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NATIONAL STANDARD OF THE
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**Code for Acceptance of Field Equipment,
Industrial Pipe Welding Construction Quality**

现场设备、工业管道焊接工程施工质量验收规范

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Table of Contents

Foreword	4
1 General Provisions	7
2 Terms.....	8
3 Basic Requirements	9
3.1 Division for Acceptance of Construction Quality	9
3.2 Acceptance of Construction Quality.....	9
3.3 Procedure and Organization for Acceptance of Construction Quality	10
4 Materials	11
5 Preparation Before Welding	13
6 Welding.....	19
7 Heat Treatment After Welding	21
8 Examination of Welded Seam Quality	24
8.1 Visual Quality Examination of Welded Seam	24
8.2 Nondestructive Detection of Welded Seam Surface.....	28
8.3 Radiographic Examination and Ultrasonic Flaw Detection for Welded Seam.....	29
8.4 Other Examination.....	30
Appendix A -- Record for Quality Acceptance of Sub-item Project.....	32
Explanation of Wording in This Code	34
List of Quoted Standards.....	35

1 General Provisions

1.0.1 This code was formulated in order to unify the acceptance of welding quality acceptance of field equipment and industrial pipelines and strengthen the engineering quality management.

1.0.2 This code is applicable to the construction quality acceptance of the welding engineering of the metallic materials such as carbon steel, alloy steel, aluminium and aluminium alloy, copper and copper alloy, nickel and nickel alloy, titanium and titanium alloy as well as zirconium and zirconium alloy.

1.0.3 The codes shall be applied together with “Code for Construction of Field Equipment, Industrial Pipe Welding Engineering” GB 50236.

1.0.4 The requirements for the construction quality acceptance of engineering technical document and contract agreement document shall not be less than those specified in this code.

1.0.5 Except meeting this code, the acceptance of welding engineering construction quality shall also meet the requirements of the current relevant national standards.

2 Terms

2.0.1 100 % examination

The entire examination of a specific item in a specified examination batch

2.0.2 Random sampling examination

The examination is conducted on a specific item by a certain proportion of random sampling.

2.0.3 Local sampling examination

A specific part of examination is conducted for a specific item on every piece in a specific examination batch.

3 Basic Requirements

3.1 Division for Acceptance of Construction Quality

3.1.1 The welding engineering quality acceptance of field equipment and industrial pipelines shall be conducted on the division into the sub-item project.

3.1.2 The sub-item project of field equipment welding engineering shall be divided according to the piece of field equipment and the sub-item project of industrial pipeline welding engineering shall be divided into according to the pipeline grades and materials.

3.2 Acceptance of Construction Quality

3.2.1 The quality acceptance of sub-item project shall meet the following requirements:

1 The dominant items shall meet the requirements of this code.

2 The measured value of every item sampling examination for general items shall fall into the range of the permissible variation as specified in this code.

3.2.2 The welding engineering quality acceptance document and record shall include the following content:

1 The welding engineering construction technology documents, construction records and reports and shall meet the requirements of the current national standard "Code for Construction of Field Equipment, Industrial Pipe Welding Engineering" GB 50236.

2 The quality acceptance records, content and form of sub-item project quality acceptance records shall meet the requirements of Appendix A of this code.

3.2.3 Where the welding engineering does not meet the requirements of this code, it shall be processed according to the following requirements:

1 The acceptance shall be re-conducted for the sub-divisional work after rework or repair.

2 The sub-item project capable of reaching the design requirement in the examination and verification of qualified examination organizations shall be accepted.

3 The sub-item project that cannot reach the design requirement in the

4 Materials

Dominant items

4.0.1 Before the application of base metal, the examination and acceptance shall be conducted according to the requirements of design document; the material, specification and appearance quality shall meet the requirements of the product standard and design document of base metal. The material marker shall be clear and complete and shall be traced back to the product quality certification.

Examination quantity: all products

Examination method: quality proof documents shall be examined, visual examination and measurement examination shall be conducted and spectrogram examination may be conducted if necessary.

4.0.2 Before the application of the welding materials, the visual quality, quality proof documents, external packing and packing mark shall be examined. Corresponding tests or reexamination shall be carried out where there is any doubt. The quality shall conform to the design document and meet the following requirements:

1 The welding materials shall be provided with intact packing as well as clear and complete marking on the package.

2 Quality proof documents shall meet requirements of the relevant current national product standards and technical conditions of order.

