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反应堆容器

Reactor Vessel

镍基合金实芯光焊丝采购规范 (ASME)

Material Purchase Specification for Nickel Alloy Bare Solid Wires

According to ASME CODE

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1. 范围/SCOPE

本文件规定了核电厂反应堆容器用镍基合金实芯光焊丝制造和验收的要求。

This specification prescribes requirements for manufacture and acceptance of nickel-alloy bare solid wires for reactor vessel of nuclear power plants.

2. 引用标准和文件 /Referenced Documents

下列的未注明版本的标准其最新版适用于本文件。

For undated references, the latest edition of the referenced document (including any amendments) applies.

ASME BPVC 2007 edition through 2008 addendum

ASME BPVC Section II Material Specifications Part C Specifications for Welding Rods Electrodes and Filler Metals.

ASME BPVC Section III Subsection NCA-General Requirements Division 1&Division2.

ASME BPVC SECTION III Div 1 Subsection NB.

ASTM A370 Standard Test Methods and Definitions for Mechanical Testing of Steel Products.

ASTM A751 Standard Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products.

ASTM E3-2011 Standard Guide for Preparation of Metallographic Specimens

ASTM E21 Standard Test Methods for Elevated Temperature Tension Tests of Metallic Materials

ASTM E1032-2006 Standard Test Methods for Radiographic Examination of Weldments.

AWS B4.0M Standard Methods for Mechanical Testing of Welds.

ISO9400 Nickel-based Alloys-Determination of Resistance to Intergranular Corrosion.

3. 通用要求 /General Requirements

3.1 标准及类别/Standard and Classification

焊丝的制造和检验应满足 AWS A5.14 中的相应要求。

Acceptance of the bare solid wires shall be in accordance with the provisions of AWS A5.14.

3.2 批的定义/Definition of lots

每批焊丝由同一炉号在一个生产制造周期所生产的同一规格数量的焊材。

A lot of bare solid wires is the quantity of one size produced in one production schedule from one heat.

4. 制造/Manufacture

4.1 焊丝尺寸/ Size

焊丝规格、焊丝盘（筒）规格、重量及公差应按表 1 规定执行。

Wire diameter, coil diameter and coil weight are shown in Table 1.

表1 焊丝及焊丝盘尺寸

Table 1 Sizes

直径 Diameter (mm)	公差 Allowed tolerance	长度 Length (mm)	焊丝盘直径 Coil Diameter(mm)	盘重 Coil Weight(Kg)
Φ0.9	±0.01	/	Φ 200/Φ 52, W=55	5
Φ 1.2	±0.01	/	Φ 200/Φ 52, W=55	5
Φ 2.4	±0.01	1000±5 (Straight)	/	5

4.2 光洁度和均匀度/Finish and Uniformity

焊丝表面应该洁净光滑, 没有影响焊接特性、焊接设备的操作或对焊缝金属

的性能有不利影响的裂纹、凹坑、划痕、氧化皮、皱纹、折叠和外来物质。

The wire shall have a smooth finish that is free of slivers, depressions, scratches, scale, seams, laps and foreign matter that would adversely affect the welding characteristics, the operation of the welding equipment, or the properties of the weld metal.

每盘焊丝应为同一批号且无焊接接头的连续长度的焊丝。焊丝在自动和半自动焊接设备上使用时, 不影响均匀、连续的送进。

Each coil shall be a continuous length of wire from a single lot of material without welds. Wires shall have been made so as not to interfere with the uniform, uninterrupted feeding of the filler metal on automatic and semiautomatic equipment.

4.3 缠绕要求/ Winding Requirements

焊丝的缠绕应无扭结、波折、锐弯或嵌住, 使焊丝在无拘束的状态下能自由松开。焊丝的外端(开始焊接的一端)应加识别标记, 使能容易找到, 并应固定牢, 以防止松脱。

Electrodes shall be wound so that kinks, waves, sharp bends or wedging are not encountered, leaving the filler metal free to unwind without restriction. The outside end of the filler metal (the end with which welding is to begin) shall be identified so it can be readily located and shall be fastened to avoid unwinding.

