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| Assets Planning and Delivery GroupEngineering |

DESIGN STANDARD DS 26-30

Type Specifications – Electrical

**Type Specification for Double Conversion 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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CONTENTS

Section Page

[1 General 6](#_Toc127181559)

[1.1 Scope 6](#_Toc127181560)

[1.2 Definition 6](#_Toc127181561)

[1.3 Contract Arrangement 6](#_Toc127181562)

[1.4 Project Specific Information 6](#_Toc127181563)

[2 Site 6](#_Toc127181564)

[3 Standards 6](#_Toc127181565)

[4 Work by the Principal 7](#_Toc127181566)

[5 Information to be Provided by the Contractor 8](#_Toc127181567)

[6 Drawings 8](#_Toc127181568)

[7 Quality Assurance 8](#_Toc127181569)

[8 Electrical Work 8](#_Toc127181570)

[9 EMC Categories 9](#_Toc127181571)

[10 Ambient Conditions 9](#_Toc127181572)

[10.1 Control Centre Environments 9](#_Toc127181573)

[10.2 Weather Protected Environments other than Control Centre’s 10](#_Toc127181574)

[10.3 Outdoor Environments 10](#_Toc127181575)

[11 Enclosure Protection 11](#_Toc127181576)

[11.1 Conformal Coating 11](#_Toc127181577)

[11.2 IP Rating in Control Centre Environment 11](#_Toc127181578)

[11.3 IP Rating in Other Than a Control Centre Environment 11](#_Toc127181579)

[11.4 Dust Filters 11](#_Toc127181580)

[12 Type of System 11](#_Toc127181581)

[12.1 Circuit Topology 11](#_Toc127181582)

[12.2 Static Bypass Switch 12](#_Toc127181583)

[12.3 Internal Manual Bypass Switch 12](#_Toc127181584)

[12.4 External Maintenance Bypass and Isolation Switch 13](#_Toc127181585)

[12.5 Galvanic Isolation 13](#_Toc127181586)

[12.6 Mounting 13](#_Toc127181587)

[12.7 Acoustic Noise 13](#_Toc127181588)

[12.8 Generator 14](#_Toc127181589)

[13 Input Conditions 14](#_Toc127181590)

[13.1 Input Voltage 14](#_Toc127181591)

[13.2 Voltage Unbalance 14](#_Toc127181592)

[13.3 Input Voltage Frequency 14](#_Toc127181593)

[13.4 Input Harmonic Voltages 14](#_Toc127181594)

[13.5 Supply Impedance 14](#_Toc127181595)

[13.6 Input Current Limitations 15](#_Toc127181596)

[13.7 Input Power Factor 15](#_Toc127181597)

[13.8 Lightning Impulse Withstand Voltage Level 15](#_Toc127181598)

[13.9 Input Supply Protective Device 15](#_Toc127181599)

[14 Output Characteristics 15](#_Toc127181600)

[14.1 Output Voltage(s) 15](#_Toc127181601)

[14.2 Output Voltage Waveform 16](#_Toc127181602)

[14.3 Steady State and Dynamic Output Voltage Characteristic 16](#_Toc127181603)

[14.4 Output Frequency 16](#_Toc127181604)

[14.5 Output Power Factor Ratings 16](#_Toc127181605)

[14.6 Output kVA Rating 16](#_Toc127181606)

[14.7 Output Voltage Imbalance 16](#_Toc127181607)

[14.8 Unbalanced Loads 16](#_Toc127181608)

[14.9 Output Overload Protection 16](#_Toc127181609)

[15 Batteries 17](#_Toc127181610)

[15.1 Type 17](#_Toc127181611)

[15.2 Battery Maximum Operating Temperature 17](#_Toc127181612)

[15.3 Mounting 17](#_Toc127181613)

[15.4 Stored Energy Time 17](#_Toc127181614)

[15.5 Restored Energy Time 17](#_Toc127181615)

[15.6 Battery Life 17](#_Toc127181616)

[15.7 Battery Management System 17](#_Toc127181617)

[16 UPS Loads 18](#_Toc127181618)

[16.1 Types of Load 18](#_Toc127181619)

[16.2 Stored Energy Requirements 18](#_Toc127181620)

[17 User Interfaces 19](#_Toc127181621)

[17.1 Front of Panel Indication 19](#_Toc127181622)

[17.2 Serial Communication Type 19](#_Toc127181623)

[17.3 Status Information 19](#_Toc127181624)

