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Technical Specifications (In-Cash Procurement)

Technical specification for procurement of Class II IP batteries in Building 46 and Building 47

The purpose of this specification is to outline the minimum requirements for the design, supply, packing and testing of the UPS batteries and accessories as part of Class II-IP system in buildings 46 and B47.

Table of Contents

1 PREAMBLE 3
2 PURPOSE 3
3 ACRONYMS & DEFINITIONS 3
3.1 Acronyms 3
3.2 Definitions 3
4 APPLICABLE DOCUMENTS & CODES AND STANDARDS 4
4.1 Applicable Documents 4
Table-1 List of applicable documents 5
4.2 Applicable Codes and Standards 5
Table-2 List of applicable standards 6
5 SCOPE OF SUPPLY 6
5.1 Equipment and components 6
5.2 Other components of the supply 7
5.3 Service included 7
5.4 Optional services and components to be supplied 8
5.5 Equipment and services supplied by others 8
6 DESIGN REQUIREMENTS 8
6.1 General description 8
6.2 Environmental conditions at site 8
6.3 Technical Requirements 9
6.3.1 General description 9
6.3.2 Characteristics of the Batteries 11
Table-3 Main Characteristics of Batteries 12
6.3.3 Racks 12
6.3.4 Discharge Profile 12
6.3.5 Fuse disconnector panels 12
6.3.6 Battery terminals 13
6.3.7 Instrumentation and Control 14
6.3.8 Other components 14
6.4 Testing 14
6.5 Acceptance Criteria for Shop Verifications and Tests 15
6.6 Testing for Fuse-Disconnector Switch 16

7 QUALITY CONTROL PROVISIONS 16
8 PACKING, PRESERVATION & SHIPPING 17
9 DELIVERY TIME 18
10 LOCATION FOR SCOPE OF WORK EXECUTION 18
11 IO DOCUMENTS & IO FREE ISSUE ITEMS 19
11.1 IO Documents 19
Table-4 Document to be provided by IO 19
11.2 Free issue items 19
12 LIST OF DELIVERABLES 19
Table-5 List of Deliverables 21
13 QUALITY ASSURANCE REQUIREMENTS 21
14 SAFETY REQUIREMENTS 21
14.1 Nuclear class Safety 21
14.2 Seismic class 21
15 SPECIFIC GENERAL MANAGEMENT REQUIREMENTS 22
15.1 Work Monitoring 22
15.2 CAD design requirements 22
16 APPENDIX 22
16.1 Tender technical data sheets 22
Table-6 Technical Datasheet 26
16.2 Acceptance criteria for test for Batteries 26
Table-7 Acceptance Criteria for Battery Test 27

1 PREAMBLE

The ITER project aims to build a fusion device, twice the size of the largest current devices, with the goal of demonstrating the scientific and technical feasibility of fusion power. It is a joint project among the European Union, China, India, Japan, South Korea, the Russian Federation, and the USA. ITER will be constructed in Europe, at Cadarache in the south of France.

2 PURPOSE

The purpose of this specification is to outline the minimum requirements for the design, supply, packing, delivery, installation and testing of the UPS batteries and accessories as part of Class II-IP system in buildings 46 and B47.

All documents or information attached to this specification are considered part of it and must be complied with by the prospective Supplier.

3 ACRONYMS & DEFINITIONS

3.1 Acronyms

The following acronyms are the main ones relevant to this document.

Abbreviation	Description
CRO	Contract Responsible Officer
GM3S	General Management Specification for Service and Supply
IO	ITER Organization
PRO	Procurement Responsible Officer
PBS	Plant Breakdown System
IP	Investment Protection
SSEN	Steady State Electric Network
PA	Procurement Arrangement
DC	Direct Current
SRO	Start of Research Operation Phase
DT	Deuterium Tritium Phase

3.2 Definitions

Client – ITER Organisation (IO)

Contractor: the economic operator who have signed the Contract in which this document is referenced, as defined in the Special Conditions of the said Contract.

Subcontractor: shall mean an economic operator who is under contract to a Contractor providing supplies, services or works to the IO, being understood that the subcontractor shall

perform, under responsibility of the Contractor, with independence and free from any subordination, a specific part of the obligations of the Contract.

Supplier: shall mean a legally registered entity, that can provide standard / catalogue goods or material, or standard services to a Contractor, or a subcontractor, that will enable the performance of the scope of work to be provided by the Contractor or subcontractor.

4 APPLICABLE DOCUMENTS & CODES AND STANDARDS

4.1 Applicable Documents

This is the responsibility of the Contractor to identify and request for any documents that would not have been transmitted by IO, including the below list of reference documents.

This Technical Specification takes precedence over the referenced documents. In case of conflicting information, this is the responsibility of the Contractor to seek clarification from IO.

Upon notification of any revision of the applicable document transmitted officially to the Contractor, the Contractor shall advise within 4 weeks of any impact on the execution of the contract. Without any response after this period, no impact will be considered.

