BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

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TYPE OF DOC.	TECHNICAL SPECIFICATION	NAME	AA	VK	RS
TITLE 400kV CURRENT TRANSFORMER		SIGN			
		DATE			
		GROUP	TBEM	W.O. No	

CUSTOMER	THE SINGARENI COLLIERIES CO. LIMITED (SCCL)
CONSULTANT	----
PROJECT	400/132 KV SWITCHYARD PACKAGE for 2 X 600MW STPP at ADILABAD

CONTENTS

Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS

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SECTION 1

SCOPE, SPECIFIC TECHNICAL REQUIREMENTS AND QUANTITIES

1.0 SCOPE

This technical specification covers the requirements of design, manufacture, testing at works, packing and dispatch of 400kV CURRENT TRANSFORMER at SCCL Singareni STPP complete with accessories as listed in this specification.

The fitment and equipments offered shall be of approved make of SCCL/NTPC or its subsequent approval from SCCL/ NTPC shall be bidder's responsibility with no commercial implications to BHEL. If any of the make offered by the bidder is not acceptable to M/s SCCL/ NTPC, the bidder has to supply alternate SCCL/ NTPC approved make, meeting the specification, with no commercial implications to BHEL.

The specification comprise of following sections:

Section-1: Scope, Specific Technical Requirements and Quantities
Section-2: Equipment Specification
Section-3: Project Details & General Technical Requirements
Section-4: Guaranteed Technical particulars (GTP)
Section-5: Enclosures to Technical Specification

In case of any conflict between various sections, order of precedence shall be in the same order as listed above.

1.1 THE EQUIPMENT IS REQUIRED FOR THE FOLLOWING PROJECT

Name of customer : The Singareni Collieries Company Limited (SCCL)

Name of Projects : 400/132 kV Switchyard Package for 2 x 600MW STPP at Adilabad for M/s SCCL

Refer Section - 3 for Project Details and General Specifications.

1.2 SPECIFIC TECHNICAL REQUIREMENTS

1.2.1 System parameters and technical requirements

Sl No.	Parameters	400kV CT
1	Nominal voltage (Phase to Phase) [kVrms]	400
2	Max. Continuous voltage *Um* (Phase to Phase) [kVrms]	420
3a	1.2/ 50 micro sec Impulse withstand voltage [kVp]	±1425
3b	250/2500 micro sec Switching Impulse withstand voltage (Dry and Wet) [kVp]	±1050

4	One min. dry and wet power frequency withstand voltage [kVrms]	630
5	One minute power frequency withstand voltage secondary terminal & earth [kV]	5
6	Rated frequency [Hz]	50
7	Rated Short Time current for 1 sec [kA]	50
8	Rated Dynamic current withstand [kA (peak)]	125
9	Rated Primary Current [A]	3000/ 2000
10	Rated Extended Primary Current	120%
11	Rated secondary current [A]	1
12	Minimum creepage Distance (phase to ground) [mm]	10500
13	Max temperature rise over design ambient temp	As per IEC 60044-1
14	Type of Insulation	A
15	Radio Interference voltage at 266kV (rms) for frequency range 0.5 to 2Mhz [micro volts]	<1000
16	Corona Extinction voltage [kV]	320
17	Partial Discharge level [pC max]	10
18	Number of Terminals	All terminals of control circuits are to be wired upto terminal box plus 20% spare terminals evenly distributed on all TBs.

1.2.2 Core Parameters for 3000A Current Transformer

Core no	Current Ratio (A)	Output Burden (VA)	Accuracy class as per IEC : 60044-1	Min. knee point voltage (volts) Vk	Max. CT Secondary winding resistance (ohms)	Max. exciting current (mA)
1	3000- 2000- 500/1	-	PS	3000V 2000V 500V	15 Ohms 10 Ohms 2.5 Ohms	20mA on 3000/1 Tap 30mA on 2000/1 Tap 120mA on 500/1 Tap
2	3000- 2000- 500/1	-	PS	3000V 2000V 500V	15 Ohms 10 Ohms 2.5 Ohms	20mA on 3000/1 Tap 30mA on 2000/1 Tap 120mA on 500/1 Tap
3	3000- 2000- 500/1	20VA 20VA 20VA	0.2s 0.2s 0.2s	-	-	ISF $\leq$ 5
4	3000- 2000- 500/1	-	PS	6000V 4000V 1000V	15 Ohms 10 Ohms 2.5 Ohms	20mA on 3000/1 Tap 30mA on 2000/1 Tap 120mA on 500/1 Tap
5	3000- 2000- 500/1-	-	PS	6000V 4000V 1000V	15 Ohms 10 Ohms 2.5 Ohms	20mA on 3000/1 Tap 30mA on 2000/1 Tap 120mA on 500/1 Tap

Intermediate tapping at 3000-2000 shall be suitable for use as 1000/1A

1.2.3 Core Parameters for 2000A Current Transformer

Core no	Current Ratio (A)	Output Burden (VA)	Accuracy class as per IEC : 60044-1	Min. knee point voltage (volts) Vk	Max. CT Secondary winding resistance (ohms)	Max. exciting current (mA)
1	2000-1000/1	-	PS	2000V 1000V	10 Ohms 5 Ohms	30mA on 2000/1 Tap 60mA on 1000/1 Tap
2	2000-1000/1	-	PS	2000V 1000V	10 Ohms 5 Ohms	30mA on 2000/1 60mA on 1000/1
3	2000-1000-500/1	20VA 20VA 20VA	0.2s 0.2s 0.2s	-	-	ISF $\leq$ 5
4	2000-1000-500/1	-	PS	4000V 2000V 1000V	10 Ohms 5 Ohms 2.5 Ohms	30mA on 2000/1 Tap 60mA on 1000/1 Tap 120mA on 500/1 Tap
5	2000-1000-500/1	-	PS	4000V 2000V 1000V	10 Ohms 5 Ohms 2.5 Ohms	30mA on 2000/1 Tap 60mA on 1000/1 Tap 120mA on 500/1 Tap

1.3 BILL OF QUANTITY

Item No.	Description	Quantity (Main)	Quantity (Spare)
01	Single Phase, 400kV, 3000A, 50kA for 1s Current Transformer	30 Nos.	01 No.
02	Single Phase, 400kV, 2000A, 50kA for 1s Current Transformer	39 Nos.	-
03	Supervision of erection testing and commissioning	1 Lot	-

Hardware (Nut Bolts and Washers) for Mounting CT on structure – 1set for each CT.

Note- Marshalling Box for a set of three (3) CTs shall be provided by BHEL, TBG

1.4 TYPE TEST

All equipments 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 (other than that of transmission line towers for which the type tests reports conducted prior to ten years shall also be accepted) 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 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.

All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.

The type test reports once approved for any projects shall be treated as reference. For subsequent projects of SCCL, 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.

1.5 DRAWINGS

The documentation requirements detailed under Section-3 shall be submitted to BHEL at various stages of contract. Softcopy of the drawings are to be submitted at contract stage.

1.6 PROVENNESS CRITERIA FOR 400kV INSTRUMENT TRANSFORMERS

400 kV Instrument Transformers being offered should be from manufacturer who has manufactured and supplied minimum fifteen (15) nos. of single phase Current Transformers and fifteen (15) nos. of single phase Capacitor Voltage Transformers suitable for Air Insulated Substation/ Switchyard of 400 kV or above class which must have been in successful operation for a minimum period of two (2) years as on the date of bid opening.

1.7 DOCUMENTS REQUIRED WITH OFFER

a) "No Technical Deviation" Certificate
b) Un-priced schedule
c) Filled up Checklist. (*Guaranteed Technical Particulars is required at contract stage*)
d) Catalogue and Technical Leaflets for the offered Equipments
e) Document supporting the requirements given in clause 1.6 above as per attached format 3A28 in Section-5.
f) Under taking for Site Supervision as per attached format 3A29 in Section-5
g) Present Order book Position as per attached format 3E in Section-5

Section-2
Equipment Specification

SUB-SECTION – B-21

SWITCHYARD INSTRUMENT TRANSFORMERS

CLAUSE NO. / FEATURES	TECHNICAL REQUIREMENTS
1.00.00	CODES AND STANDARDS Current transformers IEC 60044, BS:3938, IS: 2705 Voltage transformers IEC 60044, IEC 186A, IEC 358, IS:3156 Insulating oil IS:335
2.00.00	GENERAL REQUIREMENTS
2.01.00	The instrument transformers i.e. current and voltage transformers shall be single phase transformer units and shall be supplied with a common marshaling box for a set of three single phase units.
2.02.00	The tank as well as top metallics shall be hot dip galvanised or painted as per shade RAL 9002.
2.03.00	The instrument transformers shall be hermetically sealed units. The instrument transformers shall be provided with filling and drain plugs.
2.04.00	Polarity marks shall indelibly be marked on each instrument transformer and at the lead terminals at the associated terminal block.
2.05.00	The insulators shall have a cantilever strength of minimum 500 kg.
3.00.00	CURRENT TRANSFORMERS (CTs)
3.01.00	The CTs shall be oil filled type have single primary of either ring type or hair pin type or bar type.
3.02.00	In case of "Bar Primary" inverted type CTs, the following requirements shall be met:
3.03.00	The secondaries shall be totally encased in metallic shielding providing a uniform equipotential surface for even electric field distribution.
3.04.00	The lowest part of insulation assembly shall be properly secured to avoid any risk of damage due to transportation stresses.
3.05.00	The upper part of insulation assembly sealing on primary bar shall be properly secured to avoid any damage during transportation due to relative movement between insulation assembly and top dome.
3.06.00	The CT shall be provided with oil sight glass.
3.07.00	The core lamination shall be of cold rolled grain oriented silicon steel or other equivalent alloys. The cores shall produce undistorted secondary current under transient conditions at all ratios with specified parameters.
3.08.00	Different ratios shall be achieved by secondary taps only, and primary reconnections shall not be accepted.

CLAUSE NO. / FEATURES	TECHNICAL REQUIREMENTS
3.09.00	The guaranteed burdens and accuracy class are to be intended as simultaneous for all cores.
3.10.00	The instrument security factor at all ratios shall be less than five (5) for metering core. If any auxiliary CT/reactor is used, then all parameters specified shall be met treating auxiliary CTs/reactors as integral part of CT. The auxiliary CT/reactor shall preferably be in-built construction of the CT. In case it is separate, it shall be mounted in secondary terminal box.
3.11.00	The physical disposition of protection secondary cores shall be in the same order as given under CT requirement table(s) given below.
3.12.00	The CTs shall be suitable for high speed auto-reclosing.
3.13.00	The secondary terminals shall be terminated on stud type non-disconnecting terminal blocks inside the terminal box of degree of protection IP:55 at the bottom of CT.
3.14.00	The CTs shall have provision for taking oil samples from bottom of CT without exposure to atmosphere to carry out dissolved gas analysis periodically. Contractor shall give his recommendations for such analysis, i.e. frequency of test, norms of acceptance, quantity of oil to be withdrawn, and treatment of CT.
3.15.00	The CT shall have provision for measurement of Capacitance &Tan Delta as erected at site.
4.00.00	VOLTAGE TRANSFORMERS (CVTs)
4.01.00	Voltage transformers shall be of capacitor voltage divider type with electromagnetic unit.
4.02.00	The CVTs shall be thermally and dielectrically safe when the secondary terminals are loaded with guaranteed thermal burdens.
4.03.00	The electro-magnetic unit (EMU) shall comprise of compensating reactor, intermediate transformer, and protective and damping devices. The oil level indicator of EMU with danger level marking shall be clearly visible to maintenance personnel standing on ground.
4.04.00	The secondaries shall be protected by HRC cartridge type fuses for all windings In addition fuses shall also be provided for protection and metering windings for connection to fuse monitoring scheme. The secondary terminals shall be terminated on stud type non-disconnecting terminal blocks via the fuse inside the terminal box of degree of protection IP: 55. The access to secondary terminals shall be without the danger of access to high voltage circuit.
4.05.00	The damping device shall be permanently connected to one of the secondary winding and shall be capable of suppressing ferro-resonance oscillations.
4.06.00	CVTs shall be suitable for high frequency (HF) coupling for power line carrier communication. Carrier signals must be prevented from flowing into potential transformer (EMU) metering circuit by means of RF choke/reactor suitable for effective blocking the carrier signals over the entire frequency range of 40 to 500 kHz. HF terminal shall be brought out through a suitable bushing and shall be easily accessible for connection to the coupling filters of the carrier communication equipment. The HF terminal shall be provided with earthing link with fastener.

