BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS GROUP

ENGINEERING MANAGEMENT, NEW DELHI

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Type of Document: TECHNICAL SPECIFICATION		Sign			
Title: 11KV/433 V AUX. DISTRIBUTION TRANSFORMER		Date	24.08.12	24.09.12	24.09.12
		Group	TBEM		
		W.O. No	81009		
CUSTOMER: THE SINGARENI COLLIERIES COMPANY LTD.					
CONSULTANT: NATIONAL THERMAL POWER CORPORATION LTD.					
PROJECT: 400 KV AND 132 KV SWITCHYARD FOR SINGARENI THERMAL POWER PROJECT 2X660MW AT ADILABAD, AP					

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Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS

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 Distribution Transformers complete with accessories as listed in clause 1.3 below.

This section covers the specific technical requirements of Distribution Transformers. In case of any discrepancies between the requirements mentioned in this section and those specified in the following sections of this specification, the specifications given herein shall prevail and shall be treated as binding requirements.

1.1 The equipment is required for the following project.

CUSTOMER: THE SINGARENI COLLIERIES COMPANY LTD.

CONSULTANT: NATIONAL THERMAL POWER CORPORATION LTD.

PROJECT: 400 KV AND 132 KV SWITCHYARD FOR SINGARENI THERMAL POWER PROJECT 2X660MW AT ADILABAD, AP

Refer Section - 3 for Project Details and General Specifications.

1.2 SPECIFIC TECHNICAL REQUIREMENTS

1.2.1 TECHNICAL PARTICULARS

a)	Installation	:	Outdoor		
b)	Duty	:	Continuous		
c)	Type	:	Two winding		
d)	No of Phases	:	Three		
e)	Cooling Mode	:	ONAN		
f)	Rating	:	630 kVA, 11 / 0.433kV		
g)	Voltage variation:				
	a. HV		+/- 6%		
	b. LV		+/- 10%		
h)	Impedance at 75 °C with tolerance	:	0.05 ± 10% p.u.		
i)	Frequency	:	50 Hz		
j)	Overload	:	As per IS 6600		
k)	Max temp rise over 50°C Ambient				
	i) Oil (by thermometer)	:	50°C		
	ii) Windings (by resistance method)	:	55°C		
l)	Windings			11 kV	415 V
	i) System Fault level (kA) for 2 seconds		:	40	45
	ii) Winding connection		:	Delta	Star
	iii) Vector Group		:	Dyn11	
	iv) Insulation		:	Uniform	

v) Insulation level :
- Power frequency test level (kVrms): 28 2
- Basic impulse level (kVpeak) : 75 --

vi) Highest voltage for each winding (kV): --

vii) Method of earthing : -- Solidly Earthed

m) Insulation level for Bushings:
- Power frequency withstand voltage: 28 2
- Basic impulse withstand voltage (kVpeak): 75 --

n) Tap Changer
i) Tap range : +5% to –5% in steps of 2.5% on HV
ii) Tap control : Off –circuit tap change switch

o) Terminal details
i) High voltage : Suitable for 11/11kV, 3Cx185sq.mm XLPE cable
ii) Low voltage phase and Neutral : Suitable for 1.1kV, 7-1Cx630sq.mm XLPE cable

p) Minimum clearance in air (mm)		11 kV	415 V
i) Phase to Phase	:	280	25
ii) Phase to earth	:	140	25

q) Class of neutral bushing CT : PS class

r) Maximum No-Load losses at rated frequency and 100% voltage : 1.0kW

s) Maximum Load losses at normal ratio, rated current and 75 deg.C : 7.5kW

Equipment shall be suitable for rated frequency of 50Hz with a variation of +3% & -5% and 10% combined variation of voltage and frequency.
Rest as per the following NTPC Specifications attached herewith:
SCCL (2X600MW) BTG package, Technical Specification: Section-VI, Part-B, Technical Specifications, Sub Section-B-05, LT TRANSFORMERS (OUTDOOR), Page 1 to 9.

1.3 QUANTITIES

1.3.1 MAIN EQUIPMENT

S.NO.	DESCRIPTION	QUANTITY
1.	11 / 0.433kV, 3- phase, ONAN Dyn11, distribution transformer complete with and including off-load tap-changer, cable glands lugs, anchor bolts, etc.	02 Nos.
2.	Ten (10) percent extra oil for topping up, in non-returnable containers suitable for outdoor storage.	01 Lot
3.	Short Circuit test (special test) as per IEC 60076-5	01 No.

S.NO.	DESCRIPTION	QUANTITY
4.	Temperature Rise Test at a tap corresponding to maximum losses. DGA shall be conducted on oil sample taken before & immediately after temp. rise test. Gas analysis shall be as per IS: 9434 (based on IEC: 60567), results will be interpreted as per IS: 10593 (based on IEC: 60599).	01 No.
5.	Lightning impulse (Full and chopped wave) test on HV & LV winding(as per cl. 14 of IEC 60076-3)	01 No.
6.	Measurement of acoustic noise level as per NEMA TR-1(special test)	01 No.

1.3.2 SPARES

S.NO.	DESCRIPTION	QUANTITY
(i)	Bushings with metal parts and gaskets	
a.	HV	1No.
b.	1.1 kV	1No.
c.	Neutral	1No.
(ii)	Winding temperature indicator with alarm and trip contacts	1 No
(iii)	Oil temperature indicator with alarm & trip contacts	1 No
(iv)	Magnetic oil level gauge	1 No
(v)	Pressure relief device	1 No
(vi)	Diaphragm of explosion vent	1 No.
(vii)	Buchholz relay/Sudden pressure relay (as applicable)	1 No.
(viii)	Silica gel charge	3 charge
(ix)	Floats with contacts for Buchholz relay	1 set
(x)	Set of gasket	2 sets
(xi)	Contacts tap changer	1 set
(xii)	Set of valves(1 No. of each size)	1 set
(xiii)	Pressure gauge (applicable for sealed tank)	1 No each type
(xiv)	Air cell for conservator(if applicable)	1 No
(xv)	Set of windings for one limb in a suitable oil container.	1No.

Note: (i) Unit rates for the above items shall be provided at the tender stage.
(ii)Purchaser shall have the option to order any / no spares.

1.3.3 COMMISSIONING SPARES

i)	Set of gaskets	One set
ii)	Silica gel breather	One no
iii)	Buccholz relay	one no.

Note: Purchaser shall have the option to order any / no spares

1.4 TYPE TESTS

1.4.1 The offered items should be successfully type tested as per latest IS/IEC for the tests as listed below. Bidder shall submit valid type test reports conducted within 10 years prior from 11.11.2011 on equipment/ components identical* to those offered. In case the type tests have been conducted more than 10 years prior from 11.11.2011 OR type tests reports for the tests conducted on identical transformer are not furnished, bidder shall have to conduct the type tests free of charge prior to commencement of supplies.

*Following parameters in general shall be ensured for establishment of identical design as per IEC 60076, Part-V.

(a) Same Voltage ratio, KVA rating, vector group and impedance.
(b) Same conceptual design of core and winding.
(c) Same arrangement and geometrical sequence of the main windings.
(d) Same type of winding conductors.
(e) Same type of main windings.
(f) Absorbed power at short circuit (i.e., rated power/per unit short circuit impedance) between 30% and 130% of that relating to the reference transformer.
(g) Axial forces and winding stresses occurring at short circuit not exceeding 120% of those relating to the reference transformer.
(h) Same manufacturing process.
(i) Same Clamping and winding support arrangement.

Type tests (As per IS 2026):

1. Measurement of winding resistance. (Cl. 16.2)
2. Measurement of voltage ratio and check of voltage vector relationship. (Cl. 16.3)
3. Measurement of impedance voltage / short circuit impedance (principal tapping) and load loss (Cl. 16.4)
4. Measurement of no load loss and current (Cl. 16.5)
5. Measurement of insulation resistance (Cl 16.6)
6. Dielectric test (Cl. 16.7)
7. Temperature Rise test (Cl. 16.8)
8. Tests on on-load tap-changers(16.9)

Special Tests (As per IS 2026):

1. Measurement of zero sequence impedance. (Cl. 16.10)
2. Short circuit test. (Cl. 16.11)
3 Measurement of acoustic noise level as per NEMA standard publication TR 1.
4. Measurement of the harmonics of the no load current(16.13)

Sequence of testing shall be mutually agreed between Purchaser and Supplier.

Test on Auxiliary Equipment:

1. All auxiliary equipments are to be tested as per relevant IS.
2. HV withstand test shall be performed on auxiliary equipment and wiring after complete assembly.
3. Vacuum test, pressure test and other routine tests as per CBIP manual on transformers shall be conducted on the transformer tanks.

1.4.2 The charges for the following type tests to be carried out (refer cl. 7.00.00 of SCCL Technical Specifications) as listed below shall be furnished along with the bid:

(a) Short Circuit test (special test) as per IEC 60076-5

(b) Temperature Rise Test at a tap corresponding to maximum losses. DGA shall be conducted on oil sample taken before & immediately after temp. rise test. Gas analysis shall be as per IS: 9434 (based on IEC: 60567), results will be interpreted as per IS: 10593 (based on IEC: 60599)

(c) Lightning impulse (Full and chopped wave) test on HV & LV winding(as per cl. 14 of IEC 60076-3)

(d) Measurement of acoustic noise level as per NEMA TR-1(special test)

1.5 PROVENNESS OF L.T. OUTDOOR TRANSFORMER

Bidders must meet the Provenness Criteria for L.T. Outdoor Transformer stipulated in ATTACHMENT-3A12 (4 sheets) attached herewith at Section-5 as Annexure. The Provenness data must be furnished with the offer.

