NTPC LTD.
2X800 MW GADARWARA STPP

TECHNICAL SPECIFICATION
OF
ELEVATORS

SPECIFICATION NO.: PE-TS-394-502-A001

BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
PPEI, NOIDA, INDIA

INDEX

VOLUME-IIB

VOLUME-III

	TITLE	SPEC. NO. PE – TS – 394 - 502 – A001	
BHEL	**TECHNICAL SPECIFICATION FOR ELEVATORS**	VOLUME II	
		SECTION D	
		REV 0	DATE 20 -03 - 14
		SHEET	OF

VOL - II B

	TITLE	SPEC. NO. PE – TS -394 - 502 – A001	
	TECHNICAL SPECIFICATION	VOLUME II B	
	FOR	SECTION A	
	ELEVATORS	REV 0	DATE 20 – 03 - 14
	2X800 MW GADARWARA STPP, MP	SHEET 1	OF 1

SECTION - A

SCOPE OF ENQUIRY

SCOPE OF ENQUIRY

1.0 INTENT OF SPECIFICATION

1.1 This specification covers the design, manufacture, inspection and testing at manufacturer's works / at their sub-vendor's works, painting, packing at manufacturers or at their sub-vendor's works, duly packed for transportation to site, delivery to site, storage and handling at site, mandatory spares, erection & commissioning, carrying out trial run and acceptance / functional test at site & final painting of passenger elevator for ***2x800 MW GADARWARA STPP (STG PACKAGE)*** at Gadarwara of Narsingpur district of MP.

1.2 It is not the intent to specify all the details of design and manufacture. However, the equipment shall conform to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material, which in his judgment is not in accordance herewith.

1.3 Deviation, if any, should clearly be brought out in format provided along with price schedule, otherwise, it will be presumed that the bidder's offer is strictly in line with the specification. No other format shall be taken into cognizance and deviation taken/ sought in other format shall be automatically treated as withdrawn.

1.4 The general terms and conditions, instructions to contractor and other attachment referred to elsewhere are hereby made part of the tender specification. The contractor shall be responsible for and governed by all requirements stipulated hereinafter.

1.5 In the event of conflict between different clauses of mechanical & electrical requirement specified in the specification of **ELEVATOR,** the more stringent requirement as per the interpretation of the BHEL shall apply and the same shall be adhered and provided by the bidder during detail engineering stage without any commercial implication.

1.6 Compliance cum confirmation certificate is to be accepted by bidder without any modification.

	TITLE	SPECIFICATION NO. PE –TS –394 - 502 – A001	
BHEL	**TECHNICAL SPECIFICATION FOR ELEVATORS**	VOLUME	II B
		SECTION	B
		REV 0	DATE 20 -03 - 14
		SHEET	OF

SECTION - B

PROJECT INFORMATION

INTRODUCTION

1.00.00 BACKGROUND

Gadarwara Thermal Power Project (Gadarwara TPP) is being set up as a regional power project for the benefit of States/UTs of Western Region. This project is being set up in two stages. Each stage shall comprise of two units of 800 MW.

1.01.00 **Location and**

The site is located near villages Gangai & Umaraiya (about 9 Kms from Gadarwara town in Narsingpur district of Madhya Pradesh.The major cities Bhopal & Jabalpur are located at about 210 Kms & about 140 kms respectively from proposed project site. The nearest BG Railway Station, Gadarwara, on Jabalpur- Itarsi Section on central railway main Line is about 9 Kms from proposed project site.

The nearest commercial airport, Bhopal and Jabalpur are located about 240 Kms and about 155 Kms respectively from site. The plant latitude and longitude are 22° 51' 42" N and 78° 52' 08" respectively.

Vicinity plan of the proposed project is placed at **Annexure –A-I**

1.02.00 **Land**

About 1844 acres of land (Private Land- about 1480 acres nd Govt. Land- about 364 acres) has been envisaged for the project. In-principle land availability clearance has been obtained from Govt. of Madhya Pradesh vide letter dated 19.05.08.

1.03.00 **Water**

The make-up water requirement is estimated as 4680 Cubic Meter/Hr with ash circulation system and about 5980 Cubic Meter/Hr with once through ash water system. The source of water for the Project is Narmada River at a distance of about 30 Kms from the project site.

Govt. of Madhya Pradesh vide dated 19.05.08.has accorded water commitment from Narmada river for the project. CWC vide letter dated 27.07.12 have concurred water availability confirmation accorded by State Govt.

1.04.00 **Capacity**

2 x 800 MW - Present proposal

2 x 800 MW - In Future

1.05.00 **Meteorological data**

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

1.06.00 **Plant Water Scheme**

The Plant water scheme is described below.

1.06.01 **Condenser Cooling (CW) Water System**

It is proposed to provide recirculating type CW system with induced draft type cooling towers. For the recirculating type CW system it is proposed to supply clarified water as make up. Raw water from the make-up water pump house shall be pumped to a Water Pretreatment Plant (PT - CW system). The treated clarified water shall be led to the cold water channel of CW system. Designed Clarified Water Analysis is given in this subsection.CW system shall be operated at a C.O.C of about 4.0. Chemical treatment programme (using acid dosing and scale cum corrosion inhibitors dosing) may be employed in addition to blow down of CW water to control the CW system chemistry in case CW system is required to be operated beyond 4.0 COC. CW blow down shall be drawn from the discharge of CW pumps and the same shall be led to a Service water Tank. For carrying circulating water from CW pump house to TG-area and from TG area to cooling tower, steel lined concrete encased duct would be provided. For interconnecting CW duct with CW pump, condenser and cooling towers, steel pipes would be used. Cooled water from cooling tower will be led to CW pump house through the cold water channel by gravity.

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

The plant auxiliaries of Steam Generator and Turbine Generator shall be cooled by Demineralised (DM) water in a closed circuit. The primary circuit DM water shall be cooled through plate type heat exchangers by Circulating Water tapped from CW system in a closed secondary circuit. The hot secondary circuit cooling water shall be cooled in the cooling towers and shall be returned back to the system. It is proposed to provide independent primary cooling water circuit for Steam Generator & auxiliaries and TG & its auxiliaries.

1.06.03 **Station Auxiliaries Cooling Water System**

The station auxiliaries such as Air compressors, Compressors of ash handling plant, Cooling water circuit of Air Conditioning system, compressor of mill reject system etc. shall be cooled by separate cooling water System using separate set of pumps and cooling towers.

1.06.04 **Ash Water System**

It is proposed to operate ash water system in a closed circuit. The ash water from the ash dyke shall be recirculated after treating a part of the quantity in a side stream lime softening plant as the case may be. Make up to the ash water system (to compensate for the ash water system blow down and evaporation loss in ash dyke) shall be supplied from excess CW blow down water (Service water) and raw water supply from water source of the plant. In addition, provision shall be kept to supply treated water from Central Monitoring Basin of Liquid Effluent Treatment Plant.

1.06.05 **Other Miscellaneous Water Systems**

a) CW system blow down water shall be used for the plant service water requirement, dust suppression system of coal handling plant, makeup to the Ventilation system, ash slurry pumps sealing, sealing of Vacuum pumps (if applicable) of Ash Handling plant, make-up to fire water storage tanks and cooling water requirement of hydrogen generation plant. The service (wash water) 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. The excess service water shall be led to central monitoring basin for disposal.

b) Separate water Pre-treatment plants are proposed for Circulating Water (PT-CW) system, Demineralisation Plant (PT-DM) plant and potable (PT-Pot) water systems.

c) The drinking water requirement of the plant and colony shall be provided from the above mentioned Water (PT-Pot) pretreatment 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 clarified water & DM water is given in this sub-section at **Annexure-A-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 as per the criteria specified in sub-section-D1 of Section-VI (Part-A).

In case the acceleration criteria considered by the Bidder for the design of anchorage bolts of Steam Turbine and Generator with TG Deck in his bid is different with respect to above criteria, he shall indicate the same in his bid. The same will be discussed with the Bidder and finalized considering the following:

a) The earthquake design acceleration for the steam turbine and generator acting at the centre of gravity depends upon the layout/configuration/size of TG deck supporting columns and beams which are to be jointly decided by NTPC and the bidder.

b) As the data regarding Foundation GA & loading data to be furnished by Bidder may not be available at tender stage, the acceleration criteria proposed by the bidder can not be confirmed for acceptance at the award stage. The same can be confirmed after jointly finalizing the TG substructure arrangement by NTPC and Bidder.

c) TG deck acceleration values will be limited to the design values adopted by Bidder by suitably increasing the size of the TG supporting columns/beams during detailed engineering.