CLAUSE NO. / FEATURES	TECHNICAL REQUIREMENTS	
4.07.00	A protective surge arrester/spark gap shall preferably be provided to prevent break down of insulation by incoming surges and to limit abnormal rise of terminal voltage of shunt capacitor, tuning reactor, RF choke, etc. due to short circuit in transformer secondary. The details of this arrangement (or alternative arrangement) shall be furnished by Contractor for Owner's review.	
5.00.00	MARSHALLING BOX	
5.01.00	Marshaling box shall conform to all requirements as given in Section B-25. The wiring diagram for the interconnection of three phase instrument transformer shall be pasted inside the box in such a manner so that it is visible and it does not deteriorate with time. Terminal blocks in the marshaling box shall have facility for star/delta formation, short circuiting and grounding of secondary terminals. The box shall have enough terminals to wire all control circuits plus 20 spare terminals.	
6.00.00	PARAMETERS FOR CURRENT TRANSFORMERS	
6.01.00	GENERAL	
a)	One minute power frequency withstand voltage between secondary terminal and earth	5 kV
b)	Partial discharge level Immediately after PF test	10 pico Coulombs max.
c)	Temperature rise	As per IEC 60044
d)	Type of insulation	Class A
e)	Number of cores	Five (5): Details are given in table- I below.
f)	Rated frequency	50 Hz
g)	System neutral earthing	Effectively earthed
h)	Installation	Outdoor (up right)
i)	Seismic acceleration	0.3 g horizontal
j)	Number of terminals in marshalling box	All terminals of control circuits wired upto marshalling box plus 20 terminals spare.
k)	Rated extended primary current	120/150% of rated primary current

CLAUSE NO. / FEATURES		TECHNICAL REQUIREMENTS	
6.02.00		400 kV Current Transformers	
	a)	Rated dynamic current	125kA (peak)
	b)	Rated short time thermal current	50 kA for 1 sec.
	c)	Rated system voltage (Um)	420 kV (rms)
	d)	Corona extinction voltage (min)	320 kV (rms)
	e)	Radio Interference Voltage at 266 kV at frequency range 0.5 to 2 MHz (rms)	1000 micro volts
	f)	Rated insulation levels	
		i. 1.2/50 micro-sec. impulse	1425 kVp
		ii. 250/2500 micro-sec. switching surge withstand voltage (dry & wet)	1050 kVp
		iii. One minute power frequency withstand voltage	630 kV rms
	g)	Current Transformer shall also comply with requirement of TABLE – IA of this section.	
7.00.00		PARAMETERS FOR VOLTAGE TRANSFORMERS	
7.01.00		GENERAL	
	a)	Rated frequency	50 Hz
	b)	System neutral earthing	Effective earthed
	c)	Installation	Outdoor
	d)	Seismic acceleration	0.3 g horizontal
	e)	Standard reference range of frequencies for which the accuracies are valid	96% to 102% for protection and 99% to 101% for measurement.
	f)	High frequency capacitance for carrier frequency range	Within 80% to 150% of rated entire capacitance
	g)	Equivalent resistance over entire carrier frequency range	Less than 40 ohms

CLAUSE NO. / FEATURES	TECHNICAL REQUIREMENTS	
h)	Stray capacitance and stray conductance of LV terminal over entire carrier frequency range	As per IEC:358
i)	Rated voltage factor	1.2 continuous 1.5-30 seconds
j)	One minute power frequency withstand voltage	
	a) between LV (HF) terminal and earth	10kV rms for exposed terminals or 4 kV rms for terminals enclosed in a weather proof box.
	b) For secondary winding	2 kV rms
k)	Temp. rise over an ambient temp. of 50 deg. C	As per IEC 60044
l)	Number of terminals in control cabinet	All terminals of control circuits wired upto marshalling box plus 10 terminals spare.
m)	Rated total thermal burden	750 VA
n)	Partial discharge level	10 pico Coulombs max.
o)	Number of cores	As per details given in table-II below.
7.02.00	400kV Voltage Transformer	
a)	System fault level	50 kA for 1 sec.
b)	Rated system voltage	420 kV (rms)
c)	Rated insulation levels	
	i) 1.2 micro sec. impulse	1425 kV (peak)
	ii) 250/2500 micro sec. switching surge withstand voltage (dry & wet)	1050 kV (peak)
d)	Radio Interference voltage at 266 kV at frequency range 0.5 to 2 MHz(rms)	1000 micro volts (max.)
e)	Corona extinction voltage (min.)	320 kV (rms)
f)	HF Capacitance	4400/8800pF (nominal)

CLAUSE NO. / FEATURES	TECHNICAL REQUIREMENTS
	Voltage Transformer shall also comply with requirement of TABLE – II of this section.
8.00.00	TESTS
8.01.00	The current and voltage transformers shall confirm to type tests and shall be subjected to routine tests in accordance with the relevant IS/IEC and CTs & CVTs shall also conform to the following additional type tests as applicable: i) Radio Interference test- As per IS:8263 ii) Switching impulse withstand test. iii) Thermal withstand test i.e. application of rated voltage and rated current simultaneously by synthetic test circuit. iv) Seismic withstand test alongwith structure. v) Thermal co-efficient test i.e. measurement of Tan-Delta as function of temperature (at ambient and between 80 deg. C and 90 deg. C) and voltage (at 0.3, 0.7, 1.0 and 1.1 Um). vi) Fast transient test.
8.02.00	In addition to routine tests as per IEC/IS, measurement of partial discharge in continuation with power frequency withstand test required for 400 kV current transformer. Current Transformers shall be subjected to Instrument security factor test as routine test.

CLAUSE NO. / FEATURES	TECHNICAL REQUIREMENTS

TABLE – IA

CORE DETAILS OF 400kV CTs

Core No.	Application	Current Ratio (A)	Output Burden (VA) 185	Accuracy Class as per IEC	Min. Knee Point Voltage (volts)	Max. CT Secondary winding res.(ohms)	Max. Exciting Current At knee point voltage (mA)
1	Bus Differential	2000	-	PS	2000	10	30 on 2000/1 tap
	Check	1000 / 1	-		-1000	5	60 on 1000/1 tap
2	Bus Differential	2000	-	PS	2000	10	30 on 2000/1 tap
	Main	1000 / 1			1000	5	60 on 1000/1 tap
3	Metering	2000	20	0.2	-	-	-
		1000	20	0.2	-	-	-
		500 / 1	20	0.2	-	-	-
4	Transf. Backup/	2000	-	PS	4000 -	10 -	30 on 2000/1 tap
	Line Backup	1000 / 1	-		2000 -	5 -	60 on 1000/1 tap
	Protection	500 / 1	-		1000	2.5	120 on 500/1 tap
5	Transf. Diffl. /	2000	-	PS	4000 -	10-	30 on 2000/1 tap
	Line protection	1000 / 1	-		2000 -	5-	60 on 1000/1 tap
		500 / 1	-		1000	2.5	120 on 500/1 tap

The rated extended primary current of the CTs shall be 120% continuous of 2000 A for all Generator and bus reactor bays and 150% continuous of 2000A for all line bays.

CLAUSE NO. / FEATURES	TECHNICAL REQUIREMENTS

TABLE-II

CORE DETAILS OF 400KV CVTs

Particulars	Secondary I	Secondary II	Secondary III
Rated secondary voltage	110 / √ 3	110 / √ 3	110 / √ 3
Application	Protection	Protection	Metering
Accuracy	3P	3P	0.2
Output Burden (minimum)	100 VA	100 VA	75 VA

SUB-SECTION – B-26

SWITCHYARD SITE TESTING & COMMISSIONING

CLAUSE NO. / FEATURES	TECHNICAL REQUIREMENTS
1.00.00	INTRODUCTION An indicative list of tests is given below. Contractor shall perform any additional test based on specialties of the items as per the field QP/ instructions of the equipment supplier or Owner without any extra cost to the Owner. The Contractor shall arrange all instruments required for conducting these tests along with calibration certificates and shall furnish the list of instruments to the Owner for approval.
2.00.00	GENERAL CHECKS
a)	Check for physical damage.
b)	Visual examination of zinc coating/ plating
c)	Check from name plate that all items are as per order/ specification.
d)	Check tightness of all bolts, clamps and connecting terminals using torque wrenches.
e)	For oil filled equipment check for oil leakage, if any. Also check oil level and top up.
f)	Check ground connections for quality of weld and application of zinc rich paint over weld joint of galvanized surfaces.
g)	Check cleanliness of insulator and bushings.
h)	All checks and tests specified by the manufactures in their drawings and manuals as well as all tests specified in the relevant code of erection.
i)	Check for surface finish of grading rings (corona control ring.)
j)	Pressure test on all pneumatic lines at 1.5 times the rated pressure shall be conducted.
3.00.00	CIRCUIT BREAKERS
a)	Insulation resistance of each pole.
b)	Check adjustments, if any, suggested by manufacturer.
c)	Breaker closing and tripping time.
d)	Trip free and anti pumping operation.
e)	Contact resistance.
f)	Functional checking of compressed air plant and all accessories
g)	Functional checking of control circuits, interlocks, tripping through protective relays and auto-reclose operation.
h)	Insulation resistance of control circuits, motor etc.
i)	Resistance of closing and tripping coils.
4.00.00	ISOLATORS
a)	Insulation resistance of each pole
b)	Manual and electrical operation on interlocks
c)	Insulation resistance of control circuits and motors.
d)	Ground connections
e)	Contact resistance
f)	Proper alignment to minimise the vibration to the extreme possible during operation.
g)	Measurement of operating torque for isolator and Earth switch
h)	Resistance of operating and interlocking coils.

CLAUSE NO. / FEATURES	TECHNICAL REQUIREMENTS
5.00.00	CURRENT TRANSFORMERS
a)	Insulation Resistance Test
b)	Polarity test.
c)	Ratio identification test-checking of all ratios on all cores by primary injection of current.
d)	Magnetising characteristics test.
f)	Capacitance and Tan-Delta measurement
6.00.00	VOLTAGE TRANSFORMERS
a)	Insulation resistance test
b)	Polarity test
c)	Ratio test
7.00.00	SURGE ARRESTER
a)	Grading leakage current
b)	Resistance of ground connection.
8.00.00	WAVE TRAP
a)	Insulation resistance test.
b)	Visual check.
9.00.00	PHASING OUT
	The phasing out of all supplies in the station system shall be carried out.
10.00.00	STATION EARTHING
a)	Check soil resistivity
b)	Check continuity of grid wires
c)	Check earth resistance of the entire grid as well as various sections of the same.
d)	Check for weld joint and application of zinc rich paint on galvanised surface.
e)	Dip test on earth conductor prior to use.
11.00.00	CONDUCTOR STRINGING AND POWER CONNECTORS
a)	Physical check for finish
b)	Electrical clearance check
c)	Testing of torque by torque by torque wrenches on all bus power connectors and other accessories.
d)	Milli volt drop test on all power connectors.
e)	Sag and tension check on conductors.
12.00.00	INSULATORS
	Visual examination for finish damage, creepage distance, etc.

SECTION- 3

PROJECT DETAILS & GENERAL TECHNICAL REQUIREMENTS

3.0 GENERAL

This section stipulates the General Technical Requirements under the Contract and will form an integral part of the Technical Specification.

The provisions under this section are intended to supplement general requirements for the materials, equipment and services covered under other sections of tender documents and are not exclusive. However in case of conflict between the requirements specified in this section and requirements specified under other sections, the requirements specified under respective sections shall prevail.

3.1 PROJECT INFORMATION:

	Particular	**Details**
a)	Customer	M/S Singareni Collieries Company Limited, Kothagudem(SCCL)
b)	Project Title	2 X 600 MW Singareni Thermal Power Project at Peagdapalli (V), Jaipur (M), Adilabad Dist, Andhra Pradesh
c)	Location	Pegadapalli village, Jaipur Mandal, Adilabad District, A.P.
d)	Distance from Nearest Town - Mancherial	14.6 KM
e)	Distance from State Highway	4.6 KM
f)	Distance from NH-16 (Nirmal-Chennur section)	500 Mtrs
g)	Nearest Airport & Distance	Shamshabad Airport, Hyderabad 250 KM
h)	Nearest Railway Station	Mancherial Railway station on Nagpur-Kazipet main railway line of South Central Railway 14.6KM
SITE CONDITIONS		
a)	Max. ambient air temp.	50°C
b)	Min. ambient air temp.	0°C
c)	Max. design ambient temp.	50°C
d)	Design reference RH	95 % (at 40degC)
e)	Site elevation	143 Mtr above MSL
f)	Pollution Severity	High Pollution level (25mm/kV)
g)	Seismic Zone	Zone-III
WIND DATA		
a)	Basic Wind speed	44m/sec
b)	The risk co-efficient (K1)	1.07
c)	Category of terrain	Category-2

Note:

(i) 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/SqM for all classes of structures, i.e. A,B and C, as defined in IS:875(part-3).

(ii) Important meteorological data from nearest observatory at Ramagundam is placed at Annexure-I.

3.1.1 SYSTEM PARAMETERS:

Sl.No.	Parameters	**400 kV**	**132 kV**
1	Highest system voltage	420 kV rms	145 kVrms
2	Lightning Impulse voltage	±1425kVp	± 650kVp
3	Switching impulse voltage	±1050kVp	--
4	Power frequency withstand for 1 min (rms)	630 kV(rms)	275 kV(rms)
5	Max. fault level (1 sec.)	50 kA	31.5kA
6	Minimum creepage distance	10500 mm	3625mm

3.1.2 AUXILIARY POWER:

Normal Voltage	**Variation in Voltage**	**Frequency in Hz**	**Phase/Wire**	**Neutral Connection**
415 Volts	± 10%	50 ± 5%	¾ wire	Solidly earthed
240 Volts	± 10%	50 ± 5%	½ wire	Solidly earthed
220 Volts	190V to 240V	DC	---	Isolated 2 wire system

Combined variation of voltage and frequency shall be limited to ± 10%. Fault level of 415V system shall not be less than 45kA.

The minimum height of equipment supports shall be 2550mm. The various minimum heights of the switchyard shall be as given below from plinth level:

Voltage	Equipment /1st Level	2nd Level	3rd Level
132kV	4600mm	8000mm	12000mm
400kV (1½breaker)	8000mm	16000mm	--

3.2 INSTRUCTION TO BIDDERS:

The bidders shall submit the technical requirements, data and information as per the technical data sheets, provided in Section-4.
The bidders shall furnish catalogues, engineering data, technical information, design documents, drawings etc fully in conformity with the technical specification.

It is recognized that the bidders may have standardized on the use of certain components, materials, processes or procedures different than those specified herein. Alternate

proposals offering similar equipment based on the manufacturer's standard practice will also be considered provided such proposals meet the specified designs, standard and performance requirements and are acceptable to the Purchaser. Unless brought out clearly, the Bidder shall be deemed to conform to this specification scrupulously. All deviations from the specification shall be clearly brought out in the respective schedule of deviations. Any discrepancy between the specification and the catalogues or the bid, if not clearly brought out in the schedule, will not be considered as valid deviation.

Except for lighting fixtures, wherever a material or article is specified or defined by the name of a particular brand, Manufacturer or Vendor, the specific name mentioned shall be understood as establishing type, function and quality and not as limiting competition. For lighting fixtures, makes shall be as defined in Section-Lighting System.