CLAUSE NO.	TECHNICAL REQUIREMENTS

LT TRANSFORMERS (INDOOR / OUTDOOR)

1.00.00 CODES AND STANDARDS

Transformers	IS:2026, IS:6600, IEC 354, IEC 76
Bushing's	IS: 2099, IEC 137
Bushing CTs	IS: 2705, IEC :185
Insulating oil	IS:335, IEC 60296
~~Dry type transformers~~	~~IS: 11171, IEC 76-11~~

2.00.00 TYPE

2.01.00 **LT Out-door Transformers** — Mineral oil filled ONAN type, Three phase unit

~~2.02.00~~ ~~**LT In-door Transformers**~~ — ~~Epoxy cast resin/resin encapsulated air cooled type, Three phase unit~~

3.00.00 RATING — As per system requirement.

4.00.00 TEMPERATURE RISE

LT Outdoor Transformers (Oil Filled)	Permissible Temperature rise over an ambient of 50 deg. C
i) Winding (Resistance method)	55 deg. C
ii) Oil	50 deg. C
~~LT Indoor Transformers (Dry Type)~~	~~Permissible Temperature rise over an ambient of 50 deg. C~~
~~i) Winding (Resistance method)~~	~~90 deg. C~~

5.00.00 OPERATIONAL REQUIRTEMENTS

5.01.00 **Tap Changer**

Off-circuit, +/-5% in steps of 2.5% shall be provided. It shall be hand operated by an external handle with position markings, pad locking facility in each position and mechanical stops to prevent over cranking beyond extreme positions in case of outdoor type transformers. In case of indoor transformers, shrouded bolted links with and no live parts shall be exposed shall also be accepted.

CLAUSE NO.	TECHNICAL REQUIREMENTS
5.02.00	**Loading Capability** Continuous operation at rated KVA on any tap with voltage variation of +/-10% corresponding to the voltage of the tap as well as in accordance with IEC60076-7/IS: 6600.
5.03.00	**Flux Density** Not to exceed 1.9 Wb/sq.m. at any tap position with +/-10% voltage variation from voltage corresponding to the tap. Transformer shall also withstand following over fluxing conditions due combined voltage and frequency fluctuations: a) 110% for continuous rating. b) 125% for at least one minute. c) 140% for at least five seconds.
5.04.00	Noise Level : Not to exceed values specified in NEMA TR-1.
5.05.00	Core shall be high grade non-ageing cold rolled super grain oriented silicon steel laminations of M4 grade or better quality. The insulation of core to tank & core to core clamp shall be able to withstand a voltage of 2 kV (rms.) for 1 minute in air.
5.05.01	Bushing CTs shall be provided in the LV neutral side of adequate rating for REF protection, WTI, etc.
6.00.00	**DESIGN AND CONSTRUCTIONAL FEATURES** All transformers shall be suitable for cable or busduct termination as contemplated. If cable connection is envisaged, a dust tight cable box shall be provided. Also, a sheet steel, vermin and dust proof marshalling box shall be furnished with each transformer to accommodate temperature indicators, terminal blocks for control cables etc. The transformer shall be provided with all fittings and accessories to be complete in all respects for satisfactory operation.
6.01.00	**LT OUTDOOR TRANSFORMERS**
6.01.01	a) Tank Shall be fabricated from tested quality steel and designed to withstand continuous internal pressure of 35KN per sq.m. over normal pressure as well as short circuit forces. The main tank body shall be capable of withstanding full vacuum. All steel surfaces in contact with insulating oil shall be painted with two coats of heat resistant oil in soluble insulating varnish Tank shields, if provided, shall not resonate at natural frequency of equipment.

CLAUSE NO.	TECHNICAL REQUIREMENTS
	b) Tank mounting For all transformers, suitable bi-directional skids with pre-drilled holes shall be provided integral with the tank body for fixing the transformer tank on foundation. The transformers (except transformers upto and including 2 MVA) are to be provided with four no. of bi - directional flat rollers of detachable type & shall be mounted on wheels on foundation. Suitable locking arrangement shall be provided for the wheels to prevent accidental movement of transformer.
6.01.02	Winding conductor shall be Electrolytic grade copper. All windings of the transformers having voltage less than 66 kV shall be fully insulated.
6.01.03	Conservator tank of adequate capacity for expansion of oil from min. ambient to 100 deg.C. shall be provided. The transformers rated 7.5MVA and above shall be provided with air bag breathing through silica gel breather. For lower rating transformers, conventional single compartment conservator with dry air filling the space above oil and connected to silica gel breather shall be provided.
6.01.04	Bushings shall be Porcelain.
6.01.05	Radiators shall be Tank mounted with shut off valves.
6.01.06	Insulating Oil No inhibitors shall be used in the transformer oil. The oil supplied with transformers shall be new and previously unused and must conform to following while tested at supplier's premises and shall have following parameters.

S.No.	Property	Permissible values
1.	Kinematic Viscosity, mm^2/s	≤ 12 at 40 ° C ≤ 1800.0 at (-)30 ° C
2.	Flash Point, ° C	≥ 140° C
3.	Pour point, ° C	≤ (-)40 ° C
4.	Appearance	Clear , free from sediment and suspended matter
5.	Density kg/dm^3 at 20 ° C	≤ 0.895
6.	Interfacial Tension N/m at 25° C	≥ 0.04
7.	Neutralisation value, mgKOH/g	≤ 0.01
8.	Corrosive sulphur	Non Corrosive
9.	Water content mg/kg	≤ 30 in bulk supply ≤ 40 in drum supply
10.	Anti oxidants additives	Not detectable
11.	Oxidation Stability Neutralisation value, mgKOH/g Sludge, % by mass	≤ 1.2 ≤ 0.1

CLAUSE NO.	TECHNICAL REQUIREMENTS

S.No.	Property	Permissible values
12.	Breakdown voltage As delivered, kV After treatment, kV	 ≥ 30 ≥ 70
13.	Dissipation factor, at 90° C And 40 Hz to 60 Hz	≤ 0.005
14.	PCA content	≤1%
15.	Impulse withstand Level, kVp	≥ 145
16.	Gassing tendency at 50 Hz after 120 min, mm^3/min	≤ 5

Subsequently oil samples shall be drawn at:

Sr. No.	Parameters	Before filling in main tank at site & tested for	Prior to energization at site for following properties & acceptance norms:
i)	BDV	60 kV (min)	60 kV (min)
ii)	Moisture content	10 ppm (max.)	10 ppm (max.)

6.01.07 Marshalling box shall be provided with thermostatically controlled space heaters.

6.01.08 Additional L.V. neutral bushing shall be brought out for earthing at equipment end.

6.01.09 Fittings

Shall be provided with following fittings

a) Buchholz relay shall be provided with double float type with alarm and trip contacts.

b) A spring operated pressure relief devices with extension pipe to bring oil to plinth level along with electrically insulated contact for alarm and tripping shall be provided for transformer rating 2MVA and above.

c) Diaphragm type explosion vent shall be provided for transformers of rating less than 2MVA.

d) Winding temperature indicator (WTI) and Oil temperature indicator (OTI), Dial type (150mm) with alarm and trip contacts and maximum reading pointer along with resetting device shall be provided.

e) Magnetic oil level gauge with alarm contact shall be provided.

f) Oil level gauge Prismatic/toughened glass type.

g) Oil Temperature indicator (OTI)

CLAUSE NO.	TECHNICAL REQUIREMENTS
6.02.00	**LT INDOOR TRANSFORMERS**
6.02.01	The transformers shall be housed in a metal protective housing, having a degree of protection of IP-23. Enclosure shall be of a tested quality sheet steel of minimum thickness 2mm & shall also accommodate cable terminations. The housing door shall be interlocked such that it should be possible to open the door only when transformer is off. The enclosure shall be provided with lifting lugs and other hardware for floor mounting.
6.02.02	Winding conductor shall be electrolytic grade Copper or Aluminium. Windings shall be of class F insulation. All windings are to be uniformly insulated.
6.02.03	Transformer HV bushings shall be of solid porcelain type. However LV bushings if provided can be either solid porcelain or epoxy type. Bushing shall be suitable for satisfactory operation in the high ambient temperature inside Bus Duct enclosure.
6.02.04	Additional L.V. neutral bushing shall be brought out for earthing at equipment end.
6.02.05	For Marshalling Box the sheet steel used shall be at least 1.6 mm thick cold rolled. The box shall be tank mounted type. The degree of protection shall be IP-54 in accordance with IS-13947.
6.02.06	Fittings Winding temperature indicator (WTI) — Shall be Platinum resistance type temperature detector in each limb. Accuracy class shall be +/- 2 deg or better. Thermistors — Shall be embedded in each limb with alarm and trip contacts for remote annunciation.
7.00.00	**TESTING REQUIREMENTS**
7.01.00	The contractor shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The bidder shall indicate the charges for each of these type tests separately in the relevant schedule of Section – VII (Forms & Procedures) and the same shall be considered for the evaluation of the bids. The type tests charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by the employer's engineer. *
7.02.00	The type tests shall be carried out in presence of the employer's representative, for which minimum 15 days notice shall be given by the contractor. The contractor shall obtain the employer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set–up, instruments to be used, procedure, acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.
7.03.00	In case the contractor has conducted such specified type test(s) within last ten years as on the date of bid opening, he may submit during detailed engineering the type test reports to the owner for waiver of conductance of such type test(s). These reports should be for the tests conducted on the equipment similar to those

* Refer Annexure-4 of Section-5.

CLAUSE NO.	TECHNICAL REQUIREMENTS
	proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. The owner reserves the right to waive conducting of any or all the specified type test(s) under this contract. In case type tests are waived, the type test charges shall not be payable to the contractor. Bid opening date is 11.11.2011.
7.04.00	Following components to be supplied shall be of tested design. During detailed engineering, the contractor shall submit for employer's approval the reports of all the type tests as listed below in specification and carried out within last ten years from the date of bid opening. The 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 witness by a client. However if the contractor is not able to submit report of the type test(s) conducted within last ten years from 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 employer either at third party lab or in presence of client/employer's representative and submit the reports for approval. (a.) Neutral Grounding Resistors (if applicable) (b.) Tank Vacuum and Pressure test
7.05.00	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.
7.06.00	The type test reports once approved for any project 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.
7.07.00	**Indoor Dry Type Transformer**
7.07.01	All routine tests in accordance with IS: 11171 shall be carried out on each transformer.
7.07.02	Transformer shall be short circuit tested after conducting the routine tests. Rest of the type tests shall be conducted after successful short circuit testing. **Routine / Type Tests (Dry Type Transformers)** a.) Measurement of winding Resistance for each tap position. — Routine Test b.) Measurement of voltage ratio at each taps position. — Routine Test c.) Vector group and polarity check — Routine Test

CLAUSE NO.	TECHNICAL REQUIREMENTS	
	d.) Measurement of impedance voltage/short circuit impedance & load loss at principal tap and extreme taps	Routine Test
	e.) Measurement of no load losses and magnetising current at rated frequency and 90%, 100% and 110% rated voltage	Routine Test
	f). Short Circuit test	Type Test
	g.) Noise Level Measurement	Type Test
	h.) Measurement of zero phase sequence Impedance	Type Test
	i.) Measurement of the harmonics of no load current	Type Test
	j.) Measurement of insulation resistance	Routine Test
	k.) Temperature rise	Type Test
	l.) Insulation resistance(repeat)	Routine Test
	m.) Dielectric Tests	
	1) Power frequency/separate source AC withstand voltage test.	Routine Test
	2) Lightning impulse voltage test on all the three limbs as per Cl. 14.1 of IEC 60076-3	Type Test
	3) Induced over voltage withstand test	Routine Test
	n.) Partial discharge measurement (However if it is conducted as routine test on all the coils, this test can be performed as type test).	Routine Test
	o.) Insulation resistance measurement (Repeat)	Routine Test
	p.) Measurement of iron loss (repeat after induced voltage test)	Routine Test
	q.) Measurement of capacitance and tan delta	Routine Test
7.07.03	Type tests on Components	
	Type test reports shall be submitted for following	
	• Degree of Protection test on Marshalling Box, cable box and enclosure.	