3 The surface of the welding materials shall not be damp and contaminated, shall be free from the electrode coating damage or defects influencing welding quality and the solder wire surface shall be smooth and neat. The identification mark of the welding materials shall be clear and firm and conform to the real products.

Examination quantity: all.

Examination method: quality proof documents shall be examined, visual examination shall be conducted and the examination acceptance record or reexamination reports of welding materials shall be examined.

4.0.3 The welding material shall be baked according to the specification before application and shall be kept dry in application process and the baking conditions shall meet the requirements of welding materials directions and relevant technical document.

Before the application, de-oiling, derusting and cleaning processes shall be

5 Preparation Before Welding

I Dominant items

5.0.1 Where nondestructive testing is required for the groove face in the design document, magnetic particle testing or penetrant testing shall be conducted. Groove face quality shall not be lower than Class I as specified in the current professional standard "Nondestructive Testing of Pressure Equipment" JB/T 4730.

Examination quantity: it shall meet the requirements of the design document.

Examination method: the magnetic particle testing reports or penetrant testing reports shall be examined.

5.0.2 As for the weld seam specified for weld preheating, the preheating temperature in the weldment preheating zone shall be examined before the welding and shall meet the requirements of design document and welding process documents.

Examination quantity: all products.

Examination method: it shall be measured with temperature measurement instrument and the welding records are examined.

5.0.3 Where the pipe butt weld is assembled, the in-wall misalignment shall meet the requirements of Table 5.0.3.

Table 5.0.3 – In-wall Misalignment of Pipeline Assembling

Material category		In-wall misalignment
Carbon steel and alloy steel		$\leq 10\%$ of the wall thickness and shall not be greater than 2
Aluminium and aluminium alloy	Wall thickness ≤ 5	≤ 0.5
	Wall thickness > 5	$\leq 10\%$ of the wall thickness and shall not be greater than 2
Copper and copper alloy		$\leq 10\%$ of the wall thickness and shall not be greater than 1
Titanium and titanium alloy		$\leq 10\%$ of the wall thickness and shall not be greater than 1
Nickel and nickel alloy		≤ 0.5
Zirconium and zirconium alloy		$\leq 10\%$ of the wall thickness and shall not be greater than 1

Examination quantity: all products.

Examination method: caliper and welding examination ruler shall be applied for the examination of the weld assembly record.

5.0.4 Where the equipment and reel pipe butt weld is assembled, the butt misalignment shall meet the following requirements:

II General items

5.0.6 The position of weld seam of weldment shall meet the requirements of the design documents and the following specifications:

1 Where the shell ring and shell ring or the shell ring and end sockets of the steel-plate pipe and equipment are assembled, the longitudinal weld seam space between two adjacent two shell rings shall be greater than three times of the wall thickness and shall not be less than 100 mm; the distance between two adjacent longitudinal seams on the same shell ring shall not be less than 200 mm.

2 The distance between two butt weld central planes on the same straight pipe section of the pipe shall meet the following requirements:

1) Where the nominal dimension is greater than or equal to 150 mm, it shall not be less than 150 mm;

2) Where the nominal dimension is less than 150 mm, it shall not be less than the outside diameter of pipe and shall not be less than 100 mm.

3 The longitudinal weld seam of reel pipe shall be put at the positions easy for repair and should not be put at the bottom.

4 As for the real pipes of reinforced ring and plate, the butt weld of the reinforced ring and plate shall be misaligned from the longitudinal weld beam of the reel pipe and the space shall not be less than 100 mm. The ring weld beam of the reinforcement ring and plate distance reel pipe shall not be less than 50 mm.

5 The distance from the weld seam of the heated side pipes to the bent-up points of the pipes, the outer wall of the header and the edge of the supporter and hanger shall not be less than 70 mm; the distance between two butt weld beam centers of the same straight pipe section.

6 Except the adoption of the formed elbow, the distance from the pipe butt circular seam center and the bent-up point of the bent pipes shall not be less than the outside diameter of the pipe and shall not be less than 100 mm. The distance from the pipe butt circular seam to the edge of supporter and hanger shall not be less than 50 mm; the distance between the weld seam in demand of heat treatment and the edges of the supporter and hanger shall not be less than 5 times the weld seam width and shall not be less than 100 mm.

