加氢反应器用不锈钢实芯焊丝

订货技术条件

PURCHASE SPECIFICATION

OF STAINLESS STEEL WELDING WIRE

FOR HYDROGENANT REACTOR

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目录

Content

1 范围 Scope

本文件规定了用于加氢反应器不锈钢实芯焊丝订货及验收的技术要求。

This specification prescribes requirements for the purchase and acceptance of stainless steel welding wires for hydrogenation reactor.

2 参考规范 Applicable Code

ASME 锅炉及压力容器规范，第Ⅱ卷 C 篇 SFA-5.01/SFA-5.01M，最新版

ASME B&PVC, Sec.Ⅱ Part C SFA-5.01/SFA-5.01M，latest Edition

ASME 锅炉及压力容器规范，第Ⅱ卷 C 篇 SFA-5.9/ SFA-5.9M，最新版；类别号为 ER309L 和 ER347L。

ASME B&PVC, Sec.Ⅱ Part C SFA-5.9/ SFA-5.9M, latest Edition; Classification shall be as follows: ER309L and ER347L.

ASME 锅炉及压力容器规范，第Ⅸ卷，最新版

ASME B&PVC, Sec.Ⅸ, latest Edition

除符合上述规范要求外，还应符合本订货技术条件的规定。

Except for applicable code above, the requirement of this specification also shall be met by the manufacturer.

3 技术要求 Technical Requirements

ER309L 和 ER347L 焊丝的制造应采用任何能使产品符合规范和本技术条件要求的方法进行。每批焊丝的生产量尽量满足一次订货的要求。

The welding wires of ER309L and ER347L classification can be manufactured with any method of which products meet the requirements of applied code and this specification. To the best of manufacturer’s ability, the quantity of each heat production shall meet the ordering required as possible.

4 试验要求 Test Requirements

供方需对每批不锈钢焊丝进行如下试验：

Supplier shall test each batch of stainless steel welding wires required as follows:

4.1 焊丝化学成分分析

Chemical Analysis of Welding Wires

4.2 堆焊层熔敷金属化学成分分析

Chemical Analysis of Weld Deposit Metal for Overlay Cladding

4.3 堆焊层熔敷金属铁素体含量测定

Measuring Ferrite Content of Weld Deposit Metal for Overlay Cladding

4.4 堆焊金属层熔敷金属晶间腐蚀倾向试验

Intergranular Corrosion Tendency Test of Weld Deposit Metal for Overly Cladding

4.5 弯曲试验 Bend Test

4.6 维氏硬度试验 Vickers Hardness Test

上述检验，供方在产品出厂前，应按照 ASME SFA-5.9/SFA-5.9M（最新版）执行，其结果必须满足本技术条件的要求，并提供试验报告。

The supplier shall perform above mentioned tests with ASME SFA-5.9/SFA-5.9M (latest Edition) before products leave the factory, and all test results shall meet the requirements in this specification and supply the test reports.

5 焊接条件 Welding Conditions

5.1 焊接试验用母材 Base Metal for Welding Test

焊接试验用母材优先选用符合 ASME 规范第 II 卷 A 篇相关标准要求的 SA-387 Gr.22 Cl2 或 SA-542 Type D 板材，允许使用其他碳钢或低合金钢母材用于堆焊试验。

For the base material of welding tests, SA-387 Gr.22 Cl2 or SA-542 Type D plates specified in ASME Sec.Ⅱ, Part A are preferred. Other carbon steel or low alloy steel base materials may be used.

5.2 试件规格和形式 Weld Coupon Dimension and Shape

试件规格和形式不受限制，应满足检验项目的需要。

The weld coupon dimension and shape are not mandatory and shall meet requirements of examination items.

5.3 焊接顺序 Welding Procedure

第一层堆焊层焊接采用 ER309L 类别焊丝，第二层及后续层以上采用 ER347L 类别焊丝焊接。

Welding wire of classification ER309L is used to perform the first layer and that of classification ER347L is used to perform the second and subsequent layers.