CLAUSE NO.	TECHNICAL REQUIREMENTS
7.07.04	High voltage withstand test shall be performed on auxiliary equipment and wiring after assembly.
7.08.00	**LT Outdoor Transformers**

SN.	ROUTINE TESTS (LT Outdoor Transformers)
1.	All routine test in accordance with IEC 60076 shall be carried out in all the transformers.
2.	Measurement of Voltage Ratio (as per cl. No. 10.3 of IEC 60076-1)
3.	Measurement of winding resistance on HV & LV on all the taps (as per cl. No. 10.2 of IEC 60076-1)
4.	Vector group and Polarity Check (Cl.no.10.3 of IEC 76-1)
5.	Magnetic Balance Test
6.	Measurement of no load current with 415 V, 50 Hz AC supply
7.	Measurement of no load losses and current at 90%, 100% & 110% of rated voltage (as per cl.10.5 of IEC 60076-1)
8.	Impedance & Load Loss Measurement on principal, Max & Min. Taps
9.	IR measurement (As per cl. no:- 10.1.3 of IEC 60076-1)
10.	Dielectric tests shall be carried out as per IEC 60076-3.
11.	Separate Source Voltage Withstand Test (Table-2, 4 & cl. 11 of IEC 60076-3)
12.	Induced Over Voltage Withstand test as per IEC 60076-3
13.	Repeat no load current/loss measurement & IR measurement after completion of all dielectric test
14.	Measurement of capacitance & tan delta to determine capacitance between winding & earth. (As per cl. no:- i, 10.1.3 of IEC 60076-1)
15.	Oil leakage test: All tank & oil filled compartment shall be tested for oil tightness by being completely filled with oil of viscosity not greater than that of specified oil at the ambient temperature & applying pressure equal to the normal pressure plus 35 KN/sq. m measured at the base of the tank. The pressure shall be maintained for a period of not less than 24 hours during which time no sweating shall occur. This test shall be done on completely assembled transformer.
16.	Jacking test followed by D.P. test

CLAUSE NO.	TECHNICAL REQUIREMENTS

SN.	ROUTINE TESTS (LT Outdoor Transformers)
17.	Marshalling Box/Cable box: It shall not be possible to insert a thin sheet of paper under gaskets and through enclosure joints.
18.	IR measurement on wiring of Marshalling Box
	TYPE TESTS (LT OUTDOOR TRANSFORMERS)
19.	Short circuit test (special test) as per IEC 60076-5.
20.	Temp. rise test at a tap corresponding to maximum losses. DGA shall be conducted on oil sample taken before & immediately after temp. rise test. Gas analysis shall be as per IS: 9434 (based on IEC: 60567), results will be interpreted as per IS: 10593 (based on IEC: 60599).
21.	Lightning impulse (Full & Chopped Wave) test on HV & LV winding (as per cl 14 of IEC 60076-3)
22.	Measurement of acoustic noise level as per NEMA TR-1 (special test)
Note:	All the type tests shall be conducted after short circuit test.

7.09.00 **Type tests on Components**

Type test reports shall be submitted for following:

7.09.01 Tank Pressure & Vacuum Test (As per CBIP Norms)

7.09.02 Tests on NGR (if applicable)

S. N.	Routine Tests on NGR
1.	Ohmic value measurement (For resistance & reactance separately).
2.	Insulation resistance measurement before & after HV test
3.	HV test for 1 min. at a voltage corresponding to the insulation level of the resistor.
4.	For enclosure DOP, It shall not be possible to insert a 2.5mm dia. steel wire into the enclosure from any direction without using force.
	Type Tests on NGR
5.	Short time current test along with temperature rise test.
6.	Degree of protection test for IPX3.

SECTION 2

EQUIPMENT SPECIFICATION

2.1 GENERAL

This section covers the general technical requirements of Distribution Transformers. In case of any discrepancies between the requirements mentioned in this section and those specified in the following sections of this specification, the specifications given herein shall prevail and shall be treated as binding requirements. Requirements of Section-1 shall take precedence over all sections.

2.2 APPLICABLE STANDARDS

The transformers shall strictly conform to the following Indian standards

SPECIFICATION FOR POWER TRANSFORMERS	
Part I - General	IS 2026 (Part I): 1977
Part II - Temperature – Rise	IS 2026 (Part II): 1977
Part III - Insulation levels and Dielectric tests	IS 2026 (Part III): 1981
Part IV - Terminal marking, Tappings & connections.	IS 2026 (Part IV): 1977
Part V	IS 2026 (Part V): 1994
HIGH VOLTAGE TEST TECHNIQUES	
Part 1- General definition & test requirements	IS 2071 (Part 1): 1993
Part 2 -Test procedures	IS 2071 (Part 2): 1974
Part 3 -Measuring devices	IS 2071 (Part 3): 1976
New insulating oils	IS 335: 1993
Fittings and accessories for Power Transformers	IS 3639: 1966
Bushings for alternating voltages above 1000 V	IS 2099: 1986
Dimensions for Porcelain transformer bushings (Part 5)	IS 3347 (Part 5): 1979
Gas operated relays	IS 3637: 1966
Guide for loading of oil immersed transformers	IS 6600: 1972
Code of practice for Installation & maintenance of transformers	IS 1886: 1961

The electrical installation shall meet the requirements of Indian Electricity Act 1910 and Indian Electricity rules 1956, as amended upto date.

2.3 DESIGN & CONSTRUCTIONAL FEATURES

2.3.1 TANK

a) Tank Openings

At least two adequately sized inspection openings, one each end of the tank for easy access to bushing and earth connections.

2.3.2 CORE The core shall be constructed from high-grade non-aging cold rolled grain oriented silicon steel laminations.

2.3.3 OIL PRESERVATION

Conservation tank of adequate capacity for expansion of oil from min. ambient to 100 deg C shall be provided. For transformers rated for 8 MVA and above shall be provide with air bag breathing through silica gel breather. For lower rating transformers, conventional single compartment conservator with dry air filling the space above oil and connected to silica gel breather shall be provided.

2.3.4 BUSHING CT'S - shall be provided on LV neutral side of adequate rating as per IEC 185 for REF protection, WTI etc.

2.3.5 Additional LV Neutral bushing shall be brought out for earthing at equipment end

2.4 TRANSFORMER TRANSPORTATION

Oil Filled or Nitrogen Filled with sufficient number of impact recorders with necessary arrangement to maintain nitrogen pressure during transit or storage .

2.5 TERMINAL ARRANGEMENT

1. For cable connections, suitable cable boxes shall be provided and shall be air insulated. They shall be of sufficient size to accommodate all cables and shall have suitable removable side/top cover to facilitate cable termination and inspection.

2. Cable boxes shall be dust and vermin proof. Cable boxes shall have drilled busbars of adequate size to receive all cables. Removable drilled gland plates of non-magnetic material shall be provided in the cable boxes. All necessary cable terminating accessories such as supporting clamps and brackets, power cable lugs, hardware etc shall be provided by the supplier.

The additional supports for the cable boxes shall be of galvanized iron.

Earthing terminals shall be provided on the cable box, to suit 75x12 mm G.I flat.

2.6 MARSHALLING BOX

A metal-enclosed, weather-, vermin- and dust-proof marshalling box shall be provided, with each transformer to accommodate temperature indicators, terminal blocks, etc. It shall have a degree of protection of IP 55 as per IS 2147 (IS 13947).

It shall be provided with thermostatically controlled space heaters

2.7 INSPECTION & TESTING

The supplier shall draw a comprehensive inspection and test plan program to be followed during manufacture (MQP) and from receipt of material stage upto commissioning stage (FQP), of the transformer. The programme shall be submitted with the tender.

The Supplier shall also prepare a comprehensive inspection and test plan for all bought out / sub-contracted items and shall submit the same for Purchaser's approval. Such programme shall include the following components:

a) Buchholz relay
b) Winding temperature indicator
c) Bushings
d) Marshalling Box
e) Tap changer switch
f) Oil temperature indicator

2.8 INSPECTION

2.8.1 Tank and accessories

a) Physical and dimensional check of transformer tank and accessories
b) Crack detection of major strength weld seams by dye-penetration test.

2.8.2 Core

a) Physical inspection and check of quality of varnish, if used.
b) Sample testing of core material for checking specific loss, bend properties, magnetization characteristics and thickness.
c) Check on completed core for measurement of iron loss and check for any hot spot by exciting the core so as to induce the designed value of flux density in the core.
d) HV Test.

2.8.3 Insulating Materials

a) Sample check for physical properties of the material.
b) Check for dielectric strength
c) Check for reaction of hot oil on insulating materials.

2.8.4 Windings

a) Sample check on winding conductor for mechanical properties and electrical conductivity and on insulation covering.
b) Sample check on insulation paper for pH value, bursting strength and electric strength.

2.8.5 Oil -All standard tests in accordance with the relevant standards shall be carried out on oil samples taken from transformer before and after testing of the transformer.

2.8.6 Assembled Transformer

a) Check complete transformer against approved outline drawing, provision of all fittings, finish, etc.
b) Jacking test.

2.8.7 Additional Works Checks

a) Check for interchangeability of similar components and for mounting dimensions.
b) Check for proper provision of bracing to arrest the movement of core and winding assembly inside the tank.
c) Test for gas tightness and derivation of leakage rate to ensure adequate reserve gas capacity during transit and storage.
d) Check for proper packing and preservation of accessories like radiators, bushings, explosion vent, dehydration breather, Buchholz relay, conservator, etc.

