ODISHA POWER TRANSMISSION CORPORATION LIMITED

(A GOVERNMENT OF ODISHA UNDERTAKING)
Janpath, Bhoinagar, Bhubaneswar-751022, Odisha.

CORRIGENDUM-6 to

Invitation for Bids No CPC- NIT/OPTCL/OPSEAP/ 31 /2013-14 Dt: 28/02/2014

Bidders are requested to follow the following documents uploaded before quoting:

Bid Identification No.	Following documents are uploaded
ICB Document No: OPTCL/ADB-OPSEAP/2014/Package-I Lot-1:132 kV Sub-Station Work. Lot-2:132 kV Cabling Works	1. Reply to tech query 2. Reply to commercial query 3. EQC amendment 4. Revised Technical spec for UG cable. 5. 33 & 11 KV Indoor switch gear spec 6. Technical spec for HDPE 7. GTP for 132 KV cable. 8. 132 KV DC cable trench. 9. 132 KV SC cable trench. 10. Revised Price schedule 1st July2014 for quoting (in excel format).

NOTE: All other terms and condition of the Invitation for Bid shall remain unchanged.

01/07/2014

Chief General Manager (CPC)

Technical Queries - PACKAGE- I (LOT 1 & 2)

Sl. No	Reference	Bidders Queries	OPTCL's Reply
1	Design Services For LOT-1 &2	As per the Schedule-3, design Services of price schedule is not applicable, We presume that all the structurals as well as Civil drawings required for the construction of substation shall be provided by the OPTCL. Kindly provide the same.	bidders should fallow the the s/s layout, and GIS building drawing
2	Technical Sepecification For LOT-1 &2	As per the tender documents the geotechnical data are not given. Kindly provide the same.	Soil Testing to be done during design stage
3	Scope of Supply of Plant and Services: (Package-I) For LOT-1	As per the BOQ is given in the bid documents Surge arrestor Quantity is not given in BOQ, but it is mentioned in the scope of Supply of Plant and Services: (Package-I). Refer page no 106 of 223 in Bid documents.	Fallow the revised Price Schedule
4	GIS (Technical Specification) For LOT-1	a. clause no. 3.2.1 of GIS TS – It is mentioned on page no 12 of TS"Breaker disposition must be horizontal"Please confirm whether Vertical disposition of Breaker is acceptable.	Tech. specification stands
		b. Item 3.1.4 of GIS TS - it is mentioned that "The Gas loss of the switchgear shall be in no case higher than 0.5% per year. (as per IEC)" Where Item 3.1.9 GAS Loss mentioned that "Maximum guaranteed gas leakage loss of the switchgear shall be in no case be more than 0.2% per year" Please confirm which of the above shall prevail.	as specified in IEC
		c. Details of the Technical particulars of Current Transformer is required.	uploaded
		Regarding Drawings:- i. Please confirm that there's no main-busbar PT on the SLD.	132 kV Bus PT should be there in main bus
5	Vol- II,Technical Docs For LOT-1	As per the Technical specifications available in the bid documents, TS for these equipments PLCC, substation earthing system, and Power and control cable are not given. Kindly provide the same.	No PLCC, others as per standard
6	Vol- II,Technical Docs For LOT-1	Kindly provide the GTP for the 40MVA power transformer.	**supply is under OPTCL scope**
7	Vol- II,Technical Docs For LOT-1	For a better compatibility for this project, you are requested to kindly provide the supplier drawings alongwith GTP for Control and Protection in the existing substations Narendrapur, Chatrapur and Berhampur.	thease can be supplied after contract award
8	BOQ and TS of 132kV UG cable For LOT-2	As per the BOQ, the laying of cable is given as open trench method however as per TS, it is mentioned as Direct buried. Kindly clarify the same and also provide the complete specifications alongwith drawings for the same.	Follow uploaded trench drawings
9	Technical For LOT-2	This is reference to Satellite picture for the cable laying route as given in attached PDF file name 132kV_BerFeeder_Satelite, at some location the two cables are to be laying. In this case the proposed trench is valid for two circuit run (2 x 3 runs) or (1 x 3 runs) separately. Kindly confirm the same.	Fallow the the SLD provided . Trench dwg is uploaded
10	General For LOT-2	For installation of 132kV cabling, kindly provide us the details of the underground obstacles present in the course of cable laying route available with you. Eg. Pipelines, Existing cables, structures etc.	Under the Bidder's Scope

