3 X 660 MW NORTH KARANPURA STPP

VOLUME IIB

TECHNICAL SPECIFICATION

FOR

220V DC BATTERY

SPECIFICATION NO.: PE-TS-405-508-E001 (REV. 00)

BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENINEERING MANAGEMENT
NOIDA-201301

CONTENTS

*If bidders have any reference QAP of NTPC projects then same shall be applicable. QAP attached with specification is for reference only.

TOTAL NO. OF SHEETS = 53 (INCLUDING COVER/ SEPARATOR SHEETS)

(REFER INSTRUCTION NO. 1 OF 'INSTRUCTIONS TO BIDDERS')

IT IS CONFIRMED THAT OUR TECHNICAL OFFER COMPLIES WITH THE SPECIFICATION IN TOTO, & THAT THERE ARE NO TECHNICAL DEVIATIONS.

BIDDER'S STAMP & SIGNATURE

INSTRUCTIONS TO BIDDERS FOR PREPARING TECHNICAL OFFERS

1. In line with clause no. 15.1 of Section-C, Volume-II-B of the specification, two signed and stamped copies of the following shall be furnished by all bidders as technical offer:
    a. Battery sizing calculation with respect to load duty cycle as per Annexure-III of Section-C to be provided along with supporting documents (capability / discharge curve, temperature correction factor, float charging factor & published technical catalogue) for considered factors.
    b. Unpriced Price Schedule ("Annexure-I: BOQ cum Price Schedule", as enclosed with the specification) with bidder's signature and company stamp.
    c. A copy of this sheet ("Instructions to Bidders for Preparing Technical Offer"), with bidder's signature and company stamp.
    d. A copy of previous sheet ("List of Contents"), with bidder's signature and company stamp.
    e. A copy of next sheet ("Deviation Schedule"), with "NO DEVIATION" and bidder's signature and company stamp.
    f. A copy of sheet ("Data Sheet-A"), with required information and bidder's signature and company stamp.
    g. Documents for Provenness criteria: In order to be able to present to the client the provenness of the equipment offered, the bidder is required to furnish elaborate details of experience, capabilities, reference list etc. in the offer

2. No technical submittal except as stated above, such as copies of type test certificates, data Sheets, write-up, drawing, technical literature, etc. is required during tender stage. Any such submission, even if made, shall not be considered as part of offer.

3. Confirmations/ comments (if any) regarding delivery schedules shall be furnished as part of the commercial offer. Any reference elsewhere/ covering letter of technical offer shall not be considered by BHEL.

4. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.

5. Any changes made by the bidder in the price schedule with respect to the battery description/ quantities, notes etc. from those given in Annexure-I: BOQ cum Price Schedule shall not be considered (i.e., technical description, quantities, notes etc. as per specification shall prevail).

6. Bidder to note that, equipment comply with other internationally accepted standards such as IEC. BS, VDE etc. will also be considered if they ensure performance and constructional features equivalent or superior to standards listed Annexure-II. In such a case, the contractor shall clearly indicate the standard(s) adopted, furnish a copy in English of the latest revision of the standards along with copies of all official amendments and revisions in force as on date of opening of bid and shall clearly bring out the salient features for comparison.

BIDDER'S STAMP & SIGNATURE

PREAMBLE

1.0 The Tender documents contains three (3) volumes. The bidder shall meet the requirements of all three volumes.

1.1 **VOLUME - I** **CONDITIONS OF CONTRACT**

This consists of four parts as below:-

Volume – IA This part contains Instructions to bidders for making bids to BHEL.

Volume – IB This part contains General Commercial Conditions of the Tender & includes provision that vender shall be responsible for the quality of item supplied by their sub-vendors.

Volume – IC This part contains Special Conditions of Contract.

Volume – ID This part contains Commercial conditions for Erection & Commissioning site work, as applicable.

1.2 **VOLUME – II** **TECHNICAL SPECIFICATION**

Technical requirements are stipulated in Volume – II, which comprises of:-

Volume – IIA General Technical Conditions.

Volume – IIB Technical Specification including Drawings, if any.

1.3 VOLUME – IIB

This volume is sub-divided in to following sections:-

Section – A This section outlines the Intent of Specification

Section – B This section provides “Project Information”.

Section – C This section indicates Technical Requirements specific to Contract.

Data sheet - A :- Specific data and other requirements pertaining to the equipments.

Data sheet – C :- Indicates data / documents to be furnished after the award of Contract as per agreed schedule by the vendor (as applicable)

Quality Plan

PROVENESS CRITERIA

The Bidder should have manufactured and supplied at least two (2) numbers of offered rating or above of High Discharge type Plante Positive Plate type battery (in case bidder offers Lead Acid Plante type battery) or High Discharge type Nickel Cadmium battery (in case bidder offers Nickel Cadmium battery), at least one (1) each at two (2) different industrial installations, which should have been in successful operation for at least two (2) years prior to the date of Techno- Commercial bid opening.

NOTE: Two different installations mean two different project sites or two different contracts.

SECTION - A

SCOPE OF ENQUIRY

1.0 This specification covers the design, manufacture, assembly, testing and inspection at manufacturer's works, proper packing and delivery to site and supervision of E & C of 220V DC Battery & Battery health monitoring system as mentioned in different sections of this specification for 3x660MW NORTH KARANPURA STPP.

2.0 It is not the intent to specify herein all the details of design & manufacture. However, the equipment shall conform in all respects to high standards of design engineering and workmanship and shall be capable of performing in continuous commercial operation up to bidder's guarantee.

3.0 The general terms and conditions, instructions to bidders and other attachment referred to elsewhere are hereby made part of the Technical Specification.

4.0 The bidders shall be responsible for and governed by all requirements stipulated hereinafter.

5.0 Bidders shall confirm total compliance to the specification without any deviations from the technical/ quality assurance requirements stipulated.

6.0 The offer should be complete with technical data, catalogue, brochures and drawings as applicable.

7.0 The documents shall be in English language and MKS system of units.

1.00.00 **BACKGROUND**

North Karanpura Super Thermal Power Project (3x660 MW), a pit head coal based thermal power project, is located in Hazaribagh and Chatra districts of Jharkhand State. Basic inputs i.e. coal, water and land have already been tied up. The project is proposed for the States & Union Territories of Northern, Western and Eastern Regions and the State of Jharkhand.

The capacity of the project is 1980 MW comprising of three (3) units of 660 MW each.

1.01.00 **Location and Approach**

The power project is proposed to be located near Tandwa town in Chatra districts in the state of Jharkhand on Hazaribagh-Chatra State highway at a distance of about 50 kms from Hazaribagh city. The nearest commercial airport is Ranchi at a distance of 150 kms from project site. The nearest railhead Khalari Railway Station on Ranchi-Garhwa section of Eastern Railways is about 40 kms from project site.
Major rail/road distances from the project site are as under:

City		**Distance Approx. (kms)**
Ranchi	:	150
Khalari	:	40

The site is located near Tandwa town having latitude and longitude of about 23^0 50' N to 23º 52' N and 84^0 59' E to 85º 2' E respectively. The Vicinity Plan of the project is placed at **Annexure-I.**

Further to the information given in this sub-section, Bidders are also advised to visit the project site and collect data on local site conditions.

1.02.00 **Land**

About 2245 acres of land is being acquired for the project. About 1500 acres of land is under possession/legal possession and out of 1500 acres, about 890 acres of land is to be used for plant, ash dyke and initial enabling township. No additional land is envisaged to be acquired in plant area. About 15 acres of land is envisaged to be acquired in Hazaribagh city for Township.
Commissioner, Chatra vide dated 25.05.1999 and 14.06.2000 has given in-principle clearance for NKSTPP.

1.03.00 **Water**

Make up water available for this project would be about 22 cusec and will be arranged by constructing a dam/reservoir across river Garhi.

1.04.00 **Fuel (Coal)**

1.04.01 **Coal Requirement, Availability and Linkage**

Coal requirement for the project is estimated as 10.6 Million Tonne/Annum (MTPA), considering a GCV of 3800 kcal/kg. Ministry of Coal vide letter dated 21.10.99 accorded in-principle coal linkage of 10.00 MTPA subject to ratification by Standing Linkage Committee-Long Term (SLC (LT)), of MOC. SLC (LT) in its meeting held on 15.12.2000 firmed up the coal linkage of 10.24 MTPA for the project. Subsequently, the coal linkage was withdrawn by SLC (LT) in its meeting held on 22/23.10.08.

Cabinet Committee on Investment (GOI) in its meeting on 20.02.13 decided in-principle to restore the original coal linkage granted to NKSTPP (i.e. from Magadh Coal Block) with the stipulation that the coal supply will commence during the 13th Five Year Plan. MOC vide letter dated 09.05.2013 restored the coal linkage with the stipulation that the coal supply will commence during the 13th five year plan.

1.04.02 **Coal Transportation**

Coal from Magadh block of North Karanpura Coalfields is proposed to be transported to the project site through conveyor belt system. One external coal handling plant and one internal coal handling plant are envisaged.

1.05.00 **Meteorological Data**

Important meteorological data from nearest observatory at Hazaribag is placed at Annexure-II**.**

1.06.00 **Plant Water Scheme**

The Plant water scheme is described below.

1.06.01 **Condenser Cooling System**

It is proposed to adopt Air Cooled Condenser for the project.

1.06.02 **Equipment Cooling Water (ECW) System (Unit Auxiliaries)**

All plant auxiliaries shall be cooled by De-mineralized water (DM) in a closed circuit. The primary circuit DM water shall be cooled through heat exchangers by auxiliary cooling water system. The hot secondary circuit cooling water shall be cooled in the cooling towers and shall be returned back to the system.

1.06.03 **Ash Water System**

It is proposed to have HCSD (High concentration Slurry Disposal) system for combined fly ash and bottom ash. No recirculation of ash water from ash disposal area is envisaged.

1.06.04 **Other Miscellaneous Water Systems**

(a) Raw water shall be used for meeting the Fly ash and bottom ash system requirement etc.

(b) The service water shall be taken from clarified water tank of Pretreatment plant. Service water (wash water) collected from various areas shall be treated using oil water separators, tube settlers, coal settling pits etc. as per requirement and treated water from liquid effluent treatment plant shall be recycled back to the service water system for re-use.

(c) The drinking water requirement of the plant shall be provided from water treatment plant.

(d) Steam Cycle make-up water, makeup to the primary circuit of ECW (unit auxiliaries) system, boiler fill water and makeup to the hydrogen generation plant shall be provided from Demineralising plant.

(e) The quality of Raw water is enclosed with this sub-section as Annexure-III.

1.07.00 **Criteria for Earthquake Resistant Design of Structures and Equipment**

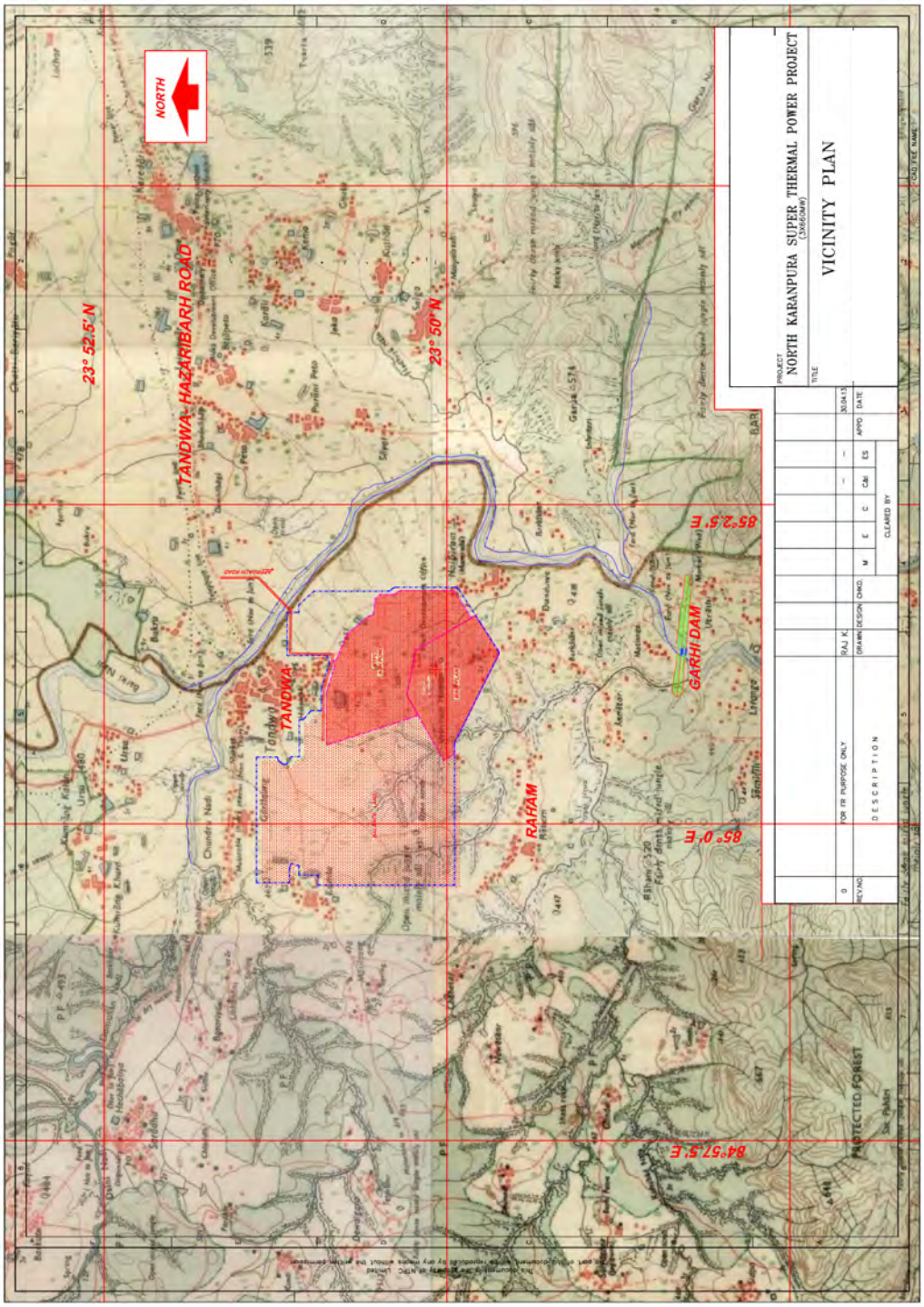
All power plant structures and equipment, including plant auxiliary structures and equipment shall be designed for seismic forces as given in the Part - B of this section.

