

ICS 25.160.10
CCS J 33

NB

**ENERGY INDUSTRY STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

NB/T 47014-2023

Replacing NB/T 47014-2011

Welding procedure qualification for pressure equipments

承压设备焊接工艺评定

Issued on: December 28, 2023

Implemented on: June 28, 2024

Issued by: National Energy Administration of the PRC

Table of Contents

Foreword	5
1 Scope	7
2 Normative references	7
3 Terms and definitions	9
4 General requirements	11
5 Welding procedure qualification factors and classification	12
6 Welding procedure qualification of butt welds and fillet welds	40
7 Welding procedure qualification of corrosion-resistant surfacing	56
8 Others	63
Annex A (informative) Flow chart of the welding procedure specification	64
Annex B (normative) Supplementary provisions for base metals, filler metals and welding processes	65
Annex C (normative) Welding procedure qualification of butt welds with a buttering layer	67
Annex D (normative) Welding procedure qualification of stainless steel-steel clad plates	69
Annex E (normative) Welding procedure qualification of heat exchanger tube-to-tubesheet welds	71
Annex F (normative) Welding procedure qualification of stud arc welding	74
Annex G (informative) Recommended forms of the welding procedure qualification report	78
Annex H (informative) English abbreviations and codes commonly used in welding procedure qualification	90

Foreword

This document was issued on 28 December 2023 by the National Energy Administration of the PRC and takes effect on 28 June 2024.

It is a NB/T standard: recommended rather than compulsory, but it is the text a Chinese reviewer applies when assessing a submission.

It is classified under ICS 25.160.10, Chinese classification J 33.

It replaces NB/T 47014-2011, which is superseded.

This document has been drafted in accordance with the rules given in GB/T 1.1-2020,

Directives for standardization - Part 1: Rules for the structure and drafting of standardizing documents.

This document replaces NB/T 47014-2011, Welding procedure qualification for pressure equipments. Compared with NB/T 47014-2011, besides structural adjustments and editorial changes, the main technical changes are as follows.

- a) Welding procedure qualification of electron beam welding has been added (see Clause 1, Table 5 and 6.1.5.6).
- b) Welding procedure qualification of zirconium materials has been added (see Table 1).
- c) The terms buttering, supplemental filler metal and heat input of strip surfacing welding have been added; the definitions of welding procedure qualification, welding defect and imperfection have been revised; and the expression welding line energy has been uniformly changed to welding heat input throughout the document (see Clause 3).
- d) The class (group) numbers of the base metal grades L415, L485, 10Ni3MoVD and TA2 have been adjusted; gas cylinder steels such as HP295 have been deleted; and the austenitic stainless steel base metal grade 015Cr21Ni26Mo5Cu2 has been deleted from class Ni-5 (see Table 1, and Table 1 of the 2011 edition).
- e) The base metal grades Q420R, 06Ni9D(R), GB/SA516Gr70, GB/SA537Cl1 and GB/SA387Gr12Cl2, together with zirconium base metal grades, have been added (see Table 1).
- f) Material class (group) numbers for zirconium materials have been added (see Table 1).
- g) The designations of aluminium welding wires have been revised (see Table 3).
- h) The separate class numbers of submerged-arc welding wires and of fluxes have been deleted; submerged-arc welding wire and flux are now classified as a combination (see Table 4, and Table 4 and Table 5 of the 2011 edition).
- i) The dedicated welding procedure qualification factors of the various welding processes have been revised: the groove form and the gap of electrogas welding have been added as supplementary factors; a change of the type or polarity of the welding current in shielded metal arc welding has been added as an essential factor; and the proportional requirements for mixed shielding gases have been revised (see Table 5).
- j) The following provisions on the maximum thickness qualified for the weldment have been deleted: post weld heat treatment of the test coupon above the upper transformation temperature, except for gas welding, stud arc welding and friction welding; short-circuiting transfer gas metal arc welding when the coupon thickness is less than 13 mm; and short-circuiting transfer gas metal arc welding when the weld metal thickness of the coupon is less than 13 mm (see Table 10 of the 2011 edition).
- k) The preparation of butt weld test coupons of large-diameter pipes and the location of the

test specimens have been added (see 6.3.5.3 and Figure 3).

l) Provisions have been added for the impact test of welded joints performed at the test temperature required by the design drawing, together with the acceptance indexes of the impact absorbed energy of welded joints of different steel grades [see 6.4.1.7.3 a)].

m) The acceptance index of the impact absorbed energy of boiler welded joints has been revised [see 6.4.1.7.3 b)].