2.8.8 Field Checks

a) Physical check on receipt at site fore any damage during transit.
b) Tests on oil samples.
c) Oil leakage test
d) Physical check for colour of silica gel in breather
e) Check for oil level in breather housing, conservator tank, etc.
f) Check for correct operation of all protections and alarms
g) Insulation Resistance Measurement of Main Winding, control wiring, etc.
h) Continuously observe the transformer operation at no load for 24 hours.

2.9 LIST OF DRAWINGS/ DOCUMENTS TO BE SUBMITTED FOR APPROVAL:

1. GA Drawing
2. R&D Plate Drawing
3. LV Cable Box Drawing

4. LV Bushing Drawing
5. HV Cable Box Drawing
6. HV Bushing Drawing
7. Marshalling Box Drawing
8. Foundation Plan Drawing
9. Over-fluxing Curve
10. Schematic Wiring Diagram
11. Winding Section Drawing
12. Guaranteed Technical Particulars
13. Type Test Reports

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.

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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.

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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 and acceptance values	X	X

3.43 Enclosures:

1. Annexure- C - Quality Co-Ordination Procedure -(9 Sheets)

2. Annexure- D- List Of Items requiring Quality Plan and Sub-Supplier approval (ANNEXURE-III) - (1 Sheet)

3. Annexure- E -Manufacturing Quality Plan (ANNEXURE- Q3) - (1 Sheet)

4. Annexure- F - Field Quality Plan(ANNEXURE- Q5) - (1 Sheet)

5. Annexure- G- Number of Copies and Modes of Documentation to be submitted-Part of Sec-3

6. Annexure- H- Title block to be followed for this project- (1 Sheet)

7. Annexure-I- Important meteorological data from nearest observatory at Ramagundam- (PROJECT INFORMATION: CLIMATOLOGICAL TABLE ANNEXURE-III) - (1 Sheet)

8. 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 Sheet/TTR/MQP/FQP for Distribution to SCCL/NTPC/BHEL Site (Stamped copy)			4	
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.

Annexure- C - QUALITY CO-ORDINATION PROCEDURE

1. PURPOSE

1.1 The purpose of this document specifies the procedure to be adopted for coordination of QA & I Activities.

2. SCOPE

This document specifies procedure of:

-Quality plan and field quality plan – approval/finalization

-Inspection/Testing of equipments/items

-Disposition of Non-conformities

-Quality audit and surveillance

3. PROCEDURE

3.1 QUALITY PLANS (QP):

3.1.1 Vendor shall submit to NTPC, the quality plans in NTPC format placed at Annexure-E of Section-3 after ensuring compliance of technical specification requirements as a minimum and putting the signature of authorized personnel of the vendor at appropriate place on each page of the quality plans. The quality plans shall be submitted along with reference documents/plant standards/NDT

Procedures/Welding specification/Heat Treatment details /Assembly & Performance test procedures as applicable as per the agreed schedule of submission of each quality plan as per MDL.

3.1.2 Wherever Reference Quality plan/Standard Quality Plan are available, vendor shall submit endorsement sheet as per NTPC format attached at Annexure-Q4 attached herewith.

3.1.3 Approval of QP in Cat-1 is essential for NTPC inspection, dispatch of materials and issuance of MDCC.

3.2 FIELD QUALITY PLANS (FQP):

3.2.1 Vendor shall submit the FQP for equipment and services in NTPC format (placed at Annexure-F) as per agreed schedule of submission as per MDL. The FQP shall include quality practices and procedures followed by vendor/sub-vendors during various stages of site activities starting from material receipt, storage till final erection of respective equipment at site.

3.2.2 Wherever reference/standard Field quality plans are available, vendor shall submit endorsement sheet as per NTPC format attached at Annexure-Q4 attached herewith.

3.2.3 FQP checks shall be implemented by Vendors with the involvement of NTPC-FQA and NTPC-Erection groups as per the classification of checks agreed in the respective approved FQP.

3.3 **INSPECTION:**

3.3.1 The notice period for inspection of materials/ components/ equipments for witnessing of the CHP stages by SCCL/NTPC, as per approved QP requirements, at the vendor's works shall be as follows:

a) Vendors of Indian Origin: 15 working days.

b) Vendors of Foreign Origin: 45 working days.

3.3.2 All the matters regarding inspection call shall be coordinated as follows:

3.3.2.1 For supplies of Indian origin:

Vendor will issue the inspection calls in NTPC format (Attached at Annexure-Q6), to the concerned SCCL/NTPC inspection office. The list of various NTPC-RIO and their addresses along with their area of jurisdiction is attached at Annexure-Q7. The call shall include copy of relevant approved QP and Data-Sheet, as applicable, internal test/ inspection report, as applicable etc. Further, Vendor's representative shall be present during stage inspections along with SCCL/NTPC representative. Vendor shall closely co-ordinate with SCCL/NTPC-RIO for inspection of in house as well as bought out items.

3.3.2.2 For supplies of other than Indian Origin: Vendor shall issue Inspection call in NTPC format to concerned NTPC-QA/CTF as per the notice period mentioned under 3.3.1 above and after ensuring all documents like QAP, drawing data sheet/BBU etc as applicable are approved in Category-I.

3.3.2.3 Where witnessing of the test is waived off in writing by SCCL/NTPC, Vendor shall proceed with the witness of test, which shall be deemed to have been carried out in the presence of SCCL/NTPC inspector and Vendor shall forward duly certified copies of the inspection and test reports to the concerned NTPC-RIO.

3.3.2.4 In case of items where NTPC inspection is not involved, Vendor shall carry out the inspection as per approved quality norms and shall forward duly certified copies of the inspection and test reports to the concerned NTPC-RIO.

3.3.2.5 For the tests witnessed by SCCL/NTPC, or when the factory tests at identified CHP stages, have been satisfactorily completed including computation of test results, wherever applicable, NTPC inspector shall sign jointly with vendor/ authorized representative (as applicable per approved QP) on the CHP Clearance/ Interim Inspection report. In case of deviations or objections, NTPC inspector shall convey the same, in writing on the CHP report itself, for clarification by vendors.

3.3.2.6 Vendor will make available to the NTPC inspector internal documents, plant standards and procedures relevant to the checks / tests carried out on material / items / equipment. Further vendors shall also ensure the availability of approved drawings / data sheets and approved quality plan at the place of inspection.

3.3.3 As NTPC is approving and stamping all documents in soft copies, all documents regarding inspection shall be coordinated as follows for smooth and trouble free inspection:

a) The main contractor, upon receipt of electronically approved and stamped documents (i.e. drawings/ data sheets/ BOM/ Quality Plan etc.) from NTPC shall take one print out & authenticate the document through their authorized signatories.

b) The main contractor shall then send this approved copy to the sub-supplier through e-mail or on CD along with authenticated hard copy of approved document.

c) These documents i.e. NTPC approved and stamped soft copy and main contractor's authenticated hard copy of NTPC approved document must be available at the place of inspection so that NTPC inspecting engineer can make use of these documents at the time of inspection.

d) The documents being approved by NTPC can be opened easily in "Adobe Acrobat 5.0 & above & the availability of the same shall be ensured by the main contractor/ sub-supplier.

e) If at the place of inspection internet connection is not available or signal is week i.e. documents can not be transmitted through e-mail, NTPC approved soft copy of the document shall be available in CD form at sub-supplier's premises.

3.4 INSPECTION PLAN:

3.4.1 To facilitate advance planning of inspection of supplies, in addition to giving inspection notice at identified CHP stages as per approved QP, Vendor shall furnish three monthly rolling inspection program (in NTPC format) every month, indicating schedule dates of inspection at identified CHP stages, such a program shall be updated each month and a copy of the same shall be made available to NTPC-PC also. Such program shall be confirmed by specific inspection calls in accordance with clause 3.3 above.

3.4.2 Above three monthly inspection program for shop manufactured and BOIs shall be furnished directly to the respective NTPC-RIOs.

3.4.3 Vendor shall furnish monthly inspection status report for previous month including pending calls and exceptions reports / NCR, on or before 7th of every month.

3.5 NON-CONFORMITY DISPOSITIONING PROCEDURE:

3.5.1 Whenever any deviation is observed with respect to relevant document and good engineering practices the same shall be referred by vendor along with justifications to NTPC-RIO, where

inspection was raised by vendor in NTPC format (placed at Annexure Q8), for review and necessary action. This shall be done only after acceptance, with or without modification / corrective action. NCR can be raised irrespective of the CHP stages, to the concerned NTPC-RIO, in whose jurisdiction the item / equipment are being manufactured. NTPC decision shall be final and binding on the NCRs. Material shall be re-offered for stage inspection, as per the NCR disposal requirements specified by NTPC.

3.5.2 Non-conformities with respect to the site activities shall also be dealt with similar fashion except that the NCR in the specified format shall be routed through NTPC-FQA group.

3.5.3 Tests, as required by the approved documents (Cat-1 approved quality plan, drawing / datasheet, as applicable), NTPC-RIO / Authorized representative shall issue the MDCC, against approved BBU, as applicable.

3.6 RESPONSIBILITY FOR ISSUING MDCC

The responsibility of issuing MDCC shall be as follows:

3.6.1 Where inspection by SCCL/NTPC is envisaged in approved QP (inspection category Cat-I) BHEL should send inspection calls to SCCL also.

3.6.2 MDCC is the final document issued by SCCL/NTPC giving dispatch clearance as well as it enables the contractor to claim due payment against dispatch. In the present case, since payments are to be released by SCCL, the formal issue of MDCC as per NTPC format. NTPC can issue CHP clearance and role of NTPC shall end once CHP clearance is issued. Based on CHP clearance further activity such as Dispatch clearance/release of payment shall be by SCCL.

INDIGENOUS SUPPLIES:

The concerned Regional Inspection Office under whose jurisdiction the manufacturer is located, inspecting engineer or reviewing engineer (in case of waiver of presence of NTPC engineer) shall issue the MDCC.

FOREIGN SUPPLIES:

For items directly despatchable to site from the foreign manufacturer, the MDCC shall be issued by NTPC's inspecting engineer. In case of waiver of presence of NTPC engineer, the MDCC shall be issued by CQA engineer on satisfactory review of test reports.

