International Association of Oil & Gas Producers

SPECIFICATION
IOGP S-753J

January 2025
Version 0.1

# Supplementary Specification to IEC TS 62933-3-1 for Battery Energy Storage Systems (BESS)

**NOTE This version (S-753J) of the specification document provides the justification statements for each technical requirement, but is otherwise identical in content to S-753.**



JIP33
JOINT INDUSTRY PROGRAMME

**Revision history**

| VERSION | DATE | PURPOSE |
|---|---|---|
| 0.1 | January 2025 | Issued for Public Review |



## Acknowledgements

This IOGP Specification was prepared by a Joint Industry Programme 33 Standardization of Equipment Specifications for Procurement organized by IOGP with support by the World Economic Forum (WEF).

### Disclaimer



### Copyright notice

# Foreword

This specification was prepared under Joint Industry Programme 33 (JIP33) "Standardization of Equipment Specifications for Procurement" organized by the International Oil & Gas Producers Association (IOGP) with the support from the World Economic Forum (WEF). Companies from the IOGP membership participated in developing this specification to leverage and improve industry level standardization globally in the oil and gas sector. The work has developed a minimized set of supplementary requirements for procurement, with life cycle cost in mind, resulting in a common and jointly agreed specification, building on recognized industry and international standards.

Recent trends in oil and gas projects have demonstrated substantial budget and schedule overruns. The Oil and Gas Community within the World Economic Forum (WEF) has implemented a Capital Project Complexity (CPC) initiative which seeks to drive a structural reduction in upstream project costs with a focus on industry-wide, non-competitive collaboration and standardization. The CPC vision is to standardize specifications for global procurement for equipment and packages. JIP33 provides the oil and gas sector with the opportunity to move from internally to externally focused standardization initiatives and provide step change benefits in the sector's capital projects performance.

This specification has been developed in consultation with a broad user and supplier base to realize benefits from standardization and achieve significant project and schedule cost reductions.

The JIP33 work groups performed their activities in accordance with IOGP's Competition Law Guidelines (November 2020).

# Table of contents



## List of tables

## List of figures

# Introduction

The purpose of the IOGP S-753 specification documents is to define a minimum common set of requirements for the procurement of battery energy storage systems (BESSs) in accordance with IEC TS 62933-3-1, Edition 1.0 2018-08 Electrical energy storage (EES) systems – Part 3-1: Planning and performance assessment of electrical energy storage systems – General specification, for application in the petroleum and natural gas industries.

The IOGP S-753 specification documents follow a common structure (as shown below) comprising a specification, also known as a technical requirements specification (TRS), a procurement data sheet (PDS), an information requirements specification (IRS) and a quality requirements specification (QRS). These four specification documents, together with the purchase order, define the overall technical specification for procurement.


**JIP33 Specification for Procurement Documents**
**Supplementary Technical Requirements Specification (TRS)**

This specification is to be applied in conjunction with the supporting PDS, IRS and QRS as follows.

**IOGP S-753: Supplementary Specification to IEC TS 62933-3-1 for Battery Energy Storage Systems (BESS)**

This specification defines technical requirements for the supply of the equipment and is written as an overlay to IEC TS 62933-3-1, following the IEC TS 62933-3-1 clause structure. Clauses from IEC TS 62933-3-1 not amended by this specification apply as written. Modifications to IEC TS 62933-3-1 defined in this specification are introduced by a description that includes the type of modification (i.e. *Add*, *Replace* or *Delete*) and the position of the modification within the clause.

NOTE Lists, notes, tables, figures, equations, examples and warnings are not counted as paragraphs.

**IOGP S-753D: Procurement Data Sheet for Battery Energy Storage Systems (BESS) (IEC)**

The PDS defines application-specific requirements. The PDS is applied during the procurement cycle only and does not replace the equipment data sheet. The PDS may also include fields for supplier-provided information required as part of the purchaser's technical evaluation. Additional purchaser-supplied documents may also be incorporated or referenced in the PDS to define scope and technical requirements for enquiry and purchase of the equipment.

**IOGP S-753L: Information Requirements for Battery Energy Storage Systems (BESS) (IEC)**

The IRS defines information requirements for the scope of supply. The IRS includes information content, format, timing and purpose to be provided by the supplier, and may also define specific conditions that invoke the information requirements.

**IOGP S-753Q: Quality Requirements for Battery Energy Storage Systems (BESS) (IEC)**

The QRS defines quality management system requirements and the proposed extent of purchaser conformity assessment activities for the scope of supply. Purchaser conformity assessment activities are defined through the selection of one of four generic conformity assessment system (CAS) levels on the basis of evaluation of the associated service and supply chain risks. The applicable CAS level is specified by the purchaser in the PDS or in the purchase order.

The specification documents follow the editorial format of IEC TS 62933-3-1 and, where appropriate, the drafting principles and rules of ISO/IEC Directives Part 2.

The PDS and IRS are published as editable documents for the purchaser to specify application-specific requirements. The TRS and QRS are fixed documents.

The order of precedence of documents applicable to the supply of the equipment, with the highest authority listed first, shall be as follows:

a) regulatory requirements;

b) contract documentation (e.g. purchase order);

c) purchaser-defined requirements (e.g. PDS, IRS and QRS);

d) this specification;

e) IEC TS 62933-3-1.

# 1 Scope

*Replace all instances of term "accumulation subsystem" in IEC TS 62933-3-1 with*

accumulation subsystem (secondary batteries)

***Justification***

*Battery energy storage is the primary focus of this specification, rendering other energy storage systems described in IEC TS 62933-3-1 irrelevant.*

*Add to section*

This specification covers additional requirements for the design, safety, functionality, performance, testing, transport, storage and handling of the BESS.

