Government of India
Department of Telecommunications
Telecommunication Engineering Centre
Gate No. 5, Khurshid Lal Bhawan, Janpath, New Delhi-110001.
(FA Division)

File No. 7-8/2025-FA/TEC **Dated: 31.07.2025**

Subject: Revision of Generic Requirements (GR) on "Uninterrupted Power Supply (UPS) System, TEC 66140:2025" - Inviting comments.

In exercise of the powers conferred by rule 5(2) of the Telecommunications (Framework to Notify Standards, Conformity Assessment and Certification) Rules 2025, the draft Standard (Draft Standard No. TEC 66140:2025) in respect of revision of Generic Requirements (GR) on ""Uninterrupted Power Supply (UPS) System,"(Standard No. TEC 66140:2025), is enclosed herewith (Annexure-I) for stakeholder consultation. It is requested to go through the aforesaid enclosed draft Standard and offer your inputs/comments. The comments may please be furnished in the template sheet enclosed herewith as Annexure-II.

The comments/inputs may be furnished through email to adgfa-tec-dot@gov.in with copy to dirfa.tec@gov.in and ddgfla.tec@gov.in at the earliest and latest within **sixty days of the date of this reference** please.

Enclosures:
(i) Draft Standard (Draft Standard No. TEC 66140:2025) (Annexure-I)
(ii) Attach Annexure-II, Template

----Sd----
(Deo Pratap)
AD (FA), TEC
Email:adgfa-tec-dot@gov.in

To,

All Manufacturer & Stakeholders

Copy to:
1. Sr DDG TEC
2. AD (IT), TEC - with request for uploading on TEC Website

Annexure-I

वर्गीय ~~आवश्यकताएँ~~ आवश्यकताओं के लिए मानक

~~सं:टीईसी/जीआर/ एफए/यूपीएस-001/05/मार्च-19~~

टीईसी 66140:2025

~~(सं: टीईसी/जीआर/ एफए /यूपीएस-001/05/ मार्च-19टीईसी/जीआर/टीएक्स/यूपीएस-01/04.दिसम्बर.2013~~ को अधिक्रमित करता है~~)~~

STANDARD FOR GENERIC REQUIREMENTS

~~No. : TEC/GR/FA/UPS-001/05/MAR-19~~

TEC 66140:2025

(Supersedes No. TEC/GR/FA/UPS-001/05/MAR-19~~TEC/GR/TX/UPS-01/04.DEC 2013~~)

निर्बाध विद्धुत आपूर्ति प्रणाली

UNINTERRUPPTED POWER SUPPLY (UPS) SYSTEM

ISO9001:2015

दूरसंचार अभियांत्रिकी केंद्र
खुर्शीदलाल भवन, जनपथ, नई दिल्ली–110001, भारत
TELECOMMUNICATION ENGINEERING CENTRE

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KHURSHIDLAL BHAWAN, JANPATH, NEW DELHI– 110001,INDIA

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Release 75: OctoberMarch, 202519

~~Price: ₹ 800/-~~

FOREWORD

Telecommunication Engineering Centre (TEC) functions under Department of Telecommunications (DOT), Government of India. Its activities include:

- Issue of Generic Requirements (GR), Interface Requirements (IR), Service Requirements (SR), Essential Requirement (ER) and Standards for Telecom Products and Services
- Field evaluation of products and Systems Support to DOT on technology issues
- Testing & Certification of Telecom products

For the purpose of testing, four Regional Telecom Engineering ~~Centers~~Centres (RTECs) have been established which are located at New Delhi, Bangalore, Mumbai, and Kolkata.

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ABSTRACT

This document contains the Generic Requirements of UPS (Uninterrupted Power Supply) Systems based on Switch Mode Power Supply (SMPS) techniques for providing uninterrupted AC power to the equipment associated with various telecom systems. UPS system used for telecom application, envisaged in this GR, works on " ON LINE" concept. In this concept, under normal operating conditions, the AC load is fed by the inverter unit of the UPS system, which in turn derives its DC power from Rectifier unit, while the battery remains floated across the output of the Rectifier unit, Rectifier unit draws AC power from the commercial AC mains or stand by DG set. In the event of interruption in the AC input to the UPS, the DC power to the inverter unit gets instantly transferred to battery, so that AC output of the inverter unit remains uninterrupted.

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HISTORY SHEET

S.No.	Name of the Generic Requirements	No. of the Generic Requirements	Remarks
1)	1, 2 & 3 KVA UPS	G/UPS-01/01 AUG 1992	UPS for Computer application
2)	1 TO 7.5 KVA UPS	G/UPS-02/01 AUG 1992	UPS for Telecom Application
3)	Uninterrupted Power Supply (UPS)	GR/UPS-01/02 JUL 2002	- Above mentioned two GRs were amalgamated in one GR. - UPS were made modular.
4)	Uninterrupted Power Supply (UPS)	GR/UPS-01/03/MAY.2006	The GR has the following additional features : - 0.5KVA, 1KVA, 2KVA and 3KVA are Unitary type (with or without VR). - 1KVA, 2KVA, 3KVA, 4KVA, 6KVA, 10KVA and higher rating of Modular UPS units with ultimate system rating 4N. Where N is the rating of basic UPS unit. Provision for one redundant unit has been made. - Maximum rating of single phase UPS system is 12KVA. All higher ratings are Three phase.

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5)	Uninterrupted Power Supply (UPS) System	TEC/GR/TX/UPS-01/04/Dec.2013	The GR has the following additional features: - This GR has been issued to accommodate the advancement in the field of Batteries/UPS due to technological changes in time.
6)	Uninterrupted Power Supply (UPS) System	TEC/GR/FA/UPS-001/05/MAR-19	The GR has the following additional features: - New safety standard IEC 62040-1 applicable for UPS sytsem - Updated EMC requirement.
7)	Uninterrupted Power Supply (UPS) System	TEC 66140:2019	Document code is changed from ' TEC/GR/FA/UPS-001/05/MAR-19 ' as per numbering scheme circulated vide letter no. 5-1/2016-RC/TEC(Pt) dated 19.01.2017
8)	Uninterrupted Power Supply (UPS) System	TEC 66140:2025	Eighth Issue:

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REFERENCES

S. No.	Standard No.	Designation
1.	QM-202	Pictorial guidelines for Visual assessment of quality of printed board assemblies (PBA) & discrete terminal assemblies.
2.	QM-204	Guidelines for workmanship standards for repair & modification of printed wiring board assemblies.
3.	QM-205	Guidelines for standard of workmanship for printed boards
4.	QM-206	Guidelines for standard of workmanship for printed boards assemblies
5.	QM-207	Guidelines for soft solder and fluxes for Telecom Equipment
6.	TEC 14016:2010 (old no. QM-333:2010)~~QM-333~~	Standard for Environmental testing of Telecommunication equipment. ~~Specification for Environmental Testing of Electronic Equipment for Transmission and Switching use.~~
7.	QM-334	Packing guidelines
8.	QM-115	Quality standard for calculation/verification of MTBF
9.	IS – 5	Standard on colours & shades
10.	IS-101	Methods of Sampling & Test for Paints, Varnishes & Related Products.
11.	IS 168	Ready Mixed Paint, Air Drying, For General Purpose-Specification
12.	IS- 613	Standard on Bus-bars
13.	IS : 1248	Standard on Shunts
14.	IS 1359	Specification for Tinning requirements
15.	IS 1554 with amendment-1 (June 1994)	Standard for Cables & Wires
16.	ITUT Rec. P-53	Standard regarding Psophometeric noise level

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17.	VDE 0675	Surge arrestors for use in AC supply systems with rated voltage from 10V to 1000V.
18.	QM-333	Specification for environment testing of electronic equipment for transmission and switching use.
19.	IS 13252 part 1	Information Technology Equipment -- Safety, Part 1: General Requirements
20.	IS 16242	Uninterrupted Power supply system--General and Safety requirements
21.	IEC 60950-1	Information technology equipment – Safety – Part 1:General requirements
22.	IEC 62040-1	Uninterrupted Power supply system – Safety – Part 1:General requirements
23.	IEC ~~Publication~~ 61000-4-2	Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test ~~Testing and measurement techniques of Electrostatic discharge immunity test~~
24.	IEC ~~Publication~~ 61000-4-3	Electromagnetic compatibility (EMC) - Part 4-3 : Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test ~~Radiated RF electromagnetic field immunity test~~
25.	IEC ~~Publication~~ 61000-4-4	Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test ~~Testing and measurement techniques of electrical fast transients/burst immunity test~~
26.	IEC ~~Publicatio~~n 61000-4-5	Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test ~~Test & Measurement techniques for surge immunity tests~~
27.	IEC ~~Publication~~ 61000-4-6	Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to

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		conducted disturbances, induced by radio-frequency fields ~~Immunity to conducted disturbances~~
28.	UL 950 ~~TEC/SD/DD/EMC-221/05/OCT-16~~	Standard for information technology equipment including electrical business equipment ~~Electromagnetic compatibility standard for Telecommunication equipment.~~
29.	TEC 67010:2011	Value Regulated Lead Acid (VRLA) Batteries with amendment dated 24.7.2012
30.	TEC 67040:2019	VRLA batteries for high rate of discharge (UPS) application
31.	TEC 67030:2024	Lithium Ion Battery for Telecom Applications

Note:

Unless otherwise explicitly stated, the latest approved issue of the standard/GR/IR, with all amendments in force, listed in references, on the issuance date of this GR/IR applicable"

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CHAPTER 1

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1 INTRODUCTIONntroduction

1.0 Scope:

This document contains the Generic Requirements of UPS (Uninterrupted Power Supply) Systems based on Switch Mode Power Supply (SMPS) techniques for providing uninterrupted AC power to the equipment associated with various telecom systems. The UPS shall be suitable for operation from grid supply AC mains or standby AC and battery sets only.

1.1 UPS system requirements: UPS system consists mainly of the following building blocks :

1. **Distribution, Switching, Control & Alarm (DSCA) unit :** Provides for Distribution, Switching, Monitoring, Control and alarm of the UPS unit/system. **For UPS with ≥4KVA (equal or more) rating shall have DSCA unit while for UPS less than 4KVA rating, DSCA function may be performed by single chip.**

2. **Rectifier:** Rectifier unit is used for conversion of AC into regulated DC.

3. **Battery Bank:** Battery of suitable capacity for providing power to the inverter when Rectifier unit is not working due to any reason.

4. **Inverter Unit:** Inverter unit shall be capable of providing uninterrupted AC power to the Telecom Equipment.

5. **Static Transfer Switch:** Static Transfer Switch is for transferring the load, automatically to AC mains (regulated or unregulated). Transfer of load back to UPS shall also be automatic but it shall take place, only

after the inverter output has stabilised and is within the specified limits. Transfer time in this case shall be within 10~~5~~ mili seconds.

6. **Manual Transfer Switch:** In case of Parallel Operation of UPS, a manual transfer switch shall be provided. Manual transfer switch is for the transfer of load from inverter to Stand by power and back to Inverter unit, manually without the interruption of power to the load. The interlocking inverter operation should be prevented from unsynchronized switches.

7. **Voltage Regulator:** Voltage Regulator (VR) is for providing Standby regulated AC power (wherever applicable) to the telecom equipment. It shall be optional depending on the purchaser' s requirement.

1.1.1 **UPS System Concept:** UPS system used for telecom application, envisaged in this GR, works on " ON LINE" concept. In this concept, under normal operating conditions, the AC load is fed by the inverter unit of the UPS system, which in turn derives its DC power from Rectifier unit, while the battery remains floated across the output of the Rectifier unit Rectifier unit draws AC power from the commercial AC mains or stand by DG set. In the event of interruption in the AC input to the UPS, the DC power to the inverter unit gets instantly transferred to battery, so that AC output of the inverter unit remains uninterrupted. Under this condition the battery gets discharged. When the commercial AC mains is restored or the Engine Alternator is switched 'ON', the DC power to the inverter unit, again, gets instantly transferred back (without any interruption to the load) to the Rectifier unit. On restoration of AC mains, Rectifier unit, always operates in " Charge Mode" . It enables the Rectifier to give higher current to the battery to recoup its lost capacity faster. When the battery gets fully recouped the Rectifier unit reverts back to the float mode, automatically.

1.1.2 **UPS System Configuration:** UPS systems envisaged in this GR may be a Unitary or Modular in configuration as described in subsequent clauses :

1.1.2.1 **Unitary UPS systems:** This type of system shall have the components as inverter unit, rectifier unit and DSCA, Static Transfer Switch, and manual transfer switch , all housed in a single cabinet. The system shall have the battery of the desired rating as per backup requirements. It may be with or without regulated standby power supplied by a Voltage regulator depending on the purchaser' s requirement.

Fig-1 of Annexure-1 show the block-schematic layout, considering, the possible two combinations as per users requirement.

1.1.2.2 **Modular UPS systems:** In these type of systems, UPS is composed of the basic modules and each module has the building block as: one rectifier unit, one inverter unit, DSCA unit. The battery shall be as per the desired rating of the UPS. The battery AH capacity will be according to the battery backup requirement. DSCA unit provides for all the control, monitoring, alarm functions and necessary terminations/switches as per the GR. In addition to this, the DSCA shall also have the capability of operating its inverter unit in synchronous mode with the inverter units of other UPS units of same make and rating. Static Transfer Switch and manual transfer switch in this concept will be common for the ultimate system capacity (as envisaged by the user) proposed to be constituted by paralleling of these UPS units). These type of UPS unit shall be capable of sharing load with other UPS units of same rating and make, in synchronous load sharing mode. Maximum number of UPS unit which can be paralleled is 5. Fig-2 and Fig-3 of annexure 1 show the block-schematic layout, considering, all the possible combinations as per users requirement.

As these UPS units are capable of synchronous load sharing with other UPS units (Maximum five such units). The user may configure a UPS system as per his/her requirements. He/She may choose the rating of UPS unit as per his/her ultimate requirement and the equipment shall be

ordered accordingly.

1.1.2.3 **Redundancy criteria:** The maximum number of UPS modules in a system shall be N+1, where N is the number of basic UPS units decided as per the load requirement of the user / purchaser, and 1 is redundant unit.

The rating of the Static Transfer Switch and Manual transfer switch shall be 1.2 times the ultimate rating of the UPS system (redundant UPS unit not counted).

1.1.3 **UPS System Rating**: The UPS system ratings as per this GR are: -

1.1.3.1 **Unitary UPS Systems:** Specified ratings for standalone UPS systems are 0.5 KVA, 1KVA, 2KVA, 3KVA & 5KVA. UPS shall deliver single phase AC and shall work on single phase AC mains/stand by AC only.

The rating of the battery shall be as per back-up requirement.

The Static Transfer Switch and manual Transfer switch shall be rated at 1.2 times of the UPS rating.

Note: For calculating the rating of Inverter unit, rectifier unit, etc. , refer guidelines given in Annexure 3.

1.1.3.2 **Modular UPS Systems:** Specified ratings for modular UPS systems, are 1KVA, 2KVA, 3KVA, 4KVA, 5KVA, 6 KVA, 7.5KVA, 10KVA or any higher rating as per user requirement. The UPS of 1KVA, 2KVA, 3 KVA , 4 KVA rating shall be single phase, while UPS of 5 KVA and higher ratings shall be three phase only.

The rating of the battery shall be as per back-up requirement.

The input rating of Voltage Regulator, if used, shall be as per the voltage

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regulation required by purchaser.

The Static Transfer Switch and manual Transfer switch shall be rated at 1.2 **times** of the UPS rating.

Note: For calculating the rating of Inverter unit and Rectifier unit, VR, Static Transfer Switch, manual transfer Switch, the guidelines given in Annexure 3 may be referred to.

1.1.3.3 Distribution, Switching, Control & Alarm Monitoring (DSCA) unit:

The UPS ~~hybrid power~~ system shall consist of a common controller called DSCA, based only on menu driven Micro Processor Controlled Techniques for control, monitoring & alarms. It shall control the operation of rectifier, battery charging etc. It shall monitor alarms, various parameters and report them to the remote monitoring system. DSCA shall display its Software version.

1.1.3.3.1 For remote monitoring purpose, system shall support SNMP (Simple Network Management Protocol) v2 or higher version.

1.1.3.3.2 However, system shall also support RS-485 modbus communication additionally if it is required by the purchaser/procurer.

1.1.3.3.3 DSCA shall have the remote software up-gradation feature through Over the Air (OTA) using Ethernet interface. However, DSCA shall also support remote software up-gradation feature using RS485 interface as applicable.

1.1.3.3.4 Setting of all the parameters shall be through menu-driven microprocessor control only. Use of potentiometer at any stage is precluded. The failure of Microprocessor or DSCA shall not affect the setting of individual rectifier / Solar charge controller / Inverter / DC-DC converter module and none of the parameter shall be disturbed. (Purchaser may decide about redundancy of DSCA based on its application.) Only the setting of new parameters from DSCA, shall be affected. In the event of failure of DSCA, all the modules shall take care of

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the load on latest settings.

1.1.3.3.5 There shall be a provision for Automatic isolation/reconnection of battery from the load. The operate and release voltages for the above conditions shall be as follows: • Cut-off Voltage (V): 42V to 44 V. • Reconnect Voltage: 48V.

1.1.3.3.6 DSCA shall communicate with Li-ion battery BMS to monitor the parameters and alarms and control the charging current of battery. Charging voltage shall be 54.0V or specified by the purchaser based on the requirement.

1.1.3.3.7 Battery path Current Limit: Battery Charging Current shall be settable from 10 to 50% of battery AH capacity.

1.1.3.3.8 Protections: Failure of control and sensing circuitry of DSCA shall not cause any hazard. The voltages of the system shall not abnormally increase to endanger the load.

