ISO 15614-6

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

Part 6:
Arc and gas welding of copper and its alloys

焊接规范与资格 金属材料的程序 焊接程序测试-
第6部分： 铜及其合金的电弧焊

Contents 内容

Foreword

前言

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.

ISO（国际标准化组织）是国家标准机构（ISO 成员机构）的全球联合会。制定国际标准的工作通常是通过 ISO 技术委员会来进行的。对设立了技术委员会的主题感兴趣的每个成员机构均有权代表该委员会。与 ISO 联络的政府和非政府国际组织也参加了这项工作。在电子技术标准化的所有问题上，ISO 与国际电子技术委员会（IEC）紧密合作。

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

国际标准是根据 ISO / IEC 指令第 2 部分中给出的规则起草的。

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.

技术委员会的主要任务是准备国际标准。技术委员会通过的国际标准草案已分发给成员机构进行投票。作为国际标准出版，至少要获得投票机构的 75％批准。

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.

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ISO 15614-6 was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 121, *Welding*, in collaboration with Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 10, *Unification of requirements in the field of metal welding*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

ISO 15614-6 是由欧洲标准化委员会（CEN）技术委员会 CEN / TC 121，焊接与技术委员会 ISO / TC 44，焊接及相关工艺，小组委员会 SC 10，标准领域的要求共同制定的根据 ISO 与 CEN 之间的技术合作协议（维也纳协议）进行金属焊接。

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

ISO 15614 由以下部分组成，其总标题为金属材料焊接程序的规范和资格-焊接程序测试

Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys

第 1 部分：钢的电弧焊和气焊以及镍和镍合金的电弧焊

Part 2: Arc welding of aluminium and its alloys

第 2 部分：铝及其合金的电弧焊

Part 3: Fusion and pressure welding of non-alloyed and low-alloyed cast irons

第 3 部分：非合金和低合金铸铁的熔焊和压力焊

Part 4: Finishing welding of aluminium castings

第 4 部分：铝铸件的精焊

Part 5: Arc welding of titanium, zirconium and their alloys

第 5 部分：钛，锆及其合金的电弧焊

Part 6: Arc and gas welding of copper and its alloys

第 6 部分：铜及其合金的电弧焊和气焊

Part 7: Overlay welding

第 7 部分：堆焊

Part 8: Welding of tubes to tube-plate joints

第 8 部分：将管子焊接到管板接头

Part 9: Underwater hyperbaric wet welding

第 9 部分：水下高压湿式焊接

Part 10: Hyperbaric dry welding

第 10 部分：高压干焊
Part 11: Electron and laser beam welding
第 11 部分：电子束和激光束焊接
Part 12: Spot, seam and projection welding
第 12 部分：点焊，缝焊和凸焊
Part 13: Resistance butt and flash welding
第 13 部分：电阻对焊和闪光焊

Introduction

介绍

ISO 15614 is part of a series of standards. Details of this series are given in ISO 15607:2003, Annex A.

ISO 15614 是一系列标准的一部分。该系列的详细信息在 ISO 15607：2003 附录 A 中给出。

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 which can be found at www.iso.org.

有关 ISO 15614 本部分任何方面的正式解释的要求，应通过您的国家标准机构直接提交给 ISO / TC 44 / SC 10 秘书处，有关其完整列表，请访问 www.iso.org。

Specification and qualification of welding procedures formetallic materials — Welding procedure test —Part 6:Arc and gas welding of copper and its alloys

焊接规范与资格 金属材料的程序 焊接程序测试-
第 6 部分： 铜及其合金的电弧焊

1 Scope

范围

This part of ISO 15614 specifies how a preliminary welding procedure specification is qualified by weldingprocedure tests. It applies to the arc and gas welding of copper and copper alloys in all product forms.
ISO 15614 的本部分规定了如何通过焊接过程测试来验证初步焊接程序规范。

This part of ISO 15614 defines the conditions for the execution of welding procedure tests and the range ofqualification for welding procedures for all practical welding operations within the range of variables listed inClause 9.
它适用于所有产品形式的铜和铜合金的电弧焊和气焊。

This part of ISO 15614 is applicable to all new welding procedures. However, it does not invalidate previouswelding procedure tests made to former national standards or specifications. Where additional tests have tobe carried out to make the qualification technically equivalent, it is only necessary to do the additional tests ona test piece made in accordance with this part of ISO 15614.
ISO 15614 的本部分定义了在第 9 条中列出的变量范围内，所有实际焊接操作的执行焊接程序测试的条件和焊接程序的资格范围。ISO 15614 的本部分适用于所有新的焊接程序。但是，它不会使根据以前的国家标准或规范进行的先前焊接程序测试无效。如果必须进行附加测试以使认证在技术上等效，则仅需要对根据 ISO 15614 此部分制造的试件进行附加测试。

Additional tests may be required by application standards.
应用程序标准可能需要其他测试。

The principles of this part of ISO 15614 may be applied to other fusion welding processes.
ISO 15614 的这一部分的原理可以应用于其他熔焊工艺。

2 Normative references

规范性引用文件

The following referenced documents are indispensable for the application of this document. For datedreferences, only the edition cited applies. For undated references, the latest edition of the referenceddocument (including any amendments) applies.
以下参考文件对于本文件的应用是必不可少的。凡是注日期的引用文件，仅所引用的版本适用。凡是不注日期的引用文件，其最新版本（包括所有的修改单）适用于本标准。

ISO 3452, *Non-destructive testing — Penetrant testing — General principles*
ISO 3452，无损检测-渗透检测-一般原则
ISO 4063:1998, *Welding and allied processes — Nomenclature of processes and reference numbers*
ISO 4063：1998，焊接和相关工艺-工艺和参考编号
ISO 4136, *Destructive tests on welds in metallic materials — Transverse tensile test*
ISO 4136，金属材料焊缝的破坏性试验-横向拉伸试验
ISO 5173, *Destructive tests on welds in metallic materials —Bend tests*
ISO 5173，金属材料焊缝的破坏性试验-弯曲试验
ISO 6520-1, *Welding and allied processes — Classification of geometric imperfections in metallic materials — Part 1: Fusion welding*
ISO 6520-1，焊接和相关工艺-金属材料中几何缺陷的分类-第 1 部分：熔焊
ISO 6947, *Welds — Working positions — Definitions of angles of slope and rotation*
ISO 6947，焊缝-工作位置-倾斜角度和旋转角度的定义