在焊丝盘中, 焊丝的弹射度和螺旋度应不妨碍焊丝在自动焊和半自动焊设备中连续地送进。

The cast and helix of filler metal in coils shall be such that the filler metal will feed in an uninterrupted manner on automatic and semiautomatic equipment.

5. 检验项目/ Test

对每一批号焊丝都必须进行下列试验。

The acceptance tests on each lot of solid wires as specified.

- (1) 焊丝和熔敷金属化学成分分析 (焊态)

Chemical analysis for wire and weld metal.

- (2) 熔敷金属拉伸试验 (焊态和焊后热处理态)

Tensile Properties for weld metal (As-welded / PWHT).

- (3) 熔敷金属冲击试验 (焊态和焊后热处理态)

KV Impact test for weld metal (As-welded / PWHT).

- (4) 焊接接头弯曲试验 (焊态和焊后热处理态)

Bend properties for weld metal (As-welded / PWHT).

- (5) 熔敷金属晶间腐蚀试验 (焊态+敏化、热处理态+敏化)

Accelerated intergranular corrosion test on weld metal (Two specimens are subjected to as-welded condition + sensitizing treatment; Two specimens are subjected to heat treatment+ sensitizing treatment.)

- (6) 金相检验 (焊态和焊后热处理态)

Metallographic Examination (As-welded / PWHT).

6. 焊接试板/Weld Plate

6.1 试板/ Weld Plate

应依据 SFA5.11 第 9 节的要求制备焊材验收试板, 试板尺寸应满足所有试验和复验项目取样要求。

The acceptance of filler metal test plates shall be prepared according to clause 9 in SFA5.11. And the dimension of the test plates shall be enough for test samples to be taken both for the series of required tests and any re-tests.

6.2 焊接参数/Welding Parameters

试板可采用表 2 推荐的参数进行焊接。

The welding parameters for the welding plates as specified in Table2.

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表2 焊接参数

Table2 Welding Parameters

焊丝规格 (mm) Size (mm)	Φ0.9	Φ1.2	Φ2.4
焊接方法 Welding process	GTAW	GTAW	GTAW
焊接位置 Welding position	平焊 (PA) Flat (PA)	平焊 (PA) Flat (PA)	平焊 (PA) Flat (PA)
预热温度 Preheat Temperatures	≥121℃	≥121℃	≥121℃
道间温度 Interpass Temperatures	≤250℃	≤250℃	≤250℃
后热 post-weld heat treatment	232~400℃, 至少 4 小时 232~400℃ for a minimum of 4 hours		
电流种类 Welding type	直流 DC		
极性 Polarity	直流正接 DCEN		
电流 (A) (机械焊) Welding Current (amperes) for machine GTAW	基值: 110-170 峰值: 220-280		
电流 (A) (手工焊) Welding Current (amperes) for manual GTAW	140-220		
电压 (V) arc Voltage (volts)	9-14		
焊速(mm/min) Travel Speed(mm/min)	<u>100-180</u>		

6.2.1. 试板检验/ Examination of the Test Plates

焊接试件须进行目视检验、液体渗透检验和射线检验, 检验应依据 ASME 第 V 卷的要求执行, 并按 ASME NB-5000 的要求进行验收。

Test plates shall be visual examined, liquid penetrant examined and radiographic examined in accordance with ASME section V. The acceptance standard shall be in accordance with ASME section III NB-5000.

6.2.2. 热处理/ heat treatment

对于热处理态试验的试板应进行一次模拟热处理, 热处理在无损检验之前或之后进行均可。模拟焊后热处理的规范应满足以下要求:

A simulated stress relieving heat treatment shall be applied to the test plates for Post weld heat treatment condition accepted test. The heat treatment shall be applied to the welding plates before specimens are removed. This heat treatment may be applied either before or after the nondestructive examination. Post weld heat treatment shall be applied according to the requirements as specified below.

(1) 热处理保温温度 600~620℃, 热处理保温时间 40 (0, +1) 小时。

Holding temperature for the post weld heat treatment shall be 600-620℃, and holding time shall be 40(0,+1) hours.

(2) 炉温在 300℃以上时, 加热和冷却速率不得超过 55℃/h。

Heating rate (and cooling) shall not exceed 55℃/h in the range above 300℃.