***Justification***

*Battery energy storage is the primary focus of this specification, rendering other energy storage systems described in IEC TS 62933-3-1 irrelevant.*

*Add to section*

This specification also covers safety requirements for the BESS identified through a gap analysis between IEC TS 62933-5-2 and the following standards:

– AS 5139;

– DNV GL Handbook for Maritime and Offshore Battery Systems;

– DNV GL Rules for classification:2023, Part 6 Chapter 2;

– DNV-RP-00-43;

– NFPA 855;

– UL 9540.

***Justification***

*The gap analysis between IEC 62933-5-2 and the listed standards is essential to identify critical safety requirements that are not addressed in IEC 62933-5-2, which could ultimately enhance the design, performance, and risk management of the BESS.*

# 2 Normative References

*Add to first paragraph*

The following documents are referred to in this specification, the PDS (IOGP S-753D) or the IRS (IOGP S-753L) in such a way that some or all of their content constitutes requirements of these specification documents.

*Add to clause*

IEC 60092 (all parts except 301, 302, 306, 307, 501, 502, 506 and 507), *Electrical installations in ships*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 61000-2-4, *Electromagnetic compatibility (EMC) – Part 2-4: Environment – Compatibility levels in industrial plants for low-frequency conducted disturbances*

IEC 61000-6-4, *Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments*

IEC 61000-6-5, *Electromagnetic compatibility (EMC) – Part 6-5: Generic standards – Immunity for equipment used in power station and substation environment*

IEC 61892 (all parts), *Mobile and fixed offshore units – Electrical installations*

IEC 62281, *Safety of primary and secondary lithium cells and batteries during transport*

IEC 62619, *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for secondary lithium cells and batteries, for use in industrial applications*

IEC 62620, *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Secondary lithium cells and batteries for use in industrial applications*

IEC TS 62933-5-2, *Electrical energy storage (EES) systems – Part 5-2: Safety requirements for grid-integrated EES systems - Electrochemical-based systems*

IEC 63056, *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for secondary lithium cells and batteries for use in electrical energy storage systems*

IEC 63462-1, *Maritime battery system – Part 1: Secondary lithium cells and batteries – Safety requirements*

IEEE 1584, *IEEE Guide for Performing Arc-Flash Hazard Calculations*

IOGP S-620, *Supplementary Specification to IEC 62271-200 High-voltage switchgear and controlgear*

IOGP S-720, *Supplementary Specification to IEC 60076-1 Transformers*

ISO 1496-1, *Series 1 freight containers — Specification and testing — Part 1: General cargo containers for general purposes*

NFPA 70E, *Standard for Electrical Safety in the Workplace*

NFPA 855, *Standard for the Installation of Stationary Energy Storage Systems*

UL 9540A, *STANDARD FOR SAFETY Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems*

UN 38.3, *Transportation Testing for Lithium Batteries and Cells*

UN 3536, *LITHIUM BATTERIES INSTALLED IN CARGO TRANSPORT UNIT lithium ion batteries or lithium metal batteries*

*Replace Clause 3 title with*

## 3 Terms, definitions, abbreviated terms and symbols

*Add new subclause 3.0 to start of clause*

### 3.0 Abbreviated terms

AC alternating current

BESS battery energy storage system

BMS battery management system

CAS conformity assessment system

DC direct current

ECMS electrical control and management system

EMC electromagnetic compatibility

ESD emergency shutdown

FGS fire and gas system

HVAC heating, ventilation and air conditioning

LED light emitting diode

LV low voltage

IP ingress protection (rating code)

IRS information requirements specification

IT insulatum terra (latin) electrical system earthing

NRTL nationally recognized testing laboratory

PCS power conversion subsystem

PDS procurement data sheet

PMS power management system

QRS quality requirements specification

TRS technical requirements specification

## 3.1 Terms and definitions

*Add new term 3.1.3*

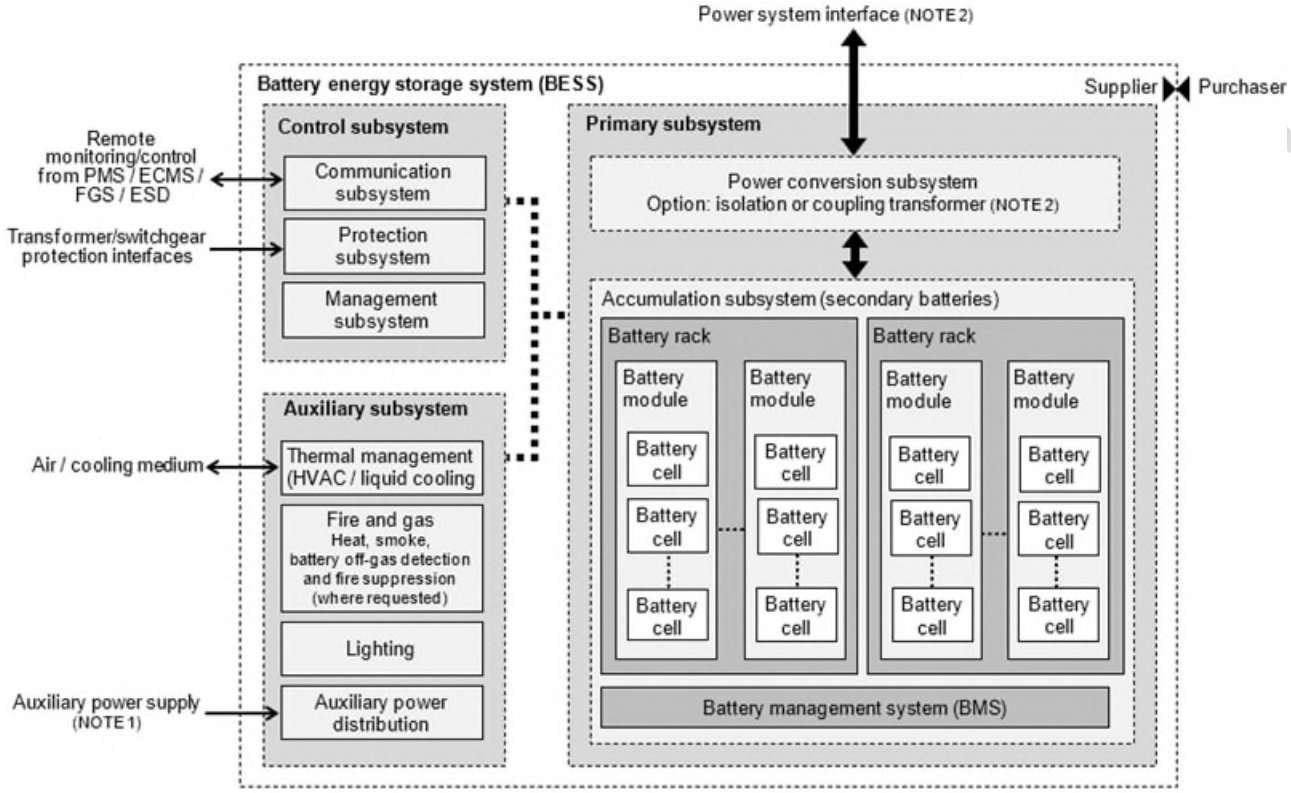
**3.1.3**
**power system interface**
interface point on the BESS where the primary subsystem connects to the external power system marks the boundary of the supply scope