For items to be brought to Vendor works from the foreign manufacturer, before final despatch to site, for assembly on other equipment, MDCC shall be issued by relevant NTPC-RIO after satisfactory activities at Vendor works and on review of CHP report of NTPC's inspecting engineer for inspection at foreign manufacturer's works or on verifying acceptance report of CQA, in case of waiver of presence of NTPC engineer for inspection at foreign source.

NOTE: Material inspection by RIO-A at the works of sub-contractor in their respective jurisdiction and dispatched to the works of the other sub-contractor for assembly or otherwise in the jurisdiction of RIO-B before final despatch to project site, shall be accorded despatch clearance on a CHP clearance report by RIO-A and the MDCC of the completed item / equipment will be issued by RIO-B as per the approved BBU.

3.6.3 In case, only review of Vendor's inspection report / test certificates by NTPC has been envisaged as per approved QP (inspection Category Cat-II), such reports shall be submitted to the concerned NTPC-RIO, in whose jurisdiction manufacturer is located.

3.6.4 In case of items where QP has not been envisaged at all (inspection category Cat-III), such material shall be cleared on the basis of Certificate of Conformity, which shall be submitted to concerned NTPC-RIO, in whose jurisdiction vendor (main contractor) is located.

4. **QUALITY AUDIT:**

4.1 The Vendor shall provide the necessary facilities to NTPC, for carrying out of the quality surveillance and audits as envisaged in the contract.

Annexure-Q4

ENDORSEMENT SHEET FOR QP

REFERENCE / *STANDARD* / FIELD QUALITY PLAN (RQP / SQP/*RFQP/SFQP*)

TO BE FILLED IN BY SUPPLIER AT TIME OF SUBMISSION		To be filled in by NTPC
PROJECT NAME		***REVIEW & ENDORSEMENT BY NTPC*** PROJECT SPECIFIC QP NUMBER ALLOTTED QP NO.:
CONTRACT NO		
CONTRACT NAME		
MAIN SUPPLIER		
MANUFACTURER WORKS & ADDRESS	M/S	REV. NO.: DATE:
ITEM /EQUIPMENT / SYSTEM/ SUB-SYSTEM DETAILS i.e. MODEL TYPE / SIZE /RATING etc.		** The RQP/SQP/RFQP/SFQP once endorsed for a particular contract shall remain valid even though the original QP may have expired or revised, unless / otherwise mutually agreed with the supplier. ①
APPROVED QP NO.: RQP/SQP/RFQP/SFQP	0000-999-QV - - REV. NO.: DATED**:	
Confirmation by Main Supplier (TICK WHICHEVER APPLICABLE)		*(TICK APPLICABLE)*
I. That the item/ component is identical to that considered for QP approval. OR,		The QP is endorsed for this project without any change
II. That there are minor changes in the item/ component with respect to that considered for QP approval, however the same do not affect the contents of QP. OR		
III. That there are minor changes in the item/ component with respect to that considered for QP approval, however the same affect the QP slightly, as indicated below / in attached sheet.		The QP is endorsed for this project with changes as indicated.
		DISTRIBUTION OF ENDORSEMENT OF A) RQP/SQP: *1. MAIN SUPPLIER (WITH A COPY OF QP) 2. MANUFACTURER 3. RIO 4. CQA-SPL 5. CQA-O/C* B) RFQP/SFQP: *1. MAIN SUPPLIER (with a copy of QP) 2. MANUFACTURER 3. NTPC FQA (with a copy of QP) 4. NTPC Erection (with a copy of QP) 5. CQA-SPL 6. CQA-O/C*
SIGN.: (Main Supplier) DATE	*SIGN.: (Manufacturer) DATE:*	NTPC (Reviewed /Approved by/ Date & Seal)

Annexure-G6

Logo Of Supplier / Sub-Supplier / Manufacturer (If possible)

FROM: SUPPLIER : (ON WHOM NTPC PLACED LOI / ORDER)

M/s:----------

Address----------

Contact Person: ----------

Ph:(O): ----------Fax:---------- Ph(R):- ----------

Mobile: ---------- e-mail:---------- ----------

INSPECTION CALL FOR NTPC INSPECTION

(FOR SUBMISSION BY SUPPLIER/ SUB-SUPPLIER)

TO:

REGIONAL INSPECTION OFFICE ----------

NTPC LTD.----------

Contact Person: ----------

Ph:(O): ----------Fax:----------

Mobile: ----------

e-mail: ----------

PROJECT NAME: ----------

PACKAGE NAME: ----------

NTPC CONTRACT NO/ PO NO: ----------

PROPOSED DATE OF INSPACTION: ----------

NO. OF DAYS REQUIRED: ----------

WEEKLY OFF DAY (OF MANUFACTURER)----------

SUB-SUPPLIER **(If Applicable)**

M/s:---------- **Address** ----------

Contact Person: ----------**Ph:(O):** ---------- **Fax:**----------

Mobile: ---------- **e-mail:** ----------

MANUFACTURER **(Place of Inspection)**

M/s ----------

Address ----------

Contact Person: ---------- ***Ph:(O):*** ----------***Fax:***----------

Mobile: ---------- ***Ph(R):*** ----------, ***e-mail:*** ----------

SL NO	BBU NO.	ITEM DESCRIPTION / TESTS	QUANTITY				Insp. Cat (*)	REFERENCE DOCUMENT	REMARKS/ UNDERTAKING
			As in BBU	Already supplied	Offered	Unit			
								QP No. Drg/Data sheet No.	1. Material internally inspected, in line with NTPC QP and found satisfactory. 2 All Reference Documents including latest revisions of NTPC approved QP /Drawing / BBU in original are available and shall be made available during inspection. 3 All stage inspection requirements if applicable have been cleared and relevant CHP's are available. 4 (Applicable for bought out items) Inspection by Main supplier is completed and material is cleared. OR Joint inspection along with Main supplier proposed. 5. Type test Approval from NTPC Engg : Obtained / Pending / Not available. 6. Material shall not be Despatched without Despatch Clearance from NTPC **SIGNATURE& DATE:**---------- **NAME & DESIGNNATION:**---------- **ORGANIZATION:**----------

Insp. Cat (*): ***Enter*** 0 – For Stage Inspection. 1 – For Final Physical Inspection. 2 – For Review of MTC's based on QP 3 – For Non-QP cases based on COC.

Annexure-Q7

NTPC REGIONAL INSPECTION OFFICES

SLNO	RIO LOCATION	AREAS COVERED	HOD AND OTHER EXECUTIVES	PHONE NOS
1	CQA	BOUGHT OUT ITEMS(BOIs) FROM FOREIGN SOURCES	more info	0120-2410219 0120-2410207 0120-2410259 0120-2410430 0120-2410231 0120-2410208 (FAX)
2	DELHI	DELHI HARYANA(EXCPT YAMUNANAGAR) RAJASTHAN PUNJAB JAMMU AND KASHMIR UP(EXCPT JHANSI,MUZAFFARNAGAR) UTTARANCHAL(RUDRAPURONLY) MP(GWALIOR ONLY)	S.K.BHOWMICK, AGM(IS) RAHUL SRIVASTAVA, DGM(IS) ENGINEERING OFFICE COMPLEX A8A SECTOR 24 NOIDA 201 301more info	2410788 2410136(FAX)
3	BANGALORE	KARNATAKA(EXCPT GULBARGA) TAMILNADU(HOSUR ONLY)	A.D. Srivastava AGM(IS) --29A 100FT ROAD B M SHRI CIRCLE INDIRA NAGAR FIRST STAGE BANGALORE560 038more info	080-25205908 080-25205901 080-25205906 (FAX)
4	BHOPAL	MP(EXCPT GWALIOR) CHHATTISGARH MAHARASHTRA(NAGPUR AND CHANDRAPUR ONLY) UP(JHANSI ONLY)	M MISHRA AGM(IS)-GROUNDFLOOR, BLOCK -II, CENTRAL ANNEXE BHEL COMPLEX BHOPAL 4620 021more info	0755-2500894 0755-2500338 0755-2508306 (FAX)
5	MUMBAI	MAHARASHTRA(EXCPT NAGPUR) GUJARAT GOA DADRA AND DAMAN SILVASA	BIRENDERA KUMAR AGM (IS) SAMRUDHI VENTURE PARK 2ND FLOOR,MIDC MAROL, ANDHERI (EAST),MUMBAI 400 093more info	022-28206355 022-25702345 022-28310218 (FAX)
6	KOLKATA	WEST BENGAL NE STATES ORRISSA BIHAR JHARKHAND	G J P NARAYANAN GM(IS) 7B-PRETORIA STREET,KOLKATA 700 071 more info	033-22828051 033-24431880 033- 22806263,2282859 (FAX)
7	HARDWAR	UP (HARDWAR,ROORKEE,SAHARANPUR,MUZAFFARNAGAR ONLY) UTTARANCHAL(EXCPT RUDRAPUR) HARYANA(YAMUNANAGAR ONLY)	M CHANDRASEKARAN AGM(IS) ADMINISTRATIVE BUILDING NO 3,BHEL RANIPUR HARDWAR 249 403more info	01334-227964 01334-231362 01334-225893 (FAX)
8	HYDERABAD	AP(EXCPT CHITTUR AND NELLORE(by rio chennai)) KARNATAKA(Gulbarga only)	RAJ SHEKHAR AGM(IS) 79 BUILDING, BHEL RAMACHANDRAPURAM,HYDERABAD,500 032more info	040-23020954 040-23058190 040-23020872 (FAX)
9	CHENNAI	TAMILNADU(EXCEPT SOUTHERN TAMILNADU and coimbatore(by rio THIRUVANANTHAPURAM) RANIPET,ERODE AND SALEM(BY rio ranipet) ,HOSUR(by rio bangalore) PONDICHERRY	M CHANDRASHEKARAN AGM(IS) ALEXANDER SQUARE NEW NO 2 SARDAR PATEL RD GUINDY,CHENNAI 600 032more info	044-22355526 044-22434932 044-2223555525 (FAX)
10	RANIPET	TAMILNADU(RANIPET,ERODE AND SALEM ONLY)	T RANGANATHAN DGM(IS) ADDRESS-C/O BHEL, VELLORE DISTRICT, RANIPET 632406 more info	04172-241510 04172-254814 04172-242310 (FAX)
11	TIRUCHIRAPALLI	TAMILNADU(TRICHY AND SOUTHERN TAMILNADU ONLY)	A SIVANANTHAN DGM(UC) C/O BHEL HPBP 2,4 BUILDINGS KAILASHPURAM, TRICHY 620 014more info	0431-2520401 0431-2551514 0431-2520309 (FAX)
12	THIRUVANTHAPURAM	KERALA , TAMILNADU(COIMBATORE ONLY)	PRASAD Bmore info	0471-2543933
SLNO	RIO LOCATION	AREAS COVERED	HOD AND OTHER EXECUTIVES	PHONE NOS