ISO 9017, *Destructive tests on welds in metallic materials — Fracture test*
ISO 9017，金属材料焊缝的破坏性试验-断裂试验
ISO 9606-3, *Approval testing of welders — Fusion welding — Part 3: Copper and copper alloys*
ISO 9606-3，焊工认可测试-熔焊-第 3 部分：铜和铜合金
ISO 10042:2005, *Welding — Arc-welded joints in aluminium and its alloys — Quality levels for imperfections*
ISO 10042：2005，焊接-铝及其合金的弧焊接头-缺陷的质量水平
ISO 3452, *Non-destructive testing — Penetrant testing — General principles*
ISO 3452，无损检测-渗透检测-一般原则
ISO 4063:1998, *Welding and allied processes — Nomenclature of processes and reference numbers*
ISO 4063：1998，焊接和相关工艺-工艺和参考编号
ISO 14175, *Welding consumables — Shielding gases for arc welding and cutting*
ISO 14175，焊接材料-电弧焊和切割的保护气体
ISO 14732, *Welding personnel — Approval testing of welding operators for fusion welding and of resistance weld setters for fully mechanized and automatic welding of metallic materials*
ISO 14732，焊接人员-熔接和电阻焊接操作人员的认可测试 用于金属材料的完全机械化和自动焊接的焊接工
ISO 15607:2003, *Specification and qualification of welding procedures for metallic materials — General rules*
ISO 15607：2003，金属材料焊接程序的规范和鉴定-一般规则
ISO/TR 15608, *Welding — Guidelines for a metallic material grouping system*
ISO / TR 15608，焊接-金属材料分组系统指南
ISO 15609-1, *Specification and qualification of welding procedure for metallic materials — Welding procedure specification — Part 1: Arc welding*
ISO 15609-1，金属材料焊接程序的规范和鉴定 - 焊接程序 规范-第 1 部分：电弧焊
ISO 15609-2, *Specification and qualification of welding procedure for metallic materials — Welding procedure specification — Part 2: Gas welding*
ISO 15609-2，金属材料焊接程序的规范和鉴定 - 焊接程序 规范-第 2 部分：气焊
ISO 15613, *Specification and qualification of welding procedures for metallic materials — Qualification based on a pre-production welding test*
ISO 15613，金属材料焊接程序的规范和鉴定-基于鉴定 在生产前的焊接测试中
ISO 17636, *Non-destructive testing of welds — Radiographic testing of fusion-welded joints*
ISO 17636，焊缝的非破坏性试验-熔焊接头的射线照相试验
ISO 17637, *Non-destructive testing of welds — Visual testing of fusion-welded joints*
ISO 17637，焊缝的无损检测-熔焊接头的外观测试
ISO 17639, *Destructive tests on welds in metallic materials — Macroscopic and microscopic examination of welds*
ISO 17639，金属材料焊缝的破坏性试验-焊缝的宏观和微观检验
ISO 17659, *Welding — Multilingual terms for welded joints with illustrations*
ISO 17659，焊接-带插图的焊接接头的多语言术语

3 Terms and definitions

术语和定义

For the purposes of this document, the terms and definitions given in ISO 15607 apply.
就本文档而言，适用 ISO 15607 中给出的术语和定义。

4 Welding processes

4 焊接工艺

Arc and gas welding are covered by the following processes in accordance with ISO 4063:1998.

根据 ISO 4063：1998，弧焊和气焊通过以下过程覆盖。

111 manual metal arc welding;

111 手工金属电弧焊；

131 metal inert gas welding, MIG welding;

131 金属惰性气体保护焊，MIG 焊接；

141 tungsten inert gas welding, TIG welding;

141 钨极惰性气体保护焊，TIG 焊；

15 plasma arc welding;

15 等离子弧焊；

311 oxy-acetylene welding.

311 氧乙炔焊。

5 Preliminary welding procedure specification (pWPS)

5 初步焊接程序规范（pWPS）

The preliminary welding procedure specification shall be prepared in accordance with ISO 15609-1 orISO 15609-2.

初步焊接程序规范应根据 ISO 15609-1 或 ISO 15609-2 进行准备。

6 Welding procedure test

6 焊接程序测试

The making and testing of test pieces shall be in accordance with Clauses 7 and 8.

试件的制造和测试应符合第 7 条和第 8 条的规定。

The welder or welding operator who undertakes the welding procedure test satisfactorily, in accordance withthis part of ISO 15614, is qualified for the appropriate range of qualification given in ISO 9606-3 or ISO 14732providing that the relevant testing requirements are met.

根据 ISO 15614 的这一部分，令人满意地进行焊接程序测试的焊工或焊接操作员只要满足相关测试要求，就具有 ISO 9606-3 或 ISO 14732 给出的适当资格范围的资格。

7 Test piece

7 试件

7.1 General

7.1 总则

The welded joint to which the welding procedure will relate in production shall be represented by making astandardized test piece or pieces, as specified in 7.2. Where the production/joint geometry requirements donot represent the standardized test pieces as shown in this part of ISO 15614, ISO 15613 shall be used.

生产过程中涉及焊接程序的焊接接头应按 7.2 的要求制作一个或多个标准化试件来表示。如果生产/接头的几何要求不代表 ISO 15614 本部分中所示的标准化试件，则应使用 ISO 15613。

7.2 Shape and dimensions of test pieces

7.2 试件的形状和尺寸

7.2.1 General

7.2.1 概述

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

试件的长度或数量应足以允许进行所有必需的试验。

Additional test pieces, or test pieces longer than the minimum size, may be prepared in order to allow for extratesting and/or for re-testing specimens (see 8.6).

为了允许进行额外的测试和/或重新测试样品，可以准备额外的试件，或者长于最小尺寸的试件（见 8.6）。

For all test pieces except branch connections (see Figure 5) and fillet welds (see Figure 4), the materialthickness, *t*, shall be the same for both plates/pipes to be welded.

对于除支管连接（参见图 5）和角焊缝（参见图 4）以外的所有试件，要焊接的两个板/管的材料厚度 t 均应相同。

If required by the application standard, the direction of plate rolling shall be marked on the test piece.

如果应用标准要求，应在试件上标出板的轧制方向。

The thickness and/or outside pipe diameter of the test pieces shall be selected in accordance with 9.3.2.1 to9.3.2.4.

