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| Assets Planning and Delivery Group  Engineering |

DESIGN STANDARD DS 26-31

Type Specification for

**Type Specification for Line Interactive L.V. Uninterruptible Power Supply**

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**FOREWORD**

The intent of Design Standards is to specify requirements that assure effective design and delivery of fit for purpose Water Corporation infrastructure assets for best whole-of-life value with least risk to Corporation service standards and safety. Design standards are also intended to promote uniformity of approach by asset designers, drafters and constructors to the design, construction, commissioning and delivery of water infrastructure and to the compatibility of new infrastructure with existing like infrastructure.

Design Standards draw on the asset design, management and field operational experience gained and documented by the Corporation and by the water industry generally over time. They are intended for application by Corporation staff, designers, constructors and land developers to the planning, design, construction and commissioning of Corporation infrastructure including water services provided by land developers for takeover by the Corporation.

Nothing in this Design Standard diminishes the responsibility of designers and constructors for applying the requirements of the Western Australia's Work Health and Safety (General) Regulations 2022 to the delivery of Corporation assets. Information on these statutory requirements may be viewed at the following web site location:

[Overview of Western Australia’s Work Health and Safety (General) Regulations 2022 (dmirs.wa.gov.au)](https://www.dmirs.wa.gov.au/sites/default/files/atoms/files/overview_general_regulations.pdf)

Enquiries relating to the technical content of a Design Standard should be directed to the Senior Principal Engineer, Electrical Section, Engineering. Future Design Standard changes, if any, will be issued to registered Design Standard users as and when published.

**Head of Engineering**

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This Standard is intended solely for application to the acquisition of water infrastructure in Operating Areas in Western Australia where the Water Corporation has been licensed to provide water services subject to the terms and conditions of its Operating License.

This Standard is provided for use only by a suitably qualified professional design engineer who shall apply the skill, knowledge and experience necessary to understand the risks involved and undertake all infrastructure design and installation specification preparation work.

Any interpretation of anything in this Standard that deviates from the requirements specified in the project design drawings and construction specifications shall be resolved by reference to and determination by the design engineer.

The Corporation accepts no liability for any loss or damage that arises from anything in the Standard including loss or damage that may arise due to the errors and omissions of any person.

REVISION STATUS

The revision status of this standard is shown section by section below.

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# General

## Scope

This Specification covers the requirements for the design, manufacture, assembly, factory testing, delivery and commissioning for a line interactive Low Voltage uninterruptible power supply requiring a single phase input supply and having a single phase output.

This Specification covers indoor wall or floor mounted uninterruptible power supplies with a rated output not greater than 5 kVA and outdoor pole or pad mounted uninterruptible power supplies rated not greater than 3 kVA.

## Definition

1. For the purposes of this Specification, the term “UPS” shall be deemed to mean uninterruptible power supply.
2. For the purposes of this Specification, the term “battery service life” shall mean the time taken for the capacity of the battery under float charge operation to decline to 80% of its rated capacity.

## Contract Arrangement

This Specification may form part of the contract documents for the supply of the works described herein or may form part of the contract documents for the supply of an overall electrical installation, as specified in the Annexure.

## Project Specific Information

The uninterruptible power supply shall be in accordance with the requirements of this Specification and the requirements specified on either the attached Annexure or on the attached Principal's drawings. Reference made in this Specification to the Annexure shall be taken to mean the Annexure or the Principal's drawings whichever is provided.

# Site

The location of and access to the site for the installation of the uninterruptible power supply shall be as shown in the Annexure.

# Standards

Unless specified otherwise, the workmanship, equipment and materials provided in accordance with this Specification shall comply in design, construction, rating and performance with the current relevant Australian or International Standards and Codes.

In particular the uninterruptible power supply shall comply with the requirements of AS 62040.1.1 (which makes reference to IEC 60950.1) and its performance shall have been tested successfully in accordance with AS 62040.2.

Specific reference is made within this Specification to the following Australian and International Standards:

AS/NZS 60950.1 (IEC 60950.1) - Information technology equipment - General requirements

AS 62040.1.1 (IEC 62040.1.1) - Uninterruptible power systems (UPS) - General and safety requirements for UPS used in operator access areas

AS 62040.2 (IEC 62040.2) - Uninterruptible power systems (UPS) - Electromagnetic compatibility (EMC) requirements

AS 62040.3 (IEC 62040.3) - Uninterruptible power systems (UPS) - Method of specifying the performance and test requirements

AS 60269.4 Fuses - Low Voltage fuses - Supplementary requirements for fuse links for the protection of semiconductor devices