Note 1 to entry: The location of the power system interface may vary based on whether isolation or coupling transformer and other optional switching devices are included as part of the supply scope, either inside or outside of it.

# 4 General structure of EES systems

## 4.1 Architecture of an EES system

*Add a new Figure 1 c)*




**Key**

- Internal interfaces managed by the supplier
- External interfaces
- Primary power interface
- Array of battery cells
- Scope demarcation

NOTE 1 The auxiliary subsystem power may be derived internally from the power conversion subsystem or supplied from an external course.

NOTE 2 See the definition of term 3.1.3 "power system interface".

**c) BESS**

**Figure 1 – Typical architectures of EES systems**

***Justification***

*This figure has been added for clarity and completeness. It shows a typical structure of a BESS and its external communication interfaces.*

*Add new NOTE after second paragraph*

NOTE Figure 1 c) shows a typical structure of a BESS and its external communication interfaces. The boundary between the supplier's and purchaser's scopes is demarcated.

## 4.2 Subsystem specifications

*Replace subclause 4.2.1 title with*

### 4.2.1 Accumulation subsystem (secondary batteries)

*Add to subclause*

Among the storage systems listed under the electrochemical category in Figure 2, only secondary batteries shall apply to the accumulation subsystem.

***Justification***

*This requirement clarifies that an accumulation subsystem with secondary batteries is the focus of this specification, therefore other energy accumulation systems depicted in Figure 2 are not in the scope.*

*Add new NOTE*

NOTE Refer to Clause 8 for additional requirements for the accumulation subsystem (secondary batteries).

### 4.2.3 Auxiliary subsystem

*Add new NOTE*

NOTE Refer to Clause 9 for additional requirements for auxiliary subsystems.

### 4.2.4 Control subsystem

*Add to subclause*

Remote control functionality shall not bypass or override the built-in safety devices and systems of the BESS.

***Justification***

*Local safety controls are essential for ensuring that the equipment operates safely and efficiently. Overriding these controls can lead to hazardous conditions, endangering both the environment and personnel.*

# 5 Planning of EES systems

## 5.2 EES system environment

### 5.2.2 Grid parameters and requirements

#### 5.2.2.4 Immunity of the EES system

*Replace second sentence with*

BESS equipment shall conform to the requirements of electromagnetic immunity levels specified in IEC 61000-6-5.

***Justification***

*This requirement specifies the EMC immunity levels to be maintained by the BESS equipment in order to have immunity against external electromagnetic interference produced by other electrical equipment.*

### 5.2.4 Standards and local regulations

### 5.2.4.2 Emissions of EES system

*Add to section*

BESS equipment shall conform to the requirements of electromagnetic emission levels specified in IEC 61000-6-4.

***Justification***

*This requirement specifies the EMC emissions levels to be maintained by the BESS equipment in order to prevent electromagnetic interference to other equipment from the BESS equipment.*

## 5.5 Functional system performance

### 5.5.1 General

### 5.5.1.2 Typical applications

**Class C**

*Add new list item 6)*

6) Spinning reserve in microgrids

   The EES system designed for spinning reserve application is an operating reserve that remains synchronised with the microgrid.

   It is typically kept in standby mode while continuously monitoring the microgrid load and generation levels.

   The spinning reserve EES system has the capacity to supply AC power to the microgrid, preventing local power generation from becoming overloaded in the event of a power generation unit failure.

   The spinning reserve capacity eliminates the need to operate additional generators, reducing emissions, fuel consumption, and operational hours on power generation equipment.

***Justification***

*Spinning reserve ensures that an extra capacity available in the system can be quickly dispatched to balance supply and demand if there is an unexpected loss of generation or a sudden surge in demand.*

### 5.5.5 Active power limitation

*Replace last sentence with*

The ESS system shall be capable of performing active power limitation as specified in the project documents and, where applicable, in accordance with the local grid code.

***Justification***

*This requirement ensures that the system can adapt to regulatory and project-specific constraints, maintaining performance and reliability levels.*

## 5.6 Communication interface

### 5.6.3 Remote monitoring and control

#### 5.6.3.4 Development of an EES system information model

**Table 4 – Example of messages of an EES system information model**

*Add new row to Table 4*

| | |
|---|---|
| **Messages related to accumulation system (secondary batteries) alarms** | The alarm messages to be exchanged shall cover the following:<br>● high and low cell or module temperature<br>● battery over and under voltage<br>● battery system isolation<br>● battery breaker / contactor trip<br>● cooling failure<br>● liquid cooling leakage, where applicable<br>● low insulation level monitoring (LV AC and DC sections of PCS with IT earthing)<br>● battery unbalance<br>● safety protection function alarms as required by the battery system design |

***Justification***

*This addition provides examples of messages related to accumulation system alarms.*

*Add new subclause*

## 5.7 Additional design requirements

### 5.7.1 Insulation monitoring system

#### 5.7.1.1

Insulation monitoring shall be provided for isolated (IT) electrical systems of the BESS.