Title	No.	Version
[RD1]. General Management Specification for Service and Supply (GM3S)	ITER_D_82MXQK	v1.4
[RD2]. Systems Requirement Document (SRD) Steady State Power Supply and Distribution PBS 43	ITER_D_28B6Y9	v3.6
[RD3]. Electrical Design Handbook Part 3: Codes and standards	ITER_D_2E8DLM	v1.3
[RD4]. Electrical Design Handbook: Part 4, Electromagnetic Compatibility	ITER_D_4B523E	v3.0
[RD5]. EDH Part 2: Terminology & Acronyms	ITER_D_2E8QVA	v1.5
[RD6]. Electrical Design Handbook: Part 5, Earthing and Lightning Protection	ITER_D_4B7ZDG	V3.0
[RD7]. Electrical Design Handbook Guide A: Electrical Installations for SSEN Client Systems	ITER_D_2EB9VT	v2.7
[RD8]. IO_cabling_rules	ITER_D_335VF9	v3.3
[RD9]. ITER Procurement Quality Requirements	ITER_D_22MFG4	V6.4

Title	No.	Version
[RD10]. Human Factors Integration Plan	ITER_D_2WBVKU	V3.0
[RD11]. Colour Code for Electrical Components	ITER_D_3E5XP2	v1.2
[RD12]. ITER numbering system (for parts/components)	ITER_D_28QDBS	v5.1
[RD13]. SSEN Input Data for the RAMI Analysis	ITER_D_4EQDJL	v1.1
[RD14]. Instructions for Seismic Analyses	ITER_D_VT29D6	v2.1
[RD15]. Specification for Labelling of Equipment on ITER Project	ITER_D_TL25DK	v3.3
[RD16]. ITER Abbreviations	ITER_D_2MU6W5	v1.19
[RD17]. Safety Important Functions and Component	ITER_D_347SF3	V2.0
[RD18]. PBS-43 System Load Specifications	ITER_D_ XANCBT	V2.0
[RD19]. Calculation to determine the cable cross sectional area for the d.c. investment protection battery cables Train A & Train B	ITER_D_CAEUCX	V2.2
[RD20]. Class II IP load profile assessment during SRO phase	ITER_D_ECQJE7	V1.0
[RD21]. Release for Shipping (RFS) for SSEN Uninterruptible Power Supplies (UPS)	ITER_D_UVR9RK	V1.1
[RD22]. ITER_430000_SLD_012 UTIL-IP I&C Architecture Diagram	ITER_D_87FDK2	V2.4

Table-1 List of applicable documents

4.2 Applicable Codes and Standards

This is the responsibility of the Contractor to procure the relevant Codes and Standards applicable to that scope of work.

Ref	Title	Doc Ref.	Version
[CS1].	Stationary lead-acid batteries. Part 11: Vented types. General requirements and methods of tests	IEC 60896-11	
[CS2].	International Electrotechnical Vocabulary-Chapter 486: Secondary cells and batteries	IEC 60050-482	

Ref	Title	Doc Ref.	Version
[CS3].	Short-circuit Currents in DC. Auxiliary Installations in Power Plants and Substations	IEC 61660	
[CS4].	Secondary cells and batteries. Monitoring of lead-acid stationary batteries. User guide	IEC/TR 62060	
[CS5].	Low-voltage switchgear and control gear assemblies	IEC 61439	
[CS6].	Low-voltage switchgear and control gear	IEC 60947	
[CS7].	Degree of protection provided by enclosures (IP Code)	IEC 60529	
[CS8].	Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK Code)	IEC 62262	
[CS9].	Recommended practice for Maintenance, Testing and Implementation of Vented Lead-Acid Batteries for Stationary applications	IEEE Std 450	
[CS10].	Recommended Practice for Installation, Design and Implementation of Vented Lead-Acid Batteries for Stationary Applications	IEEE Std 484	
[CS11].	Recommended Practice for Sizing Lead-Acid Batteries for Stationary Applications	IEEE Std 485	
[CS12].	Safety requirements for secondary batteries and battery installations Part 2: Stationary batteries	EN IEC 62485-2	
[CS13].	Low voltage electrical installations	NFC 15-100	
[CS14].	Graphical symbols for diagrams	IEC/EN 60617	
[CS15].	Electromagnetic compatibility (EMC)	IEC 61000	
[CS16].	Low Voltage Directive	2014/35/EU	
[CS17].	Hazardous Substances	2002/95/EC & 2006/66/EC	
[CS18].	Equipment and protective systems intended for use in potentially explosive atmospheres (ATEX)	1994/9/EC 1999/92/EC 2014/34/EU	

Table-2 List of applicable standards

The applicable editions of these codes and standards will be the last ones published, included the corresponding modifications, in the date of award of the order.

5 SCOPE OF SUPPLY

This section defines the specific scope of supply, in addition to the contract execution requirement as defined in [RD1].

5.1 Equipment and components

The following descriptive list is an indicative list regarding the electrical equipment to be included in the supply:

- IP-A (Building 46)
  - Class II IP Lead-acid batteries, vented type (43BRTA-EB-2602, 43BRTA-EB-2603, 43BRTA-EB-2604, 43BRTA-EB-3601, 43BRTA-EB-3602, and 43BRTA-EB-3603) provided with fuse disconnector panels (43BRTA-BP-2602, 43BRTA-BP-2603 and 43BRTA-BP-2604,43BRTA-BP-3601,43BRTA-BP-3602, and 43BRTA- BP -3603);
  - Support structures (racks) for batteries.

- IP-B (Building 47)
  - Class II IP Lead-acid batteries, vented type (43BRTB-EB-2602, 43BRTB -EB-2603, 43BRTB -EB-2604, 43BRTB -EB-3601, 43BRTB-EB-3602, and 43BRTB-EB-3603) provided with fuse disconnector panels (43BRTB -BP-2602, 43BRTB-BP-2603 and 43 BRTB -BP-2604, BRTB -BP-3601, 43 BRTB - BP -3602, and 43 BRTB- BP-3603).
  - Support structures (racks) for batteries.

NOTE:

- the batteries cells shall be sized for the SRO phase as per load profile defined in [RD20] and chapter 6.3.4 (50% UPS kVA rating (p.f.=0.86) @ 1h autonomy)
- the batteries racks and fuse disconnector panels shall be sized for DT phase: load profile is defined as the full UPS kVA rating (p.f.=0.86) @ 1h autonomy.