11	Schedule No. 2, Item No. 1.5 and 1.6	In BOQ End Termination kits are mentioned while design and drawing of structure for mounting cable termination kits is not given. Please provide.	As specified IEC Standard
12	132KV Cable Specs Package 1, Lot 2	Please clarify the type of formation (Flat/Trefoil) to be considered for laying of cable.	The Laying should be Trefoil
13	132KV Cable Specs Package 1, Lot 2	Trench drawing is not available, please provide.	uploaded
14	132KV Cable Specs Package 1, Lot 2	RCC Slabs/Tile Drawing is not available, please provide.	size as per cable trench drawing with standard allowed dimention
15	132KV Cable Specs Package 1, Lot 2	Route Marker drawing, Spacing interval & Design specifying the type of Route Marker as Pre-cast RCC or Steel is required. Please provide.	uploaded
16	132KV Cable Specs Package 1, Lot 2	Joint bay/Chamber drawing is not available, please provide.	Bay- 6 mtr x2.6mtr,depth 1.4 mtr having a consolidated base.There should be temporary suttering arrangements to prevent collapse of wall.It will be covered with dismentlable aluminium sack having window and doors at both sides for climate control.
17	1.1, 2	Plant and equipment such as Transformers, GIS Switch Gears, Control Relay Panel , CT & PT, CVT, LA, VCB, UG XLPE Cables and EOT Crane to be supplied by the bidder or its Sub-Contractor/Manufacturer should have been type tested from an Internationally accredited laboratory (KEMA, Holland/ EDF, France/Hydra-Quebec, Canada/CESI, Italy/CPRI, Bangalore, India / IPH Germany/ KERI, Korea) within last 5 years reckoned from the due date of submission of bid and meet the minimum Guaranteed Technical Particulars prescribed by the Employer. Request clarification that the type test reports from any Internationally accredited laboratory are acceptable in addition to the labs indicated above. Further, with respect to the UG XLPE covered under plant and equipment i.e., 132kV 630sq.mm and 800sq.mm sizes; in line with the practice and provision of the related IEC specifications, type test reports for 132kV or higher voltage grades for UG XLPE cables on BOQ sizes or above which are within last 5 years reckoned from the due date of submission of bid are requested to be accepted to meet the minimum guaranteed technical particulars prescribed by the employer. However, in case the type test reports furnished are not for the quoted cable but for the cable with higher voltage class and / or higher conductor size, then type test reports shall be submitted for the quoted cable before offer of inspection of cable. Request acceptance of the same.	For the time being, the type test reports from any Internationally accredited laboratory are not acceptable excpet those mentioned in the tender. Submission of type test report for UG XLPE type test report of same voltage class and same cable size as per the GTP shall only be acceptable.

18	1.2.6 i	The clause indicates that the cost of mandatory spares, Optional maintenance equipment & spares and special tools & tackles shall be deemed to be included in the cost of plant. Hence, the same shall not be considered for the purpose of comparative evaluation. While normally the cost of maintenance equipment & spares or recommended spares is not considered for the purpose of comparative bid evaluation, but the cost of mandatory spares as defined by the employer is normally considered for the purpose of comparative evaluation. Since, no mandatory spares are indicated in the BOQ, in order to ensure a fair comparative evaluation, request provision of the quantities under mandatory spares in the BOQ suitably. Request clarification	Mandatory Spares and Special Tools include in Price Schedule(Revised)
19	2.5	For LOT-2: As a part of qualification requirements specified under this clause, the bidder is required to demonstrate that he has the listed key equipment i.e., 01Km of 132kV 800sq.mm XLPE insulated cable. Our understanding is that the NIT condition calls for the demonstration or exhibition of holding 01Km of this 132kV cable in bidders stocks. Since, these EHV cables of any voltage grade or any size are of one hundred percent custom manufactured items and hence the need of holding any of these cables in stock does not arise. Accordingly, we request your acceptance on submission of a manufacturing capacity of these items, which is duly certified by chartered engineer.	Manufacture's Authorization required
20	2.6 Item No.1	For LOT-2: As a part of qualification requirements specified under this clause, the manufacturer / subcontractor should have supplied at least 25% of the following major items (identified) of the total BOQ quantity during last three financial years. For transmission of a specific MVA load, say 100MVA the cable cross section in lower voltage category 66kV IS HIGHER, 132kV shall be lower, 220kV is still lower. On account of the above, 800sq.mm Cu/Al conductor XLPE cable of 132kV grade is very rare size from any transmission utility or user. Under the circumstances, request to please accept the same as 630sq.mm or above Al/Cu XLPE cable 66kV, 132kV, 220kV.	800 sq mm Cu cable is not a rare specification .However 630 sqmm or higher cu cable is acceptable for 110 kV or above voltage class
21	Annexure-II (i)	We read ICE mentioned as IEC.	"ICE" Typographic mistake, it is "IEC"