Accordingly Bidder has to make equipment/piping layout clearing the TG column/beams.

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 sub-section-D1 of Section-VI (Part-A).

ANNEXURE–A-I


JABALPUR
MAIN PLANT
ASH POND-1
NTPC Limited
GADARWARA
22°-55'
ITARSI
22°-50'

ANNEXURE-A-II
PAGE 1 OF 2

CLIMATOLOGICAL TABLE

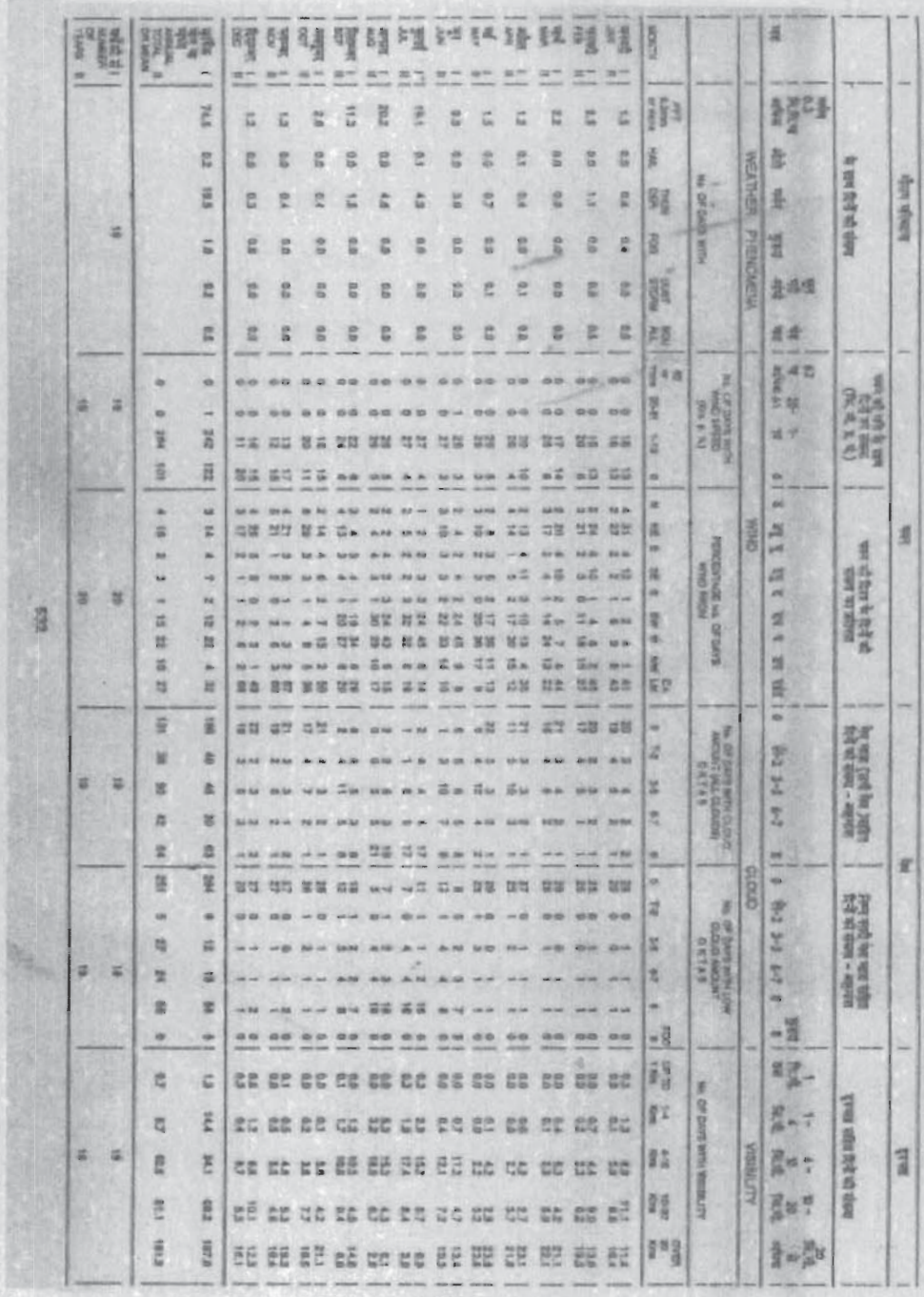
EXHIBIT - 1

STATION :Narsinghpur LAT 22°57' N LONG 79°11' E HEIGHT ABOVE M.S.L. [illegible] METRES

BASED ON OBSERVATIONS FROM 1962 TO 1980

MONTH		STATION LEVEL PRESSURE (hPa)	AIR TEMPERATURE MEAN: DRY BULB (°C)	WET BULB (°C)	DAILY MAX (°C)	DAILY MIN (°C)	HIGHEST IN THE MONTH (°C)	LOWEST IN THE MONTH (°C)	EXTREMES: HIGHEST (°C)	DATE AND YEAR	LOWEST (°C)	DATE AND YEAR	HUMIDITY: RELATIVE HUMIDITY (%)	VAPOUR PRESSURE (hPa)	CLOUD AMOUNT (Oktas of sky): ALL CLOUDS	LOW CLOUDS	RAINFALL: MONTHLY TOTAL (mm)	NO. OF RAINY DAYS	HEAVIEST IN MONTH WITH YEAR (mm)	LOWEST IN MONTH WITH YEAR (mm)	HEAVIEST FALL IN 24 HOURS (mm)	DATE AND YEAR	MEAN WIND SPEED (Km/h)
JAN	I	976.0	12.0	9.8	26.3	8.2	30.9	3.0	34.0	08 1973	1.2	23 1963	74	10.6	1.6	0.6	11.0	1.2	40.0 1970	0.0	27.8	05 1960	2.4
	II	972.4	24.6	16.6									40	12.3	1.5	0.4							
FEB	I	974.2	15.7	12.2	30.3	11.1	34.6	4.9	37.5	25 1980	1.4	27 1974	64	11.5	1.4	0.7	17.3	1.2	89.4 1973	0.0	71.0	04 1973	3.6
	II	970.3	28.5	18.3									35	13.3	1.5	0.4							
MAR	I	972.1	21.7	15.5	35.3	13.6	40.0	9.9	42.5	31 1977	6.0	02 1971 @	50	12.8	1.3	0.5	12.1	1.1	38.6 1966	0.0	27.3	14 1968	3.8
	II	967.7	33.6	21.0									30	15.2	2.0	0.7							
APR	I	966.4	27.6	19.0	40.3	21.4	43.5	15.8	47.4	28 1960	10.0	03 1959	40	15.1	1.3	0.5	6.2	0.8	35.0 1963	0.0	24.4	06 1973	4.4
	II	964.1	38.3	23.1									23	16.0	2.5	0.9							
MAY	I	965.0	32.2	22.1	42.5	25.9	45.1	20.5	47.5	28 1973	17.0	12 1968	39	19.6	1.3	0.4	7.0	0.6	31.8 1976	0.0	19.4	25 1976	5.3
	II	960.5	40.3	24.4									24	17.7	2.6	1.0							
JUN	I	961.8	29.7	24.6	38.1	26.1	43.9	21.8	47.2	08 1970	19.0	09 1971	55	20.7	4.2	2.6	159.5	7.4	422.6 1977	34.2 1969	217.8	27 1977	8.0
	II	957.9	35.6	25.6									49	23.3	5.4	3.8							
JUL	I	961.1	26.1	24.3	31.4	23.9	36.7	21.4	42.6	01 1960	19.6	12 1973	85	29.0	8.2	5.0	334.8	14.4	690.4 [illegible]	125.7 1965	154.8	02 1970	6.5
	II	958.2	29.0	25.2									74	28.8	6.6	6.7							
AUG	I	962.3	25.2	23.9	29.7	23.1	34.2	21.3	36.0	03 1972	[illegible]	16 1969	90	29.4	8.4	5.4	423.6	15.7	714.0 1972	101.0 1965	224.2	09 1972	6.0
	II	959.4	27.7	24.9									80	29.2	8.7	5.3							
SEP	I	966.3	25.5	23.4	31.9	22.5	35.1	20.0	36.5	15 1974	18.4	23 1972 @	84	27.1	3.3	2.5	100.8	6.4	416.7 1962	17.2 1975	133.4	05 1973	3.8
	II	962.8	29.4	24.3									66	26.1	3.0	3.0							
OCT	I	971.7	23.1	19.6	33.5	17.8	36.1	12.9	38.4	07 1980	5.8	31 1980	70	20.0	1.3	0.8	23.5	1.4	20.9 1971	0.0	166.4	04 1977	2.2
	II	968.0	30.7	21.3									42	16.3	2.0	0.6							
NOV	I	975.0	17.4	14.3	30.7	12.4	33.9	7.6	37.8	25 1979	2.2	30 1970	75	14.1	1.3	0.7	14.3	0.8	35.2 1977	0.0	76.8	24 1977	2.2
	II	971.5	27.7	18.1									41	15.2	1.7	0.7							
DEC	I	976.0	12.8	10.8	27.3	8.8	30.7	*3.6	33.0	01 1966	-1.4	28 1968	75	11.4	1.4	0.7	12.6	0.9	30.4 1967	0.0	62.0	11 1967	2.0
	II	973.1	24.8	17.1									41	13.8	1.6	0.8							
ANNUAL TOTAL OR MEAN	I	969.2	22.4	18.5	33.2	18.1	45.4	2.5	47.4		-1.4		67	18.8	2.8	1.7	1195.3	53.8	1602.6	646.2	224.2		4.2
	II	965.5	30.8	21.8									40	19.3	3.3	2.0			1977	1966			
NUMBER OF YEARS	I	19	19	19	19	19	19	19	19		19		19	18	18	18	19	19	19	19	19		15
	II	19	18	18									18	19	19	19							