NOTE The LV AC system (supply to the PCS from the isolation transformer) and the DC system (supply to the secondary batteries of the accumulation subsystem from PCS) are typically isolated (IT) electrical supplies in the BESS.

***Justification***

*This requirement for insulation monitoring ensures that any degradation or fault in the insulation is detected early, preventing potential electric shocks and ensuring the safety of personnel and equipment.*

#### 5.7.1.2

Insulation monitoring shall have an alarm and trip provision for low insulation resistance.

***Justification***

*Low insulation resistance can result in electrical faults and safety hazards such as electric shocks and fires. The alarm and trip function help reduce these risks by alerting remote monitoring and control systems, enabling prompt corrective action.*

**5.7.1.3**

The insulation monitoring system shall have network communication capabilities.

***Justification***

*Network communication capabilities enable the insulation monitoring systems to communicate with the remote supervisory and control system of the facility, allowing for early insulation condition corrections to prevent electrical shock hazards and equipment damage.*

### 5.7.2 Internal wiring and terminals

**5.7.2.1**

Wiring shall be labelled with alphanumeric characters located adjacent to the terminals.

***Justification***

*Labelling wiring is crucial for identifying the paths between connections, which is essential for troubleshooting. It also helps to identify interfaces for external connections. Proper identification of wires, connectors and terminals ensures accurate restoration of wiring after repairs or component replacements, minimizing the risk of human error.*

**5.7.2.2**

Wiring for external connections of the BESS (e.g. external power supplies, hardwired external control signals and hardwired field equipment) shall be routed to individual terminals on an accessible terminal block.

***Justification***

*This requirement ensures a good engineering practice to place terminals at an accessible location near the cable entry point for external connection interfaces. This facilitates segregation between internal equipment wiring and external wiring, preventing routing interferences.*

**5.7.2.3**

Terminal blocks shall be grouped by operating voltage.

***Justification***

*This requirement prevents accidental cross-connection of wires with different voltage levels, reducing the risk of electrical hazards and ensuring safe operation.*

### 5.7.3 Interconnecting cables

**5.7.3.1**

If specified, interconnecting cables shall be provided between BESS equipment or subsystems that are separately installed and are not part of the integrated container assembly.

NOTE Examples of interconnecting cables include the following:

– power cables between the isolation or coupling transformer and the PCS;

– power and control cables between the PCS and the battery container or cabinet;

– control and communication cables between the isolation transformer, PCS, battery container or cabinet, and the separately installed local BESS control.

***Justification***

*Pre-supplied interconnecting cables simplify the installation process for the end user and reduce the effort required to source compatible cables separately.*

**5.7.3.2**

The separation distance between the cable entry and the associated connection terminals within the cabinet or container shall provide the required cable core bending radius.

***Justification***

*This requirement ensures sufficient space for cable termination between the gland plate and terminals, allowing for proper spreading out of cable cores and stress-free terminal connections. Insufficient space can lead to cable core bending, which imposes mechanical stress at connection points and risks terminal damage.*

*Add new subclause*

## 5.8 Specific requirements for offshore (fixed and floating) installations

**5.8.1**

For offshore installations, BESS associated equipment, components and assemblies shall be in accordance with the general requirements of IEC TS 62933-3-1, IEC TS 62933-5-2 and one of the following:

– IEC 61892 (all parts) for electrical installations in mobile and fixed offshore units;

– IEC 60092 (all parts except 301, 302, 306, 307, 501, 502, 506 and 507) for electrical installations in ships and IEC 63462-1 for safety requirements for secondary lithium cells and batteries in maritime battery systems.

***Justification***

*This requirement ensures that specific design and safety requirements for offshore installations are complied.*

**5.8.2**

If the requirements of the International Maritime Organization (IMO), International Association of Classification Societies Ltd. (IACS) or other applicable classification societies contradicts or conflicts with the requirements of IEC standards, the more stringent requirements shall be applied.

***Justification***

*The International Maritime Organization, International Association of Classification Societies Ltd. and any other classification society provide a list of rules and requirements to be complied by the operator of the vessels. If the design and testing requirements for equipment by such classification societies are more stringent or have any ambiguity as compared to design and testing requirements for equipment installed as per IEC standards, the more stringent requirement governs.*

# 6 EES system performance assessment

## 6.2 Installation and commissioning

### 6.2.3 Commissioning phase

#### 6.2.3.1 General

*Add to start of fourth paragraph*

Doors of BESS equipment shall be lockable.

***Justification***

*This is a safety requirement to prevent unauthorised access to BESS equipment.*

*Add new clause*

# 7 BESS Safety

## 7.1

The safety requirements for the BESS shall be in accordance with IEC TS 62933-5-2.

***Justification***

*The BESS poses a potential risk of fire and explosion, especially with lithium-ion batteries. Therefore, it is crucial to comply with the safety requirements of IEC TS 62933-5-2 to mitigate the associated safety risks with battery energy storage.*

## 7.2

Caution, danger, warning labels and safety markings of the BESS shall display information in English and, if specified, in an additional language.

***Justification***

*Identifying cautions and warnings in the local language is important for the safety of personnel working around the equipment.*

## 7.3

Warning labels shall be provided on access doors of compartments containing external AC and DC voltage sources.

***Justification***

*This requirement ensures that warning labels are clearly visible to personnel during maintenance activities, alerting them to the presence of energized terminals or circuit parts supplied from external sources. These labels help reduce the risk of electrical shock to personnel.*

## 7.4

The warning labels for the BESS shall indicate the presence of lithium-ion batteries.

***Justification***

*Caution is necessary when working with lithium-ion batteries as they are sensitive to charging characteristics and may explode, ignite or cause a fire if misused or mishandled.*

**7.5**

The nameplate of the BESS container or battery cabinet shall include the manufacturer's name, purchase order reference, item serial number, item model number, technical parameters, and the month and year of manufacture.