5.4 焊接位置 Welding Position

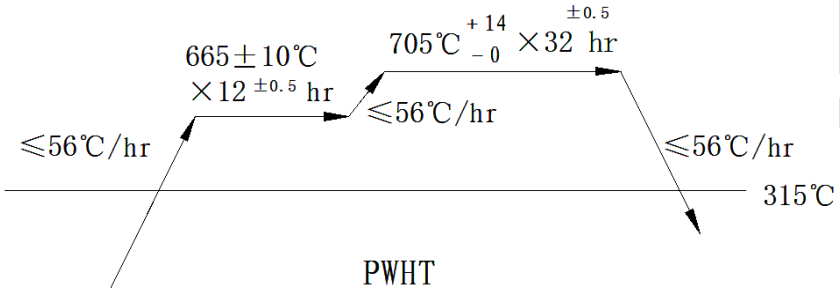
堆焊金属的焊接位置为平焊位和横焊位。

Welding position for weld overlay cladding is flat and horizontal.

5.5 焊后热处理 Post Weld Heat Treatment

试件焊后热处理按 665±10℃×$12^{\pm0.5}$hrs+705^{+14}_{-0}℃×$32^{\pm0.5}$hrs 的热处理工艺执行。

Post weld heat treatment of weld coupon shall be done with the following conditions.



6 化学成份 Chemical Analysis

6.1 焊丝化学成分 Chemical Composition of Welding Wires

焊丝化学成分见表 1.

The chemical composition of welding wires shall be as shown in table 1.

表 1 焊丝化学成分(wt%)

Table 1 Chemical Composition of welding wires (wt%)

	C	Si	Mn	P	S	Ni	Cr	Nb+Ta	Mo	Cu	N	Cr/Ni
ER309L	≤ 0.025	0.20～ 0.60	1.50～ 2.50	≤ 0.025	≤ 0.020	12.00～ 14.00	23.00～ 25.00	—	≤ 0.20	≤ 0.20	≤ 0.05	≥1.7
ER347L	≤ 0.025	0.20～ 0.60	1.50～ 2.50	≤ 0.025	≤ 0.020	9.00～ 11.00	19.00～ 21.50	0.50～ 0.80	≤ 0.20	≤ 0.20	≤ 0.05	≥1.7

6.2 堆焊层熔敷金属化学成分

Chemical Composition of Weld Deposit Metal for Overlay Cladding

距堆焊层表面 2.75 毫米至 3.25 毫米范围内的化学成分应如表 2 所示。

Chemical composition determined under 2.75mm to 3.25mm from the surface of overlay cladding shall be as show in table 2.

表 2 堆焊层熔敷金属化学成分（wt%）

Table 2 Chemical Composition of overlay cladding (wt%)

Combination	C	Si	Mn	P	S	Ni	Cr	Nb+Ta	Mo	Cu	N	Cr/Ni
1st layer: ER309L 2nd& subsequent layer:ER347L	≤ 0.030	≤ 0.90	1.00～ 2.50	≤ 0.030	≤ 0.020	9.00 ～ 11.00	18.00 ～ 21.00	8× C～ 1.00	≤ 0.20	≤ 0.20	≤ 0.05	≥1.7

7 铁素体含量 Ferrite Content

距堆焊层表面 2.75 毫米至 3.25 毫米处的熔敷金属中的铁素体含量应如表 3 所示。

Ferrite content of weld deposit metal under 2.75mm to 3.25mm from the surface of overlay cladding shall be as shown in table 3.

表 3 铁素体含量

Table 3 Ferrite content Measuring Method

Measuring Method / T.P Conditions	WRC-1992 Diagram (FN)
As-Welded	3-8

8 第二层及后续堆焊层晶间腐蚀倾向试验 Intergranular Corrosion Tendency Test for 2nd and Subsequent layers Overlay Cladding

经焊后热处理后，第二层及后续堆焊层进行抗晶间腐蚀能力检验。试样取自表面至 3mm 处，试样尺寸为 3mm×20mm×80mm，按 ASTM A262 E 法检验后无裂纹出现为合格。

The intergranular corrosion tendency test of 2nd and Subsequent layers overlay shall be examined after PWHT. The specimens of which dimension is 3mm×20mm×80mm shall be taken from the metal at 3mm depth from the surface of overlay ,and no crack occurred shall be accepted on the specimen according to ASTM A262 Practice E.