1.1.3.3.9 Monitoring Alarms and Indications: Visual indications/display shall be provided by means of bright LCDs/LEDs on DSCA to indicate the following minimum conditions (but not limited to) :

a) Battery Voltage High (above 56V)/Low (below 45.6V)

b) Rectifier fail

c) Mains fail

d) Mains "ON"/Battery Discharge

e) Fan Fail (in case fan provided at rack level)

f) Battery Fail or Battery missing (separate for each Battery)

g) Battery isolated from the load

h) Lightning and surge protection

i) Inverter fault

k) Inverter overload

l) AC output voltage abnormal

~~DSCA unit shall be part of individual UPS unit. It shall be based only on menu driven Micro Processor Controlled Techniques for control, monitoring & alarms. DSCA shall display its Software version. Setting of all the parameters shall be through menu-driven microprocessor control only. Use of potentiometer at any stage is precluded. The failure of Micro~~

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~~processor or DSCA shall not affect the setting of individual inverter or Rectifier. (Purchaser may decide about redundancy of micro-processor/Chip based on its application.) No parameter of inverter or Rectifier units shall be disturbed on the failure of DSCA. In this condition all the inverter and Rectifier shall take care of the load on default settings and share the load collectively (wherever applicable). Only the setting of new parameters from DSCA, shall be affected.~~

The system may be RS 232/ RS 485/ Ethernet (SNMP protocol) /USB compatible. It shall be feasible to set any monitoring control parameter from a remote site. All the information regarding Control and monitoring of UPS system data shall be accessible on demand from the remote site. ~~The exchange of information and protocol format shall be as given in the Annexure -4.~~

1.1.3.3.1 **In addition to the alarm, monitoring, control and the requirements of the above clause, the DSCA unit shall also provide for the following:**

- Interconnecting arrangement of the various building blocks/units i.e. Inverter & battery, Inverter & **rectifier,** Battery and **rectifier,** UPS and load through **Static** transfer switch, Manual Transfer Switch & VR (if used as per user' s requirement) etc.
- Arrangement for Isolation of Inverter unit at the input, Rectifier output and Battery, manually.
- Suitably rated contactor for auto battery low cut -off and /Reconnection.
- Terminations for :

  - AC input to the Rectifier unit
  - DC output of Rectifier and Battery
  - Input & output of the Inverter unit
  - Input & output to VR unit
  - Static Transfer Switch
  - Manual Transfer Switch

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- Load
- Circuit Breakers
- Fuses etc

- Isolation arrangement between Inverter output & AC Commercial Mains.
- All supervisory Alarms Indications.
- All necessary protection, control & Monitoring Circuitry at UPS system level.

Note: 1. Only nationally accredited lab approved isolation devices which do not produce spark while isolating or connecting the battery to Rectifier output and inverter input manually, shall be used. The contactor shall not be used for this purpose.

2. The testing authority shall ensure that the lower rating MCBs/ contactors/ Circuit-Breakers/ fuses are not paralleled to handle the higher current and only single pole devices are used.

1.1.3.4 The rating of VR unit, wherever required shall be as per the rating of UPS system. Static Transfer switch and Manual Transfer Switch shall be 120% of the rating of UPS system.

1.1.3.5 Battery capacity will depend on back-up requirements. It shall be calculated in accordance with the guidelines given in Annexure-3. The VRLA battery shall be in compliance of the GR No. TEC 67040:2019 ~~TEC/GR/TX/BAT-02/03.DEC.2013~~. The Li-ion battery shall be in compliance of the GR No. TEC 67030:2024~~TEC/GR/TX/LIB-001/01.MAR-16~~.

1.1.4 UPS System configurations

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The following UPS System configurations are proposed:

(i) Unitary UPS Systems

Category No.	Type of System	Ratings					
1	Single Phase	**System (Ultimate)**	**Basic Inverter**	**Basic rectifier**	**Static Transfer Switch**	**Manual Transfer Switch**	**Battery Capacity**
1a	Single Phase	0.5KVA	0.5KVA	*Inv + battery requirement	0.6KVA	0.6KVA	As per back-up
1b	Single Phase	1KVA	1KVA	-do-	1.2KVA	1.2KVA	-do-
1c	Single Phase	2KVA	2KVA	-do-	2.4KVA	2.4KVA	-do-
1d	**Single Phase**	3KVA	3KVA	-do-	3.6KVA	3.6KVA	-do-
		5KVA	**5KVA**	**-do-**	**6KVA**	**6KVA**	**-do-**

(ii) Modular UPS Systems

Category No.	Type of System	Ratings					
		System Configuration **(N+1)	**Basic UPS**	**Basic Rectifier**	**Static Transfer Switch**	**Manual Transfer Switch**	**Battery Capacity**
3	Single Phase	4 KVA (4+1)	1KVA	*Inv + battery requirement	4.8KVA	4.8KVA	As per back-up
3a	Single phase	4KVA (4+1)	1KVA	-do-	4.8KVA	4.8KVA	As per back-up
3b	Single Phase	8 KVA (4+1)	2 KVA	-do-	9.6KVA	9.6KVA	As per backup
3c	Single Phase	8 KVA (4+1)	2 KVA	-do-	9.6 KVA	9.6KVA	As per backup
3d	Single Phase	12 KVA (4+1)	3KVA	-do-	14.4KVA	14.4KVA	As per back-up
3e	Single	12KVA	3KVA	-do-	14.4KVA	14.4KVA	As per back-

	phase	(4+1)					up
3f	Single Phase	12 KVA (3+1)	4 KVA	-do-	14.4 KVA	14.4KVA	As per backup
3g	Single Phase	12 KVA (3+1)	4 KVA	-do-	14.4 KVA	14.4KVA	As per backup
4	Three Phase	24KVA (4+1)	6KVA	-do-	28.8KVA	28.8KVA	As per backup
4a	Three Phase	24KVA (4+1)	6KVA	-do-	28.8KVA	28.8KVA	As per backup
4b	Three Phase	40KVA (4+1)	10KVA	-do-	48KVA	48 KVA	As per backup
4c	Three Phase	40KVA (4+1)	10KVA	-do-	48KVA	48 KVA	As per backup
4d	Three Phase	4N KVA (4+1)	NKVA	-do-	(1.2*4*N) KVA	(1.2*4*N) KVA	As per backup
4e	Three Phase	4N KVA (4+1)	NKVA	-do-	(1.2*4*N) KVA	(1.2*4*N) KVA	As per backup

The rating of **rectifier** shall be sufficient to take care of 1.1 times the Inverter DC load and battery load as per back-up and rate of charging.

** In this configuration **N** is the **desired rating of Basic UPS units** for load **as decided by purchaser,** and 1 is redundant.

Note: -

1 Type approval shall be accorded for ultimate capacity only. The version of the microprocessor soft-ware shall be indicated in TAC along with the model number and category.

2. Tendering authority may choose any of the above categories (ultimate capacity) as per load requirements. Load shall include, the equipment load and any other load. While choosing the UPS it may also be ensured that the redundancy requirement has been taken care of.

3. In all the above configurations, there shall be a provision of automatic load transfer to stand-by power supply within 5 mili seconds, in the event of failure of the inverter unit of the UPS due to any reason. Standby power in this case may be a VR, AC commercial mains or standby Engine alternator. Transfer of load back to inverter

unit/ system shall also be automatic but it shall take place, only after the inverter output has stabilised and is within the specified limits. Transfer time in this case shall also be within 5 milli seconds. Manual transfer switch is for the transfer of load from inverter to Stand by power and back to Inverter unit, manually.

4. When VR is used the provision shall be made to transfer the load to standby mains/DG Set in the event of the failure of VR.

1.1.5 **UPS system compatibility with Engine Alternator:** The UPS system (including Rectifiers, and DSCA, Inverters), shall be suitable for operation from A.C mains or a DG set (of capacity 1.25 times AC load of UPS System).

~~=== End of Chapter 1 ===~~

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~~CHAPTER 2~~

2.0 TECHNICAL REQUIREMENT~~Sechnical Requirements~~

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2.1 Environmental Requirements: The whole UPS unit shall operate at specified rating & in conditions conforming to each system shall be capable of operating in conditions conforming to TEC 14016:2010~~to QM333 category B2 of SD:QM-333, Issue: March 2010 of TEC~~. This requirement shall be verified by conducting the tests on Static Transfer switch, VR, Manual Transfer Switch. It shall also comply with vibration requirements of Test No. 6 of TEC 14016:2010~~QM-333~~. The UPS unit shall also be capable of working at an altitude in excess of 3000 metres in compliance of TEC 14016:2010~~as per Test No. 7 of QM-333~~. The system shall also be capable of working in the saline atmosphere of the coastal areas in compliance of ~~Test No. 9 of QM 333~~ TEC 14016:2010. ~~"~~The Manufacturer/supplier shall submit a test result from accredited/TEC designated Lab in respect of compliance to these requirements.~~"~~

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2.2 Burn-in Test: The complete UPS unit with a Static Transfer Switch, Manual Transfer Switch & VR (if used) shall be capable of withstanding a burn-in test for 72 hours at an ambient temperature of 50°C, when the equipment is working at full rated load. This test may be performed in a temperature controlled room with free air flow. The ambient temperature shall be measured at a distance of one foot from the equipment under test. The necessary test set-up for the purpose shall be provided by the manufacturer. The temperature rise of heat dissipating components above the ambient, measured directly or at the heat sink for first 8 hours of the above test shall not be more than:

Transformers & Chokes: 70°C for B grade of Insulation. For higher grade of insulation, higher temperature rise is permissible subject to the following conditions :

It is at least 20°C below the permissible limit for the grade of insulation

ii) The temperature rise shall be at least 30°C below the curie temperature of the magnetic material.

iii) This temperature shall neither affect the other components nor shall lead to fire hazard.

Semiconductors devices: 60°Celsius or as per component specification.

2.3 **Insulation Resistance Test :** The insulation resistance of the complete UPS unit, VR, Static Transfer Switch, Manual Switch) when tested with a 500V DC megger shall not be less than 5meg ohms for the following conditions :

- Interconnected Input terminals and Earth
- Interconnected Out put terminals and Earth
- Interconnected Input terminals and Interconnected output terminals.

2.4 **Voltage Proof Test :** No breakdown or abnormal temperature rise shall occur, when-after EMI/RFI capacitors and MOVs/Tranzorbs etc. removed from the circuit .

Test to be Conducted as per module/ unit-wise

Rectifier

1. 1.5KVAC between Earth and AC input
2. 650V DC between DC output and Earth
3. 2KVAC between AC input and DC output

Inverter

1. 650V DC between input and earth
2. 1.5KVAC between AC Output and Earth
3. 2kVAC between DC Input and AC output

Alternatively, without removing EMI/RFI capacitors, the lightning protection circuitry and Tranzorbs etc., but with EMI/RFI discharge resistors removed:

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Rectifier

1. 2150V DC between Earth and AC input
2. 650V DC between DC output and earth
3. 2150DC between AC input and DC output

Inverter

1. 650V DC between input and earth
2. 2150V DC between AC Output and earth
3. 2150V DC between DC input and AC output

This DC voltage test is in accordance with UL950 & IEC 950 Standards.

~~- a test voltage of 2000V/50Hz is applied for one minute between :~~

~~- earth and interconnected output terminals.~~

~~- earth and interconnected input terminals.~~

~~- input and output terminals.~~

~~Alternatively without removing EMI/RFI capacitors, the lightning protection circuitry and Tranzorbs etc., but with EMI/RFI discharge resistors removed :~~

~~a) A 2150V DC can be applied for one minute between shorted AC output & DC input terminals.~~

~~b) 650V DC can be applied for one minute between shorted AC Input terminals, shorted input~~

~~DC terminals, shorted DC output terminals & earth.~~

~~This DC voltage test is in accordance with UL950 & IEC 950 Standards.~~

Note: This Test is to be conducted on each of the basic units of the

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system.

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2.5 **Operating Noise:** The fully equipped UPS system at full load shall not contribute more than 15 dB (weighted) to the ambient noise level taken as 45dBA. It shall be measured at a distance of 1 metre from the unit and 1.25m above the floor level in the Acoustic Range. The correction factor for Total Noise when the ambient noise level is more than 45dBA shall be as given below:

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AMBIENT NOISE	CORRECTION FACTOR	AMBIENT NOISE	CORRECTION FACTOR	AMBIENT NOISE	CORRECTION FACTOR	AMBIENT NOISE	CORRECTION FACTOR
45dBA	0 dB	49dBA	0.86dB	53dBA	2.07dB	57Dba	3.69dB
46dBA	0.18dB	50dBA	1.12dB	54dBA	2.47dB	58dBA	4.17dB
47dBA	0.39dB	51dBA	1.41dB	55dBA	2.82dB	59dBA	4.68dB
48dBA	0.61dB	52dBA	1.73dB	56dBA	3.25dB	60dBA	5.21dB

Note: The correction Factor shall be added to the limit of 60dBA to arrive at the limit when the ambient is greater than 45dBA.

2.6 **Lightening and surge protection:**

~~UPS with > 4KVA(equal or more than) rating shall have protection against the lightening and high voltage surges as per GR of Lightening and Surge Protection of Telecom Site vide GR No.TEC/GR/FA/LSP-001/02/June 2017 or latest version.~~

Stage-1 Lightning and Surge Protection is not in the scope of system.

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Stage 2 Lightning and Surge Protection for AC input of Site against the lightning and high voltage surges shall be as per GR of lightning and Surge Protection of Site (GR No. TEC 66130:2024). Purchaser may decide to buy Stage -1 & 2 protection devices for equipment safety against lightning and surges.

~~**2.6.2** Stage – 2 Surge protection device shall be provided inside the HUPS.~~

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~~UPS with > 4KVA(equal or more than) rating shall have protection against the lightening and high voltage surges as per GR of Lightening and Surge Protection of Telecom Site vide GR No. TEC/GR/FA/LSP-001/02/June~~

~~2017 or latest version. The requirement of LSP devices for UPS with <4KVA(less than) rating will be decided by purchaser.~~

2.7 **Monitoring Alarms and Indicating Lamps :** Visual indications/display such as LEDs, LCDs or a combination of both shall be provided on DSCA of the UPS unit to indicate:

2.7.1 **Functional Indications :** The following functional indications shall be provided on Rectifier, Inverter & DSCA:

a) Mains available

b) Rectifier of the Unit on : Auto Float (Battery Charged)

: Auto Charge (Battery Charging)

c) Load on : UPS

: VR (if used)

: Standby

2.7.2 **Alarm Indications: Following parameter should be monitored individually or in combination of:**

(i) For UPS with ≥4KVA(equal or more) rating:

a) AC Input out of range.

b) DC Over Voltage.

c) DC Under Voltage.

d) AC Mains " ON" and Battery Discharging.

e) Temp. Compensation fail.

f) Battery low/Battery fail or No battery.

g) Rectifier over load.

h) Rectifier unit Fail (Rectifier unit fail due to any reason).

i) Inverter unit fail (inverter fail due to any reason)

j) Lightning Protection stage II device fail.

k) UPS Overload.

l) UPS Fail.

m) AC Input Frequency out of range.

n) UPS fan fail (Due to any reason)

(ii) **For UPS with <4KVA (less) rating:**

a) AC Input out of range.

b) AC Mains " ON" and Battery Discharging.

c) Battery low/Battery fail or No battery.

d) UPS Fail.

2.7.3 All the alarms shall be available even in the absence of AC input and output. Also all alarm circuits shall be provided with suitable delay to ensure that they do not operate to transients.

2.7.4 All the alarms and protection limits shall be settable through a menu driven program.

2.7.5 All the protections/alarms shall be within a tolerance of 1% in case of DC voltage and current. For AC voltage it shall be +/-5V.

2.7.6 Every Alarm condition shall be accompanied with an Audio alarm, with a non locking type key or push button, audio cut-off facility. The visual alarm indication will, however, continue to glow to attract the attention of maintenance staff and shall extinguish by pressing the alarm reset key, only after the alarm condition is cleared by rectifying the fault or repair/replacement of the faulty unit.

2.7.7 Potential Free Contacts two (one for alarm and one redundant) shall be provided for extension of alarms to Centralised Display.

2.8 **Remote control and monitoring:** ~~UPS with > 4KVA (equal or more than) rating shall have remote control and monitoring feature. However in case of UPS with <4KVA(less than) rating, this feature will be decided by purchaser. The UPS system may be RS-232/ RS-485/ Ethernet(SNMP protocol) /USB compatible. It shall provide for the monitoring, alarm and control of the UPS system and its associated batteries from a remote~~

~~site. The exchange of information and protocol format between the UPS system and remote site shall be as given in the Annexure -4.~~

DSCA controller shall having the necessary features to exchange information between UPS system & Remote Site monitoring equipment through SNMP and RS485 Modbus Communication as specified at Section 1.3 of TEC GR 66110: 2024. OEM / Manufacturer of UPS shall ensure that UPS shall be interoperable with the equipments / products that need to be connected with the UPS system. Further, in case of any problems / issues in interoperability, the concerned manufacturer /OEM shall extend support / help in solving the problems / issues. List of alarms and parameters to be extended over (a) SNMP for remote monitoring (b) RS485/CAN/MODBUS for internal communication shall be as per TEC GR 66110 : 2024 in addition to specifically mentioned in this document. Purchaser may specify the additional alarms to be extended for remote monitoring over and above the alarms listed in TEC GR 66110:2024.

2.9 Rectifier

2.9.1 Rectifier shall employ Switch Mode Power Supply (SMPS) Techniques using switching frequencies of 20KHz and above.

2.9.2 Rectifier is intended to be used in Auto Float-cum-Charge mode as a regulated DC Power Source.

2.9.3 **Starting of UPS without battery supply:** There shall be provision to start the UPS unit without battery supply.

2.9.4 **UPS unit compatibility with Engine alternator:** The UPS unit shall be suitable for operation from A.C mains or a DG set (of capacity 1.25 times AC load of **UPS**). UPS should not create any distortion in the generator output voltage.

2.9.5 **AC input Supply:** Rectifier unit (0.5KVA, 1KVA, 2 KVA, 3 KVA, 4KVA) of the UPS system rating up to 12KVA shall operate on single phase AC input while Rectifier unit of UPS Systems of rating higher than 12KVA shall operate only on 3 phase/ 4wire AC input. The nominal input frequency is 50Hz which may vary from 48-52 Hz. The input voltage range shall be as given below:

a) Single Phase (Nominal 230V) : ~~230~~210V~~-15%~~ to ~~2~~300V~~+10%~~

b) Three Phase/4 wire (Nominal 400V) : 320V to 480V

2.9.5.1 For three phase/4 wire Rectifier unit only delta connection are permitted. Rectifier units shall work satisfactorily for unbalance of +/- 10% of nominal input. Phase current unbalance under all working conditions, mentioned in this document, shall not be more than 10%. Neutral phase current shall not exceed 100mA under all specified input, output and load conditions.

Note: Single phase and Three phase UPS system shall be configured by single phase and three phase UPS unit only at both UPS unit as well as rack level.

2.9.6 **DC output Characteristics (Auto Float/Charge Operation):** The Rectifier unit shall be capable of operating in "Auto Float-cum- Charge" mode. It shall be programmed to operate as a float rectifier or a charger depending on the charge condition of the battery sets being sensed by DSCA.

2.9.6.1 **Auto Float Mode:** The float voltage of each Rectifier unit shall be continuously adjustable & pre-settable at any value in the range of (number of cells * 2.1) & (number of cells * 2.33) Volts from DSCA. There shall also be a provision so that DSCA may over ride the values set by individual unit. The prescribed float voltage setting for VRLA battery are: (number of cells * 2.25 Volts).