7. 试验要求/Tests

7.1 化学分析/Chemical Analysis

焊丝化学分析应在每批焊丝中抽取 3%, 但不少于 3 盘进行检验, 从选出焊丝的端头取样。

Chemical analysis for solid wire should be taken from at least 3% of total coils for each lot, but at least 3 coils for each lot.

焊丝熔敷化学分析试样应取自断裂的拉伸试样的收缩截面。

The sample for chemical analysis may be taken from the reduced section of the fractured tension test specimen.

化学分析方法应符合 ASTM A751 规定。

The sample shall be analyzed according to ASTM A751.

焊丝及熔敷金属化学分析结果应符合表 3 的规定。

Chemical composition for strips and weld deposit should conform to the requirements in table 3.

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表3 焊丝及熔敷金属化学成分 (Wt%)

Table 3 Chemical Composition Requirements for solid wire And Weld Metal

焊丝	C	S	P	Si	Mn	Ni	Cr
ERNiCrFe-7	≤0.030	≤0.008	≤0.010	≤0.50	≤1.00	Balance	28.00~31.50
ERNiCrFe-7 Deposited Metal	≤0.030	≤0.008	≤0.010	≤0.50	≤1.00	Balance	28.00~31.50
ERNiCrFe-7A	≤0.030	≤0.008	≤0.010	≤0.50	≤1.00	Balance	28.00~31.50
ERNiCrFe-7A Deposited Metal	≤0.030	≤0.008	≤0.010	≤0.50	≤1.00	Balance	28.00~31.50
Item	Co	Mo	Cu	Nb+Ta	Fe	Ti	Al
ERNiCrFe-7	≤0.020	≤0.50	≤0.05	≤0.10	8.00~11.00	≤1.00 ⁽¹⁾	≤1.10 ⁽¹⁾
ERNiCrFe-7 Deposited Metal	≤0.05	≤0.50	≤0.05	≤0.10	8.00~11.00	≤1.00 ⁽¹⁾	≤1.10 ⁽¹⁾
ERNiCrFe-7A	≤0.020	≤0.50	≤0.05	0.50~1.00	8.00~11.00	≤0.50 ⁽¹⁾	≤0.50 ⁽¹⁾
ERNiCrFe-7A Deposited Metal	≤0.05	≤0.50	≤0.05	0.50~1.00	8.00~11.00	≤0.50 ⁽¹⁾	≤0.50 ⁽¹⁾
Item	N	B	Zr	W	V	Bi	Other elements (Co, B, Zr, N included), Total ⁽²⁾
ERNiCrFe-7	≤0.030	Test Date	Test Date	Test Date	Test Date	≤0.002	≤0.50
ERNiCrFe-7 Deposited Metal	≤0.030	Test Date	Test Date	Test Date	Test Date	≤0.002	≤0.50
ERNiCrFe-7A	≤0.030	≤0.005	≤0.020	Test Date	Test Date	≤0.002	≤0.50
ERNiCrFe-7A Deposited Metal	≤0.030	≤0.005	≤0.020	Test Date	Test Date	≤0.002	≤0.50

备注/ Note:

(1) Al+Ti 的最大值为 1.50%。

Al+Ti is 1.5 maximum.

(2) 应对表中给出规定数值的元素进行分析,如在常规分析中表明存在其他元素,应作进一步分析,以确定哪些元素的总量不超过表中最后一栏“其他元素总量(包含 Co、B、Zr、N)”所规定的极限值。

The weld metal shall be analyzed for the specific elements for which values are shown in this

table. If the presence of other elements is indicated in the regular analysis, further analysis should be performed to determine that the total number of those elements does not exceed the specified limit of “other elements (Co、B、Zr、N included), total” in the last column of the table.

7.2 力学性能试验/ Mechanical Properties

7.2.1. 拉伸试验/Tensile test

每批焊丝在焊态和热处理状态的条件下进行熔敷金属拉伸试验, 每一试验状态下, 室温和 350℃各两个试样。拉伸试样轴线位于试板 1/2 厚度位置, 按 AWS B4.0M 要求进行试验。试验结果见表 4 所示。

Tension tests shall be performed for each lot of wires in the post weld heat treated condition and as-welded condition. Two specimens for room temperature and two specimens for 350℃ shall be tested in each condition. Tension test specimens whose axis is located at mid-thickness of the test plates, and the tests shall be performed in accordance with AWS B4.0M. The results of tension tests shall conform to table 4.