Equipment furnished shall be complete in every respect with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/ or needed for erection, completion and safe operation of the equipment as required by applicable codes, though they may not have been specifically detailed in the Technical Specifications unless included in the list of exclusions. Materials and components not specifically stated in the specification but which are necessary for commissioning and satisfactory operation of the switchyard unless specifically excluded shall be deemed to be included in the scope of the specification and shall be supplied without any extra cost. All similar standard components/parts of similar standard equipment under supply shall be inter-changeable with one another.

The bidder shall supply type tested (including special tests as per tech. specification) equipment and materials. The test reports shall be furnished by the bidder along with equipment/ material drawings. In the event of any discrepancy in the test reports, (i.e., if any test report is not acceptable due to any design/ manufacturing changes or due to non-compliance with the Technical Specification and/ or applicable standard), the tests shall be carried out without any additional cost implication to the BHEL. BHEL reserves the right to get any or all type/tests conducted/repeated.

3.3 RULES, REGULATIONS, CODES & STANDARDS

3.3.1 In addition to codes and standards specifically mentioned in the relevant technical specifications for the equipment / plant / system, all equipment parts systems and works covered under this specification shall comply with currently applicable statutory regulations and safety codes of the Republic of India as well as of the locality where they will be installed, including the following -

a) Bureau of Indian Standards (BIS)
b) Indian Electricity Act
c) Indian Electricity Rules
d) Indian Explosives Act
e) Indian Factories Act and State Factories Act
f) Indian Boiler Regulations (IBR)
g) Regulations of the Central Pollution Control Board, India
h) Regulations of the Ministry of Environment & Forest (MoEF) , Govt. of India
i) Pollution Control Regulations of Department of Environment, Govt. of India
j) State Pollution Control Board.
k) Rules for Electrical Installation by Tariff Advisory Committee(TAC)

l) Building and other construction workers(Regulation of Employment and Conditions of Services) Central Rules,1998
m) Explosive Rules,1983
n) Petroleum Act,1984
o) Petroleum Rules,1984
p) Gas Cylinder Rules,1981
q) Static and Mobile Pressure Vessels(Unified) Rules,1981
r) Workmen's Compensation Act,1923
s) Workmen's Compensation Rule,1924
t) SCCL Safety Rules for Construction and Erection
u) SCCL Safety Policy
v) Any other statutory codes/ standards/ regulations, as may be applicable.

3.3.2 Unless covered otherwise in the specifications, the latest editions (as applicable as on date of bid opening), of the codes and standards given below shall also apply.

a) Bureau of Indian Standards(BIS)
b) Japanese Industrial Standards (JIS)
b) American National Standards Institute (ANSI)
c) American Society of Testing and Materials (ASTM)
d) American Society of Mechanical Engineers (ASME)
e) American Petroleum Institute (API)
f) Standards of the Hydraulic Institute, USA
g) International Organization for Standardization (ISO)
h) Tubular Exchanger Manufacturers' Association (TEMA)
i) American Welding Society (AWS)
j) National Electrical Manufacturers Association (NEMA)
k) National Fire Protection Association (NFPA)
l) International Electro-Technical Commission (IEC)
m) Expansion Joint Manufacturers Association (EJMA)
n) Heat Exchange Institute (HEI)

3.3.3 Other International/ National standards such as DIN, VDI, BS, etc. shall also be accepted for only material codes and manufacturing standards, subject to the Employer's approval, for which the Bidder shall furnish, along with the offer, adequate information to justify that these standards are equivalent or superior to the standards mentioned above. In all such cases the Bidder shall furnish specifically the variations and deviations from the standards mentioned under 5.01.00 and 5.02.00 together with the complete word to word translation of the standard that is normally not published in English.

3.3.4 In the event of any conflict between the codes and standards referred to in the above clauses and the requirement of this specification, the requirement of Technical Specification shall govern.

3.3.5 In case of any change in codes, standards & regulations between the date of bid opening and the date when vendors proceed with fabrication, the Employer shall have the option to

incorporate the changed requirements or to retain the original standard. It shall be the responsibility of the Contractor to bring to the notice of the Employer such changes and advise Employer of the resulting effect.

3.4 SERVICES TO BE PERFORMED BY THE EQUIPMENT BEING FURNISHED

The 400 kV system is being designed to limit the power frequency over voltage of 1.5 p.u. and the switching surge over voltage to 2.5 p.u. In 400 kV system the initial value of temporary over voltage could be 2.0 p.u. for 1-2 cycles. All the equipment/materials covered in this specification shall perform all its function satisfactorily without undue strain, restrike etc. under such over voltage conditions.All equipment shall also perform satisfactorily under various other electrical, electromechanical and meteorological conditions of the site of installation. All equipment shall be able to withstand all external and internal mechanical, thermal and electromechanical forces due to various factors like wind load, temperature variation, ice & snow, (not applicable for this project) short circuit etc for the equipment.
The equipment shall also comply with the following:

a) All equipments shall be suitable for hot line washing.

b) To facilitate erection of equipment, all items to be assembled at site shall be "match marked"'.

c) Piping, if any, between equipment control cabinet or operating mechanism to marshalling box of the equipment, shall bear proper identification to facilitate the connection at site.

d) All equipment shall be supplied with necessary interpole cabling, and its cost shall be included in the cost of equipment.

3.5 ENGINEERING DATA

3.5.1 DRAWINGS

a) All drawings shall be made in Autocad Release -14 or latest Version.
All drawings shall be plotted in ink. All dimensions and data shall be in SI metric units. All items of the equipment should be clearly identified by proper part numbers in the contract drawings. Such parts which are to be dispatched to site from works in dispatchable units and are re-assembled at site, should be marked by proper identification marks at works and indicated in the drawings and quantified. All the items of the shipping list should be identified in the drawing. The language for all inscriptions shall be English.

b) All drawings submitted by the contractor including those submitted at the time of bid shall be in sufficient detail indicating the type, size, arrangement, weight of each component for packing and shipment, external connection, fixing arrangement required, the dimensions required for installation and interconnections with other equipment and materials clearances and spaces required between various portions of equipment.

c) Each drawing shall bear a title block at the right hand bottom corner with clear mention of the name of the Owner, the System designation, specifications title, specifications number

the name of the Projects drawing number and the revisions. If standard catalogue pages are submitted the applicable items shall be indicated there. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be metric units. TITLE BLOCK TO BE FOLLOWED FOR THIS PROJECT IS GIVEN IN ANNEXURE-H.
NTPC and BHEL drawing number shall be provided to successful bidder.

d) The furnishing of detailed engineering data and drawings by the Contractor shall be in accordance with the time schedule for the Project. The review of these documents /data/ drawings by the Owner will cover only general conformance of the data/ drawings/documents to the specifications and contract, interfaces with the equipment provided by others and external connections of the dimensions which might affect plant layout. The review by the Owner should not be construed to be thorough review of all dimensions, quantities and details of the equipment, material, any devices or items indicated or the accuracy of the information submitted. The review and/or approval by the Owner shall not relieve the Contractor of any of his responsibilities and liabilities under the contract.

e) After the approval of the drawings, further work by the Contractor shall be in strict accordance with these approved drawings and no deviation shall be permitted without the written approval of the Owner.

f) All manufacturing, fabrication and execution of the work in connection with the equipment/system, prior to the approval of the drawings shall be at Contractor's risk. The Contractor is not expected to make any change in the design of the equipment/system, once they are approved by the Owner. However, if some changes are necessitated in the design of the equipment/ system at a later date, the contractor may do so, but such change shall be promptly be brought to the notice of Owner indicating the reasons for the change and get the revised drawing approved again.

h) Drawing shall include all installation and detailed piping drawings. All piping of 100 mm and larger diameter shall be routed in detail and smaller pipe shall be shown schematically or by isometric drawing.

i) As Built Drawings - After final acceptance of individual equipment/ system by the Owner the contractor will update all original drawings and documents for the equipment /system to "As Built" conditions.

j) Drawings must be checked by the contractor prior to submission to the Owner. In case drawings are found to be submitted without proper checking by the contractor, the same shall not be reviewed and returned to the contractor for re-submission.

j) The contractor shall submit the drawings /data/ document for Owner's review and approval. The Owner shall review the drawings and return to the contractor authorizing either to proceed with manufacture or fabrication or marked to show changes desired. When changes are required, drawings shall be resubmitted promptly, with revisions clearly marked for the final review. Any delays arising out of the failure of the contractor to submit /rectify in time shall not be accepted as a reason for delay in the contract schedule.

3.5.2 APPROVAL PROCEDURE

The following procedure for submission and review/approval of the drawings, data, reports, information, etc. shall be followed by Contractor:

a. All data/information furnished by Vendor in the form of drawings, documents, catalogues or in any other form for NTPC's information/interface and/or review and approval are referred by the general term "drawings".

b. All drawings (including those of subvendors') shall bear at the right hand bottom corner the 'title block' with all relevant information duly filled in. The Contractor shall give this format to his subvendor along with his purchase order for subvendor's compliance. All drawings shall be in English language. All dimensions shall be in metric units.

c. Since all Drawing/documents submission and approval shall only be in soft, i.e., pdf format, the Contractor shall submit initially (first submission) all the drawings in soft.

d. SCCL / NTPC shall review and furnish their comments/approval within 12 working days from the date of receipt of soft copy (pdf) of drawings/documents. NTPC shall furnish their comments in soft copy and the same shall be sent thro NTPC SAP C folder for viewing/ downloading by BHEL and SCCL. Commented drawings/ documents in hard copy shall not be sent to BHEL.

e. Upon review of each drawings, depending on the correctness and completeness of the drawings, the same will be categorised and approval accorded in one of the following categories:

CATEGORY I	Approved
CATEGORY II	Approved subject to incorporation of comments/modification as noted. Resubmit revised drawing incorporating the comments
CATEGORY III	Not approved. Resubmit revised drawings for Approval after incorporating comments/modifications as noted
CATEGORY IV	For information and records

f. The Contractor shall ensure submission of revised documents/drawings along with compliance report duly incorporating SCCL/NTPC comments highlighting/clouding the correction made in the revised documents/drawings. Contractor shall resubmit the drawings approved under Category II and III within three (3) weeks of receipt of comments on the drawings, incorporating all comments. Every revision of the drawing shall bear a revision index wherein such revisions shall be highlighted in the form of description or marked up in the drawing identifying the same with relevant revision number enclosed in a triangle (e.g 1.2.3. etc.)

g. While submitting the revised drawing/documents, Contractor shall attach a sheet with the drawing/document stating clearly the point wise reply to NTPC comments on previous revision and their incorporation status in the submitted revision. Contractor shall not make any changes in the portions of the drawings/documents other than those commented. If changes are required to be made in the already

approved portion, Contractor shall resubmit the drawing/document specifically identifying all the changes along with the reasons for each change so made, for NTPC's review and approval.

h. If the Vendor does not agree with any specific comments, they shall furnish the explanation for the same to NTPC for consideration and acceptance. The same shall be then discussed and agreed mutually.

i. Wherever, drawings/documents are approved in Category-II the work can be carried out on the basis of comments furnished on the drawing/document. However, the comments of NTPC will be taken care by the vendor, while submitting the revised drawing/document for formal approval in category-I. In case the contractor does not agree with any specific comments, he shall furnish the clarification for the same in writing for consideration, acceptance and formal approval under Category I. The contractor shall ensure that replies to comments of SCCL/NTPC are submitted along with the revised drawings.

j. In case Contractor does not agree with any specific comment, he shall furnish the explanation for the same to Employer consideration. In all such cases Contractor shall necessarily enclose explanations along with the revised drawing (taking care of balance comments) to avoid any delay and/or duplication in review work.

k. It is the responsibility of the Contractor to get all the drawings approved in the Category I or IV (as the case may be) and complete engineering activities within the agreed schedule. Any delay arising out of submission and modification of drawings shall not alter the contract completion schedule.

l. Contractor shall not make any changes in the portion of the drawing other than those commented. If changes are required to be made in the portions already approved, the Contractor shall resubmit the drawings identifying the changes (alongwith reasons for changes) for Employer's review and approval.

m. Final distribution of copies of Category 1 approved drawings/documents shall be submitted by Contractor as per Annexure-G.

n. Approval of drawings will not in any way relieve the Contractor of his obligations of furnishing the equipment in accordance with the specification and shall not prevent subsequent rejection if such equipment is later found to be defective.

3.6 DOCUMENTATION TO BE FURNISHED BY THE CONTRACTOR

The number of prints, manuals, CD-ROM's and manuals to be furnished for various types of document is given in ANNEXURE-G. The documentation shall include but not limited to the following as applicable, in addition to the documents if specified in Sections 1 and 2.

3.6.1 DETAILED ENGINEERING

i) Layout, General Arrangements, Elevations and Cross Section drawings of all equipment and facilities of the plant.
ii) Flow diagram. Process & Instrumentation Diagrams

iii) Technical data Sheets.
iv) Detail design calculations for components, system, piping etc. wherever applicable including sizing calculations.
v) Characteristic Curves/ Performance Correction Curves.
vi) Power Supply Single Line Diagram, Block logic, Control Schematics, Electrical Schematics etc.
vii) Protection System Diagrams and Relay Settings.
viii) Cable Schedules and interconnection diagrams
ix) Cable Routing Plan
x) Instrumentation schedule, measuring point list, functional write ups, installation drawings for field mounted instruments, wiring and tubing diagrams of the panels and enclosures etc.. Drawings for open and closed loop controls (both hardware and software). Motor list and valve schedule including type of actuator etc.
xi) Alarm and annunciation/ Sequence of Event (SOE) list and trip set points.
xii) Sequence and protection interlock schemes.
xiii) Type test reports
xiv) Control system configuration diagrams and card circuit diagrams and maintenance details.
xiv) Detailed software manuals and software listing.
xv) Detailed flow chart for digital control system.
xvi) Mimic diagram Layout
xvii) Civil drawings consisting of foundation and structural work, civil calculation sheets including structural analysis and design.
xviii) Model study reports wherever applicable
xix) Documentation in respect of Quality Assurance System as listed out elsewhere in this specification.