9 弯曲试验 Bend Test

不锈钢堆焊层经上述制度的热处理后，应进行弯曲检验，试样为堆焊层和母材的复合金属，试验方法按照 ASME 规范第Ⅸ卷执行，试验结果应满足表 4 的要求。

The bend test shall be examined after the heat treatment above-mentioned, and the specimen includes base metal and overlays. The test results shall meet the requirements in table 4 in accordance with ASME Sec.Ⅸ.

表 4 弯曲试验

Table 4 Bend Test

试验温度 Test Temp.	类型 Type	尺寸 Dimension	数量 Quantity	弯曲条件 Bend Condition
室温 Room Temp.	(a)纵向弯曲 Longitudinal Side Bend	10×30×200(d)	2	(c)D=40mm 180°
	(b)横向弯曲 Transverse Side Bend	10×30×200(d)	2	(c)D=40mm 180°
	(a)纵向弯曲 Longitudinal Side Bend	3×13×160(d)	2	(c)D=12mm 180°
	(b)横向弯曲 Transverse Side Bend	3×13×160(d)	2	(c)D=12mm 180°

注 Note：a. 纵向侧弯试样长度方向平行于堆焊方向

The length direction of longitudinal side bend specimen shall be parallel to welding direction.

b. 横向侧弯试样长度方向垂直于堆焊方向

The length direction of transverse side bend specimen shall be perpendicular to welding direction.

c. D—弯辊直径 Bending Plunger Diameter。

d. 试样长度可根据试验设备进行调整。

The length of the sample can be adjusted according to the test equipment.

10 维氏硬度试验 Vickers Hardness Test

347L 堆焊层（焊态）表面进行 HV 硬度测定，至少 5 点，硬度值供参考。

HV hardness test shall be conducted on the 347L overlayer（as welded） surface, at least 5 points. The hardness values are for reference.

11 焊丝制造质量 Manufacture Quality of the Welding Wires

（1）焊丝的规格尺寸如表5所示。每盘焊丝由同一炉号的一根组成,不允许有焊接接头。

Dimensions of welding wires are shown in table 5. Each spool of wires which have same heat No. shall be continuous，any welded joint is not permitted.

表 5 焊丝规格

Table 5 Welding Wire Size

焊丝直径 Wire Diameter (mm)	长度 Length (mm)	盘径 Spool Diameter (mm)	盘（筒）重 Each Spool (or Drum)Weight (kg)
Φ0.8±0.02	--	Φ200±2/Φ52±1	5

Φ1.0±0.02	--	W=103±2	5
Φ1.2±0.02	--	Φ300±2/Φ52±1 W=103±2	20
Φ1.6±0.02	--		20
Φ2.4±0.02	1000±5	--	5

（2）光洁度 Finish and Uniformity

焊线应有光滑的表面，没有裂口、凹陷、刮伤、氧化皮或对焊接性能、焊接设备操作或熔敷金属性能起到不利影响的其它外来物质。

The surface of welding wire shall be finished smoothly, and free from slivers, depressions, scratches, scales and other foreign matter would adversely affect the welding characteristic and the operation of the welding equipment.

（3）弹射度 Cast

对于连续长度的填充金属，缠绕在标准的 300mm 盘上焊丝的弹射度应当给焊丝造成一定的曲率，即将 1.2～2.4 米长的一段焊丝从焊丝盘上切下并放置在一个平面上时，其形成的弯曲半径不小于 380mm，又不大于 1300mm。

For the filler metal which is the continuum and winding on 300mm spool, its cast shall make a stated curvature to the welding wire. For example when cut a specimen of 1.2～2.4 meter length wire from the coil and lay unrestrained on a flat surface will form a curve which is not less than 380mm nor more than 1300mm in radius.