5.2 Other components of the supply

- All accessories (ex. ceramic funnel plug, dust lid) and parts, as well as the special tools (if any) required to install the supplied components mentioned in section 5.1.
- All inter-cell connection cables for batteries.
- Battery terminals for connection of outgoing DC cables
- Spare parts and consumables necessary for equipment testing, commissioning and insurance
- One (1) set of special tools which the Supplier deems necessary for plant maintenance during operation or site erection

- Spare parts necessary to carry out maintenance work (special tools, test and verification equipment, accessories, maintenance programs, etc)

5.3 Service included

- Packing and transport, in accordance with the requirements included in section 8 herein
- Performance of the tests indicated in section 6.4
- Supplying of the documentation required in section 12 in both PDF, and the native formats.
- Preparation of as-built documentation to include changes on site and/or drawings errors.
- Repairing or replace defective pieces supplied by the Contractor, that fail before the take-over of components.
- Propose and implement corrective actions to address non-conformities identified by Regulatory Authorities during inspections, which occurred during the design, fabrication, packing or transportation.

5.4 Optional services and components to be supplied

- Technical services on-site, for installation guidance and SAT- Site Acceptance Test.

5.5 Equipment and services supplied by others

- UPS
- External cables for connection to Fuse disconnector panel and to UPS Charger, cables sized by the Client in [RD19]
- Assembly, erection and commissioning.

6 DESIGN REQUIREMENTS

6.1 General description

The equipment included in this specification shall comply with the design requirements described below.

This specification establishes the general criteria to be followed by the Supplier in their design.

The Supplier’s final design and selection of equipment shall ensure an optimum solution is attained in terms of quality, safety, operating costs, maintenance facilities, etc. Preference will be given to simple designs with standardised, proven equipment.

Under the chapter Exceptions to the Specification, the Supplier shall include in his tender a detailed list of equipment, systems, works or services that are excluded, indicating the reason for exclusion with reference to the corresponding section of the specification.

6.2 Environmental conditions at site

Building	Max/Min Temp (ºC)	Relative Humidity (%)
Battery room	20	30-70%

6.3 Technical Requirements

6.3.1 General description

- The batteries shall be of the lead-acid, vented type, for installation in a dedicated battery room separated from the rest of the equipment. No other device capable of producing sparks or arcing (ATEX requirements) may be installed nearby.
- In case of malfunction of the normal alternating current (by means of the rectifier), the batteries shall supply loads during a set minimum time (in accordance with the discharge profile)
- The battery shall have enough capacity to feed the corresponding Class II loads for one (1) hour. Please refer Document number [RD20] for calculations. Supplier has to perform and submit the calculations considering UPS characteristics [RD21].
- The batteries shall be operated with both terminals ungrounded.
- The batteries shall be designed for a minimum operating lifetime of 20 years. As such, the potential Suppliers shall have a proven manufacturing experience of minimum 20 years for stationary lead-acid batteries for nuclear projects.
- The batteries shall be designed accordance with IEEE 446
- The electrolyte level shall be visible through side walls. Minimum and maximum electrolyte level marks shall be marked at least on one side of the container.
- The battery sizing shall be performed in accordance with IEEE 485.
- Design ambient temperature for battery sizing shall be 20ºC. Temperature correction factor shall be considered only if it is above 1.
- Additionally, the rated capacity of the battery shall be greater than that required by the design cycle, taking into consideration the following:
  - An ageing factor of 25%
  - A design margin of 10%
- The polarity of terminals of each element shall be clearly indicated with indelible markings
- The battery must be suitable for continuous stand-by operation mode with parallel rectifier. It shall be maintained fully charged and shall only be discharged occasionally.
- During normal operation, the battery shall be connected to the UPS, in parallel with the rectifier, which is feeding the battery in floating mode.

- Whenever required, the battery shall be subjected to an equalizing load, with the rectifier operating with constant voltage and current limitation.
- The battery shall be equipped, for the connection to the UPS, with a fuse-disconnector
- The battery shall be capable of ensuring permanent, momentary or temporary power supply if normal AC power is not available and continuing operation
- Cells shall be foreseen with the necessary facilities to enable the metering of the temperature and density of the electrolyte, sampling and filling of these devices with distilled water without removing them. Additionally, to the opening for the standards plugs, a service opening for the measurement of the electrolyte density should be foreseen.
- Enough space shall be projected in each cell to consider sediment accumulation during the life of the battery.
- All connections between the elements that form the battery shall be supplied. These connections shall ensure electrical contact, and they shall have enough cross section to minimize voltage drop between cells.
- Connections between elements shall be insulated. The terminals of each element shall be fitted with insulation covers to protect against accidental contacts. Covers shall be easily removable to allow inspection of the terminals. It shall be possible to measure terminals voltage without removing these covers.
- Contact protection according to BGV A3 / IP 2X shall be provided by fully insulated copper connectors and screw heads. The pole screws are to be provided with a self-dissolving coating on the thread. For easy testing of the voltage, a measurement opening on the screw head is exposed.
- The battery terminals should be plastic encapsulated; Terminal feedthroughs on the container cover must be vapor and electrolyte-tight but allow for growth of the plates, as to not damage the container cover over the lifetime.
- Interconnection cables between cells supported on separated racks (if required).
- The cell terminal pole shall be provided with connector and nuts for bolting. Poles and connectors shall be insulated.
- The polarity of the terminals of each element shall be clearly indicated with indelible markings.
- Similarly, all elements shall be provided with a nameplate or permanent marking with the following information at least:
    - Tag Number.
    - Serial number
    - Manufacturer and model
    - Type

- Year of manufacture
- Rated voltage of the battery, Vdc
- Number of elements
- Ah capacity
- Density of the electrolyte (cell fully charged at 20ºC and with its maximum filling level)
- Float voltage
- Equalizing voltage
- Boost charge voltage (if applicable)
- Weight of each element with electrolyte

- The cable feed through to the outside of the battery room shall be installed on the cable Ladder.
- This room shall have forced ventilation to prevent hazardous concentrations of hydrogen.
- The battery cells shall be provided with hydrogen recombination units to minimize the amount of hydrogen release. The hydrogen recombiner must be equipped with bi-directional valve, flame-arrestor and a 2-chamber design. All relevant materials shall be temperature resistant. Additionally, the following tests must be verified & certified by a third party: efficiency of the recombination system, backfire inhibition and overload safety.

