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反应堆压力容器

Reactor Pressuere Vessel

镍基合金实芯光焊丝采购规范

Material Purchase Specification for Nickel Alloy Bare Solid Wires

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**MODIFICATION****文件修改记录**

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2021.11.25	A	CFC	首次出版	--
2023.07.18	B	CFC	<p>(1) 第 7 页：修改试板制备的要求。 Page 7: The requirements for test plate preparation revised.</p> <p>(2) 第 8 页：修改电流极性描述。 Page 8: The description for type of current and polarity revised.</p> <p>(3) 第 10 页：修改 C 含量要求。 Page 10: The content of element C revised.</p> <p>(4) 第 12 页：修改弯曲试验要求。 Page 12: The requirements for bend tests revised.</p> <p>(5) 第 14 页：修改晶间腐蚀试验要求。 Page 14 : The requirements for accelerated intergranular corrosion test revised.</p> <p>(6) 第 15 页：修改包装要求。 Page 15: The requirements for package revised.</p> <p>(7) 第 16 页：修改标识要求。 Page 15: The requirements for marking revised.</p>	黄正凤

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## 1. 范围/SCOPE

本文件规定了用于民用核电项目反应堆压力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 pressure vessel of civilian nuclear equipments.

## 2. 引用标准和文件 //Referenced Documents

RCC-M 规范	第IV卷 S 篇, 2007 版
RCC-M. 2007	Section IV Welding
RCC-M 规范	第III卷 MC 篇, 2007 版
RCC-M, 2007	Edition III Examination Methods
ISO 9400-1990	Nickel-based alloys - Determination of resistance to intergranular corrosion
AWS A5.14-2009	镍和镍合金光填充丝和焊丝标准
AWS A5.14-2009	Specification for Nickel and Nickel-Alloy Bare Welding Electrodes and Rods

## 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

焊丝直径、焊丝盘规格、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	/	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起有不利影响的裂纹、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。

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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.

焊丝卷和焊丝筒中的焊丝的弹射度和螺旋度应使得焊丝在自动焊和半自动焊设备中均匀送丝。

The cast and helix of electrodes in coils and spools shall be such that the electrode will feed in an uninterrupted manner in 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).

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(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、热处理态、热处理态+敏化）

Accelerated intergranular corrosion test on weld metal (1 reference specimen, 1 test specimen which shall be subjected to a heat treatment, 1 test specimen which shall be subjected to the sensitizing treatment after heat 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

焊材验收时应制备焊态和热处理态试板。

**The test plates for acceptance of filler metal shall be prepared both at As-welded condition and post welding heat-treated condition.**

试板的制备应符合 RCC-M S2532 的要求。试板的尺寸应符合 NF EN 1597-1 标准中 1.4 型的规定。

**The test plate shall be prepared according to RCC-M S2530. The dimension of the test plates shall be in conformance with type 1.4.**

### 6.2 母材/Base Metal

焊材验收用试板的母材应为：

—试板应为与熔敷金属相同级别的镍基合金

The base metal used to make the test plate shall be nickel-alloy and the grade corresponding to the grade of the filler material under test.

—如果碳钢试板，应用焊丝至少堆焊 3 层镍基隔离层（隔离层厚度不小于 5mm）。

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or a carbon steel buttered with a filler material of the same grade as that to be accepted. And the buttering should be welded for 5mm at least on the test plate.

### 6.3 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.

表2 焊接参数

Table2 Welding Parameters

焊接位置 Welding position	平焊 (PA) Flat (PA)
预热温度 Preheat Temperatures	≥150℃
道间温度 Interpass Temperatures	≤250℃
后热 post-weld heat treatment	250-400℃, 至少 2 小时 250-400℃ for a minimum of 2 hours
<b>电流极性</b> <b>Current and Polarity</b>	<b>直流正接</b> <b>DCSP</b>
机械氩弧焊电流 (A) Welding Current (amperes) for Automatic GTAW	Peak current: 210A~290A Base current: 110A~210A
手工氩弧焊电流 (A) Welding Current (amperes) for manual GTAW	140A~220A
机械氩弧焊电压 (V) arc Voltage (volts) for Automatic GTAW	9~14
手工氩弧焊电压 (V) arc Voltage (volts) for manual GTAW	9~18
机械氩弧焊焊速(mm/min) Travel Speed(mm/min) for Automatic GTAW	150~220
手工氩弧焊焊速(mm/min) Travel Speed(mm/min) for Automatic GTAW	80~150

#### 6.3.1. 试板检验/ Examination of the Test Plates

焊接试件须进行目视检测、渗透检验、超声波检验和射线检验，分别按

RCC-M MC7100、MC4000、MC2000 和 MC3000 规定进行, 应达到 RCC-M S7710 规定的 I 级焊缝为合格。

Visual examination, liquid penetrant examination and radiographic examination for test coupon shall be carried out in accordance with the requirements in RCC-M MC7100, MC4000 and MC3000 respectively. The results shall satisfy class I requirements in RCC-M S7710.