n) The welding procedure factors that require requalification of the surfacing metal have been revised (see Table 15).

o) The sampling location of tubular surfacing test coupons has been revised (see 7.3.1.3.1).

p) Welding procedure qualification of butt welds with a buttering layer has been added (see Annex C).

q) The welding procedure qualification rule for stainless steel-steel clad plates welded with the base layer first and the cladding layer afterwards has been revised, that is, the base layer weld shall be qualified as a combination weld [see D.2.3 a) and D.3.2.1].

r) A welding procedure qualification rule has been added for welding the cladding layer first and the base layer afterwards [see D.2.3 b) and D.3.3].

s) The qualification rule relating the outside diameter of the test coupon to the outside diameter of the production pipe has been deleted [see D.4.2.2 a) of the 2011 edition].

t) The qualification rule for the ligament width has been revised (see E.5.3).

u) In the examination of tube-to-tubesheet welding test coupons, the measurement of the fillet weld throat thickness has been changed to the measurement of the weld leg size l , and tube-head test coupons arranged in a square pitch have been added (see E.5.4.5 and Figure E.2).

v) The recommended table forms of the preliminary welding procedure specification and of the welding procedure qualification report have been revised, and the recommended table forms of the tube-to-tubesheet welding procedure card and of the additional qualification report for tube-to-tubesheet welding have been deleted (see Annex G, and Table F.3 and Table F.4 of the 2011 edition).

Attention is drawn to the possibility that some of the contents of this document may be the subject of patent rights. The issuing body of this document assumes no responsibility for identifying patent rights.

This document was proposed by and is under the jurisdiction of the National Technical Committee on Boilers and Pressure Vessels of Standardization Administration of China (SAC/TC 262).

Drafting organizations of this document: Hefei General Machinery Research Institute Co.,

Ltd.; China Special Equipment Inspection and Research Institute; Lanzhou LS Heavy Equipment Co., Ltd.; Dalian Boiler and Pressure Vessel Inspection and Testing Research Institute Co., Ltd.; Fushun Machinery and Equipment Manufacturing Co., Ltd.; SINOPEC Engineering Construction Co., Ltd.; Shanghai Boiler Works Co., Ltd.; Sinopec Nanjing Chemical Industry Machinery Co., Ltd.; China Petroleum First Construction Co., Ltd.; PetroChina Pipeline Research Institute Co., Ltd.; Shanghai Special Equipment Supervision and Inspection Technical Research Institute; State Administration for Market Regulation; Harbin Boiler Works Co., Ltd.; CFHI Dalian Nuclear Power Petrochemical Co., Ltd.

Main drafters of this document: Fang Wunong, Li Jun, Zhang Jianxiao, Guo Chuanjiang, Hu Xihai, Dou Wanbo, Ge Zhaowen, Wang Jinguang, Wang Jiongxiang, Zhu Ning, Nie Min, Sui Yongli, Ji Fang, Gu Fuming, Chang Yanyan, Li Yinan, Yuan Jijun, Guo Guangfei, Yang Guoyi and Jiang Haiyi.

The interpretation of this document is the responsibility of the National Technical Committee on Boilers and Pressure Vessels of Standardization Administration of China (SAC/TC 262).

The previous editions of this document and of the documents it replaces are: JB 4708-1992; JB 4708-2000; NB/T 47014-2011.

1 Scope

NB/T 47014-2023 is the Chinese standard for welding procedure qualification on pressure equipment, replacing the 2011 edition. Before a vessel, boiler or pressure pipe may be welded in production, the procedure must be proved: a test coupon is welded under stated conditions, then examined and tested, and the results establish the range of production welding the procedure covers. This standard defines that process. It sets the general requirements on who may qualify a procedure and on the preliminary welding procedure specification, the test coupon and its preparation, and the record that results. It groups base materials into material numbers and groups, and filler materials into their own classification, since a qualification made on one member of a group normally covers the others. The heart of the standard is the treatment of qualification variables: for each welding process it lists the essential variables that invalidate a qualification when changed, the supplementary essential variables that apply when impact testing is required, and the non-essential variables that may be changed without requalifying. The mechanical and non-destructive testing of the coupon follows - tensile, bend, impact, hardness, macro examination and, where the product demands it, corrosion testing - with the acceptance criteria and the retest rules. Qualification for overlay and cladding, for tube-to-tubesheet welds and for repair welding is covered separately, and the appendices give the forms on which the specification and the qualification record are written. It applies across Chinese pressure equipment manufacture.

This document specifies the rules, the test methods and the acceptance indexes for the welding procedure qualification of pressure equipment, namely boilers, pressure vessels