22	Annexure-II (j)	It indicates that the contractor to note to make his own arrangement to carry out pre-commissioning and guarantee tests and the employer will not supply and make available any raw materials, utilities. We submit that as per IEC-60840-2011, clause no. 16.3, for the purpose of carrying out the commissioning test of 132kV cabling systems, (a) A.C. Voltage to be applied shall be subject to agreement between the purchaser and the contractor. The waveform shall be substantially sinusoidal and the frequency shall be between 20Hz and 300Hz. A voltage of 132kV shall be applied for 1 Hr.OR (b) Alternatively, a Voltage of Uo provided by the employer may be applied for 24hrs. Request clarification that the no-load Uo shall be made available by the employer for the purpose of carrying out the above 24 hrs no-load test (soak-test).	132 kV power supplyshall be made available to the Cotractor by Employeer(OPTCL) suject to precommissioning test of bay with adequate protection and approval from the competent authority.
23	Package – I, LOT-2 STP for 132kV Cable Tech Spec - 132kV Cable	As per STP, 132kV cables as per Sl No. 16, are to be provided with radial moisture barrier of copolymer – coated (both sides) Aluminium Tape over non-conducting longitudinal moisture barrier. However, as per the Technical Specification for 132kV cables, under the principal parameters provided under Sl No. 1.3, it is indicated that a corrugated aluminium armouring is to be provided. Radial moisture barrier of Poly-Al tape with Cu wires screen is not at all recommended for this circuit which is in coastal areas and likely to be subjected to inundated water (sealing water).	Corrugated Aluminum sheath to be provided
24	Package – I, LOT-2 STP for 132kV Cable Tech Spec - 132kV Cable	1.3.5 Cable Parameters of Tech Spec for 132kV cables indicates the required sizes as : 630mm², 800mm², 1000mm², 1200mm². Whereas, STP for 132kV cables, the sizes are 630mm² and 800mm² only. Request clarification.	basic parameters , mechanical & physical parameters will same.Only 630& 800 sq mm.
25	Package – I, LOT-2 STP for 132kV Cable Tech Spec - 132kV Cable	As per the Tech. Spec. for 132kV cables, Sl.No.1.3 corrugated aluminium sheathing is called for. Corrugated Al armouring is an incorrect terminology. a) Armouring is not at all advisable for extra high voltage cables since there will be an additional induced voltage and circulating currents in the armour which is detrimental. If the contention is a corrugated Al sheath, this will meet the short circuit requirements of the system BUT Again not a fool proof radial water / moisture barrier for the conditions as indicated above. The best solution for the above site conditions is use of required thickness lead sheath with tinned copper wire screen along with tinned cu/bronze helical tapes which will carry the system fault current as well as the site conditions.	No armouring is required