### 6.3.2. 热处理/ heat treatment

热处理态试板应进行热处理。焊后热处理的规范应满足以下要求:

Post weld heat treatment shall be carried out for the after PWHT condition tests plate. Post weld heat treatment shall be applied according to the requirements as specified.

(1) 热处理保温温度  $615 \pm 15^\circ\text{C}$ , 热处理保温时间 29 (0, +1) 小时。

Holding temperature for the post weld heat treatment shall be  $615 \pm 15^\circ\text{C}$ , and holding time shall be 29(0,+1) hours.

(2) 炉温在  $300^\circ\text{C}$  以上时, 加热和冷却速率不得超过  $55^\circ\text{C}/\text{h}$ 。

Heating rate (and cooling) shall not exceed  $55^\circ\text{C}/\text{h}$  in the range above  $300^\circ\text{C}$ .

## 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 RCC-M MC1350 规定。

The sample shall be analyzed according to RCC-M MC1350.

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.

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	<b>≤0.030</b>	≤0.008	≤0.010	≤0.50	≤1.00	Balance	28.00~31.50
ERNiCrFe-7 Deposited Metal	<b>≤0.030</b>	≤0.008	≤0.010	≤0.50	≤1.00	Balance	28.00~31.50
ERNiCrFe-7A	<b>≤0.030</b>	≤0.008	≤0.010	≤0.50	≤1.00	Balance	28.00~31.50
ERNiCrFe-7A Deposited Metal	<b>≤0.030</b>	≤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 <sup>(1)</sup>	≤1.10 <sup>(1)</sup>
ERNiCrFe-7 Deposited Metal	≤0.05	≤0.50	≤0.05	≤0.10	8.00~11.00	≤1.00 <sup>(1)</sup>	≤1.10 <sup>(1)</sup>
ERNiCrFe-7A	≤0.020	≤0.50	≤0.05	0.50~1.00	8.00~11.00	≤0.50 <sup>(1)</sup>	≤0.50 <sup>(1)</sup>
ERNiCrFe-7A Deposited Metal	≤0.05	≤0.50	≤0.05	0.50~1.00	8.00~11.00	≤0.50 <sup>(1)</sup>	≤0.50 <sup>(1)</sup>
Item	N	B	Zr	W	V	Other elements (Co、B、Zr、N included ), Total <sup>(2)</sup>	
ERNiCrFe-7	≤0.030	Test Date	Test Date	Test Date	Test Date	≤0.50	
ERNiCrFe-7 Deposited Metal	≤0.030	Test Date	Test Date	Test Date	Test Date	≤0.50	
ERNiCrFe-7A	≤0.030	≤0.005	≤0.020	Test Date	Test Date	≤0.50	
ERNiCrFe-7A Deposited Metal	≤0.030	≤0.005	≤0.020	Test Date	Test Date	≤0.50	

备注/ Note:

(1) Al+Ti 的最大值为 1.50%。

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Al+Ti is 1.5 0%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，RCC-M SI120 进行试验。试验结果见表 4 所示。

Tensile properties and conditions shall be carried out for each lot of wires in the post weld heat-treated condition and as-welded conditions. Two specimen for room temperature and two for 350℃ shall be tested in each condition. Weld metal tension tests shall be performed in accordance with RCC-M SI120. The result of tensile test 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

每批焊丝的熔敷金属在焊态和焊后热处理态下进行, 每个状态下各 3 个试样。试样尺寸应符合 RCC-M SI312 的要求, 在室温进行夏比 V 型缺口冲击试验。三个试样试验结果均应满足  $AKV \geq 60J$ 。

Impact test for each lot of wires should be performed in as-welded and postweld heat treated conditions. Three specimens shall be tested for each condition. The size of each specimen shall conform to RCC-M SI312 and the test shall be applied at room temperature. 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

焊接试板应进行弯曲性能试验, 试样种类、数量、规格尺寸及试验条件应符合表 5 的规定。

The samples shall be taken from composite welding plate. **Bend test shall be carried out at as-welded and post weld heat-treated conditions.** Test type, size, quantity and condition should conform to table 5.

