. 焊机头正确定位和移动

B.2.3 Parent metals 母材金属

a) Identification of material.材料识别

b) Methods and control of pre-heating.预热的方法和控制

c) Control of interpass temperature. 控制层间温度

B.2.4 Filler metal types 填充金属类型

a) Identification of filler metal types.识别填充金属类型

b) Storage, handling and conditions of filler metal types.填充金属类型的存储，保管和条件

c) Selection of correct size.选择正确的尺寸

d) Cleanliness of electrodes and filler wires.电极和填充线的清洁度

e) Control of wire spooling.焊线盘控制

f) Control and monitoring of gas flow rates. 控制和监测气体流速

2) The numbers refer to 编号参考 ISO 4063.

B.2.5 Safety precautions 安全须知

B.2.5.1 General 概述

a) Safe assembly, set-up and turn-off procedures.安全的装置，设置和关闭程序

b) Safe control of welding fumes and gases.安全控制焊接烟雾和气体

c) Personal protection.个人防护

d) Fire hazards.火灾隐患

e) Welding in confined spaces.在密闭空间内焊接

f) Awareness of welding environment. 对焊接环境的常识

C.2.5.2 Oxyacetylene welding 乙炔焊

a) Safe storage, handling and use of compressed gases.安全存储，处理和使用压缩气体

b) Leak detection on gas hoses and fittings.气管和配件上的泄漏检测

c) Procedure to be taken in the event of a flashback.发生闪回时应采取的步骤

D.2.5.3 All arc welding processes 所有电弧焊工艺

a) Environment of increased hazard electric shock.触电危险的环境

b) Radiation from the arc.电弧光辐射

c) Effects of stray arcing.散射电弧光的影响

E.2.5.4 Gas-shielded metal-arc welding 气保金属电弧焊

a) Safe storage, handling and use of compressed gases.压缩气体安全存储，处理和使用

b) Leak detection on gas hoses and fittings. 气体软管和配件上的泄漏检测

B.2.6 Welding sequences/procedures 焊接顺序/步骤

Appreciation of welding procedure requirements and the influence of welding parameters.
了解焊接程序要求和焊接参数的影响

B.2.7 Joint preparation and weld representation 接头准备和焊接表示

a) Conformity of joint preparation to the welding procedure specification (WPS).
接头准备工作是否符合焊接程序规范（WPS）。

b) Cleanliness of fusion faces. 溶合面的清洁度

B.2.8 Weld imperfections 焊接缺陷

a) Identification of imperfections. 缺陷识别

b) Causes. 原因

c) Prevention and remedial action. 预防和补救措施

B.2.9 Welder qualification 焊工资格

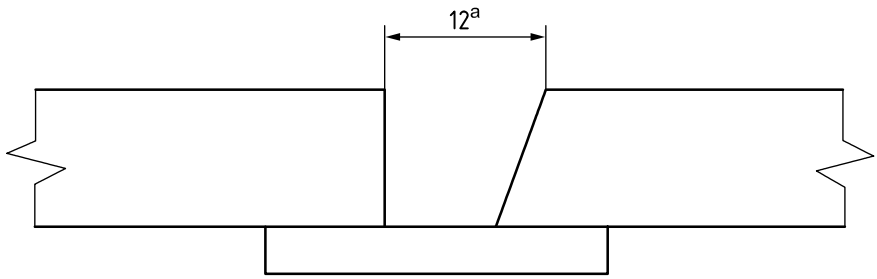
The welder shall be aware of the range of the qualification.
焊工应了解资格范围

Annex C
(informative)

FW/BW test assembly option
FW / BW测试组件选项

See Figure C.1.

Dimensions in millimetres 单位：mm



[a] Gap. 间隙

Figure C.1 — Combined FW/BW test piece
FW / BW组合测试件

Bibliography 参考书目

[1] ISO 636, *Welding consumables — Rods, wires and deposits for tungsten inert gas welding of non-alloy and fine-grain steels — Classification*

[2] ISO 2560, *Welding consumables — Covered electrodes for manual metal arc welding of non-alloy and fine grain steels — Classification*

[3] ISO 3580, *Welding consumables — Covered electrodes for manual metal arc welding of creep-resisting steels — Classification*

[4] ISO 3581, *Welding consumables — Covered electrodes for manual metal arc welding of stainless and heat-resisting steels — Classification*

[5] ISO 9000:2005, *Quality management systems — Fundamentals and vocabulary*

[6] ISO 14171, *Welding consumables — Solid wire electrodes, tubular cored electrodes and electrode/flux combinations for submerged arc welding of non alloy and fire grain steels — Classification*

[7] ISO 14172, *Welding consumables — Covered electrodes for manual metal arc welding of nickel and nickel alloys — Classification*

[8] ISO 14341, *Welding consumables — Wire electrodes and weld deposits for gas shielded metal arc welding of non alloy and fine grain steels — Classification*

[9] ISO 14343, *Welding consumables — Wire electrodes, strip electrodes, wires and rods for arc welding of stainless and heat resisting steels — Classification*

[10] ISO 14732, *Welding personnel — Qualification testing of welding operators for fully mechanized welding and weld setters for fully mechanized welding and automatic welding of metallic materials*

[11] ISO 15614-1, *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*

[12] ISO 15607, *Specification and qualification of welding procedures for metallic materials — General rules*

[13] ISO 16834, *Welding consumables — Wire electrodes, wires, rods and deposits for gas-shielded arc welding of high strength steels — Classification*

[14] ISO 17632, *Welding consumables — Tubular cored electrodes for gas shielded and non-gas shielded metal arc welding of non-alloy and fine grain steels — Classification*

[15] ISO 17633, *Welding consumables — Tubular cored electrodes and rods for gas shielded and non-gas shielded metal arc welding of stainless and heat-resisting steels — Classification*

[16] ISO 17634, *Welding consumables — Tubular cored electrodes for gas shielded metal arc welding of creep-resisting steels — Classification*

[17] ISO 17635, *Non-destructive testing of welds — General rules for metallic materials*

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

[19] ISO 17640, *Non-destructive testing of welds — Ultrasonic testing — Techniques, testing levels, and assessment*

[20] ISO 18274, *Welding consumables — Solid wire electrodes, solid strip electrodes, solid wires and solid rods for fusion welding of nickel and nickel alloys — Classification*

[21] ISO 18275, *Welding consumables — Covered electrodes for manual metal arc welding of high-strength steels — Classification*

[22] ISO 18276, *Welding consumables — Tubular cored electrodes for gas-shielded and non-gas-shielded metal arc welding of high-strength steels — Classification*

[23] ISO 21952, *Welding consumables — Wire electrodes, wires, rods and deposits for gas shielded arc welding of creep-resisting steels — Classification*

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

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

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