[17.4 Alarm Information 19](#_Toc127181625)

[17.5 Parameter Information 20](#_Toc127181626)

[18 Tests 20](#_Toc127181627)

[18.1 Type Tests 20](#_Toc127181628)

[18.2 Routine Tests 20](#_Toc127181629)

[19 Delivery 20](#_Toc127181630)

[20 Spare Parts 20](#_Toc127181631)

[21 Technical Support 20](#_Toc127181632)

[22 Manuals 21](#_Toc127181633)

[23 Training 21](#_Toc127181634)

[24 Commissioning 21](#_Toc127181635)

# General

## Scope

This Specification covers the requirements for the design, manufacture, assembly, factory testing, delivery and commissioning for a double conversion uninterruptible power supply suitable for installation in an operator access area within a weather protected location.

This Specification is applicable to an uninterruptible power supply having a rated output capacity not less than 1 kVA and not greater than 40 kVA with input and output requirements as specified in the Annexure.

This Specification is applicable to an uninterruptible power supply having a rated capacity of greater than 40 kVA and not greater than 160 kVA provided that the specified input voltage is 3 phase 415 VAC 50 Hz and the specified output voltage is 3 phase 415 VCA 50 Hz.

## Definition

1. For the purposes of this Specification, the terms “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 the building to house the UPS,
2. Unpacking the UPS at site after delivery by the Contractor,

(c) Mechanical installation of the UPS in accordance with the Contractor’s instructions,

1. Installation of UPS input and output cabling in accordance with the Contractor’s instructions,
2. 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

1. Details of any specialearthing connections and requirements 14 days
2. UPS mounting requirements 14 days
3. UPS addresses of all data listed clause 17 hereunder 28 days

(f) Technical data sheets 35 days

(g) Inspection and test plan 35 days

(h) Test certificates within 7 days of completion of commissioning

1. Comprehensive operating

 & maintenance manual within 14 days of completion of commissioning

# 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, tested and installed 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.

# Ambient Conditions

## 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. Maximum 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. Average relative humidity: *<* 95% over 24 hour period, and
10. 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.

## Weather Protected Environments other than Control Centre’s

If the UPS is specified in the Annexure to be installed in a 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:
2. In the South West Region of Western Australia (including the Metropolitan Area): < 45oC
3. Outside the South West Region of Western Australia: < 50oC.
4. Maximum average ambient air temperature over a 24 hour period;
5. In the South West Region of Western Australia (including the Metropolitan Area) : < 30oC
6. Outside the South West Region of Western Australia: < 35oC.
7. Minimum ambient air temperature: > minus 5oC.
8. Solar radiation: Negligible.
9. Altitude: < 1000 metres.
10. Weather: Fully protected against external wind and rain.
11. 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.
12. 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.
13. Average relative humidity: *<* 95% over 24 hour period, and < 90 % over one month period.
14. Average water vapour pressure: < 2.2 kPa over 24 hour period < 1.8 kPa over one month period.
15. Biological conditions: Small risk of termite attack.
16. Mechanical vibration: IEC 60721.3.3 class 3M3 - i.e. light - small vibration levels from adjacent machinery possible.

## Outdoor Environments

This Specification does not cover uninterruptible power supplies to be installed outdoors.

# Enclosure Protection

## Conformal Coating

All circuit boards shall be provided with conformal coatings adequate to provide protection against the ingress of moisture, duct, 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 installation 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 in Other Than a Control Centre Environment

1. If the UPS has been specified in the Annexure for installation in a separate lined switchroom providing an environment in accordance with clause 10.2, 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 installation in an environment in accordance with clause 10.2, 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.

## 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.

# Type of System

## Circuit Topology

1. If the UPS has a rated capacity in the range ≥ 1 kVA to < 10 kVA, the ups shall be of the double conversion type in accordance with AS 62040.3 Figure B1.
2. If the UPS is required to generate an output frequency other than 50 Hz the UPS shall be of the double conversion type in accordance with AS 62040.3 Figure B1.
3. If the UPS has a rated capacity in the range ≥ 10 kVA to 40 ≤kVA the UPS shall be of the double conversion with static bypass type in accordance with AS 62040.3 Figure B1.
4. If the UPS is provided with a separate battery charger, the electrical supply input to the charger shall be connected directly to the input supply to the UPS main rectifier input supply.
5. If the UPS is provided with a static bypass, input connections to the static bypass shall be separate from the input connections to the UPS main rectifier.