试验方法按 RCC-M SI200 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 RCC-M SI200. After bending, the face in tension shall be examined. **Any detects over 1.5mm is not allowed and the quantity for detects longer than 0.4mm can't be more than 3.**

表5 弯曲性能

Table 5 Bend Test

弯曲种类 Type	试样尺寸 (mm) Size (mm)	数量 quantity	试验条件 Test Condition
面弯 Face bend	<b><u>T×30</u></b>	2	D=4a $\alpha=180^\circ$

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背弯 Root bend	<b><u>T×30</u></b>	2	D=4a α=180°
横向侧弯 Transverse side bending	<b><u>10×T</u></b>	2	D=4a α=180°

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 the plate.** 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 RCC-M SI 400 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 RCC-M SI 400.

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，按 RCC-M SI 600 规定执行。

Accelerated intergranular corrosion test shall be carried out. **The samples shall be taken close to surface of the welding plate according to RCC-M SI 600.** 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  $4 \times 10 \times 70\text{mm}$ , 数量 3 块, 其中 1 块焊态试样, 1 块热处理试样, 1 块敏化处理试样 (热处理+敏化)。

The samples shall be taken along the direction of welding. The dimension of the specimens shall be  $4 \times 10 \times 70\text{mm}$ . The number of specimens is 3 pieces. One reference specimen are in the as-welded condition, one specimen shall be subjected to a heat treatment and one specimen shall be subjected to **heat treatment and sensitizing treatment**

热处理试样按焊后模拟热处理要求进行, 敏化试样需经  $(700 \pm 10)^\circ\text{C} \times 30$  分钟敏化处理, 升温至规定温度的时间不超过 5 分钟, 然后以  $(60 \pm 5)^\circ\text{C/h}$  速度缓冷至  $500^\circ\text{C}$ , 然后空冷。

Heating time shall not exceed five minutes. Specimens shall then be cooled in the furnace very slowly to  $500^\circ\text{C}$  at a constant rate of  $60^\circ\text{C} \pm 5^\circ\text{C}$  per hour. The specimens may subsequently be air cooled.

**应依据 ISO 9400 B 法进行腐蚀试验。。**

**Corrosion test shall be performed according to ISO 9400 method B.**

试验后的弯曲试样不应有晶间腐蚀引起的裂纹或开裂倾向, 若发生疑问, 可用金相法检验。

The specimens subjected to bend test should not exhibit fissures or cracks that result in intergranular corrosion. Microscopic examination shall only be performed where doubt arised.

## 8. 复验/Retest

凡是第一次验收不合格的项目, 则对该项目在同样的试验条件下进行双倍试样的复验。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。

If any test fails to meet its requirements for the first time, that test must be

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repeated twice. The results of both retests shall meet the requirements of this specification. Specimens for retest shall be taken from the original test coupon. If impossible, a new test assembly should be prepared for all the tests.

对于化学分析, 只需要对不符合要求的那些元素进行复验, 检验结果应全部合格。如再不合格, 则该批焊丝应 100% 检验, 需方仅对合格的焊带予以验收。

For chemical analysis, retest shall be only for those elements which fail to meet the requirements. Test results should be totally qualified. If failed again, this lot solid wire should be inspected by 100%, only qualified strips will be accepted by the buyer.

## 9. 包装和标识/ Packing and Marking

### 9.1 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.

相同规格的所有盘的焊丝应该是由同一炉批号无焊接接头的材料组成

All spools with the same size shall the the same heat and lot without 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。

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  $\pm 10\%$ .

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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) <sup>(1)</sup>	重量(kg) <sup>(2)</sup>
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%).

## 9.2 标识/ Marking

每箱焊丝的外侧和每盘焊丝的一侧都应该附有标签。

**Adhesive labels shall be attached to the outside of the cartons and one 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.

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

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- 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.
- 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.

## 10. 质量要求/ Quality Requirements

### 10.1 质量保证要求

一重应已评价、评定和审查过供应商的质量保证体系, 或者供应商拥有一个有效的质量系统证书。供应商应将质量保证体系的要求贯彻到下一步的采购文件里。

The supplier shall have a quality assurance program that has been evaluated, qualified and audited by CFHI, or the supplier shall hold a current Quality System Certificate. The supplier shall incorporate appropriate quality assurance program requirements in subtier procurement documents.

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.

### 10.2 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。

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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.

— 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;

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Records of any nonconforming items including the disposition.

— 供应商的名称和商标；

Supplier's name and trade designation.

— 根据 RCC-M S5142 编制的焊材的工艺评定卡片，内容包括：材料所保证的几何、物理性能；焊接工艺、电源种类、极性、参数范围、层间温度及存储条件等。

Qualification data sheets per RCC-M S 5142, including the guaranteed geometrical, physical and chemical characteristics of the filler material, welding procedure, source type, polarity, parameter scope, inter-pass temperature, welding position, storage term, etc.