3.6.2 ERECTION DRAWINGS

a. Contractor shall furnish erection drawings for the guidance or commencement of erection or the first shipment, whichever is earlier. These shall generally comprise of fabrication/assembly drawings, various component/part details drawing, assembly, clearance data requirements, etc. The drawings shall contain details of components/ equipment with identification number, match marks, bill of materials, assembly procedures etc.
b. For all major equipment apart from above details, assembly sequence and instructions with check-lists shall be furnished in the form of erection manuals.

3.6.3 INSTRUCTION MANUAL

a. The Contractor shall submit to the Employer preliminary instruction manuals for all the equipments for review. The final instructions manuals incorporating Employer's comments and complete in all respect shall be submitted at least thirty (60) days before the first shipment of the equipment. The instruction manuals shall contain full details and drawings of all the equipments, the transportation, storage, installation, testing, operation and maintenance procedures, etc. separately for each component/equipment alongwith log record format.

b. If after commissioning and initial operation of the plant, the instruction manuals require any modifications/additions/changes, the same shall being corporated and the updated final instruction manuals shall be submitted.

c. The operating and maintenance instructions together with drawings (other than shop drawings) of the equipment, as completed, shall have sufficient details to enable the Employer to maintain, dismantle, reassemble and adjust all parts of the equipment. They shall give a step by step procedure for all operations likely to be carried out during the life of the plant/equipment, including erection, testing, commissioning, operation, maintenance dismantling and repair. Each manual shall also include a complete set of approved drawings together with performance/rating curves of the equipment and test certificates, wherever applicable. The contract shall not be considered completed for purpose of taking over until such instructions and drawings have been supplied to the Employer.

d. A separate section of the manual shall be for each size/type of equipment and shall contain a detailed description of construction and operation, together will all relevant pamphlets, drawings and list of parts with procedures for ordering spares. Maintenance instructions shall include charts showing lubrication, checking, testing and replacement procedure to be carried out daily, weekly, monthly and at longer intervals to ensure trouble free operation. Where applicable, fault location charts shall be included to facilitate finding the cause of mal-operation or breakdown. A collection of the manufacturer'' standard leaflets will not accepted to be taken as a compliance of this clause. The manual shall be specifically compiled for the concerned project.

3.7 MATERIAL /WORKMANSHIP

Where the specification does not contain references to workmanship, equipment, materials and components of the covered equipment, it is essential that the same must be new, of highest grade of the best quality of their kind, conforming to best engineering practice and suitable for the purpose for which they are intended and shall ensure satisfactory performance throughout the service life.

In case where the equipment, materials or components are indicated in the specification as “similar” to any special standard the purchaser shall decide upon the question of similarity. When required by the specification or when required by the purchaser the contractor shall submit, for approval, all the information concerning the materials or components to be used in manufacture. Machinery, equipment, materials and components supplied, installed or used without such approval shall run the risk of subsequent rejection, it being understood that the cost as well as the time delay associated with the rejection shall be borne by the Contractor.

The design of the Works shall be such that installation, future expansions, replacements and general maintenance may be undertaken with a minimum of time and expenses. Each component shall be designed to be consistent with its duty and suitable factors of safety subject to mutual agreements. All joints and fastenings shall be devised, constructed and documented so that the component parts shall be accurately positioned and restrained to fulfill their required function. In general, screw threads shall be standard metric threads. The use of other thread forms will only be permitted when prior approval has been obtained from the Purchaser.

Whenever possible, all similar part of the works shall be made to gauge and shall also be made interchangeable with similar parts. All spare parts shall also be interchangeable and shall be made of the same materials and workmanship as the corresponding parts of the equipment supplied under the specification. Where feasible, common component units shall be employed in different pieces of equipment in order to minimize spare parts stocking requirements. All equipment of the same type and rating shall be physically and electrically interchangeable.
The equipment offered in the bid only shall be accepted for supply, with the minimum modifications as agreed/accepted.

3.8 LIMIT OF CONTRACT

All the equipment, materials and services furnished by the manufacturer shall be complete in every respect with all mountings, fitting, fixtures and standard accessories normally provided with such equipment, and needed for erection, completion and safe operation of the equipment as required by applicable codes though they may not have been specifically detailed in technical specification and unless included in the list of exclusions. The manufacturer shall supply at no extra cost to Employer any additional material/service not covered specifically but which are found to be required for fulfillment of the scope of work under specification.

3.9 PROVISIONS FOR EXPOSURE TO HOT AND HUMID CLIMATE

Outdoor equipment supplied under the specification shall be suitable for service and storage under tropical conditions of high temperature, high humidity' heavy rainfall and environment favorable to the growth of fungi and mildew. The indoor equipment located in non-air-conditioned areas shall also be of same type.

3.10 SPACE HEATERS

The heaters shall be suitable for continuous operation at 240 V as supply voltage. On –off switch and fuse shall be provided.

One or more adequately rated thermostatically connected heaters shall be supplied to prevent condensation in any compartment. The heaters shall be installed in the compartment and electrical connections shall be made sufficiently away from below the heaters to minimize deterioration of supply wire insulation. The heaters shall be suitable to maintain the compartment temperature to prevent condensation.

The heaters shall be suitably designed to prevent any contact between the heater wire and the air and shall consist of coiled resistance wire centered in a metal sheath and completely encased in a highly compacted powder of magnesium oxide or other material having equal heat conducting and electrical insulation properties or they shall consist of resistance wire wound on a ceramic and completely covered with a ceramic material to prevent any contact between the wire and the air. Alternatively, they shall consist of a resistance wire mounted into a tubular ceramic body built into an envelope of stainless steel or the resistance wire is wound on a tubular ceramic body and embedded in vitreous glaze. The surface temperature of the heaters shall be restricted to a value which will not shorten the life of the heater sheaths or that of insulated wire or other component in the compartments.

3.11 FUNGI STATIC VARNISH

Besides the space heaters, special moisture and fungus resistance varnish shall be applied on parts which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part where the treatment will interfere with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application of the varnish.

3.12 VENTILATION OPENING

In order to ensure adequate ventilation, compartments shall have ventilation openings provided with fine wire mesh of brass to prevent the entry of insects and to reduce to a minimum the entry of dirt and dust. Outdoor compartment openings shall be provided with shutter type blinds.

3.13 DEGREE OF PROTECTION

The enclosure of the Control Cabinets, Junction boxes and Marshalling Boxes, panels etc. to be installed shall provide degree of protection as detailed here under:

a) Installed out door: IP- 55
b) Installed indoor in air conditioned area: IP-31
c) Installed in covered area: IP-52
d) Installed indoor in non air-conditioned area where possibility of entry of water is limited: IP-41.
e) For LT Switchgear (AC & DC distribution Boards) : IP-52

The degree of protection shall be in accordance with IS: 13947 (Part –I) / IEC-947 (Part-I) / IS 12063/IEC 529. Type test report for degree of protection test, on each type of the box shall be submitted for approval.

3.14 RATING PLATES, NAME PLATES AND LABELS

3.14.1 The equipment nameplate should preferably be of stainless steel. In case of aluminium, it should be at least 2mm thick.. The inscription on the nameplate shall be engraved and no punching shall be accepted except for equipment serial number and year of manufacture. These nameplates shall be black with white engraved lettering.

3.14.2 The rated current, extended current rating and rated thermal current shall be clearly indicated in the name plate in case of current transformer.

3.14.3 Rated voltage, voltage factor and intermediate voltage shall be clearly indicated on the nameplate in case of capacitor voltage transformer.

3.14.4 Name plates of cubicles and panels may be made of non-rusting metal or 3 ply lamicoid.

3.14.5 Each switch shall a clear inscription identifying its function. Switches shall also have a clear inscription of each position indication.

3.15 GROUND TERMINAL

Each equipment shall be provided with two grounding pads, each with two holes for M12 bolts and spring washers suitable for connection to 75mm x 12mm galvanized steel flat. The two pads shall be provided, one each at the middle of the two opposite sides of the bottom frame of the equipment.

3.16 BOLTS, NUTS AND WASHERS

Bolts, nuts and plain washers of size M12 and above shall be hot-dip galvanized, while sizes below M12 shall be electro-galvanized or stainless steel. All spring washers shall be electro-galvanized mild steel suitable for at least service condition -3 as per IS-1573.

In general, screw threads shall be standard metric threads. The use of other thread form will be used only after prior approval. The Contractor shall furnish locking devices for threaded fasteners, which will lock them in such a manner so as to prevent them from coming loose in transport and in service.

3.17 GALVANIZING

The galvanized surfaces shall consist of a continuous and uniform thick coating of zinc, firmly adhering to the steel by dry process. The finished surface shall be clean and smooth and shall be free from defects like discolored patches, bare spots, unevenness of coating, spelter which is loosely attached to the steel globules, spiky deposits, blistered surfaces, flaking and peeling off, etc.

Unless otherwise specified in Section 1 or 2, the minimum weight of the zinc coating shall be as follows –

It shall be 610 gm/sq.m and minimum thickness of coating shall be 85 microns for all items thicker than 6 mm. The average coating thickness shall be 95 microns. For items less than 6 mm, requirements of coating thickness shall be as per clause 4.1 of IS 4759,1984. For surfaces which will be embedded in concrete, the zinc coating shall be 900 gm/sq.m minimum. Galvanizing of each member shall be carried out in one complete immersion.

After galvanizing, no drilling or welding shall be performed on the galvanized parts of the equipment.

All bolts, nuts, lock nuts, washers, etc. shall be hot dip galvanized. Nuts, however, may be tapped, but not to cause appreciable racking of the nuts on the bolts.

Galvanized material must be transported properly to ensure that galvanized surfaces are not damaged during transit. Measure shall be taken to avoid formation of white corrosion products on zinc surfaces during transport and storage. Application of zinc rich paint at site shall not be allowed.

Purity of zinc used for galvanizing shall be 99.95% as per IS 209, 1992. Sodium dichromate treatment may be provided, subject to approval of the Owner, to avoid formation of white rust after hot dip galvanization.

Presence of any defect noticed on inspection shall render the material liable to rejection.

The Contractor shall supply all samples and equipment and carry out the tests without any extra cost.

Galvanized steel shall be subjected to six one-minute dips in copper sulphate solution as per IS 2633. Sharp edges with radii less than 2.5 mm shall be able to withstand four immersions of the standard Preece test. All other coatings shall withstand six immersions. The following galvanizing tests shall essentially be performed.

i) Coating thickness as per IS 2633 :1986
ii) Uniformity of zinc as per IS 2633 :1986
iii) Adhesion test as per IS 2629 :1985
iv) Mass of zinc coating as per IS 6745 :1972

3.18 PAINTING

The sheet steel to be painted shall be pretreated in tanks in accordance with IS: 6005. Degreasing shall be done by alkaline cleaning. Rust and scales shall be removed by pickling with acid. After pickling, the parts shall be washed in running water. Then these shall be rinsed in slightly alkaline hot water and dried. The phosphate coating shall be "class-C" as specified in IS: 6005. The phosphated surfaces shall be rinsed and passivated prior to application of stoved lead oxide primer coating. After primer application, two coats of finishing synthetic enamel paint on panels shall be applied. Electrostatic paining shall also be acceptable. Finishing paint on outside of the panels shall be as required otherwise by the Employer. The inside of the panels shall be glossy white. Each coat of finishing shall be properly stoved. The paint thickness shall not be less than 50 microns. Finished parts shall be coated by peelable compound by spraying method to protect the finished surfaces from scratches, grease, dirt and oil spots during testing, transportation, handling and erection.

3.19 QUALITY ASSURANCE PROGRAMME

3.19.1 The Contractor shall adopt suitable quality assurance programme to ensure that the equipment and services under the scope of contract whether manufactured or performed within the Contractor's works or at his subcontractor's premises or at the Employer's site or at any other place of work are in accordance with the specifications. Such programmes shall be outlined by the Contractor and shall be finally accepted by the Employer/authorised representative after discussions before the award of the contract. The QA programme shall be generally in line with ISO-9001/IS- 14001.

A quality assurance programme of the contractor shall generally cover the following:

i. His organisation structure for the management and implementation of the proposed quality assurance programme
ii. Quality System Manual
iii. Design Control System
iv. Documentation Data Control System
v. Qualification data for Bidder's key Personnel.
vi. The procedure for purchase of materials, parts, components and selection of sub-contractor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc.
vii. System for shop manufacturing and site erection controls including process, fabrication and assembly.

viii. Control of non-conforming items and system for corrective actions and resolution of deviations.
ix. Inspection and test procedure both for manufacture and field activities.
x. Control of calibration and testing of measuring testing equipments.
xi. System for Quality Audits.
xii. System for identification and appraisal of inspection status.
xiii. System for authorising release of manufactured product to the Employer.
xiv. System for handling storage and delivery.
xv. System for maintenance of records, and
xvi. Furnishing of quality plans for manufacturing and field activities detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component as per formats No.QS-01-QAI-P-09/F1-R1 and QS-01-QAI-P-09/F2-R1 enclosed as Annexure- E and Annexure-F respectively.

3.19.2 GENERAL REQUIREMENTS - QUALITY ASSURANCE

3.19.2.1 All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. An indicative programme of inspection/tests to be carried out by the contractor for some of the major items is given in the respective technical specification. This is, however, not intended to form a comprehensive programme as it is the contractor's responsibility to draw up and implement such programme duly approved by the Employer. The detailed Quality Plans for manufacturing and field activities should be drawn up by the Bidder and will be submitted to Employer for approval. Schedule of finalisation of such quality plans will be finalised before award on enclosed format No. QS-01-QAI-P-01/F3 enclosed as Annexure- D.