***Justification***

*The nameplate contains crucial information necessary for identifying, operating and ensuring the safety of equipment or assemblies.*

**7.6**

The BESS shall have an integrated battery management system (BMS) to continuously monitor, control and protect the battery for the functional safety of the specific battery type (e.g. lithium-ion).

***Justification***

*The battery management system ensures that key parameters of the battery such as voltage, current and temperature are maintained within their operational limits for proper performance and safety of the battery.*

**7.7**

The acoustic noise level, measured at a distance of 1 m from the container and any equipment placed outside the container in any direction, shall not exceed the specified limit.

***Justification***

*This requirement ensures compliance with occupational and environmental safety to prevent noise pollution.*

**7.8**

The design of the BESS shall include measures (e.g. insulation, segregation, fast-acting protective devices) to mitigate arc flash incident energy hazards and electric shocks.

***Justification***

*Electrical hazards such as arc flashes and electric shocks pose serious risks to individuals working with or near electrical systems. Proper safety measures protect personnel by reducing exposure to high-energy discharges and preventing accidental contact with live parts.*

**7.9**

BESS arc flash calculations and hazard assessment shall be conducted in accordance with IEEE 1584 and NFPA 70E.

***Justification***

*This requirement ensures the safety of personnel and equipment. Arc flash calculations and hazard assessment help reducing and managing risks.*

*Add new clause*

# 8 Accumulation subsystem (secondary batteries)

## 8.1 Battery

Secondary lithium cells and batteries shall comply with the requirements of the standards listed in Table 9.

***Justification***

*The standards in Table 9 contain the requirements for performance, safety, shipping, transportation and fire safety testing related to propagating thermal runaway within battery systems.*

*Add new Table 9*

**Table 9 – Compliance requirements**

| Requirement | Applicable standards |
|---|---|
| Marking, designation and performance | IEC 62620 |
| Safety | IEC 62619 and IEC 63056 |
| Safety during shipping and transportation | IEC 62281, UN 38.3 and UN 3536 |
| Test method for evaluating thermal runway fire propagation in battery systems | UL 9540A |

***Justification***

*These standards contain the requirements for performance, safety, shipping, transportation and fire safety testing related to propagating thermal runaway within battery systems.*

## 8.2 Battery module

### 8.2.1

The battery module design shall allow access for maintenance and replacement.

***Justification***

*This requirement ensures that the battery module design includes the necessary provisions for accessibility.*

### 8.2.2

A cell failure or thermal runaway within a module shall comply with one of the following requirements:

– not propagate and cascade to other cells of the module;

– not propagate and cascade to the neighbouring module where the total energy of the cells that propagate within the module is limited to 11 kWh.

***Justification***

*This requirement ensures that necessary mitigation measures are integrated into the module design to prevent thermal runaway propagation.*

#### 8.2.3

If the battery module is cooled by a liquid, the cooling system shall include a means to detect leakage of the cooling medium.

***Justification***

*The cooling medium leak can lead to a hazardous situation. Leakage detection notifies maintenance personnel for appropriate action.*

### 8.3 BESS container

### 8.3.1 Common requirements to non-walk-in and walk-in type container

#### 8.3.1.1

The container design and fabrication shall comply with the requirements of ISO 1496-1 and the specified local codes or regulatory standards.

***Justification***

*Compliance with the specified standards is essential to ensure container structural design integrity and safety.*

#### 8.3.1.2

The container shall be fabricated using non-combustible material.

***Justification***

*Containers constructed from non-combustible materials reduce the risk of fire hazards associated with batteries (e.g. lithium-ion) used in the BESS.*

#### 8.3.1.3

The floor shall be seal welded.

***Justification***

*Seal welding helps to withstand container pressure and maintain the required ingress protection.*

#### 8.3.1.4

The floor finish shall have a non-skid epoxy surface.

***Justification***

*Non-skid epoxy surface reduces the risk of slip hazards and accidents.*

#### 8.3.1.5

The floor shall be reinforced to withstand the load and stress of the installed electrical equipment.

***Justification***

*Reinforcement provides mechanical strength and keeps the installation firm and secure.*

#### 8.3.1.6

Container openings and penetrations created for external electrical and mechanical connections (e.g. conduit sleeves, transit frames, pipes) shall be provided with a prefabricated solution.

***Justification***

*Prefabricated solutions reduce the need for on-site construction or modifications.*

#### 8.3.1.7

Joints around openings and penetrations shall be sealed using fire-resistant material.

***Justification***

*Sealing helps to withstand container pressure, maintain the required fire resistance rating and ingress protection.*

#### 8.3.1.8

The ingress protection design of the container shall be in accordance with the specified site location, environmental conditions and special conditions.

***Justification***

*This requirement ensures protection against the intrusion of objects, water and dust, or accidental contact.*

#### 8.3.1.9

The container shall have a provision to release the excess pressure in the event of a deflagration.

***Justification***

*A gas release from a battery can elevate the container pressure, and releasing the excess pressure is crucial for maintaining safety.*

#### 8.3.1.10

The container shall be equipped with a thermal management system.

***Justification***

*It is essential to maintain the required climatic conditions within the container. Lithium-ion batteries, among others, are highly sensitive to temperature and require specific temperature ranges for their safe operation and optimal performance.*

#### 8.3.1.11

The container shall be equipped with a fire detection system.

***Justification***

*The fire detection system promptly identifies and addresses any potential fire hazards. This early detection helps mitigate risks and protect personnel.*

#### 8.3.1.12

The container shall be equipped with an off-gas detection system.

***Justification***

*The off-gas detection system detects the presence of toxic and explosive gases that can occur during battery thermal runaway, alerting personnel to take appropriate safety measures.*

#### 8.3.1.13

The main electrical equipment housed inside the container shall be earthed at a minimum of two connection points.