应根据 9.3.2.1 至 9.3.2.4 选择试件的厚度和/或外径。

The shape and minimum dimensions of the test piece shall be as given in 7.2.2 to 7.2.6.

试件的形状和最小尺寸应按 7.2.2 至 7.2.6 的规定。

7.2.2 Butt joint in plate with full penetration

7.2.2 完全对接的板对接

The test piece shall be prepared in accordance with Figure 1.

试件应按照图 1 制备。

7.2.3 Butt weld between plates with raised edges

7.2.3 边缘凸起的板之间的对接焊

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

试件应按照图 2 制备。

7.2.4 Butt joint in pipe with full penetration

7.2.4 管道中的对接接头应完全浸入

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

试件应按照图 3 准备。

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

注：“管子”一词单独或组合使用，是指“管子”，“管子”或“空心部分”。

7.2.5 T-joint

7.2.5 T 型接头

The test piece shall be prepared in accordance with Figure 4.

试件应按照图 4 制备。

This may be used for fully penetrated butt welds or fillet welds.

这可用于完全渗透的对接焊或角焊。

7.2.6 Branch connection

7.2.6 分支连接

The test piece shall be prepared in accordance with Figure 5. The angle 〈 is the minimum to be used inproduction. This may be used for fully penetrated joints (set-on or set-in or set-through joint, and for filletwelds).

试件应按照图 5 进行准备。是用于生产的最低要求。这可用于完全渗透的接头（固定或嵌入或贯通接头，以及角焊缝）。

7.3 Welding of test pieces

7.3 试件的焊接

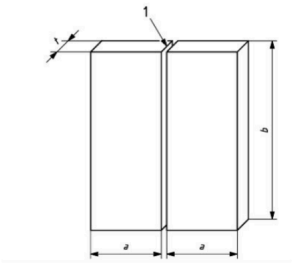
The preparation and welding of test pieces shall be carried out in accordance with the pWPS, and under thegeneral conditions of welding in production which they shall represent. Welding positions and limitations forthe

angle of slope and rotation of the test piece shall be in accordance with ISO 6947. If tack welds are to befused into the final joint, they shall be included in the test piece.

试件的准备和焊接应按照 pWPS 进行，并应在其代表的生产中的一般焊接条件下进行。

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

试件的焊接位置和倾斜角度及旋转角度的限制应符合 ISO6947。如果将点焊焊入最终接头中，则应将其包括在试件中。



Key

关键

1 joint preparation and fit-up as detailed in the preliminary Welding Procedure Specification (pWPS)

1 接头准备和装配，如初步焊接程序规范（pWPS）中所述

a minimum value 150 mm

最小值 150 毫米

b minimum value 300 mm

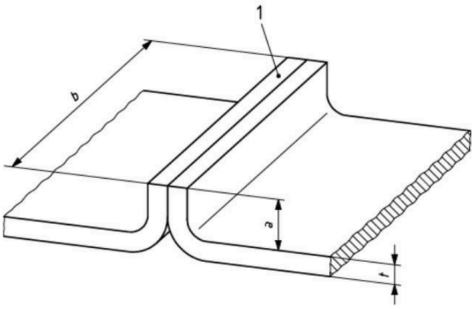
b 最小值 300 毫米

t material thickness

t 材料厚度

Figure 1 — Test piece for a butt joint in plate with full penetration

图 1-全熔透对接的板中对接接头的测试件



Key

关键

1 joint preparation and fit-up as detailed in the preliminary Welding Procedure Specification (pWPS) or as shown in ISO 17659

1 接头准备和装配，如初步焊接程序规范（pWPS）中所述

a minimum value 100 mm

最小值 150 毫米

b minimum value 300 mm

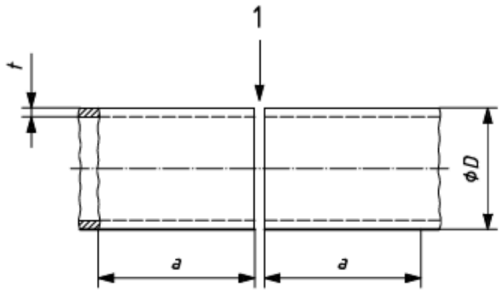
b 最小值 300 毫米

t material thickness

t 材料厚度

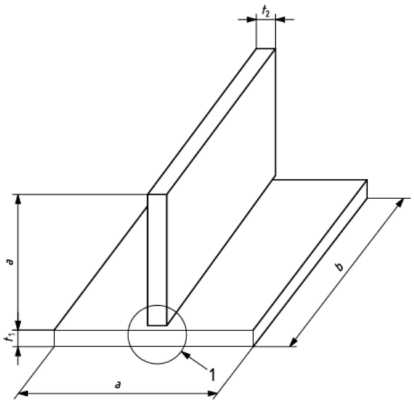
Figure 2 — Butt welds between plates with raised edges

图 2 板材喇叭形对接焊缝



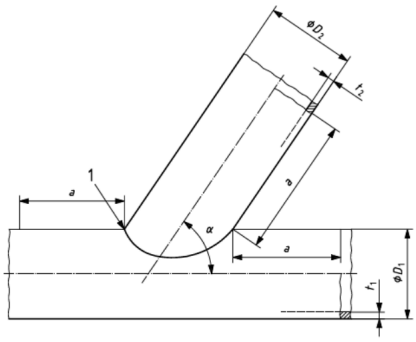
Key
关键
1 joint preparation and fit-up as detailed in the preliminary Welding Procedure Specification (pWPS)
1 接头准备和装配，如初步焊接程序规范（pWPS）中所述
a minimum value 150 mm
最小值 150mm
D outside pipe diameter
D 管外径
t material thickness
材料厚度

Figure 3 — Test piece for a butt joint in pipe with full penetration
全熔透管对接焊缝试样



Key
关键
1 joint preparation and fit-up as detailed in the preliminary Welding Procedure Specification (pWPS)
1 接头准备和装配，如初步焊接程序规范（pWPS）中所述
a minimum value 150 mm
最小值 150mm
b minimum value 300 mm
最小值 300mm
t1 – t2, material thickness,
材料厚度

Figure 4 — Test piece for a T-joint
T 形接头试样



Key
关键
1 joint preparation and fit-up as detailed in the preliminary Welding Procedure Specification (pWPS)
1 接头准备和装配，如初步焊接程序规范（pWPS）中所述
α branch angle
支管角度
a minimum value 150 mm
最小值 150mm
D_1 outside diameter of the main pipe
D1 主管外径
t_1 main-pipe material thickness
主管壁厚