## Static Bypass Switch

If the UPS is to be provided with a static bypass switch, the latter shall comply with the following:

1. The static bypass switch shall consist of fully rated silicon controlled rectifiers and shall be capable of manual initiation.
2. The UPS shall be able to recharge the batteries while supplying full power to the load via the static bypass switch.
3. The static bypass switch shall transfer automatically the critical load from the inverter to the bypass input supply if the associated logic senses any one of the following conditions:
(i) inverter overload
(ii) battery run time expired
(iii) rectifier or inverter fault.
4. The static bypass switch shall transfer automatically the critical load back to the inverter if the associated logic senses that:
(i) following a load transfer due to an instantaneous over load transfer, the
 load current has fallen to less than 100% of the UPS rating
(ii) the rectified or inverter fault has been cleared.
5. If the output voltage, frequency and phase angle are the same as the input voltage, frequency and phase angle, or within the Contractor’s specified tolerances of same, the load transfers from the inverter to the static bypass and back again shall be bump less and without interruption to the UPS output voltage. Otherwise the duration of interruption to the UPS output voltage during such load transfers shall be not more than 10 milliseconds.
6. If more than 10 transfers from and back to the inverter occur in a 15 minute period, the load shall be locked into the static bypass mode and an alarm condition signalled.

## Internal Manual Bypass Switch

If the UPS is to be provided with a static bypass switch, in addition it shall be provided with an internal manual bypass switch as hereunder.

1. The internal manual bypass switch shall:
(i) Connect to the load to the bypass input supply
(ii) Isolate the rectifier (and charger if applicable) from the incoming

 electrical supply

1. Isolate the load from the inverter, but shall leave the batteries connected to the UPS so that the operation of the latter can be checked.
2. Interlocking or warning notices shall be provided to require transfer of load to and from the inverter to be executed via the static bypass switch.

## 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.
2. 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.
3. 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.
4. The external maintenance bypass and isolation switch shall provide auxiliary contact closures to indicate its position to the UPS.

## Galvanic Isolation

1. If the UPS is specified in the Annexure to be installed on a site supplied electrically at High Voltage, galvanic isolation between input and output shall not be required and the UPS neutral and earth outputs shall be derived from the main power system neutral bar and earth bar respectively.
2. If the UPS is specified in the Annexure to be installed on a site supplied electrically at Low Voltage, the UPS shall be provided with galvanic isolation by means of an input transformer with the secondary star point earthed to provide an output neutral connection.
3. In either case, a warning label shall be provided near the UPS power supply input terminals warning against disconnection of inputs before the UPS inverter is shut down.

## Mounting

The UPS shall be separately wall mounted or separately floor 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 the maximum value specified in the Annexure.

## Generator

1. If so specified in the Annexure, the UPS shall be suitable for operation from a standby generator having the characteristics specified in the Annexure.
2. If the UPS is specified in the Annexure to be suitable for operation from a specified generator, the capacitive current taken at start up by any input harmonic filters provided shall not exceed 90% of the 0.1 leading power factor current capacity of the alternator as specified in the Annexure.
3. The systems or switching between the incoming mains supply and the standby generator shall be outside the scope of work covered by this Specification.

# Input Conditions

## Input Voltage

The UPS shall be rated for operation from a three phase and neutral electrical supply having an input voltage as specified in the Annexure with a voltage tolerance of +10% /-15%.

## Voltage Unbalance

The UPS shall be rated for operation from an alternating current supply having a voltage imbalance of not more than 5%.

## 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 Impedance

The incoming supply to the UPS will have source impedances to the point of common coupling with other loads as detailed in the Annexure for mains supply and for standby generating set supply (if the latter is applicable).

The Low Voltage system configuration will be either:

(a) Neutral grounded only at the transformer (TN-S), or

(b) M.E.N. system (TN-C-S),

as detailed in the Annexure.

## Input Current Limitations

1. If the UPS is of a 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

The UPS shall have a lightning impulse withstand voltage level of 2 kV at the power supply input terminals.

## 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)

1. The UPS shall have either a single phase and neutral output or a three phase and neutral output as specified in the Annexure.
2. If the UPS has a single phase output, the output voltage shall be 220 volts, 230 volts or 240 Volts phase to neutral, as specified in the Annexure.
3. If the UPS has a three phase output, the output voltage shall be 380 volts, 400 volts or 415 Volts phase to phase, as specified in the Annexure.