3.19.2.2 Manufacturing Quality Plan will detail out for all the components and equipment, various tests/inspection, to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Contractor's Quality Control Organisation, the relevant reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of materials procurement, manufacture, assembly and final testing/performance testing. The Quality Plan shall be submitted on electronic media e.g. CD or E-mail for review.

3.19.2.3 Field Quality Plans will detail out for all the equipment, the quality practices and procedures etc. to be followed by the Contractor's site Quality Control Organisation, during various stages of site activities from receipt of materials/equipment at site.

3.19.2.4 The Bidder shall also furnish copies of the reference documents/plant standards/acceptance norms/tests and inspection procedure etc., as referred in Quality Plans alongwith Quality Plans. These Quality Plans and reference documents/standards

etc. will be subject to Employer's approval without which manufacturer shall not proceed. These approved documents shall form a part of the contract. In these approved Quality Plans, Employer shall identify customer hold points (CHP), i.e. test/checks which shall be carried out in presence of the Employer's Project Manager or his authorised representative and beyond which the work will not proceed without consent of Employer/Authorised representative in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Employer alongwith technical justification for approval and dispositioning.

3.19.2.5 No material shall be despatched from the manufacturer's works before the same is accepted subsequent to predespatch final inspection including verification of records of all previous tests/inspections by Employer's Project Manager/Authorised representative and duly authorised for despatch issuance of MDCC.

3.19.2.6 All material used for equipment manufacture including casting and forging etc. shall be of tested quality as per relevant codes/standards. Details of results of the tests conducted to determine the mechanical properties, chemical analysis and details of heat treatment procedure recommended and actually followed shall be recorded on certificates and time temperature chart. Tests shall be carried out as per applicable material standards and/or agreed details.

3.19.2.7 All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME Section IX/BS-4870 or other International equivalent standard acceptable to the Employer. All welding/brazing procedures shall be submitted to the Employer or its authorized representative for approval prior to carrying out the welding/brazing.

3.19.2.8 Contractor shall list out all major items /equipments / components to be manufactured in house as well as precured from sub-contractors (BOI). All the sub-contractor proposed by the Contractor for procurement of major bought out items including castings, forging, semi-finished and finished components/equipment, etc., list of which shall be drawn up by the Contractor and finalised with the Employer, shall be subject to Employer's approval on the enclosed format No.QS-01-QAI-P-01/F3. The contractor's proposal shall include vendor's facilities established at the respective works, the process capability, process stabilization, QC systems followed, experience list, etc. alongwith his own technical evaluation for identified sub-contractors enclosed and shall be submitted to the Employer for approval within the period to any procurement. Such vendor approval shall not relieve the contractor from any obligation, duty or responsibility under the contract.

3.19.2.9 For components/equipment procured by the contractors for the purpose of the

contract, after obtaining the written approval of the Employer, the contractor's purchase specifications and inquiries shall call for quality plans to be submitted by the suppliers. The quality plans called for from the sub-contractor shall set out, during the various stages of manufacture and installation, the quality practices and procedures followed by the vendor's quality control organization, the relevant reference documents/standards used, acceptance level, inspection of documentation raised, etc. Such quality plans of the successful vendors shall be finalised with the Employer and such approved Quality Plans shall form a part of the purchase order/contract between the Contractor and sub-contractor. Within three weeks of the release of the purchase orders/contracts for such bought out items/components, a copy of the same without price details but together with the detailed purchase specifications, quality plans and delivery conditions shall be furnished to the Employer on the monthly basis by the Contractor along with a report of the Purchase Order placed so far for the contract.

3.19.2.10 Employer reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Contractor's or their subcontractor's quality management and control activities. The contractor shall provide all necessary assistance to enable the Employer carry out such audit and surveillance.

3.19.2.11 The contractor shall carry out an inspection and testing programme during manufacture in his work and that of his sub-contractor's and at site to ensure the mechanical accuracy of components, compliance with drawings, conformance to functional and performance requirements, identity and acceptability of all materials parts and equipment. Contractor shall carry out all tests/inspection required to establish that the items/equipments conform to requirements of the specification and the relevant codes/standards specified in the specification, in addition to carrying out tests as per the approved quality plan.

3.19.2.12 Quality audit/surveillance/approval of the results of the tests and inspection will not, however, prejudice the right of the Employer to reject the equipment if it does not comply with the specification when erected or does not give complete satisfaction in service and the above shall in no way limit the liabilities and responsibilities of the Contractor in ensuring complete conformance of the materials/equipment supplied to relevant specification, standard, data sheets, drawings, etc.

3.19.2.13 For all spares and replacement items, the quality requirements as agreed for the main equipment supply shall be applicable.

3.19.2.14 Repair/rectification procedures to be adopted to make the job acceptable shall be subject to the approval of the Employer/ authorized representative.

3.19.2.15 ENVIRONMENTAL STRESS SCREENING

All solid state electronic systems/equipment shall be free from infant mortile components. For establishing the compliance to this requirement, the contractor/sub-contractor should meet the following.

1) The Contractor/Sub-contractor shall furnish the established procedure being followed for eliminating infant mortile components. The procedure followed by the Contractor/Sub-contractor should be substantiated along with the statistical figures to validate the procedure being followed. The necessary details as required under this clause shall be furnished at the stage of QP finalization.

Or

In case the Contractor /Sub-contractor do not have any established procedure to eliminate infant mortile components then two or 10% whichever is less,

Most densely populated Panels shall be tested for Elevated Temperature Cycle Test as per the following procedure.

a. Elevated Temperature Test Cycle

During the elevated temperature test which shall be for 48 hours , the ambient temperature shall be maintained at 50 deg.C. The equipment shall be interconnected with devices and kept under energised conditions so as to repeatedly perform all operations it is expected to perform in actual service with load on various components being equal to those which will be experienced in actual service.

During the elevated temperature test the cubicle doors shall be closed (or shall be in the position same as they are supposed to be in the field) and inside temperature in the zone of highest heat dissipating components/modules shall be monitored. The temperature rise inside the cubicle should not exceed 10 deg.C above the ambient temp. at 50 deg.C.

In case any failure during the test cycle, the further course of action should be mutually discussed for demonstrating the intent of the above requirement.

b. Burn in Test Cycle

The test shall be conducted on all the panels fully assembled and wired including the panels having undergone the above mentioned elevated temperature test.

The Burn in Test Cycle shall be 120hrs and process shall be similar to the elevated temperature test as above except that the temperature shall be reduced to the ambient temperature prevalent at that time.

During the above tests, the process I/O and other load on the system shall be simulated by simulated inputs and in the case of control systems, the process which is to be controlled shall also be simulated. Testing of individual components or modules shall not be acceptable.

During the Burn in Test the cubicle doors shall be closed(or shall be in the position same as they are supposed to be in the field) and inside temperature in the zone of highest heat dissipating components/modules shall be monitored. The temperature rise inside the cubicle should not exceed 10degC above the ambient temperature.

The Contractor/Sub-contractor shall carry out routine test on 100% item at contractor/sub-contractor's works. The quantum of check/test for routine & acceptance test by employer shall be generally as per criteria/sampling plan defined in referred standards. Wherever

standards have not been mentioned quantum of check/test for routine / acceptance test shall be as agreed during detailed engineering stage.

3.19.3 QUALITY ASSURANCE DOCUMENTS

3.19.3.1 The Contractor shall be required to submit QA Documentation as indicated in Annexure-G.

3.19.3.2 Each QA Documentation shall have a project specific Cover Sheet bearing name & identification number of equipment and including an index of its contents with page control on each document.

3.19.3.3 Typical contents of Quality Assurance Document are as below:-

i) Quality Plan,
ii) Material mill test reports on components as specified by the specification and approved Quality Plans.
iii) Factory test reports/results for testing required as per applicable codes and standard referred in the specification and approved Quality Plans.
iv) Manufacturer/works test reports/results for testing required as per applicable codes and standard referred in the specification and approved Quality Plans.
v) Non-destructive examination results /reports including radiography interpretation reports.
Sketches/drawings used for indicating the method of traceability of the radiographs to the location on the equipment.
vi) Heat Treatment Certificate/Record (Time- temperature Chart)
vii) All the accepted Non-conformance Reports (Major/Minor) / deviation,
including complete technical details / repair procedure)Verification sketches, if used and methods used to verify that the inspection and testing points in the Quality Plan were performed satisfactorily
viii) CHP / Inspection reports duly signed by the Inspector of the Employer and Contractor for the agreed Customer Hold Points.
ix) Certificate of Conformance (COC) whever applicable.
x) MDCC

3.19.3.4 Similarly, the contractor shall be required to submit Quality Assurance Documents (in line with above) pertaining to field activities as per Approved Field Quality Plans and other agreed manuals/ procedures, prior to commissioning of individual system as indicated in Annexure-G.

3.19.3.5 Due to the large variety of equipment items, it is always possible to adapt the content of the quality document to better match the particularities of any equipment. This shall be done in agreement with the Supplier and the Inspector.
The Quality Document file shall be progressively completed by the Supplier's sub-supplier to allow regular reviews by all parties during the manufacturing.Each quality document shall have a project specific Cover Sheet bearing name & identification number of equipment and including an index of its contents with page control on each document.

3.19.3.6 Before dispatch/commissioning of any equipment, the Supplier shall make sure that the corresponding quality document or in the case of protracted phased deliveries, the

applicable section of the quality document file is completed. The supplier will then notify the Inspector regarding the readiness of the quality document (or applicable section) for review.

i) If the result of the review carried out by the Inspector of the Quality document (or applicable section) is satisfactory.The Inspector shall stamp, the quality document (or applicable section) for release.

ii) If the quality document is unsatisfactory, the Supplier shall endeavor to correct the incompleteness, thus allowing to finalize the quality document (or applicable section) by time compatible with the requirements as per contract documents. When it is done, the quality document (or applicable section) is stamped by the Inspector.

iii) If a decision is made to ship equipment, whereas all outstanding actions cannot be readily cleared for the release of the quality document by the time as per contract documents (or finalization of the applicable section of the quality document within one month as per corresponding shipment date).The supplier shall immediately, upon shipment of the equipment, send a copy of the quality document Review Status

(signed by the Supplier Representative) to the Inspector and notify of the committed date for the completion of all outstanding actions & submission.The Inspector shall stamp the quality document for applicable section when it is effectively completed.
The final quality document will be compiled and issued at the final assembly place of equipment before shipment.

3.19.4 TRANSMISSION OF QUALITY DOCUMENTS

On release of QA Documentation by Inspector, one set of quality document shall be forwarded to Corporate Quality Assurance Department and other set to respective Project Site of Employer.
For the particular case of phased deliveries, the complete quality document to the Employer shall be issued not later than 3 weeks after the date of the last delivery of equipment.

3.19.5 QUALITY CO-ORDINATION PROCEDURE

The purpose of this document specifies the procedure to be adopted for coordination of QA & I Activities. Refer QUALITY CO-ORDINATION PROCEDURE enclosed as Annexure-C.

3.20 PROJECT MANAGER'S SUPERVISION

3.20.1 To eliminate delays and avoid disputes and litigation, it is agreed between the parties to the Contract that all matters and questions shall be referred to the Project Manager and without prejudice to the provisions of 'Arbitration' clause in Section GCC, Section-IV; the Contractor shall proceed to comply with the Project Manager's decision.

3.20.2 The work shall be performed under the supervision of the Project Manager. The scope

of the duties of the Project Manager pursuant to the Contract, will include but not be limited to the following:

a) Interpretation of all the terms and conditions of these documents and specifications:

b) Review and interpretation of all the Contractor's drawing, engineering data, etc:

c) Witness or his authorised representative to witness tests and trials either at the manufacturer's works or at site, or at any place where work is performed under the contract :

d) Inspect, accept or reject any equipment, material and work under the contract:

e) Issue certificate of acceptance and/or progressive payment and final payment certificates:

f) Review and suggest modifications and improvement in completion schedules from time to time : and

g) Supervise Quality Assurance Programme implementation at all stages of the works.

3.21 TYPE TESTING , INSPECTION, TESTING & INSPECTION CERTIFICATE

3.21.1 The word 'Inspector' shall mean the Project Manager and/or his authorised representative and/or an outside inspection agency acting on behalf of the Employer to inspect and examine the materials and workmanship of the works during its manufacture or erection.

3.21.2 The Project Manager or his duly authorised representative and/or an outside inspection agency acting on behalf of the Employer shall have access at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection and if part of the works is being manufactured or assembled on other premises or works, the Contractor shall obtain for the Project Manager and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works.

3.21.3 The Contractor shall give the Project Manager/Inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the Contractor's account except for the expenses of the Inspector's. The Project Manager/Inspector, unless the witnessing of the tests is virtually waived, will attend such tests within fifteen (15) days of the date on which the equipment is noticed as being ready for test/inspection failing which the contractor may proceed with test which shall be deemed to have been made in the inspector's presence and he shall forthwith forward to the inspector duly certified copies of test reports in two (2) copies.

3.21.4 The Project Manager or Inspector shall within fifteen (15) days from the date of inspection as defined herein give notice in writing to the Contractor, or any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract. The Contractor shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall inform in writing to the Project Manager/Inspector giving reasons therein, that no modifications are necessary to comply with the contract.

3.21.5 When the factory tests have been completed at the Contractor's or subcontractor's works, the Project Manager /Inspector shall issue a certificate to this effect fifteen (15) days after completion of tests but if the tests are not witnessed by the Project Manager /Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Contractor's test certificate by the Project Manager /Inspector. Project Manager /Inspector to issue such a certificate shall not prevent the Contractor from proceeding with the works.The completion of these tests, or the issue of the certificates shall not bind the Employer to accept the equipment should it, on further tests after erection be found not to comply with the contract.

3.21.6 In all cases where the contract provides for tests whether at the premises or works of the Contractor or any sub-contractor, the Contractor, except where otherwise specified shall provide free of charge such items as labour, material, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Project Manager /Inspector or his authorised representatives to carry out effectively such tests on the equipment in accordance with the Contractor and shall give facilities to the Project Manager/Inspector or to his authorised representative to accomplish testing.

