International Association of Oil & Gas Producers

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December 2019

Supplementary Specification to IEC 62040-3 AC Uninterruptible Power Systems (UPS)

JIP33 JOINT INDUSTRY PROGRAMME

Revision history

VERSION	DATE	PURPOSE
0.1	December 2019	Issued for Public review

Acknowledgements

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

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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 for projects 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 approved specification, building on recognized industry and/or 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, facilitating improved standardization of major projects across the globe. 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 2014).

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List of Tables

Introduction

The purpose of this specification is to define a minimum common set of specification requirements for the procurement of AC Uninterruptible Power Systems (UPS) in accordance with IEC 62040-3, Edition 2.0, 2011, Uninterruptible power systems (UPS) - Part 3: Method of specifying the performance and test requirements, for application in the petroleum and natural gas industries.

This JIP33 standardized procurement specification follows a common document structure comprising the four documents as shown below, which together with the purchase order define the overall technical specification for procurement.

JIP33 Specification for Procurement Documents
Supplementary Technical Specification

It is required to use all of these documents in conjunction with each other when applying this specification, as follows:

S-701: Supplementary Specification to IEC 62040-3 for AC Uninterruptible Power Systems (UPS)

This specification is written as an overlay to IEC 62040-3, following the clause structure of the parent standard, to assist in cross-referencing the requirements. Where clauses from the parent standard IEC 62040-3 are not covered in this specification, there are no supplementary requirements or modifications to the respective clause. The terminology used within this specification follows that of the parent standard and otherwise is in accordance with ISO/IEC Directives, Part 2.

Modifications to the parent standard defined in this specification are identified as *Add* (add to clause or add new clause), *Replace* (part of or entire clause) or *Delete*.

S-701D: Data Sheet for AC UPS

This document provides project specific requirements where this specification requires the purchaser to define an application specific requirement. It also includes information required by the purchaser for technical evaluation. Additional purchaser supplied documents are also listed in the data sheet, to define scope and technical requirements for enquiry and purchase of the equipment.

S-701L: Information Requirements for AC UPS

This document defines the information requirements, including format, timing and purpose, for information to be provided by the vendor. It also defines the specific conditions which must be met for conditional information requirements to become mandatory. The information requirements listed in the IRS have references to the source of the requirement.

S-701Q: Quality Requirements for AC UPS

This document includes a conformity assessment system (CAS) which specifies standardized user interventions against quality management activities at four different levels. The applicable CAS level is specified by the purchaser in the data sheet.

The data sheet and IRS are published as editable documents for the purchaser to specify application specific requirements. The supplementary specification and QRS are fixed documents.

Unless defined otherwise in the purchase order, the order of precedence (highest authority listed first) of the documents shall be:

a) regulatory requirements;

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

c) purchaser defined requirements (data sheet, IRS, QRS);

d) this specification;

e) the parent standard.

1 Scope

Add to second paragraph

This specification also specifies the UPS manufacturing requirements of the various assemblies such as rectifiers, inverters and static switches and functional requirements related to measurement, protection and alarms. Packing, handling, preservation and storage requirements are also defined.

2 Normative References

Add to clause

IEC 60076-11	Power transformers – 11: Dry-type transformers
IEC 60085	Electrical insulation – Thermal evaluation and designation
IEC 60092 (all parts)	Electrical installations in ships
IEC 60146-1-3	Semiconductor convertors requirements and line commutated convertors Part 1-3: Transformers and reactors
IEC 60529	Degrees of Protection Provided by Enclosures (IP Code)
IEC 60947-2	Low-voltage switchgear and controlgear – Part 2: Circuit-breakers
IEC 60947-4-1	Low-voltage switchgear and controlgear – Part 4-1: Contactors and motor-starters – Electromechanical contactors and motor-starters
IEC 61000-2-4: 2002	Electromagnetic compatibility (EMC) – 2-4: – Compatibility levels in industrial for low-frequency conducted disturbances
IEC 61892-1	Mobile and fixed offshore units – Electrical installations – Part 1: General requirements and conditions
IEC 61892 (all parts)	Mobile and fixed offshore units – Electrical installations
IEC 62040-1:2017	Uninterruptible power systems (UPS) – Part 1: Safety requirements
IEC 62040-3: 2011	Uninterruptible power systems (UPS) – Part 3: Method of specifying the performance and test requirements
IEC 62040 (all parts)	Uninterruptible power systems (UPS)
IEEE C57.110	Recommended Practice for Establishing Liquid Immersed and Dry-Type Power and Distribution Transformer Capability when Supplying Nonsinusoidal Load Currents