2.9.6.2 **Auto Charge voltage:** In Auto charge mode Rectifier unit shall supply battery & equipment current at a voltage 2.3V/cell (This shall be settable between 2.1V/cell and 2.4V/cell) till the battery terminal voltage reaches the this value. It shall change over to constant voltage mode when the battery terminal voltage has reached this set charge voltage.

2.9.6.3 In both Auto Float & Auto Charge Mode, the DC output voltage shall be maintained within +/-1% of the half load pre-set voltage in the range 25% load to full load when measured at the output terminals over the full specified input range.

2.9.7 **Efficiency**: The efficiency of the UPS unit while working on Rectifier and Inverter shall be as given below :

	Units working on Single phase AC	Units working on Three phase AC
i) At nominal~~all~~ AC input, output and full rated load other specifier.~~,~~	better than 90%	better than 95%
ii) At all AC input conditions,~~Specified DC range : - (1.85V to 2.3V/cell)~~ and load between ~~2~~50% to 100%	better than 85~~90~~%	better than 92%

2.9.8 **Input Power Factor :** The true input power factor at nominal input, output, and full rated load shall be better than 0.98. In any other working condition and load between 50% to 100% shall be better than 0.95. Only active power factor correction shall be employed for the purpose. ~~The true input Power Factor at all input, output voltage and load between 25 to 100% shall be better than 0.95. Active Power factor correction only shall be employed for the purpose.~~

2.9.9 A resistor shall be provided to discharge the capacitors after the Rectifier unit have stopped operation and output is isolated.

2.9.10 **Electrical Noise:** The Rectifier units shall be provided with suitable filter on

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the output side.

2.9.11 **The Peak-to-Peak Ripple:** Battery charging circuit ripple Voltage shall not exceed 300mV (without battery connected) at rated capacity & Nominal Input Voltage.~~Peak to peak ripple imposed on DC voltage, without battery connected, but full load Inverter being fed by it. shall not exceed 1% of the DC voltage at the Switching Frequency measured by an Oscilloscope of 50/60 MHz band-width (Typical).~~

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2.9.12 **Transient Response :**

2.9.12.1 **Soft Start Feature:** Slow start circuitry shall be employed such that the input current and input voltage of Rectifier unit reach their nominal value within 10 seconds for UPS less than 4KVA rating or within 60 seconds for UPS >4KVA(equal or more) rating.. The maximum instantaneous current during start up shall not exceed the peak value of the Rectifier input current at full load and the lowest specified input voltage.

2.9.12.2 **Voltage overshoot/Undershoot:** The requirements of this clause shall be achieved without a battery connected to the output of Rectifier unit. The Rectifier unit shall be designed to minimise output voltage Overshoot/ Undershoot such that when they are switched on the DC output voltage shall be limited to +/-5% of the set voltage & return to their steady state within 20 ms for any load of 25% to 100%.

2.9.12.3 The DC output voltage overshoot for a step change in AC mains from specified lowest to highest and vice-versa shall not cause shut- down of Rectifier unit and the voltage overshoot shall be limited to +/- 5% of its set voltage and return to steady state within 20 ms.

2.9.12.4 The Rectifier unit shall be designed such that a step load change of 25 to 100% shall not result in DC output voltage Overshoot/ Undershoot of not more than 5% and return to steady state value within 10 ms without

resulting the tripping of unit.

2.9.13 Total Harmonic Distortion :

2.9.13.1 Total Voltage Harmonic Distortion: The Total line harmonic voltage distortion shall not be more than 5~~10~~% under all working condition. ~~in conformity with CIGRE's limits.~~

2.9.13.2 Total Current Harmonic Distortion: The total current harmonic distortion contributed by the UPS unit at the input shall not exceed 5% for input voltage range 100 to 300V ~~nominal 230 volts AC with voltage variation of -15% to +10%~~ for single phase units and 320V to 480V for three phase systems & load 25 to 100% of the rated capacity.

2.9.14 Current limiting (Voltage Droop) : The Current limiting (Voltage Droop) shall be provided for Float/Charge operation(for the operation of the rectifier). The float/charge current limiting shall be continuously adjustable between 50 to 100% of rated output current for output voltage range of 42vdc to 56 vdc~~1.85V/cell to 2.33V/cell~~. For test purposes upper limit of 100% + 5% and lower limit of 50% - 5% shall be acceptable. The float and charge current limit adjustment shall be provided through a menu driven program on DSCA.

1.2.9.15 Battery Monitoring:

2.9.15.1 **Battery Under Voltage Isolation:** There shall be a provision for Automatic Isolation/ reconnection of battery from the load. The Tendering Authority shall specify the load and battery capacity. The DC contactors used for the purpose shall be of single pole only. The operate and release voltages for the above conditions shall be as follows :

Cut-off : 1.85V/cell. Shall be settable between 1.75V & 1.9V/cell)

Reconnect: When the Rectifier voltage has built-up fully. (Shall be settable between 2.15V to 2.35V/cell)

2.9.15.2 **Battery Health Monitoring In Auto Mode:** To keep the battery in healthy state the battery condition shall be continuously monitored. On restoration of AC mains after an interruption, depending on the battery condition (depth of discharge) sensed, the system shall change over to Auto Charge mode to charge the battery at higher voltage of 2.3V/cell till the battery is fully recouped.

2.9.15.3 **Battery Health Check:** There shall be a provision of monitoring the voltage, current, trickle current and temperature (programmable) of the batteries associated with the UPS System at a set periodicity. There shall also be a provision of monitoring of each cells of the battery bank for voltage and temperature. This feature shall be provided for UPS $\geq$ 4KVA rating. However in case of UPS with less than 4KVA, Purchaser may ask for this feature, if required.

If required by Purchaser, The provision for conducting a partial discharge (about 20%) test, of a pre-determined duration and frequency, shall be made available in the UPS system (Frequency and duration of partial discharge test shall be programmable). During this test, the current and voltage of the battery as well as each individual cell shall be recorded. It shall also record the temperature of each cell.

The provision of partial test discharge shall be implemented in such a

way that at a time only one battery is put to discharge, so as to ensure that necessary battery reserve is available in case of power failure during or immediately after the test discharge. Provision shall be made for observing the state of charge of battery before commencing this test. In case the battery is not fully charged this test may be deferred till the battery is fully recouped.

Any abnormality observed during above observations shall be highlighted by initiating an alarm. All the above information shall be made available to the remote site through RS 485(Refer Annexure 4 for specified protocol).

Note: The Battery Health Check feature shall be optional. However, type approval shall only be accorded with the above provision. The manufacturer will give the list of hardware equipment required for the purpose in the instruction and maintenance manual. User shall clearly indicate the requirement of battery health check feature while ordering the power plant. The manufacturer shall also undertake that the above provision will become fully function by adding the hard ware (indicated in the instruction manual) for the purpose.

2.9.15.4 **Battery path Current Limiting Circuit :** In Auto Mode to ensure the availability of required UPS System load and safety of the battery, the current in each battery path shall be settable as per the battery capacity so that the battery path current is kept at 10% to 20% of battery AH capacity as per the tender requirements. Tendering Authority will give the capacity of the battery to be used for this purpose and the rate of charge proposed. For the type approval the manufacturer shall demonstrate the facility and undertake to make provision as per order.

2.9.15.5 **Temperature Compensation for Battery:** There shall be provision for monitoring the temperature of battery and consequent arrangement for Automatic temperature compensation of the Rectifier output voltage to match the battery temperature dependent charge characteristics. Details are mention in GR No. TEC 67040:2019~~TEC/GR/TX/BAT-02/03.DEC.2013~~ (for VRLA battery) and GR No. TEC 67030:2024~~TEC/GR/TX/LIB-~~

~~001/01.MAR-16~~ (for lithium-ion battery). This feature shall be provided for UPS ≥ 4KVA rating. However in case of UPS with less than 4KVA, Purchaser may ask for this requirement depending upon criticality of operation

2.9.16 Protections:

2.9.16.1 AC Input: There shall be an automatic cut-off of the mains AC input supply of the Rectifier unit whenever the input voltage is beyond the specified operating range (nominal 230 volts AC with voltage range 100V to 300V~~variation of -15% to +10%~~ for single phase and 320V to 480V for three phase systems). Suitable alarm indication shall also be provided. The unit shall resume normal working automatically when the input is restored within the working limits. Hysteresis within specified working limits shall prevent shutting down of the Rectifier unit. A tolerance of +/-5V is acceptable for protection & alarm operation. Reconnection shall occur at a voltage, 10 V lower than the set voltage for high isolation limit and 10V higher than the lower set limit to avoid hunting. The circuitry used for sensing the voltage for operation of isolation/ reconnection device shall be able to withstand a voltage 15% higher than the specified extreme limit of isolation.

2.9.16.2 In case of the unit working on three phase input supply, it shall be isolated (if required for the protection of the unit) in the event of unbalance beyond 10% and shall restore when the input is within limits.

2.9.16.3 **D. C. Over voltage :**

2.9.16.3.1 Rectifier unit shall be fitted with an internal over- voltage protection circuit.

2.9.16.3.2 In case output DC voltage exceeds 2.33V/cell(for VRLA battery) and 56V (for Li-Ion battery), the over voltage protection circuit shall operate & shut-off the faulty unit. A tolerance of +/- 1% is permitted in this case. Restoration of the Rectifier shall be through a reset switch/push button.

2.9.16.4 Shutting-off of faulty UPS unit shall not affect the operation of other UPS units (if used).

2.9.16.5 Operation of over-voltage shut down shall be suitably indicated on the unit and also extended to DSCA unit.

2.9.16.6 The circuit design shall ensure protection against the discharge of the Battery through the Rectifier unit under any condition.

2.9.16.7 The over voltage protection circuit failure shall not cause any safety hazard.

2.9.16.8 **Fuse/Circuit Breakers :** Fuses or circuit breakers shall be provided for each Rectifier unit as follows :

1. Live AC input line (MCB).
2. Negative D.C output (handled enclosed ultra-fast fuse assembly or DC circuit breaker) .
3. Against failure of Control sensing circuit.

2.9.16.9 All fuses/circuit breaker used shall be suitably fault rated.

2.9.16.10 **Over Load/Short Circuit:** Each unit of UPS shall be Protected for Over load/Short circuit.

2.10 **Inverter**

2.10.1 The inverter shall be based on Switch Mode Power Supply (SMPS) techniques using switching frequencies of 20KHz and above.

2.10.2 **Inverter Input Operating Range :** i) Input Voltage:48vdc in case of VRLA battery, 54vdc~~.~~ in LI-ion battery

The Inverter of the UPS unit shall operate without any degradation between the voltage range between

ii) Input Voltage(Range):~~54vdc in LI-ion battery~~

~~VRLA battery: (~~2.33 X Number of cells~~)~~ ~~in the battery~~ in case of VRLA battery and ~~1.75 X number of the cell in~~ and ~~LI-Ion~~(42vdc to 57vdc) in the case of in LI-ion battery ~~the~~ battery.

2.10.3 **Input Switch over :** The switch-over to battery and vice versa shall not cause any interruption to the inverter output AC power.

2.10.4 **Inverter Output and Standby mains Isolation:** The isolations between the inverter output and the AC/Standby commercial mains shall be provided by means of any proven solid state arrangement. Isolation device shall be approved by any accredited laboratory.

2.10.5 **Load of Transfer:** Provision of automatic transfer of load to stand by power (AC mains, DG Set or VR) through a Static Transfer Switch (provided for isolation between inverter system output and Stand by power, within 10~~5~~ mili seconds, in the event, the inverter/s fail/s to take load due to any reason. Transfer of load back to inverter unit/ system shall also be automatic but it shall take place, only after the inverter output has stabilised and is within the specified limits. Transfer time in this case shall

also be within 105 mili seconds. The rating of Static Transfer Switch shall be 1.2 times the rating of UPS System.

2.10.5.1 The transfer switch used for the purpose shall be capable of transferring load at PF between 0.7 lead to 0.7 lag.

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2.10.5.2 The Static Transfer switch shall not add any distortion to the output.

2.10.5.3 Output of Inverter in bypass mode should be 176Vde to 265 vdc for single phase and 320V to 460V. If bypass voltage is beyond the defined range, it shall disconnect the load from the bypass supply.

2.10.6 **Parallel operation :** In Modular configuration inverter unit of each UPS (similar make, type and rating) shall work together in parallel load sharing arrangement in synchronous mode of operation for all specified input and output conditions.

2.10.6.1 The current sharing shall be within +/- 10% of the average current per inverters individual capacity of each inverter in the system (mounted in the same or different racks) when loaded between 50 to 100% of its rated capacity for all working conditions.

2.10.7 **Protections :** Adequate protection shall be provided for :

2.10.7.1 **DC Reverse Polarity:** There shall not be any damage to the components of the inverter battery and load in case the DC polarity is reversed & the unit shall start its normal functioning when the correct polarity is restored.

2.10.7.2 **DC Under Voltage:** In case the DC –voltage to the inverter due to any reason goes below the set value, it shall trip at the input. This voltage shall be settable between 1.75V/cell & –1.9V/cell, with the normal setting at 1.85V/cell in case of VRLA battery and between 42V to 52V in case of Li-Ion battery. The inverter shall start automatically when the input is restored to a value higher than 2V/cell in case of VRLA battery and 53vdc in case of Li-Ion battery.

2.10.7.3 **DC Over Voltage:** The inverter shall trip when the input voltage due to any reason goes beyond the defined range~~2.5V/cell~~. The inverter shall start automatically when the input is restored to a value lower than 2.3V/cell in case of VRLA battery and 55vdc in case of Li-Ion battery.

2.10.7.4 **Output Voltage High:** The Inverter should automatically get switched off or disconnected in the event of the output voltage exceeding 10% over the set output voltage for more than 1 second.

2.10.7.5 **Output Voltage Low:** Inverter shall trip in the event the output voltage due to any reason goes below 10% of the set output voltage for more than 1 second.

2.10.7.6 **Output Frequency Out of Range:** The inverter shall trip, if the output frequency goes beyond +/- 2Hz of the nominal 50 Hz.

2.10.7.7 **Overload**: The inverter shall be capable of taking 110% of its full rated load for one hour without any damage or overheating of the components. While taking 110% overload, the output voltage shall remain within the specified limits. Inverter shall also be capable of withstanding an overload of 150% for one minute. The over load condition shall also create inverter over load alarm. If the over load of 150% persists for more than 1minute the inverter shall trip creating inverter fail alarm. In case of short circuit or overload of 150%, the inverter shall shutdown instantly, creating " inverter fail" alarm at DSCA. In all the above cases it shall restore only

when the load is within specified limits. Over load at system level shall also create " system over load alarm " . The UPS system shall be capable of handling Crest Factor of 3.5 times the steady state for period of 40ms (two cycles).

2.10.7.8 There shall be necessary protection circuit against surges & transients.

2.10.8 **DC Voltage:** The DC voltages shall be as per manufacturers design. All the protections for manual safety shall be provided as per the latest IEC UL standards for the purpose. The battery shall remain floated across the DC Rectifier unit output and Inverter input.

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2.10.8.1 The positive terminal of the input shall be taken as earthed.

2.10.9 **Output :**The inverter shall be capable of delivering a continuous uninterrupted single phase sine wave full output power as per its rating as follows:

i) 230V/50 Hz AC in case of 0.5KVA, 1KVA, 2KVA, 3 KVA and 4 KVA , 5KVA, 7.5 KVA, 10KVA UPS unit and

ii) 400V/50 Hz three phase sine-wave full output power as per its rating and also in case of higher ratings,

The full rated output power shall be achievable for the rated power factor of 0.7 in both the cases of Single Phase or Three Phase. On energisation, the output shall build up gradually within 5 seconds.

2.10.9.1 The output of the inverter shall be continuously settable at any value between 210 to 230V in case of single phase unit and 390V to 420V in case of three phase inverter units. It shall be maintained within +/-2% of the set value for :

a) Input voltage variations in the range as specified in clause above.
b) Load current variations from Zero to 100% (full load).
c) Load power factor variations from 0.7 lagging to 0.7 leading.

2.10.9.2 The Output Voltage shall be free of modulation and hunting.

2.10.9.3 To get the stabilised frequency the crystal oscillators shall only be used. The frequency of the output voltage shall remain within 50 +/- 0.5Hz for all specified conditions of the GR.

2.10.10 **Power Factor**: The Power Factor with resistive load and at nominal input shall be near unity without the use of Power Factor improvement capacitors.

2.10.11 **Transient Response** : The transient overshoot shall not exceed 10% with battery floated under the following conditions provided it gets restored within regulating range within 6~~10~~0ms :

i) Load Switch ON
ii) Step change of input voltage specified in the GR.
iii) Load change from 100% to 10%. and vice versa

Note : For test purposes, transient overshoot at the output can be up to 30% when the battery not floated at the input, provided it is restored within the limit of 10% under two cycles (40 ms) and regulating range within 6~~10~~0 ms.

2.10.12 **Inrush Current**: It shall be possible to start the unit on no load or any load up to full load. Maximum instantaneous current during start-up shall not exceed the peak value of inverter input current at full load for the lowest input voltage specified.

2.10.13 Total Harmonic Distortion:

2.10.13.1 Total Voltage Harmonic Distortion: The Total line harmonic voltage distortion shall not be more than 3% for resistive load and shall not be more than 5% for non-linear load~~under all working conditions~~.

2.10.14 The inverter shall not have any tendency to hunt under any input and output conditions.

2.11 Voltage Regulator (VR)

2.11.1 The VR provided (if asked for bypassed) shall be capable of providing regulated AC to the load. VR for single phase UPS system shall be single phase and three phase UPS systems shall be three phase.

2.11.2 The VR shall be natural air cooled & shall be in conformity of ensuing clauses of the GR.

2.11.3 All non-current carrying metal parts shall be bonded together and adequately earthed in accordance with standard practice for Telecom Equipment.

2.11.4 The transformers and inductors used shall be vacuum impregnated & shall be of natural air cooled type & conform to IS 2026 and IS 6297. The gauge of wire shall be such that the current density does not exceed 1.85A/Sq mm.

2.11.5 Unit shall be designed for continuous operation at any load from no load to full load.

2.11.6 The output voltage shall be maintained within 2% of the set nominal output voltage in case of single phase unit and three phase systems at all loads from 25 to 100%, and the rated power factor of 0.7. Output voltage shall be settable between 210V and 230V in case of single phase~~units~~ and 390V to 410 in case of the 3 phase systems.

2.11.7 The regulator shall work satisfactorily within supply frequency of 50 Hz +/- 2%. For every 1% variation in frequency, up to 1.5% change in output voltage is permissible.