3.21.7 The inspection by Project Manager / Inspector and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed Quality Assurance Programme forming a part of the contract.

3.21.8 To facilitate advance planning of inspection in addition to giving inspection notice, the Contractor shall furnish quarterly inspection programme indicating schedule dates of inspection at Customer Hold Point and final inspection stages. Updated quarterly inspection plans will be made for each three consecutive months and shall be furnished before beginning of each calendar month.

3.21.9 All inspection, measuring and test equipments used by contractor shall be calibrated periodically depending on its use and criticality of the test/measurement to be done. The Contractor shall maintain all the relevant records of periodic calibration and instrument identification, and shall produce the same for inspection by NTPC. Wherever asked specifically, thecontractor shall re-calibrate the measuring/test equipments in the presence of Project Manager / Inspector.

3.21.10Associated document for Quality Assurance programme:

List of items requiring quality plan and sub-supplier approval: QS-01-QAI-P-1/F3-R0 (Annexure-D)

Manufacturing Quality Plan Format no. (Annexure-E) : QS-01-QAI-P-09/F1-R1

Field Quality Plan Format no. (Annexure-F) : QS-01-QAI-P-09/F2-R1

3.21.11 PRE-COMMISSIONING AND COMMISSIONING FACILITIES

a) On completion of erection of the equipment and before start-up, each item of the equipment shall be thoroughly cleaned and then inspected jointly by the Owner and the contractor for correctness and completeness of installation and acceptability for start-up, leading to initial pre-commissioning tests at site. The list of pre-commissioning tests to be performed shall be as mutually agreed and included in the contractor's quality assurance programme as well as those included in elsewhere in the Technical Specifications.

b) The contractor's pre-commissioning/commissioning/start-up engineers, specially identified as far as possible shall be responsible for carrying out all the pre-commissioning tests at site. On completion of inspection, checking and after the pre-commissioning tests are satisfactorily over the complete equipment shall be placed on initial operation during which period the complete equipment shall be operated integral with sub-systems and supporting equipment as a complete plant.

c) All piping system shall be flushed steam blown as required and cleanliness demonstrated using acceptable industry standards procedures to accomplish this work shall be submitted for approval to the Owner six months prior to the respective implementations. The Owner will approve final verification of cleanliness.

d) The time consumed in the inspection and checking of the units shall be considered as a part of the erection and installation period.

e) The check outs during the pre-commissioning period should be programmed to follow the construction completion schedule. Each equipment/system, as it is completed in construction and turned over to Owners commissioning (start-up) Engineer(s) should be checked out and cleaned. The checking and inspection of individual system should then follow a prescribed schedule to be agreed by Owner.

3.22 PACKAGING & PROTECTION

3.22.1 PACKING, MARKING AND SHIPPING

The packing and shipping shall be carried out in accordance with the standard practice of Contractor and with the following additional requirements:

a. The equipment shall be prepared in such a manner as to protect the equipment from damage or deterioration during shipping or storage. The shipments can be exposed to heavy rains, hot sun, high humidity and sudden extreme changes of temperature. The equipment shall be packed and shipped so as to protect it from all such conditions and any other abnormal conditions, generally expected during shipping & storage.

b. The metallic containers, if any, shall be considered as the property of the Contractor and he will be allowed to remove them from site once the contents are unpacked, inspected, documented and placed in temporary storage or in final position.

c. The equipment shall be shipped in such a manner as to facilitate unloading, handling and storage enroute and at the site. The Contractor shall provide lifting lugs and special lifting devices for proper handling and erection.

d. The Contractor shall be liable for any damage or loss resulting due to careless, improper,

poor or insufficient packing and handling.

e. Spare parts and spare equipment shall be packed separately in containers adequate for long term storage, plainly marked "Spare Parts Only". They shall be crated individually or in kits to be used in one single renewal or overhaul operation. Other spare part kits shall not be disturbed when using one set or kit.

f. The Contractor shall at all times protect and preserve from damage, loss, corrosion and all other forms of damage, all parts of the works.

g. PACKING IN CRATES

For the equipment packed in crates, the packing wood shall be as per relevant Indian/ International standards. The base of the crate shall be made of wooden batons and planks giving necessary reinforcement, so that the bottom of the equipment is at a height of 100mm minimum from the ground level. The size of the plank shall be decided by the sub-contractor to suit the weight of equipment. Minimum thickness of the plank shall be 25mm and minimum width shall be 150mm. Crate shall be made while keeping the gap from 25mm to 200mm depending upon the size of equipment and weight. However, the responsibility of proper packing and safe delivery of the equipment to site lies with the supplier

3.22.2 TRANSPORTATION

a. The Contractor shall make a careful examination of access rail/roadways to the site in order to confirm the practical maximum transport weight and dimensions as well as a careful examination of the ports of disembarkation particularly with respect to the capacity of the cranes installed and access roads.

b. All instruments and computer/microprocessor based equipment imported into India from overseas for the purpose of this contract shall be air freighted to the nearest possible point and further by rail/road taking due precautions as per manufacturer's recommendations. Employer shall have the right to decide the items that should be air freighted and Employer's decision shall be binding on Contractor

3.22.3 INSURANCE

a. The Contractor shall insure all shipments and works at his own expense for not less than the full replacement cost plus any additional cost for accelerated manufacturing of the replacement parts.

b. Loss or the damage to equipment during shipping or transportation to the site(s) or otherwise shall not constitute groups for claims for extension in time or for extra payment.

3.22.4 STORAGE OF EQUIPMENT

a. The Contractor shall provide and construct adequate storage sheds for proper storage of equipment. Sensitive equipments shall be stored indoors. All equipment during storage shall be protected against damage due to act of nature or accidents. The storage instructions of the equipment manufacturers shall be strictly adhered to.

b. The necessary transport packing shall be removed as soon as possible after receipt of equipment at the work site(s).

3.23 CLAMPS AND CONNECTORS INCLUDING TERMINAL CONNECTORS

3.23.1 The material of clamps and connectors shall be Aluminium alloy casting conforming to designation A6 of IS:617 for connecting to equipment terminals and conductors of aluminium. In case the terminals are of copper, the same clamps/connectors shall be used with 2mm thick bimetallic liner.

3.23.2 The material of clamps and connectors shall be Galvanised mild steel for connecting to shield wire.

3.23.3 Bolts, nuts and plain washers shall be hot dip galvanised mild steel for sizes M12 and above. For sizes below M12, they shall be electro-galvanised mild steel. The spring washers shall be electro-galvanised mild steel.

3.23.4 All castings shall be free from blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be rounded off to meet specified corona and radio interference requirements.

3.23.5 They shall have same current rating as that of the connected equipment. All current carrying parts shall be at least 10 mm thick. The connectors shall be manufactured to have minimum contact resistance.

3.23.6 Flexible connectors, braids or laminated strips shall be made up of copper/aluminium.

3.23.7 Current rating and size of terminal/conductor for which connector is suitable shall be put on a suitable sticker on each component which should last atleast till erection time.

3.24 ELECTRICAL EQUIPMENT/ENCLOSURES

All electrical equipments and devices, including insulation, heating and ventilation devices shall be designed for ambient temperature and a maximum relative humidity as specified elsewhere in the specifications.

3.25 CASTING

All castings shall be true to pattern, free from defects and of uniform quality and condition. The surface of castings, which do not undergo machining, shall be free from foundry irregularities. The casting shall be tested for NDT, chemical, mechanical and metallographical tests. This shall be specified in quantity plan for the specific equipment. Iron casting material shall be in accordance with ASTM A 126 class B. Steel casting shall be manufactured in accordance with ASTM A 27 and shall be subject top appropriate tests and inspection.

3.26 FORGINGS

If requested by purchases, forging shall be tested by magnetic particle, dye penetration, radiographic, ultrasonic or any combination of methods, which may suit material type and forging design. The testing is to be carried out according to appropriate ASTM standards.

The forging shall be tested for mechanical and metallographical tests as per ASTM.

3.27 FABRICATED COMPONENTS

All components machined or fabricated from plate, sheet or bar stock shall meet the material requirements of ASTM. Structural steel, rolled shapes, bars etc. shall comply with the latest ASTM for A36.

All or a representative number of such components shall be subjected to one or more of the tests: visual, dye penetration, magnetic particle (transverse and longitudinal), ultrasonic or radiograph. These tests shall be in accordance with the ASTM. The acceptance shall be as per ASTM Specifications.

3.28 CONTROL CABINETS , JUNCTION BOXES, TERMINAL BOXES & MARSHALLING BOXES FOR OUTDOOR EQUIPMENT

3.28.1 All types of control cabinets, junction boxes, marshaling boxes, lighting panels, terminal boxes, operating mechanism boxes, Kiosks etc. shall generally conform to IS:5039, IS:8623 and IEC:439 as applicable.

3.28.2 They shall be of painted sheet steel or aluminium. The thickness of sheet steel shall be 2mm cold rolled or 2.5mm hot rolled. The thickness of aluminium shall be 3mm and shall provide rigidity. Top of the boxes shall be sloped towards rear of the box. The paint shall be of grey RAL 9002 on the outside and glossy white inside. However, the junction and switch boxes shall be of hot dip galvanised sheet steel of 1.6mm thickness.

3.28.3 The cabinets/boxes/kiosks/panels shall be free standing or wall mounting or pedestal mounting type. The bottom part of all boxes shall be mounted atleast 1000mm from ground.They shall have hinged doors with padlocking arrangement. All doors, removable covers and plates shall be gasketed all around with neoprene gaskets.

3.28.4 The degree of protection of of all the outdoor boxes shall not be less than IP 55 as per IS 2147.

3.28.5 The cable entry shall be from bottom, for which removable gasketed cable gland plates made of 3mm thick sheet steel shall be provided.

3.28.6 Suitable 240V, single phase, 50Hz ac heaters with thermostats controlled by switch and fuse shall be provided to maintain inside temperature 10deg. above the ambient.

3.28.6.1 The size of enclosure and the layout of equipment inside shall provide generous clearances. Each cabinet/box/kiosk/panel shall be provided with a 15A, 240V ac, 2pole, 3 pin industrial grade receptacle with switch. For incoming supply, MCB of suitable rating shall be provided. Illumination of each compartment shall be with door operated incandescent lamp. All control switches shall be of rotary switch type.

3.28.6.2 Each cabinet/box/kiosk/panel shall be provided with two earthing pads to receive 75mmx12mm GS flat. The connection shall be bolted type with two bolts per pad.The hinged door shall be connected to body using flexible wire. The cabinets/boxes/kiosks/panels shall also be provided with danger plate, and internal wiring

diagram pasted on inside of the door. The front label shall be on a 3mm thick plastic plate with white letters engraved on black background

3.29 TERMINAL BLOCKS

3.29.1 They shall be non-disconnecting stud type of extensible design equivalent to Elmex type CAT-M4.

3.29.2 The terminal blocks shall be of 1100 V grade, and rated to continuously carry maximum expected current. The conducting part shall be tinned or silver plated.

3.29.3 They shall be of moulded, non-inflammable thermosetting plastic. The material shall not deteriorate with varied conditions of temperature and humidity. The terminal blocks shall be fully enclosed with removable covers of transparent, non deteriorating plastic material. Insulating barriers shall be provided between the terminal blocks so that the barriers do not hinder the wiring operation without removing the barriers.

3.29.4 The terminals shall be provided with marking tags for wiring identification.

3.29.5 Unless otherwise required (expected current rating) or specified, terminal blocksshall be suitable for connecting the following conductors on each side:
All CT & VT circuits - Min. four 2.5 sq.mm. copper flexible conductor
AC & DC power supply -Two 16 sq.mm. aluminium conductor
Circuits
Other control circuits - Min. two 2.5 sq.mm. copper flexible conductor

3.29.6 The terminal blocks for CT and VT secondary leads shall be provided with test links and isolating facilities. CT secondary leads shall also be provided with short-circuiting and earthing facilities.

3.30 Wiring

3.30.1 All wiring shall be carried out with 1100 V grade stranded copper wires. The minimum size of the stranded conductor used for internal wiring shall be as follows:
a) All circuits except CT circuits 2.5 sq.mm
b) CT circuits 4 sq. mm (minimum number of strands shall be 3 per conductor).

3.30.2 All internal wiring shall be securely supported, neatly arranged readily accessible and connected to equipment terminals and terminal blocks.

3.30.3 Wire terminations shall be made with solderless crimping type of tinned copper lugs which firmly grip the conductor and insulation. Insulated sleeves shall be provided at all the wire terminations. Engraved core identification plastic ferrules marked to correspond with the wiring diagram shall be fitted at both ends of each wire. Ferrules shall fit tightly on the wires shall not fall off when the wires and shall not fall off when the wire is disconnected from terminal blocks.

3.30.4 All wires directly connected to trip circuit breaker shall be distinguished by the addition of a red coloured unlettered ferrule. Number 6 & 9 shall not be included for ferrules purposes.

3.30.5 All terminals including spare terminals of auxiliary equipment shall be wired upto terminal blocks. Each equipment shall have its own central control cabinet in which all contacts including spare contacts from all poles shall be wired out. Interpole cabling for all equipment's shall be carried out by the Contractor.

3.31 CABLE GLANDS AND LUGS

3.31.1 Cable glands shall be Double compression type, tinned/Nicked plated (coating thickness not less than 20 microns in case of tin and 10 to 15 microns in case of nickel) brass cable glands for all power and control cables. They shall provide dust and weather proof terminations. They shall comprise of heavy duty brass casting, machine finished and tinned to avoid corrosion and oxidation. Rubber components used in cable glands shall be neoprene and off tested quality. Required number of packing glands to close unused openings in gland plates shall also be provided.

3.31.2 The cable glands shall be tested as per BS:6121. The cable glands shall also be duly tested for dust proof and weather proof termination.