AS 60529 Degrees of protection provided by enclosures (IEC 60529)

IEC 60721.3.3 Classification of environmental conditions - Classification of groups of environmental parameters and their severities - Stationary use at weather protected locations

# Work by the Principal

The following work will be carried out by the Principal or by others under the direction of the Principal:

1. provision of building to house the UPS if the latter is specified in the Annexure for installation indoors,
2. mechanical installation of the UPS in accordance with the Contractor’s instructions,
3. installation of UPS input and output cabling in accordance with the Contractor’s instructions,
4. commissioning of UPS in accordance with the Contractor’s instructions,
5. provision of a UPS external bypass and isolate switch together with the remainder of the electrical installation including the supply and installation of the standby generating set if the latter is specified in the Annexure.

# Information to be Provided by the Contractor

The Contractor shall provide the following documentation in respect to the UPS within the listed number of days after receipt of the Principal’s order:

1. equipment general arrangement drawings 14 days
2. complete and detailed electrical connection diagrams  
   including terminal designations 14 days
3. details of any specialearthing connections and requirements 14 days
4. UPS mounting requirements 4 days
5. UPS addresses of all data listed clause 17 hereunder 28 days
6. technical data sheets 28 days
7. commissioning instructions 28 days
8. routine test certificates 28 days
9. comprehensive operating & maintenance manual 28 days

# Drawings

All drawings relating to electrical equipment provided by the Contractor shall be in accordance with the latest issue of the relevant Australian Standards and shall be available in electronic format.

Adequate contrast shall be maintained between drawing and background, and the clarity and quality of the drawings shall enable the Principal to microfilm the prints and to reproduce, by photographic processes, clear and legible A3 copies for records purposes.

The drawings shall provide, in the title block, the number and title of the Contract, as well as details to identify the drawing, its contents, revision status, and date of issue.

# Quality Assurance

Electrical equipment and software shall be designed, manufactured and tested under a Quality System certified by an Accredited Authority to be in accordance with AS/NZS ISO 9001 or an approved equivalent.

All software to be installed in equipment being provided under the scope of this Specification shall be developed by the equipment manufacturer and shall have been tested successfully in the manufacturer’s works before delivery in accordance with clause 19.

# Electrical Work

All electrical work shall be performed by appropriately qualified and experienced personnel each of whom shall have a current electrical worker’s license to perform such work.

# EMC Categories

If the UPS is specified in the Annexure to be installed on a site supplied electrically at High Voltage, the uninterruptible power supply shall comply with the EMC emission and immunity requirements of AS 62040.2 category C2 or C3 depending on current rating. Such equipment shall be suitable for installation in industrial and commercial environments.

If the UPS is specified in the Annexure to be installed on a site supplied electrically at Low Voltage, the uninterruptible power supply shall comply with the EMC emission and immunity requirements of AS 62040.2 category C1. Such equipment shall be suitable for installation in residential environments.

The UPS shall carry the CE mark certifying compliance with the requirements of IEC 62040.2.

The UPS shall be entitled to carry the Australian C-tick in respect to EMC emission.

# Installation Environments

## General

The UPS shall be suitable for installation in one of the following environments, as specified in the Annexure and detailed hereunder:

1. indoor control centre environment,
2. indoor environment other than a control centre,
3. outdoor environment.

## Control Centre Environments

If the UPS is specified in the Annexure to be installed in a manned control centre provided with temperature control, the UPS shall be suitable for installation in the following environmental conditions:

1. Maximum ambient air temperature: < 30oC.
2. Max. average ambient air temperature over a 24 hour period; < 25oC.
3. Minimum ambient air temperature: > minus 5oC.
4. Solar radiation: Negligible.
5. Altitude: < 1000 metres.
6. Weather: Fully protected against external wind and rain.
7. Dust pollution level: IEC 60721.3.3 class 3S2 - i.e. light - no special precautions to minimise the presence of dust, but not located in proximity to dust sources.
8. Chemically active substances: IEC 60721.3.3 class 3C1L i.e. no significant salt, smoke, or corrosive or flammable gases or vapours.
9. Max. average relative humidity: *<* 95% over 24 hour period, and
10. Max. average water vapour pressure: < 2.2 kPa over 24 hour period < 1.8 kPa over one month period.
11. Biological conditions: Negligible risk of biological attack
12. Mechanical vibration: IEC 60721.3.3 class 3M1 - i.e. insignificant vibration levels

## Indoor Environment other than Control Centre

If the UPS is specified in the Annexure to be installed in an indoors weather protected environment other than a manned control centre provided with temperature control, the UPS shall be suitable for installation in the following environmental conditions:

1. Maximum ambient air temperature:

(i) in the South West Region of Western Australia (including the Metropolitan Area) : < 45oC

(ii) outside the South West Region of Western Australia: < 50oC

1. Maximum average ambient air temperature over a 24 hour period;

(i) in the South West Region of Western Australia (including the Metropolitan Area) : < 30oC

(ii) outside the South West Region of Western Australia: < 35oC

1. Minimum ambient air temperature: > minus 5oC
2. Solar radiation: Negligible
3. Altitude: < 1000 metres
4. Weather: Fully protected against external wind and rain
5. Dust pollution level: IEC 60721.3.3 class 3S3 - i.e. medium - no special precautions to minimise the presence of dust, and with dust sources in the vicinity
6. Chemically active substances: IEC 60721.3.3 class 3C2 - i.e. medium- possible significant smoke - possible air borne salt if specified in the Annexure to be at a site within 20 km of the sea
7. Max. average relative humidity: *<* 95% over 24 hour period, and < 90 % over one month period
8. Max. average water vapour pressure: < 2.2 kPa over 24 hour period   
   < 1.8 kPa over one month period
9. Biological conditions: Small risk of termite attack
10. Mechanical vibration: IEC 60721.3.3 class 3M3 - i.e. light - small vibration levels from adjacent machinery possible.

## Outdoor Environment

If the UPS is specified in the Annexure to be installed in an outdoor environment, the UPS shall be suitable for installation in the following environmental conditions:

1. Maximum ambient air temperature:

(i) in the South West Region of Western Australia (including the Metropolitan Area) : < 45oC

(ii) outside the South West Region of Western Australia: < 50oC

1. Maximum average ambient air temperature over a 24 hour period;

(i) in the South West Region of Western Australia (including the Metropolitan Area) : < 35oC.

(ii) outside the South West Region of Western Australia: < 40oC

1. Minimum ambient air temperature: > minus 5oC.
2. Solar radiation: Unshaded - fully exposed to solar radiation- an additional 5oC to be allowed for solar heating (and UPS enclosure to be painted gloss white)
3. Altitude: < 1000 metres
4. Weather: Fully exposed to wind and rain
5. Dust pollution level: IEC 60721.3.3 class 3S3 - i.e. medium - no special precautions to minimise the presence of dust, and with dust sources in the vicinity
6. Chemically active substances: IEC 60721.3.3 class 3C2 - i.e. medium- possible significant smoke - possible air borne salt if specified in the Annexure to be at a site within 20 km of the sea
7. Max. average relative humidity: *<* 95% over 24 hour period, and< 90 % over one month period
8. Max. average water vapour pressure: < 2.2 kPa over 24 hour period   
   < 1.8 kPa over one month period
9. Biological conditions: Small risk of termite attack
10. Mechanical vibration: IEC 60721.3.3 class 3M3 - i.e. light - small vibration levels from adjacent machinery possible.

# Degree of Protection

## Conformal Coating

All circuit boards shall be provided with conformal coatings adequate to provide protection against the ingress of moisture, dust and airborne chemicals in the specified environment without reliance on the equipment enclosure. Conformal coating shall be applied during manufacture at the factory.

## IP Rating in Control Centre Environment

If the UPS has been specified in the Annexure for wall or floor mounting in a control centre environment, the UPS shall be provided with an enclosure providing a degree of protection not less than IP31 in accordance with AS 60529.

## IP Rating Indoor Environment other than a Control Centre

1. If the UPS has been specified in the Annexure for wall or floor mounting in a separate lined switchroom providing an environment in accordance with clause 10.3, the UPS shall be provided with an enclosure providing a degree of protection not less than IP51 in accordance with AS 60529.
2. If the UPS has been specified in the Annexure for wall or floor mounting in an environment in accordance with clause 10.3, but not in a separate lined switchroom, the UPS shall be provided with an enclosure providing a degree of protection not less than IP52 in accordance with AS 60529.

## IP Rating in Outdoor Environment

If the UPS has been specified in the Annexure for pole or pad mounting in an outdoor environment, the UPS shall be provided with an enclosure providing a degree of protection not less than IP54 or IP53W in accordance with AS 60529.

## Dust Filters

If dust filters are used in order to achieve the required degree of protection (IP rating), such filters shall be of the easily replaceable type.

If the UPS is fitted with dust filters, its output current rating shall be site derated by 50 % below its nominal current rating with clean dust filters, so as to allow for partially blocked dust filters.

Enclosure designs which do not require dust filters in order to achieve the required degree of protection (IP rating) will be preferred.