6.3.2 Characteristics of the Batteries

The main characteristics of the battery shall be the following:

Type	Lead-acid, vented type
Applicable standards	IEC 60896-11 and IEEE 485
Rated voltage	400V
number of cells for the UPS system	192
Float charge voltage	2.15 to 2.25
Equalizing charge voltage	2.25 to 2.40
Final Discharge Voltage, V/Cell, Battery	1.8V/cell (346V/battery)
Design life of battery	Greater than or equal to 20 years

Battery Autonomy	1 hour
Design margin	10%
Aging factor	25%
Design temperature	20ºC

Table-3 Main Characteristics of Batteries

6.3.3 Racks

- Battery racks must be designed to provide adequate mechanical strength and stability.
- The battery shall be supplied with a steel rack for the assembly of the accumulators. The rack shall be electrically insulated from the containers and the ground so that the battery has a ground insulation of at least 50MΩ in the most unfavourable conditions when the containers are clean and dry.
- Rack shall be acid-resistant and duly treated and protected against corrosion caused by the environment.
- The layout of the elements and the design of the rack shall not hinder the visual inspection of the level markings, the nameplate, the identification of the elements, and in general any maintenance operation required.
- Design of the racks shall allow installation of acid-resistant trays serving the purpose of containing possible electrolyte leaks due to cracking or breaking of the containers.
- Rack shall be designed according to the dimensions and weight of the battery.
- Rack size shall not exceed the maximum footprint (concrete plinths) allocated in the buildings as per IO general arrangement drawings for B46/B47 – Refer document list 11. Racks shall be provided for the full capacity in DT phase (2 strings), i.e. half the space in the rack is empty for future installation of another string.

6.3.4 Discharge Profile

Batteries shall be calculated as per IEEE 485 and taking into account ageing factor 25%, design margin 10%, as well as temperature correction factor (if applicable) previously indicated, in order to be able to supply 50% rated power of the inverters during the autonomy time of the battery (1 hour). Please see [RD20] for details.

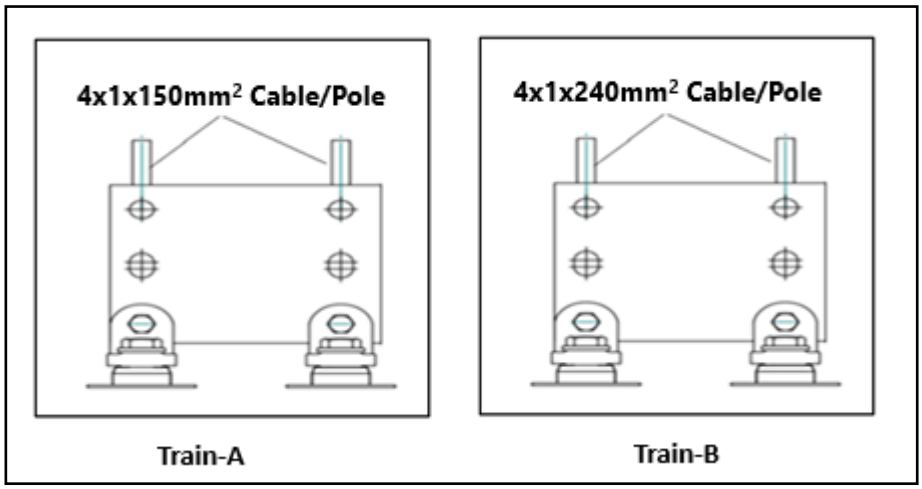
6.3.5 Fuse disconnector panels

- One (1) fuse-disconnector panel shall be provided for each battery.
- This panel shall be wall mounted inside the battery room (indoor installation)

- The panel shall be made of 2 mm thick steel plate, with protection class IP31, and accessible through a door with hinges and locks.
- The panel shall be provided with the following equipment:
  - One (1) fuse-disconnector (two poles):
    - Rated voltages: 400V
    - Rated current: The suitable rated current, considering the discharges currents.
    - Rated short-circuit making and breaking capacity of the fuse-disconnector: The suitable breaking and making capacity, considering the short-circuit contribution of the battery.
- Cable terminals with the necessary cable glands
- Earthing strip to connect to ground metal parts of the panel
- Panel shall be naturally cooled
- Cable entry shall be from the bottom, exit from the top.
- There shall be an ID plate under the internal component, terminal, etc. In addition, nameplate with the ID-number shall be screwed onto the front of the panel.
- There shall also be a nameplate indicating the characteristics screwed onto the front of the panel:
  - Manufacturer/year of manufacturer
  - Tag number
  - Serial number
  - Input voltage, Vdc
  - Rated current, A
  - Short-circuit withstand current, kA
  - Dimensions and weight

6.3.6 Battery terminals

The Supplier shall provide the battery end terminals suitable for connection of the DC cable, with hood cover included suitable for maximum battery rated current and for connection of 4x150mm2 cables per pole for Train A and 4x240mm2 cables per pole for Train B, two holes per cable lug. Reference document number [RD19]. The distance between the holes for the battery poles shall be decided by Supplier, based on the chosen battery cell type. See below sketch, for information.