26	Package – I, LOT-2 STP for 132kV Cable Tech Spec - 132kV Cable	1.4 a) Operational Characteristics of Tech Spec for 132kV cables indicates that one/two, three – phase feeders, each consisting of 1 runs of 4 single core cables, feed power at 132kV. Since the same is not clearly understood by us, request clarification whether you are looking a single circuit feeds comprising of 4 runs of 132kV single core cables with 1 cable as spare or only 3 cables to feed power at 132kV. In case of spare cable in each feeder is envisaged, the quantities in the BOQ / BOM is required to undergo changes.	only 3 cables to feed power at 132kV . No spare core
27	Package – I, LOT-2 STP for 132kV Cable Tech Spec - 132kV Cable	1.5.2 Conductor Screen indicates that the minimum thickness of the same shall be 0.55mm. However, STP, indicates that the minimum average thickness of the same shall be 1.50 mm. Request clarification.	It should not be lesser than 1.5mm
28	Package – I, LOT-2 Tech Spec - 132kV Cable	1.5.7 It calls for the provision of HDPE (ST-7) outersheath which is extruded but having the red / yellow / blue colour or similar (as per phase). To give RYB coloured outer sheath could not recommended since pigmentation (to get the required colour) affects the properties of the base polymer HDPE (ST-7)	Outer sheath will be black
29	Package – I, LOT-2 Tech Spec - 132kV Cable	1.5.7. It calls for the embossing at every one meter for supplier name, manufacturer name, DMRC, Voltage grade etc. 1.5.11 Identification Marking: It calls for identification markings at three meter intervals to identify Name of Manufacture, Year Of Manufacture and Voltage grade to be printed / embossed at one meter length interval. However, Name of the purchase shall be embossed. Request acceptance that the identification marking be provided either by embossing or by printing at every one meter / at every three meter intervals for Manufacturer Name, OPTCL, Voltage grade etc.,	Embossing is mandatory

30	Package – I, LOT-2 Tech Spec - 132kV Cable	With regard to the Tests and Type Test Reports; It indicates that,a) At Sec-2, BDS, Sl.No. C. Preparation of Bids under ITB 11.2(k), it calls for the submission with the technical bid the type test certificate conducted during last 5 years for 132kV XLPE UG Cable which is one of the major item to be supplied. b) Under Sec-3, EQC, 1.1 Technical Evaluation Sl. No. 2, the following factors shall apply i.e., 132kV XLPE UG Cables to be supplied by the bidder/manufacturer should have been type tested from an Internationally accredited laboratory 1. KEMA, Holland 2. EDF, France/Hydra-Quebec, Canada 3. CESI, Italy 4. CPRI, Bangalore, India 5. IPH Germany 6. KERI, Korea Within last 5 years reckoned from the due date of submission of bid and meet the minimum Guaranteed Technical Particulars prescribed by the Employer. c) At 1.6.1. Type Tests and Type Test Reports: The equipment offered should be type tested. Type test report should not be more than seven years old, reckoned from the date of bid opening, in respect of the following tests, carried out in accordance with ISS-7098/IEC-871, from Govt./Govt. approved test house, shall be submitted along with bid: i) Physical tests for insulation and outer sheath. ii) Bending test iii) Di-electrical power factor test iv) Heating cycle test followed by di-electrical power factor as a function of voltage and PD test v) Impulse withstand test The remaining type test report as per clause 3 of ISS-7098/ IEC-871/IEC-60840 shall be submitted by the successful bidder within three months from the date of placement of order. These type test reports shall be from Govt./Govt. approved test house and shall not be more than five years old, reckoned from the date of placement of order. The failure to do so will be considered as a breach of contract. Request clarifications on the following: 1. We read IEC-871 above as IEC-60840. 2. As explained at Sl.No.9 of this pre-bid query document, request your acceptance that the type test reports from any Internationally accredited laboratory are acceptable in addition to the labs indicated above for 132kV or higher voltage grade for UG XLPE cables on BOQ sizes or above which are within last 5 years reckoned from the due date of submission of bid are requested to be accepted to meet the minimum guaranteed technical particulars prescribed by the employer. However, in case the type test reports furnished are not for the quoted cable but for the cable with higher voltage class and / or higher conductor size, then type test reports shall be submitted for the quoted cable before offer of inspection of cable. Request acceptance of the same.	The type test reports should not be more than 5 yrs old
31	Package – I, LOT-2 Tech Spec - 132kV Cable	We read the existing clause no. 5.7.1 & 5.7.2 as 1.5.7.1 & 1.5.7.2.	OK
32	Package – I, LOT-2 Tech Spec - 132kV Cable	We note that 1000mm² and 1200mm² 132kV single core cables as mentioned under clause no. 1.5.9.3 are not covered under this tender. Request confirmation.	not in scope
33	Package – I, LOT-2 Tech Spec - 132kV Cable	1.8 Test Certificates: We read the relevant specification as IS: 7098 (Part-III)-1985 / IEC-60840 with latest amendments thereof for approval of the purchaser.	Technical specification stands
34	Package – I, LOT-2 Tech Spec - 132kV Cable	1.9 Packing: It calls for supply of 132kV cables on Non-Returnable Wooden Drums. Request acceptance of the same as on Non-Returnable Steel Drums.	Returnable Steel Drums.