Examination quantity: all products.

Examination method; visual examination and examination in adoption of the steel ruler

6 Welding

I Dominant items

6.0.1 As for weld seam with impact ductility requirement, the weld heat input shall be measured in welding and shall be recorded. The weld heat input shall meet the requirements of design document and welding process documents.

Examination quantity: all products.

Examination method: the welding records shall be measured and examined in the adoption of measuring instruments, stopwatch and steel ruler.

6.0.2 As for the weld seam specified for intermediate nondestructive testing, the nondestructive testing shall be conducted after the visual examination qualification and the weld quality shall meet the relevant requirements of Chapter 8 in this code.

Examination quantity: it shall meet the requirements of the design document.

Examination method: the nondestructive testing reports are examined.

6.0.3 As for the weld seam with specified requirements for the inter-pass temperature, the inter-pass temperature shall meet the requirements of welding process documents. As for the weldment with the requirements for preheating before welding, the inter-pass temperature shall fall in the scope of the specified preheating temperature.

Examination quantity: all products.

Examination method: the welding record shall be measured and examined with the temperature measurement instrument.

6.0.4 As for the weld seam with the requirement of back chipping on the rear surface, visual examination shall be conducted after back chipping and the weld seam after back chipping shall expose metallic luster and the groove shape shall be regular and tidy as well as meet the requirements of welding process. Where the magnetic particle testing or penetrant testing is required according to the design document, the weld quality of magnetic particle testing or penetrant testing shall not be less than Class I as specified in the current professional standard "Nondestructive Testing of Pressure Equipment" JB/T 4730.

Examination quantity: all products.

7 Heat Treatment After Welding

I Dominant items

7.0.1 The post-weld heat treatment parameters of the field equipment and pipes shall meet the requirements of design document, the current national standard “Code for Construction of Field Equipment, Industrial Pipe Welding Engineering” GB 50236, heat treatment process document and the following requirements:

1 As for the weld seam of integral heat treatment in the furnace and the local treatment of sections in the furnace, the parameters such as the in- and out- furnace temperature, heating speed, cooling speed, constant temperature, constant temperature time, the maximum temperature difference in the effective heating zone and the temperature difference between any two points for measuring temperature shall be examined and recorded.

2 As for the weld seam of integral heat treatment and local heating treatment outside the furnace, the parameters such as the heating speed, cooling speed, constant temperature, constant temperature time, the maximum temperature difference in the effective heating zone and the temperature difference between any two points for measuring temperature shall be examined and recorded.

Examination quantity: all products.

Examination method: the automatic temperature measurement instrument shall be applied and the heat treatment curve and reports are examined.

7.0.2 The post-weld heat treatment effect examination of field equipment and pipe shall meet the requirements of design document and the current national standard “Code for Construction of Field Equipment, Industrial Pipe Welding Engineering” GB 50236. Where product welding examination specimens are required to be fabricated, they shall meet the requirements of Article 8.4.1 in this code. Where the hardness examination is required according to specification, it shall meet the following requirements:

1 Except other specifications in the design document, the hardness value of the heat treatment weld seam and the heat-affected zone shall meet the requirements of Table 7.0.2. As for the materials unlisted in Table 7.0.2, the hardness value of weld seam and heat-affected zone is: the hardness value of the carbon steel shall not be greater than 120 % of the base metal hardness measurement value; the alloy steel shall not be greater than 125 % of the base metal hardness measurement value.

2 Where heat treatment is re-conducted on the weld seam, hardness examination shall be re- conducted.

8 Examination of Welded Seam Quality

8.1 Visual Quality Examination of Welded Seam

I Dominant items

8.1.1 The examination classes of field equipment weld seam shall be divided into Class I, II and III according to the requirements of 100 % nondestructive testing, partial nondestructive testing and non-required nondestructive testing. The appearance quality of field equipment weld seam shall meet the requirements of Table 8.1.1-1 and Table 8.1.1-2 in this code.

Examination quantity: all products.

Examination method: visual examination and welded seam examination ruler measurement shall be adopted and the welding records shall be examined.