NTPC	NON- CONFORMITY REPORT FOR MANUFACTURING & INSPECTION STAGES	FOR NTPC USE ONLY NC NO.: DATE: PAGE : 1 OF 3

CONTRACT NAME & NO :_____

PACKAGE UNIT NO. :_____

CONTRACTOR :_____

SUB-CONTRACTOR :_____

PLACE OF MANUFACTURE :_____

CATEGORY OF NON- CONFORMITY Annexure-C8

A ☐ REFER NOTE-2

B ☐

DETAILS

ITEM DESCRIPTION:_____ IDENTIFICATION NO._____

RANGE/SIZE/TYPE :_____ QUALITY PLAN NO:_____ & CLAUSE NO. CHP NO:

STAGE OF NON-CONFORMITY ☐
DESIGN (A) / RAW MATERIAL (B) / ASSEMBLY(C)/ IN PROCESS(D)-(SPECIFY)_____
STORAGE(E) / HANDLING(F) / TESTING(G) / ANY OTHER(H)-(SPECIFY)_____

NON-CONFORMITY-DESCRIPTION WITH CAUSE (Attach Relevant Drgs/Details)

PROPOSED DISPOSITION WITH JUSTIFICATION - (FOR CORRECTION)
(Note: Attach Details including design calculation)

DISPOSITIONING CODE ☐
REFER NOTE-6

STEPS TO PREVENT RECURRANCE-(FOR CORRECTIVE ACTION)

NAME & DESIGN SIG. OF CONTRACTOR DATE _____ (SEAL)

ENCL: 1.
2.

FINAL DISPOSITIONING BY INSPECTION INCHARGE OF RIO

DISPOSITIONING CODE ☐
REFER NOTE-6

DATE: NAME & DESIG. SIGNATURE:

Annexure-D

(ANNEXURE-III)

Project : Package : Supplier : Contractor No. :	Stage ::	LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB-SUPPLIER APPROVAL SUB-SYSTEM :	DOC. NO.: REV. NO.: DATE : PAGE : OF

S. N.	Item	QP/ Insp. Cat.	QP No.	QP Sub. Schedule	QP approval schedule	Proposed sub-supplier	Place	Sub-suppliers approval status / category	Sub-supplier Details submission schedule	Remarks

LEGENDS

SYSTEM SUPPLIER/SUB-SUPPLIER APPROVAL STATUS CATEGORY (SHALL BE FILLED BY SCCL)

A – For these items proposed vendor is acceptable to SCCL. To be indicated with letter "A" in the list alongwith the condition of approval, if any.

DR – For these items "Detailed required" for SCCL review. To be identified with letter "DR" in the list.

NOTED – For these items vendors are approved by Main Supplier and accepted by SCCL without specific vendor approval from SCCL. To be identified with "NOTED."

QP/INSPN CATEGORY:

CAT-I : For these items the Quality Plans are approved by SCCL and the final acceptance will be on physical inspection witness by SCCL.

CAT-II : For these items the Quality Plans approved by SCCL. However no physical inspection shall be done by SCCL. The final acceptance by SCCL shall be on the basis review of documents as per approved QP.

CAT-III : For these items Main Supplier approves the Quality Plans. The final acceptance by SCCL shall be on the basis certificate of conformance by the main supplier.

UNITS/WORKS : Place of manufacturing Place of Main Supplier of multi units/works.

FORMAT NO.: QS-01-QA1-P-1/F3-R0	1/1	Engg. Div. / QA&I

Annexure- E

Annexure- Q3

MFGR.'s LOGO	MANUFACTURER'S NAME AND ADDRESS	MANUFACTURING QUALITY PLAN		PROJECT : PACKAGE : CONTRACT NO. : MAIN-SUPPLIER:
		ITEM : SUB-SYSTEM:	QP NO.: REV.NO.: DATE: PAGE: .... OF....	

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
					M	C / N					M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D*	** 10.			11.

MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER
SIGNATURE	

LEGEND: * RECORDS, INDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
** M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC
P: PERFORM W: WITNESS AND V: VERIFICATION, AS APPROPRIATE,
CHP: NTPC SHALL IDENTIFY IN COLUM "N" AS 'W"

FOR NTPC USE

DOC. NO.:		REV..... CAT.....
REVIEWED BY	APPROVED BY	APPROVAL SEAL

Annexure-F

Annexure-G5

SUPPLIER'S LOGO	SUPPLIER'S NAME AND ADDRESS	FIELD QUALITY PLAN		PROJECT : PACKAGE : CONTRACT NO. : MAIN-SUPPLIER:
		ITEM : SUB-SYSTEM:	QP NO.: REV. NO.: DATE: PAGE: ..., OF....	

SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS OF CHECK #	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		REMARKS
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	10.

MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER
SIGNATURE	

LEGEND: * RECORDS, INDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
LEGEND TO BE USED: CLASS #: A = CRITICAL, B=MAJOR, C=MINOR;
'A' SHALL BE WITNESSED BY NTPC PQA, 'B' SHALL BE WITNESSED BY NTPC SR.CTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER. (A & B CHECK SHALL BE NTPC CHP STAGE)

FOR NTPC USE

DOC. NO.:		REV.....
REVIEWED BY	APPROVED BY	APPROVAL SEAL

ANNEXURE – H

NTPC DRAWING NO.

OWNER :

THE SINGARENI COLLIERIES COMPANY LTD.
(A Government company)
POWER PROJECT DIVISION

CONSULTANT :

एन टी पी सी लिमिटेड
NTPC Limited
(A Government of India Enterprise)
CONSULTING WING

PROJECT :

SCCL COAL BASED THERMAL POWER PLANT
(2 X 600MW)

PACKAGE

BOILER TURBINE GENERATOR PACKAGE

CONTRACTOR

BHARAT HEAVY ELECTRICALS LTD.
POWER SECTOR
PROJECTS ENGINEERING MANAGEMENT
NEW DELHI

DEPT CODE		NAME	SIGN	DATE
	DRN			
	CHD			
	APPD			

TITLE

LEGEND

							DEPT.	SCALE	DRAWING NO.	
							SIGN			
							DATE		SHEET 1 OF 1	REV. 00

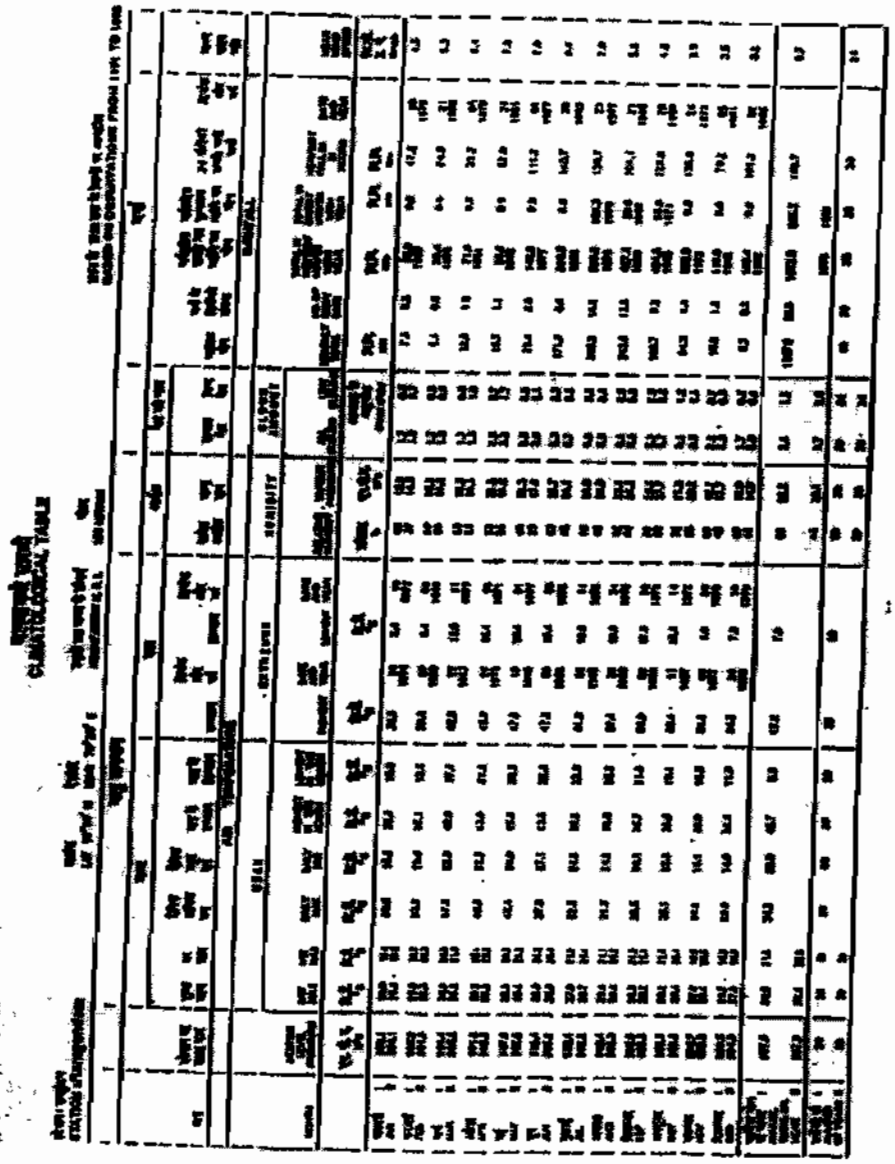
CLAUSE NO.	PROJECT INFORMATION

Annexure-I

CLIMATOLOGICAL TABLE

ANNEXURE-III

(PAGE 1 OF 1)



Annexure-J (1/2)