1.08.00 **Criteria for Wind Resistant Design of Structures and Equipment**

All structures and equipment of the power plant, including plant auxiliary structures and equipment, shall be designed for wind forces as given as given in Part B of this section.

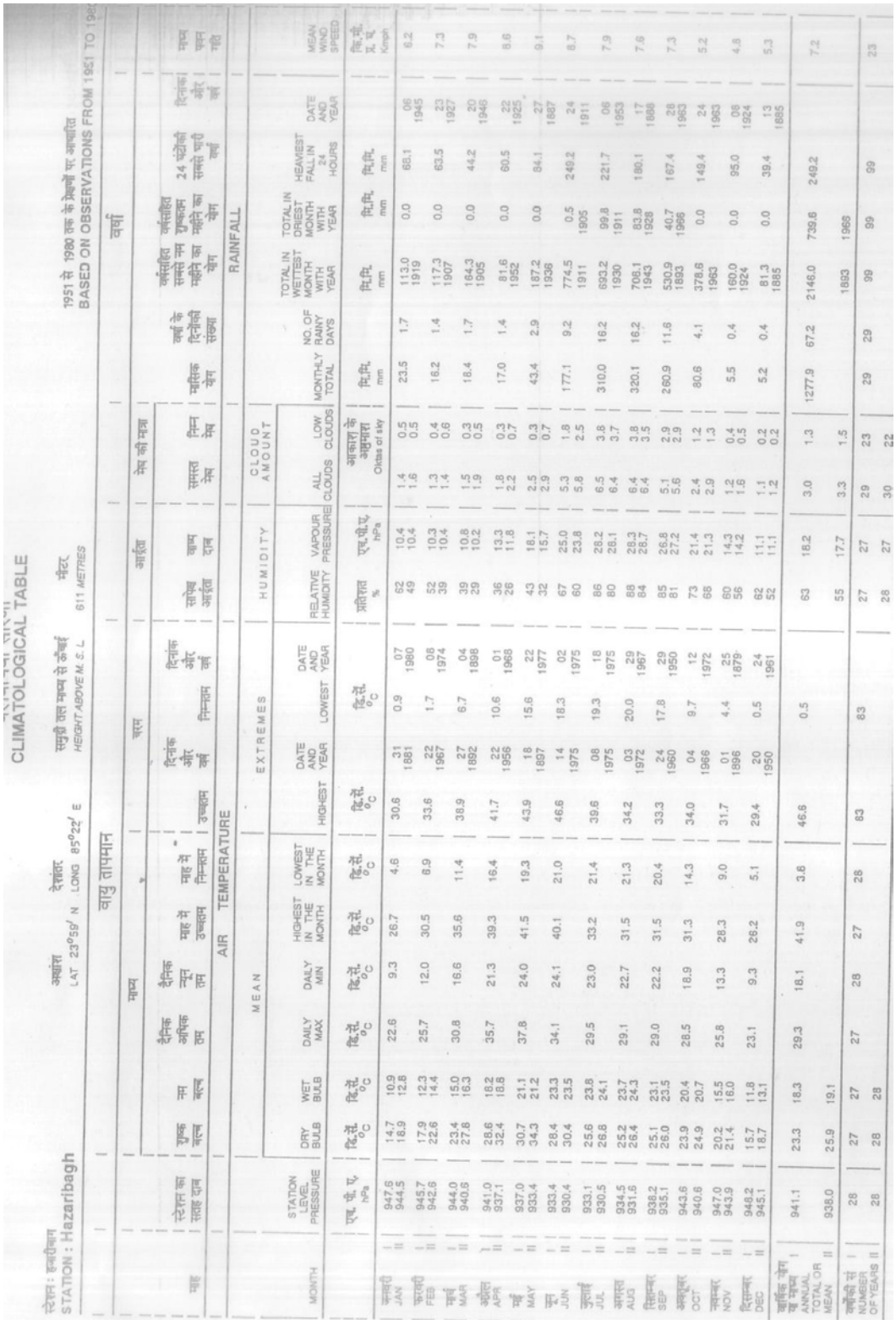
Annexure-I

VICINITY PLAN



Annexure-II

CLIMATOLOGICAL TABLE



CLIMATOLOGICAL TABLE

स्टेशन : हजारीबाग STATION : Hazaribagh

अक्षांश LAT 23°59′ N देशांतर LONG 85°22′ E समुद्री तल माप से ऊँचाई HEIGHT ABOVE M. S. L. 611 METRES

1951 से 1980 तक के प्रेक्षणों पर आधारित BASED ON OBSERVATIONS FROM 1951 TO 1980

MONTH	स्टेशन स्तर पर वायुदाब STATION LEVEL PRESSURE एच. पी. ए. hPa	वायु तापमान AIR TEMPERATURE MEAN शुष्क बल्ब DRY BULB डि.से. °C	नम बल्ब WET BULB डि.से. °C	दैनिक अधिकतम का माह DAILY MAX डि.से. °C	दैनिक न्यूनतम का माह DAILY MIN डि.से. °C	HIGHEST IN THE MONTH डि.से. °C	LOWEST IN THE MONTH डि.से. °C	EXTREMES उच्चतम HIGHEST डि.से. °C	दिनांक और वर्ष DATE AND YEAR	निम्नतम LOWEST डि.से. °C	दिनांक और वर्ष DATE AND YEAR	HUMIDITY RELATIVE HUMIDITY प्रतिशत %	वाष्प दाब VAPOUR PRESSURE एच.पी.ए. hPa	CLOUD AMOUNT सकल मेघ ALL CLOUDS आकाश के अष्टमांश Oktas of sky	निम्न मेघ LOW CLOUDS आकाश के अष्टमांश Oktas of sky	MONTHLY TOTAL मि.मि. mm	वर्षा के दिनों की संख्या NO. OF RAINY DAYS	RAINFALL मासिक योग मि.मि. mm	वर्षासहित समस्त माह का योग TOTAL IN WETTEST MONTH WITH YEAR मि.मि. mm	वर्षारहित समस्त माह का योग TOTAL IN DRIEST MONTH WITH YEAR मि.मि. mm	24 घंटों में समस्त वर्षा HEAVIEST FALL IN 24 HOURS मि.मि. mm	दिनांक और वर्ष DATE AND YEAR	MEAN WIND SPEED माध्य वायु गति कि.मी. प्र. घं. Kmph
जनवरी JAN	I 947.6	14.7	10.9	22.6	9.3	26.7	4.6	30.6	31 1881	0.9	07 1980	62	10.4	1.4	0.5	23.5	1.7	113.0	0.0	68.1	06 1945	6.2
	II 944.5	18.9	12.8									49	10.4	1.6	0.5			1919				
फरवरी FEB	I 945.7	17.9	12.3	25.7	12.0	30.5	8.9	33.6	22 1967	1.7	08 1974	52	10.3	1.3	0.4	16.2	1.4	117.3	0.0	63.5	23 1927	7.3
	II 942.6	22.6	14.4									39	10.4	1.4	0.6			1907				
मार्च MAR	I 944.0	23.4	15.0	30.8	16.6	35.6	11.4	38.9	27 1892	6.7	04 1898	39	10.8	1.5	0.3	18.4	1.7	164.3	0.0	44.2	20 1946	7.9
	II 940.6	27.8	18.3									29	10.2	1.9	0.5			1905				
अप्रैल APR	I 941.0	28.6	18.2	35.7	21.3	39.3	16.4	41.7	22 1956	10.6	01 1968	36	13.3	1.8	0.3	17.0	1.4	81.6	0.0	60.5	22 1925	8.6
	II 937.1	32.4	18.8									26	11.8	2.2	0.7			1952				
मई MAY	I 937.0	30.7	21.1	37.8	24.0	41.5	19.3	43.9	18 1897	15.6	22 1977	43	18.1	2.5	0.3	43.4	2.9	187.2	0.0	84.1	27 1887	9.1
	II 933.4	34.3	21.2									32	15.7	2.9	0.7			1936				
जून JUN	I 933.4	28.4	23.3	34.1	24.1	40.1	21.0	46.6	14 1975	18.3	02 1975	67	25.0	5.3	1.8	177.1	9.2	774.5	0.5	249.2	24 1911	8.7
	II 930.4	30.4	23.5									60	23.8	5.8	2.5			1911	1905			
जुलाई JUL	I 933.1	25.6	23.8	29.5	23.0	33.2	21.4	39.6	08 1975	19.3	18 1975	86	28.2	6.5	3.8	310.0	16.2	693.2	99.8	221.7	06 1953	7.9
	II 930.5	26.8	24.1									80	28.1	6.4	3.7			1930	1911			
अगस्त AUG	I 934.5	25.2	23.7	29.1	22.7	31.5	21.3	34.2	03 1972	20.0	29 1967	88	28.3	6.4	3.8	320.1	16.2	706.1	83.8	180.1	17 1886	7.6
	II 931.6	26.4	24.3									84	28.7	6.4	3.5			1943	1928			
सितम्बर SEP	I 936.2	25.1	23.1	29.0	22.2	31.5	20.4	33.3	24 1960	17.8	29 1950	85	26.8	5.1	2.9	260.9	11.6	530.9	40.7	167.4	28 1963	7.3
	II 935.1	26.0	23.5									81	27.2	5.6	2.9			1893	1998			
अक्टूबर OCT	I 943.6	23.9	20.4	28.5	18.9	31.3	14.3	34.0	04 1966	9.7	12 1972	73	21.4	2.4	1.2	80.6	4.1	378.6	0.0	149.4	24 1963	5.2
	II 940.6	24.9	20.7									68	21.3	2.9	1.3			1963				
नवम्बर NOV	I 947.0	20.2	15.5	25.8	13.3	28.3	9.0	31.7	01 1896	4.4	25 1879	60	14.3	1.2	0.4	5.5	0.4	160.0	0.0	95.0	06 1924	4.8
	II 943.9	21.4	16.0									56	14.2	1.6	0.5			1924				
दिसम्बर DEC	I 948.2	15.7	11.8	23.1	9.3	26.2	5.1	29.4	20 1950	0.5	24 1961	62	11.1	1.1	0.2	5.2	0.4	81.3	0.0	39.4	13 1885	5.3
	II 945.1	18.7	13.1									52	11.1	1.2	0.2			1885				
वार्षिक योग ANNUAL TOTAL OR MEAN	I 941.1	23.3	18.3	29.3	18.1	41.9	3.6	46.6		0.5		63	18.2	3.0	1.3	1277.9	67.2	2146.0	739.6	249.2		7.2
	II 938.0	25.9	19.1									55	17.7	3.3	1.5			1893	1968			
वर्षों की संख्या NUMBER OF YEARS	I 28	27	27	27	28	27	28	83		83		27	27	29	23	29	29	99	99	99		23
	II 28	28	28									28	27	30	22							

Annexure-III

RAW WATER ANALYSIS

Sl. No.	Constituent	as	mg per litre
1.	Calcium	CaCO3	65
2.	Magnesium	CaCO3	41
3.	Sodium	CaCO3	98
4.	Potassium	CaCO3	5
5.	Total Cations	CaCO3	209
6.	Total Alkalinity	CaCO3	150
7.	Chloride	CaCO3	25
8.	Sulphate	CaCO3	34
9.	Total Anions	CaCO3	209
9.	Silica (Reactive)	SiO2	9
11.	Iron	Fe	1.2
12.	pH Value	-	7.6-8.2
13.	Turbidity	NTU	200
14.	Organics(As per KMnO4 method)	Number	2

ANNEXURE-IV-1

TABLE-1

LIGHT DIESEL OIL CHARACTERISTICS
(AS PER IS 15770-2008)

	Characteristics	LDO
1.	Pour Point (max)	21 ℃ & 12℃ for Summer and Winter respectively
2.	Kinematic viscosity in centistokes at 40 deg.C	2.5 to 15.0
3.	Sediment percent by mass (max)	0.10
4.	Total sulphur percent by mass (max)	1.5
5.	Ash percentage by mass (max)	0.02
6.	Carbon residue (Rams bottom) percent by pass (max.)	1.50
7.	Acidity inorganic	Nil
8.	Flash point (Min.) - Pensky Martens	66 deg.C
9.	Copper strip corrosion for 3 hours at 100℃	Not worse than No. 2
10.	Water content, % by volume (max)	0.25
11.	GCV(kcal/kg)	10,000

TABLE-2 **ANNEXURE-IV-2**

HIGH SPEED DIESEL OIL CHARACTERISTICS

[AS PER IS **1460-2005 (BS-II)]**

S. No.	Particulars	Unit	Value
1.	PHYSICAL PROPERTIES		
	a. Distillation volume recovery @ 350^0C	% vol. (min)	85
	b. Distillation volume recovery @ 370^0C	% vol. (min)	95
	c. Kinematic Viscosity @ 40 Degree C	cSt	2.0 – 5.0
	d. Density @ 15 Degree C	kg/m^3	820 – 860
	e. Pour Point		
	- Summer	Degree C (max)	15
	- Winter	Degree C (max)	03
	f. Cold Filter Plugging Point		
	- Summer	Degree C (max)	18
	- Winter	Degree C (max)	06
	g. Flash Point (Abal)	Degree C (max)	35
	h. Lubricity WSD 1.4 @ 60 Degree C	Microns (max)	460
2.	HEATING VALUE		
	a. Higher Heating Value (HHV)	Kcal/Kg	11,000
	b. Lower Heating Value (LHV)	Kcal/Kg	10,300
3.	ACIDITY		
	a. Inorganic	mg KOH/g	Nil
	b. Total	mg KOH/g	0.2 (max.)
4.	Copper Strip Corrosion 3 hours @100^0C	No.	1 (max)
5.	RCR on 10% residue	% wt.	0.3 (max)
6.	CONTAMINANTS		
	a. Ash	ppm (wt.)	100 (max)
	b. Sediments	% wt	0.05 (max)
	c. Total Sulphur	% wt	0.05 (max)
	d. Water Content	% volume	0.05 (max)
	e. Trace Metals		
	- Na + K	ppm (wt)	0.30 (max)
	- Vanadium	ppm (wt)	0.50 (max)
	- Lead	ppm (wt)	0.50 (max)
	- Calcium	ppm (wt)	2.0
	- Ni + Zn	ppm (wt)	Nil
7.	Nitrogen content (FBN)	% wt.	0.015

TABLE-3 **ANNEXURE-IV-3**

PROPOSED COAL CHARACTERISTICS FOR NORTH KARANPURA STPP (3 x 660 MW)

S.No.	Characteristics (as received basis)	Range of 95 % coal supplies			Range of 5 % coal supplies
		Column - 1	Column - 2	Column - 3	
1.0	PROXIMATE ANALYSIS	Design	Worst	Best	
1.1	Total Moisture (%)	15	18	12	12-18
1.2	Ash (%)	40	46	36	33-46
1.3	Volatile Matter (%)	19	18	22	23-18
1.4	Fixed Carbon (%)	26	18	30	31-18
1.5	Total (%)	100	100	100	
2.0	ULTIMATE ANALYSIS				
2.1	Carbon (%)	29.73	23.08	37.32	40.62-23.08
2.2	Hydrogen (%)	3.7	3.54	3.92	4.02-3.54
2.3	Sulphur (%)	0.5	0.6	0.4	0.4-0.6
2.4	Nitrogen(%)	1.8	1.45	1.6	1.4-1.45
2.5	Oxygen(%)(By difference)	8.66	6.7	8.32	8.12-6.7
2.6	Carbonates (%)	0.58	0.6	0.4	0.4-0.6
2.7	Phosphorous(%)	0.03	0.03	0.04	0.04-0.03
2.8	Total Moisture (%)	15	18	12	12-18
2.9	Ash (%)	40	46	36	33-46
	Total	100	100	100	
2.10	GCV (Kcal/Kg)	3300	2800	4000	4300-2800
2.11	Hard Grove Index	55	50	60	50-65
3.0	ASH ANALYSIS				
3.1	Silica (%)	59.79	61.3	56.7	62-56
3.2	Alumina(%)	25.36	28	23.5	28-23
3.3	Iron Oxide (%)	7.2	6	10	6-10
3.4	Titania	1.2	1	1.5	1-1.7
3.5	Phophoric Anhydride (%)	2.6	1.5	3	1-3
3.6	Lime (%)	0.88	0.5	1.5	0.5-1.7
3.7	Magnesia (%)	0.55	0.4	1	0.4-1.1
3.8	Sulphuric Anhydride (%)	1.2	0.5	1.4	0.5-1.7
3.9	Alkalies (by difference)	1.22	0.8	1.4	0.6-1.8
	Total	100	100	100	
4.0	ASH FUSION RANGE				
	REDUCING ATMOSPHERE				
4.1	Initial Deformation Temp.(oC	1100	1100	1100	1100-1150
4.2	Hemispherical Temp. (oC)	1300	1250	1350	1250-1400
4.3	Fusion Temperature (oC)	1400	1400	1400	1400-1450

ANNEXURE-IV-4

TABLE – 4

TYPICAL IMPORTED COAL AND ASH CHARACTERISTICS

Sl.No.	Characteristics (as received basis)	Imported Coal	
		Worst	**Best**
1.0	**Proximate Analysis**		
1.1	Total Moisture (%)	20	16
1.2	Ash (%)	10	10
1.3	Volatile Matter (%)	30	45
1.4	Fixed Carbon (%)	40	29
1.5	Total (%)	100	100
2.0	**Ultimate Analysis**		
2.1	Carbon (%)	56.4	62.4
2.2	Hydrogen (%)	4.5	4.9
2.3	Sulphur (%)	0.9	0.8
2.4	Nitrogen (%)	0.9	0.5
2.5	Oxygen (%) (By difference)	7.3	5.4
2.6	Carbonates (%)	0	0
2.7	Phosphorous (%)	0	0
2.8	Total Moisture (%)	20	16
2.9	Ash (%)	10	10
	Total	100	100
2.10	GCV (Kcal/Kg)	5800	6500
2.11	Hard Grove Index	45	60
2.12	YGP (mg/kg)	100	70
3.0	**Ash Analysis**		
3.1	Silica (SiO2) (%)	32.74	34.94
3.2	Alumina(Al2O3) (%)	30.5	28.43
3.3	Iron Oxides(Fe2O3) (%)	18.2	15.2
3.4	Titania (TiO2)	1.56	1.76
3.5	Phosphoric Anhydride(P2O5) (%)	0.44	0.54
3.6	Lime (CaO) (%)	6.12	7.62
3.7	Magnesia (MgO) (%)	1.83	1.93
3.8	Sulphuric Anhydride (%)	6.95	7.65
3.9	Sodium Oxide (Na2O) (%)	0.3	0.4
3.10	Balance alkalies (by difference)	1.36	1.56
	Total	100	100
4.0	**Ash Fusion Temperature reducing temperature**		
4.1	Initial deformation Temp (ºC)	1100	1250
4.2	Hemispherical Temp. (ºC)	1300	1350
4.3	Flow Temp. (ºC)	1400	1400

SECTION – 'C'

SECTION – C

SPECIFIC TECHNICAL REQUIREMENT

1.0 SCOPE OF ENQUIRY

This specification covers the design, manufacture, assembly, testing and inspection at vendor's works, packing, despatch to site and supervision of E&C of 220V DC batteries as described in the various sections of this specification. In this specification, as erection and commissioning is not included in vendor's scope, Vendor shall still not be absolved of his responsibility of establishing the correctness of equipment at site.

2.0 EQUIPMENT AND SERVICES TO BE FURNISHED BY THE BIDDER

The bidder shall supply the following equipment in accordance with the various sections of this specification. The BOQ cum Price Schedule is enclosed as Annexure-I.

3.0 SERVICES AND EQUIPMENT TO BE EXCLUDED

A) Civil works like foundation and cable cellar, flooring of the battery room etc.
B) Ventilation of battery and charger room.
C) DCDB
D) Power and control cables
E) Erection of the equipment
F) Battery charger, battery fuse box and discharge resistor panel

4.0 CODES AND STANDARDS

Unless otherwise specified, the latest revisions of codes/standards specified in Annexure-II enclosed are applicable and shall be referred to. Equipment complying with other internationally accepted standards such as IEC. BS, VDE etc. will also be considered if they ensure performance and constructional features equivalent or superior to standards listed in Annexure-II. In such a case, the contractor shall clearly indicate the standard(s) adopted, furnish a copy in English of the latest revision of the standards along with copies of all official amendments and revisions in force as on date of opening of bid and shall clearly bring out the salient features for comparison.

5.0 **SCHEDULE OF PRICES** – BOQ cum Price Schedule for 220V DC Battery (Annexure-I Main Items) shall be considered for price evaluation purpose.

DELIVERY: Ex-works delivery of equipment shall be as per NIT.

6.0 SYSTEM CONCEPT

6.01 220V DC system for each unit shall be an ungrounded system comprising of 2x100% batteries each with individual float cum boost charger and 1x100% sectionalised DCDB. The 220V DC system is designed to cater the control, protection, interlocking, emergency DC lighting and emergency DC drives for BTG area. Each side of DCDB will cater DC load duty cycle requirement as per Annexure-III of Section-C. Bidder to furnish sizing calculations in support of the battery Capacity chosen by Bidder.

6.02 Battery and charger will be connected to DCDB as per Annexure-IV. The battery shall be designed to restrict maximum fault level on DCDB limited to 20kA.

6.03 In case of failure of AC, battery will meet the DC load requirement. After restoration of power, the float charger will continue to supply the loads as well as trickle charge the battery. Under discharge condition, at a time only one battery will be put to boost charge.

6.03 The 220V batteries shall be sized considering emergency load cycle requirement of 45 minutes and design factors as per Annexure-III.

6.04 The voltage at load terminal will not exceed the limits of +10% and -15% of nominal system voltage for 220V DC system.

6.05 Batteries shall be connected to DC distribution board through single cores cables Aluminium cable (4-1CX630sqmm (Al)/ pole FRLS cable: Tentative size) for each pole. Battery terminals shall be made suitable for above cable.

6.06 The equipment will be located indoor but in a hot, humid and tropical atmosphere.

6.07 Necessary accessories required for maintenance and testing of batteries shall be supplied with each battery bank as per enclosed Annexure-V.

7.0 OTHER TECHNICAL REQUIREMENTS

7.1 Lead-Acid Batteries

DC Batteries shall be stationary lead acid Plante positive plate type conforming to IS-1652. The battery shall be high discharge performance type. The batteries shall meet the 'Load Duty Cycle' requirements under all site-operating conditions as specified. For the purpose of design an ambient temperature of 50 degree centigrade and relative humidity of 85% shall be considered. DC Batteries shall be suitable for standby duty. The Batteries shall normally be permanently connected to the load in parallel with a charger and shall supply the load during emergency conditions when AC supplies are lost. Batteries shall be suitable for a long life under continuous float operations and occasional discharges. The batteries shall be boost charged at about 2.7 volts per cell maximum and float charged at about 2.25 V/cell. Batteries should be suitable for continuous operation for the maximum ambient temperature as defined in technical parameters.

a) Containers:
Containers shall be made of transparent glass, robust, heat resistant, shock absorbing, leak proof, non-absorbent, acid resistant, non-bulging type and free from flaws such as wrinkles, cracks, blisters, pinholes etc. Electrolyte level lines shall be marked on containers in case of translucent containers. The marking for the electrolyte level shall be for upper & lower limits. Container shall be SAN container closed/sealed lid type. Open type cells are not acceptable. Lid and sealing compound shall be non-cracking type. The container made of plastics shall be type tested as per IS-1146. All type tests shall be carried out for sealing compound as per IS-3116. The pole sealing arrangement shall be such that no acid particle gets entrapped due to acid creep as a result of capillary action and it shall be possible to remove and refix the sealing to carry out maintenance.

b) Vent Plugs:
Vent plugs shall be provided in each cell. They shall be anti-splash type to prevent explosion and contamination, having more than one exit hole shall allow the gases to escape freely but shall prevent acid from coming out. The design shall be such that the water loss due to evaporation is kept to minimum. In addition the ventilator shall be easily removed from topping up the cells and of such dimensions that the syringe type hydrometer can be inserted into the vent to take electrolyte sample.

c) Plates:
The plates shall be designed for maximum durability during all service conditions including high rate of discharge and rapid fluctuation of load. The construction of plate shall be as per IS-1652.