631



जलवायवी सारणी
CLIMATOLOGICAL TABLE

स्टेशन : नरसिंहपुर
STATION : Narsinghpur

ANNEXURE-A-III

DESIGN CLARIFIED WATER ANALYSIS

Sl. No.	Constituent	as	mg per litre
1.	Calcium	$CaCO_3$	102
2.	Magnesium	$CaCO_3$	41
3.	Sodium	$CaCO_3$	35
4.	Potassium	$CaCO_3$	3
5.	Total Alkalinity	$CaCO_3$	113
6.	P-Alkalinity	$CaCO_3$	Nil
7.	Chloride	$CaCO_3$	43
8.	Sulphate	$CaCO_3$	25
9.	Silica (Reactive)	SiO_2	16
10.	Iron	Fe	0.3 mg/l
11.	pH Value	-	6.8 - 8.5
12.	Turbidity	NTU	10

Note- Clarified water shall be used as make up water for cooling water system.

ANNEXURE – A-III

ANALYSIS OF DM WATER TO BE USED FOR MAKE-UP WATER TO CONDENSER

Sl.No.	Characteristics	Value
1.	Silica (Max.)	0.01 ppm as Sio2
2.	Iron as Fe	Nil
3.	Total hardness	Nil
4.	pH value	6.8 -7.3
5.	Conductivity	Not more than 0.1micro mho/cm excluding the effects of free CO2

ANNEXURE-WL(GADARWARA)

CRITERIA FOR WIND RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT

All structures shall be designed for wind forces in accordance with IS:875 (Part-3) and as specified in this document. See Annexure – B for site specific information.

Along wind forces shall generally be computed by the Peak (i.e. 3 second gust) Wind Speed method as defined in the standard.

Along wind forces on slender and wind sensitive structures and structural elements shall also be computed, for dynamic effects, using the Gust Factor or Gust Effectiveness Factor Method as defined in the standard. The structures shall be designed for the higher of the forces obtained from Gust Factor method and the Peak Wind Speed method.

Analysis for dynamic effects of wind must be undertaken for any structure which has a height to minimum lateral dimension ratio greater than "5" and/or if the fundamental frequency of the structure is less than 1 Hz.

Susceptibility of structures to across-wind forces, galloping, flutter, ovalling etc. should be examined and designed/detailed accordingly following the recommendations of IS:875(Part-3) and other relevant Indian standards.

It should be estimated if size and relative position of other structures are likely to enhance the wind loading on the structure under consideration. Enhancement factor, if necessary, shall suitably be estimated and applied to the wind loading to account for the interference effects.

Damping in Structures

The damping factor (as a percentage of critical damping) to be adopted shall not be more than as indicated below for:

a) Welded steel structures	: 1.0%
b) Bolted steel structures	: 2.0%
c) Reinforced concrete structures	: 1.6%
d) Steel stacks	: As per IS:6533 & CICIND Model Code whichever is more critical.

ANNEXURE-B

SITE SPECIFIC DESIGN PARAMETERS

The various design parameters, as defined in IS: 875 (Part-3), to be adopted for the project site shall be as follows:

a) The basic wind speed "V_s" at ten metres above the mean ground level : 39 metres/second

b) The risk coefficient "K_1" : 1.06

c) Category of terrain : Category-2

Note: Notwithstanding the values of the above mentioned parameters, the design wind pressure so computed at any point shall not be taken less than 1500 N/Sq. metre for all classes of structures, i.e. A, B & C, as defined in IS: 875 (Part-3).

Gadarwara Thermal Power Project

CRITERIA FOR EARTHQUAKE RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT

All structures and equipment shall be designed for seismic forces adopting the site specific seismic information provided in this document and using the other provisions in accordance with IS:1893 (Part 1):2002 and IS:1893 (Part 4):2005. Pending finalization of Parts 2, 3 and 5 of IS:1893, provisions of part 1 shall be read along with the relevant clauses of IS:1893:1984, for structures other than the buildings and industrial structures including stack-like structures.

A site specific seismic study has been conducted for the project site. The peak ground horizontal acceleration for the project site, the site specific acceleration spectral coefficients (in units of gravity acceleration 'g') in the horizontal direction for the various damping values and the multiplying factor (to be used over the spectral coefficients) for evaluating the design acceleration spectra are as given at Annexure-I.

Vertical acceleration spectral values shall be taken as 2/3rd of the corresponding horizontal values.

The site specific design acceleration spectra shall be used in place of the response acceleration spectra, given at figure-2 in IS:1893 (Part 1) and Annex B of IS:1893 (Part 4). The site specific acceleration spectra along with multiplying factors specified in Annexure-I includes the effect of the seismic environment of the site, the importance factor related to the structures and the response reduction factor. Hence, the design spectra do not require any further consideration of the zone factor (Z), the importance factor (I) and response reduction factor (R) as used in the IS:1893 (Part 1 and Part 4).

Damping in Structures

The damping factor (as a percentage of critical damping) to be adopted shall not be more than as indicated below for:

a)	Steel structures	:	2%
b)	Reinforced Concrete structures	:	5%
c)	Reinforced Concrete Stacks	:	3%
d)	Steel stacks	:	2%

Method of Analysis

Since most structures in a power plant are irregular in shape and have irregular distribution of mass and stiffness, dynamic analysis for obtaining the design seismic forces shall be carried out using the response spectrum method. The number of vibration modes used in the analysis should be such that the sum total of modal masses of all modes considered is at least 90 percent of the total seismic mass and shall also meet requirements of IS:1893 (Part 1). Modal combination of the peak response quantities shall be performed as per Complete Quadratic Combination (CQC) method or by an acceptable alternative as per IS:1893 (Part 1).

In general, seismic analysis shall be performed for the three orthogonal (two principal horizontal and one vertical) components of earthquake motion. The seismic response from the three components shall be combined as specified in IS:1893 (Part 1).

For buildings, if the design base shear (V_B) obtained from modal combination is less than the base shear ($\bar{V}_B$) computed using the approximate fundamental period (T_a) given in IS:1893:Part 1 and using site specific acceleration spectra with appropriate multiplying factor, the response quantities (e.g. member forces, displacements, storey forces, storey shears and base reactions) shall be enhanced in the ratio of $\bar{V}_B / V_B$. However, no reduction is permitted if $\bar{V}_B$ is less than V_B.

For regular buildings less than 12m in height, design seismic base shear and its distribution to different floor levels along the height of the building may be carried out as specified under clause 7.5, 7.6 & 7.7 of IS:1893 (Part 1) and using site specific design acceleration spectra. The design horizontal acceleration spectrum value (Ah) shall be computed for the fundamental natural period as per clause 7.6 of IS:1893 (Part 1) using site specific spectral acceleration coefficients with appropriate multiplying factor given in Annexure-I. Further, the spectral acceleration coefficient shall get restricted to the peak spectral value if the fundamental natural period of the building falls to the left of the peak in the spectral acceleration curve.