CLAUSE NO.	QUALITY ASSURANCE

Outdoor Transformers

Annexure-QA-6

Attributes / Characteristics / Items/ Components Sub Systems	Visual & Dimensional Checks	Mechanical properties	Electrical strength	Thermal properties	Chemical Composition	Compatibility with oil	NDT / DPT / MPI / UT	Ageing Test.	Voltage Ratio, Vector Group & Polarity, Magnetic Balance Test	Make / Type / Rating / Model / TC / General Physical Inspection.	2 kV Isolation test on core	WPS & PQR	Routine Test as per relevant standard	Vacuum & Pressure Test	Tan delta
Tank, H.V. & L.V. Cable Box / Flange throat	Y	Y					Y							Y	
Conservator / Radiator / Cooler / Pipes	Y	Y					Y								
Copper Conductor (IS:191)	Y	Y	Y		Y										
Insulating Material	Y	Y	Y	Y	Y	Y									
CRGO Lamination & Built Core	Y	Y	Y		Y	Y									
Bushing / Insulator (IS:2544 / 5621)	Y	Y											Y		
Gasket	Y				Y	Y		Y							
Air Cell	Y														
Transformer Oil													Y		
On Load / Off-Circuit Tap Changer (IEC :214)	Y												Y		
Core Coil Assembly & Pre-tanking	Y								Y		Y				
Marshalling Box	Y	Y					Y						Y		
WTI, OTI, MOG, PRD, Thermister, Breather, Terminal Connector, Bushing CT, Fan & Pumps with Drives, Impact Recorder, Buchholz Relay, Globe & Gate Valve, PD Detector, FRA and DGA Equipment										Y			Y		
Welding (ASME Sect-IX)	Y											Y			
OCTC (Before installation in transformer) (For 132 kV Transformers)															Y

Annexure-J (2/2)

CLAUSE NO.	QUALITY ASSURANCE

Attributes / Characteristics / Items/Components Sub Systems	Oil Leakage Test	Jacking test followed by DP Test on load bearing Member	DGA of Oil for main tank and OLTC Chamber	Measurement of capacitance and tan delta	Partial Discharge measurement (long duration)as per IEC-76 clause No. 12.4	Routine Test	Paint Shade, Thickness and finish	Nitrogen Dew Point Measurement before final packing on transformer at receipt at site.
Complete Transformer (IS: 2026 / IEC:76)	Y	Y	Y	Y	Y	Y	Y	Y

Notes : 1) This is an indicative list of checks / tests. The manufacturer is to furnish a detailed quality plan indicating the Practice and procedure along with relevant supporting documents during QP finalisation for all items. 2) All major Bought Out Items will be subject to Employer approval.

SECTION 4

GUARANTEED AND TECHNICAL PARTICULARS

S. No		Description	Unit	Particulars
1		Name of manufacturer		
2		Rating		
	a)	Normal full load output at normal tap	kVA	
	b)	Continuous output at nominal tap (corresponding to IS rating)	kVA	
	c)	Voltage between HV side and neutral	kV	
	d)	Voltage between LV side and neutral	V	
3		Maximum temperature rise of		
	a)	Windings (by resistance method)	°C	
	b)	Cores (by thermometer)	°C	
	c)	Oil (by thermometer)	°C	
4		Magnetizing current and power		
	a)	at normal voltage and frequency ()	A	
	b)	at max. voltage and normal frequency	A	
5		Core Loss		
	a)	- at normal voltage and frequency	kW	
	b)	- at maximum voltage and frequency	kW	
6		Resistance of windings		
	a)	Resistance of HV windings per phase	Ω	
	b)	Resistance of LV windings per phase	Ω	
7		Copper loss at normal voltage and current al normal tap	kW	
8		Core		
	a)	Max. Induction at normal voltage and frequency	lines /cm^2	
	b)	Grade of laminations used		
	c)	Type of insulation between core stampings		
9		Efficiency at max. permissible temperature, at unity and 0.8 power factors (p.f.)		
10		Efficiency at max. permissible temperature, at		
	a)	125%		
	b)	100%		
	c)	75%		
	d)	50%		
	e)	25%		
11		Maximum working current density of		
	a)	HV winding	A/m m^2	
	b)	LV winding	A/m m^2	

S. No		Description	Unit	Particulars
12		Reactance drop on full load	%	
13		Regulation		
	a)	- at full load & unity p.f. at 75°C	%	
	b)	- at full load & 0.8 p.f. lag at 75°C	%	
14		Impedance	p.u.	
15		Details of tappings on HV side		
16		Overload capacity of transformers for 2 hours	%	
17		Minimum clearance to earth		
	a)	of primary winding in and out of oil	mm	
	b)	of secondary winding in and out of oil	mm	
18		Width of oil duct between core and LV winding and between LV and HV winding	mm	
19		Impulse strength of HV winding (stating wave form adopted)	kV	
20		Total radiating surface	m^2	
OTHER PARTICULARS				
21		Overall dimensions of the transformer (L x B x H)	mm	
22		Weights		
	a)	Core laminations	kg	
	b)	Winding (Copper)	kg	
	c)	Transformer core (coil & insulation)	kg	
	d)	Tank and fitting	kg	
	e)	Oil	kg	
	f)	Transformer complete with oil	kg	
23		Oil		
	a)	Quantity required for first filling	litres	
	b)	Class		
	c)	Maker's name		

Also as per SCCL (2X600MW) BTG package, Technical Specification enclosed as below:

Section-VI, Part-G, Technical Data Sheet – LT TRANSFORMERS, 3Pages

CLAUSE NO.	Bidder's Name .....

Technical Data Requirements

OUTDOOR/INDOOR TRANSFORMERS

S.N.	Parameters	
1.01	Manufacturer's name and address	
1.02	Standard Applicable	
1.03	Rating (MVA)	
1.04	Voltage ratio	
1.05	Vector group	
1.06	Type of Cooling	
1.07	Magnetising Inrush current (Amps)	
1.08	Guaranteed positive sequence Impedance between HV & LV at 75 deg.C at Principal tap/ Max Tap / MinTap	
1.09	Tap Changing equipment (Make & Type)	
1.10	Nos. of radiators & rating as % of trans. cooling equipment	
1.11	Thermal Data	
	a) Temperature rise in top oil over an ambient of 50 deg.C	
	b) Temperature rise in winding by resistance measurement method over an ambient of 50 deg.C	
1.12	Bushings Make & Type	
	(i) HV	
	(ii) LV	
	(iii) HVN	

CLAUSE NO.	Bidder's Name	
S.N.	Parameters	
	(iv) LVN	
1.13	Proposed method of transformer transportation	
	(i) Oil filled or N2 filled	
	(ii) Road Freight/ Rail Freight	
1.14	Approximate Dimensions (in mm)	
	a) Tank: (lxbxh)	
	b) Overall with radiators: lxbxh	
	c) Radiator overall:lxbxh	
	d) Height of untanking	
	e) Shipping dimensions	
	f) Largest package lxbxh	
1.15	Weight of the followings(in Kgs):-	
	a) Core	
	b) Copper	
	c) Total insulation	
	d) Tank & fittings	
	e) Oil (Kg)	
	f) Untanking weight	

CLAUSE NO.	Bidder's Name .....

S.N.	Parameters	
	(heaviest piece)	
	g) Total weight	
	h) Total shipping wt.	
	i) Radiator bank	
1.16	NGR	
	a) Make	
	b) Voltage rating	
	c) Resistance	
	d) Short time current and duration	
	Dry Type Transformer	
1.01	Manufacturer's name and address	
1.02	Standard Applicable	
1.03	Rating (MVA)	
1.04	Voltage ratio	
1.05	Vector group	
1.06	Thermal Data	
	a) Temperature rise in winding by resistance measurement method over an ambient of 50 deg.C	
1.07	Approximate Overall Transformer Dimensions	
1.08	Total Weight of Transformer	
1.09	PD level for coil (maximum)	

SECTION 5

ENCLOSURES TO SPECIFICATIONS

ANNEXURE 1	NO DEVIATION CERTIFICATE (1sheet)
ANNEXURE 2	CHECK LIST OF INFORMATION TO BE FURNISHED WITH THE OFFER (1sheet)
ANNEXURE 3	PROVENNESS CRITERIA FOR ISOLATORS: ATTACHMENT-3A12 (4 sheets)
ANNEXURE 4	BREAK UP OF TYPE TEST CHARGES PRICED IN SCHEDULE-2 (1sheet)
ANNEXURE 5	CHECKLIST FOR 11KV/433V AUX. DISTRIBUTION TRANSFORMER (4 sheets)

ANNEXURE-1

It is confirmed that there are no deviations and the offer is in full compliance with the specification. It is also confirmed that there are no deviations in any other form such as comments, variations and/ or exceptions. Further it is confirmed that at all drawings / data sheets/QP/ type tests reports shall be submitted to BHEL for organising approval of ultimate customer. Also, furnishing of all relevant information / repetition of type tests (if required for meeting the specification requirement) shall be carried out by us at no extra cost to BHEL & without affecting delivery requirements.

Signature of the authorized representative of Bidder

Name _____

Designation _____

Place _____

Date _____

Company seal

Annexure-2

CHECK LIST FOR INFORMATION TO BE FURNISED WITH OFFER

BIDDER SHALL PUT A TICK '✓' **IF THE INFORMATION IS ENCLOSED WITH THE OFFER, PUT A CROSS 'X' IF THE INFORMATION IS NOT ENCLOSED OR WRITE 'NOT APPLICABLE' IF THE QUERY/ SCHEDULE IS NOT RELEVANT AND RETURN THIS CHECKLIST AS PART OF THE OFFER DULY SIGNED**

The offer may not be considered if the following information and this Checklist are not enclosed with the offer.