The separators (made of acid resisting material) shall maintain the electrical insulation between the plates and shall permit free flow of electrolyte. Separators shall be suitable for continuous immersion in the electrolyte without distortion. The positive and negative terminal posts shall be clearly marked. The proper arrangement shall be made inside battery to keep endplates in position.

d) Sediment Space:
Sufficient sediment space shall be provided so that cells will not have to be cleaned during normal life and prevent shorts within the cells.

e) Cell Insulator:

Each cell shall be separately supported on PVC/porcelain/hard rubber insulators fixed on the racks with adequate clearance between adjacent cells. Minimum distance between adjacent cells shall be more than the bulge allowed for two cells in accordance with IS:1146.

f) Electrolyte:
The electrolyte shall be prepared from battery grade Sulphuric Acid conforming to IS-266 and distilled water conforming to IS-1069. The cells shall be shipped in dry uncharged condition and electrolyte shall be supplied separately in non-returnable containers. 10% extra electrolyte shall be furnished as extra fitting to cover spillage in transit or during erection.

g) Connectors and Fasteners:
Lead or lead coated copper connectors (or a better product) shall be used for connecting up adjacent cells and rows. The cell terminal post shall be provided with bolts, nuts, clamps and washers shall be lead coated with minimum thickness 0.025 mm to prevent corrosion. The thickness of lead coating shall be measured as per appendix-F of IS-6848. All the terminals and inter-cell connectors shall be fully insulated or shrouded. End take of connections from positive and negative poles of batteries shall be done through single core cable having stranded Aluminium conductor and XLPE insulation (4-1CX630sqmm (Al)/ pole FRLS cable: Tentative size). The bidder shall supply lead coated bent copper plate, tubular copper lugs, clamps, bolts, nuts, washers, etc. for termination of these cables on batteries. Suitable numbers of inter rack connectors shall be supplied by the bidder to suit

the battery room layout during detailed engineering. Calculation for sizing of connectors and fasteners shall be furnished during detail engineering.

All connectors and lugs shall be capable of continuously carrying the 45 minutes discharge current of respective batteries and through fault short circuit current, which the battery can produce and withstand for the period of one minute. The successful bidder shall furnish necessary sizing calculations to prove the compliance for the same at contract stage.

h) Battery Racks:
The batteries shall be supported on wooden/ metal racks properly treated for anti sulphuric acid resistance. Batteries shall preferably be located in the single tier arrangement. However, batteries having a complete cell weight of lower than 50 Kg could be located in the double tier arrangement. The batteries rack and wooden support for cable termination shall be coated with three (3) coats of anti-acid paint of approved shade. Numbering tags, resistant to acid, for each cell shall be attached on to the necessary racks. The bottom tier of the stand shall not be less than 150 mm above the floor. Wherever racks are transported in dismantled condition, suitable match markings shall be provided to facilitate easy assembly.

i) Following information shall be indelibly marked on outside of each cell:
- Manufacturer's name and trade marks
- Country and year of manufacturer
- Manufacturer type designation
- AH capacity at 10 hour discharge rate
- Serial number

j) Positive and negative terminal posts shall be clearly and indelibly marked for easy identification. Numbering tags for each cell shall also be attached on to the racks.

k) Following minimum information shall be given on the instruction cards:
- Manufacturer's instructions for filling and initial charging of the battery together with starting and finishing charging rate
- Maintenance instructions
- Designation of cell in accordance with relevant standard
- Storing conditions of electrolyte

8.0 Nickel Cadmium Batteries

DC batteries shall be Stationary, high discharge vented type Nickel-Cadmium batteries with pocket plates (KPH) conforming to IS 10918. The batteries shall be high discharge performance type. For the purpose of design an ambient temperature of 50 degree centigrade and relative humidity of 85% shall be considered. The plates will be designed for the maximum durability under all service conditions including high rate of discharge and rapid fluctuation of loads. The batteries shall normally be permanently connected to the load in parallel with a charger and shall supply the load during emergency conditions when AC supplies are lost. Batteries shall be suitable for a long life under continuous float operations and occasional discharges. The batteries shall be boost charged at about 1.54 to 1.7 volts per cell maximum and float charged at about 1.42 V/cell. Batteries should be suitable for continuous operation for the maximum ambient temperature as defined in technical parameters.

8.1 Containers:

Containers shall be made of polypropylene plastic material. Containers shall be robust, heat resistant, leak proof, non-absorbent, alkali resistant, non-bulging type and free from flaws such as wrinkles, cracks, blisters, pinholes etc. Electrolyte level lines shall be marked on containers in case of translucent containers.

8.2 Vent Plugs:

Vent plugs shall be provided in each cell. They shall be anti-splash type, having more than one exit hole and shall allow the gases to escape freely but prevent alkali from coming out. The design shall be such that the water loss due to evaporation is kept to minimum. In addition the ventilator shall be easily removed for topping up the cells and of such dimensions that the syringe type hydrometer can be inserted into the vent to take electrolyte sample.

8.3 Plates:

The plates shall be designed for maximum durability during all service conditions including high rate of discharge and rapid fluctuation of load. The construction of plate shall conform to latest revision of IS 10918. The separators shall maintain the electrical insulation between the plates and shall permit free flow of electrolyte. Separators shall be suitable for continuous immersion in the electrolyte without distortion. The positive and negative terminal posts shall be clearly marked.

8.4 Sediment Space:

Sufficient sediment space shall be provided so that cells will not have to be cleaned during normal life and prevent shorts within the cells.

8.5 Electrolyte:

The electrolyte shall be prepared from battery grade Potassium Hydroxide conforming to relevant BS 1069. Depending upon installation schedule, whether batteries to be despatched charged or uncharged shall be decided by purchaser and informed to supplier during detailed engineering. Necessary electrolyte for makeup shall be supplied separately. However, there shall not be any commercial implication on account of this. In case batteries are shipped un-charged, the electrolyte shall be supplied in non-returnable containers. 10% extra electrolyte shall be furnished as extra fitting to cover spillage in transit or during erection.

8.6 Connectors and Fasteners:

Nickel coated copper connector shall be used for connecting up adjacent cells and rows. Bolts, nuts, clamps and washers shall be Nickel coated with minimum thickness of 0.02 mm to prevent corrosion. All the terminals and inter-cell connectors shall be fully insulated or shrouded. End take of connections from positive and negative poles of batteries shall be done through single core cable having stranded Aluminium conductor and XLPE insulation. The bidder shall supply necessary supports and lugs for termination of these cables on batteries. Suitable numbers of inter rack connectors shall be supplied by the bidder to suit the battery room layout during detailed engineering.

All connectors and lugs shall be capable of continuously carrying the 45 minutes discharge current of respective batteries and through fault short circuit current which the battery can produce and

withstand for the period declared. The successful bidder shall furnish necessary sizing calculations to prove the compliance for the same at contract stage. The same shall be subject to customer's approval.

8.7 Battery Racks:

The batteries shall be supported on Mild Steel racks. The racks shall be free standing type mounted on porcelain/hard rubber/PVC pads insulators/high impact plastic insulators. Batteries shall preferably be located in the single tier arrangement. However, batteries having a complete cell weight of lower than 50 Kg could be located in the double tier arrangement. The batteries racks and supports for cable termination shall be coated with three (3) coats of anti-alkali paint of approved shade. The nameplates, resistant to alkali, for each cell shall be attached on the necessary racks.

Wherever racks are transported in dismantled conditions, matchmakings shall be provided to facilitate easy assembly.

8.8 Following information shall be indelibly marked on outside of each cell:

- Manufacturers' name and trade marks
- Country and year of manufacture.
- Manufacturer type designation.
- AH capacity at 5 hour discharge rate.
- Serial number

8.9 Following minimum information shall be given on the instruction cards:

- Manufacturer's instructions for filling and initial charging of the battery together with starting and finishing charging rate
- Maintenance instructions
- Designation of cell in accordance with IS standards
- Storing conditions of electrolyte

9.0 PERFORMANCE GUARANTEE

9.1 Bidders shall guarantee that battery offered shall meet the 'Load Duty Cycle' requirements as stipulated in this specification and as confirmed by them in technical data sheets. In case the performance of battery at site is not as per the performance guarantee, the bidder will have to replace the battery at site free of cost.

10.0 INSPECTIONS & TESTING

10.1 All equipment to be supplied shall be of type tested design. During detail engineering, the contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. However, if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this

contract at no additional cost to the owner either at third party lab or in presence of client/owners representative and submit the reports for approval.
The bidder shall confirm compliance to quality plan enclosed with the specification, which is subject to BHEL & NTPC approval and the inspection shall be carried out based on this approved Quality Plans (QP No. PE-QP-999-508-E002, Rev. 0 & Annexure-X for Lead-Acid type and PE-QP-999-508-E002ARev.0 & Annexure-XI for Ni-Cd Type). Any changes in quality plan at contract stage shall be without any commercial implication to BHEL/ customer.

10.2 All acceptance and routine tests as per relevant standards shall be carried out by the manufacturer. Charges for all these routine and acceptance tests for all the materials shall be deemed to be included in the bid price.

10.3 The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and “No design change”. Minor changes if any shall be highlighted on the endorsement sheet.

10.4 a) All tests as listed below for Lead-Acid battery shall be carried out on sample cell selected at random by the owner at site after completion of installation.

1) Verification of markings.
2) Verification of dimensions.
3) Test for capacities for 10 hrs. discharge rate along with the test for voltage during discharge.

b) All tests as listed below for Ni-Cd battery shall be carried out on sample cell selected at random by the owner at site after completion of installation.

(a.) Physical Examination
(b.) Dimensions, Mass & layout
(c.) MARKING
(d.) Polarity and absence of short circuit.
(e.) Ampere - hour capacity
(f.) Retention of charge
(g.) Insulation resistance

Necessary testing equipment required for testing at site (including site visit) shall be arranged by successful bidder

10.5 For all components / materials, for which type test reports have been asked as per relevant standard, such Type tests should have been carried out on identical components / materials. In absence of such type tests reports or in case such reports are not found to be meeting the specification/standards requirements, vendor shall conduct all such type tests without any commercial/delivery implication to BHEL/customer according to the relevant standards and reports shall be submitted to the owner for approval. (Type test charges as per clause 10.6 shall not be applicable in such cases).

10.6 All material used for the construction of the equipment / items shall be new and shall be in accordance with the requirements of this specification. Materials utilised shall be those, which have established themselves for use in such applications.

10.7 The vendor shall submit for Owner's approval the reports of all the type tests carried out as per latest IS-1146 (for rubber & plastic containers for lead-acid storage batteries)/ IS-1652 (for lead-acid plante batteries). The complete type test reports shall be for any rating of battery in a particular group, based on plate dimensions being manufactured by supplier.

10.8 The vendor shall submit for Owner's approval the reports of all the type tests carried out as per latest IS-1146(for all applicable tests for containers) / IS-10918 (for NI-CD batteries). The complete type test reports shall be for any rating of battery in a particular group, based on plate dimensions being manufactured by supplier.

11.0 **DC HEALTH MONITORING SYSTEM**

11.1 DC Health Monitoring System shall include microprocessor based hardware and software to monitor the condition of each battery cell of 220V DC systems battery banks on-line on 24x7 basis. With DC Health Monitoring System it shall be possible to measure & analyse the individual cell and battery parameters so that any damage to battery shall be prevented by pro-active maintenance. A typical Architecture is shown in Annexure-VIII. Each Battery set shall have its own independent DC Health Monitoring System.

11.2 DC Health Monitoring System shall measure and store the following parameters at predetermined time interval as decided by the owner during detail engineering

- Each Cell Voltage
- Battery DC Current
- FF Ambient and Cell temperature

Further, DC Health Monitoring System module shall have additional provision of accepting at least 6 Nos. of Digital inputs and 2 Nos. of Analog inputs (4-20mA). DC Health Monitoring System shall also be able to store these inputs status for future reference.

11.3 **Technical Parameters**

a.	Input Power Supply	230V AC(UPS) / 220V DC
b.	Voltage Measurement Accuracy	0.5% or better
c.	Current Measurement Accuracy	0.5% or better
d.	Operating Temperature Range	0-50 C
e.	Mounting	Panel Mounting
f.	IP Protection	IP42

12.0 **Communication**

DC Health Monitoring System shall communicate with the Switchgear SCADA System and provide alarms for abnormal condition of Cell/Battery as finalized by owner during detailed engineering. DC Health Monitoring System modules shall have one port suitable for connecting laptop locally and one port suitable for TCP/IP protocol for communication to SCADA system. The Cable required for connecting the cells to DC Health Monitoring System and DC Health Monitoring System to SCADA system shall also be under bidder's scope.

DC FAIL alarm shall be generated and given in Central Control Room buzzer (Audio Visual Fascia).

13.0 **Software**

Necessary software for communication between DC Health Monitoring System and Switchgear SCADA System as well as for analysis of stored data shall be provided by the vendor. The software for analysis shall be capable of showing graphical representation of various stored parameters and shall give some corrective suggestion based on the abnormal parameters. The software shall calculate and show battery Ah during charge/discharge cycles.

14.0 Logging of cell/battery parameters (voltage, current and temperature) and alarm conditions as well as event log of all activities affecting the battery bank shall be possible with date/time stamp. Logged data can be exported in MS Excel format.

15.0 **DOCUMENTATION**

15.1 By all Bidders as technical offer:

(i) Battery sizing calculation (in IEEE format) with respect to load duty cycle as per Annexure-III of Section-C to be provided along with supporting documents (capability / discharge curve, temperature correction factor, float charging factor & published technical catalogue) for considered factors.