2.11.8 The VR shall work satisfactorily for input range 100Vac to 300vac~~230C-15%/+10%~~ at 50 Hz in case of single phase units & 320Vac to 480Vac at 50 Hz in case of three phase units respectively without degradation in its performance.

2.11.9 For sudden variation in AC input voltage over the specified range or load from 25% to 100% of the rated load the output voltage to settle within +/- 5% of the set value within 50 ms provided it is restored to specified limits within 250 ms.

1.2.11.10 The full load efficiency of the VR shall not be less than 90% for input voltage 230V and an output voltage of 230V AC in case of single phase and 400V input and output in case of three phase and load power factor 0.7 lead to 0.7 lag. It shall also not be less than 85% for other input and Load between 25% to 100% and power factor between 0.7 lagging and 0.7 leading.

2.11.11 The Total line harmonic voltage distortion at the output shall not be more than 5% for input, output and load conditions.

2.11.12 The total current harmonic distortion introduced at the input i.e. mains shall not be more than **5%** for loads 25% to 100% under any working conditions as specified above.

2.11.13 The Unit shall be capable of handling any load from 0.7 lag to 0.7 lead without degradation in THD as specified in clause. The Voltage shall remain within +/-5% of the set value for the change in PF from unity to 0.7 lag to 0.7 lead.

2.11.14 Unit shall be protected against over load & short circuit & shall start its normal operation without any degradation in its performance, when overload or short circuit is removed.

~~=== End of Chapter 2 ===~~

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~~CHAPTER 3~~

~~General Requirements~~

3.0 GENERAL REQUIREMENTS~~eneral Requirements~~

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3.1 Constructional Features: The rack structure shall be made up of rigid and self-supporting structure of steel profiles. It shall be free of sharp edges or corners. The sides shall have suitable ventilating arrangements. The front door (if provided) & rear door shall be hinged type. Rear door & front door (if provided) shall have proper ventilation arrangement. Use of fans on the sides for forced ventilation is precluded as the racks are mounted side-by-side in the field. The gauge of metal sheet for load bearing part shall not be less than 1.5 mm and for rest of the parts shall not be less than 1.2mm. Sheet used in manufacturing Shall be Galvanized (GI – >80gsm) or MS Iron. ~~The gauge of panels shall be 2 mm (minimum) for UPS with > 4KVA rating. For UPS less than 4KVA rating, material/thickness should be as per purchaser requirement but comply with QM 333 standard.~~

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3.1.1 The structural strength of the rack shall be such as to withstand its ultimate mechanical load (with all the individual units mounted) without any deformity.

3.1.2 The base of rack shall ensure uniform floor loading of not more than 320 kg/Sq. metre. Lifting facilities shall be provided by removable eyebolt located at the top of the rack/unit. The necessary arrangement for fixing the rack/unit on the floor shall also be provided.

3.1.3 The top of the rack shall be fully covered except for ventilation & cable entries. Each air flow vent shall be covered by a grill to prevent the entry of foreign material larger than 5mm.

3.1.4 With doors in position, all the common visual alarms and meters shall be clearly visible. In case of hinged door, meters and alarm indications are permitted on door also. However, the fixtures on the door shall not restrict the movement of door in any way.

3.1.5 The rack shall be designed for easy maintenance & installation. Rack mounting arrangement shall be such as to provide easy access from front, rear and top for Installation and Maintenance.

3.1.6 The rack shall be made standalone with a rigid framework with bottom clearance of 110 mm with a tolerance of +/- 10mm.

3.1.7 In case of Modular system if more than one UPS can be accommodated in a rack there shall be provision of easily mounting to/removing from the front side of the rack. In such case UPS unit shall be designed to slide into the rack on a suitable mechanical arrangement. The associated AC, DC connections, Control, alarms & interface cable connecting the unit shall be connected/disconnected easily without causing any interruption in the supply and damage to load or other working units. The units as per this GR shall not be site specific.

3.1.8 All basic units shall be preferably cooled by natural convection, however forced cooling is permitted, subject to the compliance of the clause 3.1.10.

3.1.9 **Dimensions:** The UPS units shall preferably 19 inch rack configuration. The depth of rack/unit shall not be more than 600 mm from front door (when provided) to rear with door fitted. The width shall not be more than 600 mm(max) and height shall not be more than 2200mm(max).

In case it is not feasible to accommodate the unit in 19 inch rack. **Dimensions shall be as per manufacturer design**. Once Type approved the

dimensions shall not be changed.

3.1.10 **Cooling Arrangements:** Proper thermal engineering of hardware design shall be done by the manufacturer so as to ensure the uninterrupted use of the equipment. Unit/rack (if rack accommodates more than one unit complete with all panels fitted shall preferably be designed to allow cooling by natural convection. The use of fans (complying with the MTBF requirements of this GR) for inducing an accelerated air-flow is permitted at unit level only. However the fans can only be used on the front and rear of the unit. Use of fans on the sides of the unit or rack is not permitted. The manufacturer shall also ensure that the failure of the fan does not cause any fire hazard. The failure of fan shall draw the immediate attention of the maintenance staff. The fan shall be switched off when output of the unit fails due to any reason and shall start automatically on the restoration of their output.

3.1.11 In case of Modular systems, the units shall be removable from the front of the rack only. All AC and DC input, DC and AC output and control, alarm and monitoring cables interconnecting the units and racks shall be easily disconnected by plugs or connectors.

3.1.12 **Distribution, Switching, Control, Alarm and Monitoring (DSCA)**

~~**3.1.12.1** This clause is deleted.~~

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3.1.12.12 The DSCA unit shall be equipped to meet the ultimate system capacity. All AC, DC or control/alarm cabling/wiring shall be pre-wired for the ultimate Rack capacity so that mere plugging-in of UPS unit shall add to the AC power output.

3.1.13 **Accessibility :**

3.1.13.1 All the termination points shall be easily accessible from front, rear or top

with proper labelling and safety compliance .

3.1.13.2 AC and DC terminals shall be separated by physical barriers to ensure safety.

3.1.13.3 All the terminals except AC earth shall be electrically isolated.

3.1.13.4 All the AC, DC control of alarm carline shall be supplier with the power shelf.

3.1.14 **Terminations :** The Input & output AC terminals for single phase systems shall be clearly marked as L and N and for three phase systems as R, Y, B & N and Input DC terminals as +ve & -ve respectively.

3.1.14.1 **AC Termination:**

3.1.14.1.1 AC termination shall be suitably protected against the accidental touch/contact with the working staff for their protection and shall also have clear and prominent "DANGER" Marking.

3.1.14.1.2 Screening shall be provided between AC & DC components to prevent accident.

3.1.14.1.3 All the connections between DSCA unit and individual units shall be through proper rated cables only.

3.1.14.1.4 Fuses & Circuit-breakers provided shall be easily accessible and properly rated.

3.1.14.2 **DC Terminations :**

3.1.14.2.1 All the Connection between the individual units and DSCA unit shall be through a proper rated lugged and cables only.

3.1.14.2.2 All the AC, DC and Control, alarm cabling shall be supplied with the system.

3.1.14.2.3 All conductors shall be properly rated to prevent excessive heating.

3.1.14.2.4 DC output of the Rectifier unit & input to the Inverter unit shall be through proper rated hot plug-in connectors on the unit and lugged termination on the termination end.

3.1.14.5 The DC input through the cable is permitted for UPS systems with the input load up to 200A. For higher input loads, bus-bar only shall be used. However for inter-rack connections, cables of proper rating are permitted.

3.1.15 Mounting of Component & Layout :

3.1.15.1 Component mounting and fixing methods shall be secured.

3.1.15.2 Suitable mechanical structure/arrangement for holding units in position shall be provided so that the unit is held firmly by sliding through it.

3.2 Bus-bars: Tinned bus-bars or tinned High conductivity electrolytic copper strips with purity of 99.90%(min.) as per standard IS~~BIS-613~~ latest issue shall be able to withstand maximum load current. The bus-bars shall be capable of carrying current density of 2 Amp/mm^2 and size shall not be less than 25mmX5mm in any case. Nuts & Bolts shall be of stainless steel along with tinned copper washers. The tinning shall be in compliance of IS 1359 : 1992 & its thickness shall be 10 μm(minimum).

3.3 Cables & Wiring: All insulated conductors except those within the confines of a printed circuit board assembly, shall be of the rating enough to withstand the maximum current and voltage during fault and overload. Uninyvin cables and also allowed to use in system. All the wires and cables including uninyvin cables used shall be fire retardant as per IS1554 with amendment 1 (June 94). All the cables & wires used shall

also be Rodent & reptiles repellent.

3.3.1 All wiring shall be neatly secured in position and adequately supported. Where wires pass through any part of metal panel or cover the hole through which they pass shall be suitably bushed.

3.4 **Earthing:** Proper Earth terminal (two in each rack), with effective electrical contact with framework, shall be provided. All metal parts of the components, which do not carry current, shall be bonded thereto. Nominal cross-sectional area of earth continuity conductor (copper only), not contained within the cable, shall be half (minimum) of each current carrying conductor to be protected but in no case it shall be less than 3 mm diameter. Suitable terminals shall be provided for terminating earth conductor. Continuity conductor used for purpose shall only be of copper. Suitable terminals shall be provided for terminating earth conductor. The manufacturer shall clearly specify the earthing requirements for trouble-free performance of the UPS system.

3.5 **Documentation:** Technical literature in English and Hindi with complete layout, detailed block schematic and circuit diagrams of its assemblies with test voltages at different test points of the units shall be provided. A soft copy or QR code as well as a hard copy of the above shall also be provided. All aspects of installation, operation, maintenance, trouble shooting and repair shall be covered in this manual. The manual shall also include the following :

a) Installation, Operation and Maintenance manual part shall include :

i) Safety measures to be observed in handling of the equipment.
ii) Precautions at the time of installation, operation and maintenance.
iii) Required Test Jigs and fixtures.
iv) Procedures for routine maintenance, preventive maintenance, trouble shooting and replacement.

v) Illustration of internal and external mechanical parts.

vi) Complete layout, detailed block schematic and circuit diagrams of its assemblies with test voltages at different test points.

vii) Circuit description and working of UPS System (Inverter, Rectifier, DSCA units, Static Transfer Switch and VR unit) at various stages staring from AC input to Rectifier to the AC output with Block Schematic.

viii) Circuit description & working of DSCA.

ix) A Table giving details of size/dimension of maintenance of cables & Bus-bar used in the design.

x) Earthing Guide lines for the UPS system as per BIS Specification.

xi) Test method for testing each and every parameter of the unit and whole system.

b) Repair manual :

i) List of replaceable parts used with the source of procurement.

ii) Detailed ordering information for all replaceable parts for ordering of spares as and when required.

iii) Procedure with flowchart for trouble shooting and sub-assembly replacement.

iv) Test Instruments, Test fixtures, accessories and tools required for maintenance and repair.

v) Systematic trouble shooting charts (fault tree) for probable faults and their remedial action.

vi) Address and telephone numbers of Maintenance centre.

3.5.1 Hard copy of the documentation shall be prepared using good quality paper with clear and crisp printing. All the drawings in clear printing shall be attached to the hand-book binding. The binding of the manual shall be long lasting and presentable. One set of flow chart drawings necessary for trouble-shooting shall be provided with lamination, with each manual.

3.6 **Quality Requirements**

3.6.1 **Components :** The component parts of the equipment shall be of professional grade of reputed manufacturer to ensure prompt and continuous service and delivery of spare parts. Use of potentiometer is precluded. Switching components used on the AC input side shall be rated at 600V (minimum).

3.6.1.1 **Power Transformers and Chokes :** Power transformers and chokes shall use class B or higher grade of insulation. These shall be wound with copper wire and adequate insulation shall be provided.

3.6.1.2 Fuses or circuit breakers shall be provided wherever appropriate to protect against failure of control/sensing circuit. Fuses shall conform to BIS specification.

3.6.1.3 **Static Transfer Switch:** Static Transfer Switch **approved by any accredited Lab**, capable of handling 120% of the rated system capacity in compliance of Note 3 of clause 1.1.4 and clause 2.10.5.

3.6.1.3.1 **Manual Transfer Switch:** Manual Transfer Switch **approved by any accredited Lab**, capable of handling 120% of the rated system capacity in compliance of Note 3 of clause 1.1.4.

3.6.1.4 **Meters:** There shall be provision on UPS with ≥ 4KVA rating to monitor the followings:

a) AC input voltage to the UPS, AC output voltage, current of the UPS unit.
b) DC current & voltage (rectifier unit, battery & Inverter unit).
c) Frequency input to rectifier unit, output of the inverter." .
d) Output Power of UPS in K Watts or Watts.

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For UPS with less than 4KVA rating to monitor the followings:

a) AC input voltage to the UPS, AC output voltage, output current of the UPS unit.

b) DC current & voltage.

c) Output Power of UPS in K Watts or Watts.

Digital display panel' s resolution should be such that it is clearly and unambiguously readable from a distance of 1 metre. Normally the meters mounted at DSCA display on external meter shall indicate the System voltage and current. The meters with accuracy as given below shall be used :

a. Current : +/- 1.5% of the range or better, shall be able to read full digit for meter range 50A and above & 1 place decimal for lower meter range.

b. Voltage : +/- 1.5% of the range or better with a resolution of One decimal point in case of DC voltmeter and full digit in case of AC voltmeters.

The range for ammeters used shall be capable to read 125% of the maximum current of the unit/system (nearest high available shall be selected). The range of AC voltmeters shall be 0 V to 300 V where voltages are measured between phase and neutral and 0 to 500V where voltages are measured between the phases & that of DC voltmeters shall be as per Inverter input requirements.

c. Shunts : The shunts (75mV) for ammeters, if used, shall have an accuracy class 1.5 & conform to IS :1248 (latest issue). Separate shunt shall be used for each path. Other proven techniques having higher accuracy and resolution are also permitted.

d. Frequency Meter: Frequency Meter of accuracy of +/- 1% & resolution of one place decimal (sufficient to read +/-0.1 Hz) and range 45 Hz to

55 Hz shall be used.

Note: Use of rotary switch for the purpose is precluded.

3.6.1.5 **Component Approval :** The components used in UPS system, shall be certified by accredited National/International Lab and approved by CACT wing. Components shall neither be combustible nor support combustion. NABL approved test reports are also be acceptable as an alternative to approval of CACT wing.

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3.7 **Quality & Workmanship:**

a) The equipment shall be manufactured in accordance with international quality management systems ISO-9001-2015, for which the manufacturer shall be duly accredited. A quality plan describing the quality assurance system followed by the manufacturer would be required to be submitted.

b) The equipment shall be manufactured as per the latest BSNL QA Guidelines indicated in Quality Manuals QM-118(Quality reliability in product design), Manuals QM-202 (Pictorial guidelines for Visual assessment of quality of printed board assemblies (PBA) and discrete terminal assemblies), QM-204 (Guidelines for workmanship standards for repair & modification of printed wiring board assemblies), QM-205 (Guidelines for standard of workmanship for printed boards), QM-206 (Guidelines for standard of workmanship for printed boards assemblies), QM-207 (Guidelines for soft solder and fluxes for Telecom Equipments) and QM 210 (Guidelines for standard of workmanship for surface Mounting Devices).

All wiring shall be neatly secured in position and adequately supported. Metal panel or cover holes through which the wires or cables pass shall be suitably bushed.

c) All materials and workmanship shall be of professional quality to ensure the MTBF requirements.

d) The equipment and components shall not use any material which support combustion.

3.8 **Quality Assurance Tests** : Each of the UPS system supplied against the specific order after type approval shall be inspected and tested to ensure that the requirements of this document have been met. For these test, testing agency shall be designated by purchaser.

3.9 **Finish and Painting** : The finish of the structure and panels shall conform to the latest issue of IS 101 & IS 168. The structure and panels shall only be powdered coated. The thickness of powder coating shall be between 650 to 1070 micrometers. The Colour used shall conform to IS 5 latest issue. Colour scheme shall be as follows :

Outside except front panel - RAL 7035(light Grey)~~Satin Blue, No. 177.~~

Inside and front panel. - Shall harmoniously match the ~~outside Colour~~. Outside Colour.

UPS (Inverter & Rectifier units) Units - Shall harmoniously match with rack colour.

3.10 **Marking & Labelling :**

3.10.1 It shall be possible to locate each component on the PCB by the layout & circuit drawing. All terminals shall be properly sign-written and all components properly labelled to enable their identification with reference to the supplier's Installation operation, maintenance manual and repair manuals. Designation of keys, switches and other components mounted on the front/inside panel and their operating positions shall be clearly engraved or sign- written. The wiring shall be clearly and permanently

identified with the designation or colour code which corresponds to the equipment circuit diagram. Where non-standard colours are used cable functions shall be clearly & permanently labelled at both ends.

3.10.2 Fuse holder identification shall include details of fuse rating and type. In case of fuses on PCB the rating shall be either on fuse or PCB at the base of the fuse.

3.10.3 A screen printed, circuit & cabling diagram shall be placed in side of the front door or any other convenient place for ready reference of the maintenance staff.

3.10.4 **Danger Label :** Each unit shall have a screen printed "Danger" label duly fixed in prominent place with RED characters against WHITE background.

3.10.5 **Name plate :** A name plate, anodised or screen printed, shall be suitably fixed on each rack/unit and contain following information :

1. TEC Standard~~GR~~ Number :
2. TAC No. :
3. Type of the Unit :
4. Manufacturer's name and identification :
5. Model No. :
6. Unit Serial No. :
7. Input voltage :
8. Output Voltage & rating :
9. Battery voltage (DC):

10~~9~~. Year & Month of manufacturing~~e~~ :

3.10.5.1 On the front top of the Rack, an etched engraved or anodised designation plate in BOLD letters showing " System Configuration & the rating of the system" shall be provided.

3.11 **MTTR & MTBF:**

3.11.1 **MTTR:** The mean time to replace / restore (MTTR) a faulty module/unit (Rectifier, Inverter, CCU, DC-DC Converter) shall be less than 2 minutes.~~The mean time to repair/replace a faulty unit shall be decided by purchaser.~~

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3.11.2 **MTBF (Mean Time Between Failure):** MTBF of the each module/unit shall not be less than 100,000 hours excluding fan. ~~MTBF of the system and MTBF for fans shall be decided by purchaser. The MTBF shall be verified as per QM-115~~. MTBF, predicted and observed values shall be furnished along with calculations by the manufacturer. Based on these figures three years maintenance spares shall be specified by the equipment supplier. The equipment availability shall exceed 99.9%.

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3.12 **Field Observations:** For new products field observation will be carried out for the first 5 systems procured by the department, to assess the performance of the equipment for a period not exceeding 6 months from the date of commissioning. The manufacturer shall undertake to repair/replace the system without any financial obligation to the user, in case the performance of the system is not found satisfactory during the period of observation. User shall also provide the feed-back to TEC, so that necessary improvement may be incorporated in the GR.