# Type of System

## Circuit Topology

The UPS shall be of the line interactive type in accordance with AS 62040.3 Figure B3.

## External Maintenance Bypass and Isolation Switch

1. The external maintenance bypass and isolation switch will provide switching facilities to:

(i) supply the load directly with the UPS isolated from all A.C. supplies.

(ii) isolate the supply from the batteries to the UPS, if the nominal voltage of the batteries exceeds 48 VDC,

(iii) isolate the load.

1. Terminals shall be provided on the UPS to allow connection of the above external maintenance bypass and isolation switch so that the above switching facilities can be provided.
2. A caution label shall be fitted to the UPS warning against disconnecting the UPS before switching the external maintenance bypass and isolation switch to the ‘isolate UPS’ position.
3. The external bypass and isolation switch will provide auxiliary contact closures to indicate its position to the UPS.

## Galvanic Isolation

If galvanic isolation is specified in the Annexure as being required, the UPS shall be equipped with an A.C. input transformer and circuitry to provide such isolation. However, UPS’s which provide galvanic isolation shall be acceptable even if galvanic isolation is not specified as being required.

## Mounting

1. If the UPS has been specified in the Annexure for indoor installation, the UPS shall be wall or floor mounted, as specified in the Annexure.
2. If the UPS has been specified in the Annexure for outdoor installation, the UPS shall be pole or pad mounted, as specified in the Annexure.

## Acoustic Noise

The sound noise pressure emitting from the UPS measured at 1 metre from the unit's enclosure when operating either normally or in stored energy mode shall be not more than 45 dBA.

## Generator

1. If the UPS is specified to be suitable for operation from a standby generator, the impedance of the supply from the generator, will not be more than the impedance of an alternator having the same kVA rating as the UPS and a transient reactance of 15%.
2. If the UPS is specified in the Annexure to be suitable for operation from a standby generator, the kW and kVA ratings of the generating set will not be less than the kVA rating of the UPS.

## Operator Interface Panel

The UPS shall be provided with an operator interface panel which shall display UPS operating mode, alarms etc.

## Communications

The UPS shall be provided with a communication link which shall allow remote monitoring of the operating status of the UPS.

# Input Conditions

## Input Voltage

The UPS shall be rated for operation from a 240 volt single phase and neutral electrical supply with a voltage tolerance of +10% /-15%.

## Input Voltage Frequency

The UPS shall be rated for operation from an alternating current supply having a frequency of 50 Hz.

If the UPS is specified in the Annexure to be suitable for use in conjunction with a standby generator the UPS shall be rated for a frequency tolerance of + 5 %.

Otherwise the UPS shall be rated for a frequency tolerance of + 2.5 %

## Input Harmonic Voltages

The UPS shall be be capable of operating satisfactorily from a supply with a sinusoidal input voltage having a total harmonic distortion factor of less than 8 % and having individual harmonics within the limits specified Table 2 of AS 62040.3.

## Supply Characteristics

The Low Voltage system configuration will be either:

1. neutral grounded only at transformer (TN-S), or
2. (b) M.E.N. system (TN-C-S)

The mains supply fault level at the input terminals of the UPS will be as specified in the Annexure.

## Input Current Limitations

1. If the UPS is of type without galvanic isolation the input circuit shall be without inductive components which would cause any magnetic inrush current.
2. If the UPS is provided with galvanic isolation the magnetic inrush current shall be less than 500 % of the UPS rated input current and shall be of a duration of less than 20 milliseconds.
3. When operating via the maximum supply impedance specified, the UPS shall not cause the input voltage waveform total harmonic distortion to exceed 6% or the individual harmonic voltages to exceed 70 % of the limits specified Table 2 of AS 62040.3.

## Input Power Factor

The uninterruptible power supply shall have a rated input power factor of not less than 0.95.

## Lightning Impulse Withstand Voltage Level

If specified for use in conjunction with a standby generator, the uninterruptible power supply shall be suitable for operation utilising a single phase supply from a generator having the ratings and characteristics specified in the Annexure.

## Input Supply Protective Device

The UPS will be supplied from a circuit provided with circuit breaker protection or conventional HRC fuse protection as specified in the Annexure.

The UPS shall be provided with internal semi-conductor fuse protection in accordance with AS 60269.4.

# Output Characteristics

## Output Voltage(s)

The UPS shall have a nominal rated single phase and neutral output voltage of either 230 volts or 240 volts.

## Output Voltage Waveform

The UPS output voltage waveform shall be sinusoidal in both the normal and stored energy modes with a total harmonic distortion factor of less than 8% and with individual harmonics within the limits specified Table 2 of AS 62040.3.

## Steady State and Dynamic Output Voltage Characteristic

The UPS shall maintain the steady state output voltage within the range 220 volts to 250 volts in both the normal and stored energy modes of operation.

The UPS shall have an output voltage dynamic performance of classification 1 as in AS 62040.3 during changes of operating mode and with increasing and decreasing load changes as specified under test conditions specified in AS 62040.3.

## Output Frequency

The UPS supply shall maintain an output voltage frequency as specified in the Annexure within a tolerance of ± 6% in both normal and stored energy modes of operation.

## Output Power Factor Ratings

The UPS shall have, for steady state loads, a rated output power factor range of from not less than 0.5 lagging to not less than 0.9 leading without derating of UPS being required. In addition the UPS shall be suitable for supplying any transient currents specified in the Annexure at a power factor of not less than 0.3 lagging.

## Output VA Rating

The UPS shall have an output VA rating not less than that specified in the Annexure.

## Output Overload Protection

The UPS shall be provided with output overload protection device(s) to prevent damage to the uninterruptible power supply in the event of short circuit, overload or earth faults in the output circuit.

# Batteries

## Type

1. Batteries to be installed in a control centre environment in accordance with clause 10.2 shall be absorbed glass matt (AGM) valve regulated lead acid batteries in accordance with cluse 15.3 (a), or shall be Gel type valve regulated lead acid batteries in accordance with clause 15.3(b).
2. Batteries to be installed in an environment in accordance with clause 10.3 i.e. a weather protected environment other than a control centre environment, shall be Gel type valve regulated lead acid batteries, preferably with positive tubular plates.
3. Batteries to be installed in an environment in accordance with clause 10.4 i.e. an outdoor environment, shall be Gel type valve regulated lead acid batteries, preferably with positive tubular and silver anoded plates.

## Battery Voltage

If the UPS is specified in the Annexure for outdoor installation, the battery bank nominal voltage shall not exceed 48 volts**.**

## Battery Operating Temperature

1. AGM batteries shall have a rated maximum operating temperature of not less than 50oC for both charging and discharging modes of operation.
2. Gel type batteries for operation indoors shall have a rated maximum operating temperature of not less than 55oC for both charging and discharging modes of operation.
3. Gel type batteries for installation in outdoor UPS enclosures shall have a rated maximum operating temperature of not less than 60oC for both charging and discharging mode of operation.

## Battery Mounting

1. If the UPS is specified in the Annexure for installation indoors, the associated batteries shall be mounted in the same enclosure as the UPS proper or shall be mounted in a separate matching enclosure provided by the Contractor, as specified in the Annexure.
2. If the UPS is specified in the Annexure for installation outdoors, the associated batteries shall be mounted in the same enclosure as the UPS proper.

## Stored Energy Time

The UPS stored energy time as defined in AS 62040.3 shall be as specified in the Annexure.

## Restored Energy Time

The UPS restored energy time as defined in AS 62040.3 shall be as specified in the Annexure.

## Battery Life

1. AGM valve regulated batteries shall have a rated service life of not less than four years when being float charged by a temperature compensated charger in an ambient temperature of 20oC.
2. Gel type valve regulated batteries for installation indoors shall have a rated service life of not less than four years when being float charged by a temperature compensated charger in an average ambient temperature of 30oC.
3. The battery charging voltage, in both boost charge and float charge modes, shall be controlled so as to provide compensation for battery ambient temperatures.

## Battery Management System

1. The UPS shall be equipped with a battery management system monitoring and controlling the charging and discharging of batteries so as to increase substantially the operating life of batteries beyond what would be achieved with the use of constant voltage float charging.
2. The battery charging voltages for float charge and high rate charge shall be strictly in accordance with the recommendations of the battery manufacturer.
3. The battery float charging voltage shall be controlled so as to provide compensation for battery ambient temperature variations.
4. The battery management system shall provide an early warning of end of battery normal working life.

# UPS Loads

## Types of Load

The UPS shall be suitable for supplying the following types as loads generating the UPS output current demands specified in the Annexure:

1. linear steady state loads , e.g. motors, lighting, instrumentation, general purpose power,
2. linear transient loads, e.g. motor starting, and transformer inrush currents,
3. non-linear steady state loads, e.g. variable speed controllers,
4. sensitive non-linear steady state loads, e.g. instrumentation, computers.