Replace clause heading with

3 Terms and definitions, acronyms and abbreviations

Add new subclause

3.6 Acronyms and abbreviations

HMI	human machine interface
LAN	local area network
MCB	miniature circuit breaker
MCCB	moulded case circuit breaker
MTTR	mean time to repair

PCB printed circuit board

THD total harmonic distortion

VPI vacuum pressure impregnation

4 Environmental conditions

4.2 Normal conditions

4.2.1 Operation

4.2.1.1 Ambient temperature and relative humidity

Replace first paragraph with

UPS equipment conforming to this standard shall perform as rated when operating within the following ambient ranges:

– temperature 0 ºC to +50 ºC;

– relative humidity of 10 % to 90 %.

5 Electrical conditions, performance and declared values

5.1 General

5.1.2 Markings and instructions

Replace "Subclause 4.7, Markings and instructions, of IEC 62040-1" with "Clause 6, Information and marking requirements, of IEC 62040-1:2017"

Add to subclause

In addition to the information required on the nameplate in accordance with IEC 62040-1:2017, 6.2, the item serial number, and month and year of manufacture, shall be included.

Add to subclause

In addition to English as the default language, caution, danger and warning labels shall have information displayed in the local language, as defined in the data sheet.

5.1.3 Safety

Add to subclause

The sound pressure level shall not exceed 70 dBA at any load condition, from no load to the rated load of the UPS, when measured at a distance of one metre from the UPS, in any direction.

5.1.4 Electromagnetic compatibility

Replace subclause with

The UPS shall conform to the electromagnetic emission and immunity levels detailed in IEC 62040-2, for the category level specified in the data sheet.

Add new subclause

5.1.5 AC UPS Design basis

The operational life of the UPS and its components at rated load shall be in accordance with Table 5.

Add new table

Table 5 – UPS operational life

Components	Minimum operation life (years)
Rectifier unit, inverter unit and static switch unit	20
Cooling fans	5
DC Capacitors	10

Add new subclause

5.1.6 Availability

Irrespective of its configuration, the UPS shall achieve reliability integrity level 4, in accordance with Table K.1.

Add new subclause heading

5.1.7 Overload capability

Add new subclause

5.1.7.1

The UPS shall be designed to operate at 125 % of rated load for ten minutes.

Add new subclause

5.1.7.2

The UPS shall be designed to operate at 150 % of rated load for one minute.

Add new subclause

5.1.7.3

The UPS shall be designed to deliver a short circuit current of 200 % of rated current for 0.1 second without transfer to bypass.

5.2 UPS input specification

5.2.1 Conditions for normal mode operation

Replace list item d) with

d) frequency variation ± 5 % of rated frequency;

Add "for public low voltage networks" at the beginning of list item f)

Add new list item h) after NOTE 4

h) for industrial networks, total harmonic distortion (THD) of voltage ≤ 10 % as per class 3 compatibility levels, with a maximum level of individual harmonic voltages in accordance with IEC 61000-2-4, Table 2, Table 3 and Table 4. Refer to IEC 61892-1 for offshore installations.

5.3 UPS output specification

5.3.4 Performance classification

Add to subclause

The UPS shall comply with the requirement of the performance-based classification code defined in the data sheet.

5.6 Communication circuits

Add to subclause

The UPS shall be provided with communication hardware compliant with the interface media and protocol specified in the data sheet.

Add to subclause

Any cable distance limitations for the specified protocol shall be defined.

Add to subclause

A list of mapping addresses of the data communication and signalling circuits intended to be exchanged with the information technology equipment (e.g. SCADA system, local area networks (LAN) or telecommunication networks) shall be provided.

