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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 7166-2015

Replacing GB/T 7166-1987

**Characteristics and test methods for in-core and primary
coolant circuit temperature sensors in nuclear power plants**

核电厂反应堆堆芯和主冷却剂回路内温度计的特性和试验方法

(English Translation)

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Foreword

This standard was drafted in accordance with GB/T 1.1-2009 given rules.

This standard replaces GB/T 7166-1987 "nuclear reactor core or primary envelope temperature measurements characteristics and test methods" and GB/T 7166-Compared to 1987, the main technical changes are as follows.

- Modify the standard name;
- Increasing the scope of the standard (see Chapter 1);
- Increasing the normative references (see Chapter 2);
- Deleted the term "heap main envelope" and its definition (see 1987 edition 1.1);
- Increasing the term "resistance thermometer", "thermocouple", "armored thermocouple", "thermowell", "measurement accuracy", "sensitive Degree "and" in-situ calibration "and its definition (see 3.2,3.3,3.4,3.5,3.7,3.8 and 3.10);
- Modify the term "thermometer", "Temperature Measurement System" and "life" and its definition (see 31, 1987 Version 1.2; 3.6, 1987 Version 1.3;. 39, 1987 version 1.4);
- Increased security applications (see 4.2) and nuclear environmental conditions (see 4.3);

--- Increased the resistance thermometer, thermocouple thermometer, and a brief description of other types of thermometers, thermocouples and resistance thermometers and Characteristics were compared (see Chapter 5);

--- "7.2.5 Electrical Environmental Conditions" in the increase of mineral insulated thermocouple requirements (see Chapter 7, 1987 edition, Chapter 4);

--- "8.4 field testing," adding "thermometer field performance should be checked and confirmed" requirements (see Chapter 8, 1987 edition Chapter 5);

--- Added "qualification test" (see Chapter 9).

This standard uses redrafted law revision adopted IEC 60737:2010 "Nuclear power plant safety is important instruments thermometer (core and main Coolant loop) characteristics and test methods." this standard and IEC 60737:2010 as compared to some adjustments in the structure of the specific structural adjustments are as follows.

--- IEC 60737. 3.1 2010 adjusted this standard 3.7,3.4 3.2,3.5 adjusted 3.9,3.7 3.8,3.6 3.4,3.8 3.1,3.9 adjusted 3.3,3.11 3.6,3.10 adjusted to 3.5;

--- IEC 60737:2010 in 6.5 a) ~ g) adjustment of this standard 6.5.1 - 6.5.7;

--- IEC 60737:2010 in 8.2 a) ~ c) Adjustment of this standard 8.2.1 - 8.2.3;

--- IEC 60737:2010 in 8.3.2 a) ~ c) Adjustment of this standard 8.3.2.1 ~ 8.3.2.3;

--- IEC 60737:2010 in 8.3.3 a) ~ b) Adjustment of this standard 8.3.3.1 ~ 8.3.3.2.

This standard and IEC 60737:2010 technical differences and their reasons are as follows.

--- On normative references, this standard has been adjusted technical differences, in order to adapt our technical conditions, the adjusted situation Focus is reflected in the status of Chapter 2, "2 Normative references", the specific adjustments are as follows.

- equivalents adoption of international standards GB/T 16839.1 instead of IEC 60584-1;
- equivalents adoption of international standards GB/T 16839.2 instead of IEC 60584-2;
- Modify with international standards of GB/T 12727 instead of IEC 60780;
- use equivalent to international standards of GB/T 13625 instead of IEC 60980;
- equivalents adoption of international standards GB/T 18404 instead of IEC 61515;
- Modify with international standards of GB/T 29308 instead of IEC 62342;
- Modify with international standards of NB/T 20060 instead of IEC 60709;
- Modify with international standards of NB/T 20069 instead of IEC 62385;
- Modify with international standards of NB/T 20148 instead of IEC 62397;
- non-equivalent to international standards of JB/T 8622 instead of IEC 60751;

- Remove the reference to IEC 61226;
- Remove the reference to IEC 61513;
- Remove the IEC 62460 reference.

--- Removed in 3.2, 3.3 standard terminology not used.

--- "6.2.2 Cable", used in the original "shall" to require cable mineral insulated cables, but according to the existing level of technology development and practical application experience plants through the use of radiation resistant organic insulating materials also meet the appropriate environmental conditions, so Here the claim to the recommended use of "should." this standard made the following editorial changes.

--- Remove the IEC 60737:2010 references;

--- Increasing the GB/T 2900.82 and GB/T 25475 as a reference.

The standard proposed by China National Nuclear Corporation.

This standard by the National Nuclear Instrument Standardization Technical Committee (SAC/TC30) centralized.

This standard was drafted. China Nuclear Power Institute.

Introduction

This standard describes a strong focus on the application of the characteristics of radiation environment, and is located within a loop reactor pressure boundary and (or) highly radioactive Applications thermometer.

Nuclear reactor affected by the conditions of work is often different from non-nuclear applications. Located in the reactor core member in a very harsh ring Among territory.

Intense neutron and gamma radiation generated by nuclear transmutation, nuclear heating and structural changes will affect the mechanical and electrical properties of these devices, Therefore, the selection of equipment and material selection should pay particular attention.

In addition, the need to consider the design of high-pressure environment, high temperature, gradient and temperature cycling, as well as temperature measurement system may Anti Reactors security or economic impact.

Since the application in nuclear environments, thermometer need for strict identification requirements.

Nuclear power plant reactor core and primary coolant circuit within Characteristics and test methods thermometer

1 Scope

This standard specifies the characteristics of a nuclear power plant reactor core and primary coolant circuit within the temperature measuring device, design, manufacturing and testing method.

This standard applies to thermometer PWR Nuclear Power Plant reactor core and primary coolant circuit in use, including thermocouples and resistance temperature Meter (RTD). Other reactor type nuclear power plant may refer to this standard.

2 Normative references

The following documents for the application of this document is essential. For dated references, only the dated version suitable for use herein Member. For undated references, the latest edition (including any amendments) applies to this document.

GB/T 4989 thermocouple compensation wire GB/T 12727 Nuclear power plant safety systems of electrical equipment qualification (GB/T 12727-2002, IEC 60780:1998, MOD) GB/T 13625 Nuclear power plant safety systems of electrical equipment seismic qualification (GB/T 13625-1992, eqv IEC 60980. 1988) GB/T 16839.1 Thermocouples - Part 1. indexing table (GB/T 16839.1-1997, idt IEC 60584-1:1995) GB/T 16839.2 thermocouple Part 2. Tolerances (GB/T 16839.2-1997, idt IEC 60584-2. 1982) GB/T 18404 sheathed thermocouple cables and thermocouples (GB/T 18404-2001, idt IEC 61515:1995) GB/T 29308 Nuclear power plant instrumentation and control systems important to safety aging management requirements (GB/T 29308-2012, IEC 62342.

2007, MOD)

JB/T 8622 Industrial platinum resistance indexing table and technical conditions (JB/T 8622-1997, neq IEC 60751. 1983) NB/T 20060 Nuclear power plant instrumentation and control systems important to safety isolation criterion (NB/T 20060-2012, IEC 60709:2004, MOD) NB/T 20069 Nuclear power plant safety supervision important instrument channel performance test (NB/T 20069-2012, IEC 62385:2007, MOD) NB/T 20148 Instrumentation important to safety of nuclear power plants resistance thermometers (NB/T 20148-2012, IEC 62397:2007, MOD)

3 Terms and Definitions

The following terms and definitions apply to this document.

Thermometer temperature measuring sensor to the device used to measure a given measuring point temperature within the core or primary coolant circuit, it may be fixed or movable.

Note 1: for example, resistance thermometers and thermocouples (sheathed thermocouple