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**ENERGY INDUSTRY STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

NB/T 20600-2021

**Design and fabrication specification for fuel assembly and
associated core components in HPR1000 nuclear power plants**

华龙一号核电厂燃料组件及相关组件设计和制造规范

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Foreword

This document was issued on 7 January 2021 by the National Energy Administration of the PRC and takes effect on 1 July 2021.

It is a NB/T standard: recommended rather than compulsory, but it is the text a Chinese reviewer applies when assessing a submission.

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1 Scope

NB/T 20600-2021 is the design and fabrication specification for the fuel assemblies and the

associated core components of the HPR1000 - Hualong One - the Chinese pressurised water reactor design now built at home and exported. The fuel assembly is the component that has to hold uranium dioxide pellets in a fixed geometry for several years inside a reactor core, under irradiation, high temperature, coolant flow that induces vibration, and the mechanical loads of handling and of postulated accidents. The specification sets the general requirements the assembly must satisfy - the design basis, the service conditions and the criteria against which each is judged. It then covers the assembly itself and each of its parts: the fuel rods with their cladding, pellets, springs and end plugs, the skeleton formed by guide thimbles and instrumentation tube, the spacer grids that hold the rods and mix the coolant, and the top and bottom nozzles. The associated core components follow - control rod assemblies, burnable absorber and source assemblies, and the plugging devices - each with its own requirements. For every component the specification gives the materials and their condition, the dimensional and tolerance requirements, the design analyses that must be performed, and the fabrication, welding and inspection required, together with the cleanliness, handling and documentation appropriate to nuclear fuel. Note that the standard defines no terms of its own: it states explicitly that none require definition.

This document specifies the design and fabrication requirements for the fuel assemblies and the associated core components of HPR1000 (Hualong One) nuclear power plants.

This document applies to the design and fabrication of the fuel assemblies and the associated core components of HPR1000 nuclear power plants. It may also be used for reference in the design and fabrication of the fuel assemblies and the associated core components of other pressurized water reactor nuclear power plants.

A description of the fuel assemblies and the associated core components of HPR1000 nuclear power plants is given in Annex A.

2 Normative references

The contents of the following documents constitute indispensable provisions of this document through the normative references made to them in the text. For dated references, only the edition corresponding to that date applies to this document; for undated references, the latest edition (including all amendments) applies to this document.

GB/T 223 (all parts), Methods for chemical analysis of iron, steel and alloy.

GB/T 228.1, Metallic materials - Tensile testing - Part 1: Method of test at room temperature.

GB/T 228.2, Metallic materials - Tensile testing - Part 2: Method of test at elevated temperature.

GB/T 229, Metallic materials - Charpy pendulum impact test method.

GB/T 230.1, Metallic materials - Rockwell hardness test - Part 1: Test method.

GB/T 231.1, Metallic materials - Brinell hardness test - Part 1: Test method.

GB/T 232, Metallic materials - Bend test method.

GB/T 238, Metallic materials - Wire - Reverse bend test method.

GB/T 239.1, Metallic materials - Wire - Part 1: Single twist test method.

GB/T 239.2, Metallic materials - Wire - Part 2: Double twist test method.

GB/T 2976, Metallic materials - Wire - Wrapping test method.

GB/T 4162-2008, Ultrasonic testing method for wrought and rolled steel bars.

GB/T 4334, Corrosion of metals and alloys - Test methods for intergranular corrosion of stainless steels.

GB/T 4340.1, Metallic materials - Vickers hardness test - Part 1: Test method.

GB/T 4740, Test method for compressive strength of ceramic materials.

GB/T 5163, Sintered metal materials (excluding hardmetals) - Permeable sintered metal materials - Determination of density, oil content and open porosity.

GB/T 6394, Determination of estimating the average grain size of metal.

GB/T 6402, Ultrasonic testing method for steel forgings.

GB/T 6579, Laboratory glassware - Thermal shock and thermal shock endurance test method.

GB/T 8651, Ultrasonic lamb wave inspection method for metal sheets and plates.

GB/T 10266, Technical specification for sintered uranium dioxide pellets.

GB/T 10561, Steel - Determination of content of non-metallic inclusions - Micrographic method using standard diagrams.

GB/T 11170, Stainless steel - Determination of multi-element contents - Spark discharge atomic emission spectrometric method (routine method).

GB/T 11809, Metallographic examination and X-ray radiographic examination of the seam welds of pressurized water reactor fuel rods.

GB/T 11813, Helium mass spectrometer leak detection of pressurized water reactor fuel rods.

GB/T 11839-2008, Determination of boron in uranium dioxide pellets - Curcumin extraction photometric method.

GB 11841, Determination of uranium in uranium dioxide powder and pellets - Ferrous sulphate reduction - Potassium dichromate oxidimetric method.