Add new clause

7 Constructional requirements

7.1 General

7.1.1

The UPS shall be designed to minimize the mean time to repair (MTTR) by using self-diagnostics, comprehensive alarm descriptions and easy accessibility to components and circuits.

7.1.2

Components, printed circuit boards (PCBs), connectors and terminals and the associated locations of these items shall be identified with labels in accordance with IEC 62040-1.

7.1.3

The spare parts list shall include limited life components that require periodic replacement with the required replacement frequency.

7.1.4

An obsolescence management plan in accordance with an industry recognized system (e.g. IEC 62402) shall be provided for all UPS assembly components.

7.1.5

The documentation provided with the equipment shall include an installation manual, maintenance manual, operational manual and manufacturing record book.

7.2 Enclosure

7.2.1

The UPS shall be installed in an enclosure made of one or more floor mounted, free-standing, self-supporting steel cabinets or wall mounted cabinets as specified in the data sheet.

7.2.2

The enclosure shall have a minimum degree of protection of IP31 in accordance with IEC 60529.

7.2.3

The battery bank shall be integrated in the UPS cabinets or placed separately, as specified in the data sheet.

7.2.4

Undrilled removable gland plates of the cabinet shall be used for cable entry.

7.2.5

Gland plates used for cable entry shall be non-magnetic for single core cables.

7.3 Accessibility and maintenance safety

7.3.1

The location and grouping of components and auxiliary equipment shall permit identification and access for operational, maintenance and repair purposes, without interruption of supply to the load.

7.3.2

Protection devices that cause the UPS to trip shall not be mounted on the door.

7.3.3

Live components and parts which are accessible when the compartment door is opened, shall be protected by enclosures, barriers or shrouds to a degree of protection of at least IP2X.

7.3.4

A separate compartment, with a dedicated door shall be provided to house the lockable maintenance bypass switch and the bypass isolation transformer.

7.3.5

Terminals shall be provided in the maintenance bypass compartment for all wiring to and from the rectifier/inverter compartment, to enable complete isolation of the rectifier/inverter compartment.

7.3.6

Document holders shall be provided inside the enclosure doors, if specified in the data sheet.

7.4 Components

7.4.1

Main circuit switches, miniature circuit breakers (MCBs) and moulded case circuit breakers (MCCBs) shall have padlocking facilities.

7.4.2

Mechanical type main circuit switches shall be in accordance with IEC 60947-3.

7.4.3

Main circuit switches shall comply with utilization category AC22 and DC22 for AC and DC switches respectively, in accordance with IEC 60947-3.

7.4.4

Main circuit switches shall be of independent, manually operated and air-break type for continuous duty.

7.4.5

MCBs and MCCBs shall comply with IEC 60947-2.

7.4.6

Contactors shall be rated for uninterrupted duty in accordance with IEC 60947-4-1.

7.4.7

Contactors shall comply with utilization category of AC-1 and DC-1 for AC and DC contactors respectively in accordance with IEC 60947-4-1.

7.4.8

Transformers and reactors used for input and output isolation shall be air-cooled type in accordance with IEC 60146-1-3.

7.4.9

The UPS shall have a mimic diagram showing the topology and status indication, located on the front panel.

7.5 Internal wiring & terminals

7.5.1

Insulation material of internal wires shall be zero halogen, flame retardant, non-toxic and have a low smoke index.

7.5.2

Wiring shall be labelled with alphanumeric characters on insulated ferrules, located adjacent to the terminals.

7.5.3

Wiring for external connections shall be routed to individual terminals on an accessible terminal block.

7.5.4

Space and termination arrangements shall be provided for cables to be terminated without difficulty.

7.6 Earthing

7.6.1

A main earth rail shall be provided in close proximity to the external cable glands.

7.6.2

The cubicle shall be bonded to the main earth rail in accordance with IEC 62040-1.

7.6.3

All exposed, non-current carrying parts of the UPS inclusive of the enclosure, components and doors shall be earthed.

7.6.4

The inverter output and bypass transformer neutrals shall be connected to the main earth rail within the enclosure.

7.6.5

The gland plates shall be earthed to the main earth rail.

7.7 Ventilation

7.7.1

The cooling system design of the UPS shall adopt convection cooling or fan assisted forced air cooling.