## Stored Energy Requirements

The various parameters to be considered in determining the stored energy requirements shall be as defined hereunder:

Vpn = output voltage phase to neutral

Ils = linear steady state load current

Qls = Ils integrated with respect to time over the stored energy time

Ilt = linear transient load current

Qlt = Ilt integrated with respect to time over the stored energy time

Ihs = non-linear steady state load current

Qhs = Ihs integrated with respect to time over the stored energy time

Iht = non-linear transient load current

Qht = Iht integrated with respect to time over the stored energy time

Ep = Qls \*Vpn

= UPS output stored energy

# User Interfaces

## Front of Panel Indication

The uninterruptible power supply shall be provided with light emitting diode indication on the front panel of the following:

1. UPS On,
2. UPS Operating On Battery,
3. UPS Alarm

The uninterruptible power supply shall be provided with light emitting diode or LCD indication on the front panel of the following:

1. UPS Fault
2. Output Overload,
3. Battery Overload,
4. Charger Over Voltage,
5. Charger Failure,
6. Low Battery Charge,
7. High Output Voltage,
8. Low Output Voltage.

## Serial Communications Type

The uninterruptible power supply shall be provided with a serial communications port with an interface of the type specified in the Annexure.

## Status Information

The following status information shall be accessible via the communications port:

1. UPS On,
2. UPS Operating On Battery,
3. UPS Bypassed,
4. UPS Fault,
5. Line to UPS On.

## Alarm Information

The following alarm information shall be accessible via the communications port:

1. Output Overload,
2. Charger Over Voltage,
3. Low Battery Charge,
4. Battery Replacement Due,

## Parameter Information

The following parameter information shall be accessible via the communications port:

1. Output A.C. Voltage,
2. Output A.C. Frequency,
3. Output A.C. Current,
4. Output A.C. Power,
5. Battery Voltage,
6. Battery Capacity,
7. Estimated Back Up Time.

# Tests

## Type Tests

The UPS shall have been type tested to verify the requirements of AS 62040.2 and AS 62040.3.

## Routine Tests

The UPS shall be routine tested in accordance with AS 62040.3 to verify the unit's functionality.

# Delivery

Once routine tests have been completed satisfactorily, the Contractor shall repack the equipment and deliver the equipment to the Principal’s works or to site as specified in the Annexure.

# Spare Parts

The Contractor shall guarantee to hold in Perth Western Australia one set of complete electronics spare parts for the UPS.

# Technical Support

The Contractor shall maintain a comprehensive and timely level of technical support in Perth Western Australia for all equipment supplied under the Contract. Such support may be provided by the Contractor per se, or through a local service agent authorised and supported technically by the Contractor.

# Manuals

The Contractor shall supply 3 copies of comprehensive instruction manuals, written in English, pertaining specifically to the works provided under the Contract, and covering the complete operation and maintenance of all equipment supplied.

The manuals shall be printed on high grade A4 sized paper and each shall be bound in a high grade A4 size loose leave binder.

Information included in the manuals shall include:

1. detailed descriptions of functions performed
2. set up and operating instructions
3. safety instructions and warnings
4. maintenance instructions and warnings
5. recommended spare parts and special tools list
6. connection diagrams.

# Training

The Contractor shall supply, as part of the Contract, training for the number of Water Corporation electrical technicians specified in the Annexure. Such training shall cover commissioning as well as first line fault findings and first line servicing of the UPS.

# Commissioning

If so specified in the Annexure, the Contractor shall commission the UPS so as to ensure that it is set up and calibrated correctly. Such commissioning may be carried out in conjunction with the training that the Contractor is required to provide. The Principal shall give the Contractor 14 days notice of when the UPS will be installed and connected ready for commissioning.

**Annexure to Specification**

**for**

**Line Interactive L.V. Uninterruptible Power Supply**

**Project:**

**Contract Arrangement** *(Stand alone contract or part of combined installation contract, the latter combined contract number)*

**Site Location:**

**Site Distance from Sea**  km

**Type of Access to Site**

**Installation Environment** *(control centre environment, other indoor environment or outdoor environment)*

**UPS for Use with Standby Generating Set** *(yes or no)*

**Mains Electricity Supply to Site** *(L.V or H.V.)*

**Type of UPS Mounting**

(*wall, floor, pole or pad mounted)*

**Maximum Sound Pressure Level at 1 metre**  dBA

**Stored Energy Time** *(as per AS 62040.3)* minutes

**Restored Energy Time** *(as per AS 62040.3)* minutes

**UPS Input Power System Specifications**

Type of input over current device (circuit breaker or fuse)