Design/Detailing for Ductility for Structures

The site specific design acceleration spectra is a reduced spectra and has an in-built allowance for ductility. Structures shall be engineered and detailed in accordance with relevant Indian/International standards to achieve ductility.

ANNEXURE – I

SITE SPECIFIC SEISMIC PARAMETERS FOR DESIGN OF STRUCTURES AND EQUIPMENT

The various site specific seismic parameters for the project site shall be as follows:

1)	Peak ground horizontal acceleration (MCE)	: 0.18 g
2)	Multiplying factor to be applied to the site specific horizontal acceleration spectral coefficients (in units of gravity acceleration 'g') to obtain the design acceleration spectra	
a)	for ordinary moment resisting steel frames designed and detailed as per IS:800	: 0.0525
b)	for braced steel frames designed and detailed as per IS:800	: 0.039
c)	For special moment resisting RC frames designed and detailed as per IS:456 and IS:13920	: 0.0315
d)	for steel chimney	: 0.079
e)	for design of structures not covered under 2 (a) to 2 (d) above and under 3 below	: 0.0525
3)	Multiplying factor to be applied to the site specific horizontal acceleration spectral coefficients (in units of gravity acceleration 'g') for design of equipment and structures where inelastic action is not relevant or not permitted	: 0.105

Note: g = Acceleration due to gravity

The horizontal seismic acceleration spectral coefficients are furnished in subsequent pages.

ANNEXURE – I

HORIZONTAL SEISMIC ACCELERATION SPECTRAL COEFFICIENTS
(In units of 'g')

Time Period (Sec)	Damping Factor (as a percentage of critical damping)	
	2%	5%
0	1	1
0.03	1	1
0.04	1.287	1.178
0.05	1.564	1.337
0.06	1.835	1.482
0.07	2.101	1.618
0.08	2.361	1.746
0.09	2.618	1.866
0.1	2.871	1.982
0.105	2.996	2.037
0.11	3.121	2.092
0.115	3.245	2.145
0.12	3.368	2.198
0.123	3.442	2.229
0.127	3.500	2.270
0.13	3.500	2.300
0.135	3.500	2.500
0.14	3.500	2.500
0.145	3.500	2.500
0.15	3.500	2.500
0.2	3.500	2.500
0.25	3.500	2.500
0.3	3.500	2.500
0.35	3.500	2.500
0.4	3.500	2.500
0.43	3.500	2.500
0.45	3.500	2.500
0.48	3.500	2.500
0.49	3.369	2.500
0.5	3.302	2.500
0.52	3.175	2.212
0.555	2.975	2.072
0.56	2.948	2.054
0.565	2.922	2.035
0.57	2.896	2.018
0.575	2.871	2.000
0.58	2.847	1.983
0.585	2.822	1.966

ANNEXURE – I

HORIZONTAL SEISMIC ACCELERATION SPECTRAL COEFFICIENTS
(In units of 'g')

Time Period (Sec)	Damping Factor (as a percentage of critical damping)	
	2%	5%
0.59	2.798	1.949
0.595	2.775	1.933
0.6	2.752	1.917
0.65	2.540	1.769
0.7	2.359	1.643
0.75	2.201	1.533
0.8	2.064	1.438
0.85	1.942	1.353
0.9	1.834	1.278
0.95	1.738	1.211
1	1.651	1.150
1.05	1.572	1.095
1.1	1.501	1.045
1.15	1.436	1.000
1.2	1.376	0.958
1.25	1.321	0.920
1.3	1.270	0.885
1.35	1.223	0.852
1.4	1.179	0.821
1.45	1.139	0.793
1.5	1.101	0.767
1.55	1.065	0.742
1.6	1.032	0.719
1.65	1.001	0.697
1.7	0.971	0.676
1.75	0.943	0.657
1.8	0.917	0.639
1.85	0.892	0.622
[illegible]	[illegible]	[illegible]
1.95	0.847	0.590
2	0.826	0.575
2.05	0.805	0.561
2.1	0.786	0.548
2.15	0.768	0.535
2.2	0.750	0.523
2.25	0.734	0.511
2.3	0.718	0.500
2.35	0.703	0.489
2.4	0.688	0.479

ANNEXURE – I

HORIZONTAL SEISMIC ACCELERATION SPECTRAL COEFFICIENTS
(In units of 'g')

Time Period (Sec)	Damping Factor (as a percentage of critical damping)	
	2%	5%
2.45	0.674	0.469
2.5	0.660	0.460
2.55	0.647	0.451
2.6	0.635	0.442
2.65	0.623	0.434
2.7	0.611	0.426
2.75	0.600	0.418
2.8	0.590	0.411
2.85	0.579	0.404
2.9	0.569	0.397
2.95	0.560	0.390
3	0.550	0.383
3.05	0.541	0.377
3.1	0.533	0.371
3.15	0.524	0.365
3.2	0.516	0.359
3.25	0.508	0.354
3.3	0.500	0.348
3.35	0.493	0.343
3.4	0.486	0.338
3.45	0.479	0.333
3.5	0.472	0.329
3.55	0.465	0.324
3.6	0.459	0.319
3.65	0.452	0.315
3.7	0.446	0.311
3.75	0.446	0.307
3.8	0.435	0.303
3.85	0.423	0.299
3.9	0.413	0.295
3.95	0.402	0.291
4	0.392	0.288

SECTION – C
SPECIFIC TECHNICAL REQUIREMENTS

1.0 Introduction

Passenger elevator shall be provided for access to various operating floors / platforms in TG building/Service Building/Administration building for 2x800 MW GADARWRA Project to facilitate movement of operating and maintenance personnel.

2.0 Scope of equipment supply and services

2.0.1 Design, Engineering, Manufacture, Inspection & Testing at manufacturer's works or at their sub-vendor's works, Painting at manufacturer's or at their sub-vendor's works, duly packed for transportation to site, delivery to site, storage and handling at site, mandatory spares, Erection & Commissioning, carrying out trial run and Acceptance / functional tests at site & final painting of Passenger Elevators for 2 x 800 MW GADARWARA STPP as listed below:-

Sl. no	Building	No. of elevators	Capacity	No. of landings	Total rise	Type	Speed
1.	TG Hall	2 Nos.	1088 Kg	0.0m, 8.5m ,18.0m ,32.0m, &41.0m.(One dummy landing between 18.0M & 32.0M floor)	41 M	Conventional Type Passenger elevator with simplex operation	1.0 M/s
2.	Service Building	2 Nos.	1088Kg	0.0m, 4.5 m , 9.0 m ,13.5 m, &18..0 m.	18 M	Conventional Type Passenger elevator with duplex operation	1.0 M/s
3.	Administrative Building	2 Nos.	1088 Kg	0.0 m, 6.0 m ,10.5 m, &15.0 m.	15 M	Panoramic Type Passenger elevator with duplex operation	1.0 M/s

2.0.2 Elevator shall include but shall not be limited to the following:-

1) Elevator car with SS 304,1.5 mm thick hair line finish. Flooring for all passenger type elevators shall be vitrified ceramic tile of matt finish as indicated in the Data sheet.

2) Guide rails for car and counterweights.

3) Counterweight.

4) DCEM brakes.

5) Spring buffer for car and counterweight.

6) Driving arrangement including motor, gear box, sheaves etc.

7) All electrical equipment including power cable, control cable, controller panel, safety devices including push buttons, limit switches, safety switches, indicators etc.

8) Isolating Switch

9) Car doors & car ceiling and hoist way doors of SS-304 with thickness (min.) 1.5 mm.

10) Car operating panel, digital control, car position indicator at all floors, luminous hall buttons, auto door operating mechanism, alarm bell, car light & car fan.

11) Intercom connection.

12) Ropes for hoisting.

13) Circuit breaker, switch fuse unit etc. in machine room for terminating the power supply cable (power supply cable provided by purchaser up to machine room level), other power/control and trailing cabling and equipment earthling.

14) Ladder in pits.

15) Emergency light with rechargeable battery.

16) All fixing materials require fixing rails, brackets, equipment including nuts and bolts.