表4 熔敷金属拉伸性能

Table 4 Tensile Properties of Deposited Metal

温度 Temperature	屈服强度 (MPa) Yield Strength (MPa)	拉伸强度 (MPa) Tensile Strength (MPa)	延伸率(%) Elongation At Room Temperature (%)	断面收缩率(%) Reduction of Area (%)
室温 Room Temperature	≥310	585-750	≥30	提供实测数据
350℃	≥190	≥510	提供实测数据 For Information	提供实测数据 For Information

7.2.2. 冲击试验/ Impact Toughness of deposited metal

每批焊丝熔敷金属在焊态和焊后热处理态下在室温进行夏比 V 型缺口冲击试验, KV 冲击每组 3 个试样。试验尺寸应符合 ASTM A370 图 11A 型的要求,

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试样中心线位于试板 1/2 厚度位置。依据 AWS B4.0M 的要求进行夏比 V 型缺口冲击试验。三个试样试验结果均应满足 $AKV \geq 60J$ 。

KV Impact test for each lot of wires should be performed in as-welded and postweld heat treated conditions. KV Impact was performed at room temperature. Three specimens shall be tested for each series. Specimens shall be in accordance with SA-370, Figure 11, Type A, and specimens center shall be located at the midthickness of the test plates. The Charpy V-notch test shall be performed in accordance with AWS B4.0.M The value of each Charpy V-notch impact specimen shall be equal to or more than 60J.

7.2.3. 弯曲性能/Bend Tests

弯曲试验应在焊态和焊后热处理态下进行。每个状态下试样种类、数量、规格尺寸及试验条件应符合表 5 的规定。

Bend test for each lot of wires should be performed in as-welded and postweld heat treated conditions. Test type, size, quantity for each condition should conform to table 5.

试验方法按 AWS B4.0M 的规定执行。试样弯曲后, 在拉伸面上不允许出现具有特征性的裂纹, 单个裂纹、气孔和夹渣等缺陷的长度不得超过 1.5mm。长度在 0.4mm 以上的允许裂纹数量不超过 3 个。

The bend test shall be performed in accordance with AWS B4.0M. After bending, the face in tension shall be examined, and any defects over 1.5mm is not allowed and the quantity for defects longer 0.4mm can't be more than 3.

表5 弯曲性能

Table 5 Bend Test

<u>试样状态</u>	弯曲种类	试样尺寸 (mm)	数量	试验条件
<u>Specimen condition</u>	Type	Size (mm)	Quantity	Test Condition
<u>焊态</u>	面弯	T×30×200	2	D=4a α=180°
<u>As welded</u>	<u>Face bend</u>			
<u>热处理态</u>				

<u>PWHT</u>				
<u>As welded</u>	背弯	T×30×200	2	D=4a α=180°
<u>热处理态</u>	<u>Root bend</u>			
<u>PWHT</u>				
<u>As welded</u>	横向侧弯	10×T×200	2	D=4a α=180°
<u>热处理态</u>	Transverse side bending			
<u>PWHT</u>				

注: T 为试板厚度, D 为弯曲试验机的芯棒直径, a 为弯曲试样的厚度。

Note: T is the thickness of test plates, D is the plunger diameter of the bend test machine, a is the thickness of the bend specimens.

7.3 金相检验/ Metallographic Examination

焊态和热处理态试板均应进行金相检验。金相检验依据 ASTM E3 的要求进行金相检验。

Metallographic examination shall be carried out in the condition of as-welded and the condition of after heat treatment. The test shall meet the requirements in ASTM E3.

宏观金相检验应无任何裂纹、未熔合、夹渣和气孔等缺陷。

Macrographic examination: No visible cracks or any incomplete fusion, inclusions and any porosity.

微观检验放大 200 倍进行, 焊缝中应无微裂纹、未熔合和夹渣缺陷。

Micrographic examination: No present of cracks, microcracks, incomplete fusion, inclusions and so on in 200X magnification.