BIDDER: OFFER REFERENCE:

1. Technical offer with detailed schedules of equipment/ material and spares _____
2. Guaranteed Technical Particulars _____
3. List of past supplies complete with purchase Order & Project name, quantity, order reference, etc. where identical equipment have been supplied. _____
4. Manufacturer's quality plans for approval _____
5. Field Quality plan for approval _____
6. General Arrangement drawings with dimensions and weights and foundation/fixing details _____
7. Drawing/data submissions schedule _____
8. Type test reports. The type test reports shall be accompanied with a list listing all the relevant clauses of the applicable standard and the corresponding type test report. The manufacturer shall also furnish a certificate certifying that the test reports have been carried out on equipment identical in all respects to the one offered. In case the reports are for different equipment and the applicability of the report is permitted as per applicable standards, the justification shall be enclosed to the list of type test reports. _____
9. Bar Chart showing time schedule showing time required for design, manufacture, test and inspection, transport, erection, site testing and commissioning _____
10. Makes of all important components, like motors, operating switches, fuses, etc. _____
11. Provenness Data _____
12. Any additional information called for in any part of the technical specification. _____

Date: **Signature of the authorized representative of Bidder**

Company Seal

Annexure-3

BOILER TURBINE GENERATOR PACKAGE FOR
SINGARENI THERMAL POWER PROJECT (2X600 MW)
BID DOCUMENT NO. CW-9596-108
[Experience details of Sub-Vendor Qualification
as per Item 4.6.5 of Sub-Section-IIA-01, Part-A of Section-VI]

Sub-Vendor's Name and Address :

To
Employer's Name and Address

Sub: ***Sub-Qualifying Requirement for LT Outdoor Transformer***

(I) We/Our confirm that we..... have manufactured & supplied atleast two (2) numbers of 16 MVA, 11 KV or higher rating oil filled transformers which are in successful operation in at least two (2) different installations for a period of atleast two (2) years as on date of bid opening as per stipulated requirements mentioned at Clause No. 4.6.5 of Sub-Section-IIA-01, Part-A of Section-VI of Bidding Documents. The details of the same are given below:

Sl. No.	Item Description	Installation No.1	Installation No.2
1.00.00	Name of the station and its location		
1.01.00	Client name and its address, Fax and Tel. No.		
1.02.00	Name and designation of the responsible person in client's organisation		
1.03.00	Contract No. & Date		
1.04.00	Voltage Ratio		
1.05.00	MVA Ratings		

Sl. No.	Item Description	Installation No.1	Installation No.2
1.06.00	Voltage Class of transformers		
1.07.00	Date of Commissioning of transformers		
1.08.00	Date of commencement of successful operations		
1.09.00	Scope of work executed for aforesaid transformers included the following :		
	(i) Manufacturing	Yes/No	Yes/No
	(ii) Supplied	Yes/No	Yes/No
2.00.00	Certificate(s) from the client(s) are enclosed along with the bid at Annexure-..... to this Attachement-3A-12.		

B. We confirm that we..... have our own facilities for conducting all routine and type tests on transformers as per IS:2026 (except short circuit test) as per stipulated requirements mentioned at Clause No. 4.6.5 of Section-IIA-01, Part-A of Section-VI. The details of the same are given below:

Sl.No.	Name of Test	Yes/No
1.	**Routine Tests :**	
	(a) Measurement of Winding resistance	
	(b) Measurement of voltage ratio and check of voltage vector relationship	
	(c) Measurement of impedance voltage, short circuit impedance (principle tapping) and load loss	
	(d) Measurement of No load loss and current	
	(e) Measurement of insulation resistance	
	(f) Dielectric test	
2.	**Type Test**	
	(a) Measurement of Winding resistance	
	(b) Measurement of voltage ratio and check of voltage vector relationship	
	(c) Measurement of impedance voltage, short circuit impedance (principle tapping) and load loss	
	(d) Measurement of No load loss and current	
	(e) Measurement of Insulation resistance	
	(f) Dielectric test	
	(g) Temperature rise	

Note :

1) Bidder's to use their own format for giving details of all routine and type test facilities available with them.

2) Certificates from client(s) must also be attached as Annexure..... to this Attachment-3A-12.

C. We hereby confirm that 16 MVA, 11 KV or higher rated oil filled transformer manufactured by us have been successfully short circuit tested to meet requirements mentioned at Clause 4.6.5 of Sub-Section-IIA-01, Part-A of Section-VI. The details of the same are given below:

Sl. No.	Item Description	Details
1.00.00	Name of the station and its location	
1.01.00	Client name and its address, Fax and Tel. No.	
1.02.00	Name and designation of the responsible person in client's organisation	
1.03.00	Contract No. & Date	
1.04.00	Voltage Ratio	
1.05.00	MVA Ratings	
1.06.00	Voltage Class of transformers	
1.07.00	Date of Commissioning of Transformers	
1.08.00	Date of Commencement of successful operations	
1.09.00	Short circuit test conducted successfully	Yes/No
2.00.00	Certificate(s) from the client(s)/Lab are enclosed along with the bid at Annexure-..... to this Attachement-3A-12.	

Note :

1) Bidder may provide any additional information regarding short circuit test on transformers and enclose along with their bid at Annexure..... to this Attachment-3A-1.

2) If needed bidder may use own performa for giving necessary details regarding short circuit test conducted on transformers and enclose with their bid at Annexure..... to this Attachment-3A-12.

Date :

Place :

(Signature).....

(Printed Name).....

(Designation).....

(Common seal).....

Sl. No.	Description of Test	Charges for each Type/ Rating	No. of Type/ rating	* Total Charges
1.	2.	3.	4.	5.
7.0	**LT Transformer (Outdoor)**			
7.1	Noise level			
7.2	Short circuit test			
7.3	Temperature rise test			
7.4	CW Lightning Impulse on HV & LV winding as per IEC 76			
8.0	**LT Transformer (Indoor)**			
8.1	Noise level			
8.2	Short circuit test			
8.3	Zero sequence impedance			
8.4	Temperature rise test			
8.5	CW Lighting Impulse test on winding as per IEC			
8.6	Partial discharge test			
8.7	Measurement of harmonics of no load current			

[redacted]

RETURN THIS CHECKLIST AS PART OF THE OFFER DULY SIGNED

The offer may not be considered if the following information and this Checklist are not enclosed with the Offer.

[redacted]

Sl. No.	Parameters	Data	Compliance	Remark
(a)	Applicable IS	IS:2026 / IEC: 60076	Yes	
(b)	Rated Voltage (i) HV Winding (kV) (ii) LV Winding (kV)	 (i) 11000 (ii) 0.433	 Yes Yes	
(c)	Service- (i) Outdoor/ Indoor	(i) Outdoor	Yes	
(d)	% Impedance	As per IS/IEC	Yes 5%	
(e)	Rated frequency (Hz)	50	Yes	
(f)	Number of phases	3	Yes	
(g)	Connections (i) HV Winding (ii) LV Winding	 (i) Delta (ii) Star	 Yes Yes	
(h)	Winding Connections	Dyn 11	Yes	
(i)	Type of cooling	ONAN	Yes	
(j)	Tap changing equipment (i) Type (ii) No. of steps	 Off circuit tap change switch +5% to -5% in steps of 2.5% on HV side	 Yes Yes	
(k)	Maximum Temperature rise over an ambient of 50 °C (i) Oil (if applicable °C) (ii) Windings (°C)	 (i) 50°C (ii) 55°C	 Yes Yes	
(l)	Withstand time for three phase short circuit at terminals (second)	2 sec	Yes	

(m)	Insulation level (A) Power frequency voltage withstand (i) HV Winding (kV rms)- (ii) LV Winding (kV rms)- (B) Basic Impulse level (i) HV Winding (kVp) (ii) LV Winding (kVp) (C) Highest voltage (i) HV Winding (kV) (ii) LV Winding (kV)-	 (A) (i) 28 (ii) 2 (B) (i) 75 (ii) NA (C) (i) 12 (ii) 1.1	 Yes Yes Yes Yes Yes Yes	
(n)	Terminal arrangement (i) High voltage- Suitable for Cables /Overhead conductor (ii) Low voltage- (iii) LV Neutral-	 (i) Cables (ii) Cable box (iii) Cable box	 Yes Yes Yes	
(o)	Bushing (A) High voltage side (i) Rated Voltage(kV) (ii) Rated Current(A) (iii) Basic Impulse level (kV) (iv)Minimum Creepage distance (mm) (v) Wet and dry power frequency Winding Voltage (kV rms) (B) Low voltage and Neutral (i) Rated Voltage(V) (ii) Rated Current(A) (iii) Minimum Creepage distance	 (A) (i) 12 (ii) 100 (iii) 75 (iv) 300 (v) 28 (B) (i) 0.433 (ii) 1000 (iii)11	 Yes Yes Yes Yes Yes Yes Yes Yes	
(p)	Minimum clearance (mm) in air (i) Phase to Phase (HV side) (ii) Phase to Earth(HV side) (iii) Phase to Phase (LV side) (iv) Phase to Earth(LV side)	 (i) 280 (ii) 140 (iii) 25 (iv) 25	 Yes Yes Yes Yes	
(q)	Method of Earthing	Solidly earthed	Yes	

Y. Loss figures as per cl 1.2.1.7 of Section-1 — Yes

Whether Type test reports of the tests conducted earlier (not more than 10 **years from 11.11.2011**) on similar equipment submitted.

YES

If type test report submitted, indicate report number.

Sl. No.	TESTS	REPORT NO.
A	**Type tests**	
1.	Measurement of winding resistance	
2.	Measurement of voltage ratio and check of voltage vector relationship	
3.	Measurement of impedance voltage /short –circuit impedance (principal tapping) and load loss	
4.	Measurement of no-load loss and current	
5.	Measurement of insulation resistance	
6.	Dielectric test	
7.	Temperature –rise	
8.	Test on on–load tap –changers, where appropriate	
B	**Special Tests**	
1.	Short circuit tests	
2.	Measurement of acoustic noise level	
3.	Measurement of Zero Impedance of three-phase trasnsformer	
4.	Measurement of the harmonics of the no load current	

If the valid type test reports are not available with the bidder then the above mentioned tests shall be conducted by the bidder without any cost/ delivery implication to BHEL/SCCL.

YES

Bidders are required to furnish the following mandatory informations/ confirmations failing which the offer shall be liable for technical rejection.

Sl.no.	***Description***	***Bidder's confirmation***
1.	Confirm whether the scope shall be as per cl.1.0 section-1.	
2.	Confirm the schedule of items and quantities of main equipment have been quoted as per cl.1.3.1 of Section 1.	
3.	Confirm the main equipment is inclusive of all accessories as per specification.	
4.	Confirm the price list for mandatory spares have been quoted as per cl.1.3.2 of section-1.(bidders to quote prices for all items individually)	

Sl.no.	*Description*	*Bidder's confirmation*

5. Confirm acceptance to type testing requirement as per clause 1.4.1 of section-1.

6. Confirm acceptance to routine tests as per clause 7.08.00 of SCCL Technical Specification.

7. Confirm that the charges have been quoted for type tests as per clause 1.4.2 of section-1.
(bidders to quote charges for each test under this clause individually)

8 Confirm that the offer meets Provenness of L.T. outdoor transformer as per cl. 1.5 of section-1.

9 Whether schedule of technical deviations enclosed. Bidders to submit the schedule duly filled up even if the offer has NIL DEVIATION.

Date:

Signature :

Name:

Designation & Company Seal: