



SPECIFICATION

Bonner Sphere Spectrometer

1. Scope

- 1.1. This Specification describes the requirements for a Bonner Sphere Spectrometer (the "System") for use in a subcritical assembly.
- 1.2. The System shall be supplied to the End-User, the Nuclear Research Center located in Ulaanbaatar, Mongolia, under IAEA Technical Cooperation project MON1008.
- 1.3. Variations to this specification require explicit written approval by the IAEA technical officer.
- 1.4. Any assumptions (e.g. facilities, standards, equipment already possessed by End-User) must be clearly identified.

2. Applicable Documents

- 2.1. The Equipment shall not violate IEC 61508 (Functional Safety of Electrical/Electronic/Programmable Electronic Safety-related Systems).

3. Requirements

The System shall include the following equipment and functionality:

- 3.1. Capable of measuring the fluence distribution of the neutron field in the energy range from 1 meV to 20 MeV with accuracy better than 10%;
- 3.2. Moderators: Polyethylene spheres with diameters of 3, 3.5, 4, 4.5, 5, 6, 7, 8, 10, 12, 15 and 18 inch, with holes for fitting the detectors;
- 3.3. Detectors: One (1) ³He-filled spherical proportional counter, with polyethylene housings for fitting in the moderators;
- 3.4. Software with all needed components to control the System and for reporting results, including code for automatic spectra calculation and simulated response functions. The software interface and operation manual shall be in the English language;
- 3.5. All electronic components and cables necessary for full functionality; and
- 3.6. Electrical requirement: 220/240 V, 50 Hz.

4. Marking and Packing

- 4.1. The System shall have all safety markings in English language.
- 4.2. The System, for the shipment to the End-User, shall be packed in accordance with international standards that are applicable for the shipment by air of this kind of equipment



5. Quality Requirements

- 5.1. The System shall be manufactured and installed in accordance with the Supplier's ISO quality assurance system or an equivalent quality assurance system. The Supplier shall retain documents demonstrating compliance and provide them on request.
- 5.2. The System, prior to shipment, shall be tested for conformance of the System with manufacturer's performance specifications and the minimum requirements specified herein.
- 5.3. The System, after installation, shall be tested by the Supplier together with the End-User to demonstrate that the performance meets the manufacturer's performance specifications and the minimum requirements specified herein.

6. Installation and Training

- 6.1. The Supplier shall install the System at the End-User location. Prior to installation, the Supplier shall confirm with the End-User that all required facilities and materials are available.
- 6.2. The Supplier shall provide three (3) days of training for three (3) staff of the End-User in the operation and maintenance of the System at the End-User's location, immediately after the installation of the System.
- 6.3. On completion of installation, testing, and training, the Supplier shall obtain a certificate of completion (acceptance protocol) from the End-User and forward it to the IAEA.

7. Deliverable Data Items

- 7.1. The Supplier shall provide two (2) complete sets of operation and servicing manuals and technical drawings in the English language.

8. Warranty and Support

- 8.1. The System shall be supplied with a comprehensive warranty, valid for one (1) year from the date of the certificate of completion;
- 8.2. The Supplier shall identify a support plan appropriate for the End-User, with full contact details. In-country or regional support is preferred; and
- 8.3. The Supplier shall list required consumables, any routine or preventative maintenance that is recommended, and components where replacement is expected within a typical ten-year life span.