7.7.2

Cooling fans shall be installed with a redundant (N+1) configuration.

7.7.3

In the event of a cooling fan being out of service, the UPS shall continue to deliver the rated load without switching to bypass mode.

7.7.4

In the event of a cooling fan being out of service, the UPS shall continue to deliver the rated load without the maximum continuous temperature of components exceeding the designed limits.

7.7.5

Fans shall be equipped with monitoring facilities to provide an alarm in the event of a fan failure.

7.7.6

The UPS shall not incorporate cooling air filters that need periodic cleaning or replacement.

7.8 Additional requirements for offshore (fixed and floating) installations

7.8.1

For offshore installations, the UPS and associated equipment and components shall be type designed, tested and certified in accordance with general requirements of IEC 62040 (all parts) and:

– specific requirements of IEC 61892 for mobile and fixed units; or
– specific requirements of IEC 60092 for electrical installations in ships.

7.8.2

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

7.9 Battery isolator box

7.9.1

The battery isolator box shall be a lockable enclosure made of sheet steel for wall, frame or pedestal installation.

7.9.2

The battery isolator box design shall depend on its location of installation and in accordance with the environmental conditions specified in the data sheet.

7.9.3

The battery isolator box shall have a minimum degree of protection of IP31 (with closed door) in accordance with IEC 60529.

7.9.4

The choice of enclosure of battery isolator box shall depend on the area classification assigned to its location of installation, as specified in the data sheet.

7.9.5

The battery isolator box enclosure shall have undrilled, removable gland plates.

7.9.6

The battery isolator shall be a switch fuse unit or MCCB.

7.9.7

The battery isolator shall be selected for the rated DC voltage and DC current rating.

7.9.8

The auxiliary supply for the MCCB control element (under voltage coil or shunt trip coil) shall be compatible with the UPS control supply.

7.9.9

The battery isolator shall have potential free contacts hard wired to the terminals, if specified in the data sheet.

Add new clause

8 Functional requirements

8.1 Rectifier

8.1.1 Rectifier components

8.1.1.1

The rectifier unit of the UPS shall have a mains input transformer to galvanically isolate the AC and DC sections.

8.1.1.2

The rectifier unit and components on the input side of the UPS shall supply the rated output while simultaneously boost charging the battery.

8.1.1.3

If specified in the data sheet, the active front end rectifier shall carry out an online battery capacity discharge test by feeding the power back to the power source.

8.1.1.4

The UPS shall have an automatic or manual feature to perform on-line battery capacity testing by discharging of the battery into the load.

8.1.1.5

If an on-line battery monitoring system is specified, the UPS shall integrate with the on-line battery monitoring system to continuously assess individual cell condition of the battery bank.

8.1.1.6

If an on-line battery monitoring system is specified, the UPS shall generate an alarm when the battery parameters exceed the set limits.

8.1.1.7

The total AC ripple at the battery terminals including that generated by the inverter and load, shall not exceed the tolerance limits given by battery manufacturer.

8.1.2 Operation

8.1.2.1

The rectifier unit shall operate according to the constant voltage, current limiting and soft start philosophy.

8.1.2.2

The rectifier unit shall restart automatically upon restoration of the mains power supply following a power interruption.

8.1.2.3

The rectifier unit shall be rated to recharge the battery to a nominal 90 % within 10 hours and 100 % within 24 hours following a discharge at rated load for the specified autonomy time, simultaneously meeting the inverter input requirements while the inverter is delivering its rated output.

8.1.2.4

The rectifier shall perform battery charging at float charge or boost charge and equalization charge, depending on the type of battery selected for energy storage.

8.1.2.5

The float or boost charge voltage shall be adjustable while the UPS is in operation.

8.1.2.6

Upon restoration of mains power supply following a power interruption, the rectifier unit shall initiate the boost-charge cycle automatically, depending upon type of battery selected for energy storage.

8.1.2.7

The duration of the boost charging shall be controlled by:

– automatic timer; or
– feedback of the battery current and voltage indicating that adequate battery charge has been achieved.

8.1.2.8

The rectifier unit shall revert automatically to float charging upon completion of the boost charging.