(ii) Unpriced Price Schedule (“Annexure-I: BOQ cum Price Schedule”, as enclosed with the specification) with bidder’s signature and company stamp.

(iii) A copy of sheet “Instructions to Bidders for Preparing Technical Offer” with bidder’s signature and company stamp.

(iv) A copy of sheet “List of Contents” with bidder’s signature and company stamp.

(v) A copy of sheet “Deviation Schedule” with “NO DEVIATION” and bidder’s signature and company stamp.

(vi) A copy of sheet “Data Sheet-A” with required information and bidder’s signature and company stamp.

(vii) Documents for Provenness criteria: In order to be able to present to the client the provenness of the equipment offered, the bidder is required to furnish elaborate details of experience, capabilities, reference list etc. in the offer

15.2 Final documents to be submitted after award of contract shall be as given in Annexure-VI.

15.3 No. of prints to be submitted by vendor after award of contract shall be as specified under Annexure-VII.

15.4 **Instruction Manuals**

Instruction manuals for the installation, operation and maintenance of battery to be supplied shall be furnished at least two months before the date of despatch of equipment.
The installation and maintenance manual of battery shall contain the following:

A) General description giving type and rating of various batteries.
B) Technical data.
C) Salient constructional details.
D) Instruction to be followed on receipt at site.
E) Instructions for foundations, if any.
F) Erection procedures and checks (handling at site, erection, pre-commissioning).
G) Procedure for filling of electrolyte.
H) Commissioning procedures and site tests.
I) Routine, periodic and preventive inspection and maintenance procedures.
J) Safety rules.
K) Possible faults, their causes and remedies.
L) Copies of the type, acceptance and routine test certificates in bound volume.
M) Catalogues, literature and drawings.
N) Outline dimension drawings showing constructional features, relevant cross sectional views and earthing details, operator oriented description of equipment and accessories.
O) Operating procedures, maintenance procedures & precautions to be taken during operation and maintenance work.

15.5 Bidder shall furnish field quality plan detailing out the specific quality control procedure covering receipt of material/equipment and handling at site, storage, erection, commissioning, post commissioning etc.

16.0 **TOOLS AND TACKLE**

Tools & tackle which are essential to facilitate assembly, adjustments, maintenance & dismantling of equipment shall be provided as part of equipment supplied. The above tools shall be supplied along with the initial consignment of equipment so as to be available prior to erection but may not be used for erection purposes.

17.0 **BASIC DESIGN DOCUMENTS**

'Basic Design Documents' cover: Battery sizing calculations, battery data sheet, connector sizing calculation, Quality Plan, OGA for 220V battery, BOM, List of approved makes, type test reports & type test procedure (if applicable) for battery.

18.0 **AS-BUILT DRAWINGS**

Though only supply of equipment is under bidder's scope, bidder may note that all as-built correction (as given by purchaser to vendor) shall have to be incorporated in the originals by the vendor and copies of the as-built corrected drawings / documents as per requirement shall be submitted by the vendor.

19.0 Statutory and regulatory requirements as per IE rule 1956 with amendment - 3 rule 1986, rules Nos. 35, 42, 50 & 51 shall be adhered to.

3 X 660 MW NORTH KARANPURA
BOQ-cum-PRICE SCHEDULE FOR 220V DC BATTERY (Lead-Acid Plante Battery)
ANNEXURE -I

OPTION-I

Sr. No.	Item code	Item Description	Unit	Quantity	UNT PRICE	TOTAL PRICE	Remarks
(A)	**MAIN ITEMS**						
1.0	**508-14001-A**	**220V BATTERY 1**	Nos.	6			
		Break up detail					
		220V DC, AH capacity to be decided by bidder as per Annexure-III of Section-C, 1.85 ECV, 107 cells, Lead-Acid plante High discharge type battery with all accessories listed as 1.1 below.	Sets	6			If one string is not meeting the required AH capacity, two strings of 107 cells each shall be provided. The complete connectors required to connect two strings shall be in bidder's scope.
		Electrolyte (sulphuric acid for first filling plus10% extra)	Lot	6			
		Wooden racks with 3 coats of anti acid paints for 220V DC Battery	Lot	6			
		Stand insulators plus 5% extra	Lot	6			
		Cell interconnectors with 5% extra and end take-off with one no. extra	Lot	6			
		Lead coated connection hardware plus 5% extra	Lot	6			
		Cell numbering tags with fixing arrangement (1set)	Lot	6			
		Teakwood Cable clamps with hardware	Lot	6			
1.1		**LIST OF ACCESSORIES (for each set of battery)**					
a		Hydrometer	Nos.	2			
b		Set of hydrometer syringes (suitable for the vent holes in different cells)	Nos.	2			
c		Thermometer for measuring electrolyte temperature	Nos.	5			
d		Specific gravity correction chart	Nos.	2			
e		Wall mounting type holder for hydrometer and thermometer	Nos.	2			
f		Cell testing digital voltmeter (3-0-3V) with testing leads	Nos.	2			
g		Rubber apron	Nos.	2			
h		Pair of rubber hand gloves	Nos.	2			
i		Set of insulated spanners	Nos.	2			
j		`No smoking' notice	Nos.	2			
k		Goggles (industrial)	Nos.	2			
l		Instruction card	Nos.	10			
m		Minimum and maximum temperature indicator for Battery Room	Nos.	1			
n		Acid mixing jar	Nos.	1			
2.0	**508-14007-A**	**CELL MONITORING SYSTEM BATTERY1**	Nos.	6			Cell monitoring system shall includes complete hardware, sofware and cables etc. to meet specification requirements.
3.0	**508-14010-A**	**E & C SPARES**					
a		Gloves	SET	2			
b		Vent plugs	Nos.	60			
c		Intercell connectors	Nos.	60			
4.0	**508-14013-A**	**MANDATORY SPARES**					
		Complete dry cell	Nos.	2% or 5 Nos. whichever is more			
		Intercell connectors with hardware	Nos.	5% or 10 nos. whichever is more			
		Vent plug	Nos.	5% or 10 nos. whichever is more			
		Acid level indicating float (for opaque containers only)	Nos.	5% or 10 nos. whichever is more			
		Stand insulator	Nos.	5% or 10 nos. whichever is more			
		Cell insulator	Nos.	5% or 10 nos. whichever is more			
5.0	**508-14016-A**	SUPV.OF E&C					
(i)		SUPV.OF E&C OF 220V DC Battery	SET	6			Refer note (ii).
(ii)		SUPV.OF E&C of cell monitoring system	SET	6			Refer note (ii).

Notes:

(i) Bidder to quote for either Option-I (i.e Lead-acid Plante type battery) or Option-II (i.e Ni-Cd type battery)

(ii) One set refers to complete one battery bank connected on one section of DCDB.

(iii) Cable Lugs at Battery terminals shall be in bidder's scope & size shall be informed during detailed engineering.

3 X 660 MW NORTH KARANPURA
BOQ-cum-PRICE SCHEDULE FOR 220V DC BATTERY (Ni-Cd Battery)
ANNEXURE -I

OPTION-II

Sr. No.	Item code	Item Description	Unit	Quantity	UNT PRICE	TOTAL PRICE	Remarks
(A)	**MAIN ITEMS**						
1.0	**508-14001-A**	**220V BATTERY 1**	Nos.	6			
		Break up detail					
		220V DC, AH capacity to be decided by bidder as per Annexure-III of Section-C, 1.14 ECV, 170 cells, Ni-Cd pocket plate High discharge type battery with all accessories listed as 1.1 below	Sets	6			If one string is not meeting the required AH capacity, two strings of 170 cells each shall be provided. The complete connectors required to connect two strings shall be in bidder's scope.
		Electrolyte (Potassium Hydroxidefor first filling plus10% extra)	Lot	6			
		MS racks with 3 coats of anti alkali paints for 220V DC Battery	Lot	6			
		Stand insulators plus 5% extra	Lot	6			
		Cell interconnectors with 5% extra and end take-off with one no. extra	Lot	6			
		Nickel coated connection hardware plus 5% extra	Lot	6			
		Cell numbering tags with fixing arrangement (1set)	Lot	6			
1.1		**LIST OF ACCESSORIES (for each set of battery)**					
a		Hydrometer	Nos.	2			
b		Set of hydrometer syringes (suitable for the vent holes in different cells)	Nos.	2			
c		Thermometer for measuring electrolyte temperature	Nos.	5			
d		Wall mounting type holder for hydrometer and thermometer	Nos.	2			
e		Cell testing digital voltmeter (3-0-3V) with testing leads	Nos.	2			
f		Rubber apron	Nos.	2			
g		Pair of rubber hand gloves	Nos.	2			
h		Set of insulated spanners	Nos.	2			
i		`No smoking' notice	Nos.	2			
j		Goggles (industrial)	Nos.	2			
k		Instruction card	Nos.	10			
l		Minimum and maximum temperature indicator for Battery Room	Nos.	1			
m		Alkali mixing jar	Nos.	1			
2.0	**508-14007-A**	**CELL MONITORING SYSTEM BATTERY1**	Nos.	6			Cell monitoring system shall includes complete hardware, sofware and cables etc. to meet specification requirements.
3.0	**508-14010-A**	**E & C SPARES**					
a		Gloves	SET	2			
b		Vent plugs	Nos.	60			
c		Intercell connectors	Nos.	60			
4.0	**508-14013-A**	**MANDATORY SPARES**					
		Complete dry cell	Nos.	2% or 5 Nos. whichever is more			
		Intercell connectors with hardware	Nos.	5% or 10 nos. whichever is more			
		Vent plug	Nos.	5% or 10 nos. whichever is more			
		Acid level indicating float (for opaque containers only)	Nos.	5% or 10 nos. whichever is more			
		Stand insulator	Nos.	5% or 10 nos. whichever is more			
		Cell insulator	Nos.	5% or 10 nos. whichever is more			
5.0	**508-14016-A**	SUPV.OF E&C					
(i)		SUPV.OF E&C OF 220V DC Battery	SET	6			Refer note (ii).
(ii)		SUPV.OF E&C of cell monitoring system	SET	6			Refer note (ii).

Notes:

(i) Bidder to quote for either Option-I (i.e Lead-acid Plante type battery) or Option-II (i.e Ni-Cd type battery)

(ii) One set refers to complete one battery bank connected on one section of DCDB.

(iii) Cable Lugs at Battery terminals shall be in bidder's scope & size shall be informed during detailed engineering.

ANNEXURE-II

LIST OF APPLICABLE STANDARDS

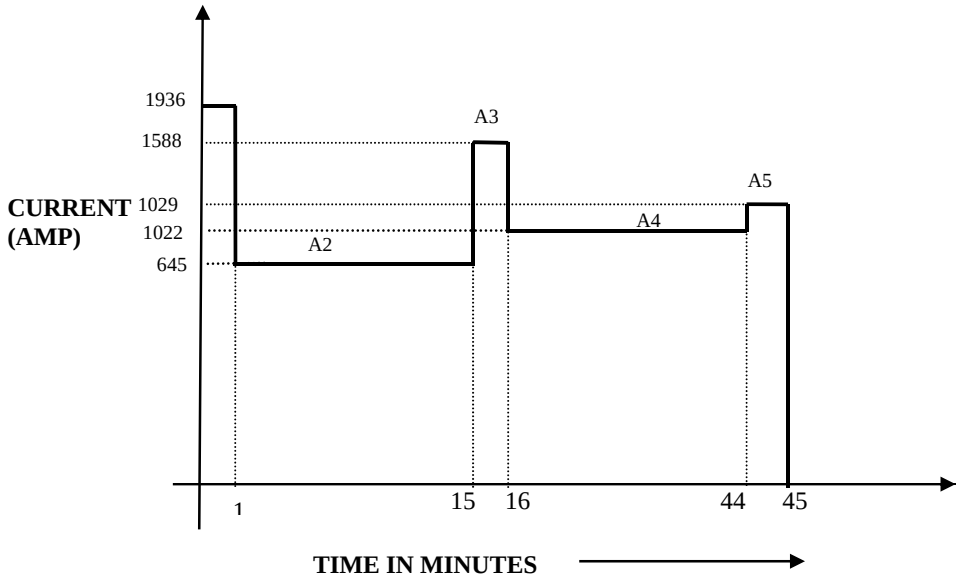
1.	STATIONERY LEAD ACID PLANTE BATTERY	IS 1652
2.	RECOMMENDED PRACTICE FOR SIZING LEAD ACID BATTERIES	IEEE 485
3.	SPECIFICATION FOR WATER FOR STORAGE BATTERIES	IS 1069
4.	SPECIFICATION FOR SULPHURIC ACID FOR LEAD ACID BATTERIES	IS 266
5.	RUBBER & PLASTIC CONTAINERS FOR LEAD ACID BATTERIES	IS 1146
6.	SYNTHETIC SEPARATORS FOR LEAD ACID BATTERIES	IS 6071
7.	SEALING COMPOUND FOR LEAD ACID BATTERIES	IS 3116
8.	METHODS OF TESTS FOR LEAD ACID BATTERIES	IS 8320
9.	SPECIFICATION FOR HIGH PERFORMANCE PLANTE'S CELLS	BS-6290
10.	ELECTRICAL VOCABULARY, PRIMARY CELLS AND BATTERIES.	IS: 1885
11.	SPECIFICATION FOR VENTED TYPE NICKEL CADMIUM BATTERIES	IS: 10918
12.	INDIAN ELECTRICITY RULES & INDIAN ELECTRICITY ACTS	

Note:

Bidder to note that wherever IS is mentioned above, internationally accepted standards such as IEC. BS, VDE etc. will also be considered if they ensure performance and constructional features equivalent or superior to standards listed above. In such a case, the contractor shall clearly indicate the standard(s) adopted, furnish a copy in English of the latest revision of the standards along with copies of all official amendments and revisions in force as on date of opening of bid and shall clearly bring out the salient features for comparison.