Current rating of input circuit breaker or fuse amps

**Annexure to Specification**

**for**

**Line Interactive L.V. Uninterruptible Power Supply**

UPS input fault level with mains supply kA

L.V. system configuration *(TN-S or TN-C-S)*

Standby generator kVA rating kVA

Standby generator single phase or 3 phase

UPS input fault level with standby gen. set supply kA

**UPS Output Requirements**

Rated output kVA......................kVA Frequency ...................Hz

**Load Requirements**

Max. steady state linear current amps

Max. steady state non-linear current amps

Max. steady state rms current (linear and non- linear combined) amps

Peak transient current amps

Max. individual transient current time *(default value 5 seconds)* seconds

Stored Energy *(determined in accordance with clause 16.2)* kW\*hr

**Battery Mounting** (*indoor UPS only)*

*(in same enclosure as UPS or in separate enclosure)*

**Delivery** *(to site or to Principal’s works)*

**Training**

Number of training places to be provided:

**Commissioning Services** *(required or not required)*

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| --- | --- | --- | --- | --- | --- |
| **Line Interactive L.V. Uninterruptible Power Supply Tender Technical Response Schedule** | | | | | |
| DS26.31 | **Subject** | **Noted** | Compliant | | **Comments** |
| **Clause No.** |  |  | **Yes** | **No** |  |
| **1** | **General** |  |  |  |  |
| **2** | **Site** |  |  |  |  |
| **3** | **Standards** |  |  |  |  |
| **4** | **Work by Principal** |  |  |  |  |
| **5** | **Information by Contractor** |  |  |  |  |
| **6** | **Drawings** |  |  |  |  |
| **7** | **Quality Assurance** |  |  |  |  |
| **8** | **Electrical Work** |  |  |  |  |
| **9** | **EMC Categories** |  |  |  |  |
| **10** | **Installation Environment** |  |  |  |  |
| 10.1 | General |  |  |  |  |
| 10.2 | Control Centre |  |  |  |  |
| 10.3 | Other Indoor |  |  |  |  |
| 10.4 | Outdoor Environment |  |  |  |  |
| **11** | **Degree of Protection** |  |  |  | IP rating = |
| 11.1 | Tropicalisation |  |  |  |  |
| 11.2 | IP Rating in Control Centre Environment |  |  |  |  |
| 11.3 | IP Rating Indoor Environment other than a Control Centre |  |  |  |  |
| 11.4 | IP Rating in Outdoor Environment |  |  |  |  |
| 11.5 | Dust Filters |  |  |  | Dust filters offered? |
| **12** | **Type of System** |  |  |  |  |
| 12.1 | Circuit Topology |  |  |  |  |
| 12.2 | External Maintenance Bypass and Isolation Switch |  |  |  |  |
| 12.3 | Galvanic Isolation |  |  |  |  |
| 12.4 | Mounting |  |  |  |  |
| 12.5 | Acoustic Noise |  |  |  | Noise dBA = |
| 12.6 | Generator |  |  |  |  |
| 12.7 | Operator Interface Panel |  |  |  |  |
| 12.8 | Communications |  |  |  |  |
| **13** | **Input Conditions** |  |  |  |  |
| 13.1 | Input Voltage |  |  |  | Upper limit volts = |
|  |  |  |  |  | Lower limit volts = |

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| **Line Interactive L.V. Uninterruptible Power Supply Tender Technical Response Schedule** | | | | | |
| DS26.31 | **Subject** | **Noted** | Compliant | | **Comments** |
| **Clause No.** |  |  | **Yes** | **No** |  |
| 13.2 | Input Frequency |  |  |  | Upper limit Hz = |
|  |  |  |  |  | Lower limit Hz = |
| 13.3 | Input Harmonic Voltage |  |  |  |  |
| 13.4 | Supply Characteristics |  |  |  |  |
| 13.5 | Input Current Limitations |  |  |  | Full load amps = |
|  |  |  |  |  | Inrush amps = |
| 13.6 | Input Power Factor |  |  |  | Input p.f. |
| 13.7 | Lightning Impulse Withstand |  |  |  | L.I.W. volts = |
| 13.8 | Input Supply Protective Device |  |  |  |  |
| **14** | **Output Characteristics** |  |  |  |  |
| 14.1 | Output Voltage |  |  |  | Rated output volts = |
| 14.2 | Output Voltage Waveform |  |  |  | Output T.H.D. % = |
| 14.3 | Output Voltage Characteristics |  |  |  | Steady state volts tolerance % = |
| 14.4 | IP Rating in Outdoor Environment |  |  |  | Upper limit Hz = |
| 14.5 | Output Power Factor |  |  |  | Rated output p.f. = |
| 14.6 | Output kVA |  |  |  | Rated output = |
| 14.7 | Output Overload Protection |  |  |  |  |
| **15** | **Batteries** |  |  |  |  |
| 15.1 | Type |  |  |  |  |
| 15.2 | Battery Voltage |  |  |  |  |
| 15.3 | Battery Operating Temperature |  |  |  |  |
| 15.4 | Mounting |  |  |  |  |
| 15.5 | Stored Energy Time |  |  |  | Full load stored hours = |
| 15.6 | Restored Energy Time |  |  |  | Full load restored hours = |
| 15.7 | Battery Life |  |  |  | Life years at 25 deg. C = |
|  |  |  |  |  | Life years at 35 deg. C = |
| 15.8 | Battery Management System |  |  |  | Details to be attached |
| **16** | **UPS Loads** |  |  |  |  |
| 16.1 | Type of Load |  |  |  |  |
| 16.2 | Stored Energy Requirements |  |  |  |  |
| **17** | **User Interfaces** |  |  |  |  |
| 17.1 | Front of Panel Indications |  |  |  |  |
| 17.1 (a) | UPS On |  |  |  |  |
| 17.1 (b) | UPS Operating on Battery |  |  |  |  |
| 17.1 (c) | UPS Alarm |  |  |  |  |