Figure 5 — Test piece for a branch connection
支管链接测试试样

8 Examination and testing
8 检验与测试

8.1 Extent of testing
8.1 测试范围

Testing includes both non-destructive testing (NDT) and destructive testing which shall be in accordance withthe requirements of Table 1.
试验包括非破坏性试验（NDT）和破坏性试验，应符合表 1 的要求。
An application standard may specify additional tests which may include:
应用标准可能会指定其他测试，其中包括：
longitudinal weld tensile test;
纵向焊缝拉伸试验；
all-weld metal bend test;
全焊缝金属弯曲试验；
corrosion tests;
腐蚀测试；
chemical analysis;
化学分析；
hardness test.
硬度测试。
NOTE Specific service, material or manufacturing conditions may require more comprehensive testing than isspecified in this part of ISO 15614, in order to gain more information and to avoid repeating the welding procedure test at alater date just to obtain additional test data.
注：特定的服务，材料或制造条件可能需要比 ISO 15614 的本部分规定的测试更为全面的测试，以便获得更多信

息并避免在以后再次进行焊接过程测试，以获取额外的测试数据。

检查和试样测试

Table 1 — Examination and testing of test pieces

Test piece	Type of test	Extent of testing	Footnote
Butt joint with full penetration — (Figures 1, 2 and 3) 全熔透对接焊缝，图1,2,3,	Visual 外观检查	100 %	—
	Radiographic testing 射线探伤	100 %	—
	Penetrant testing 渗透探伤	100 %	—
	Transverse tensile test 横向拉伸试样	2 test specimens	—
	Transverse bend test 横向弯曲试样	2 root and 2 face test specimens	a, b, c —
	Macro-examination 宏观检查	1 test specimen	—
T-joint with full penetration — (Figure 4) T型接头全熔透焊缝，图4 Branch connection with full penetration — (Figure 5) 支管连接全熔透焊缝，图5	Visual 外观检查	100 %	d
	Penetrant testing 渗透探伤	100 %	d
	Macro-examination 宏观检查	2 test specimens	d
Fillet welds — (Figure 4) and (Figure 5) 角焊缝，图4，图5	Visual 外观检查	100 %	d
	Penetrant testing 渗透探伤	100 %	d
	Macro-examination 宏观检查	2 test specimens	d

[a] For bend tests, see 8.4.3. 弯曲试验件8.4.3

[b] 2 root and 2 face bend test specimens may be preferably substituted by 4 side bend test specimens for $t \geqslant 12$ mm.
对于t大于等于12mm，可选择2个面弯试样和2个背弯试样，或者4个侧弯试样

[c] For cast materials or wrought/cast combinations, the bend test may be replaced by a fracture test according to ISO 9017.
对于铸造材料或锻造/铸件组合，可以根据ISO 9017的弯曲试验代替弯曲试验

[d] Tests as detailed do not provide information on the mechanical properties on the joint. Where these properties are relevant to the application, an additional qualification shall also be held e.g. a butt weld qualification.
详细的测试无法提供有关接头机械性能的信息。这些属性与 申请时，还应持有其他资格，例如对接焊缝鉴定

8.2 Location and taking of test specimens

8.2 试样的放置和取放

The test specimens shall be taken in accordance with Figures 6, 7, 8 and 9.

试样应按照图 6、7、8 和 9 进行采集。

Test specimens shall be taken after all non-destructive testing (NDT) has been carried out and has passed therelevant inspection criteria for the NDT method(s) used.

在进行了所有无损检测（NDT）并通过了所用无损检测方法的相关检验标准后，应取样品。

It is acceptable to take the test specimens outside areas which have imperfections within the acceptancelimits for the NDT method(s) used.

可接受的是，将试样带到不合格缺陷在所使用的无损检测方法接受极限之内的区域。

8.3 Non-destructive testing

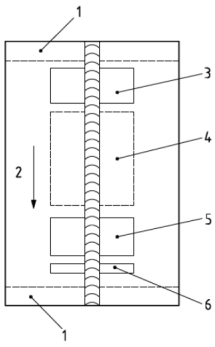
8.3 无损检测

All non-destructive testing in accordance with 8.1 and Table 1 shall be carried out on the test pieces prior tocutting of the test specimens. Any post-weld heat treatment that is specified shall be completed prior to nondestructivetesting.

在切割试样之前，应在试样上进行所有符合 8.1 和表 1 的非破坏性试验。指定的任何焊后热处理均应在无损检测之前完成。

Depending on joint geometry, materials and the requirements for work, the NDT shall be carried out asrequired in Table 1, in accordance with ISO 17637 (visual testing), ISO 17636 (radiographic testing), andISO 3452 (penetrant testing).

根据接头的几何形状，材料和工作要求，应按照 ISO 17637（视觉测试），ISO 17636（射线照相测试）和 ISO 3452（渗透测试）的要求，按照表 1 的要求执行无损检测。



Key

关键

1 discard 25 mm

1 丢弃 25 毫米

2 welding direction

2 焊接方向

3 area for:

3 区域：

1 tensile test specimen;

1 个拉伸试样

bend test specimens.

弯曲试样。

4 area for:

4 区域为：

additional test specimens, if required.

如果需要，还可以提供其他测试样品。

5 area for:1 tensile test specimen;bend test specimens.

5 区域，用于：1 个拉伸试样；弯曲试样。

6 area for:macro test specimen.

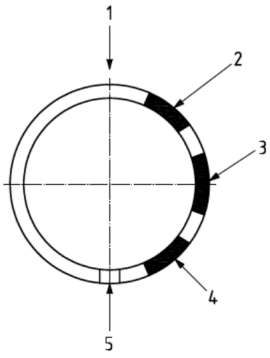
6 区域 宏观测试样本。

NOTE Not to scale.