17) Facia plates (750 mm minimum) & sill angels.

18) Full length infra-red Curtain safety feature in door along with pressure limiter as an extra mechanical safety.

19) ELCB if required as per statutory requirement.

20) Any other equipment required to meet the requirement of local statuary and regulatory body and prevailing lift etc.

21) Car lighting, recessed fluorescent light fittings for illumination level of 100 lux on car floor.

22) Mirror of the car rear panel

23) Floor announcement cum music system to be provided.

24) List of mandatory spares in terms of numbers/ sets shall be furnished by the bidder along with the offer

25) Three (3) sided SS- mirror finish hand railing at suitable height.

26) Maintenance tools and tackles along with un-priced list with the offer.

27) Minor civil work required during installation of elevator.

28) Automatic rescue device with battery drive - Modern advanced electronic drive system of rescuing passenger trapped in an elevator shall be provided.

29). Emergency safety devices - The lift shall be provided with safety device attached to the lift car frame and placed beneath the car & shall be capable of stopping and sustaining the lift car up at governor tripping speed with full rated load in car.

30). All steel embedment for fixing landing doors / indicators etc. to the elevator well shaft and fascia plate shall be supplied by the bidder

31). Guide rails complete with supporting brackets for the car and counter weights.

32). Elevator drive machines complete with electric motor, reduction gear unit, suspension ropes, buffers for the cars and the counter weights and other drives and control mechanism. All foundation anchor bolts, sleeves, anchoring steels and any item required to complete the job satisfactorily shall be provided by the bidder. The bidder shall also provide for the grouting of anchor bolts, sleeves, anchoring steel etc. and other anchorages.

33). Any other steel works as well as all other accessories / components not specified in the technical specification but necessary for making the elevator complete.

34). All minor building works including the supply of steel items, associated with installations of equipments in the machine room hoist way, hoist way door, frames and elevator pit, shall form part of bidder's scope of supply, BHEL / customer will provide the elevator well complete with foundation and brick walls around the lift well together with overhead machine room. The machine room will be provided with RCC floor slab with necessary pockets for anchor bolts and slots.

35). Please also refer enclosed customer specification vide section VI, PART-A and PART-B.

36). All Equipment's / facilities needed for erection commissioning of elevator shall be in bidder's scope.

37). Bidder to note that all LT Power cables (Fixed power and control cables etc), Trailing cable and instrument / signal cable for elevator shall be in bidder's scope as per electrical specification. Trailing cable shall be FRLS type (with

strain bearing member). Detailed cable specification shall be as per cable specification attached in electrical portion specification.

38) 1/2 Kg CO2/suitable type Fire extinguisher in bidder scope. Fixing arrangement shall be provided in Car accordingly.

39). Bidder shall include scaffoldings along with whitewash inside shaft required in their scope of work.

40) lighting in car,shaft,pit & M/c room as per electrical specification

41) Window / split type air conditioner (min 2T) per elevator in the machine room which includes fans, air filter and accessories to prevent dust ingress in the machine room.

42) Functional Guarantee test shall be carried out at site for over speed test and over load test, travel and hoist speed checks as per IS 14665 (Latest).

43). Preparation of all necessary drawings / data sheets / documents / calculations as required for obtaining necessary local administration permits / approval from statutory authority and make arrangements for inspection and tests required thereby for necessary approval on behalf of the customer. Fees as required for obtaining approval from statutory bodies shall also be included in the scope of work of the bidder.

44) Elevator shall be provided with AC VVVF type drive control system.

45) Mandatory Spares

46) Maintenance tools & tackles

NOTES:

1) Min dimensions as specified in applicable IS 14665 (all five parts) shall be considered / provided for lift shaft / pit / car / M/c Room. Safety requirement shall be as per IS 14665 (Relevant part).

2) Make of various bought out items & QAP shall subject to approval of BHEL / Customer during detail engineering stage.

3) Bidder shall provide all required spares during E & C without any commercial implication.

4) Car frame and structure (guide brackets, supports etc.) and other equipment shall be painted with epoxy based paint for all elevators.

5) Protection class for motor shall be IP 54 and main control panel shall be min IP 21and elevator control shall be VVVF type. Push buttons, Car operating Panel,

Landing Operating Panel, Landing door motor and other equipment shall be IP-54.

6) Factor of safety for rope shall be 12 (min).

7) All Landing door shall be fire rated for at min 1 hour or as per latest IS.

8) Motor shall be min. S4 duty with thermal class 130 (B) or better insulation.

9) Full length infra-red Curtain safety feature in door along with pressure limiter as an additional mechanical safety.

10) Bidder shall comply to the quality requirements as enclosed with specification. Quality plan shall be submitted by the successful bidder for approval during detail engineering.

11) Bidder shall provide equipment as per requirements indicated in this specification, statutory and regulatory requirements, and prevailing local lift act requirements.

12) Bidder shall confirm that supply, installation and commissioning of elevator shall be completed within project schedule as indicated elsewhere from placement of intent / letter of intent.

3.0 SCOPE OF SERVICES

Scope of services will broadly include the followings:-

1) Complete erection, testing and commissioning including all testing and commissioning materials, consumables and other tools and tackles required for erection of complete elevator package.

2) Painting of all equipments / items within the battery limit.

3) Unloading, storage, handling and transportation at site for all items of elevator.

4) Minor civil work

5) Necessary consumables and instrumentation as required for inspection and testing at works as well as at site including pre-commissioning activities, if any, shall be arranged by the successful bidder at their own cost.

6) Functional Test.

7) Preparation of civil input drawings including elevator pit, shaft, machine room etc.

8) Any other service as required for making the installation complete in all respect and satisfactory erection and commissioning of the system.

9) Relevant requirements as per GTR, GCC, ECC & SCC.

4.0 Exclusion

1) Complete civil works for hoist way, machine room, pit complete with the side enclosure (brick / RCC), interconnecting platform (if any) and monorail beam.

2) Hoist with travelling trolley of 3T capacity to facilitate handling of equipment in the machine room and monorail beam

3) Power supply cable (AC 415 V, 3 Phase, 3 wire 50 Hz) up to machine room level. Further cabling (all cables including power, control and instrumentation) shall be provided by the bidder.

4) Electrical exclusion as per separate scope sheet attached in the specification.

5.0 Operation

Refer attached NTPC specification

6.0 Controls

The control shall be variable voltage and variable frequency type and shall provide smooth and constant acceleration and retardation under all conditions of operation. Suitable control panels shall be provided in the machine room. The lift will be automatically stopped by upper and lower terminal switches. The elevators will have an emergency stop switch, limit switches and other safety devices according to statutory rule

7.0 Cables and wirings

The cables used in the elevator installations shall conform to the latest edition of IS 4289(Please also refer cl. No.1.04.03 page 4 of 4 of attached NTPC spec). All wiring / cabling between the equipments in the lift machine room and that between the machine room and equipment in the lift well and at the landing shall be wired in HDP conduits / galvanised steel conduits to be supplied by the bidder. Alternatively, armoured cables may be used. However, bidder shall refer detailed specification of cables / wirings elsewhere in the specification.

8.0 Earthing

The elevator structures and all electrical equipments, including metal conduits shall be effectively earthed with the earth conductors provided in the machine room as per IS 3043.

9.0 <u>DESIGN CRITERIA</u>

The design criteria and equipment specification will be as follows:

i) The rated speed will be one (1) m/sec. Proper allowance will be made for impact and wear and the factor of safety for rope shall not be less than twelve (12) or as per IS 14665 (all parts). The suspension wire rope will confirm to IS-14665 or approved equivalent international standard.

ii) The lift will be providing with automatic travelling device which will take care of overrun and under run of the car and rope stretch that the car floor is within 6.0 mm from the landing level at the floors while in operation.

iii) The lift will be equipped with upper and lower terminal switches arranged to stop the car automatically within the limit of the top car clearance and bottom run-by, from the any normal operating speed.

iv) The elevator car shall be provided with SS-304 sheet fabricated, bright finished to approved shade (including landing doors of the car). Vitrified ceramic tile of matt finish flooring as indicated in the data sheet - A, concealed fan and indirect lighting, emergency lighting, intercom, car position and travel direction indicator.

v) As the elevator is to provide service in a power station, it is necessary for the equipment to be specially coated (painted). This will include application of anticorrosive paint as applicable. The electrical equipment will have enclosures meeting degree of protection as covered under electrical specification.

vi) The elevator as a whole will comply with relevant Indian Standard i.e. 14665 or approved international standard. The outline dimensions of electric lift shall meet the requirements of IS 14665 (latest edition).

vii) The elevator shall be provided with AC VVVF type drive control system.

viii) Doors are automatic, center opening with emergency key opening at all landings, horizontal sliding type for car as well as for hoist way. Trap door shall be provided as per IS-14665 (latest edition).