35	Section-1, Package –I, LOT-2 Tech Spec For Laying Of Cable	1.1.3 : We read that the EHV cables between OPTCL existing substations and the proposed GIS substation be laid in ground depending upon the site conditions of the site conditions of the selected route(s).	OK
36	Section-1, Package– I, LOT-2 Tech Spec For Laying Of Cable	1.1.4: Cable Laying Cases: Request confirmation that Case-1, flat formation not applicable.	Trefoil
37	Section-1, Package– I, LOT-2 Tech Spec For Laying Of Cable	1.1.5 Details of Case-2: Trefoil Formation: From the bidding documents it is understood that the tendered cables laying takes the position of one trefoiled circuit in one trench at a considerable length and at some length two trefoiled circuits in one trench is likely involved, the indicated trench dimensions may not be correct. Request clarification along with the required trenches dimensions. Further, also clarify that a warning tape marked with purchaser`s name be laid at a desired location in the trench and not the warning net.	Refer trench drawing
38	Section-1, Package – I, LOT-2 Tech Spec For Laying Of Cable	2.1.0 & 2.1.1: Straight Through Joints It indicates that the straight through Joints should be HEAT SHRINKABLE type or cold shrink type of proven technology and make, suitable for underground buried cables. The joint should comprise of stress control sleeves, insulating sleeves and co-extruded dual wall Tubing comprising of an insulating and semi-conducting layer. A mechanical connector with shear head bolts shall make the conductor connection. Heat Shrinkable technology / cold shrinkable is not applicable for accessories both joints and terminations for 132kV and higher category. The available technology which is used by all reputed international accessories manufacturers is pre-moulded joints/terminations. The pre-moulded straight through joints can be supplied with overall heat shrinkable sleeves and with coffin box with a suitable filling compound to provide sufficient protection against water and possible mechanical damages	PRE MOULDED JOINTS TERMINATION
39	Section-1, Package – I, LOT-2 Tech Spec For Laying Of Cable	1.1.8 Details of Case 5 & 7: Indicative arrangement is shown in the drawing. Request to provide the drawing since the same is not available in the bidding documents.	Employer had arranged the site visit of Bidders to ascertain the site situation
40	Section-1, Package – I, LOT-2 Tech Spec For Laying Of Cable	1.1.11 Pulling Chambers: Request elaboration on the necessicity of the pulling chambers. In our opinion, these are not required. Please confirm.	Not required,ref tech spec.