6.3.7 Instrumentation and Control

The Supplier shall provide BMS (Battery Management System) to be sized for SRO phase initially (1x192 elements per battery) but with possibility to add DT phase batteries also (2x192 elements per battery). Refer [RD22]. Modbus communication protocol shall be provided for interfacing with higher control & monitoring system. BMS shall have capability to ensure that all batteries elements are kept within optimum voltage range by using equalizing feature (using current diversion for each separate element). Also, the BMS shall provide real time information of voltage for each element, impedance, temperature and string current, also provides warning notifications through audio, visual, and network messages for system events.

6.3.8 Other components

Additionally, the supplier shall include the following elements within the scope of supply:

- Two (2) portable density meters, for the measuring of the load level
- Two (2) thermometers, per battery, suitable for measurement of the electrolyte temperature
- One (1) manual device to raise, lower or remove jars from the racks (optional)

6.4 Testing

The UPS Battery systems shall be fully tested in accordance with current edition of the relevant IEC standards, and the performance of the tests shall be witnessed by an IO/F4E representative (if requested).

The equipment manufacturer shall submit testing procedures, according to applicable IEC standards, for all the tests described in this section. In the event that one of the tests described in this section is not strictly covered by an IEC standard, the equipment manufacturer shall submit testing procedures with their proposal. All the test procedures shall be reviewed by IO for acceptance before being performed. For each equipment item, the equipment manufacturer shall provide the reports for type tests carried out on

equipment similar to that of the supply and he shall carry out the routine tests indicated below. The type tests shall be carried out at reputed testing laboratory, the tests must have been carried out during the last 5 years

The batteries shall be subjected to the following in-shop tests and checks, as per standards IEC 60896-11 and IEEE 450.

6.4.1 Type Test

The tests shall be carried out as required by standard IEC 60896-11.

No tests will be required if certificates and protocols from type tests are available for batteries of the same kind as that supplied.

6.4.2 Routine Test

The following tests shall be run on the battery in the factory, in installation conditions similar to those of its location in the plant:

- Dimensional check and general appearance of elements
- Capacity tests, as per section 14 of standard IEC 60896-11
- Insulation resistance test with respect to the rack and the ground
- Chemical tests to measure the density, electrolyte analysis and composition

6.4.3 Site Acceptance Test

The following verifications and tests shall be performed at site under supervision of the Supplier:

- Visual inspection
- Capacity test, as per section 14 of standard IEC 60896-11
- Service test, as per standard IEEE 450 to determine that the battery meet duty cycle requirements.
- Insulation resistance test with respect to the rack and the ground

6.5 Acceptance Criteria for Shop Verifications and Tests

The acceptance criteria shall be in accordance with the values indicated in Appendix 0

These criteria shall be in accordance with the corresponding standards and must not deviate from the data included by the equipment manufacturer in the certified datasheets defined in Appendix 16.1.

Meeting the criteria included in these acceptance criteria does not exempt the manufacturer from full compliance with test requirements included in the referenced standards.

Moreover, the equipment manufacturer must send a list indicating all the tests to be performed, with a reference to each associated procedure, indicating the applicable standard and specifying the acceptance criteria, as indicated in Appendix 16.1. This list must be reviewed and accepted by IO.

6.6 Testing for Fuse-Disconnector Switch

The Fuse-disconnector shall be tested as per IEC 60947-3.

7 QUALITY CONTROL PROVISIONS

The IO shall ensure a close oversight of the production of its main Suppliers.

The Supplier shall submit an Inspection Points Programme (or Manufacturing Inspection Program - MIP) for approval by the IO PBS43. This programme explicitly and correlatively addresses each of the stages of procurement, manufacture and tests, and preparation for shipment, indicating the inspection points to be carried out by the Supplier.

For each point, he shall indicate the internal procedure that will be applied and whether a report or other associated documentation will be generated (quality certificates, reception reports, etc).

With this programme, the IO shall select the points he or his representatives wish to witness or check: W(Witness), HP (Hold Points), NP (Notification Points) or R (Review).

A Notification Point (NP) is a milestone where the Supplier is required to notify the IO, that it has completed a specific task or a specific deliverable and is proceeding to the next task or to the next action on the specific deliverable. A NP is meant to enable the IO personnel to follow the progress of the Contract and possibly to witness a critical manufacturing step at the Supplier's premises. The Notification shall be sent by the Supplier to the IO at least 10 working days prior to the scheduled manufacturing step. The IO shall decide whether or not they want to attend. A NP shall not affect the production flow of the Supplier that shall continue the work even without a reply from the IO.

A Hold Point (HP) is a milestone where the Supplier is required to notify the IO, that it has completed a specific task or a specific deliverable and must stop the associated processes until a HP Clearance is issued. The HP Clearance shall be issued on the basis of clearly identified Quality Control and data and Acceptance test results to be provided to the IO at the time of the request. The IO shall have a maximum of 5 working days to review the Suppliers data and to notify the Supplier of its decision. In case of clearance the Supplier shall resume its activity. In case of rejection, the Supplier shall develop a recovery plan that shall be submitted and reviewed by the IO within 10 working days of submission.

A Witness Point (W) is a milestone which identifies an operation to be witnessed. Adequate notice shall be given to the IO, in order to allow the IO to participate to the operation.

Review (R) identifies a document or report to be reviewed.

IO will review the following control points:

- FAT (HP)
- Delivery report (before shipment) (HP)

The data generated during the execution of the present Contract shall be handled electronically and entered into the ITER IDM. The structure of this database shall be defined by the IO. The Supplier shall use this database to store information related to the Contract. All data entered in the database will be kept strictly confidential by the IO and, under no circumstances, shall be communicated or made accessible to other Suppliers or the DAs. Data consistency checks shall be implemented to facilitate IO oversight. Relevant data shall be made available by the Supplier to the IO through IDM each time a control point is requested, or a deviation request, a non-conformance report, or any other document which is part of the Contract deliverables is issued by the Supplier. This requirement does not apply for other documents and data files which are, for example, managed through specialized CAD software (e.g. CATIA, see System Design and others) and so undergo other requirements specified in separate documents.