10.0 Other Technical Requirements

1) Characteristic curves of all motors shall be furnished by the bidder during detail engineering stage for approval showing torque, speed, current and voltage.

2) Electrical requirements shall be as per requirements enclosed elsewhere in the specification.

3) C&I requirements shall be as per requirements enclosed in the specification.

4) Bidder shall procure all items from BHEL / customer approved sub vendor only. No argument on this account shall be entertained.

5) Complete elevator installation shall be in accordance with the requirements of concerned approving authority.

6) Minor civil and structural works shall be carried out by the bidder if required at site for which no additional commercial implication shall be entertained by BHEL.

7) In case of any contradictory requirement amongst the various clauses within the specification and clarifications not having been sought by the bidders, the most stringent requirement as per interpretation of BHEL's engineer shall be final and binding on the bidder for which BHEL will not entertain any commercial implication.

8) Data sheets of various items shall be prepared by the bidder and shall be submitted to BHEL / customer / consultant for approval after placement of order and any changes required by BHEL / customer / consultant for the same shall be incorporated and adhered by the bidder without any commercial implications.

9) GA drawing indicating design data, material of construction etc. shall be prepared by the bidder during detail engineering stage based on specification / contractual requirement and there should be no commercial implication on account of finalization of the drawings and documents.

10) O & M manual shall be furnished to BHEL / customer / consultant for approval during detailed engineering stage.

11) Field quality plan / quality assurance plan / check list shall be prepared by the bidder for each item of elevator and shall be submitted to BHEL / customer / consultant for approval after placement of order and any changes required by BHEL / customer / consultant for the same shall be incorporated and adhered by the bidder without any commercial implications.

12) All possible efforts shall be made by the bidder to get the approval of drawings and documents from BHEL / customer / consultant at the earliest and the documents prepared / generated by them or their sub-vendors shall be checked by their competent authority before submission to BHEL.

13) Revision made by the bidder in any drawings and documents shall be highlighted by indicating the no. of revisions in a triangle without fail so that the minimum time is required by BHEL to review the drawings and documents.

14) Bidder to note that all the drawings shall be prepared in Auto Cad - 2010 version and required number of hardcopies and soft copies shall be furnished to BHEL during detailed engineering stage. Exact requirement of number of hard copies and soft copies of all drawings and documents as required by BHEL / customer / consultant shall be informed to the successful bidder during detail engineering stage and bidder to furnish the same for which no additional cost shall be entertained.

15) 21 days time is required by BHEL to offer their comments on the drawings and documents being submitted by the bidder (during detailed engineering stage in the event of L.O.I being placed) from the date of receipt.

16) Civil works will be provided by BHEL / customer. Hence, bidder has to furnish the civil inputs in time. Bidder has to carry out the rectification in the civil works in the event of any changes in the civil input data furnished by them or delay in submission of input data by them. Bidder to furnish the civil foundation drawing along with the loading data for approval during detailed engineering stage showing / indicating the followings :-

a) Scope of work by BHEL and bidder shall be indicated with different legend or in the form of note.

b) Recommended locations of earthing pads.

c) Civil loads along with detailed calculation of loading

d) Details of pockets / cut outs as required for anchor bolts.

17) Bidder to depute competent designer (s) at BHEL's office during detailed engineering stage to discuss drawings and other technical documents as and when required by BHEL. However, minimum seven (7) days' notice shall be served for the same.

18) All the drawings which are required to be furnished to BHEL during detailed engineering stage shall include technical parameters, details of paints, BOQ / BOM etc in tabular form indicating all components including bought out items and their quantity, material of construction indicating its applicable code / standard, weight, make etc.

19) All drawings and documents including general arrangement drawing, data sheet, calculation etc. shall be furnished to BHEL during detailed engineering stage and shall include / indicate the following details for clarity w.r.t. inspection, construction, erection and maintenance etc.:-

a) All drawings and documents shall bear BHEL's title block and drawing / document number. However, BHEL's drawing / document numbering scheme shall be furnished to the successful bidder after the placement of L.O.I.

b) All drawings and documents shall indicate the list of all reference drawings including general arrangement.

c) All drawings shall include / show plan, elevation, side view, cross - section, skin section, blow - up view, all major self manufactured and bought out items shall be labeled and included in BOQ / BOM in tabular form.

d) Specification / schedule of painting shall be made as a part of general arrangement drawing of each item indicating at least 3 make.

20) Bidder to assess the capability of their sub-vendors in terms of preparation of drawings, calculations, documents, quality assurance, supply of material etc. as per project schedule before placing the order on them. No deviations shall be entertained.

21) Bidder to furnish prices and unit price of each item of proposed system as per BHEL's price format only along with the final price bid.

22) Bidder shall check that specifications of all the items are available in the NIT specification. However, in the event of absence of specification for any item, bidder will approach BHEL to furnish the specification of missing items and new specification will be adhered by the bidder for which no commercial implication shall be entertained by BHEL.

23) Bar chart, list of drawings and documents including data sheet, manual calculation, quality plan, field quality plan, PG test procedure, list of sub – vendors (mechanical, C & I and erection and commissioning), technical specification and material of construction, painting specification / schedule, dispatch schedule etc. of various items as required by BHEL / customer / consultant shall be submitted to BHEL / customer / consultant during detail engineering stage for approval and the approved drawings / documents shall be adhered by the bidder without any commercial implication.

24) List of Mandatory spares and list of tools and tackles in terms of numbers shall be furnished by the bidder along with the offer.

25) List of commissioning spares and list of tools and tackles in terms of numbers shall be furnished by the bidder along with the offer.

26) All drawings shall be prepared as per BHEL's title block and bear BHEL's drawing No. and customer / consultant's drawing no; which will be forwarded to the successful bidder during detail engineering stage.

27) Commercial implication includes price implication as well as delivery implication.

28) Dummy landing/s, as required in case travel between two consecutive landings is more than 11 m, shall be considered by bidder in his offer.

1.00.00 ELEVATOR

1.01.00 **Passenger Elevators**

The Passenger elevators shall be as under.

(i) 2 nos. panoramic type elevator with five glass panels on rear side having capacity of 16 persons (1088 kg.) for Administrative building.

(ii) 2 nos. conventional enclosure type elevator having capacity of 16 persons (1088 kg.) for Service building.

(iii) 1 no. conventional enclosure type elevator having capacity of 16 persons (1088 kg.) for each TG building.

1.01.01 The scope shall include all items / accessories, service along with all electrical equipment etc. required to meet all design, installation, operation, safety, protection and other requirements of IS:14665 (latest edition) (all parts), 'Lift' and service lifts'. This scope shall include all items / devices needed to comply with the requirements indicated elsewhere in the specification. The scope shall include but not limited to the following :

a) 1 No. fireman's switch for each elevator.

b) Machinery supporting Beam.

1.01.02 The location of Elevators shall be as per tender drawings enclosed with the specification.

1.01.03 Complete erection, testing and commissioning including all testing and commissioning materials, consumables and other tools and tackles required for erection

1.01.04 To obtain necessary local administration permits /approvals and make arrangements for inspection and tests required thereby.

A - 8

SERVICE ELEVATORS

1.00.00 **SERVICE ELEVATORS**

1.01.00 DESIGN CRITERIA AND OPERATIONAL SPECIFICATION

1.01.01 **Design**

Elevator shall be of conventional enclosure type for Service Building and for TG building. Elevator shall be of panoramic type with five glass panels on rear side for Administration building .The elevator shall meet the quality of international standard. The quality of glass panel on rear should be of highest grade from safety point of view and should meet the best standard.

1.01.02 No. of floors to be served shall be as per the specification and tender drawing of the Employer. Bidders shall quote variation in price for addition/deletion of one landing level in the relevant schedule of Forms and Procedures. However, bidder shall quote for above indicated landing levels in his base offer. No of floors and landing elevations are tentative only. The final landing elevations for all buildings shall be subject to approval by the Employer after award.