3.13 **Packing:** Packing shall be done in accordance with latest guidelines for UPS system, issued by QA wing of BSNL.

~~=== End of Chapter 3 ===~~

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~~CHAPTER 4~~

~~Safety requirements~~

4.0 Electromagnetic Compatibility (EMC/EMI)

4.1 Radio Frequency Interference (RFI) Suppression

The system (FR/FC, CCU, INVERTER & DSCA modules) shall be designed to minimize the level of electromagnetic interference (EMI), both conducted and radiated, detected in its vicinity and generated by the module and shall comply the following clauses:

I. Conducted and Radiated Emission from the Power equipment.

Name of EMC Standard: CISPR 11 (2015) or latest

" Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement ".

Limits: -

a) To comply with Class A of CISPR 11 (2015) or latest.

b) The values of limits shall be as per relevant tables under CISPR11 (2015) or latest.

II. Conducted Susceptibility Limits: Power equipment used in Telecom Network shall not malfunction when high voltage surge as specified below is superimposed at the input power mains to the power equipment, for more than two seconds as per IEC 61000- 4-18. The equipment shall also not fail or degrade in performance after the surge is withdrawn.

Test levels:

Voltage Rise time (First peak) : 75 nano sec +/- 20%.

Oscillation Frequencies : 100KHz & 1 MHz +/- 10%

Repetition rate : at least 40/s for 100KHz and 400/s for 1 MHz

Decaying : 50% of the peak value between the 3rd & 6th periods

Burst duration : not less than 2s

Surge amplitude : 250V(-10%) to 2.5 KV(+10%)

Wave shape : Damped

Level	Open Circuit output test voltage (kV)	
	Slow damped oscillatory wave (100KHz,1MHz)	
	Line to Line	Line to Ground
2	0.5	1

III. Electrostatic discharge (ESD) immunity limits: The limits and test methods as per IEC 61000- 4-2, (both Contact discharge method and Air discharge method) as given below:

Test level:

Contact discharge		Air discharge	
Level	Test voltage (KV)	Level	Test voltage (KV)
2	4	3	8

IV. Electrical fast transient/Burst immunity limits: The limits and test methods as specified in IEC 61000-4-4.

Test level:

Open– circuit output test voltage (+/-10%) &repetition rate of impulses (+/-20%)		
Level	On Power supply port, Protection Earth	
	Voltage peak KV	Repetition rate KHz
2	1	2.5
Rise time of one Pulse - 5 ns +/- 30% Impulse duration - 50 ns +/- 30%		

V. **Radiated radio-frequency Electromagnetic field immunity limits:** The limits and test methods as specified in IEC 61000-4-3.

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Test Level:

Frequency range : 80 MHz to 1000 MHz	
Level	Test field strength V/m
3	10

VI. Surge immunity limits: The limits and test methods shall be as specified in IEC 61000-4-5 " Testing & Measurement techniques for Surge immunity test" for the following limits:-

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For mains power input ports:

(a) 1.0 kV +/- 10% peak open circuit voltage for line to ground coupling

(b) 0.5 kV +/- 10% peak open circuit voltage for line to line coupling

(c) 4.0 kV +/- 10% peak open circuit voltage for line to ground coupling (d) 2.0 kV +/- 10% peak open circuit voltage for line to line coupling

VII. Radio-Frequency Conducted Susceptibility immunity limits: The limits and test methods as per IEC 61000-4-6.

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Test level:

Frequency range : 150KHz to 80MHz	
Level	Voltage level (e.m.f.)
2	3

VIII. Immunity to voltage dips & short interruptions (applicable to only ac mains power input ports, if any):

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Name of EMC Standard: As per IEC 61000-4-11 (2004) (with Input current less than 16A) / IEC 61000-4-34 (2015) (with Input current more than 16A) as applicable " Testing & measurement techniques- voltage dips, short interruptions and voltage variations immunity tests" for the following limits: -

i. a voltage dip corresponding to a reduction of the supply voltage of 30% for 500ms (i.e. 70 % supply voltage for 500ms)

ii. a voltage dip corresponding to a reduction of the supply voltage of 60% for 200ms; (i.e. 40% supply voltage for 200ms)

iii. a voltage interruption corresponding to a reduction of supply voltage of > 95% for 5s.

iv. a voltage interruption corresponding to a reduction of supply voltage of >95% for 10ms.

Performance Criteria shall be as per Table 1 under Clause 6 of TEC Standard No. TEC 11016:2016 (old no. TEC/SD/DD/EMC-221/05/OCT-16).

Applicable Performance Criteria shall be as per Table 3 under Clause 7.2 of TEC Standard No. TEC 11016:2016 (old no. TEC/SD/DD/EMC-221/05/OCT-16).

g) Immunity to voltage dips & short interruptions (applicable to only ac mains power input ports with Input current less than 16A, if any):

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Name of EMC Standard: As per IEC 61000-4-11 (2004) " Testing & measurement techniques- voltage dips, short interruptions and voltage variations immunity tests" for the following.

Limits:-

i. a voltage dip corresponding to a reduction of the supply voltage of 30% for 500ms (i.e. 70 % supply voltage for 500ms)

ii. a voltage dip corresponding to a reduction of the supply voltage of 60% for 200ms; (i.e. 40% supply voltage for 200ms)

iii. a voltage interruption corresponding to a reduction of supply voltage of > 95% for 5s.

iv. a voltage interruption corresponding to a reduction of supply voltage of >95% for 10ms.

Performance Criteria shall be as per Table 1 under Clause 6 of TEC Standard No. TEC/1016/2016(old No. TEC/SD/DD/EMC-221/05/OCT-16).

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Applicable Performance Criteria shall be as per Table 3 under Clause 7.2 of TEC Standard No. TEC/1016/2016(old No. TEC/SD/DD/EMC-221/05/OCT-16).

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h) Immunity to voltage dips & short interruptions (applicable to only ac mains power input ports, if any):

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Name of EMC Standard: As per IEC 61000-4-11 (2004) (with Input current less than 16A) / IEC 61000-4-34 (2015) (with Input current more than 16A) as applicable " Testing & measurement techniques- voltage dips, short interruptions and voltage variations immunity tests" for the following limits: -

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i. a voltage dip corresponding to a reduction of the supply voltage of 30% for 500ms (i.e. 70 % supply voltage for 500ms) 30 TEC Standard No. TEC 66160:2024

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ii. a voltage dip corresponding to a reduction of the supply voltage of 60% for 200ms; (i.e. 40% supply voltage for 200ms)

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iii. a voltage interruption corresponding to a reduction of supply voltage of > 95% for 5s.

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iv. a voltage interruption corresponding to a reduction of supply voltage of >95% for 10ms.

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Performance Criteria shall be as per Table 1 under Clause 6 of TEC Standard No. TEC 11016:2016 (old no. TEC/SD/DD/EMC-221/05/OCT-16).

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Applicable Performance Criteria shall be as per Table 3 under Clause 7.2 of TEC Standard No. TEC 11016:2016 (old no. TEC/SD/DD/EMC-221/05/OCT-16).

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i) Immunity to voltage dips & short interruptions (applicable to only DC power input ports, if any):

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Name of EMC Standard: IEC 61000-4- 29:2000: Electromagnetic compatibility (EMC) - Part 4-29: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests

Limits:

i. Voltage Interruption with 0% of supply for 10ms. Applicable Performance Criteria shall be B.

ii. Voltage Interruption with 0% of supply for 30ms, 100ms, 300ms and 1000ms. Applicable Performance Criteria shall be C.

iii. Voltage dip corresponding to 40% & 70% of supply for 10ms, 30 ms. Applicable Performance Criteria shall be B

iv. Voltage dip corresponding to 40% & 70% of supply for 100ms, 300 ms and 1000 ms. Applicable Performance Criteria shall be C

v. Voltage variations corresponding to 80% and 120%of supply for 100 ms to 10s as per Table 1c of IEC 61000-4-29. Applicable Performance Criteria shall be B.

Note 1: Classification of the equipment:

Class B: Class B is a category of apparatus which satisfies the class B disturbance limits. Class B is intended primarily for use in the domestic environment and may include:

- Equipment with no fixed place of use; for example, portable equipment powered by built in batteries;
- Telecommunication terminal equipment powered by the telecommunication networks
- Personal computers and auxiliary connected equipment.

Please note that the domestic environment is an environment where the use of broadcast radio and television receivers may be expected within a distance of 10 m of the apparatus connected.

Class A: Class A is a category of all other equipment, which satisfies the class A limits but not the class B limits.

Note 2: The test agency for EMC tests shall be an accredited agency and details of accreditation shall be submitted.

Note 3: For checking compliance with the above EMC requirements, the method of measurements shall be in accordance with TEC Standard No. TEC 11016:2016 (Old No. TEC/SD/DD/EMC-221/05/OCT-16) and the references mentioned therein unless otherwise specified specifically. Alternatively, corresponding relevant Euro Norms of the above IEC/CISPR standards are also acceptable subject to the condition that frequency range and test level are met as per above mentioned sub clauses (a) to (g). The details of IEC/CISPR and their corresponding Euro Norms are as follows:

~~1.3.14.0 SAFETY TEQUIREMENTSafety requirements~~

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~~4.1 Operating personnel safety requirements~~

~~4.1.1 The equipment shall conform to IS 16242 part 1:(2014) " Uninterrupted power supply(UPS) Part 1: General and safety Requirements for UPS {equivalent to IEC 62040-1 (2008) " information technology Equipment-Safety" Part 1: General Requirements}. The manufacturer/supplier shall submit a certificate in respect of compliance to these requirements.~~

~~OR~~

~~The equipment shall conform to IS 13252 part 1: 2010+Amd 2013+Amd 2015 " Information Technology Equipment – Safety- Part 1: General Requirements" [equivalent to IEC 60950- 1:2005+A1:2009+A2:2013 " Information Technology Equipment – Safety- Part 1: General~~

~~Requirements"]. The Manufacturer/supplier shall submit a certificate in respect of compliance to these requirements.~~

~~OR~~

~~The equipment shall conform to IEC 62040-1 (2017) " information technology Equipment-Safety" Part 1: General Requirements {equivalent to IS standard ' as and when released by BIS' }. The manufacturer/supplier shall submit a certificate in respect of compliance to these requirements.~~

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~~**Note 1: The Certificate against IS 13252(equivalent to IEC 60950) for UPS systems will be valid for one year from date of issue of this GR. Afterward only IS 16242(equivalent to IEC 62040-1) will be applicable on UPS system.**~~

~~**Note 2: The Certificate against IS 16242(2014) {equivalent to IEC 62040(2008)} for UPS systems will continue till such time BIS adopts standard IEC 62040(2017) and releases its equivalent IS standard. Afterward IEC 62040(2017) {equivalent IS standard} will be applicable on UPS systems.**~~

~~**4.1.2**~~ ~~The equipment shall follow proper construction practice to minimize unintended radiation due to leakage from any gap or monitoring points. All unused ports and monitoring points should be terminated. The power flux density shall not exceed 1 mW/cm2 at a distance of 2.5 cms.~~

~~**4.1.3**~~ ~~Protection against short circuit/open circuit in the accessible points shall be provided. All switches/controls on front panel shall have suitable safeguards against accidental operations.~~

~~**4.1.4**~~ ~~Additional Safety Requirement (if UPS having remote Power feeding facility): UPS with remote Power feeding facility shall conform to IEC 60950-21 (2002) " Information technology equipment" - Safety - Part 21:~~

~~Remote power feeding. The manufacturer/supplier shall submit a certificate in respect of compliance to these requirements.~~

~~4.1.5~~ ~~Additional Safety Requirement (if UPS to be installed outdoors): UPS to be installed outdoors shall conform to IEC 60650-22 (2016) " Information technology equipment – Safety – Part 22: Equipment to be installed outdoors. The manufacturer/supplier shall submit a certificate in respect of compliance to these requirements.~~

~~=== End of Chapter 4 ===~~

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~~CHAPTER 5~~

~~EMI/EMC Requirements~~

1.3.15 SAFETY TEQUIREMENTS

The equipment shall conform to relevant safety requirements as per IS 16242 (Part 1) : 2014/ IEC 62040-1 : 2017+ AMD1:2021+ AMD2:2022 or latest as prescribed under Table no. 1 of the TEC document ' SAFETY REQUIREMENTS OF TELECOMMUNICATION EQUIPMENT': TEC10009: 2024.

~~1.3.15.0 Electromagnetic Compatibility (EMC)~~

~~1.5.1 Radio Frequency Interference (RFI) Suppression~~

~~The system (FR/FC, CCU, INVERTER & DSCA modules) shall be designed to minimize the level of electromagnetic interference (EMI), both conducted and radiated, detected in its vicinity and generated by the module and shall comply the following clauses:~~

~~I. Conducted and Radiated Emission from the Power equipment.~~

~~Name of EMC Standard: CISPR 11 (2015) or latest~~

~~" Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement ".~~

~~Limits: -~~

~~To comply with Class A of CISPR 11 (2015) or latest.~~

~~The values of limits shall be as per relevant tables under CISPR11 (2015) or latest.~~

~~Conducted Susceptibility Limits: Power equipment used in Telecom Network shall not malfunction when high voltage surge as specified below is superimposed at~~

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~~the input power mains to the power equipment, for more than two seconds as per IEC 61000- 4-18. The equipment shall also not fail or degrade in performance after the surge is withdrawn.~~

~~Test levels:~~

~~Voltage Rise time (First peak) : 75 nano sec +/- 20%.~~

~~Oscillation Frequencies : 100KHz & 1 MHz +/- 10%~~

~~Repetition rate : at least 40/s for 100KHz and 400/s for 1 MHz~~

~~Decaying : 50% of the peak value between the 3rd & 6th periods~~

~~Burst duration : not less than 2s~~

~~Surge amplitude : 250V(-10%) to 2.5 KV(+10%)~~

~~Wave shape : Damped~~

~~Level~~	~~Open Circuit output test voltage (kV)~~	
	~~Slow damped oscillatory wave (100KHz,1MHz)~~	
	~~Line to Line~~	~~Line to Ground~~
~~2~~	~~0.5~~	~~1~~

~~Electrostatic discharge (ESD) immunity limits: The limits and test methods as per IEC 61000- 4-2, (both Contact discharge method and Air discharge method) as given below:~~

~~Test level:~~

~~Contact discharge~~		~~Air discharge~~	
~~Level~~	~~Test voltage (KV)~~	~~Level~~	~~Test voltage (KV)~~
~~2~~	~~4~~	~~3~~	~~8~~

~~Electrical fast transient/Burst immunity limits: The limits and test methods as specified in IEC 61000-4-4.~~

~~Test level:~~

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Open– circuit output test voltage (+/-10%) &repetition rate of impulses (+/-20%)		
Level	On Power supply port, Protection Earth	
	Voltage peak KV	Repetition rate KHz
2	1	2.5
Rise time of one Pulse - 5 ns +/- 30% Impulse duration - 50 ns +/- 30%		

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Radiated radio-frequency Electromagnetic field immunity limits: The limits and test methods as specified in IEC 61000-4-3.

Test Level:

Frequency range : 80 MHz to 1000 MHz	
Level	Test field strength V/m
3	10

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~~Surge immunity limits: The limits and test methods shall be as specified in IEC 61000-4-5 " Testing & Measurement techniques for Surge immunity test" for the following limits:-~~

~~For mains power input ports:~~

~~1.0 kV +/- 10% peak open circuit voltage for line to ground coupling~~

~~0.5 kV +/- 10% peak open circuit voltage for line to line coupling~~

~~4.0 kV +/- 10% peak open circuit voltage for line to ground coupling (d) 2.0 kV +/- 10% peak open circuit voltage for line to line coupling~~

~~Radio-Frequency Conducted Susceptibility immunity limits: The limits and test methods as per IEC 61000-4-6.~~

~~Test level:~~

~~Frequency range : 150KHz to 80MHz~~	
~~Level~~	~~Voltage level (e.m.f.)~~
~~2~~	~~3~~

~~Immunity to voltage dips & short interruptions (applicable to only ac mains power input ports, if any):~~

~~Name of EMC Standard: As per IEC 61000-4-11 (2004) (with Input current less than 16A) / IEC 61000-4-34 (2015) (with Input current more than 16A) as applicable " Testing & measurement techniques- voltage dips, short interruptions and voltage variations immunity tests" for the following limits: -~~

~~a voltage dip corresponding to a reduction of the supply voltage of 30% for 500ms (i.e. 70 % supply voltage for 500ms)~~

~~a voltage dip corresponding to a reduction of the supply voltage of 60% for 200ms; (i.e. 40% supply voltage for 200ms)~~

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~~a voltage interruption corresponding to a reduction of supply voltage of > 95% for 5s.~~

~~a voltage interruption corresponding to a reduction of supply voltage of >95% for 10ms.~~

~~Performance Criteria shall be as per Table 1 under Clause 6 of TEC Standard No. TEC 11016:2016 (old no. TEC/SD/DD/EMC-221/05/OCT-16).~~

~~Applicable Performance Criteria shall be as per Table 3 under Clause 7.2 of TEC Standard No. TEC 11016:2016 (old no. TEC/SD/DD/EMC-221/05/OCT-16).~~

~~**General Electromagnetic Compatibility (EMC) Requirements**: - The equipment shall conform to the EMC requirements as per the following standards and limits indicated therein. A test certificate and test report shall be furnished from an accredited test agency.~~

~~a) Conducted and radiated emission (applicable to telecom equipment):~~

~~Conducted and radiated emission (applicable to telecom equipment):~~

~~Name of EMC Standard: " CISPR 32 (2015) - Electromagnetic compatibility of multimedia equipment - Emission requirements"~~

~~i. To comply with Class B of CISPR 32 (2015).~~

~~ii. For Radiated Emission tests, limits below 1 GHz shall be for measuring distance of 3m.~~

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~~OR~~

~~Conducted and radiated emission (applicable to instruments such as power meter, frequency counter etc.):~~

~~Name of EMC Standard: "As per CISPR 11 {2015} - Industrial, scientific and medical (ISM) radio- frequency equipment -Electromagnetic disturbance characteristics- Limits and methods of measurement" for the following~~

~~Limits :-~~

~~i. To comply with the category of Group 1 of Class B of CISPR 11 {2015}~~

~~ii. The values of limits shall be as per clause No. 8.5.2 of TEC Standard No. TEC/SD/DD/EMC-221/05/OCT-16.~~

~~b) Immunity to Electrostatic discharge:~~

~~Name of EMC Standard: As per IEC 61000-4-2 {2008) "Testing and measurement techniques of Electrostatic discharge immunity test" for the following.~~

~~Limits: -~~

~~i. Contact discharge level 2 {± 4 kV} or higher voltage;~~

~~ii. Air discharge level 3 {± 8 kV} or higher voltage;~~

~~Performance Criteria shall be as per Table 1 under Clause 6 of TEC Standard No. TEC/SD/DD/EMC-221/05/OCT-16.~~

~~Applicable Performance Criteria shall be as per Table 3 under Clause 7.2 of TEC Standard No. TEC/SD/DD/EMC-221/05/OCT-16~~

~~**c) Immunity to radiated RF**:~~

~~**Name of EMC Standard:** As per IEC 61000-4-3 (2010) "Testing and measurement techniques-Radiated RF Electromagnetic Field Immunity test" for the following~~

~~**Limits:**~~

~~**For Telecom Equipment and Telecom Terminal Equipment with Voice interface (s)**~~

~~i. Under test level 2 {Test field strength of 3 V/m} for general purposes in frequency range 80 MHz to 1000 MHz and~~

~~ii. Under test level 3 (10 V/m) for protection against digital radio telephones and other RF devices in frequency ranges 800 MHz to 960 MHz and 1.4 GHz to 6.0 GHz.~~

~~**For Telecom Terminal Equipment without Voice interface (s)**~~

~~Under test level 2 {Test field strength of 3 V/m} for general purposes in frequency range 80 MHz to 1000 MHz and for protection against digital radio telephones and other RF devices in frequency ranges 800 MHz to 960 MHz and 1.4 GHz to 6.0 GHz.~~

~~Performance Criteria shall be as per Table 1 under Clause 6 of TEC Standard No. TEC/SD/DD/EMC-221/05/OCT-16.~~

~~Applicable Performance Criteria shall be as per Table 3 under Clause 7.2 of TEC Standard No. TEC/SD/DD/EMC-221/05/OCT-16.~~

~~**d) Immunity to fast transients (burst):**~~

Name of EMC Standard: As per IEC 61000- 4- 4 (2012) "Testing and measurement techniques of electrical fast transients / burst immunity test" for the following.