The Supplier shall submit periodic reports to the IO, with a frequency depending on the progress of the works. Progress meetings shall be conducted at the IO or Supplier premises, as required by the IO.

The Supplier shall ensure that access rights are granted to IO personnel at all locations where ITER work is being performed.

In case of concerns regarding the quality of production, the IO reserves the right to perform unscheduled inspections in accordance with the ITER Procurement Quality Requirements. Planned and documented audits will be performed by the IO, and regulatory body representatives in France, to verify compliance with the technical and quality requirements of the Contract.

Moreover, the IO reserves the right to take photographs of the ITER equipment during the contract life.

8 PACKING, PRESERVATION & SHIPPING

- As a rule, the equipment Supplier shall transport the goods in compliance with the laws, directives and ordinances of France, and any applicable local, municipal or regional laws and regulations.
- A copy of the Certificate of Shipping Authorisation shall be shipped with the material so that the material can be unloaded at the site with proof that the material being received has been accepted.
- The equipment Supplier shall include an additional quantity for replacement of any materials that may suffer deterioration or breakage during transport or erection and shall submit detailed information concerning the storage.
- Supplier shall prepare all equipment covered by this specification in a manner that protects it from damage during shipment and storage prior to installation
- Prior to installation, equipment will be stored indoors with a temperature range of 5 to 30 Deg.C and an uncontrolled relative humidity
- All equipment cabinets shall be provided with features for protection and secure
- attachment to transport vehicle and with lifting features in place.

- The battery cell shall be delivered filled and charged. Instruction for maximum storage conditions (charging requirements) required to avoid loss of warranty to be provided.
- All auxiliary components, spare parts, tools, accessories shall be packed in separate boxes and crates.
- Each package of the shipment shall be labelled on the outside with the appropriate handling instructions and with sufficient information for the identification of its contents, name of the plant, the unit to which it is assigned, manufacturer's name, Purchase Order number and total weight. The label shall be visible and there shall be no possibility of identification errors.
- Correct marking of the packages prevents losses and damage to the cargo and makes it easier to handle and erect on site. It is therefore an essential part requiring special attention.

The following information shall be marked:

- Shipping address and route
- Weight in kg. Mandatory whenever the weight exceeds 55 kg
- Dimensions
- City of origin
- Handling instructions, lifting points
- Equipment manufacturer and package number, for crosschecking with the Packing List
- Marks to indicate sealed inner packaging and revisions of the desiccants
- All materials and/or equipment shall be correctly packed for shipping, and the correct measures taken by utilizing anticorrosive protections, protections against high temperatures, protections against rough handling and blows originating in transport conditions.

9 DELIVERY TIME

The maximum expected duration from the contract signature to the supply of the scope of work is 9 months and the maximum duration is 16 months. The contract shall be extended with the time required in case the site conditions (B46/B47) are not ready to receive the battery cells and place them on charging in max 6 months from delivery. The Supplier shall produce a Schedule showing all phases which comply with the required delivery date. This detailed Schedule shall be submitted to the IO for approval/acceptance, before starting any work in relation to the Contract.

The final delivery time for battery cells shall be agreed prior deliver with IO to minimize the storage time and reducing the risk of warranty loss.

10 LOCATION FOR SCOPE OF WORK EXECUTION

The Supplier can perform the work at their own location.

11 IO DOCUMENTS & IO FREE ISSUE ITEMS

11.1 IO Documents

Under this scope of work, IO will deliver the following documents by the stated date:

Ref	Title	Doc ID*	Expected date
1	General One-Line Diagram B46 / IP TA	MUC329	Contract signature
2	General One-Line Diagram B47 / IP TB	MUCDQY	Contract signature
3	CAM_EXE_FK_46_1289-v5.0___TB13 - Building 46 - Civil Works - Concrete pedestals concrete formworks drawings	34F8P7 (F4E IDM)	Contract signature
4	CAM_EXE_FK_47_1292-v5.0___TB13 - Building 47 - Civil Works - Concrete pedestals concrete formworks drawings	34EUEG (F4E IDM)	Contract signature
5	CAM_MRR_DW_46_1045-v4.0___TB13 - Building 46 - General arrangement drawings	2XNXCF (F4E IDM)	Contract signature
6	CAM_MRR_DW_47_1047-v4.0___TB13 - Building 47 - General arrangement drawings	2XP9XN (F4E IDM)	Contract signature

Table-4 Document to be provided by IO

*latest version approved in IDM to be used.

11.2 Free issue items

No free issue item is expected from IO.

12 LIST OF DELIVERABLES

The Supplier shall provide IO with the documents and data required in the application of this technical specification, the GM3S Ref [1] and any other requirement derived from the application of the contract.