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| **Line Interactive L.V. Uninterruptible Power Supply Tender Technical Response Schedule** | | | | | |
| DS26.31 | **Subject** | **Noted** | Compliant | | **Comments** |
| **Clause No.** |  |  | **Yes** | **No** |  |
| 17.1 (d) | UPS Bypassed |  |  |  |  |
| 17.1 (e) | UPS Fault |  |  |  |  |
| 17.1 (f) | Output Overhead |  |  |  |  |
| 17.1 (g) | Battery Overload |  |  |  |  |
| 17.1 (h) | Charger Over Voltage |  |  |  |  |
| 17.1 (i) | Charger Failure |  |  |  |  |
| 17.1 (j) | Low Battery Charge |  |  |  |  |
| 17.1 (k) | High Output Voltage |  |  |  |  |
| 17.1 (l) | Low Output Voltage |  |  |  |  |
| 17.2 | Serial Communication Type |  |  |  |  |
| 17.3 | Status Information |  |  |  |  |
| 17.3 (a) | UPS On |  |  |  |  |
| 17.3 (b) | UPS Operating on Battery |  |  |  |  |
| 17.3 (c) | UPS Bypassed |  |  |  |  |
| 17.3 (d) | UPS Fault |  |  |  |  |
| 17.3 (e) | Line to UPS On |  |  |  |  |
| 17.4 | Alarm Information |  |  |  |  |
| 17.4 (a) | Output Overload |  |  |  |  |
| 17.4 (b) | Charger Overvoltage |  |  |  |  |
| 17.4 (c) | Low Battery Charge |  |  |  |  |
| 17.4 (d) | Battery Replacement Due |  |  |  |  |
| 17.5 | Parameter Information |  |  |  |  |
| 17.5 (a) | Output A.C. Voltage |  |  |  |  |
| 17.5 (b) | Output A.C. Frequency |  |  |  |  |
| 17.5 (c) | Output A.C. Current |  |  |  |  |
| 17.5 (d) | Output A.C. Power |  |  |  |  |
| 17.5 (e) | Battery Voltage |  |  |  |  |
| 17.5 (f) | Battery Capacity |  |  |  |  |
| 17.5 (g) | Estimated Back Up Time |  |  |  |  |
| **18** | **Tests** |  |  |  |  |
| 18.1 | Type Tests |  |  |  |  |
| 18.2 | Routine Tests |  |  |  |  |

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| **Line Interactive L.V. Uninterruptible Power Supply Tender Technical Response Schedule** | | | | | |
| DS26.31 | **Subject** | **Noted** | Compliant | | **Comments** |
| **Clause No.** |  |  | **Yes** | **No** |  |
| **19** | **Delivery** |  |  |  |  |
| **20** | **Spare Parts** |  |  |  |  |
| **21** | **Technical Support** |  |  |  |  |
| **22** | **Manuals** |  |  |  |  |
| **23** | **Training** |  |  |  |  |
| **24** | **Commissioning** |  |  |  |  |
|  | **Dimensions** |  |  |  | Mass, kg = |
|  |  |  |  |  | Width, mm = |
|  |  |  |  |  | Length, mm = |
|  |  |  |  |  | Height, mm = |
|  | **Manufacturer’s Declaration** |  |  |  | To be completed, attached and in accordance with AS 62040.3 |

END OF DOCUMENT