***Justification***

*Equipment earthing protects personnel from electrical hazards that can occur due to leakage currents.*

#### 8.3.1.14

Earthing connections and terminations shall be made using compression-type termination accessories (e.g. compression lug, anti-loosening washer, bolt and nut).

***Justification***

*This requirement prohibits the use of mechanical type earthing bosses or studs which are prone to loosening or rotating on the stud, thereby compromising the required surface contact with the earth bar to achieve a low impedance earthing connection.*

#### 8.3.1.15

Non-current carrying metallic components and parts of the container shall be earthed.

***Justification***

*Earthing of metallic components and parts protects personnel from electrical hazards that can occur due to leakage currents.*

#### 8.3.1.16

The container shall have a provision for earthing to the local (main) earth grid at a minimum of two opposite connection points.

***Justification***

*Container earthing protects personnel from electrical hazards that can occur due to leakage currents.*

### 8.3.2 Specific requirements to walk-in type container

#### 8.3.2.1

Walk-in containers that are at least 6.09 m (20 ft) shall have two separate means of access and egress through hinged doors.

NOTE Walk-in containers that are less than 6.09 m (20 ft) long can have a single access and egress.

***Justification***

*This is a minimum safety requirement for any electrical facility having walk-in access. Two-way egress enhances safety in case of an emergency.*

**8.3.2.2**

The walk-in container shall have at least one door suitable for the installation and removal of equipment housed inside the container.

***Justification***

*This eliminates the need for additional access or openings to install or remove the equipment.*

**8.3.2.3**

Access and egress doors shall have inside panic hardware for emergency exit.

***Justification***

*Panic hardware provides a quick and easy means of egress during emergencies, enhancing safety.*

**8.3.2.4**

Door panic hardware shall override key locks.

***Justification***

*Panic hardware enables quick and easy emergency egress without interlocks, enhancing safety.*

**8.3.2.5**

The electrical equipment enclosures inside the container shall have a minimum internal degree of protection in accordance with Table 10.

***Justification***

*The degree of protection specifies the extent of protection provided by the enclosure against access to hazardous parts by personnel, against solid objects ingress and against water ingress.*

*Add new Table 10*

**Table 10 – Minimum internal degree of ingress protection for the container**

| Location | Minimum internal degree of ingress protection |
|---|---|
| Between panels or cabinet enclosures | IP 2X |
| Between compartments of each functional unit and other compartments | IP XXB |
| Fuse-links and associated fuse carriers | IP XXB |
| Air-insulated live parts inside enclosures or on the inside face of compartment doors that are accessible with the compartment door open | IP XXB |
| NOTE IPXXB is stipulated in accordance with IEC 60529 as distinct to the use of designation IP2X when the door is open and the danger is access to hazardous parts within. IPXXB provides finger "touch-safe" protection against contact with live parts and electric shock equivalent to IP2X. | |

***Justification***

*This requirement ensures that personnel are protected against accidental contact with hazardous parts or live components that are accessible with the compartment door open. The ingress requirement of IP2X ensures protection against openings ≥ 12,5 mm for objects and tools or protected against access by finger while performing internal maintenance. IPXXB is stipulated (as distinct to IP2X) as once the door is open, the compartment is no longer an enclosure. The degree of protection IPXXB is chosen when the danger is addressing access to hazardous parts only (direct contact) rather than protection of an enclosure against ingress of solid foreign objects combined with protection against access to hazardous parts. IPXXB is the equivalent of "touch-safe".*

**8.3.2.6**

The container interior normal, emergency and egress lighting shall comply with the requirements of the specified local codes or regulatory standards.

***Justification***

*This requirement ensures adequate lighting for personnel safety and visibility inside the container.*

**8.3.2.7**

The container shall be fitted with LED lighting.

***Justification***

*This requirement ensures adequate lighting for personnel safety and visibility inside the container.*

**8.3.2.8**

The container shall be provided with a minimum of one single phase and neutral, 3-pin receptacle.

***Justification***

*The receptacle provides power supply for handheld equipment used during maintenance or repair.*

## 8.4 Outdoor battery cabinet

**8.4.1**

The cabinet shall be a free-standing assembly.

***Justification***

*This requirement ensures that the cabinet is standalone without any additional support or attachment, making cabinet assembly or installation easier.*

**8.4.2**

The cabinet shall be fabricated using non-combustible material.

***Justification***

*Cabinets made of non-combustible material reduce the risk of fire hazards associated with batteries (e.g. lithium-ion) used in the BESS.*

### 8.4.3

Joints around the cabinet openings and penetrations created for external connections shall be sealed using fire-resistant material.

***Justification***

*Sealing helps to maintain the required fire resistance rating and ingress protection.*

### 8.4.4

The cabinet shall be provided with an integral thermal management system.

***Justification***

*This requirement ensures the required climatic conditions within the cabinet for the safe and optimal operation of the battery.*

### 8.4.5

The cabinet shall be provided with integral heat and smoke detectors.

***Justification***

*Heat detection senses a rapid rise in temperature as a result of combustion due to a fire and provides an alert. Smoke detection senses the presence of smoke, as a key indication of fire, and provides an alert.*

### 8.4.6

The cabinet shall be provided with integral off-gas detectors.

***Justification***

*The off-gas detectors are used to monitor and detect the presence of toxic and explosive gases that can occur during battery thermal runaway, alerting personnel to take appropriate safety measures.*

### 8.4.7

The cabinet shall have provision to release the excess pressure in the event of a deflagration.

***Justification***

*A gas release from a battery can elevate the cabinet pressure, and releasing the excess pressure is crucial for maintaining safety.*

### 8.4.8

The ingress protection design of the cabinet shall be in accordance with the specified site location, environmental conditions and special conditions.

***Justification***

*This requirement ensures protection against the intrusion of objects, water, dust or accidental contact.*

### 8.4.9

The cabinet shall have a minimum internal degree of ingress protection in accordance with Table 11.