1.01.03 Elevators shall be designed based on following criteria :

i)	Design/construction/installation codes.	:	Latest edition of IS: 14665 (all parts)
ii)	Load carrying capacity	:	a) 1088 kgs. (equivalent to 16 persons) for passenger elevators for service building , TG building and Administration building
iii)	Rated speed	:	1.0 m/sec.
iv)	Position of machine room	:	Directly above the elevator shaft.
v)	Machine room	:	Machine room shall be provided by NTPC. However window air conditioner of minimum 2T capacity per elevator shall be provided by bidder.

1.02.00 **CONSTRUCTION**

Construction of the elevators shall specifically meet all requirements of the codes indicated and shall have following additional features:

i)	Flooring of Cabin	:	Vitrified ceramic tiles of mat finish.
ii)	Car enclosure & car panels	:	Stainless Steel
iii)	Handrails on 3 sides	:	Mirror Stainless Steel
iv)	False ceiling	:	Powder painted
v)	Car opening & Hoist way opening	:	Protected by central opening sliding Stainless Steel door
vi)	CABIN ACCESSORIES	:	The following accessories shall be provided : a) Recessed fluorescent light fittings on car floor. b) Car control station c) Emergency stop switch. d) 5/15A ,3 pin plug socket with switch on top of lift car.

1. AUTOMATIC RESCUE DEVICE (ARD)-(BATTERY DRIVE) :

   Bidder to provide a modern Advanced electronic drive system of "RESCUING Passenger Trapped in a ELEVATOR".

2. EMERGENCY SAFETY DEVICES :

   The lift shall be provided with safety Device attached to the lift car frame and placed beneath the car. The safety device shall be capable of stopping and sustaining the lift car up at governor tripping speed with full rated load in car.

1.02.01 All steel embedment for fixing landing doors/indicators etc. to the Elevator well shaft and fascia plate shall be supplied by the Bidder.

1.02.02 Guide rails complete with supporting brackets for the car and counter weights.

1.02.03 Elevator drive machines complete with electric motor, reduction gear unit, suspension ropes, buffers for the cars and the counter weights and other drive and control mechanism. All foundation anchor bolts, sleeves, anchoring steel and any item required to complete the job satisfactorily shall be provided by the bidder. The bidder shall also provide for the grouting of anchor bolts, sleeves, anchoring steel, etc. and other anchorages. Bidder shall provide hoist and hoisting beam in the machine room ceiling.

1.02.04 Any other steel works as well as all other accessories/components not specified in the specification but necessary for making the Elevator complete.

1.02.05 All minor building work including the supply of steel items, associated with installation of equipment in the machine room hoist way, hoist way door, frames and Elevator pit, shall form part of bidders scope of service, owner will provide the Elevator-well complete with foundation and brick walls around the lit-well together with overhead machine room including trap door and entry door for machine room. The machine room will be provided with R.C.C. floor slab with necessary pockets for anchor bolts and slots.

1.03.00 **OPERATION**

1.03.01 Elevator shall have provisions to meet following operational requirements :

a) Selective Duplex collective, automatic operation with or without attendant through illuminated push button station located inside the lift car.

b) Door operating shall be automatic door operation and electronic door protection system for opening/closing of car and landing doors.

c) Bidder shall provide car operating panel with luminous buttons & Braille script for visually impaired, panel height shall be disabled-friendly as per National Building Code guidelines, car position indication in car (both visual and audio) combined with direction arrows, overload warning indicator, battery operated alarm bell and emergency light and fan & hands free speaker telephone set with suitable battery, charger & controls.

d) Bidder shall provide emergency indicator to indicate the location of elevator in case of elevator being stuck up between the floors through automatic flashers (both audio & visual)

d) Bidder shall provide electronic door detector (Infra red curtain type).

e) Two push buttons, one for upward movement and the other for downward movement at each intermediate landing and one push button at each terminal landing shall be provided in order to call the car. Digital hall position indicator at all floors, tell lights at all floors shall also be provided by the bidder. Push buttons shall be provided with Braille script.

f) For facilitating the movement of visually & hearing impaired persons, hall lantern and car arrival chimes shall be provided in service building and TG building elevators.

g) All fixtures shall be in stainless steel face plates.

h) Push buttons shall be fixed in the car for holding the doors open for any length of the time required.

i) All other safety/protection/operation interlocks as required by IS:14665 (latest edition).

1.04.00 **Elevator Electricals:**

1.04.01 **Electric motor:**

The driving motors shall conform to I.S 325 and suitable for the Variable Voltage Variable Frequency (VVVF) application. All motors shall be squirrel cage induction type, suitable for operation at 415V (+/- 10% variation) , 3 phase, 3 wire, 50HZ (+3% to -5% variation) supply. Motors shall be provided with **thermal class 130 (B) or better insulation**

1.04.02 **Controls:**

The controls shall be Variable Voltage and Variable frequency type and shall provide smooth and constant acceleration and retardation under all conditions of operation . Suitable control panel shall be provided in the machine room.

1.04.03 **Cables and wiring:**

All the cables except trailing cables shall be as per IS:1554-1 or IS-7098-I. the PVC outer sheath of these cables shall be flame retardant, low smoke (FRLS) type with the following FRLS properties.

a) Oxygen index of min. 29 (as per IS:10810 Part-58)

b) Acid gas emission of max. 20% (as per IEC-754-I).

c) Smoke density rating shall not be more than 60% (as per ASTMD-2843).

The circular trailing cables shall be either in accordance with IS 4289 Part-I (Elastomer insulated) or IS-4289 Part-II (PVC insulated). The flat type trailing cables if offered shall be in accordance with IEC-60227-6.

All wiring / cabling between the equipments in the lift machine room and that between the machine room and equipments in the lift well and at the landings shall be wired in HDP conduits/ galvanized steel conduits to be supplied by the contractor. Alternatively armored cables may be used.

1.04.04 **Earthing:**

The elevator structures and all Electrical equipment, including metal conduits shall be effectively earthed with the earth conductors provided in the machine room as per IS: 3043

PASSENGER / SERVICE ELEVATORS & LIFTS

ITEM / TESTS/CHECK	Material Test	WPS/WQR/PQR	DPI / MPI	Ultrasonic Test	RT	Surface finish of gears	Assy/fittup	Dimensions	Functional/Operational Test/Run Test	Performance Test	Other Tests	All Tests as per Ref STD
Shaft/Rack/Gears	Y		Y	Y				Y				
Geared Machine									Y			
Welding		Y	Y									
Complete Lifts/Elevators								Y	Y	Y1	Y2	Y
Electrical & Instrumentation Items											Y3	

Notes:

Y1 - At Site

Y2 - Load and Overload test at site.

Y3 - Refer relevant portion of Technical Specification for testing requirements on electrical & instrumentation items.

	TITLE	SPEC. NO. PE – TS – 394 - 502 – A001	
BHEL	**TECHNICAL SPECIFICATION FOR ELEVATORS**	VOLUME II	
		SECTION D	
		REV 0	DATE 20 -03 - 14
		SHEET	OF

VOL - II B

ELECTRICAL

TECHNICAL SPECIFICATION

FOR

ELECTRIC HOIST

(ELECTRICAL PORTION)

1.0 **EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:**

a) Services and equipment as per "Electrical Scope between BHEL and Vendor".
b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
d) Erection and Commissioning spares.
e) Erection & Maintenance tools & tackles.
f) Electrical load requirement
g) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
h) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer /BHEL approval without any commercial and delivery implications to BHEL
i) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.
j) Motor shall meet minimum requirement of motor specification.
k) LT power & control cables shall meet minimum requirement of LT power & control cables specification.
l) Cabling, earthing & lightning protection shall meet minimum requirement of cabling, earthing & lightning protection specification.

2.0 **EQUIPMENT & SERVICES TO BE PROVIDED BY PURCHASER FOR ELECTRICAL & TERMINAL POINTS:**

Refer "Electrical Scope between BHEL and Vendor".