注意不按比例

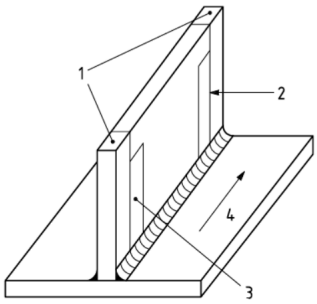
Figure 6 — Location of test specimens for a butt joint in plate

板对接接头的试样取样位置



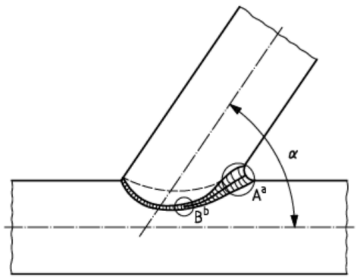
Key
关键
1 discard 25 mm
1 丢弃 25 毫米
2 welding direction
2 焊接方向
3 area for:
3 区域：
1 tensile test specimen;
1 个拉伸试样
bend test specimens.
弯曲试样。
4 area for:
4 区域为：
additional test specimens, if required.
如果需要，还可以提供其他测试样品。
5 area for:1 tensile test specimen;bend test specimens.
5 区域，用于：1 个拉伸试样；弯曲试样。
6 area for:macro test specimen.
6 区域 宏观测试样本。
NOTE Not to scale.
注意不按比例

Figure 7 — Location of test specimens for a butt joint in pipe
管对接焊缝取样位置



Key
关键
1 discard 25 mm
去除 25mm
2 macro test specimen
宏观试样
3 macro test specimen
宏观试样
4 welding direction
焊接方向
NOTE Not to scale.
注意 非比例取样

Figure 8 — Location of test specimens in a T-joint
T 型接头试样取样位置



Key
关键
α branch angle
支管角度
a Macro test specimen taken in position A.
A 位置宏观试样
b Macro test specimen taken in position B.
B 位置宏观试样
NOTE Not to scale.
注：非比例试样

8.4 Destructive testing
8.4 破坏性测试

8.4.1 General
8.4.1 概述

The extent of testing shall be as required by Table 1.
测试范围应符合表 1 的要求。

8.4.2 Transverse tensile test
8.4.2 横向拉伸试验

Test specimens and method for transverse tensile testing for butt joints shall be in accordance with ISO 4136.
对接接头的试样和横向拉伸试验方法应符合 ISO 4136。

For pipes of outside diameter > 50 mm, the excess weld metal shall be removed on both faces to give the testspecimen a thickness equal to the wall thickness of the pipe.
对于外径> 50 mm 的管子，应在两面上去除多余的焊接金属，以使试件的厚度等于管子的壁厚。

For pipes of outside diameteru50 mm, and when full-section small diameter pipes are used, the excess weldmetal may be left undressed on the inside surface of the pipe.

对于外径小于等于 50 mm 的管道，以及使用全截面小直径管道时，多余的焊缝金属可能会在管道的内表面留下未清理的表面。

8.4.3 Bend test

8.4.3 弯曲测试

The purpose of this test is to reveal any internal or surface breaking imperfections according to ISO 6520-1.

该测试的目的是揭示根据 ISO 6520-1 的任何内部或表面破坏缺陷。

Test specimens and the procedure for bend testing for butt joints shall be in accordance with ISO 5173.

试样和对接接头的弯曲测试程序应符合 ISO 5173。

For all groups, the bending angle shall be 180o using the calculated former diameter based upon materialelongation as follows:

对于所有组，弯曲角度应为 180o，使用基于材料伸长率计算出的模型前直径如下：

a) For elongation > 5 %

a）伸长率> 5%

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

where

这里

d is the diameter of the former;

d 是前者的直径；

t_s is the thickness of the bend test specimen (this includes side bends);

ts 是弯曲试样的厚度（包括侧弯）；

A is the minimum tensile elongation required by the material specification (for a combination of differentalloys, the lowest individual value shall be used).

A 是材料规格要求的最小拉伸伸长率（对于不同合金的组合，应使用最低的单个值）。

Table 2 gives examples of the maximum calculated former diameter for some elongations and thicknesses.

表 2 给出了某些伸长率和厚度的最大计算模型直径的示例。

Values shall be rounded down to aid those performing tests.

数值应四舍五入，以帮助进行测试的人员。

A smaller former diameter may be used at the discretion of the testing facility.

测试设备可自行决定使用较小的原直径。

b) For elongationu≤5 %, annealing shall be carried out before testing. The former diameter shall becalculated with the elongation given, as specified in Table 2.

b）对于伸长率≤5%，应在试验前进行退火。前者的直径应按照表 2 规定的伸长率计算。

During testing, the test specimens shall not reveal any one single flaw > 3 mm in any direction. Flawsappearing at the corners of a test specimen during testing shall be ignored during the evaluation.

在测试过程中，试样不得在任何方向上暴露出任何大于 3mm 的单个缺陷。在评估过程中，应忽略在测试样品的角部出现的瑕疵。

表2 —某些伸长率和厚度的最大计算模型直径的示例

Table 2 — Examples of maximum calculated former diameter for some elongations and thicknesses

Thickness of the bend test specimen 弯曲试样的厚度 t_s mm	Elongation, A 延伸率A% %							
	8	10	12	15	17	20	25	35
	Maximum calculated former diameter, d 最大压头直径 mm							
1,5	17	13,5	11	8,5	7,5	6	4,5	3
3	34	27	22	17	14	12	9	6
4	46	36	29	23	20	16	12	7
6	69	54	44	34	29	24	18	11
8	92	72	59	45	39	32	24	15
10	115	90	73	57	49	40	30	19
12	138	108	88	68	59	48	36	22
15	172	135	110	85	73	60	45	28
20	230	180	147	113	98	80	60	37
25	288	225	183	142	122	100	75	46
30	345	270	220	170	146	120	90	56

8.4.4 Macroscopic examination

8.4.4 宏观检查

The test specimen shall be prepared and examined in accordance with ISO 17639 on one side to clearlyreveal the fusion line, the HAZ and the build-up of the runs.

试样应按照 ISO 17639 的一侧进行准备和检查，以清楚显示熔合线，热影响区和通道的堆积。

The macroscopic examination shall include unaffected parent metal and shall be recorded by at least onemacro-reproduction per procedure test.

宏观检查应包括未受影响的母体金属，并应按照每个程序测试至少进行一次宏观复制记录。

The acceptance levels stated in 8.5 shall apply.

8.5 中规定的接受水平应适用

8.4.5 Fracture testing

8.4.5 断裂测试

Test specimens and the procedure for fracture testing for butt joints shall be in accordance with ISO 9017.