## Output Voltage Waveform

The uninterruptible power supply 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 ± 2 % in both the normal and stored energy modes of operation. The UPS shall have an output voltage dynamic performance of classification 3 as defined 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 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 kVA Rating

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

## Output Voltage Imbalance

For three phase outputs, the voltage imbalance between phases shall be not more than 3%.

## Unbalanced Loads

If the UPS has three phase outputs, it shall be capable of maintaining its specified performance when supplying out of balance loads up to the level of imbalance specified in the Annexure.

## Output Overload Protection

The UPS shall be provided with output overload protection device(s) to prevent damage to the UPS 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 (AGM) valve regulated lead acid batteries in accordance with clause 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 10.2 i.e. weather protected environment other than a control centre environment shall be Gel type valve regulated lead acid batteries preferably with positive tubular plates.

## Battery Maximum Operating Temperature

 (a) AGM batteries shall have a rated maximum operating temperature of not less than 40oC for both charging and discharging modes of operation.

1. Gel type batteries shall have a rated maximum operating temperature of not less than 55oC for both charging and discharging modes of operation.

## Mounting

Batteries shall be mounted internally in the unit’s enclosure or shall be mounted externally, as specified in the Annexure.

## Stored Energy Time

The uninterruptible power supply stored energy time as defined in
AS 62040.3 shall be as specified in the Annexure.

## Restored Energy Time

The uninterruptible power supply 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 charged in an ambient temperature of 20oC.
2. Gel type valve regulated batteries shall have a rated service life of not less than four years when being float charged by a temperature compensated charged in an average ambient temperature of 30oC.

## 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 charging voltage, in both boost charge and float charge modes, shall be controlled so as to provide compensation for battery ambient temperatures.
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 per phase

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

Ilt = linear transient load current per phase

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

Ihs = non-linear steady state load current per phase

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

Iht = non-linear transient load current per phase

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

Ep = (Qls +Qlt +Qhs +Qht )\*Vpn

= UPS output stored energy per phase

Ept = total required stored energy = Ep1 +Ep2 +Ep3

where Ep1 = stored energy for phase 1

 Ep2 = stored energy for phase 2

 Ep3 = stored energy for phase 3

# 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:

(a) UPS On,

(b) UPS Operating On Battery,

(c) UPS Alarm

(d) UPS Bypassed

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

(e) UPS fault

(f) Output Overload

(g) Battery Overload

(h) Charger Over Voltage

(i) Charger Failure

(j) Low Battery Charge

(k) High Output Voltage

(l) Low Output Voltage

## Serial Communication Type

The interruptible 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:

(a) UPS On,

(b) UPS Operating On Battery,

(c) UPS Bypassed,

(d) UPS Fault,

(e) Line to UPS On.

## Alarm Information

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

(a) Output Overload,

(b) Charger Over Voltage,

(c) Low Battery Charge,

(d) Battery Replacement Due,

## Parameter Information

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

(a) Output A.C. Voltage,

(b) Output A.C. Frequency,

(c) Output A.C. Current,

(d) Output A.C. Power,

(e) Battery Voltage,

(f) Battery Capacity,

(g) Estimated Back Up Time.

# Tests

## Type Tests

The uninterruptible power supply 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.

If the attendance of the Principal’s Representative at such routine tests specified in the Annexure as being required, the Contractor shall give the Principal 14 days notice of when the equipment will be ready for such tests. Routine tests to be carried out in the Perth Metropolitan Area.

# Delivery

Once routine tests have been completed satisfactorily, the Contractor shall repack the equipment and deliver the equipment to site.

# 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**

**Double Conversion 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:** ………………………………………………………………

**Ambient Conditions** *(control centre environment or other weather protected environment):*

……………………………………………………………………………………………………………………………………………………………………………………………… `

**UPS to be Located in Lined Switchroom** *(yes or no):* ………………………………………………..

**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 or floor 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**

Input voltage number of phases: ………………………………………………..

Input voltage, phase to neutral: ……………………………………………….. volts

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

Current rating of input circuit breaker or fuse: ……………………………………………….. amps

Supply impedance to UPS input terminals:

Supplied from mains: ……………………………………………….. + j……………… ohms

Supplied from standby gen set: ……………………………………….+ j …………….. ohms

**Annexure to Specification**

**for**

**Double Conversion L.V. Uninterruptible Power Supply**

**UPS Output Requirements**

Phase to neutral voltage: volts Number of phases

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

Max. steady state current unbalance *(3 phase UPS only):* …………………………………. %

Max. transient current unbalance *(3 phase UPS only):* ……………………………………. %

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

**Battery Location**

Mounting *(within UPS or external to UPS):* ………………………………………………..