ANNEXURE-III

LOAD DUTY CYCLE



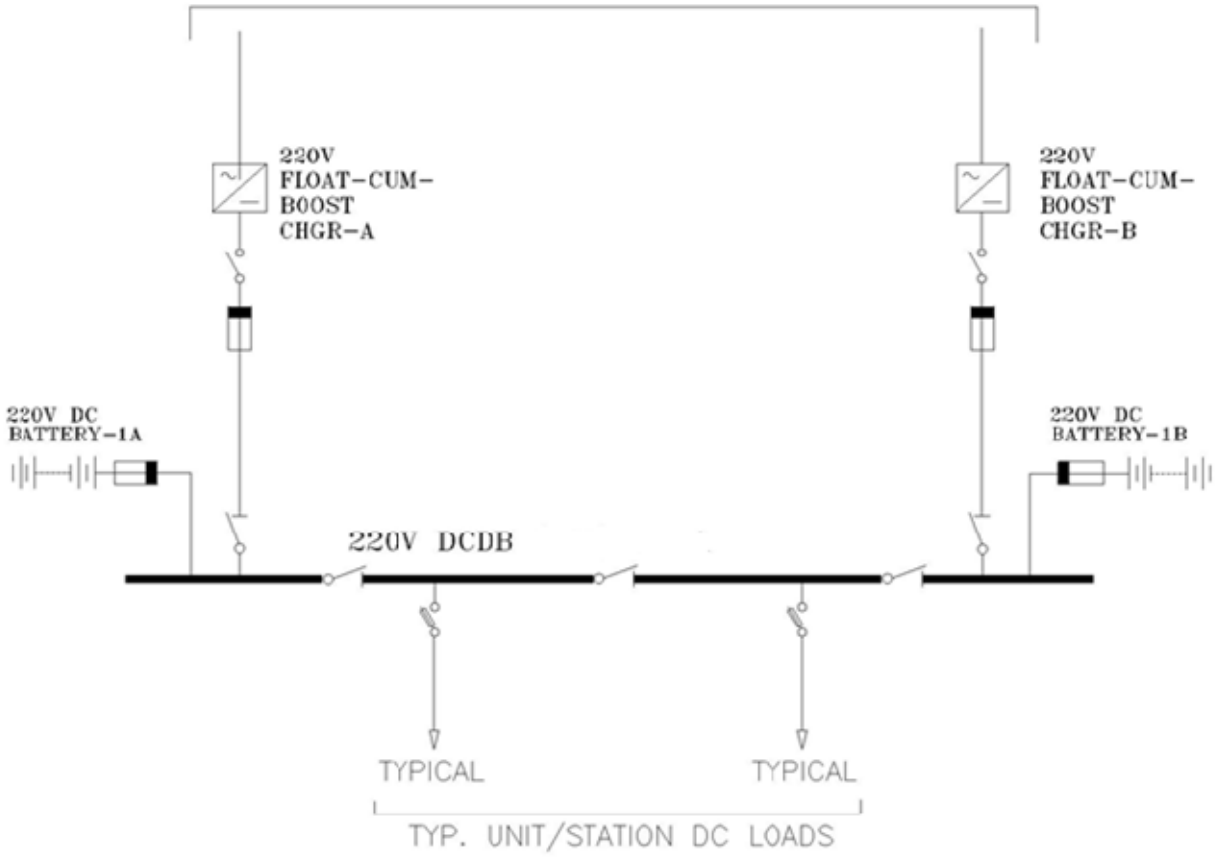
FACTORS TO BE CONSIDERED FOR BATTERY SIZING:

1. AGEING FACTOR : 1.25
2. MIN.ELECTROLYTIC TEMP. : 15 ˚C
3. END CELL VOLTAGE : 1.85V (for Lead-Acid Plante) & 1.14V (for Ni-Cd) PER CELL
4. TEMPERATURE CORRECTION FACTOR : As per manufacturer's data

NOTE: BIDDER HAS TO TAKE AGEING FACTOR (MARGIN) IN THEIR SIZING AND SELECTION OF BOTH LEAD-ACID AND NI-CD BATTERY. NO DEVIATION IS ACCEPTABLE ON AGEING FACTOR.

ANNEXURE-IV

ONE LINE DIAGRAM FOR 220V UNIT DC SYSTEM



ANNEXURE-V

ACCESSORIES

Following accessories shall be provided for each battery bank:

7.1 Each battery is furnished with following items (Lead-Acid Type)

Sl. No.	Fittings
1	First charge of electrolyte plus 10% extra
2	Teakwood racks with 3 coats of anti-acid paint
3	Stand insulators plus 5% extra
4	Cell inter-connectors with 5% extra and end take-off with one no. extra
5	Lead coated connection hardware plus 5% extra
6	Cell numbering tags with fixing arrangement (1 set)
7	Teak wood clamps with hardware (1 set)

7.2 Additionally, following set of accessories shall be provided for each battery (Lead-acid type):

Sl. no	Name of accessory	QTY (in Nos.)
1	Hydrometer (Syringe type) suitable for specific gravity reading	2
2	Set of hydrometer syringes suitable for the vent holes in different cells	2
3	Thermometer for measuring electrolyte temperature	5
4	Specific gravity correction chart	2
5	Wall mounting type holder for hydrometer and thermometer	2
6	Cell testing digital voltmeter (3-0-3V) with testing leads	2
7	Rubber apron	2
8	Pair of rubber hand gloves	2
9	Set of insulated spanners	2
10	`No smoking' notice	2
11	Goggles (industrial)	2
12	Instruction card	10
13	Minimum and maximum temperature indicator for Battery Room	1
14	Acid mixing Jar	1

7.3 Each battery is furnished with following items (For Ni-Cd Type)

Sl. No.	Fittings
1	First charge of electrolyte plus 10% extra
2	Mild steel racks with 3 coats of anti-alkali paint
3	Stand insulators plus 5% extra
4	Cell inter-connectors with 5% extra and end take-off with one no. extra
5	Nickel coated connection hardware plus 5% extra
6	Cell numbering tags with fixing arrangement (1 set)

7.4 Additionally, following set of accessories shall be provided for each battery (For Ni-Cd type):

Sl. no	Name of accessory	QTY (in Nos.)
1	Hydrometer (Syringe type) suitable for specific gravity reading	2
2	Set of hydrometer syringes suitable for the vent holes in different cells	2
3	Thermometer for measuring electrolyte temperature	5
4	Wall mounting type holder for hydrometer and thermometer	2
5	Cell testing digital voltmeter (3-0-3V) with testing leads	2
6	Rubber apron	2
7	Pair of rubber hand gloves	2
8	Set of insulated spanners	2
9	`No smoking' notice	2
10	Goggles (industrial)	2
11	Instruction card	10
12	Minimum and maximum temperature indicator for Battery Room	1
13	Alkali mixing Jar	1

ANNEXURE-VI

LIST OF STANDARD DELIVERABLES

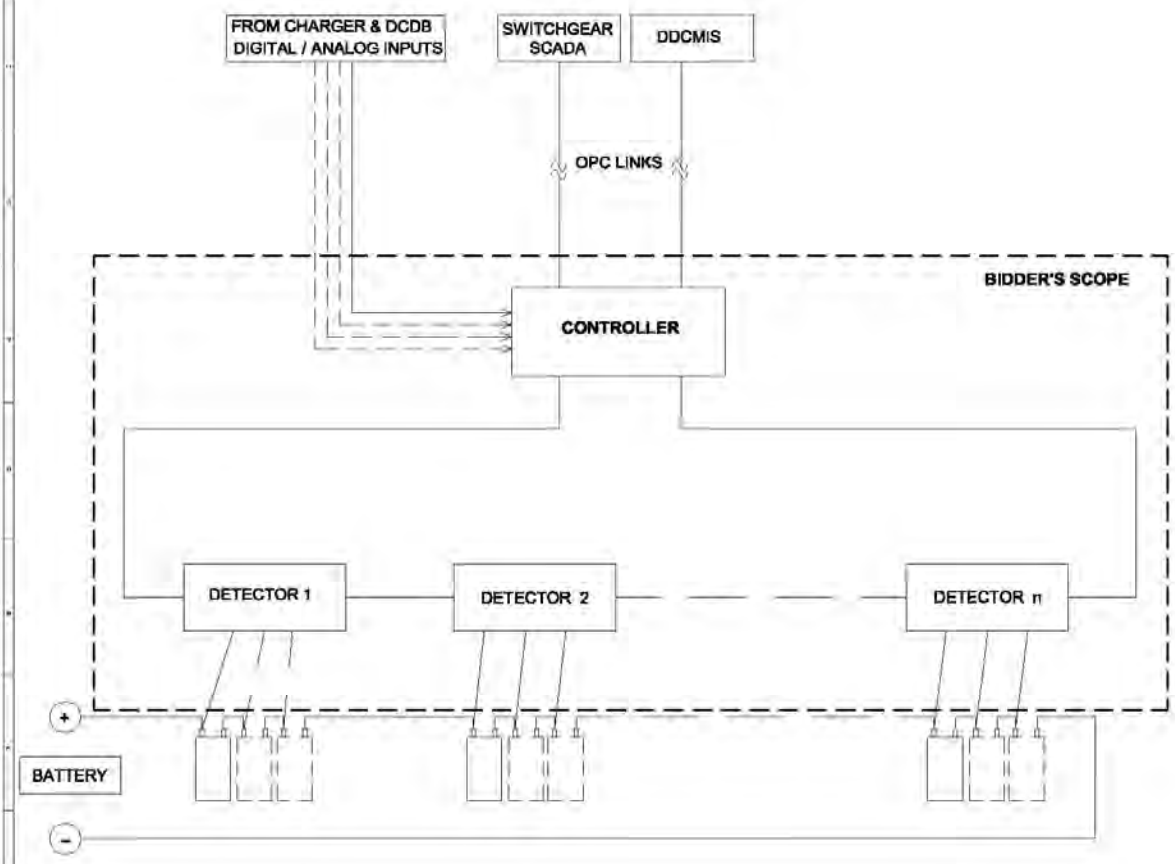
S. No.	DOCUMENT TITLE	DWG. / DOCUMENT No.
1	Data Sheet for battery	PE-V0-405-508-E201
2	Battery sizing calculation (Including battery catalogues, curves etc)	PE-V0-405-508-E202
3	Fault calculation & Connector sizing calculation	PE-V0-405-508-E203
4	General Arrangement drawing for Battery	PE-V0-405-508-E204
5	Bill of Material for the battery	PE-V0-405-508-E205
6	List of Mandatory Spares for battery	PE-V0-405-508-E206
7	O & M manual for battery	PE-V0-405-508-E207
8	Field Quality Plan for battery	PE-V0-405-508-E208
9	Type test reports for the battery	PE-V0-405-508-E209
10	Cable Termination arrangement for battery terminal	PE-V0-405-508-E210
11	Quality Plan for battery	PE-QP-999-508-E002
12	Loose items to be shipped with battery	PE-V0-405-508-E211
13	Packing list (to be submitted after dispatch of battery)	PE-V0-405-508-E212

ANNEXURE-VII

No. OF DRAWINGS / DOCUMENTS REQUIRED FROM VENDOR

S. NO.	DESCRIPTION	No. hard prints/copies	No. of CD-ROMs	REMARKS
1	First Submission/subsequent submission	soft copy pdf format		
2	Final approval drgs. / docs. for Distribution	10 Copies	4 CD-ROMS	
3	Operation & Maintenance manual for approval	soft copy pdf format		
4	Approved Operation & Maintenance Manual for distribution	10 Copies	4 CD-ROMS	
5	Type Test Certificates/ Reports	10 Copies	4 CD-ROMS	

ANNEXURE-VIII



TYPICAL ARCHITECTURE FOR DC HEALTH MONITORING SYSTEM

ANNEXURE - IX

LIST OF SUB-VENDOR

Abbreviations:

A : Proposed vendor for the respective items is acceptable. To be indicated with letter “A” in the list along with condition of approval, if any.

DR : “ Details required” of the proposed vendor for BHEL/ NTPC review . To be identified with letter DR in the list.
All makes in the category ‘DR’ are subject to BHEL / NTPC approval during detailed engineering without any Commercial or delivery implication to BHEL.