（4）螺旋度 Helix

对于连续长的填充金属，缠绕在 300mm 盘上焊丝的螺旋度，应当是将测定了弹射度的同一根焊丝放置在一个平面上，所测得相邻两圈之间的垂直间隔不大于 25mm。

For the helix of the filler metal which is the continuum and winding on 300mm spool, the specimen shall be the same with the cast measuring and put it on the same flat surface, the vertical distance is no more than 25mm between the adjacent circles.

（5）缠绕要求 Winding Requirements

焊丝的缠绕要避免扭折、弯曲或影响送丝的骤弯、能够无限层绕，保证焊丝在焊接设备上能连续均匀的进给。焊丝的外端应作标记，并牢固地固定。

Welding wire shall be wound so that kinks, waves, sharp bends, or wedging are

not encountered, leaving the wire free to unwind without restriction. To ensure the wire will feed in an uninterrupted manner in automatic and semiautomatic equipment. The outside end of the welding wire shall be identified and secured to avoid unwinding.

（6）每批焊丝应抽取 10%，但至少 2 盘进行形状、尺寸、表面质量检查，其检验结果应符合本技术条件的规定。

More than 10 percent of welding wire but at least 2 spools in one heat shall be withdrawn to check the shape, size and appearance quality of it according to the requirements as specified in this specification.

12 包装 Packaging

（1）盘装焊丝的焊丝盘，其材料及结构型式应当在正常搬运或使用时，能保证防止焊丝盘本身和填充金属不发生损坏或变形。骨架采用钢制结构。

The welding wire spools shall be steel structure to prevent damage and distortion of the spools and the welding wire during normal handling and usage.

（2）焊丝盘应足够地清洁及干燥，以便保持填充金属洁净。焊丝盘外表要用蜡纸包裹，在海上运输时应加以密封，防止受潮或腐蚀。

The welding wire spools shall be cleaned and dried enough to maintain the cleanliness of the welding wire. The outside of welding wire spools shall be wrapped with wax paper. It should be sealed over sea transportation to protect against moisture and corrosion.

（3）直根填充丝，应采用纸板筒或塑料筒密封包装。

The rod wire shall be packaged and sealed in board or plastic drum.

13 包装标识 Marking of Packages

每个单位包装件的外表都应清晰地标出下述内容。

The following information shall be legibly marked on the outside of each unit package:

（1）制造厂名称和商标 Manufacturer name and brand name

（2）焊丝牌号、标准号和类别号 Brand name，specification and classification number

（3）规格尺寸和净重 Size and net weight

（4）批号、检验号或炉号 Lot ,control, heat number

（5）生产日期 Production date

（6）警示标签 Warning Label

14 材料合格证书 Certified Material Test Report

供方所提供的每一批次焊丝，都必须提供材料合格证书，其内容包括下述项目。

Each batch of welding wires supplied by the seller must offer the certificate material test report including the following contents:

（1）商品名称Trade Designation

（2）ASME标准号和AWS类别号 ASME specification and AWS classification designations

（3）规格和净重 Size and net weight

（4）批号、检验号或炉号 Lot, control, or heat number

（5）生产日期 Production date.

（6）用户名称 Customer's name

（7）制造厂名称 Manufacturer's name

（8）用户规范号和版本号 Customer's Spec.No. and Rev.No.

（9）试验采用的基材名称 Material Designation of Base Metal for Acceptance Test

（10）焊接条件 Weld Conditions

（11）热处理状态 Heat Treatment Condition

（12）ASME SFA-5.9/SFA-5.9M 要求的试验结果 Test Results required in ASME SFA-5.9/SFA-5.9M

（13）用户订单号 Customer's purchase order number

（14）QA责任人的证明声明和签字 Certification Statement and Signature by Responsible Person to QA