Limits:

Test Level 2 i.e. a) 1 kV for AC/DC power lines; b) 0. 5 kV for signal / control / data / telecom lines;

Performance Criteria shall be as per Table 1 under Clause 6 of TEC Standard No. TEC/SD/DD/EMC-221/05/OCT-16.

Applicable Performance Criteria shall be as per Table 3 under Clause 7.2 of TEC Standard No. TEC/SD/DD/EMC-221/05/OCT-16.

e) Immunity to surges:

Name of EMC Standard: As per IEC 61000-4-5 (2014) " Testing & Measurement techniques for Surge immunity test" for the following.

Limits:

i) For mains power input ports:

(a) 1.0 kV peak open circuit voltage for line to ground coupling

(b) 0.5 kV peak open circuit voltage for line to line coupling

(c) 4.0 kV peak open circuit voltage for line to ground coupling

(d) 2.0 kV peak open circuit voltage for line to line coupling

ii) For telecom ports:

(a) 1.0 kV peak open circuit voltage for line to ground

(b) 0.5 KV peak open circuit voltage for line to line coupling.

(c) 4.0 kV peak open circuit voltage for line to ground

(d) 2.0 KV peak open circuit voltage for line to line coupling.

Performance Criteria shall be as per Table 1 under Clause 6 of TEC Standard No. TEC/SD/DD/EMC-221/05/OCT-16.

~~Applicable Performance Criteria shall be as per Table 3 under Clause 7.2 of TEC Standard No. TEC/SD/DD/EMC-221/05/OCT-16.~~

~~**f) Immunity to conducted disturbance induced by Radio frequency fields:**~~

~~**Name of EMC Standard:** As per IEC 61000-4-6 (2013) "Testing & measurement techniques-Immunity to conducted disturbances induced by radio- frequency fields" for the following.~~

~~**Limits:-**~~

~~Under the test level 2 {3 V r.m.s.}in the frequency range 150 kHz-80 MHz for AC / DC lines and Signal /Control/telecom lines.~~

~~Performance Criteria shall be as per Table 1 under Clause 6 of TEC Standard No. TEC/SD/DD/EMC-221/05/OCT-16.~~

~~Applicable Performance Criteria shall be as per Table 3 under Clause 7.2 of TEC Standard No. TEC/SD/DD/EMC-221/05/OCT-16.~~

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~~**g) Immunity to voltage dips & short interruptions (applicable to only ac mains power input ports with Input current less than 16A, if any):**~~

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~~**Name of EMC Standard:** As per IEC 61000-4-11 (2004) " Testing & measurement techniques- voltage dips, short interruptions and voltage variations immunity tests" for the following.~~

~~**Limits:-**~~

~~i. a voltage dip corresponding to a reduction of the supply voltage of 30% for 500ms (i.e. 70 % supply voltage for 500ms)~~

~~ii. a voltage dip corresponding to a reduction of the supply voltage of 60% for 200ms; (i.e. 40% supply voltage for 200ms)~~

~~iii. a voltage interruption corresponding to a reduction of supply voltage of > 95% for 5s.~~

~~iv. a voltage interruption corresponding to a reduction of supply voltage of >95% for 10ms.~~

Performance Criteria shall be as per Table 1 under Clause 6 of TEC Standard No. TEC/SD/DD/EMC-221/05/OCT-16.

Applicable Performance Criteria shall be as per Table 3 under Clause 7.2 of TEC Standard No. TEC/SD/DD/EMC-221/05/OCT-16.

OR

Immunity to voltage dips & short interruptions (applicable to only ac mains power input ports with Input current more than 16A, if any):

Name of EMC Standard: As per IEC 61000-4-34 (2015) " Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests for equipment with input current more than 16 A per phase" for the following.

Limits:-

i. a voltage dip corresponding to a reduction of the supply voltage of 30% for 500ms (i.e. 70 % supply voltage for 500ms)

ii. a voltage dip corresponding to a reduction of the supply voltage of 60% for 200ms; (i.e. 40% supply voltage for 200ms)

iii. a voltage interruption corresponding to a reduction of supply voltage of > 95% for 5s.

iv. a voltage interruption corresponding to a reduction of supply voltage of >95% for 10ms.

Performance Criteria shall be as per Table 1 under Clause 6 of TEC Standard No. TEC/SD/DD/EMC-221/05/OCT-16.

Applicable Performance Criteria shall be as per Table 3 under Clause 7.2 of TEC Standard No. TEC/SD/DD/EMC-221/05/OCT-16.

h) Immunity to voltage dips & short interruptions (applicable to only DC power input ports, if any):

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~~**Name of EMC Standard:**IEC 61000-4- 29:2000: Electromagnetic compatibility (EMC) - Part 4-29: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests~~

~~**Limits:**~~

i. ~~Voltage Interruption with 0% of supply for 10ms. Applicable Performance Criteria shall be B.~~

ii. ~~Voltage Interruption with 0% of supply for 30ms, 100ms, 300ms and 1000ms. Applicable Performance Criteria shall be C.~~

iii. ~~Voltage dip corresponding to 40% & 70% of supply for 10ms, 30 ms. Applicable Performance Criteria shall be B~~

iv. ~~Voltage dip corresponding to 40% & 70% of supply for 100ms, 300 ms and 1000 ms. Applicable Performance Criteria shall be C~~

v. ~~Voltage variations corresponding to 80% and 120%of supply for 100 ms to 10s as per Table 1c of IEC 61000-4-29. Applicable Performance Criteria shall be B.~~

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~~**Note 1:** Classification of the equipment:~~

~~Class B: Class B is a category of apparatus which satisfies the class B disturbance limits. Class B is intended primarily for use in the domestic environment and may include:~~

- ~~Equipment with no fixed place of use; for example, portable equipment powered by built in batteries;~~
- ~~Telecommunication terminal equipment powered by the telecommunication networks~~
- ~~Personal computers and auxiliary connected equipment.~~

~~Please note that the domestic environment is an environment where the use of broadcast radio and television receivers may be expected within a distance of 10 m of the apparatus connected.~~

~~**Class A:** Class A is a category of all other equipment, which satisfies the class A limits but not the class B limits.~~

~~**Note 2:** The test agency for EMC tests shall be an accredited agency and details of accreditation shall be submitted.~~

~~**Note 3:** For checking compliance with the above EMC requirements, the method of measurements shall be in accordance with TEC Standard No. TEC/SD/DD/EMC-221/05/OCT-16 and the references mentioned therein unless otherwise specified specifically. Alternatively, corresponding relevant Euro Norms of the above IEC/CISPR standards are also acceptable subject to the condition that frequency range and test level are met as per above mentioned sub clauses (a) to (g). The details of IEC/CISPR and their corresponding Euro Norms are as follows:~~

~~IEC/CISPR~~	~~Euro Norm~~
~~CISPR 11~~	~~EN 55011~~
~~CISPR 22~~	~~EN 55022~~
~~IEC 61000-4-2~~	~~EN 61000-4-2~~
~~IEC 61000-4-3~~	~~EN 61000-4-3~~
~~IEC 61000-4-4~~	~~EN 61000-4-4~~
~~IEC 61000-4-5~~	~~EN 61000-4-5~~
~~IEC 61000-4-6~~	~~EN 61000-4-6~~
~~IEC 61000-4-11~~	~~EN 61000-4-11~~

~~=== End of Chapter 5 ===~~

CHAPTER 2

2.1 Purchaser Guidelines

Note: A distinction has been made with respect to capacity of UPS. UPS with capacity upto 4KVA is treated as small whereas UPS capacity with >4KVA is treated as large in this GR. UPS upto 4KVA has less stringent requirements

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compare to UPS more than 4KVA. In case of critical application, purchaser may ask for stringent requirement as applicable to large capacity UPS with more than 4KVA.

1. As UPS units are capable of synchronous load sharing with other UPS units (Maximum five such units). The user may configure a UPS system as per his requirements. He may choose the rating of UPS unit as per his ultimate requirement and the equipment shall be ordered accordingly.

2. The actual load requirement of the UPS system required shall be given by the purchaser.

3. The Voltage Regulator shall be provisioned as per the purchaser's requirement. The rating of Voltage Regulator, if used, shall be as per voltage regulation required by purchaser.

4. In the table of clause 1.1.4 for Modular UPS system, the system configuration shall depend upon the capacity of the basic module and the redundancy requirements which shall be given by the purchaser.
5. Chapter-3: clause 3.6.1.5: **Component Approval :** The components used in UPS system, shall be certified by accredited National/International Lab. However Purchaser may ask for any specific lab
6. Chapter-3: clause 3.8: **Quality Assurance Tests :** Each of the UPS system supplied against the specific order after type approval shall be inspected and tested to ensure that the requirements of this document have been met. For these test, testing agency shall be designated by purchaser.
7 Chapter-3: clause 3.11.1 & 3.11.2: MTTR & MTBF shall be decided by purchaser.
8. **Clause 1.1.3.3:** Purchaser may decide about redundancy of micro-processor/Chip based on its application.
9. **Clause 8.12.6:** The purchaser must ensure the availability of separate coordinated Stage-I & II protection devices, as per GR No. TEC 66130:2024 at telecom site, for protection of the Power System, against lightening and

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high voltage surges. ~~The requirement of LSP devices for UPS with <4KVA(less than) rating will be decided by purchaser.~~

~~10.~~ ~~Clause 2.8: **Remote control and monitoring:** In case of UPS with <4KVA(less than) rating, this feature will be decided by purchaser.~~

10~~1~~. Clause 2.9.15.3: **Battery Health Check**: In case of UPS with less than 4KVA, Purchaser may ask for this feature. If required by Purchaser, the provision for conducting a partial discharge (about 20%) test, of a pre-determined duration and frequency, shall be made available in the UPS system (Frequency and duration of partial discharge test shall be programmable).

11~~2~~. Cl 2.9.15.5 Temperature compensation for battery: **In case of UPS with less than 4KVA, Purchaser may ask for this requirement depending upon critical operation.**

12. The purchaser may specify the requirement of field-trial. Feedback, if any, may be furnished to TEC for improvement in the GR.

13. The purchaser/procurer shall specify the requirements for optional management features like Battery Health Monitoring, Energy Saving Management, proper functioning during voltage and phase outages, Solar efficiency and Fuel Saving Management, Battery Efficiency & Battery Management, Rectifier Control – Efficiency Management, etc.

14. RS 485 and Ethernet (SNMP) communication cable of suitable length shall be protected with surge protection devices (to be decided by purchaser) to be mounted on both side of the cable.

15. Purchaser may specify the additional alarms to be extended for remote monitoring.

16. Purchaser may specify the preference of load sharing among input sources.

17. Purchaser may specify the requirement of LED indication on the respective unit / module or on LCD panel regarding health of the respective unit / module (clause 3 of chapter 1 refers).

Note 3:

1. Load shall include equipment load, battery charging and other load (inverter etc.) if any. Higher battery load for Lithium battery may be considered.

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2. While choosing the power System the user shall ensure that the redundancy requirement of rectifier has been taken care of.

3. Float & Charge voltage shall be normally 54.0V in case of Li-ion battery compatible power System. However, the purchaser may also specify Float & Charge voltage based on their requirements. Also, of required, the purchaser may specify the battery path current in respect of Li-ion battery, if required.

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2.2 Ordering Information

The following items need to be specified during ordering by Tendering Authority, depending on the requirements.

I. **Application :** AC input and output : i) Single phase or ii) Three phase

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II. **Type of configuration** : i) Unitary or ii) Modular

III. **System proposed:** Category and ultimate system capacity Refer Clause 1.1.4:

IV. **Battery Back-up proposed:** ½ hour, 1 hour, 2hour, 3 hour or 4 hours.

V. In case of Modular system:

- Number of UPS Required at preset.
- Number of UPS requirement Ultimate.

VI. **Voltage Regulator :** Required/Not required

VII. Inverter output ports

VII. Battery breakers details (quantity and rating)

VIII. Additional requirement of RS485 modbus communication for remote monitoring (Default SNMP)

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Note : 1. While choosing the UPS system, the user shall ensure that the redundancy requirement has been taken care of.

2. Tendering authority may chose any of the categories (ultimate capacity) as per clause 1.1.4 according to his load requirements. Load shall include, the equipment load and any other load.

3. Load may be calculated as per guidelines given in annexure 3.

ABBREVIATIONS

A or Amps.	Amperes
AC.	Alternating Current
AH.	Ampere Hour
BIS.	Bureau Of Indian Standards
BSNL.	Bharat Sanchar Nigam Limited
CACT.	Component Approval Centre Telecommunication
DB.	Decibel
DBA.	Decibel Absolute
DC.	Direct Current
deg C.	Degrees Celsius
DG.	Diesel Generator
DOT.	Department of Telecommunication
DTS.	Department of Telecommunication Services
emf.	Electro motive force
EMI.	Electro Magnetic Interference
FET.	Field Effect Transistor
FSD.	Full Scale Deflection
FR/FC.	Float Rectifier cum Charger
FR/BC.	Float Rectifier cum Battery Charger
GR.	Generic Requirements
IS.	Indian Standards
Kg.	Kilo Grams
KHz.	Kilo Hertz
LED.	Light Emitting Diodes
LCD.	Liquid Crystal Device
MHz.	Mega Hertz
MOV.	Metal Oxide Varistor
MTBF.	Mean Time between Failures
Ms.	milli seconds
PCB.	Printed Circuit Board

PF.	Power factor
QA.	Quality Assurance
QM.	Quality Manual
RFI.	Radio Frequency Interference
RTEC.	Regional Telecom Engineering Centre
SMPS.	Switch Mode Power Supply
SVR	Static Voltage Regulator
STS	Static Transfer Switch
TEC.	Telecom Engineering Centre
T & D.	Technical & Development
V.	Volts
VRLA.	Valve Regulated Lead Acid
VR	Voltage Regulator.

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ANNEXURE-1

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Schematic Drawings of UPS System

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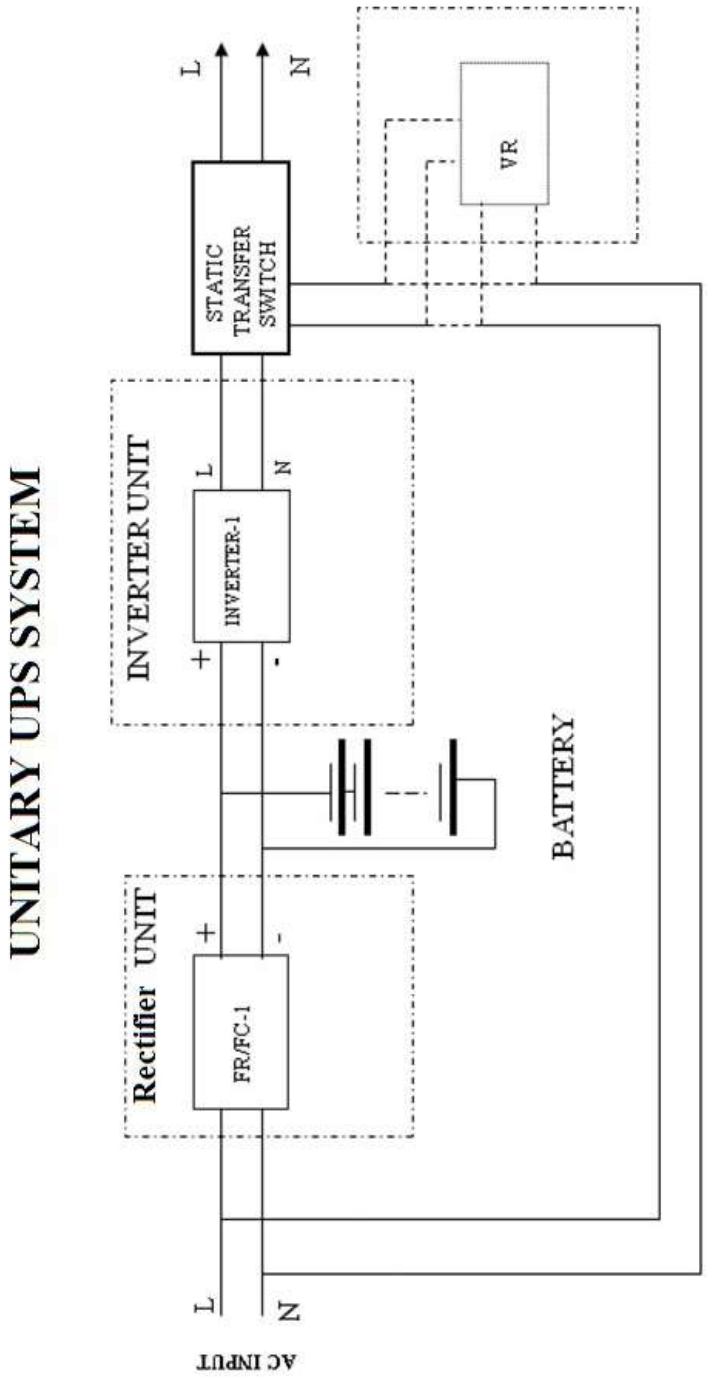
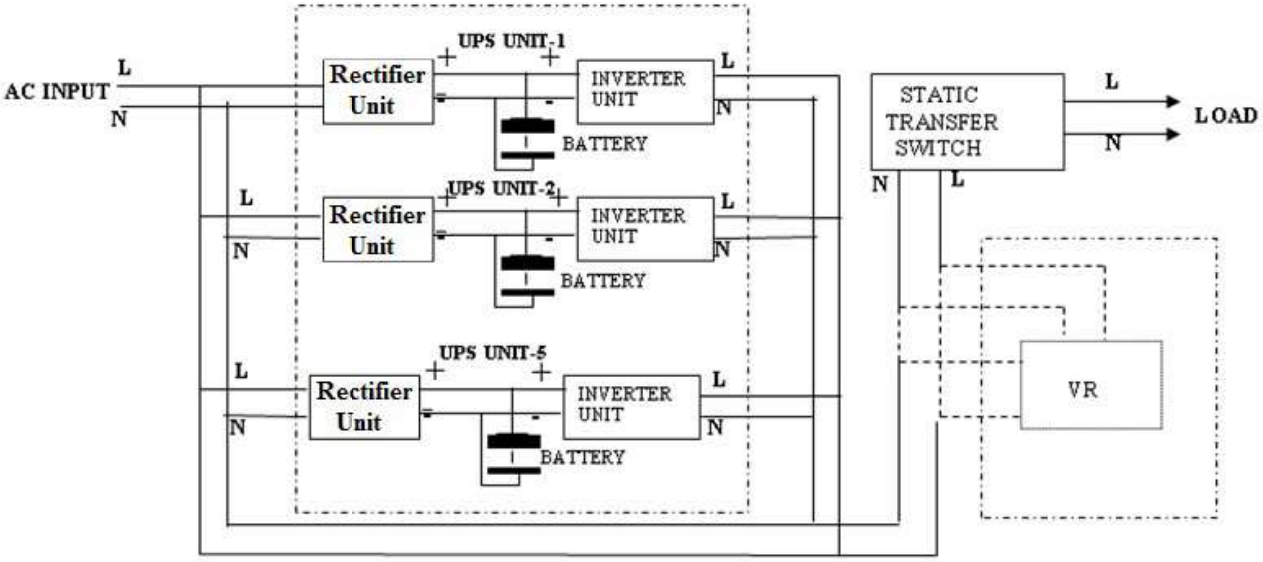


Note: VR is Indicative in figure.