8.1.2.9

The rectifier unit shall have provision for terminating the boost charging in case of failure of the ventilation system in the battery room.

8.1.2.10

The rectifier unit shall have provision for temperature compensation for VRLA batteries, to control the battery charging voltage with an accuracy of ±1 %.

8.2 Inverter

8.2.1

The inverter unit shall initiate the current limiting feature for a short circuit at the output of the UPS.

8.2.2

The inverter design shall permit 150 % of its rated output to be delivered for one minute.

8.2.3

In the event of a fault on the outgoing circuit of the UPS distribution, the inverter shall operate the downstream protection:

– within 20 milliseconds;
– without damage; and
– without transfer to the bypass supply.

8.2.4

With the DC input voltage varying between battery high rate charge and end of discharge voltage, the inverter shall keep the output voltage and frequency within the operational tolerances.

8.2.5

The output voltage regulation shall be maintained within ±1 % of rated output voltage while operating independently of the bypass.

8.2.6

The waveform of the output voltage of the UPS shall be sinusoidal with a relative harmonic content not exceeding 5 % for linear and non-linear loads.

8.3 Static and maintenance bypass

8.3.1

The switching devices of the static bypass unit at the inverter output and the bypass path, shall be sized for a continuous current rating equivalent to the rated output of the UPS.

8.3.2

The static bypass circuit shall have a short time current rating of:

– 1000 % of the UPS current rating for 50 milliseconds; and
– 150 % of the UPS current rating for 60 seconds.

8.3.3

The protection device used in the static bypass circuit shall permit short time rated currents.

8.3.4

The protection device used in the static bypass circuit shall prevent damage to the static switch if the overcurrent persists for longer than the specified times.

8.3.5

The static bypass circuit shall not have fast acting fuses.

8.3.6

The UPS shall be provided with the facility to initiate a manual transfer from the inverter supply to the bypass supply and vice-versa.

8.3.7

The load transfer on manual command shall be executed only if:

– bypass voltage is within ±10 % of the rated UPS output voltage;
– bypass frequency is within ±3 % of rated frequency; and
– inverter output and bypass voltages are synchronized.

8.3.8

An overall maintenance bypass shall be provided across the UPS for servicing purposes.

8.4 Transformers (input, bypass and output)

8.4.1

In accordance with IEC 60076-11, transformers shall be:

– copper wire wound;
– with a high-grade silicon steel core; and
– air cooled type design.

8.4.2

The transformer design shall use winding insulation material of thermal class H in accordance with IEC 60085.

8.4.3

An epoxy based insulating varnish shall be applied with a vacuum pressure impregnation (VPI) system in accordance with IEC 60076-11.

8.4.4

The transformers shall be rated for minimum of K-4 (K factor) in accordance with IEEE C57.110.

8.5 Measurement, protection and control

8.5.1 General

The UPS shall be equipped with necessary equipment to:

– provide the required measurements;
– generate required indications and alarms; and
– initiate protection to mitigate the consequences of internal/external faults and component and control circuit malfunctions.

8.5.2 Indication and display

8.5.2.1

The UPS shall have an interactive operator interface using a microprocessor based human machine interface (HMI) mounted on the front door to:

– indicate UPS operation status;
– accept input commands;
– monitor operating parameters; and
– display fault diagnostics.

8.5.2.2

The following statuses shall be displayed on the HMI or by LED signalling lights located on the UPS front panel:

– AC input power supply healthy;
– bypass power supply healthy;
– rectifier ON;
– inverter ON;
– battery breaker ON;
– load on inverter;

– load on bypass;

– inverter/static bypass synchronized.

8.5.2.3

This HMI display shall have a mimic diagram representing the power flow path, as a single line diagram of the UPS and status of components.

8.5.2.4

Failure of the HMI display or indicating equipment on the UPS shall not compromise the operation of UPS.

8.5.2.5

The HMI shall have password protected multiple levels of access:

– for viewing (by the operator);

– settings (by trained operating personnel); and

– service (by the manufacturer's personnel).

8.5.2.6

The HMI shall have storage for retaining:

– historical data;

– event/alarm logging with time, date stamping; and

– historical trending for assisting troubleshooting and failure analysis.