试样和对接接头断裂试验的程序应符合 ISO 9017。

8.5 Acceptance levels

8.5 接受水平

A welding procedure is qualified if the imperfections in the test piece are within the specified limits of qualitylevel B in ISO 10042:2005, except for imperfection types as follows: excess weld metal, excess convexity,excess throat thickness and excessive penetration, for which quality level C shall apply.

如果试件中的缺陷在 ISO 10042：2005 中规定的质量等级 B 的规定范围内，则焊接程序是合格的，但以下缺陷类型除外：焊接金属过多，凸度过大，喉部厚度过大和熔深过大，为此质量 C 级适用。

NOTE The correlation between the quality levels of ISO 10042 and the acceptance levels of the different NDTtechniques are given in ISO 17635.

注：ISO 17635 中给出了 ISO 10042 的质量水平与不同 NDT 技术的接受水平之间的相关性。

8.6 Re-testing

8.6 重新测试

If the test piece fails to comply with any of the requirements for visual examination or NDT specified in 8.5,one further test piece shall be welded and subjected to the same examination. If this additional test piece doesnot comply with the requirements, the welding procedure test has failed.

如果试件不符合 8.5 的任何目视检查要求或 NDT，则应再焊接一个试件并进行同样的检查。如果此附加试件不符合要求，则表明焊接工艺测试失败。

If any test specimens fails to comply with the requirements for destructive testing in accordance with 8.4 butonly due to weld imperfections, two further test specimens shall be obtained for each one that failed. The additional test specimens can be taken from the same test piece if there is sufficient material available, orfrom a new test piece.

如果任何试样未能满足 8..4.2 规定的破坏性试验要求，但仅由于焊接缺陷，则应为每一个不合格的试样再获得两个试样。如果有足够的可用材料，则可以从同一试件中取出其他试样，也可以从新的试件中取出。

If a tensile test specimen fails to meet the requirements of 8.4.2, two further test specimens shall be obtainedfor each one that failed. Both shall satisfy the requirements of 8.4.2.

如果拉伸试样不能满足 8.4.2 的要求，则每个不合格的试样应另取两个试样。两者均应满足 8.4.2 的要求。

Each additional test specimen shall be subjected to the same tests as the initial test specimen that failed. Ifeither of the additional test specimens does not comply with the requirements, the welding procedure test hasfailed.

每个附加的试样应进行与失效的初始试样相同的试验。如果两个附加试样中的任何一个都不符合要求，则表明焊接程序测试失败。

9 Range of qualification

9 资格范围

9.1 General

9.1 总则

Each of the conditions given in this clause shall be met in order to comply with this part of ISO 15614.

为了符合 ISO 15614 的本部分，必须满足本条中给出的每个条件。

Changes outside of the ranges specified shall require a new welding procedure test.

超出规定范围的变化应要求重新进行焊接程序测试。

9.2 Related to the manufacturer

9.2 与制造商有关

A qualification of a pWPS by a welding procedure test according to this part of ISO 15614 obtained by amanufacturer is valid for welding in workshops or sites under the same technical and quality control of themanufacturer.

制造商根据 ISO 15614 的本部分通过焊接程序测试对 pWPS 进行的鉴定，对于在制造商进行相同技术和质量控制的车间或现场进行焊接有效。

Welding is under the same technical and quality control when the manufacturer who performed the weldingprocedure test retains complete responsibility for all welding carried out to it.

当进行焊接过程测试的制造商对进行的所有焊接负全部责任时，焊接将受到相同的技术和质量控制。

9.3 Related to the parent material

9.3 与母材有关

9.3.1 Parent material grouping

9.3.母材物料分组

In order to minimise the number of welding procedure tests, copper and copper alloys are grouped accordingto ISO/TR 15608.

为了减少焊接程序测试的次数，根据 ISO / TR 15608 对铜和铜合金进行了分组。

Separate welding procedure qualifications are required for each parent material or parent materialcombinations not covered by the grouping system.

分组系统未涵盖的每种母材或母材组合都需要单独的焊接程序资格。

Permanent backing material shall be considered as a parent material within the qualification (sub-)group.

永久支持材料应被视为资格（子）组中的父级材料。

The range of qualification for similar and dissimilar joints is given in Table 3.

表 3 给出了相似和不同接头的鉴定范围。

Any dissimilar material joint not covered by Table 3 shall require a specific test with no range of qualificationfor other parent materials.

表 3 中未涵盖的任何异种材料接缝均应要求进行特定的测试，而没有其他母材料的资格范围。

If one parent material could belong to two groups or sub-groups, then it shall always be classified in the lowernumbered group or sub-group.

如果一种母体材料可以属于两个组或子组，则应始终将其分类为编号较低的组或子组。

NOTE Minor compositional differences between similar grades arising from the use of national standards need norequalification.

注：使用国家标准引起的相似等级之间的微小成分差异无需重新鉴定。

The ranges of qualification are given in Table 3.

表 3 给出了资格范围。

表3 —铜组和亚组的资格范围

Table 3 — Range of qualification for copper groups and sub-groups

测试接头材料组别 Material group(s) of test joint	Range of qualification 覆盖范围
31 – 31	31
32 – 32	32
33 – 33	33
34 – 34	34
35 – 35	34 and 35
36 – 36	32 and 36
37 – 37	37
38 – 38	38

9.3.2 Parent material thickness and pipe diameter

9.3.2 母材厚度和管径

9.3.2.1 General

9.3.2.1 概述

For single-process qualification, the thickness *t* shall have the following meanings:

对于单工艺鉴定，厚度 t 具有以下含义：

a) For a butt joint:

a）对于对接：

the parent material thickness.

母材厚度。

b) For a fillet weld:

b）角焊缝：

the parent material thickness qualified for joints between different thicknesses is that of the thicker material. For each thickness range qualified as in Table 4 there is also an associated range ofqualification for throat thicknesses, a, for single-run fillet welds as given in 9.3.2.3.

适用于不同厚度之间的接缝的母材厚度是较厚材料的厚度。对于表 4 中规定的每个厚度范围，如 9.3.2.3 所示，对于单道角焊缝，喉道厚度也具有相关的范围。

c) For a set-on branch connection:

c）对于分支分支连接：

the thickness of the branch pipe.

支管的厚度。

d) For a set-in or set-through branch connection:

d）对于内置或直通分支连接：

the thickness of the main pipe.

主管的厚度。

e) For a T-joint in plate with full penetration:

e）对于完全穿入的 T 型接头：

the thickness of the prepared plate.