Metallographic examination shall be carried out in the state of welding and in the state of heat treatment.

7.4 晶间腐蚀加速试验/ Accelerated Intergranular Corrosion Test

晶间腐蚀加速试验取样时尽可能少地去除表层金属, 并取在稀释区以外。

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Accelerated intergranular corrosion test shall be carried out. The samples shall be taken close to surface of welding plate. When taking test specimens, the minimum amount of metal shall be removed from the surface of the deposit.

试样长度与焊接方向平行, 尺寸为 $2\times 20\times 40\text{mm}$, 数量4块, 其中2块焊态试样加敏化试样, 2块热处理态加敏化试样。

The samples shall be taken along the direction of welding. The dimension of the specimens shall be $2\times 20\times 40\text{mm}$. The number of specimens is 4 pieces. Two specimens are subjected to as-welded condition + sensitizing treatment; Two specimens are subjected to heat treatment+ ensitizing treatment.

敏化处理试样取自热处理态试板, 需要经历敏化 $675^{\circ}\text{C}\times 1$ 小时的敏化处理。

Sensitizing treatments specimens shall be taken from the heat treatment test plate. Than the specimens shall be subjected to sensitizing treatments. The "sensitizing" treatments temperature shall be 675°C , and the time shall be 1 hour.

试验方法按 ASTM A262 “E” 法或 ISO 9400 “B” 法执行。试样弯曲后按 ASTM A262 “E” 法或 ISO 9400 “B” 法评定。

The corrosion tests shall be carried out according to ASTM A262 Method E or ISO 9400 Method B. The above intergranular corrosion test shall be evaluated according to practice E in ASTM A262 or practice B in ISO 9400.

8. 复验/Retest

如果下列任何试验的结果不符合要求, 必须对不合格的试验进行双倍复验, 且试验结果均应符合要求。下列以外的试验项目不允许复验。复验的试样应在原试件上切取。重复试验只允许一次。

- 1) 对于化学分析, 只需对那些不符合要求的特定元素进行复验
- 2) 拉伸性能: 抗拉强度、屈服强度及断后伸长率同时作为复验项目进行复验。
- 3) 弯曲性能: 应作两组复试, 两组试样复试的结果均合格。
- 4) 冲击性能: 应在规定温度下两组复试, 两组试样复试的结果均合格。

If the results of the following tests fail to meet the requirement, double retesting shall be performed. The results of both retests shall meet the requirement. Double retesting is not allowed for test other below. The retest shall be carried out for only once.

1) For chemical analysis, retest need be only for those specific elements which failed to meet the test requirement.

2) Tensile Test : Yield Strength Tensile Strength and Elongation are simultaneously used as retest items review.

3) Bend Test: Two groups should be retest, the results of the two groups are qualified.

4) Impact Test: Two groups should be retest, the results of the two groups are qualified.

复验的试样应取自同一熔敷金属试件中,在不可能切取足够数量的复验试样的情况下,须另制备一块试板,重新进行焊材验收试验,所有验收试验的检验结果均需满足规定的要求。

Specimens for retest shall be taken from the original test coupon. If impossible, a new test assembly should be prepared for all the tests.

9. 首次使用的焊材和 G 类别焊材的附加要求 / Additional requirements for filler metal for first application or with a “G” suffix

对于首次用于三代核电厂的焊接材料商业牌号或者 G 类别的焊材,须增加以下要求:

For trade designation of welding materials used for the first time in third-generation nuclear power plants or the filler metal with a “G” suffix, the following requirements shall be added.

9.1 焊接材料制造商的业绩证明/ **Experiences of welding material**

Manufacturer

焊接材料制造商需提供证据表明，证明该焊接材料具有在核电领域或相似质量要求的其他工业中的应用业绩。

The welding material manufacturer shall provide information to prove the application experience of the welding material in the field of nuclear power or other industries with similar quality requirements.