***Justification***

*The degree of protection specifies the extent of protection provided by the enclosure against access to hazardous parts by personnel, against solid objects ingress and against water ingress.*

*Add new Table 11*

**Table 11 – Minimum internal degree of ingress protection for the outdoor battery cabinet**

| Location | Minimum internal degree of ingress protection |
|---|---|
| Between panels or cabinet enclosures | IP 2X |
| Between compartments of each functional unit and other compartments | IP XXB |
| Fuse-links and associated fuse carriers | IP XXB |
| Air-insulated live parts inside enclosures or on the inside face of compartment doors that are accessible with the compartment door open | IP XXB |
| NOTE IPXXB is stipulated in accordance with IEC 60529 as distinct to the use of designation IP2X when the door is open and the danger is access to hazardous parts within. IPXXB provides finger "touch-safe" protection against contact with live parts and electric shock equivalent to IP2X. | |

***Justification***

*This requirement ensures that personnel are protected against accidental contact with hazardous parts or live components that are accessible with the compartment door open. The ingress requirement of IP2X ensures the protection against openings ≥ 12,5 mm for objects and tools and against access by finger during internal maintenance. IPXXB is stipulated (as distinct to IP2X) as once the door is open, the compartment is no longer an enclosure. The degree of protection IPXXB is chosen when the danger addresses access to hazardous parts only (direct contact) rather than protection of an enclosure against ingress of solid foreign objects combined with protection against access to hazardous parts. IPXXB is the equivalent of "touch-safe".*

### 8.4.10

The non-current carrying metallic components and parts of the cabinet shall be earthed.

***Justification***

*Earthing of cabinet metallic components and parts protects personnel from electrical hazards that can arise due to leakage currents.*

### 8.4.11

Earthing connections and terminations shall be made using compression-type termination accessories (e.g. compression lug, anti-loosening washer, bolt and nut).

***Justification***

*This requirement prohibits the use of mechanical type earthing bosses or studs which are prone to loosening or rotating on the stud, thereby compromising the required surface contact with the earth bar to achieve a low impedance earthing connection.*

### 8.4.12

Hinged doors and panels with powered devices shall be bonded with a flexible copper conductor, connecting the devices to the cabinet earth bar or metallic structure.

***Justification***

*This requirement ensures that the personnel is protected from electrical hazards that can occur due to leakage currents.*

### 8.4.13

If the BESS is skid mounted, main electrical equipment including the battery cabinet shall be earthed to the skid at a minimum of two connection points.

***Justification***

*This requirement ensures earthing, protecting personnel from electrical hazards that can occur due to leakage currents.*

### 8.4.14

If the BESS is skid mounted, the skid shall have a provision for earthing to the local (main) earth grid at a minimum of two opposite connection points.

***Justification***

*This requirement protects personnel from electrical hazards that can occur due to leakage currents.*

*Add new clause*

## 9 Auxiliary subsystem

## 9.1 Fire and gas system

### 9.1.1

The fire and gas detection system shall comply with the requirements of NFPA 855 and the specified local codes or regulatory standards.

NOTE An integrated design approach is important for a fire and gas system when placing a battery inside a room. Liaising with the battery supplier is essential for gathering specific inputs regarding the fire and gas safety features incorporated into the battery system while designing the overall system requirements for the room.

***Justification***

*NFPA 855 and local codes or regulatory standards specify the requirements to mitigate risks associated with energy storage systems. This includes preventing fires, explosions and electrical hazards. Compliance with NFPA 855 and local regulatory standards ensures the safety of the BESS, personnel working around them and environment.*

### 9.1.2

The fire and gas detection system shall at least be provided with heat detectors, smoke detectors, battery off-gas detectors and local fire alarm panels.

***Justification***

*This requirement ensures that the minimum essential components of the fire and gas system are included in the design.*

**9.1.3**

The off-gas detection system shall initiate actions to mitigate the risks associated with a thermal runaway event.

***Justification***

*The off-gas detection system detects the presence of toxic and explosive gases. Initiating actions in response to off-gas detection is crucial for personnel safety, equipment protection and operational reliability.*

**9.1.4**

The fire and gas detection system shall be provided with an externally mounted high-visibility strobe light.

***Justification***

*Visual alarm alerts personnel promptly and effectively in case of fire and gas hazards.*

**9.1.5**

If specified, an integrated fire suppression system shall be provided.

***Justification***

*Fire suppression systems are integrated with fire detection systems that automatically activate the suppression mechanism upon detecting smoke, heat or flames.*

**9.1.6**

The fire and off-gas detectors shall be connected to a local fire alarm panel.

***Justification***

*Integrating fire and off-gas detectors with the local fire alarm panel ensure that any signs of fire or gas leaks are detected early. This allows for a swift response, which is crucial in preventing incidents from escalating.*

**9.1.7**

The local fire alarm panel and detectors shall be microprocessor-based with network communication capabilities for remote alarming and diagnostics.

***Justification***

*Microprocessor-based detectors and panels process complex algorithms to improve the accuracy of fire and gas detection, reducing false alarms and ensuring timely and precise responses. Network communication capabilities enable alarms and alerts to be sent remotely to operators, security teams and emergency services to ensure appropriate action.*

## 9.2 Thermal management system

### 9.2.1

The thermal management system shall comply with the requirements of NFPA 855 and the specified local codes or regulatory standards.

NOTE An integrated design approach is important for a thermal management system when placing a battery inside a room. Liaising with the battery supplier is essential for gathering specific inputs regarding cooling or thermal management features incorporated into the battery system while designing the overall system requirements for the room.

***Justification***

*Compliance with NFPA 855 and specified local codes or regulatory standards is essential for ensuring the safe and effective operation of the thermal management system within the BESS.*

### 9.2.2

The thermal management system shall maintain climatic conditions required by the battery design for the specified site location, the environmental conditions and special conditions.