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

3.1 Bidder shall confirm total compliance to the electrical specification without any deviation from the technical/quality assurance requirements stipulated. In line with this two signed and stamped copies of the following shall be furnished by the bidder as technical offer:

a) A copy of this sheet "Electrical equipment Specification for Electric Hoist" and sheet "Electrical Scope between BHEL and Vendor" with bidder's signature and company stamp.
b) List of Erection and Commissioning spares.
c) List of Erection & Maintenance tools & tackles.
d) Electrical load requirement

3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

4.0 List of enclosures :

a) Electrical scope between BHEL & vendor.
b) Technical specification, datasheets & quality plans for 415V Electric motors.
c) Technical Specification, datasheets & quality plans for LT power & control cables.
d) Technical Specification, datasheets & quality plans for cabling, earthing & lightning protection.
e) Electrical Load data format.

ANNEXURE – I TO SECTION – C : STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGE : ELEVATORS

PROJECT :2X800 MW GADARWARA STPP

S. NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V Local Starter Panel/ Push Buttons	Vendor	Vendor	NTPC will provide two/one number 415 V supply feeders in machine room.
2	Power cables, control cables, screened control cables and any special cables (if required) between equipment supplied by vendor.	Vendor	Vendor	
3	Cabling material (cable trays, accessories, cable tray supporting system, conduits etc).	Vendor	Vendor	
4	Equipment Earthing	Vendor	Vendor	All equipments metallic enclosures / frames, metal structure etc. shall be grounded at two points each to the nearest grounding points / risers provided by customer.
5	Motors	Vendor	Vendor	
6	Cable glands and lugs for equipment supplied by vendor	Vendor	Vendor	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type tinned copper heavy duty lugs for power cables. 3 solderless crimping type heavy duty copper lugs for control cables.
7	a) Input cable schedules (C & I) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for C & I systems for vendor supplied equipment shall be furnished during detail engineering by vendor in soft copies in the BHEL cable schedule format for review by customer.
8	Equipment layout drawings	Vendor	-	
9	Electrical Equipment GA drawing	Vendor	-	For necessary interface review by NTPC

GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

1.0 INTENT OF SPECIFIATION

The specification covers the design, materials, constructional features, manufacture, inspection and testing at manufacturer's work, and packing of Low voltage (LV) squirrel cage induction motors along with all accessories for driving auxiliaries in thermal power station.

Motors having a voltage rating of below 1000V are referred to as low voltage (LV) motors.

2.0 CODES AND STANDARDS

Motors shall fully comply with latest edition, including all amendments and revision, of following codes and standards:

IS:325	Three phase Induction motors
IS : 900	Code of practice for installation and maintenance of induction motors
IS: 996	Single phase small AC and universal motors
IS: 4722	Rotating Electrical machines
IS: 4691	Degree of Protection provided by enclosures for rotating electrical machines
IS: 4728	Terminal marking and direction of rotation rotating electrical machines
IS: 1231	Dimensions of three phase foot mounted induction motors
IS: 8789	Values of performance characteristics for three phase induction motors
IS: 13555	Guide for selection and application of 3-phase A.C. induction motors for different types of driven equipment
IS: 2148	Flame proof enclosures for electrical appliance
IS: 5571	Guide for selection of electrical equipment for hazardous areas
IS: 12824	Type of duty and classes of rating assigned
IS: 12802	Temperature rise measurement ofr rotating electrical machnines
IS: 12065	Permissible limits of noise level for rotating electrical machines
IS: 12075	Mechnical vibration of rotatinf electrical machines

In case of imported motors, motors as per IEC-34 shall also be acceptable.

3.0 DESIGN REQUIREMENTS

3.1 Motors and accessories shall be designed to operate satisfactorily under conditions specified in data sheet-A and Project Information, including voltage & frequency variation of supply system as defined in Data sheet-A

3.2 Motors shall be continuously rated at the design ambient temperature specified in Data Sheet-A and other site conditions specified under Project Information
Motor ratings shall have at least a 15% margin over the continuous maximum demand of the driven equipment, under entire operating range including voltage & frequency variation specified above.

3.3 Starting Requirements

3.3.1 Motor characteristics such as speed, starting torque, break away torque and starting time shall be properly co-ordinated with the requirements of driven equipment. The accelerating torque at any speed with the minimum starting voltage shall be at least 10% higher than that of the driven equipment.

3.3.2 Motors shall be capable of starting and accelerating the load with direct on line starting without exceeding acceptable winding temperature.

The limiting value of voltage at rated frequency under which a motor will successfully start and accelerate to rated speed with load shall be taken to be a constant value as per Data Sheet - A during the starting period of motors.

3.3.3 The following frequency of starts shall apply

i) Two starts in succession with the motor being initially at a temperature not exceeding the rated load temperature.

ii) Three equally spread starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature. (not to be repeated in the second successive hour)

iii) Motors for coal conveyor and coal crusher application shall be suitable fro three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be sutable fro mimimum 20,000 starts during the life time of the motor

3.4 **Running Requirements**

3.4.1 Motors shall run satisfactorily at a supply voltage of 75% of rated voltage for 5 minutes with full load without injurious heating to the motor.

3.4.2 Motor shall not stall due to voltage dip in the system causing momentary drop in voltage upto 70% of the rated voltage for duration of 2 secs.

3.5 **Stress During bus Transfer**

3.5.1 Motors shall withstand the voltage, heavy inrush transient current, mechnical and torque stress developed due to the application of 150% of the rated voltage for at least 1 sec. caused due to vector difference between the motor residual voltage and the incoming supply voltage during occasional auto bus transfer.

3.5.2 Motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torque under above condition.

3.6 Maximum noise level measured at distance of 1.0 metres from the outline of motor shall not exceed the values specified in IS 12065.

3.7 The max. vibration velocity or double amplitude of motors vibration as measured at motor bearings shall be within the limits specified in IS: 12075.

4.0 **CONSTRUCTIONAL FEATURES**

4.1 Indoor motors shall conform to degree of protection IP: 54 as per IS: 4691. Outdoor or semi-indoor motors shall conform to degree of protection IP: 55 as per IS: 4691and shall be of weather-proof construction. Outdoor motors shall be installed under a suitable canopy

4.2 Motors upto 160KW shall have Totally Enclosed Fan Cooled (TEFC) enclosures, the method of cooling conforming to IC-0141 or IC-0151 of IS: 6362.

Motors rated above 160 KW shall be Closed Air Circuit Air (CACA) cooled

4.3 Motors shall be designed with cooling fans suitable for both directions of rotation.

4.4. Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors.

4.5 Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point.

4.6 In case Class 'F' insulation is provided for LV motors, temperature rise shall be limited to the limits applicable to Class 'B' insulation.
In case of continuous operation at extreme voltage limits the temperature limits specified in table-1 of IS:325 shall not exceed by more than 10°C.

4.7 **Terminals and Terminal Boxes**

4.7.1 Terminals, terminal leads, terminal boxes, windings tails and associated equipment shall be suitable for connection to a supply system having a short circuit level, specified in the Data Sheet-A.

Unless otherwise statedin Data Sheet-A, motors of rating 110 kW and above will be controlled by circuit breaker and below 110 kW by switch fuse-contactor. The terminal box of motors shall be designed for the fault current mentioned in data sheet "A".

4.7.2 Unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end.

4.7.3 Connections shall be such that when the supply leads R, Y & B are connected to motor terminals A B & C or U, V & W respectively, motor shall rotate in an anticlockwise direction when viewed from the non-driving end. Where such motors require clockwise rotation, the supply leads R, Y, B will be connected to motor terminals A, C, B or V W & V respectively.

4.7.4 Permanently attached diagram and instruction plate made preferably of stainless steel shall be mounted inside terminal box cover giving the connection diagram for the desired direction of rotation and reverse rotation.

4.7.5 Motor terminals and terminal leads shall be fully insulated with no bar live parts. Adequate space shall be available inside the terminal box so that no difficulty is encountered for terminating the cable specified in Data Sheet-A.

4.7.6 Degree of protection for terminal boxes shall be IP 55 as per IS 4691.

4.7.7 Separate terminal boxes shall be provided for space heaters.. If this is not possible in case of LV motors, the space heater terminals shall be adequately segregated from the main terminals in the main terminal box. Detachable gland plates with double compression brass glands shall be provided in terminal boxes.

4.7.8. Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LV motors.

4.7.9 Cable glands and cable lugs as per cable sizes specified in Data Sheet-A shall be included. Cable lugs shall be of tinned Copper, crimping type.

4.8 Two separate earthing terminals suitable for connecting G.I. or MS strip grounding conductor of size given in Data Sheet-A shall be provided on opposite sides of motor frame. Each terminal box shall have a grounding terminal.

4.9 **General**