3.31.3 Cables lugs shall be tinned copper solder less crimping type conforming to IS:8309 and 8394 suitable for aluminum or copper conductor (as applicable). The cable lugs shall suit the type of terminals provided. The cable lugs shall be of Dowell make or equivalent.

3.32 CONDUITS, PIPES AND ACCESSORIES

3.32.1 The Contractor shall supply and install all rigid conduits, mild steel pipes, flexible conduits, hume pipes, etc. including all necessary sundry materials, such as tees, elbows, check nuts, bushing reduces, enlargers, wooden plugs, coupling caps, nipples, gland sealing fittings, pull boxes, etc.

3.32.2 Rigid conduits shall be flow-coat metal conduits of Nagarjuna Coated Tubes or equivalent make. The outer surface of the conduits shall be coated with hot-dip zinc and chromate conversion coatings. The inner surface shall have silicone epoxy ester coating for easy cable pulling. Mild steel pipes shall be hot-dip galvanised. All rigid conduits/ pipes shall be of a reputed make.

3.32.3 Flexible conduits shall be heat-resistant lead coated steel, water-leak, fire and rust proof, and be of PLICA make or equivalent.

3.33 MOTOR CONTROL CENTRE

3.33.1 The 415 Volt motor control centres (if provided separately) shall conform to the requirements for boxes/cabinets/kiosks. They shall be fixed type, shall be fully sectionalised and shall be equipped with load break switches. Motor feeders shall be provided with isolating switch fuse unit and Contractor with thermal overload relay and single phase protection. The motor Contractor shall have one normally open auxiliary contact for alarm purposes. The motor control circuit shall be independent from all other control circuits.

3.33.2 Isolating Switches

The incoming power supply isolating switch operation handle shall be interlocked with the control cabinet door as to prevent opening of door when main switch is closed. Device for

by passing the door interlock shall also be provided. Switch handle shall have provision for locking in both fully open and fully closed positions.

3.33.3 Fuses

All fuses shall be of the HRC cartridge type, conforming to IS:2208 and suitable to mount on plugin type of fuse bases. Fuses shall be provided with visible operation indicators to show that they have operated. All accessible live connections shall be adequately shrouded, and it shall be possible to change fuses with the circuit alive, without danger of contact with live conductor. Insulated fuse pulling handle shall be supplied with each control cabinet.

3.34 MOTORS

3.34.01 Motors shall be "Squirrel Cage" three phase induction motors of sufficient size capable of satisfactory operation for the application and duty as required for the driven equipment and shall conform to type tests and shall be subjected to routine tests as per applicable standards.

3.34.02 Enclosures

a) For motors to be installed outdoor, the motor enclosure shall have degree of protection IP:55. For motors to be installed indoor, i.e. inside a box, the motor enclosure shall be dust proof equivalent to IP:44.
b) Two independent earthing points shall be provided on opposite sides of the motor for bolted connection of earthing conductor.
c) Motors shall have drain plugs so located that they will drain water resulting condensation or other causes from all pockets in the motor casing.
d) Motors weighing more than 25 kg shall be provided with eyebolts, lugs or other means or facility for lifting.

3.34.03 Operational Features:

a) Continuous motor ratings (name plate rating) shall be at least suitable for the driven equipment at design duty operating point of driven equipment that will arise in service.
b) Motors shall be capable of giving rated output without reduction in the expected life span when operated continuously in the given system.

3.34.04 Starting Requirements

a) All induction motors shall be suitable for full voltage direct on-line starting. These shall be capable of starting and accelerating to the rated speed alongwith the driven equipment without exceeding the acceptable winding temperature even when the supply voltage drops.

b) Motors shall be capable of withstanding the electrodynamic stresses and heating imposed if it is started at a voltage of 110% of the rated value.

c) The locked rotor current shall not exceed six(6) times the rated full load current for all motors subject to tolerance given in IS:325.

d) Motors when started with driven equipment imposing full staring torque and supply voltage conditions specified shall be capable of withstanding at least two

successive starts from cold condition at room temperature and one start from hot condition without injurious heating of winding. The motors shall also be suitable for three equally spread starts per hour under the above referred supply condition.

e) The locked rotor withstand time under hot condition at 110% of rated voltage shall be more than starting time with the driven equipment of minimum permissible voltage by a least two seconds or 15% of the accelerating time whichever is greater. In case it is not possible to meet the above requirement, the Contractor shall offer centrifugal type speed switch mounted on the motor shaft which shall remain closed for speeds lower than 20% and open for speeds above 20% of the rated. The speed switch shall be capable of withstanding 120% of the rated speed in either directions of rotation.

3.34.05 The maximum permissible temperature rise over the ambient temperature shall be within the limits specified in IS:325 (for 3 phase induction motors) after adjustment due to increased ambient temperature specified.

3.34.06 The double amplitude of motor vibration shall be within the limits specified in IS:729. Vibration shall also be within the limits specified by the relevant standard for the driven equipment when measured at the motor bearings.

3.34.07 All the induction motors shall be capable of running at 80% of rated voltage for a period of 5 minutes.

3.35 AUXILIARY SWITCH

The auxiliary switch shall conform of following type tests:

a) Electrical endurance test - A minimum of 1000 operations for 2A. D.C. with a time constant greater than or equal to 20 milliseconds with a subsequent examination of mV drop/ visual defects/ temperature rise test.
b) Mechanical endurance test - A minimum of 5000 operations with a subsequent checking of contact pressure test/ visual examination
c) Heat run test on contacts
d) IR/HV test, etc.

3.36 LAMPS AND SOCKETS

3.36.1 Lamps: All incandescent lamps shall use a socket base as per IS-1258, except in the case of signal lamps.

3.36.2 Sockets: All sockets (convenience outlets) shall be suitable to accept both 5 Amp & 15 Amp pin round Standard Indian plugs. They shall be switched sockets with shutters.

3.36.3 Hand Lamp: A 240 Volts, single Phase, 50 Hz AC plug point shall be provided in the interior of each cubicle with ON-OFF Switch for connection of hand lamps.

3.37 SWITCHES AND FUSES:

Each control panel shall be provided with necessary arrangements for receiving, distributing, isolating and fusing of DC and AC supplies for various control, signalling, lighting and space heater circuits. The incoming and sub-circuits shall be separately provided with switch-fuse units. Selection of the main and sub-circuit fuse ratings shall be

such as to ensure selective clearance of sub-circuit faults. Potential circuits for relaying and metering shall be protected by HRC fuses.

All fuses shall be of HRC cartridge type conforming to IS 9228 mounted on plug-in type fuse bases. Miniature circuit breakers with thermal Protection and alarm contacts will also be accepted. All accessible live connection to fuse bases shall be adequately shrouded. Fuses shall have operation indicators for indicating blown fuse condition. Fuse carrier base shall have imprints of the fuse rating and voltage.

All control switches shall be of rotary type. Toggle/piano switches shall not be accepted.

3.38 BUSHINGS, HOLLOW COLUMN INSULATORS, SUPPORT INSULATORS

3.38.1 Bushings shall be manufactured and tested in accordance with IS: 2099 & IEC:137 while hollow column insulators shall be manufactured and tested in accordance with IEC 233/IS 5284. The support insulators shall be manufactured and tested as per IS: 2544 / IEC 168/IEC 273. The insulators shall also conform to IEC 815 as applicable.
Support insulators/ bushings/ hollow column insulators shall be designed to have ample insulation, mechanical strength and rigidity for the conditions under which they will be used.

3.38.2 Porcelain used shall be homogenous, free from laminations, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified, tough and impervious to moisture. Hollow porcelain should be in one integral piece in green & fired stage.

3.38.3 Glazing of the porcelain shall be uniform brown in colour, free form blisters, burns and other similar defects.

3.38.4 When operating at normal rated voltage there shall be no electric discharge between conductor and insulators which would cause corrosion or injury to conductors or when operating at normal rated voltage.

3.38.5 The design of the insulator shall be such that stresses due to expansion and contraction in any part of the insulator shall be lead to deterioration. All ferrous parts shall be hot dip galvanised.

3.38.6 Contractor shall make available data on all the essential features of design including the method of assembly of shells and metal parts, number of shells per insulator, the manner in which mechanical stresses are transmitted through shells to adjacent parts, provision for meeting expansion stresses, results of corona and thermal shock tests, recommended working strength and any special design or arrangement employed to increase life under service conditions.

3.38.7 Post type insulators shall consist of a porcelain part permanently secured in metal base to be mounted on supporting structures. They shall be capable of being mounted upright. They shall be designed to withstand all shocks to which they may be subjected to during operation of the associated equipment.

3.38.8 Bushing porcelain shall be robust and capable of withstanding the internal pressures likely to occur in service. The design and location of clamps, the shape and the strength of the porcelain flange securing the bushing to the tank shall be such that there is no risk of fracture. All portions of the assembled porcelain enclosures and supports other than gaskets, which may in any way be exposed to the atmosphere shall be composed of completely non hygroscopic material such as metal or glazed porcelain.

3.38.9 All iron parts shall be hot dip galvanised and all joints shall be air tight. Surface of joints shall be trued; porcelain parts by grinding and metal parts by machining. Insulator/ bushing design shall be such as to ensure a uniform compressive pressure on the joints.

3.38.10 Bushings, hollow column insulators and support insulators shall conform to type tests and shall be subjected to routine tests and acceptance test/ sample test in accordance with relevant standards.

3.38.11 Insulator shall also meet requirement of IEC - 815 as applicable, having alternate long & short sheds.

3.39 CORONA AND RIV TESTS AND SEISMIC WITHSTAND TEST:

The corona (for 400kV only) and RIV tests shall confirm to the requirements as per **Annexure A** to this chapter. The seismic withstand test for shall conform to requirements as per **Annexure B** to this chapter.

3.40 ELECTRICAL NOISE CONTROL

3.40.1 The equipment furnished by the Contractor shall incorporate necessary techniques to eliminate measurement and control problems caused by electrical noise. Areas in Contractor's equipment which are vulnerable to electrical noise shall be hardened to eliminate possible problems. Any additional equipment, services required for effectively eliminating the noise problems shall be included in the proposal. The equipment shall be protected against ESD as per IEC-61000-2. Radio frequency interference. (RFI) and electro magnetic interference (EMI) protection against hardware damage and control system mal operations/errors shall be provided for all systems as per EN-50082-2(1995).

3.40.2 SURGE PROTECTION FOR SOLID STATE EQUIPMENT

All solid state systems /equipment shall be able to withstand the electrical noise and surge as encountered in actual service conditions and inherent in a power plant and shall meet the requirements of surge protection as defined in ANSI C37.90.1-1989 on its suitable equivalent class of IEC 254-4. Details of the features incorporated and relevant tests carried out. The test certificates. etc. shall be submitted by the Bidder.

3.40.3 Electronic Module/Component Details

The Contractor shall have to furnish two (2) sets of all maintenance manual of each and every electronic card/module as employed on the various systems and equipment including peripherals etc., offered by him. The Contractor will also have to furnish the data regarding the expected failure rate of various modules and other system components. Further, the Contractor shall furnish a set of operating manuals which should include block diagrams, make, model/type, details wiring and external connection drawings etc as required to do the testing and maintenance of the electronic modules.

3.41 DEVIATIONS FROM SPECIFICATIONS

Deviation, if any, from any these specifications shall be listed out separately. Bidder shall attach a separate sheet titled as "DEVIATIONS FROM SPECIFICATIONS" and list all deviations details of each deviation Section wise and Clause wise. In absence of any deviation listed out separately, adherence the specifications shall be assumed.

3.42 INFORMATION TO BE FURNISHED BY THE CONTRACTOR/ SUB CONTRACTOR

Information/ documents to be furnished at the TENDER / CONTRACT STAGE shall be as given below: (marked `X' in the appropriate column)

DETAILS OF DOCUMENTATION TO BE FURNISHED	At Tender Stage	At Contract Stage
Technical offer with details of equipment, scope etc	X	
Guaranteed Technical particulars	X	X
Schedule of Tests to be conducted	X	
Schedule of deviations, if any, Section wise, clause wise, with respect to technical specifications	X	
List of past supplies complete with purchase & project ref., quantity, order ref., etc. where identical equipment have been supplied.	X	-
Manufacturing Quality Plan/ Standard Check List	X	X
Field Quality Plan	X	X
GA drg with dimensions & weight and foundation/ fixing details	X	X
Drg & Data submission schedule (to be furnished at contract stage shall be specified date-wise here).	X	X
Type test Reports.	X	X
Bar chart showing the time schedule indicating the time required for design submission of drawing, manufacture of eqpt, test and inspection.	X	
Routine / Acceptance test reports.		X
Installation , Operation & Maintenance Manual	X	X
Field Quality Plan for receipt and storage, installation, testing and commissioning with details of test equipment, tests to be conducted	X	X

and acceptance values		

3.43 Enclosures:

1. Annexure- A - Corona And Radio Interference Voltage (RIV) Test - (3 Sheets)
2. Annexure- B - Seismic Withstand Test- (1 Sheet)
3. Annexure- C - Quality Co-Ordination Procedure -(9 Sheets)
4. Annexure- D- List Of Items requiring Quality Plan and Sub-Supplier approval (ANNEXURE-III) - (1 Sheet)
5. Annexure- E -Manufacturing Quality Plan (ANNEXURE- Q3) - (1 Sheet)
6. Annexure- F - Field Quality Plan(ANNEXURE- Q5) - (1 Sheet)
7. Annexure- G- Number of Copies and Modes of Documentation to be submitted-Part of Sec-3
8. Annexure- H- Title block to be followed for this project- (1 Sheet)
9. Annexure-I- Important meteorological data from nearest observatory at Ramagundam- (PROJECT INFORMATION: CLIMATOLOGICAL TABLE ANNEXURE-III) - (1 Sheet)
10. Annexure- J- Quality Assurance- (2 Sheets)

ANNEXURE-G

NUMBER OF COPIES AND MODES OF DOCUMENTATION TO BE SUBMITTED

S. No.	DESCRIPTION	TENDER STAGE	CONTRACT STAGE		
			PRINTS	CD-ROMS	MANUALS
1	Drawings (for approval at Contract Stage)	2	PDF		
2	Drawings (after Revision for approval at Contract Stage)		PDF		
3	Final approved drawings for stamping (Hard copy)		4		
4	Drawings for Distribution (Stamped copy)		17		
5	Drawings “As Built “		2	6	
6	Design Calculations/Design Memorandum/Data Sheet/TTR/MQP/FQP (for Approval at Contract Stage)	1	PDF		
7	Final approved Design Calculations/Design Memorandum/Data Sheet/TTR/MQP/FQP for stamping (Hard copy)		3		
8	Design Calculations/Design Memorandum/Data			4	

	Sheet/TTR/MQP/FQP for Distribution to SCCL/NTPC/BHEL Site (Stamped copy)				
10	Erection and Commissioning and Performance Procedure Manual			4	13
11	Operation and Maintenance Manuals			4	13
12	Inspection Test Reports (Routine and Acceptance Test Reports)			4	13

NOTE:

Quality Documentation shall be arranged in plastic folders in the same order as they appear in the QP, with cover sheet and index with QP itself as the first document at the top.