Table 8.1.1-1 -- Field Equipment Weld Appearance Quality

Examination class		I	II	III
Requirements of nondestructive examination		100 %	Local sampling examination	No requirement
Defect name	Flaws	Not allowed	Not allowed	Not allowed
	Incomplete penetration	Not allowed	Not allowed	Not allowed
	Incomplete fusion	Not allowed	Not allowed	Not allowed
	Surface pores	Not allowed	Not allowed	Not allowed
	Exposed slag inclusion	Not allowed	Not allowed	Not allowed
	Incompletely filled weld	Not allowed	Not allowed	Not allowed
	Undercut	Not allowed	Depth: $\leq 0.05T$ and ≤ 0.5 mm; continuous length ≤ 100 mm and the total undercut length on both sides ≤ 10 % the full length of weld seam	Depth: $\leq 0.10T$ and ≤ 1 mm; the length is unlimited
	Root shrinkage (hidden concave of the root)	Not allowed	Depth: $\leq 0.2 + 0.02T$ and ≤ 0.5 mm; the length is unlimited	Depth $\leq 0.2 + 0.02T$ and ≤ 1.0 mm; the length is unlimited
	Insufficiency of fillet weld thickness	Not allowed	Not allowed	$\leq 0.3 + 0.05T$ and ≤ 2.0 mm; the total length of internal flaw for every 100 mm weld length ≤ 25 mm
	Asymmetry of leg of a	Difference $\leq 1 + 0.1t$	Difference $\leq 1 + 0.15t$	Difference $\leq 2 + 0.2t$

weld					
Undercut	Not allowed	Depth: longitudinal seam is not allowable and other weld seam $\leq 0.05T$ and ≤ 0.5 mm; continuous length ≤ 100 mm and the total undercut length on both side $\leq 10\%$ of the full length of weld seam	Depth: longitudinal seam is not allowable and other weld seam $\leq 0.05T$ and ≤ 0.5 mm; continuous length ≤ 100 mm and the total undercut length on both side $\leq 10\%$ of the full length of weld seam	Depth: longitudinal seam is not allowable and other weld seam $\leq 0.05T$ and ≤ 0.5 mm; continuous length ≤ 100 mm and the total undercut length on both side $\leq 10\%$ of the full length of weld seam	Depth: longitudinal seam is not allowable and other weld seam $\leq 0.1T$ and ≤ 1 mm; the length is unlimited
Root shrinkage (root depression)	Not allowed	Depth $\leq 0.2 + 0.02T$ and ≤ 0.5 mm; the length is unlimited	Depth $\leq 0.2 + 0.02T$ and ≤ 1.0 mm; the length is unlimited	Depth $\leq 0.2 + 0.02T$ and ≤ 1.0 mm; the length is unlimited	Depth: $\leq 0.2 + 0.04T$ and ≤ 2.0 mm; the length is unlimited
Insufficiency of fillet weld thickness	Not allowed	Not allowed	$\leq 0.3 + 0.05T$ and ≤ 1.0 mm; the total length of the internal flaw for every 100 mm weld length ≤ 25 mm	$\leq 0.3 + 0.05T$ and ≤ 1.0 mm; the internal flaw total length for every 100 mm weld length ≤ 25 mm	$\leq 0.3 + 0.05T$ and ≤ 2.0 mm; the total length of internal flaw for every 100 mm weld length ≤ 25 mm
Asymmetry of leg of a fillet weld	Difference $\leq 1 + 0.1t$	Difference $\leq 1 + 0.15t$	Difference $\leq 1 + 0.15t$	Difference $\leq 1 + 0.15t$	Difference $\leq 2 + 0.2t$

**Table 8.1.2-2 -- Appearance Quality of Pipeline Weld Seam
(Reinforcement and Root Project) (mm)**

Base material thickness T		≤ 6	$> 6 \sim 13$	$> 13 \sim 20$	$> 25 \sim 50$	> 50
Examination class	I	≤ 1.5	≤ 1.5	≤ 3.0	≤ 3.0	≤ 4.0
	II, III, IV	≤ 1.5	≤ 3.0	≤ 4.0	≤ 5.0	—
	V	≤ 2.0	≤ 4.0	≤ 5.0	≤ 5.0	—

Note: As for the root project of aluminium and aluminium alloy, where the base material thickness is less than or equal to 2 mm, the root project shall be less than or equal to 1.5 mm; where base material thickness is 2 mm ~ 6 mm, the root projects shall be less than or equal to 2.5 mm.