准备好的板的厚度。

For multi-process procedures, the deposited metal thickness for each process shall be used as a basis for therange of qualification for the individual welding process.

对于多工艺程序，应将每个工艺的沉积金属厚度用作单个焊接工艺合格范围的基础。

9.3.2.2 Range of qualification for parent material thickness

9.3.2.2 母材厚度的合格范围

The qualification of a welding procedure test on thickness *t* shall include qualification for thicknesses in theranges given in Table 4.

厚度 t 的焊接工艺试验的合格评定应包括在表 4 给出的范围内的厚度合格评定。

For multi-process procedures, the deposited weld metal thickness for each welding process shall be used as abasis for the range of qualification for the individual welding process.

对于多工艺程序，应将每个焊接工艺的沉积焊缝金属厚度用作单个焊接工艺合格范围的依据。

Table 4 — Range of qualification for thicknesses for plates and pipes

板或管厚度的覆盖范围

Dimensions in millimetres

Thickness of the test piece, *t* 试板厚度	Range of qualification 覆盖范围
$t \leqslant 3$	0,5 *t* to 2 *t*
$3 < t \leqslant 20$	3 to 2 *t*
$t > 20$	$\geqslant$ 0,8 *t*

For fully mechanized and automatic single-run processes, the depth of penetration is the maximum depthqualified.

对于完全机械化和自动的单次运行过程，穿透深度为合格的最大深度。

9.3.2.3 Range of qualification for throat thickness of single-run fillet welds

9.3.2.3 单道角焊缝的喉道厚度合格范围

If hardness requirements are specified, a qualification of fillet welds, carried out on plates with thickness equalto or greater than 30 mm, applies for all plate and throat thicknesses.

如果规定了硬度要求，则对所有厚度等于或大于 30 mm 的钢板进行角焊缝鉴定。

In addition, for single-run fillet welds, the range of qualification of the throat thickness "*a*" shall be "0,75*a*" to"1,5*a*".

另外，对于单道角焊缝，喉道厚度" a"的合格范围应为" 0.75a"至" 1.5a"。

Where a fillet weld is qualified by means of a butt weld test, single-layer welds qualify for single-run andmulti-run fillet welds, but multi-run welds qualify only multi-run fillet welds.

如果角焊缝通过对接焊缝测试合格，则单层焊缝可用于单道和多道角焊，而多道焊仅可用于多道角焊。

9.3.2.4 Range of qualification for plates and pipes

9.3.2.4 板和管的资格范围

Qualification given for plates also covers pipes and vice versa.

板材的资格也包括管道，反之亦然。

9.3.3 Angle of branch connection

9.3.3 分支连接角度

A welding procedure test carried out on a branch connection with angle α shall qualify all branch angles α1 in the range of α≤α1≤90°

在角度为岬姆种Я妳由辖□械暮附映绦蚤馕杂κ顾□蟹种Ы嵌柔 1 合格，帷茆 1≤90?

9.4 Common to all welding procedures

9.4 所有焊接程序的共同点

9.4.1 Welding process

9.4.1 焊接过程

Each degree of mechanization shall be qualified independently (manual, partly mechanized, fully mechanizedand automatic).

每个机械化程度应独立鉴定（手动，部分机械化，完全机械化和自动）。 该资格仅对焊接工艺测试中使用的焊接工艺有效。

The qualification is only valid for the welding process(es) used in the welding procedure test.
对于多工艺过程，可以对每个焊接过程进行单独的焊接过程测试，以进行焊接过程鉴定。也可以将焊接过程测试作为多过程过程测试来执行。
For multi-process procedures, the welding procedure qualification may be carried out with separate weldingprocedure tests for each welding process. It is also possible to carry out the welding procedure test as a multiprocessprocedure test. The qualification of such a test is only valid for the process sequence carried outduring the multi-process procedure test.
这种测试的资格仅对在多过程程序测试期间执行的过程顺序有效。
NOTE It is not allowed to use a multi-process procedure test to qualify any single process, unless the testing carriedout on the process conforms to this part of ISO 15614.
注：除非对过程进行的测试符合 ISO 15614 的这一部分，否则不允许使用多过程程序测试来限定任何单个过程。

9.4.2 Welding positions

9.4.2 焊接位置

Welding of a test in any position (pipe or plate) qualifies for welding in all positions (pipe or plate).
在任何位置（管道或板）进行测试的焊接都可以在所有位置（管道或板）进行焊接。

9.4.3 Type of joint/weld

9.4.3 接头/焊接的类型

The range of qualification for the type of welded joints is as used in the welding procedure test subject tolimitations given in other clauses (e.g. diameter, thickness) and additionally:
焊接接头类型的合格范围如在焊接程序测试中所使用的那样，受其他条款（例如直径，厚度）的限制以及另外：
a) Butt welds qualify full and partial penetration butt welds; and fillet welds. Fillet weld tests shall be requiredwhere this is the predominant form of production welding.
a）对接焊缝适用于全部和部分熔透对接焊缝；和角焊缝。如果这是生产焊接的主要形式，则必须进行角焊缝测试。
b) Butt joints in pipe also qualify branch connections with an angle≥60°.
b）管道中的对接接头也可以使分支连接的角度≥60 啊?
c) T-joints butt welded only qualify T-joints butt welded and fillet welds [see a)].
c）对接的 T 型接头仅合格 T 形对接焊和角焊缝[见 a）]。
d) Welds made from one side without backing qualify welds made from both sides and welds with backing.
d）从一侧无背衬的焊缝合格，由两侧和有背衬的焊缝合格。
e) Welds made with backing qualify welds made from both sides.
e）带有衬背的焊缝可从两侧进行合格的焊缝。
f) Welds made from both sides without gouging qualify welds made from both sides with gouging.
f）不带气刨的两侧焊缝合格，但不带气刨的两侧焊缝合格。
g) Fillet welding qualifies fillet welding only.
g）角焊仅使角焊合格。
h) It is not permitted to change a multi-run deposit into a single-run deposit (or single run on each side) for a given process.
h）对于给定的过程，不允许将多次运行存款更改为一次运行存款（或在每一侧进行一次运行）。

9.4.4 Filler material, designation

9.4.4 填充材料，名称

Filler materials cover other filler materials, as long as they have equivalent mechanical properties and thesame nominal composition according to the designation in the appropriate standard for the filler materialconcerned.
填充材料可以覆盖其他填充材料，只要它们具有相同的机械性能和根据有关填充材料的适当标准中的名称具有相同的标称成分即可。

9.4.5 Type of current

9.4.5 电流类型

The qualification given is the type of current (alternating current AC, direct current DC) and polarity used in thewelding procedure test.
给定的资格是焊接程序测试中使用的电流类型（交流电，直流电）和极性。

9.4.6 Heat input

9.4.6 热输入

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

本节的要求仅在规定了热量输入的控制时适用。

The upper limit of heat input qualified is 25 % greater than that used in welding the test piece.