Final Documentation shall be submitted in bound volumes with Customer & Project etc. written on top.

Section-4
Guaranteed Technical Particulars

SUB-SECTION - DB19

EHV INSTRUMENT TRANSFORMER

CLAUSE NO.	Bidder's Name	
	E - 3 **EHV INSTRUMENT TRANSFORMER** (Bidder to fill up following data for each type and rating of the equipment alongwith the bid)	
A.	**CURRENT TRANSFORMERS**	
	1. Name & country of the Manufacturer	.....
	2. Manufacturer's type designation	.....
	3. Standard applicable	.....
	4. Rated frequency (Hz)	.....
	5. Rated Voltage (KV)	.....
	6. i) Rated continuous normal current (A)	.....
	ii) Rated thermal current (A)	.....
	7. Short time current withstand for 1 sec. (kA)	.....
	8. Dynamic current withstand (kA peak)	.....
	9. 1.2/50 micro second impulse withstand voltage (kv peak)	.....
	10. 250/2500 micro second switching withstand voltage (kV peak dry and wet)	.....
	11. One minute dry & wet power frequency withstand voltage (kV rms)	.....
	12. No. of cores per CT	.....

CLAUSE NO.	Bidder's Name	
	13. Transformation Ratio	.....
	14. Number of secondary turns	.....
	15. Rated Out put (VA) at different taps.	.....
	16. Accuracy class	.....
	17. Knee - point voltage (volts) at different taps	.....
	18. Secondary data	.....
	a) Secondary resistance at different taps	.....
	b) Oversize factor and transient error under reclosing duty condition	.....
	19. Maximum exciting current at	.....
	a) 100% kpv (mA)	.....
	b) 25% kpv (mA)	.....
	c) 20% kpv (mA)	.....
	d) 10% kpv (mA)	.....
	20. Total creepage distance (mm)	.....
	21. a) No. of primary turns	.....
	b) Material and cross section of primary	.....
	c) Whether bar type or ring type primary	.....
	22. Total weight (Kg)	.....

SUB-SECTION - DB26

EHV INSULATORS

CLAUSE NO.	Bidder's Name	
	E - 1 TO 6&12	
	EHV INSULATORS	
A.	**BUSHING / HOLLOW INSULATORS**	
	(Bidder shall furnish these data for each equipment separately i.e. for circuit Breakers, Instrument Transformer, Surge Arrestors, etc.)	
	1. Manufacturer's Name	.....
	2. Country of Manufacturer	.....
	3. Type	.....
	4. Applicable Standards	.....
	5. i) Height	.....
	ii) Diameter (Top)	.....
	iii) Diameter (Bottom)	.....
	6. Creepage distance	.....
	a) Total (mm)	.....
	7. Rated Voltage	.....
	8. Power frequency withstand voltage for 1 min. (kv rms)	.....
	i) Dry	.....
	ii) Wet	.....
	9. 1.2/50 micro sec. impulse withstand voltage (kVp)	.....
	10. 250/2500 Micro sec. switching impulse withstand voltage (kVp)	.....
	i) Dry	.....
	ii) Wet	.....

CLAUSE NO.	Bidder's Name	
	11. Weight (Kg)	.....
	12. Cantilever Strength (Kg)	.....
	13. OGA drawing enclosed	Yes/No
B.	**BUS POST INSULATOR**	
	(Bidder shall furnish these data for solid core Insulators for Disconnecting switches, bus support, etc. separately)	
	1. Manufacturer's Name	.....
	2. Country of Manufacturer	.....
	3. Type of Insulator (Product No.)	.....
	4. Applicable Standards	.....
	5. No. of units per Stack	.....
	6. Diameter & No. of Bolts	.....
	ii) Top	.....
	ii) Bottom	.....
	7. Bolt circle diameter (mm)	.....
	ii) Top	.....
	iii) Bottom	.....
	8. Height of complete stack (mm)	.....
	9. Total Creepage distance (mm)	.....
	10. Power frequency withstand voltage of insulator with corona ring	.....
	i) Dry (kV rms)	.....
	ii) Wet (kV rms)	.....

SECTION 5

List of Enclosures with Technical Specification:

1. Format for Provenness Criteria
2. Format for Undertaking for Site Supervision
3. Format for Present Order Book Position
4. Checklist

(B) **For 400 KV Instrument Transformers :** In order to satisfy the requirement of Supvendor experience as indicated in Technical Specification, Clause No. 4.6.21 of Sub-Section-IIA-01, Part-A, Section-VI, we declare that M/s..... ..... is a manufacturer who has manufactured and supplied minimum fifteen (15) nos. of single phase Current Transformers and fifteen (15) nos. of single phase Capacitor Voltage Transformers suitable for Air Insulated Substation/Switchyard of 400 KV or above class which are in successful operation for a minimum period of two (2) years as on the date of bid opening. The details are given below.

S.No.	Description		Installation
1	Name and Address of Manufacturer and Name of contact person with email ID, Telephone & Fax Nos.		
2	Client's Name & its Address alongwith Name of contact person with email ID, Telephone & Fax Nos.		
3	Name & Location of the Substation/ Switchyard		
4	Name of Contract		
5	Contract Reference No. & Date		
6.	Scope of the work for the aforesaid Contract includes		
	(i)	Manufacture	Yes*/No*
	(ii)	Type Test	Yes*/No*
	(iii)	Supply	Yes*/No*
7.	(i)	No. of Single phase Current Transformers Supplied	
	(ii)	No. of Single phase Capacitor Voltage Transformers Supplied	
	(iii)	Voltage Level (in KV)	

S.No.	Description	Installation
	(iv) Whether suitable for Air insulated Substation/Switchyard	Yes*/No*
8.	Date of Commissioning	
9.	Date of commencement of successful operation	
10.	No. of years in Successful operation as on date of Bid opening	
11.	Client(s) certificate(s) enclosed in support of stated experience at Sr.No. 6 to 10 at Annexure..... to this Attachment-3A28	

(USE SEPARATE SHEET FOR EACH EXPERIENCE/CONTRACT)

Date :

Place :

(Signature).....

(Printed Name).....

(Designation).....

(Common Seal).....

BOILER TURBINE GENERATOR PACKAGE FOR
SINGARENI THERMAL POWER PROJECT (2X600 MW)
BID DOCUMENT NO. CW-9596-108

Sub-Vendor's Name and Address :

To
Employer's Name & Address

Dear Sirs,

We confirm having enclosed at Annexure..... to this Attachment-3A45, the undertaking from the respective equipment manufacturer's for site supervision of equipments (as per enclosed format) as per Technical Specification, Clause No. 4.6.25 of Sub-Section-IIA-01, Part-A, Section-VI, as per details given beow :

Sl. No.	**Item Description**	**Name & Address of Manufacturer**	**Manufacturer's Undertaking for site supervision of equipments (Letter Ref.No. & Date)**
1.	400 KV Circuit Breakers	M/s.....	
2.	400 KV Instrument Transformers		
	(i) 400 KV Current Transformers	M/s.....	
	(ii) 400 KV Capacitor Voltage Transformers	M/s.....	
3.	400 KV Disconnectors	M/s.....	
4.	400 KV Surge Arrestors	M/s.....	
5.	Substation Automation System & Protective Relays	M/s.....	

Date :

Place :

(Signature).....

(Printed Name).....

(Designation).....

(Common seal).....

BOILER TURBINE GENERATOR PACKAGE FOR
SINGARENI THERMAL POWER PROJECT (2X600 MW)
BID DOCUMENT NO. CW-9596-108
(Manufacturer's Undertaking for Site Supervision of equipments)

Sub-Vendor's Name and Address :

To
Employer's Name & Address

Ref. No. :

Dated :

To,

Dear Sirs,

We..... who are established and reputed manufacturer, meeting the requirement of Supply item(s) of ..... having factories at.....(Address of Factory) do hereby authorized M/s.....(Name and Address of Sub-vendor) to submit the bid, and sign the Contract with you against the above IFB.

We hereby undertake that erection, testing and commissioning of the offered equipment at site shall be carried out under our supervision.

Yours faithfully,

(Signature of the Authorised Representative)

Name :

Designation :

Common Seal of Company :

Note : This undertaking should be on the letterhead of the manufacturer and should be signed by a competent person duly authorised by the Company and having the power of attorney, duly attested by a Notory public, to bind the manufacturer. It should be included by the Sub-vendor in his bid.

BOILER TURBINE GENERATOR PACKAGE FOR
SINGARENI THERMAL POWER PROJECT (2X600 MW)
BID DOCUMENT NO. CW-9596-108
(Present Order Book Position for 400KV Instrument Transformers)

Sub-Vendor's Name and Address :

To
Employer's Name & Address

List of Orders received in last five years & present status.

Sl. No.	Client	Order Value	No. of Units & Unit size	Date of Order	Present Status		% work completed Engg./ Manufact-uring/ Erection	Completion of Supply		Completion of Erection testing & commissioning		Reason for delay (if any)
					Sch-edule	Actual/ Expec-ted		Sch-edule	Actual/ Expec-ted	Sch-edule	Actual/ Expected	

Date :

Place :

(Signature).....
(Printed Name).....
(Designation).....
(Common Seal).....

Note : 1. The above attachment shall be filled up by the bidder.
2. Continuation sheets of like size and format may be used as per Bidder's requirement and shall be annexed to this Attachment.

CHECK LIST FOR 400kV CURRENT TRANSFORMER

Put a tick mark (√) on 'YES' if the specified requirement is met, or put a tick mark on 'NO', if the specified requirement is not met and give comments in the "Remarks" column.

Sl. No.	Parameters	Data	YES/NO	Remarks
1	Manufacturer's type designation	Bidder to furnish in Remarks Col.		
2	Type of CT			
	a) Insulating medium	Oil	YES/NO	
	b) Installation	Outdoor	YES/NO	
	c) Mounting	Upright	YES/NO	
	d) Tank design	i. Live tank	YES/NO	
		ii. Dead tank	YES/NO	
3	Standards Applicable	IEC 60044-1, IEC-60044-4 , IS-2705-(P1 to P4), ANSI-C5713, IEC335	YES/NO	
4	Rated Voltage (kV rms)	400KV	YES/NO	
5	Rated Primary Current	3000A and 2000A	Yes/No	
6	Rated short time thermal current	50 KA for 1(one)Sec	YES/NO	
7	Rated dynamic current	125 kA	YES/NO	

8	Max. Temperature rise over design ambient temperature	As per IEC:60044-1	YES/NO	
9	One minute power frequency withstand voltage - Secondary Terminal and Earth	5KV	YES/NO	
10	Cantilever Strength	Not less than 500Kg	YES/NO	
11	Class of Insulation	A	YES/NO	
12	Core parameters	As per table a clause 1.2.2 and 1.2.3 of Section -I	YES/NO	
13	Technical parameters	As per table a clause 1.2.1 of Section -I	YES/NO	
14	External Surface			
	Tank and Top Metallics	i. Hot dip galvanized OR	YES/NO	
		ii. Painted	YES/NO	
15	Specific requirements for Oil/SF6 CT's			
	a. Oil filled CT's:			
	i. Standard to which oil conforms	IS-335 / IEC-60296	YES/NO	
	ii. Oil filling and drain plug provided.		YES/NO	
	iii. Oil sight glass provided		YES/NO	

16	**Hermetic Sealing**			
	a. Hermetically Sealed		YES/NO	
17	Polarity of CT permanently marked		YES/NO	
18	Name Plate			
	As per IEC standards, and shall clearly indicate Year of manufacture, Rated current , Extended current rating & rated thermal current		YES/NO	
19	Terminal Box -Ingress Protection	IP 55	YES/NO	
20	In case of "Bar primary" inverted type CT	The CT conforms to the additional requirements specified under 3.00.00 of Section –II. Clauses 3.03.00, 3.04.00, 3.05.00	YES/NO	
21	Rated extended current	120%	YES/NO	
22	Packing & Transportation			
	a. CT suitable for horizontal transportation.		YES/NO	
	b. Details of packing design shall be furnished for review at contract stage .		YES/NO	
23	CT suitable for High speed auto-reclosing.		YES/NO	
24	The CT manufacturer meets the **Provenness Criteria as per** Technical Specification.		YES/NO	

25	Valid Type test reports as per Section-II, 8.01.00 are available and attached along with this offer.		YES/NO	
27	Following Documents are attached along with the offer :			
	a. Filled Checklist.		YES/NO	
	b. No Deviation Certificate		YES/NO	
	c. Documents to support the Provenness Criteria		YES/NO	
	d. Undertaking for Site Supervision		YES/NO	
	e. Present Order book Position		YES/NO	
	f. Catalogue/ leaflets			
	g. Drawings		YES/NO	