S.No	Items	Sub vendor Name	Place	Sub vendor approval status as per NTPC
1	Battery Health Monitoring system	M/s HBL Power system	Hyderabad	DR
		M/s Emerson	Mumbai	A
		M/s Chhabi Electrical	Jalgaon	DR
		M/s Statcon	Hapur	DR
		M/s B Tech Inc	USA	DR
		M/s Eltek SGS Pvt. Ltd.	Gurgaon	A
		M/s Hitachi Hi Rel	Gandhinaga	DR

DATASHEET -A

1.	Rated voltage (V)	:	220V DC
2.	Type of Battery	:	Lead-Acid Plante /Ni-Cd high discharge type
3.	Design Ambient	:	50°C
4.	Min Electrolyte temp.	:	15°C
5.	Cell Container	:	As per specification
6.	DC System Earthing		Unearthed
7.	Conforming to	:	As per Annexure-II
8.	No. of cells & End cell voltage	:	107 Nos & 1.85V(Lead-Acid) /170 Nos &1.14V (Ni-Cd)
9.	Nominal Float voltage (V)	:	2.25 V/cell (Lead-Acid)/1.42V/cell (Ni-Cd)
10.	Boost voltage (Maximum) (V)	:	Bidder to furnish the detail along with offer
11.	AH Capacity of battery at temp 'T' (**27°C / 20°C)**	:	Bidder to furnish quoted AH capacity and battery sizing calculation along with offer for battery
12.	Arrangement of batteries on racks	:	Single tier /Double Tier as per technical specification
13.	Connection from battery to Charger	:	4- 1CX630sqmm (Al)/ pole (FRLS cable) (Tentative Size)
14.	Fault current (DC)	:	20 kA (Max)

Notes:

1. Bidder shall furnish following along with offer:
   i) Battery capability / discharge curve.
   ii) Battery sizing calculation
   iii) Indicate value at sl. No. 10 & 11 above.

2. Bidders stand guarantee that the rating offered at S. No. 11 shall meet 'Load Duty Cycle' as per Annexure-III of specification.

DATA SHEET –C

S. No.	PARAMETER	UNIT	VALUE
1.0	Make and Type		
2.0	AH capacity at 27º C and end voltage		
2.1	At 10 Hr discharge rate	AH	
2.2	At 1 Hr discharge rate	AH	
3.0	Battery Discharge current		
3.1	At one minute rate	Amp	
3.2	At 30 minutes rate	Amp	
3.3	At 30 minutes rate at end voltage	Amp	
3.4	At 60 minutes rate	Amp	
3.5	At 60 minutes rate at end voltage	Amp	
4.0	Types of plates		
4.1	Negative plates		
4.2	Positive plates		
5.0	Method of connection between cells		
6.0	Voltage per cell at the end of charge at the finishing rate	V	
7.0	Recommended Trickle charge current	Amp	
8.0	Type and material of separators		
9.0	Material of container		
10.0	Type of container		
11.0	Internal resistance of cells	Ohms	
12.0	Total resistance of connectors	Ohms	
13.0	Insulator Material for		
13.1	Cells		
13.2	Racks		
14.0	Average life	Years	
15.0	Recommended boost charger rating for		
15.1	Charging in 8 hours	Amp	

15.2	Charging in 10 hours	Amp	
S. No.	**PARAMETER**	**UNIT**	**VALUE**
16.0	Allowable ripple content acceptable to battery (r.m.s)	%	
17.0	Hydrogen evaluation		
18.0	Cell designation in accordance with IS: 1651/1652		
19.0	Applicable standard		
20.0	Whether battery performance curve and calculation for capacities enclosed		
21.0	Recommended Maximum period of storage of Electrolyte before first charge		
22.0	Amount and specific gravity of electrolyte per cell required for first filling at 27º C		
23.0	Recommended specific gravity of electrolyte at 27º C		
23.1	When fully charged		
23.2	When fully discharged		
24.0	Container dimensions	(L X B X H)mm	
25.0	Distance between centres of cells when erected	Mm	
26.0	Terminal connectors		
26.1	Type		
26.2	Material		
27.0	Battery Racks		
27.1	Type & Material		
27.2	Outline dimensions	(L X B X H) mm	
27.3	Net weight	Kg	
28.0	Weight per cell	Kg	
28.1	Net dry weight	Kg	
28.2	Net weight with electrolyte	Kg	
29.0	Total shipping weight of one battery unit (without electrolyte)	Kg	
30.0	Taps provided at cell no.		
31.0	Connection from battery to charger (busbar/ cable)		
32.0	Recommended size of (busbar/ cable)		

33.0	Whether backup calculation furnished		
34.0	Cable lugs at battery terminals of suitable size		

	QUALITY PLAN	CUSTOMER :	PROJECT: 3x660 MW North Karanpura STPP TITLE	SPECIFICATION NO.
		BIDDER/ : VENDOR	STANDARD QUALITY PLAN NO.- PE-QP-999-508-E002, REV.0	SPECIFICATION : TITLE
	SHEET 1 OF 3	SYSTEM	ITEM : LEAD ACID BATTERY	DOC. NO.

SL. NO.	COMPONENT/ OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.0	**RAW MATERIALS & BOUGHT OUT ITEMS**											
1.1	(Pure Lead for Pos. plate, Lead Alloy for Neg. plate & Sulphuric acid)	Chemical	MA	Chemical Analysis	Random Sample	IS:1652, IS:266, IS:1069 & MFR's Std.	IS:1652, IS:266, IS:1069 & MFR's Std.	Test Cert.	3/2	-	1	
1.2	**SEPARATOR**											
a)	Visual	Visual	MA	Visual	Random Sample	IS:1652 & MFR's Std.	IS:1652 & MFR's Std.	Test Cert.	3/2	-	1	
b)	Physical	Physical		Physical	-do-	-do-	-do-	-do-	3/2	-	1	
c)	Chemical	Chemical		Chemical	-do-	(For Synthetic IS : 6071)	(For Synthetic IS : 6071)	-do-	3/2	-	1	
d)	Electrical Resistance Test	Electrical		Electrical	-do-	-do-	-do-	-do-	3/2	-	1	
e)	Acceptance test Dimension, Volume Porosity, Wettability of separator	Test		As per Standard	-do-	-do-	-do-	-do-	3/2	-	1	
1.3	**TERMINAL POST**											
a)	Dimensional Conformance	Visual	MA	Visual	Random Sample	IS:1652, IS:8320 & MFR's Std.	IS:1652, IS:8320 & MFR's Std.	Test Cert.	3/2	-	1	
b)	Material Conformance	Chemical	CR	Chemical	-do-	-do-	-do-	-do-	3/2	-	1	
c)	Thread size depth & chamfer	Physical	MA	Measurement	-do-	-do-	-do-	-do-	3/2	-	1	
d)	Surface finish & defects	Visual	MA	-do-	100%	-do-	-do-	-do-	3/2	-	1	
e)	Plating Quality	Thickness	CR	-do-	Random Sample	-do-	-do-	-do-	3/2	-	1	

BHEL	PARTICULARS	BIDDER/ VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/ VENDORS COMPANY SEAL

LEGEND : 1 - BHEL/ CUSTOMER 2 - VENDOR 3 - SUB- VENDOR P - PERFORM W - WITNESS V - VERIFICATION

	QUALITY PLAN	CUSTOMER :	PROJECT: 3x660 MW North Karanpura STPP TITLE	SPECIFICATION NO.
		BIDDER/ VENDOR :	STANDARD QUALITY PLAN NO.- PE-QP-999-508-E002, REV.0	SPECIFICATION : TITLE
	SHEET 2 OF 3	SYSTEM	ITEM : LEAD ACID BATTERY	DOC. NO.

SL. NO.	COMPONENT/ OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.4	**CONNECTOR**											
a)	Dimension	Dimension	MA	Measurement	Random Sample	IS:1652, IS:6848 & Appd. Drg./Doc.	IS:1652, IS:6848 & Appd. Drg./Doc.	Test Cert.	3/2	-	1	
b)	Thickness of lead coating	Visual		Visual	-do-	-do-	-do-	-do-	3/2	-	1	
1.5	**VENT CAP**											
a)	Dimensional Conformance	Dimension	MA	Measurement	-do-	Refer Remarks#	Refer Remarks#	-do-	3/2	-	1	*# Vent cap shall be easily removed from topping up the cells and of such dimensions that the syringe type hydrometer can be inserted into vent to take electrolyte sample.*
1.6	**CONTAINER**											
a)	Verification Constructional requirement	Visual	MA	Visual	Sample Plan as per IS:1146	IS:1652, IS:1146, IS:8320	IS:1652, IS:1146, IS:8320	Test Cert.	3/2	-	1	
b)	Verification of Markings	Visual	MA	-do-	-do-	-do-	-do-	-do-	3/2	-	1	
c)	High Voltage Test	Electrical	MA	-do-	-do-	-do-	-do-	-do-	3/2	-	1	
d)	Drops Ball Test	Mechanical	MA	-do-	-do-	-do-	-do-	-do-	3/2	-	1	
e)	Plastic Yield Test	-do-	MA	-do-	-do-	-do-	-do-	-do-	3/2	-	1	
f)	Acid Resistance Test	Chemical	MA	-do-	-do-	-do-	-do-	-do-	3/2	-	1	
g)	Hydraulic thrust enduarnce test	Physical	MA	-do-	-do-	-do-	-do-	-do-	3/2	-	1	
2.0	**FINISHED BATTERY**	Routine Test	CR	Elec. & Meas.	100%	IS:1652 & IS:8320	IS:1652 & IS:8320	Test Cert.	3/2	-	1	
3.0	**FINAL INSPECTION**											
3.1	**Type Test #**											
a)	Verification Constructional requirement	Visual	MA	Visual	Sample Plan as per IS: 8320	IS:1652	IS:1652	Inspection Report	3/2	1	-	*# Conduction of Type Tests from S.No. (d) to (g) shall be as per Annexure-A enclosed.*
b)	Verification of Markings	Dimension	MA	Measurement	-do-	-do-	-do-	-do-	3/2	1	-	
c)	Verification of Dimensions	-do-	MA	-do-	-do-	-do-	-do-	-do-	3/2	1	-	
d)	Test for Capacity & Voltage during discharge	Test	CR	As per IS: 1652	-do-	-do-	-do-	-do-	3/2	1	-	

BHEL	PARTICULARS	BIDDER/ VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/ VENDORS COMPANY SEAL

LEGEND : 1 - BHEL/ CUSTOMER 2 - VENDOR 3 - SUB- VENDOR P - PERFORM W - WITNESS V - VERIFICATION

BHEL	**QUALITY PLAN**		CUSTOMER :			PROJECT: 3x660 MW North Karanpura STPP TITLE			SPECIFICATION NO.			
			BIDDER/ VENDOR :			STANDARD QUALITY PLAN NO.- PE-QP-999-508-E002, REV.0			SPECIFICATION : TITLE			
	SHEET 3 OF 3		SYSTEM			ITEM : LEAD ACID BATTERY			DOC. NO.			
SL. NO.	COMPONENT/ OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
e)	AH & WH efficiency Test	-do-	CR	As per IS:1652	Sample Plan as per IS:8320	IS:1652	IS:1652	Inspection Report	3/2	1	-	
f)	Retension of Charge	-do-	CR	-do-	-do-	-do-	-do-	-do-	3/2	1	-	
g)	Endurance Test	-do-	CR	-do-	-do-	-do-	-do-	-do-	3/2	1	-	
3.2	**Acceptance Test**											
a)	Verification of Markings	Visual	MA	Visual	Sample Plan as per IS: 8320	IS:1652	IS:1652	Inspection Report	3/2	1	-	
b)	Verification of Dimensions	Dimension	MA	Measurement	-do-	-do-	-do-	-do-	3/2	1	-	
c)	Test for Capacity	Capacity	CR	As per IS: 1652	-do-	-do-	-do-	-do-	3/2	1	-	
d)	Test for Voltage during discharge	Voltage during discharge	CR	-do-	-do-	-do-	-do-	-do-	3/2	1	-	
4.0	**ACCESSORIES**	Visual & Dimension	MA	Visual	100%	Appd. Drg./Doc.	Appd. Drg./Doc.	-do-	2	1	-	
5.0	**CABLE LUGS**	Visual	MA	Visual	100%	Appd. DataSheet	Appd. DataSheet	-do-	2	1	-	

NOTE:- Wherever IS is mentioned equivalent IEC is also acceptable. In case of any technical requirement not covered by IEC, technical requirement as per IS shall prevail.