Below is the minimum list of documents, but not limited to, that are required within the expected timing:

D#	Deliverable	Due date
D1	Technical Data Sheet (preliminary)	T0* + 1 month
	Preliminary outline drawings showing the dimensions and physical layout of the equipment	

D#	Deliverable	Due date
	Battery Sizing Calculation (Preliminary)	
	List of special tools and equipment for installation and commissioning (mainly for batteries)	
	Spares and consumables required for installation and commissioning and 5 years of operation	
	Manufacturing schedule and completion dates, months after receipt of order	
	Method of testing, including a description of test configurations (functional units, sub-assemblies, battery arrangements)	
	Quality Assurance Program Description and Survey	
D2	Manufacturing and inspection plan (MIP)	T0 + 2 months
	Type tests	
	Schedule for manufacturing including fabrication, inspection, test, and shipping dates	
	Technical Data Sheet (final design)	
	Battery Sizing Calculation (Final)	
	Outline drawings depicting the physical envelope of the complete assembly including location of connection points, lifting and jacking points, control panels, and equipment weights	
	Rating plate (nameplate) drawing	
	List of all accessories indicating manufacturer and model number	
	Design and drawings of the anchorage	
D3	Packaging procedure (racks)	T0 + 3 months
	Shipping instructions including drawings, dimensions, weights and instrumentation for transport of individual components (racks)	
	Final version of all drawings and all other technical information reflecting as-built configuration (racks)	
D4	Packaging procedure (batteries cells, battery end terminals and fused switches)	T0 + 9 months
	Shipping instructions including drawings, dimensions, weights and instrumentation for transport of individual components ((batteries cells and fused switches)	
	Final version of all drawings and all other technical information reflecting as-built configuration (batteries cells and fused switches)	
D5	Other documentations: -Technical Data Sheet (as-built condition) for racks	T0 + 9 months**

D#	Deliverable	Due date
	- Technical Data Sheet (as-built condition) for battery terminals (optional item) -Installation, commissioning, operating and maintenance manuals -Manufacturing dossier including FAT -Certificate of conformity -Warranty certifications -Release for shipping form	
D6	**Optional items:** Final report for site installation, Site inspection and Site Acceptance Test;	T0 + 15 months**

Table-5 List of Deliverables

*T0 = Date of the entry into force of the Contract

**the expected timing may be delayed if a hold (maximum 15 months) in manufacturing of battery cells is requested by IO.

Supplier shall prepare their document schedule based on the above and using the template available in the GM3S [RD1]appendix II.

13 QUALITY ASSURANCE REQUIREMENTS

The equipment included in the scope of supply shall follow the quality standards corresponding to a Class 2 quality classification. The equipment shall comply with the ITER Procurement Quality Requirements [RD9]

14 SAFETY REQUIREMENTS

14.1 Nuclear class Safety

The nuclear safety class for the components to be procured under this specification are Non-SIC (non-PIC), non-PIA activities are foreseen as part of this specification

14.2 Seismic class

The equipment included in this specification is classified as Non-Seismic Components (NSC).

The batteries in this specification are classified as investment protection, thus the seismic level is required to be SL1 (anchoring only).

The investment protection related equipment shall be able to restart after a defined seismic event without further testing and maintenance. The period of repair, testing and commissioning before restart has been fixed to 3 calendar months. The supplier shall guarantee this time limit before

the restart after SL1 seismic event, then no seismic analysis or test is not needed for the equipment itself.

But the equipment Manufacturer shall at least perform the analysis-based (static equivalent method) validation to prove that the fixation accessory can withstand the seismic acceleration value which is defined in Appendix 16.1

15 SPECIFIC GENERAL MANAGEMENT REQUIREMENTS

Requirement for [RD1]GM3S section 6 applies completed/amended with the below specific requirements:

15.1 Work Monitoring

The Supplier shall submit periodic reports to the IO, with a frequency depending on the progress of the works. Progress meetings shall be conducted at the IO or Supplier premises, as required by the IO.

The Supplier shall ensure that access rights are granted to IO personnel at all locations where ITER work is being performed.

In case of concerns regarding the quality of production, the IO reserves the right to perform unscheduled inspections in accordance with the ITER Procurement Quality Requirements. Planned and documented audits will be performed by the IO, and regulatory body representatives in France, to verify compliance with the technical and quality requirements of the Contract.

Moreover, the IO reserves the right to take photographs of the ITER equipment during the contract life.

15.2 CAD design requirements

This contract requires for CAD activities, [RD1]GM3S section 6.2.2.2 applies

16 APPENDIX

Appendix Number	Appendix Name
16.1	Tender Technical Datasheets
16.2	Acceptance Criteria for Tests

16.1 Tender technical data sheets

The "**REQUIRED**" column sets out the main characteristics/requirements that the equipment must comply with. The equipment manufacturer (**the tenderer**) shall complete the "**OFFERED**" column without leaving any spaces blank and specifying their compliance against requirement

In the “REQUIRED” column, the acronym “TBDM” (To Be Defined by the Manufacturer) shall be used to indicate any values to be completed by the manufacturer and that do not have to comply with some specific requirements.

CHARACTERISTICS	REQUIRED	OFFERED
1. BATTERIES		
Equipment Tag	43BRTA-EB-2602, 43BRTA-EB-2603, 43BRTA-EB-2604, 43BRTA-EB-3601, 43BRTA-EB-3602, 43BRTA-EB-3603, 43BRTB-EB-2602, 43BRTB -EB-2603, 43BRTB -EB-2604, 43BRTB -EB-3601, 43BRTB-EB-3602, 43BRTB-EB-3603	
Manufacturer	TBDM	
Place of manufacture	TBDM	
Quality Class	2	
Seismic Class	NSC	
Safety Class	Non-SIC	
SL1 FRS (only for anchorage)	0.6g for horizontal direction 0.4g for vertical direction	
Applicable standard	IEC 60896-11 and IEEE 485	
Model	TBDM	
Type	Lead-acid vented type	
Number of elements per battery string	192	
Number of strings	1- for SRO phase 2- for DT phase	
Autonomy of the battery, h	1	
Rated voltage, Vdc	Bidder to decide	
Rated capacity (indicating final discharge voltage and discharge time), Ah	TBDM as per load profile for SRO phase defined in [RD20]	
Discharge rate, A	TBDM	
Maximum charge time in:		
- Float, s	TBDM	
- Equalize, s	TBDM	
- Deep charge, s	TBDM	
Design margin, %	10	