8.5.2.7

The HMI shall have a communication feature for remote monitoring and control via a serial interface.

8.5.2.8

If specified in the data sheet, necessary software/hardware shall be provided for monitoring, review and control of settings on the UPS, on- or off-line.

8.5.3 Measurements

The following measurement data shall be displayed on the HMI or by discrete measuring or display instruments located on the front panel of the UPS:

– UPS input voltage per phase;

– UPS input current per phase;

– DC voltage;

– battery current (+/-);

– UPS output voltage per phase;

– PS output current per phase;

– UPS output frequency;

– remaining autonomy time of the battery (percentage or minutes).

8.5.4 Alarms and protection

8.5.4.1

The alarm and protection functions shall be identified on the operator interface HMI by indicators with a first failure feature.

8.5.4.2

Alarm and trip functions shall be provided in accordance with Table 6 as a minimum.

Add new table

Table 6 – Minimum alarm and trip functions

Trouble Description	Alarm	Rectifier Trip	Inverter Trip
AC input power supply - **undervoltage**	✓	Off [a b]	
Rectifier failure	✓	✓	
DC overvoltage	✓	✓	
DC undervoltage	✓		✓
Battery discharging	✓		
Battery breaker off / battery disconnected	✓		
Battery temperature high (VRLA batteries only)	✓		
Cooling fan failure	✓		
Inverter failure	✓		✓
Inverter overcurrent	✓		
Inverter Output voltage deviation	✓		✓
Inverter/bypass unsynchronized	✓		
Power module overtemperature	✓		✓

[a] In case the AC input power supply falls below allowable limits, the rectifier shall shut down.

[b] When the AC input power supply resumes and remains within allowable limits, the rectifier shall start automatically and no reset is required.

8.5.4.3

Alarms associated with trip functions shall be reset manually, locally or remotely, except for the AC input power supply alarm (see Table 6).

8.5.4.4

Alarms shall activate a common relay with two potential free contacts, one normally open and one normally closed, wired to a terminal block for connection to a remote common UPS alarm.

8.5.4.5

Alarms and changes in operation modes shall be time stamped and stored chronologically in a non-volatile memory of the HMI in a “first in – first out” rolling manner.

8.5.5 Controls

8.5.5.1

The timer settings and threshold limits of specific parameters shall be adjustable on-line without requiring the outage of the UPS.

8.5.5.2

The rectifier unit shall permit battery boost charge operation for vented batteries and valve regulated Nickel Cadmium (Ni Cd) batteries, in manual and automatic modes.

8.5.5.3

After batteries undergo a period of discharge, boost charging shall be automatically initiated and continue until the batteries are fully recharged.

8.5.5.4

The inverter unit shall control the output of the UPS to maintain synchronism with the bypass voltage during variations in mains frequency, up to the synchronization limits specified in the data sheet.

8.5.5.5

If variations in mains frequency exceed the allowable synchronization limits, the inverter shall revert to the internal frequency control.

8.5.5.6

The internal control supply of the UPS shall be available as long as any of the power sources to the UPS is present.

Add new clause

9 Packing, handling, preservation and storage

9.1

The UPS and associated equipment and components shall be packed to protect against damage during transportation.

9.2

The packing shall be suitable for storing the UPS in the environmental conditions, for the duration specified.

NOTE The choice of packing type and the requirement of particular protection depend on the characteristics of the equipment and material to be packed, its handling requirements and kind of transport (air, sea, truck, rail or container) chosen.

9.3

Additional storage and preservation requirements to be followed during storage of the UPS shall be provided.

9.4

Packing, handling and transportation methods shall be provided, if the purchaser is responsible for transportation of the UPS.

9.5

Special handling instructions, including "fragile", "keep dry", "this side up" and "sling here", accompanied by internationally recognized symbols, shall be applied to the external packaging, where applicable.

9.6

A packing list, containing the following details as a minimum, shall be provided for each package:

– number of packages;
– type of package;
– item description;
– quantity of items
– net weight;
– gross weight; and
– package dimensions.

Bibliography

IEC 62402, *Obsolescence management*

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