BHEL	**PARTICULARS**	**BIDDER/ VENDOR**	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/ VENDORS COMPANY SEAL

LEGEND : 1 - BHEL/ CUSTOMER 2 - VENDOR 3 - SUB- VENDOR P - PERFORM W - WITNESS V - VERIFICATION

ANNEXURE-A

QUALITY PLAN
STANDARD QP NO. : PE-QP-999-508-E002, REV. 0

LIST OF TYPE TEST FOR LEAD ACID BATTERY

S No	Test	Type test description	Referred standard	Test to be specifically conducted (Yes/No)	BHEL/Customer's approval Req. on test certificate (Yes/No)
1	Type Test	• Test for Capacity & Voltage during discharge	IS:1652	No	Yes
		• AH & WH efficiency Test	IS:1652	No	Yes
		• Retension of Charge	IS:1652	No	Yes
		• Endurance Test	IS:1652	No	Yes

CLAUSE NO.	QUALITY ASSURANCE ANNEXURE-X	एनटीपीसी NTPC

DC SYSTEM SQE 8

LEAD ACID BATTERY

ATTRIBUTES / CHARACTERISTICS → ITEMS, COMPONENTS, SUB SYSTEM ASSEMBLY ↓	Dimensions & Finish	Conformance to relevant part drg. & Manufacturer's standards	Chemical composition	Lead Coating Thickness (min. 25 microns, IS: 6848 App.F) & Adhesion Check	Conformance to CPWD Spec. for Teak Wood	Paint Process checks, Paint Shade, Thickness, Adhesion & Finish	Constructional requirements as per NTPC Spec.	Insulation Resistance	Marking (Routine & Acceptance Test)	Checking of Polarity & absence of short circuit (Routine & Acceptance Test)	Test for Capacities for 10 hrs. discharge rate along with the test for voltage during discharge (Acceptance Test)
Container & Lids (IS : 1146)	Y	Y									
Vent Plugs	Y	Y									
Sealing Compound (IS : 3116)		Y	Y								
Positive & Negative Plates		Y	Y								
Separators (IS : 6071)	Y	Y									
Electrolyte (Water / Sulphuric Acid) (IS : 1069 / 266)		Y	Y								
Inter-cell Connectors & Fasteners	Y	Y		Y							
Battery Stand	Y	Y			Y	Y					
Cell Insulators	Y	Y						Y			
Stack Assembly	Y	Y									
Lead Acid Battery (IS : 1652)	Y						Y		Y	Y	Y

Note: This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.

	STANDARD QUALITY PLAN		CUSTOMER :			PROJECT: 3x660 North Karanpura STPP			SPECIFICATION			
						TITLE			NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN			SPECIFICATION TITLE			TECHNICAL SPECIFICATION FOR 220V DC BATTERY
		SHEET 1 OF 4	SYSTEM			ITEM : NI CD BATTERY			SECTION			VOLUME III
SL. NO.	COMPONENT/ OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.0	**RAW MATERIALS & BOUGHT OUT ITEMS**											
1.1	**CELL CONTAINER**											
a)	Dimensional & constructional conformance	Visual	MA	IS:10918	Random Sample	IS:10918	IS:10918	Test Cert.	3/2	-	1	
b)	Ball drop test	Mechanical	MA	-do-	-do-	-do-	-do-	-do-	3/2	-	1	
c)	Hydraulic thrust enduarnce test	Physical	MA	-do-	-do-	-do-	-do-	-do-	3/2	-	1	
d)	Resistance to alkali	Chemical	MA	-do-	-do-	-do-	-do-	-do-	3/2	-	1	
e)	HV test	Electrical	MA	-do-	-do-	-do-	-do-	-do-	3/2	-	1	
f)	Shade difference, straightness of side walls, free from burrs, flash lines etc.	Visual	MA	-do-	-do-	-do-	-do-	-do-	3/2	-	1	
1.2	**TERMINAL POST**											
a)	Dimensional Conformance	Visual	MA	IS:10918	Random Sample	IS:10918	IS:10918	Test Cert.	3/2	-	1	
b)	Material Conformance	Chemical	CR	As per IS-2062	-do-	As per IS-2062	As per IS-2062	-do-	3/2	-	1	
c)	Thread size depth & chamfer	Physical	MA	Measurement	-do-	-do-	-do-	-do-	3/2	-	1	
d)	Surface finish & defects	Visual	MA	-do-	100%	MFR's Std.	MFR's Std.	Test Cert.	3/2	-	1	
e)	Plating Quality	Thickness	CR	-do-	Random Sample	-do-	-do-	-do-	3/2	-	1	

BHEL	**PARTICULARS**	**BIDDER/ VENDOR**	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/ VENDORS COMPANY SEAL

	STANDARD QUALITY PLAN		CUSTOMER :			PROJECT: 3x660 North Karanpura STPP TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER: PE-QP-999-508-E002A, REV. 0			SPECIFICATION TITLE			TECHNICAL SPECIFICATION FOR 220V DC BATTERY
	SHEET 2 OF 4		SYSTEM			ITEM : NI CD BATTERY			SECTION			VOLUME III
SL. NO.	COMPONENT/ OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	**W**	**V**	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**			**11**
1.3	**CONNECTOR**											
a)	Material Conformance	Chemical	CR	As per IS-1897	Random Sample	As per IS-1897	As per IS-1897	-do-	3/2	-	1	
b)	Dimensional Conformance	Visual	MA	Measurement	-do-	Approved drg/ doc & MFR's Std.	Approved drg/ doc & MFR's Std.	-do-	3/2	-	1	
c)	Visual defects	Visual	MA	-do-	100%	-do-	-do-	-do-	3/2	-	1	
d)	Plating Quality (Duplex)	Thickness	CR	-do-	Random Sample	-do-	-do-	-do-	3/2	-	1	
1.4	**SEPARATOR**											
a)	Dimensional Conformance	Visual	MA	Measurement	-do-	As per BHEL Spec. / IS:10918	As per BHEL Spec. / IS:10918	-do-	3/2	-	1	
b)	Colour shade difference, burrs, flash at the edge	Visual	MA	-do-	-do-	-do-	-do-	-do-	3/2	-	1	
1.5	**Vent Cap**											# Vent cap shall be easily removed from topping up the cells and of such dimensions that the syringe type hydrometer can be inserted into vent to take electrolyte sample.
a)	Dimensional Conformance	Dimension	MA	Measurement	-do-	Refer Remarks#	Refer Remarks#	-do-	3/2	-	1	

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	STANDARD QUALITY PLAN		CUSTOMER :			PROJECT: 3x660 North Karanpura STPP TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ : VENDOR			QUALITY PLAN NUMBER: PE-QP-999-508-E002A, REV. 0			SPECIFICATION TITLE			TECHNICAL SPECIFICATION FOR 220V DC BATTERY
	SHEET 3 OF 4		SYSTEM			ITEM : NI CD BATTERY			SECTION			VOLUME III

SL. NO.	COMPONENT/ OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.6	**Rubber Components (Gaskets & Sealing ring etc)**											
a)	Material quality	Shore hardness	CR	-do-	-do-	-do-	-do-	-do-	3/2	-	1	
b)	Resistance to alkali & oil	Chemical	MA	-do-	-do-	-do-	-do-	-do-	3/2	-	1	
c)	Dimensional Conformance	Dimension	MA	Measurement	-do-	-do-	-do-	-do-	3/2	-	1	
d)	Flash or burrs	Visual	MA	Visual	-do-	-do-	-do-	-do-	3/2	-	1	
1.7	**Strip**											
a)	Plating Quality including thickness	Dimension	CR	Measurement	1 sample/ coil	MFR's Std.	MFR's Std.	Test Cert.	3/2	-	1	Nickel plating thickness of steel strip shall be minimum 3 microns.
2.0	**FINISHED BATTERY**	Routine Test	CR	Elec. & Meas.	100%	IS:10918 & IS:8320	IS:10918 & IS:8320	Test Cert.	3/2	-	1	
3.0	**FINAL INSPECTION**											
3.1	**Type Test #**											
a)	Physical Examination	Visual	MA	Visual	Random Sample	Approved drg/ doc & IS:10918	Approved drg/ doc & IS:10918	Test Cert.	3/2	1	-	
b)	Dimensions, Mass & Layout	Dimension	MA	Measurement	-do-	-do-	-do-	-do-	3/2	1	-	
c)	Cell marking	-do-	MA	-do-	-do-	-do-	-do-	-do-	3/2	1	-	
d)	Polarity & absence of short circuit	Electrical	MA	-do-	Sample Plan as per IS: 8320	-do-	-do-	-do-	3/2	1	-	By voltage measuremnet according to polarity

BHEL	**PARTICULARS**	**BIDDER/ VENDOR**	
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	STANDARD QUALITY PLAN		CUSTOMER :			PROJECT: 3x660 North Karanpura STPP TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER: PE-QP-999-508-E002A, REV. 0			SPECIFICATION TITLE			TECHNICAL SPECIFICATION FOR 220V DC BATTERY
	SHEET 4 OF 4		SYSTEM			ITEM : NI CD BATTERY			SECTION			VOLUME III
SL. NO.	COMPONENT/ OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	W	V	REMARKS
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**			**11**
e)	Air pressure test	Visual	MA	Measurement	-do-	-do-	-do-	-do-	3/2	1	-	
f)	Insulation Resistance	-do-	MA	-do-	-do-	-do-	-do-	-do-	3/2	1	-	
g)	Ampere-hour capacity	Test	CR	As per IS: 10918	Sample Plan as per IS: 8320	-do-	-do-	Inspection Report	3/2	1	-	
h)	Endurance Test	-do-	CR	-do-	-do-	-do-	-do-	-do-	3/2	1	-	# Conduction of Type Tests from S.No. (g) to (j) shall be as per Annexure-A enclosed.
i)	Retension of Charge	-do-	CR	-do-	-do-	-do-	-do-	-do-	3/2	1	-	
j)	Test for discharge performance at low temp.	-do-	CR	-do-	-do-	-do-	-do-	-do-	3/2	1	-	
3.2	**Acceptance Test**											
a)	Physical Examination	Visual	MA	Visual	Random Sample	Approved drg/ doc & IS:10918	Approved drg/ doc & IS:10918	Test Cert.	3/2	1	-	
b)	Dimensions, Mass & Layout	Dimension	MA	Measurement	-do-	-do-	-do-	-do-	3/2			
c)	Cell marking	-do-	MA	-do-	-do-	-do-	-do-	-do-	3/2	1	-	
d)	Polarity and absence of short circuit	Electrical	MA	-do-	Sample Plan as per IS: 8320	-do-	-do-	Inspection Report	3/2	1	-	
e)	Air pressure test	Visual	MA	Measurement	-do-	-do-	-do-	-do-	3/2	1	-	
f)	Insulation Resistance	Electrical	MA	-do-	-do-	-do-	-do-	-do-	3/2	1	-	
g)	Ampere-hour capacity	Test	CR	As per IS: 10918	Sample Plan as per IS: 8320	-do-	-do-	-do-	3/2	1	-	
4.0	**ACCESSORIES**	Visual & Dimension	MA	-	100%	Approved drg/ doc	Approved drg/ doc	-do-	2	1	-	
5.0	**CABLE LUGS**	Visual	MA	-	100%	Approved drg/ doc	Approved drg/ doc	-do-	2	1	-	

NOTE:- Wherever IS is mentioned equivalent IEC is also acceptable. In case of any technical requirement not covered by IEC, technical requirement as per IS shall prevail.

LEGEND : P : PERFORMER W: WITNESSER V: VERIFIER CHP: CUSTOMER HOLD POINT SHALL BE DECIDED AT CONTRACT STAGE

1. End Customer/ End Customer's Consulatnt & BHEL
2. Vendor
3. Sub-Vendor of Vendor

BHEL	PARTICULARS	BIDDER/ VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/ VENDORS COMPANY SEAL

ANNEXURE-A

QUALITY PLAN

STANDARD QP NO. : PE-QP-999-508-E002A, REV. 0

LIST OF TYPE TEST FOR Ni-Cd BATTERY

S No	Test	Type test description	Referred standard	Test to be specifically conducted (Yes/No)	BHEL/Customer's approval Req. on test certificate (Yes/No)
1	Type Test	• Ampere-hour capacity	IS:10918	No	Yes
		• Test for discharge performance at low temp.	IS:10918	No	Yes
		• Retension of Charge	IS:10918	No	Yes
		• Endurance Test	IS:10918	No	Yes

Ni- Cd BATTERY

ATTRIBUTES / CHARACTERISTICS → / ITEMS, COMPONENTS, SUB SYSTEM ASSEMBLY	Dimensions & Finish	Impact Strength	Conformance to relevant part drg. & Manufacturer's standards	Resistance to Alkali	Chemical composition	Nickel Plating thickness	Paint Shade, Thickness, Adhesion & Finish	Air Pressure Test after heat sealing	Marking & Mass (Routine & Acceptance Test)	Air Pressure Test (Acceptance Test)	Retention of Charge Test (Acceptance Test)	AH Test (Acceptance Test)	Insulation Resistance (Acceptance Test)	Polarity & absence of short circuit (Routine & Acceptance Test)
Container & Lids	Y	Y	Y	Y										
Vent Plugs	Y		Y	Y										
Perforated Steel Strips	Y		Y	Y		Y								
Active Material for Positive & Negative Plates			Y		Y									
Separators	Y		Y	Y										
Electrolyte			Y		Y									
Inter-cell Connectors & Fasteners	Y		Y	Y		Y								
Battery Stand	Y			Y			Y							
Cell Insulators	Y		Y	Y										
Stack Assembly	Y		Y					Y	Y			Y		Y
Ni-Cd Battery (IS : 10918)	Y								Y	Y	Y	Y	Y	Y

Notes:

1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.
2. Makes of all major Bought Out Items will be subject to NTPC approval.