合格的热输入上限比焊接试件所用的上限大 25%。

The lower limit of heat input qualified is 25 % lower than that used in welding the test piece.

合格的热输入下限比用于焊接试件的下限低 25%。

9.4.7 Preheat temperature

9.4.7 预热温度

When preheating is required, the lower limit of qualification is the nominal preheat temperature applied at thestart of the welding procedure test.

当需要预热时，合格的下限是在焊接程序测试开始时施加的名义预热温度。

9.4.8 Interpass temperature

9.4.8 道间温度

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

合格的上限是在焊接程序测试中达到的最高层间温度。

9.4.9 Post-weld heat treatment or ageing

9.4.9 焊后热处理或时效

Post-weld heat treatment, e.g. artificial ageing, natural ageing, shall be specified in the pWPS.

焊后热处理，例如 pWPS 应规定人工老化，自然老化。

Addition or deletion of post-weld heat treatment or ageing is not permitted.

不允许添加或删除焊后热处理或时效。

The temperature range and the ageing conditions specified in the pWPS correspond to the range qualified.

pWPS 中指定的温度范围和老化条件与合格的范围相对应。

9.4.10 Initial heat treatment

9.4.10 初始热处理

A change in the initial heat treatment condition prior to the welding of copper and its alloys is not permitted.

不允许在焊接铜及其合金之前改变初始热处理条件。

9.5 Specific to processes

9.5 特定于过程

9.5.1 Process 131

9.5.1 处理 131

9.5.1.1 The qualification given to the shielding gas and backing gas is restricted to the symbol of the gas according to ISO 14175. A change of the helium content of more than 25 % necessitates re-qualification. Shielding gases not covered by ISO 14175 are restricted to the nominal composition used in the test.

9.5.1.1 对保护气体和保护气体的鉴定仅限于根据 ISO 14175 的气体符号。氦含量的变化超过 25%则需要重新鉴定。 ISO 14175 未涵盖的保护气体仅限于测试中使用的标称成分。

9.5.1.2 The qualification given is restricted to the wire system used in the welding procedure test (e.g. singlewire or multiple-wire system).

9.5.1.2 给出的资格仅限于焊接工艺测试中使用的焊丝系统（例如单焊丝或多焊丝系统）。

9.5.2 Process 141

9.5.2 处理 141

9.5.2.1 The qualification given to the shielding gas and backing gas is restricted to the symbol of the gas according to ISO 14175. A change of the helium content of more than 25 % necessitates re-qualification.Shielding gases not covered by ISO 14175 are restricted to the nominal composition used in the test.

9.5.2.1 对保护气体和保护气体的鉴定仅限于根据 ISO 14175 的气体符号。氦含量的变化超过 25%则需要重新鉴定。ISO14175 未涵盖的保护气体为限于测试中使用的标称成分。

9.5.2.2 A weld procedure test made without a backing gas qualifies a welding procedure with backing gas.

9.5.2.2 在没有背衬气体的情况下进行的焊接工艺测试表明有背衬气体的焊接工艺合格。

9.5.2.3 Welding with filler material does not qualify for welding without filler material or vice versa.

9.5.2.3 使用填充材料进行焊接不符合不使用填充材料进行焊接的条件，反之亦然。

9.5.3 Process 15

9.5.3 处理 15

9.5.3.1 Welding with filler material does not qualify for welding without filler material or vice versa.

9.5.3.1 使用填充材料进行焊接不符合不使用填充材料进行焊接的条件，反之亦然。

9.5.3.2 The qualification given is restricted to the plasma gas composition used in the welding procedure test.

9.5.3.2 所给出的资格仅限于焊接工艺试验中使用的等离子气体成分。

9.5.3.3 The qualification given to the shielding gas and backing gas is restricted to the symbol of the gas according to ISO 14175. A change of the helium content of more than 25 % necessitates re-qualification.Shielding gases not covered by ISO 14175 are restricted to the nominal composition used in the test.

9.5.3.3 对保护气体和保护气体的鉴定仅限于根据 ISO 14175 的气体符号。氦含量的变化超过 25%则需要重新鉴定。ISO14175 未涵盖的保护气体为限于测试中使用的标称成分。

9.5.4 Process 311

9.5.4 处理 311

Welding with filler material does not qualify for welding without filler material or vice versa.

使用填充材料进行焊接不符合不使用填充材料进行焊接的条件，反之亦然。

10 Welding procedure qualification record (WPQR)

10 焊接工艺鉴定记录（WPQR）

The welding procedure qualification record (WPQR) is a statement of the results of assessing each test piece including re-tests. The relevant items listed for the Welding Procedure Specification (WPS) in ISO 15609-1and ISO 15609-2 shall be included, together with details of any features that would be rejectable by therequirements of Clause 8. If no rejectable features or unacceptable test results are found, a WPQR detailingthe welding procedure test piece results is qualified and shall be signed and dated by the examiner orexamining body

焊接程序合格记录(WPQR)是对每个试件的评估结果的陈述,包括重新测试。应包括 ISO 15609-1 和 ISO 15609-2 中焊接程序规范（WPS）列出的相关项目，以及第 8 条要求可以拒绝的任何特征的详细信息。

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

如果没有可否接受的特征或不可接受的测试结果如果发现，详细说明焊接程序试件结果的 WPQR 是合格的，并应由检查员或检查机构签名并注明日期 WPQR 格式应用于记录焊接程序和测试结果的详细信息，以促进数据的统一表示和评估。

An example of the WPQR-format is shown in Annex A.

附件 A 中显示了 WPQR 格式的示例。

电弧焊

铜钢喷嘴电弧焊

钢筋闪光对焊和电弧焊

电弧焊

电弧焊

电弧

发表评论

验证码: 换一张

匿名评论

提交