9.2 焊接材料的使用性能证明/ **Proof of the performance of welding materials**

焊接材料制造商需提供证据表明，焊接材料至少已经过三个炉/批号的试验，证明该焊接材料在采用生产中使用的焊接变素范围的情况下，其焊缝化学成分和力学性能可以满足规定的要求。提供的证明应属于由相同的焊接材料制造商生产，具有相同的商业牌号，相同的型号且在配方中没有重大变化的焊接材料。

The welding material manufacturer shall provide evidence that welding material have through at least three furnace/batch number of the test, show that the welding material using the welding variable used in production, its chemical composition and mechanical properties of weld can satisfy the requirement of regulations. Certificates provided shall be of the same welding material manufactured by the same welding material manufacturer, of the same trade designation, of the same type and without significant changes in the formula.

9.3 焊接材料使用性能证明的另一种方法/**Another method of proving the performance of the welding material**

如果焊接材料制造商提供 9.2 节中的证据，需进行试验证明该焊接材料在不同的条件下，其化学成分和力学性能满足规定的要求。至少应对三种不同的炉

/批号和至少两种直径(如果在生产中使用的直径超过一种)的焊接材料进行试验。试验需证明在生产中使用高和低的冷却速度和相似的焊接工艺(即薄板使用高热输入、高道间温度、低冷却速度和厚板使用低热输入、低道间温度、高冷却速度)的条件下, 都能满足化学成分和力学性能的要求。

If the welding material manufacturer is unable to provide the evidence in Section 9.2, tests shall be carried out to prove that the chemical composition and mechanical properties of the welding material meet the specified requirements under different conditions. At least three different furnace/lot numbers and at least two sizes (if more than one is used in production) shall be tested for welding materials. The tests shall prove that the requirements of chemical composition and mechanical properties can be met in production using high and low cooling rates and similar welding processes (i.e., high heat input, high interpass temperature, low cooling rate for thin plates and low heat input, low interpass temperature, high cooling rate for thick plates).

10. 包装和标识/ Packing and Marking

10.1 包装/ Packing

每盘或每包焊丝应按照 AWS-5.14 要求以密封包装供货, 应保证在正常条件下的运输和贮存过程中免受损伤。

Each spool or package of wires should be provided in hermetically sealed package in accordance with AWS-5.14 to prevent damage during shipment and store under normal condition.

相同直径的所有盘的焊丝应该是由一根连续长度的材料组成。

All spools with the same diameter shall be as single continuous length of wire with no splices.

焊丝盘中每层排列应该平齐, 不产生错边现象。

The wire shall be level wound.

每盘焊丝应该被存放在密封的箱子内, 在运输过程中起保护作用。

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Each spool shall be placed in a closed carton for protection for shipment.

托盘上所有箱的焊丝应该是同一批的。

All cartons on skid shall be one lot of wire.

每盘焊丝的净重公差不能超过 $\pm 10\%$ 。

The tolerance on net weight of wire coiled on each spool shall not exceed $\pm 10\%$.

运输托盘尺寸和重量应该满足表 6 规定。

The shipping pallet size and weight should conform to table 6 below.

表6 焊丝托盘规格

Table 6 Size of Pallet

托盘类型	尺寸(mm) ⁽¹⁾	重量(kg) ⁽²⁾
Pallet type	Size(mm)*	Weight(kg)**
装焊条的托盘 (木制箱子)	Max.960H×1100W×1200L	Max.1200/托盘
Pallet for wire (wooden box)	Max.960H×1100W×1200L	Max.1200/Pallet

注: (1): 这个尺寸包括木质支承材料

This size should be meant as including wooden support material.

(2): 可能的话, 托盘的重量近似为 1200kg (允许公差+0/-10%)

If possible, the weight of pallet is approximately 1200kg (tolerance +0/-10%).

10.2 标识/ Marking

每箱焊丝的外侧和每盘焊丝的两侧都应该附有标签。

Adhesive labels shall be attached to both the outside of the cartons and to both side of each spool.

所有包装箱或货盘的编号应该连续, 在同一批运输的焊材中, 包装箱或货盘不允许有重复的编号。

All cartons and pallets shall be numbered consecutively. No carton or pallet number shall duplicable that of any other carton, or pallet contained in the same shipment.

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单件包装箱: 所有标签按 AWS-5.14 的要求标识, 至少应包括以下内容:

Unit containers: All labels shall be identified with the information required by SFA-5.14, it contains the following information as minimum.