FIG-1

ANNEXURE-I

Modular UPS System (Single Phase)



Note: VR is indicative in figure

FIG- 2

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ANNEXURE-I

Modular UPS System (Three Phase)

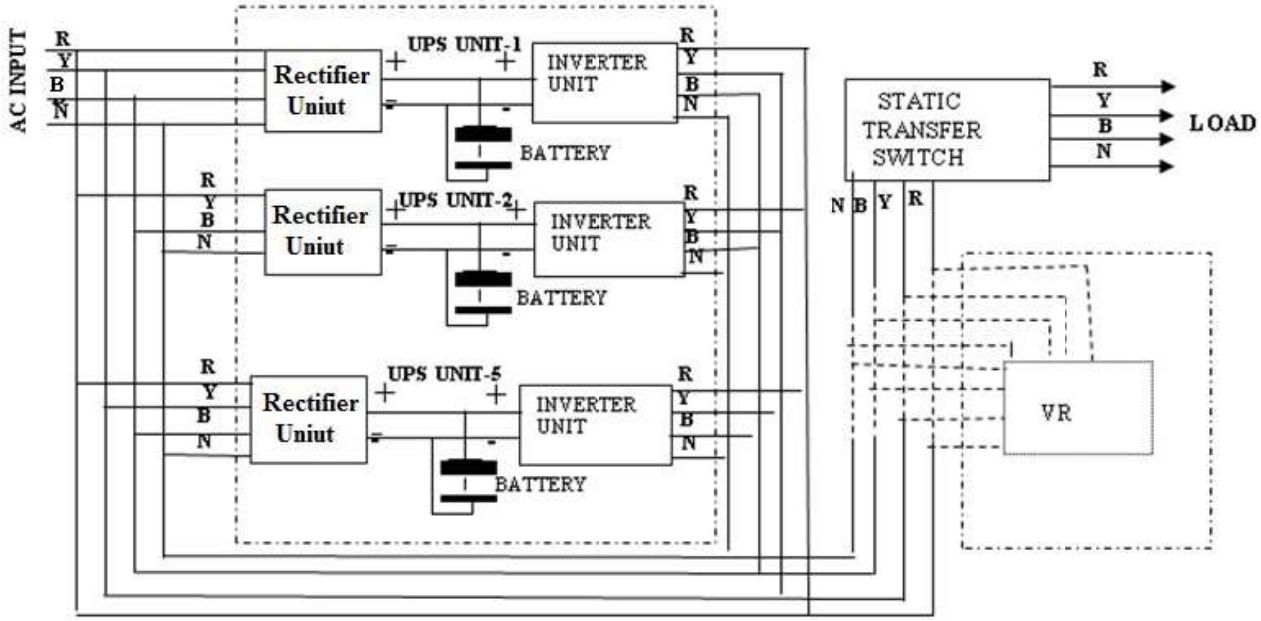

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FIG- 3

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ANNEXURE 2

Ordering Information

The following items need to be specified during ordering by Tendering Authority, depending on the requirements.

Application : AC input and output : i) Single phase or ii) Three phase

Type of configuration : i) Unitary or ii) Modular

System proposed: Category and ultimate system capacity Refer Clause 1.1.4:

Battery Back-up proposed: ½ hour, 1 hour, 2hour, 3 hour or 4 hours.

In case of Modular system:

- Number of UPS Required at preset.
- Number of UPS requirement Ultimate.

Voltage Regulator : Required/Not required

Note : 1. While choosing the UPS system, the user shall ensure that the redundancy requirement has been taken care of.

3. Tendering authority may chose any of the categories (ultimate capacity) as per clause 1.1.4 according to his load requirements. Load shall include, the equipment load and any other load.

3. Load may be calculated as per guidelines given in annexure 3.

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ANNEXURE-23

Calculation Guidelines

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Calculations for Battery Bank, UPS System, VR, Static Transfer Switch & Manual Transfer Switch as per Battery Back-up & Redundancy Requirements.

UPS System Load:

Unitary:

Calculations for Battery Bank:

The following inputs are required to work out battery bank requirement:

i) Rated Inverter unit Load (rating of UPS).
ii) Back-up requirement

Battery Bank(AH)=((UPS rated capacity in VA/inverter efficiency)*back-up in hours)) /(0.8*((affective battery capacity at given Rate of discharge)*(1.9*(number of cell in the battery bank)))

Where :

a) 1.9*number of cells is average battery voltage during discharge as average cell voltage during discharge is 1.9V.
b) 0.8 is the permissible DOD.
c) For Effective battery capacity refer GR for VRLA battery High rate of discharge (UPS) application GR No. TEC/GR/TX/BAT-02/03.DEC.2013. The Li-ion battery shall be in compliance of the GR No. TEC/GR/TX/LIB-001/01.MAR-16.

Rectifier Unit Rating :

The following inputs are required to work out Rectifier requirement :

i) Load of the Inverter unit

ii) The battery Load at the specified rate of charge, say C/10 or any rate other than C/10

Capacity of Rectifier Unit = Load of the inverter unit + Battery Load

Where : Inverter unit load in VA is : (Inverter unit capacity/(Inverter efficiency)

Battery Load in VA is : (battery AH capacity, as calculated above)*(Rate of Charge)*2.3V*(number of cells in the battery) : 2.3V is the Rectifier charge voltage

SVR Rating : Same as UPS System.

Static Transfer and Manual Transfer Switch ratings: 1.2 X UPS rating

Sample calculations:

Calculation – 1

UPS System - Unitary:

Required Inputs :

UPS rating : 2KVA

Battery Backup requirements : ½ hour

DC Voltage : 12V/ 48V(24 cell battery)

Voltage Regulator : Required/Not Required : Required

1. Inverter Rating : 2KVA

2. Battery bank calculation :

((2000/(.80*45.6*))*0.5)/(0.8*0.5) = 68.5 AH say 70AH

Batteries available are either 80AH or 120AH.

" The following calculations is to be done based on available battery capacity in market. The calculation carried out in this GR based on 80AH or 120AH battery is for illustrative purpose."

*** Number of cells*1.9, number of cells in this is 24**

Similarly for other battery backup requirements battery capacity may be calculated.

3) Rectifier calculations:

Case 1 : When the battery Charging current is restricted to C/10 :

(2000/0.80) +(80*0.1*2.3*24) = 2500 + 552 = 3052VA Say 3000VA

Case 2 : When the battery Charging current is C/5 :

(2000/0.80) + 80*0.2*2.3*24 = 2500 + 1004 = 3504 VA Say 3500VA

4. Static and Manual transfer Switch : Shall be rated to handle 1.2 * 2000 = 2400VA or 2.4KVA.

5. VR: Shall be as per UPS rating.

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Sample Calculation-2

In case Modular UPS systems

Required Inputs:

1. UPS System rating : 15KVA(15000VA)
2. Redundancy requirement : Yes
3. Battery Backup requirements : say 2 hours
4. Input rating of the inverter : 111V to 141V (60 cells in the battery)
5. Rate of Charging for battery : C/10

1. **UPS Unit Rating :** Most suited UPS system available as per clause 1.1.4 UPS System based on 6KVA three phase UPS unit (3 + 1) Configuration.

2. **Battery bank calculation :**

((6000/(.8*1.9*60))*2)/(0.8*0.783) = 210 AH of 60 cell battery.

3. **Rectifier unit calculations:**

(6000/0.85) + 200*0.1*2.3*60 = 7059 + 2760 = 9819VA

4. **Static and manual Transfer Switch:** shall be 120% of ultimate Inverter unit rating minus redundancy i.e. 6 X 3 X 1.2 = 21.6 KVA

5. VR: As per the rating of the inverter unit minus redundancy. 18KVA

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~~ANNEXURE -34~~

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~~Remote Monitoring protocol~~

~~Protocol or Sequence of Exchange of Information between power plant & its peripheries (UPS system) & Remote Site Monitoring equipment.~~

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~~RS 485 (4 wire) interface at speed 19.2Kbps (minimum) shall be used for both monitoring & control between inverter systems and other associated equipment (UPS) and Remote site (First level) of monitoring & control. The protocol shall be as given below;~~

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~~- First four bytes as starting or hand shake bites (includes identifications etc.)~~

~~- 5th Byte for equipment Identification (Power plant , battery, Inverter etc.)~~

~~- 6th Byte for Class of parameter (Alarms urgent, alarms non-urgent, Monitoring etc.)~~

~~- 7th , 8th and 9th Bytes for the parameter observation/medications:~~

~~Equipment side will along with parameter code same that on Master side along with desired information.~~

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~~- 10th and 11th for checksum for parity on both sides in communication.~~

~~The exchange of information between the Remote site controller and the power equipment shall on 4 wire RS 485 bus. All the eleven bytes shall be sent as a packet for exchange of information.~~

~~In this concept Remote site equipment shall work as a Master and power equipment as slave in the Master slave concept. In this concept :~~

~~- The master will send all the above 11 bytes containing the information for each byte as given above..~~

~~- UPS after verify the correctness of the data will send back the desired~~

~~information in the same pattern as given above with bytes 7 to 9 shall contain the desired information and 10th 11th the checksum number.~~

~~- In case of mismatch, UPS or remote controller will send a fixed anomaly signal.~~

~~- On receipt of mismatch the previous data will again be offered by the concerned end.~~

~~- In case of acknowledgement (desired information or next information) the concerned end will put-up the next information.~~

~~Each byte information in HEX shall be as detailed below:~~

~~5th Byte: Equipment Designation~~

~~Equipment Designation~~	~~Hex Code~~	
	~~From Master~~	~~From Slave Equipment~~
~~Power Plant s(AC-DC Converters) (sixteen Max.)~~	~~00 to 0F~~	~~00 to 0F~~
~~Battery Bank (Maximum sixteen)~~	~~10 to 1F~~	~~10 to 1F~~
~~Inverter Systems (Max Sixteen)~~	~~20 to 2F~~	~~20 to 2F~~
~~UPS System (Max Sixteen)~~	~~30 to 3F~~	~~30 to 3F~~
~~SPV System(Max Sixteen)~~	~~40 to 4F~~	~~40 to 4F~~
~~DG Set (Max Sixteen)~~	~~50 to 5F~~	~~50 to 5F~~
~~Air conditioning group (Max Sixteen)~~	~~60 to 6F~~	~~60 to 6F~~
~~Fire Alarm Group ((Max. Sixteen)~~	~~70 to 7F~~	~~70 to 7F~~
~~Security Group (Max Sixteen)~~	~~80 to 8F~~	~~80 to 8F~~
~~Flood Group (Max Sixteen)~~	~~90 to 9F~~	~~90 to 9F~~
~~Any other equipment~~	~~A0 to FF~~	~~A0 to FF~~

~~6th Byte: Classification of Information~~

~~Class of Parameter~~	~~Hex Code~~	
	~~From Master~~	~~From Slave Equipment~~

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Alarms Urgent	01	01
Alarms Non-urgent	02	02
Monitoring of Parameters	03	03
Parameter Control	04	04
System Details	05	05
Any other information	06 to FF	06 to FF

7th to 9th Byte: Parameter name:

UPS Systems (5th Byte 30 to 3F)

i) Alarms Urgent (6th Byte : 01)

Parameter Name	Hex Code	
	From Master	From Slave Equipment
Mains "ON"/Battery Discharging – Any reason for failure of Charger unit of UPS to deliver the output (including AC input contactor failure)	01, 00, 00	01, 01, 00 : OK 01, 02, 00 : FAULT
Battery Fail OR No Battery – Battery	02, 00, 00	02, 01, 00 : OK 02, 02, 00 : FAULT
System Over Load	Same sequence	Same sequence
Rectifier unit Voltage High	Same sequence	Same sequence
Rectifier unit Voltage Low	Same sequence	Same sequence
Fan Fail – Rack	Same sequence	Same sequence
Temp. Compensation fail – Battery	Same sequence	Same sequence
Inverter System Over Load	Same sequence	Same sequence
Load Voltage High	Same sequence	Same sequence
Load Voltage Low	Same sequence	Same sequence
Unit Input Voltage High	Same sequence	Same sequence
Unit Input Voltage Low	Same sequence	Same sequence

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Inverter Frequency Out of Range	Same sequence	Same sequence
Any other Alarm condition	Same sequence	Same sequence

ii) Alarms Non-Urgent (6th byte : 02)

Parameter Name	Hex Code	
	From Master	From Slave Equipment
Mains High	01, 00, 00	01, 01, 00 : OK 01, 02, 00 : FAULT
Mains Low	02, 00, 00	02, 01, 00 : OK 02, 02, 00 : FAULT
Rectifier: Fail	Same sequence	Same sequence
Fan Fail	Same sequence	Same sequence
Over Voltage	Same sequence	Same sequence
Under Voltage/Output Fail	Same sequence	Same sequence
Over Load	Same sequence	Same sequence
Inverter : Fail	Same sequence	Same sequence
Fan Fail	Same sequence	Same sequence
Output Voltage High	Same sequence	Same sequence
Output Voltage Low	Same sequence	Same sequence
Input Voltage High	Same sequence	Same sequence
Input Voltage Low	Same sequence	Same sequence
Over Load	Same sequence	Same sequence
Any other Alarm condition	Same sequence	Same sequence

iii) Monitoring Parameters (6th Byte : 03)

Parameter Name	Hex Code

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	From Master	From Slave Equipment
UPS - on Mains/Stand by	01, 00, 00	01, 01, 00 : MAINS 01, 02, 00 : STAND BY
Inverter Load on power plant/Battery	02, 00, 00	02, 01, 00 : Power Plant 02, 02, 00 : Battery
Load on Inverter/ Stand by	03, 00, 00	03, 01, 00 : Inverters 03, 02, 00 : Stand by Mains
Rectifier unit - Voltage	04, 00, 00	04, VALUE(H), VALUE(L)
Rectifier unit- Load	05, 00, 00	05, VALUE(H), VALUE(L)
Battery Path Current	Same sequence	Same sequence
Battery trickle Current	Same sequence	Same sequence
System Load	Same sequence	Same sequence
UPS unit- Output Voltage	Same sequence	Same sequence
Input Voltage	Same sequence	Same sequence
Frequency	Same sequence	Same sequence
Load Sharing performance of Inverters (%)	Same sequence	Same sequence
Any other Alarm condition	Same sequence	Same sequence

iv) Parameter Control (6th Byte : 04)

Parameter Name	Hex Code	
	From Master	From Slave Equipment
Mains High	01, VALUE(H), VALUE(L)	01, VALUE(H), VALUE(L)
Mains Low	02, VALUE(H), VALUE(L)	02, VALUE(H), VALUE(L)
Rectifier unit Over Load	03, VALUE(H),	03, VALUE(H),

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	VALUE(L)	VALUE(L)
Rectifier unit Float Voltage	04, VALUE(H), VALUE(L)	04, VALUE(H), VALUE(L)
Rectifier Charge Voltage	05, VALUE(H), VALUE(L)	05, VALUE(H), VALUE(L)
Rectifier Load Voltage High	Same sequence	Same sequence
Rectifier Load Voltage Low	Same sequence	Same sequence
Battery : Path Current Limit	Same sequence	Same sequence
Rectifier: Over Voltage	Same sequence	Same sequence
Under Voltage	Same sequence	Same sequence
Over Load	Same sequence	Same sequence
UPS unit Over Load	Same sequence	Same sequence
Load Voltage High	Same sequence	Same sequence
Load Voltage Low	Same sequence	Same sequence
Input Voltage High	Same sequence	Same sequence
Input Voltage Low	Same sequence	Same sequence
Any other parameter to be control	Same sequence	Same sequence

Note : 1. If the remote controller wants to check the current setting, it shall send 8th and 9th bytes as 00 00 along with the data of 7th byte as given above, the associated equipment shall return the current value.