**Standby Generator Ratings** *(check against UPS Specification requirements)*

Rated size kVA Rated power factor

Rated voltage volts Number of phases

Rated frequency Hz + %

Rated current amps Winding pitch

Steady state voltage regulation: …………………………………………………………………. %

Transient voltage drop for 60 % linear load step at 0.3 p.f. ………………………………………………..

AVR root mean square response type *(yes or no):* ………………………………………………..

**Routine Tests**

Principal’s Representative to Witness *(yes or no):* ………………………………………………..

**Annexure to Specification**

**for**

**Double Conversion L.V. Uninterruptible Power Supply**

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

**Training**

Number of training places to be provided:

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

|  |
| --- |
| **Type Specification for Double Conversion L.V. Uninterruptible Power Supply Tender Technical Response Schedule** |
| DS26.30 | **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** | **Ambient Conditions** |  |  |  |  |
| **11** | **Enclosure Protection** |  |  |  | IP rating = |
| **12** | **Type of System** |  |  |  |  |
| 12.1 | Circuit Topology |  |  |  |  |
| 12.2 | Static Bypass Switch |  |  |  |  |
| 12.3 | Internal Manual Bypass Switch |  |  |  |  |
| 12.4 | External Maintenance Bypass and Isolation Switch |  |  |  |  |
| 12.5 | Galvanic Isolation |  |  |  |  |
| 12.6 | Mounting |  |  |  |  |
| 12.7 | Acoustic Noise |  |  |  | Noise dBA = |
| 12.8 | Generator |  |  |  |  |
| **13** | **Input Conditions** |  |  |  |  |
| 13.1 | Input Voltage |  |  |  | Upper limit volts = |
|  |  |  |  |  | Lower limit volts = |
| 13.2 | Voltage Imbalance |  |  |  | Allowable voltage imbalance % = |
| 13.3 | Input Frequency |  |  |  | Upper limit Hz = |
|  |  |  |  |  | Lower limit Hz = |
| 13.4 | Input Harmonic Voltage |  |  |  |  |
| 13.5 | Supply Impedance |  |  |  |  |
| 13.6 | Input Current Limitations |  |  |  | Full load amps = |
|  |  |  |  |  | Inrush amps = |
| 13.7 | Input Power Factor |  |  |  | Input p.f. |
| 13.8 | Lightning Impulse Withstand |  |  |  | L.I.W. volts = |
| 13.9 | 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 % = |
| **Type Specification for Double Conversion L.V. Uninterruptible Power Supply Tender Technical Response Schedule** |
| DS26.30 | **Subject** | **Noted** | Compliant | **Comments** |
| **Clause No.** |  |  | **Yes** | **No** |  |
| 14.4 | Output Frequency |  |  |  | Upper limit Hz = |
| 14.5 | Output Power Factor |  |  |  | Rated output p.f. = |
| 14.6 | Output kVA |  |  |  | Rated output = |
| 14.7 | Output Voltage Imbalance |  |  |  | Output voltage imbalance % = |
| 14.8 | Unbalanced Loads |  |  |  | Allowable load unbalance % = |
| 14.9 | Output Overload Protection |  |  |  |  |
| **15** | **Batteries** |  |  |  |  |
| 15.1 | Type |  |  |  |  |
| 15.2 | Battery Max. Operating Temperature  |  |  |  | Max operating deg. C = |
| 15.3 | Mounting |  |  |  |  |
| 15.4 | Stored Energy Time |  |  |  | Full load stored hours = |
| 15.5 | Restored Energy Time |  |  |  | Full load restored hours = |
| 15.6 | Battery Service Life |  |  |  | Service life years at 20 deg. C = |
|  |  |  |  |  | Service life years at 30 deg. C = |
| 15.7 | 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 |  |  |  |  |
| 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 |  |  |  |  |

|  |
| --- |
| **Type Specification for Double Conversion L.V. Uninterruptible Power Supply Tender Technical Response Schedule** |
| DS26.30 | **Subject** | **Noted** | Compliant | **Comments** |
| **Clause No.** |  |  | **Yes** | **No** |  |
| 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 |  |  |  |  |
| **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