CHARACTERISTICS	REQUIRED	OFFERED
Aging factor, %	25	
Design temperature, ºC	20	
Floating voltage per element (V/elem)	2.15 ÷ 2.25 (to be confirmed by manufacturer)	
Equalization voltage per element (V/elem)	2.25 – 2.40 (to be confirmed by manufacturer)	
Consumption current on float, A	TBDM	
Consumption current on equalization, A	TBDM	
Short-circuit current which the fully charged battery will develop at the battery terminals, kA	TBDM	
Estimated maximum permissible duration of the short-circuit current without damaging the battery		
- Under fully discharged conditions, s	TBDM	
- Under fully charged conditions, s	TBDM	
Density if the electrolyte during discharge period, gr/ml	TBDM	
Continuous current rating of the inter-cell connections, A	TBDM	
Continuous current rating of the terminal lugs A	TBDM	
Max dimension of the battery rack (LxDxH), mm	Bidder to decide (Refer GA for Space Availability)	
Weight, kg	TBDM	
Cell dimensions (LxDxH), mm	TBDM	
Cell weight, kg	TBDM	
Internal resistance, Ω/cell	TBDM	
Total battery internal resistance, including connectors, Ω	TBDM	
Heat loss at:		
- Floating voltage, kW/h	TBDM	
- Equalize voltage, kW/h	TBDM	
- Deep charge, kW/h	TBDM	
Connection parts between elements:		
- Material	TBDM	
- Conductivity at 20ºC, %	TBDM	
- Resistance of connections between elements at 20 ºC, Ω	TBDM	
Hydrogen recombination units (equipped with Bi-Directional valve, Flame-arrestor and a 2-chamber design)	required	

CHARACTERISTICS	REQUIRED	OFFERED
Hydrogen emission rate (with hydrogen recombination units provided):		
- Floating voltage, m^3/h	TBDM	
- Equalize voltage, m^3/h	TBDM	
Battery life		
- Expected, years	20	
- Guaranteed, years	TBDM	
Racks:		
- Number of racks	TBDM for DT phase (full rating of UPS @1h autonomy)	
- Material	TBDM	
- Dimensions, mm	TBDM	
- Weight, kg	TBDM	
- Ground insulation, MΩ	50	
Design life of the battery, years	>20	
Failure rate, failures/h	$1.2*10^{-6}$	
Total time to repair, h	TBDM	
2. Battery Management System		
Battery Management system (As per Clause number 6.3.7	TBDM	
3. BATTERY FUSE DISCONNECTOR PANELS		
Equipment Tag	43BRTA-BP-2602, 43BRTA-BP-2603 43BRTA-BP-2604, 43BRTA-BP-3601, 43BRTA- BP -3602, 43BRTA- BP -3603 43BRTB -BP-2602, 43BRTB-BP-2603 43BRTB -BP-2604, 43BRTB -BP-3601, 43-BRTB-BP-3602, 43BRTB- BP-3603	
Rated Voltage, Vdc	Bidder to Decide	
Rated current disconnector, A	Bidder to Decide	
Rated current fuse, A	1000A for Train-A 1250A for Train-B	
RAL Code	70001	
Short circuit withstand, kA	25	

CHARACTERISTICS	REQUIRED	OFFERED
IP degree	IP31	
Type	Wall mounted	
Manufacturer	TBDM	
Place of manufacture	TBDM	
Quality Class	QC2	
Seismic Level	NSC	
Cable entry incoming/outgoing	Top& Bottom	
Max enveloped dimensions (LxDxH), mm	Bidder to decide (Refer GA for Space Availability)	
Weight, Kg	TBDM	
4. TESTS		
Type tests as per section 6.4 of Technical Specification	REQUIRED	
Routine tests as per section 6.4 of Technical Specification	REQUIRED	
Site tests as per section 6.4 of Technical Specification	ONLY ASSISTANCE	

Table-6 Technical Datasheet

16.2 Acceptance criteria for test for Batteries

TEST CLASSIFICATION	TEST DESCRIPTION	APPLICABLE STANDARD	TEST VALUES	ACCEPTANCE CRITERIA
Type test	Capacity test	IEC 60896-11, clause 14	Battery discharge current. Battery discharge time	According to standard IEC 60896-11 subclause 14.10
Type test	Test of suitability for floating battery operation	IEC 60896-11, clause 15	Initial voltage of each cell. Voltage of each cell after 3 and 6 months. Density and position of the electrolyte.	According to standard IEC 60896-11 subclause 15.7
Type test	Endurance test in overcharge	IEC 60896-11, clause 17	Battery capacity.	According to standard IEC 60896-11 subclause 17.7

TEST CLASSIFICATION	TEST DESCRIPTION	APPLICABLE STANDARD	TEST VALUES	ACCEPTANCE CRITERIA
Type test	Charge retention test	IEC 60896-11, clause 18	Battery capacity after 90 days of storage	According to standard IEC 60896-11 clause 18
Type test	Short-circuit current and internal resistance determination test	IEC 60896-11, clause 19	Voltage and current after discharges	According to standard IEC 60896-11 clause 19
Routine test	Capacity test	IEC 60896-11, clause 14	Battery discharge current. Battery discharge time	According to standard IEC 60896-11 subclause 14.10
Site test	Service test	IEEE 450,	Battery discharge current. Battery discharge time	Battery complies with the corresponding discharge curves
Routine test	Insulation resistance with respect to the rack and the ground	--	Insulation resistance	Insulation resistance greater than 50 MΩ
Site test	Capacity test	IEC 60896-11, clause 14	Battery discharge current. Battery discharge time	According to standard IEC 60896-11 subclause 14.10
Site test	Insulation resistance with respect to the rack and the ground	--	Insulation resistance	Insulation resistance greater than 50 MΩ

Table-7 Acceptance Criteria for Battery Test