2. If the associated equipment returns the same value as sent by controller it shall be taken as accepted otherwise not accepted and shall be resent after doing the needful.

v) System details: (6th Byte : 05)

Parameter Name	Hex Code	
	From Master	From Slave Equipment
System Make	May be generated in the remote controller by manual inputting	

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System Ultimate capacity	May be generated in the remote controller by manual inputting	
System Equipped capacity	03,00,00	03, VALUE(H), VALUE(L)
Number of Rectifier	04,00,00	04, VALUE(H), VALUE(L)
Rating of Rectifier	Same sequence	Same sequence
Number of Rectifier Working	Same sequence	Same sequence
Number of Rectifier Faulty	Same sequence	Same sequence
Number of Inverters	Same sequence	Same sequence
Rating of Inverters	Same sequence	Same sequence
Number of Inverters Working	Same sequence	Same sequence
Number of Inverters Faulty	Same sequence	Same sequence
Any other information	Same sequence	Same sequence

c) Li-Ion Battery Module (5th byte : 20 to 2F)

i) Alarms Urgent (6th byte : 01)

Parameter Name	Hex Code	
	From Master	From Slave Equipment
Module 1 Cell Overvoltage Alarm	10, 00, 00	10,01,00 OK 10,02,00 Alarm
Module 2 Cell Overvoltage Alarm	11, 00, 00	11,01,00 OK 11,02,00 Alarm
———	Same Sequence	Same Sequence
Module 16 Cell Overvoltage Alarm	1F, 00, 00	1F,01,00 OK 1F,02,00 Alarm
Module 1 Cell Under Voltage Alarm	20, 00, 00	20,01,00 OK 20,02,00 Alarm
———	Same Sequence	Same Sequence
Module 16 Cell Under Voltage Alarm	2F, 00, 00	2F,01,00 OK 2F,02,00 Alarm
Module 1 Charge Over Temperature Alarm	30, 00, 00	30,01,00 OK 30,02,00 Alarm
———	Same Sequence	Same Sequence
Module 16 Charge Over Temperature Alarm	3F, 00, 00	3F,01,00 OK

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		3F,02,00-Alarm
Module 1 Discharge Over Temperature Alarm	40, 00, 00	40,01,00-OK 40,02,00-Alarm
----------	Same Sequence	Same Sequence
Module 16 Discharge Over Temperature Alarm	4F, 00, 00	4F,01,00-OK 4F,02,00-Alarm
Module 1 Charge Over Current Level-2 Alarm	50, 00, 00	50,01,00-OK 50,02,00-Alarm
----------	Same Sequence	Same Sequence
Module 16 Charge Over Current Level-2 Alarm	5F, 00, 00	5F,01,00-OK 5F,02,00-Alarm
Module 1 Discharge Over Current Level-2 Alarm	60, 00, 00	60,01,00-OK 60,02,00-Alarm
----------	Same Sequence	Same Sequence
Module 16 Discharge Over Current Level-2 Alarm	6F, 00, 00	6F,01,00-OK 6F,02,00-Alarm
Module 1 Total Cell Over Voltage Alarm	70, 00, 00	70,01,00-OK 70,02,00-Alarm
----------	Same Sequence	Same Sequence
Module 16 Total Cell Over Voltage Alarm	7F, 00, 00	7F,01,00-OK 7F,02,00-Alarm
Module 1 Total Cell Under Voltage Alarm	80, 00, 00	80,01,00-OK 80,02,00-Alarm
----------	Same Sequence	Same Sequence
Module 16 Total Cell Under Voltage Alarm	8F, 00, 00	8F,01,00-OK 8F,02,00-Alarm
Module 1 Hardware Alarm	90, 00, 00	90,01,00-OK 90,02,00-Alarm
----------	Same Sequence	Same Sequence
Module 16 Hardware Alarm	9F, 00, 00	9F,01,00-OK 9F,02,00-Alarm
Module 1 Isolated Alarm	A0, 00, 00	A0,01,00-OK A0,02,00-Alarm
----------	Same Sequence	Same Sequence
Module 16 Isolated Alarm	AF, 00, 00	AF,01,00-OK AF,02,00-Alarm
Module 1 SOC Low level-2 Alarm	B0, 00, 00	B0,01,00-OK B0,02,00-Alarm
----------	Same Sequence	Same Sequence
Module 16 SOC Low level-2 Alarm	BF, 00, 00	BF,01,00-OK BF,02,00-Alarm
Module 1 Ambient Temperature High Alarm	C0, 00, 00	C0,01,00-OK C0,02,00-Alarm

----------	Same Sequence	Same Sequence
Module 16 Ambient Temperature High Alarm	CF, 00, 00	CF,01,00 OK CF,02,00 Alarm
Module 1 Ambient Temperature Low Alarm	D0, 00, 00	D0,01,00 OK D0,02,00 Alarm
----------	Same Sequence	Same Sequence
Module 16 Ambient Temperature Low Alarm	DF, 00, 00	DF,01,00 OK DF,02,00 Alarm

II) Alarms Non Urgent (6th byte : 02)

Parameter Name	Hex Code	
	From Master	From Slave Equipment
Module 1 Charge Over Current Level 1 Alarm	10, 00, 00	10,01,00 OK 10,02,00 Alarm
Module 2 Charge Over Current Level 1 Alarm	11, 00, 00	11,01,00 OK 11,02,00 Alarm
----------	Same Sequence	Same Sequence
Module 16 Charge Over Current Level 1 Alarm	1F, 00, 00	1F,01,00 OK 1F,02,00 Alarm
Module 1 Charge Under Temperature Alarm	20, 00, 00	20,01,00 OK 20,02,00 Alarm
----------	Same Sequence	Same Sequence
Module 16 Charge Under Temperature Alarm	2F, 00, 00	2F,01,00 OK 2F,02,00 Alarm
Module 1 Discharge Under Temperature Alarm	30, 00, 00	30,01,00 OK 30,02,00 Alarm
----------	Same Sequence	Same Sequence
Module 16 Discharge Under Temperature Alarm	3F, 00, 00	3F,01,00 OK 3F,02,00 Alarm
Module 1 Discharge Over Current Level 1 Alarm	40, 00, 00	40,01,00 OK 40,02,00 Alarm
----------	Same Sequence	Same Sequence
Module 16 Discharge Over Current Level 1 Alarm	4F, 00, 00	4F,01,00 OK 4F,02,00 Alarm
Module 1 Current Limit Mode Alarm	50, 00, 00	50,01,00 OK 50,02,00 Alarm
----------	Same Sequence	Same Sequence
Module 16 Current Limit Mode Alarm	5F, 00, 00	5F,01,00 OK 5F,02,00 Alarm
Module 1 Cell Unbalanced Alarm	60, 00, 00	60,01,00 OK 60,02,00 Alarm
----------	Same Sequence	Same Sequence

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Module 16 Cell Unbalanced Alarm	6F, 00, 00	6F,01,00 OK 6F,02,00 Alarm
Module 1 CBMS Communication Fail Alarm	70, 00, 00	70,01,00 OK 70,02,00 Alarm
----------	Same Sequence	Same Sequence
Module 16 CBMS Communication Fail Alarm	7F, 00, 00	7F,01,00 OK 7F,02,00 Alarm
Module 1 SOC Low Level 1 Alarm	80, 00, 00	80,01,00 OK 80,02,00 Alarm
----------	Same Sequence	Same Sequence
Module 16 SOC Low Level 1 Alarm	8F, 00, 00	8F,01,00 OK 8F,02,00 Alarm
Module 1 Cell Under Voltage Warning	90, 00, 00	90,01,00 OK 90,02,00 Alarm
----------	Same Sequence	Same Sequence
Module 16 Cell Under Voltage Warning	9F, 00, 00	9F,01,00 OK 9F,02,00 Alarm

iii) Monitoring Parameters (6th byte : 03)

Parameter Name	Hex Code	
	From Master	From Slave Equipment
Battery Bank instantaneous Capacity	01,00,00	01, Value (H), Value (L)
Total Battery Bank State of Charge	02,00,00	02, Value (H), Value (L)
Battery Bank Estimated Backup time	03,00,00	03, Value (H), Value (L)
Total Battery Bank Current	04,00,00	04, Value (H), Value (L)
Total Battery Bank Current Limit	05,00,00	05, Value (H), Value (L)
Module Max Charge Current Limit	06,00,00	06, Value (H), Value (L)
Instantaneous Maximum Module Current	07,00,00	07, Value (H), Value (L)
Ambient Temperature	08,00,00	08, Value (H), Value (L)
Required Charge Voltage	09,00,00	09, Value (H), Value (L)
Module 1 Remaining Capacity (xx.xAH)	20,00,00	20, Value (H), Value (L)
Module 2 Remaining Capacity (xx.xAH)	21,00,00	21, Value (H), Value (L)
----------	Same Sequence	Same Sequence
Module 16 Remaining Capacity (xx.xAH)	2F,00,00	2F, Value (H), Value (L)
Instantaneous Module 1 Current (xx.xA)	30,00,00	30, Value (H), Value (L)
----------	Same Sequence	Same Sequence
Instantaneous Module 16 Current (xx.xA)	3F,00,00	3F, Value (H), Value (L)
Module 1 Voltage (xx.xxV)	40,00,00	40, Value (H), Value (L)
----------	Same Sequence	Same Sequence
Module 16 Voltage (xx.xxV)	4F,00,00	4F, Value (H), Value (L)

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Module 1 State Of Charge (in percentage 0-100%)	50,00,00	50, Value (H), Value (L)
———	Same Sequence	Same Sequence
Module 16 State Of Charge (in percentage 0-100%)	5F,00,00	5F, Value (H), Value (L)
Module 1 State Of Health (in percentage 0-100%)	60,00,00	60, Value (H), Value (L)
———	Same Sequence	Same Sequence
Module 16 State Of Health (in percentage 0-100%)	6F,00,00	6F, Value (H), Value (L)
Module 1 Maximum Cell Voltage (x,xxxV)	70,00,00	70, Value (H), Value (L)
———	Same Sequence	Same Sequence
Module 16 Maximum Cell Voltage (x,xxxV)	7F,00,00	7F, Value (H), Value (L)
Module 1 Minimum Cell Voltage (x,xxxV)	80,00,00	80, Value (H), Value (L)
———	Same Sequence	Same Sequence
Module 16 Minimum Cell Voltage (x,xxxV)	8F,00,00	8F, Value (H), Value (L)
Module 1 Maximum Cell Temperature (xx,x' C)	90,00,00	90, Value (H), Value (L)
———	Same Sequence	Same Sequence
Module 16 Maximum Cell Temperature (xx,x' C)	9F,00,00	9F, Value (H), Value (L)
Module 1 Minimum Cell Temperature (xx,x' C)	A0,00,00	A0, Value (H), Value (L)
———	Same Sequence	Same Sequence
Module 16 Minimum Cell Temperature (xx,x' C)	AF,00,00	AF, Value (H), Value (L)
Module 1 Charge Current Limit	B0,00,00	B0, Value (H), Value (L)
———	Same Sequence	Same Sequence
Module 16 Charge Current Limit	BF,00,00	BF, Value (H), Value (L)

iv) Parameter Control (Sixth Byte as 04)

Parameter Name	Hex Code	
	From Master	From Slave Equipment

iv) System details (Sixth Byte as 05) :

Parameter Name	Hex Code	
	From Master	From Slave Equipment
Number of Modules Installed	01, 00, 00	01, Value (H), Value (L)
Number of Active Modules	02, 00, 00	02, Value (H), Value (L)
Total Battery Rated Capacity	03,00,00	03, Value (H), Value (L)
Module 1 Rated Capacity	04,00,00	04, Value (H), Value (L)
Module 2 Rated Capacity	05,00,00	05, Value (H), Value (L)
———	Same Sequence	Same Sequence
Module 16 Rated Capacity	13,00,00	13, Value (H), Value (L)
Module 1 Make (string of less or equal to16 char including null)	20, 00, 00 21,00,00 22,00,00	20, Value (H), Value (L) 21, Value (H), Value (L) 22, Value (H), Value (L)

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e.g. for make of abcdefgh Response will be 03, hexvalue of a, hexvalue of b	23,00,00 24,00,00 25,00,00 26,00,00 27,00,00	23, Value (H), Value (L) 24, Value (H), Value (L) 25, Value (H), Value (L) 26, Value (H), Value (L) 27, Value (H), Value (L)
Module 1 Date of Commission of battery (string of less or equal to16 char including null) e.g. for date of d1d2/m1m2/y1y2 ,h1h2:m1m2:s1s2 Response will be 02, hexvalue of d1, hexvalue of d2	28, 00, 00 29,00,00 2A,00,00 2B,00,00 2C,00,00 2D,00,00 2E,00,00 2F,00,00	28, Value (H), Value (L) 29, Value (H), Value (L) 2A, Value (H), Value (L) 2B, Value (H), Value (L) 2C, Value (H), Value (L) 2D, Value (H), Value (L) 2E, Value (H), Value (L) 2F, Value (H), Value (L)
Module 2 Make	Same sequence as Module 1(30-37)	Same sequence as Module 1
Module 2 Date of Commission of battery	Same sequence as Module 1(38-3F)	Same sequence as Module 1
Module 16 Make	Same sequence as above	Same sequence as above
Module 16 Date of Commission of battery	Same sequence as above	Same sequence as above

Note : In case the above information can not be provided by the UPS system the same may be generated in the First stage manually by in-putting the information. Faulty Rectifier & inverter details can be generated from the Rectifier & inverter Fail alarms.

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~~ANNEXURE-5~~

~~Purchaser Guidelines~~

~~**Note: A distinction has been made with respect to capacity of UPS. UPS with capacity upto 4KVA is treated as small whereas UPS capacity with >4KVA is treated as large in this GR. UPS upto 4KVA has less stringent requirements compare to UPS more than 4KVA. In case of critical application, purchaser may ask for stringent requirement as applicable to large capacity UPS with more than 4KVA.**~~

~~1. As UPS units are capable of synchronous load sharing with other UPS units (Maximum five such units). The user may configure a UPS system as per his requirements. He may choose the rating of UPS unit as per his ultimate requirement and the equipment shall be ordered accordingly.~~

~~2. The actual load requirement of the UPS system required shall be given by the purchaser.~~

~~3. The Voltage Regulator shall be provisioned as per the purchaser's requirement. The rating of Voltage Regulator, if used, shall be as per voltage regulation required by purchaser.~~

~~4. In the table of clause 1.1.4 for Modular UPS system, the system configuration shall depend upon the capacity of the basic module and the redundancy requirements which shall be given by the purchaser.~~

~~5. Chapter-3: clause 3.6.1.5: **Component Approval :** The components used in UPS system, shall be certified by accredited National/International Lab. However Purchaser may ask for any specific lab~~

~~**6.** Chapter-3: clause 3.8: **Quality Assurance Tests :** Each of the UPS system supplied against the specific order after type approval shall be inspected and tested to ensure that the requirements of this document have been met. For these test, testing agency shall be designated by purchaser.~~

7 Chapter-3: clause 3.11.1 & 3.11.2: MTTR & MTBF shall be decided by purchaser.

8. **Clause 1.1.3.3:** Purchaser may decide about redundancy of micro-processor/Chip based on its application.

9. **Clause 2.6:** The requirement of LSP devices for UPS with <4KVA(less than) rating will be decided by purchaser.

10. Clause 2.8: **Remote control and monitoring:** In case of UPS with <4KVA(less than) rating, this feature will be decided by purchaser.

11. Clause 2.9.15.3: **Battery Health Check**: In case of UPS with less than 4KVA, Purchaser may ask for this feature. If required by Purchaser, the provision for conducting a partial discharge (about 20%) test, of a pre-determined duration and frequency, shall be made available in the UPS system (Frequency and duration of partial discharge test shall be programmable).

12. Cl 2.9.15.5 Temperature compensation for battery: **In case of UPS with less than 4KVA, Purchaser may ask for this requirement depending upon critical operation.**

~~ABBREVIATIONS~~

~~A or Amps.~~	~~Amperes~~
~~AC.~~	~~Alternating Current~~
~~AH.~~	~~Ampere Hour~~
~~BIS.~~	~~Bureau Of Indian Standards~~
~~BSNL.~~	~~Bharat Sanchar Nigam Limited~~
~~CACT.~~	~~Component Approval Centre- Telecommunication~~
~~DB.~~	~~Decibel~~
~~DBA.~~	~~Decibel Absolute~~
~~DC.~~	~~Direct Current~~
~~deg C.~~	~~Degrees Celsius~~
~~DG.~~	~~Diesel Generator~~
~~DOT.~~	~~Department of Telecommunication~~
~~DTS.~~	~~Department of Telecommunication Services~~
~~emf.~~	~~Electro motive force~~
~~EMI.~~	~~Electro Magnetic Interference~~
~~FET.~~	~~Field Effect Transistor~~
~~FSD.~~	~~Full Scale Deflection~~
~~FR/FC.~~	~~Float Rectifier cum Charger~~
~~FR/BC.~~	~~Float Rectifier cum Battery Charger~~
~~GR.~~	~~Generic Requirements~~
~~IS.~~	~~Indian Standards~~
~~Kg.~~	~~Kilo Grams~~
~~KHz.~~	~~Kilo Hertz~~
~~LED.~~	~~Light Emitting Diodes~~
~~LCD.~~	~~Liquid Crystal Device~~
~~MHz.~~	~~Mega Hertz~~
~~MOV.~~	~~Metal Oxide Varistor~~
~~MTBF.~~	~~Mean Time between Failures~~
~~Ms.~~	~~milli seconds~~
~~PCB.~~	~~Printed Circuit Board~~
~~PF.~~	~~Power factor~~

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~~QA.~~	~~Quality Assurance~~
~~QM.~~	~~Quality Manual~~
~~RFI.~~	~~Radio Frequency Interference~~
~~RTEC.~~	~~Regional Telecom Engineering Centre~~
~~SMPS.~~	~~Switch Mode Power Supply~~
~~SVR~~	~~Static Voltage Regulator~~
~~STS~~	~~Static Transfer Switch~~
~~TEC.~~	~~Telecom Engineering Centre~~
~~T & D.~~	~~Technical & Development~~
~~V.~~	~~Volts~~
~~VRLA.~~	~~Valve Regulated Lead Acid~~
~~VR~~	~~Voltage Regulator.~~

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ANNEXURE-II

NAME OF ……. (MANUFACTURER / / STAKEHOLDER)

I. **COMMENTS ON "Uninterrupted Power Supply (UPS) System, TEC 66140:2025" (Draft document TEC 66140:2025)**

Clause No.	Clause Description	Comments, if any	Remarks, if any

Note: The comments on the draft for Standard revision of GR on" Uninterrupted Power Supply (UPS) System" may be provided in the above format vide Email to adgfa-tec-dot@gov.in with copy to dirfa.tec@gov.in and ddgfla.tec@gov.in