- 尺寸
- Size of wire
- 批号、炉号或检验号
- Lot, heat or control number
- AWS 分类号
- AWS classification . No.
- 商标
- Trade name
- 净重
- Net weight
- 制造方或供货商的名称
- Name of manufacturer or supplier
- 生产日期
- Producing date

— 每一箱焊丝必须有识别标志, 可查出焊丝的生产班次、生产线以及制造焊丝的焊芯化学成分范围

— Each box of wires shall have labels which could trace back to shifts, production line and the range of chemical composition of the core wire

单件包装箱的包装: 在每个箱子还应明显的标出除了采购单号和规格书号, 修订版号之外的相同信息。

Packing of unit containers: each box shall be plainly marked with the same information required on the unit containers in addition to the purchase order number and the specification and revision number/letter.

焊丝的每个包装外部都应醒目地、字迹清晰地标明下述内容。

The following should be shown strikingly and clearly on surface of each packet of strip and flux.

- 材料的分类号和牌号。
- Classification number and brand.
- 制造厂名称和商标。
- Name of manufacture and trademark.

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—规格尺寸和净重。

—Size and net weight.

—批号、检验号和炉（罐）号。

—Lot, heat and inspection number.

—生产日期。

—Making date.

如果购买直段焊棒，每根直段焊棒上应标记 AWS 类别号。

Each welding rod shall be imprinted AWS classification number.

11. 质量要求/ Quality Requirements

11.1 质量保证要求

焊材供货商应遵循 HAF003 或 ASME BPVC Section III NCA-3800 的要求制订和实施质量保证大纲，具体要求按采购合同执行。

The welding material supplier shall formulate and implement Quality Assurance Program according to ASME BPVC Section III NCA-3800 or HAF003-1991. The Quality Assurance Program shall conform to requirements of the purchase contract in detail.

为检查或审查采购过程的每个阶段，一重、一重的用户和一重的授权核检查师有权进入供应商的车间、接触设备和记录。

CFHI, CFHI's customer, and CFHI's authorized nuclear inspector shall have access to the supplier's plant facilities and records for inspection or audit at each tier of procurement.

发货前，当供应商确定了一项不符合项时，对于不符合项的处理办法应得到买方批准。

When a nonconformance is identified by the supplier prior to shipment, the nonconformance shall be submitted to CFHI for approval of the disposition.

11.2 材料的证明/ Certification of Material

鉴定材料试验报告 (CMTR) 应随焊材一起交货, 并至少应包括下列内容:

The Certified Material Test Report (CMTR) shall be delivered with the welding consumable and shall include the following information as minimum:

(1) 所有要求的化学分析、试验和检验的实际结果。

The actual results of all required chemical analysis, tests and examinations.

(2) 进行化学分析、试验或检验的分供方的证明。对于除化学分析、试验或检验以外其它要求保留追溯性的工作, 应将这些工作和进行这些工作的合格分供方列在 CMTR 上, 或者将合格分供方的证明附在 CMTR 上;

The subsupplier's certification for performing chemical analysis, tests or examinations. The operations other than chemical analysis, tests or examinations requiring maintenance of traceability, these operations and the approved subsuppliers performing them shall be listed on the CMTR or the approved subsupplier's certification for the operation may be furnished as an attachment to the CMTR.

— 尺寸和净重。

Size and net weight.

— 材料标识描述。

Material identification description.

— 材料组织的质量系统证书和有效期 (适用时);

The Material Organization's Quality System Certificate number and expiration date, as applicable.

— 相应的书面的质量系统大纲的版本和日期 (适用时)。

The revision and date of the applicable written Quality System Program, as applicable.

— 标准号和分类号

Specification and classification designation.

— 批号、管理号或炉号;

Lot, control or heat number.

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— 焊接规范；

Welding parameters

— 采购定单号和采购规格书号；

Purchase order number and the procurement specification number.

— 任何不符合项及处理的记录；

Records of any nonconforming items including the disposition.

— 供应商的名称和商标；

Supplier's name and trade designation.

— 推荐的焊接工艺、电源种类、极性、焊接位置等参数。

— **Recommended welding process, power source type, polarity, parameter scope, inter-pass temperature, welding position and other welding parameters.**