***Justification***

*It is essential to maintain the required climatic conditions within the container. Lithium-ion batteries, among others, are highly sensitive to temperature and require specific temperature ranges for their safe operation and optimal performance.*

### 9.2.3

If an HVAC system is provided, it shall be supplied with air-conditioning units, electrical heaters, air handling and associated ductwork accessories required by the system design.

***Justification***

*It is essential to maintain the required climatic conditions within the container. Lithium-ion batteries, among others, are highly sensitive to temperature and require specific temperature ranges for their safe operation and optimal performance.*

### 9.2.4

If the HVAC system includes an air handling or ventilation system, the HVAC system shall be provided with the air intake and exhaust facilities required by the system design.

***Justification***

*Air intake and exhaust facilities are designed to prevent environmental conditions such as dust, debris, moisture and insects from ingress into the HVAC system.*

### 9.2.5

If outdoor HVAC equipment is supplied, it shall be suitable for the specified site location, environmental conditions and special conditions.

***Justification***

*Selecting outdoor HVAC equipment to suit specified site location and environmental conditions is essential for ensuring reliable performance, durability and efficiency.*

*Add new clause*

## 10 Transformers

### 10.1

If supplied, the isolation or coupling transformer upstream of the BESS (PCS) shall comply with the requirements of IOGP S-720.

***Justification***

*The IOGP S-720 set of specification documents specifies the requirements for compliance when an isolation or coupling transformer is supplied as part of the BESS.*

### 10.2

If supplied, the distribution transformer associated with the externally fed auxiliary power supply of the BESS shall comply with the requirements of IOGP S-720.

***Justification***

*The IOGP S-720 set of specification documents specifies the requirements for compliance when a distribution transformer is supplied as part of the BESS.*

*Add new clause*

## 11 High-voltage switchgear

If supplied, the high-voltage switchgear and associated devices upstream of the BESS (PCS) shall comply with the requirements of IOGP S-620.

***Justification***

*The IOGP S-620 set of specification documents specifies the requirements for compliance when a high-voltage switchgear is supplied as part of the BESS.*

*Add new clause*

## 12 Transport, storage and handling

### 12.1

Transport and anchoring hardware shall be installed to prevent damage due to tilt or inclination of shipping sections when manoeuvring during transportation and installation.

***Justification***

*Proper transport and anchoring hardware ensure that the equipment remains secure and stable during transportation. Securing the equipment with appropriate hardware prevents unexpected movements that can pose safety risks to personnel handling or installing the equipment.*

### 12.2

Transport and anchoring hardware shall be identified for removal post-installation.

***Justification***

*Identifying assemblies supplied in multiple transport units facilitates efficient reassembly, prevents misplacement, minimises errors, improves coordination and ensures completeness.*

**12.3**

Assemblies supplied in multiple transport units shall be identified to facilitate reassembly at site.

***Justification***

*Identifying assemblies supplied in multiple transport units facilitates efficient reassembly, prevents misplacement, minimizes errors, improves coordination and ensures completeness.*

**12.4**

If specified, the packaging shall have a means of electrical connection (e.g. receptacle, disconnect switch) for an external power supply to the internal space heaters of the equipment during storage.

***Justification***

*This requirement ensures that the internal conditions within the packaging during storage are kept free from condensation and related damages.*

**12.5**

The connection device for the external power supply to the internal space heaters shall be clearly labelled with the required electrical service information.

***Justification***

*This requirement ensures that anyone connecting or maintaining the power supply can quickly identify the correct electrical specifications and requirements. This requirement helps prevent mistakes that can lead to electrical hazards such as fire or electric shock.*

# Bibliography

*Add to Bibliography*

**The following documents are informatively cited in the text of this specification, IEC TS 62933-3-1, the PDS (IOGP S-753D) or the IRS (IOGP S-753L).**

API Specification Q1, *Specification for Quality Management System Requirements for Manufacturing Organizations for the Petroleum and Natural Gas Industry*

API Specification Q2, *Specification for Quality Management System Requirements for Service Supply Organizations for the Petroleum and Natural Gas Industries*

AS 5139, *Electrical installations - Safety of battery systems for use with power conversion equipment*

DNV GL Handbook for Maritime and Offshore Battery Systems, *Report No.: 2016-1056, Revision: V1.0 Document No.: 15DJV2L-2*

DNV GL Rules for classification, Part 6 Chapter 2, *Part 6 Additional class notations Chapter 2 Propulsion, power generation and auxiliary systems*

DNV-RP-0043, *Safety, operation and performance of grid-connected energy storage systems*

IEC 60721-2-6, *Classification of environmental conditions – Part 2: Environmental conditions appearing in nature – Earthquake vibration and shock*

IEC 60812, *Failure modes and effects analysis (FMEA and FMECA)*

IEC 61025, *Fault tree analysis (FTA)*

IEC 61508, *Functional safety of electrical/electronic/programmable electronic safety-related systems*

IEC 62402 , *Obsolescence management*

IEEE 802.3, *IEEE Standard for Ethernet*

ISO 3166-1, *Codes for the representation of names of countries and their subdivisions — Part 1: Country code*

ISO 9001, *Quality management systems — Requirements*

ISO 10005, *Quality management — Guidelines for quality plans*

ISO 11228 (all parts), *Ergonomics — Manual handling*

ISO 12944-2, *Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 2: Classification of environments*

ISO/IEC Directives, Part 2, *Principles and rules for the structure and drafting of ISO and IEC documents*

NFPA 68, *Standard on Explosion Protection by Deflagration Venting*

UL 9540, *STANDARD FOR SAFETY Energy Storage Systems and Equipment*

**Registered Office**
City Tower
Level 14
40 Basinghall Street
London EC2V 5DE
United Kingdom

T +44 (0)20 3763 9700
reception@iogp.org

**Brussels Office**
Avenue de Tervuren 188A
B-1150 Brussels
Belgium

T +32 (0)2 790 7762
reception-europe@iogp.org

**Houston Office**
15377 Memorial Drive
Suite 250
Houston, TX 77079
USA

T +1 (713) 261 0411
reception-americas@iogp.org

www.iogp.org