8.1.3 Color and lustre examination shall be conducted on the weld surface of titanium and titanium alloy as well as zirconium and zirconium alloy before the post-weld cleaning. The examination result of color and lustre of the titanium and titanium alloy weld seam shall meet the requirements of Table 8.1.3. The

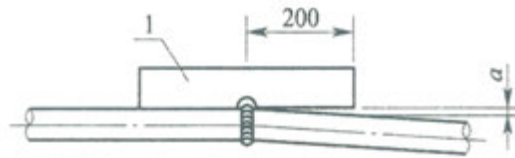


Figure 8.1.5 -- Angular Deformation of Pipeline Welding Joint

1 - Steel rule; α - Angular deformation (straightness) deviation

Examination quantity: all products.

Examination method: visual examination and measurement with ruler and checking ruler is adopted at 200 mm from the weld junction center.

8.1.6 The butt weld of equipment and reel pipe, the angular deformation (corner angle) quantity of the circumferential seam and longitudinal seam shall not be greater than 10 % of the wall thickness plus 2 mm and shall not be greater than 5 mm.

Examination quantity: all products.

Examination method: the interior template or external templates with chord length equal to 1/6 internal diameter and not less than 300 mm are applied to examine the angular deformation of longitudinal seam (the corner angle formed by welded joint hoop stress); the angular deformation of circumferential seam (corner angle formed axially formed at the welded joint) with the ruler of not less than 300 mm long.

8.2 Nondestructive Detection of Welded Seam Surface

I Dominant items

8.2.1 Magnetic particle testing or penetrant testing shall be applied on weld surface according to the requirements of the design document. The weld surface nondestructive testing with reheating crack tendency shall be conducted after heat treatment. As for the unqualified weld seam in magnetic particle testing and penetrant testing, the specified testing method on the repair positions shall applied for re-examination. Weld quality shall not be lower than Class I as specified in the current professional standard "Nondestructive Testing of Pressure Equipment" JB/T 4730.

Testing quantity: it shall meet the requirements of the design document.

Examination method: the magnetic particle or penetrant testing reports as well as equipment cutting plan or axonometric drawing of pipes are examined.

2) Where the nominal dimension of pipes is greater than or equal to 500 mm, partial examination shall be conducted for each circumferential seam according to the required examination quantity and shall not be less than the weld length of 150 mm.

3) Partial examination shall be conducted for the longitudinal seam and circumferential seam on the equipment as well as the longitudinal seam on the pipes according to the specified examination quantity and the weld length shall not be less than 150 mm.

4) In sampling or partial examination, random examination shall be conducted on the weld seam welded by every welder according to the specified proportion. Where circumferential seam intersects with longitudinal seam, the cross point with longitudinal seam shall be included in the maximum range and the examination length of the longitudinal seam shall not be less than 38 mm.

5) The sampling or partial survey shall be conducted according to the examination lot. The examination lot and the positions of sampling or partial examination shall be determined by the welding examination staff.

6) Where tapping or opening compensation is conducted on the welded joints, 100 % radiographic testing or ultrasonic testing shall be conducted on the weld seam with 1.5 times initial hole diameter or within the diameter range of the opening compensation plates. The weld seam covered with compensation plate shall be ground flat. Weld defect shall not exist at the edge of the pipe orifice.

Examination method: visual examination and the radiographic detection or ultrasonic detection reports as well as the cutting plan of equipment or axonometric drawing of pipes shall be examined.

8.3.2 Where disqualification is found in the partial examination or sampling examination of radiographic (or ultrasonic detection) of weld seam, the originally specified testing method shall be adopted in the same examination welded by the welder for extended examination. The weld quality shall meet the requirements of Article 8.3.1 in this code.

Testing quantity: it shall meet the requirements of the design document.

Examination method: the radiographic or ultrasonic detection reports as well as equipment cutting plan or axonometric drawing of pipes are examined.

8.4 Other Examination

I Dominant items

8.4.1 Where the product welding examination specimen is fabricated according

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