41	Section-1, Package – I, LOT-2 Tech Spec For Laying Of Cable	7.1.0.5 & 7.1.1.4: The cable and cable accessories intended to be used for this work shall be (i) Type-tested within the last ten (10) years period prior to the date of bid opening. (ii) Proven in service for at least two (2) years as on the date of bid opening. Request clarification that the type tests should not be older than 5 years as on the date of bid opening as indicated earlier in the bidding documents.	Ten(10) years is a Typographical Mistake TYPE TEST SHOULD NOT BE OLDER THAN FIVE(5) YEARS AS PER BIDDING DOCUMENT
42	Section-1, Package – I, LOT-2 Tech Spec For Laying Of Cable	7.3.6. Short Circuit Test: It calls for conducting this test at Manufacturer`s works which are approved by KEEMA, Netherlands or CESI Italy or at KEEMA, Netherlands or CESI Milano, Italy and shall be witnessed by the Employer`s authorized representative. Request acceptance of conducting this test if required at CPRI-Bangalore, India which shall be witnessed by Employer`s authorized representative.	CPRI, BANGALORE Accepted
43	Section-1, Package – I, LOT-2 Tech Spec For Laying Of Cable	7.3.11 (iii) : It calls for conducting AC Voltage test for the installation as a part of Pre-Commissioning Test on the completed power cable installation as per Cl. No. 15.2 of IEC-60840. We read the Cl. No. 15.2 of IEC-60840 as 16.3 of IEC-60840 and request confirmation that the required Uo shall be provided by the Owner to carry out the specified no-load commissioning test for 24hrs (soak-test).	Same as Sl.No-36
44	LOT-2, Tech Spec For Construction of Bays.	The bidding documents contains only a general specifications of the equipments like Control Panels, Breaker C.T etc and no Layout and SLD drawings were provided. Further, as seen from the BOQ, these bays are to be constructed at existing sub-stations, the layout and make of various equipment at that station is required. Request to provide a. Detailed scope for bay extension work b. SLD, Layout drawings c. Drawings and makes of equipment at the existing substation d. Earthing drawing of existing sub-station.	DETAIL SPEC, SLD & Other Related Drawings uploaded in OPTCL website
45	Vol II 132KV Cable Spec, Package-I, Lot 2. 1.14 ISO Accrediation	The process stipulated is VCV process. There are other two technologies, one of which is CCV technology being used extensively by International manufacturers, like, M/s Brugg Kabel AG, Switzerland & M/s NKT, Germany for more than 50 yrs. Hence, kindly consider following points and request acceptance of CCV process also : (a) CCV with Twin Trot Rotating Caterpillar System and TROSS mechanism. KEI has intalled this process which is also being used for more than 50 yrs. by reputed international manufacturers like, Brugg and NKT. KEI has produced a 220KV cable with this equipment which passed successfully 220 KV PQ Test (test carried out to determine the long term life of the cable system). . (b) Specifying only VCV process will result in restricted bidding, only 1 manufacturer in India out of the 5 have this process."	Tech. Specification stands

46	Schedule No. 1 - Plant and Mandatory Spare Parts Supplied from Abroad, Item No. 1.9	Please provide the details of existing equipment, layout, section drawing, earthing layout at Berhampur, Chhatrapur and Narendrapur.	not relevant
47	Schedule No. 1 - Plant and Mandatory Spare Parts Supplied from Abroad, Item No. 1.9	Please provide the details of arrangement for Connection of Hybrid GIS to existing busbar at Berhampur	OPTCL arranged the site visit of Bidders of it's own for assessment. Hence Bidders have to furnish the arrangement of connection following all the statutary rules and regulations which will be approved by OPTCL before execution.
48	Schedule No. 1 - Plant and Mandatory Spare Parts Supplied from Abroad, Item No. 1.9	Please provide technical Specification for Control and relay panel for bay extension work at Berhampur, Chhatrapur and Narendrapur.	as specified in IS
49	Schedule No. 1 - Plant and Mandatory Spare Parts Supplied from Abroad, Item No. 1.9	BOQ doesnot Specify any requirement for SAS (Substation Automation System) at Berhampur, Chhatrapur and Narendrapur. Please confirm that it is not required	SAS only at GIS s/s
50	General	We note that as per approved list of OPTCL following make approved for Control and Relay panel ABB/SIEMENS/AREVA/other Manufcaturers using relay of ABB/SIEMENS/AREVA/SEL/GE. Please Confirm	accepted
51	SLD/Price Sch.	OPTCL to confirm whether BUS PT is required or not if required please confirm the same is missing in SLD	132kV Bus PT required. The revised SLD uploaded
52	SLD/Price Sch./ Specification,	OPTCL to confirm whether PT is required or not in transformer bay if required provide the specification in price schedule the same is missing and also confirm whether the same is AIS type or GIS type	PT not required in transformer bay
53	Clause No.3.2.9 of Specification,Pg. No. 21	OPTCL to confirm what type of 132kV termination kit to be used at Transformer Bay side whether it is dry type or wet type and provide the specification accordingly.	The out door sealing end wet type of reputed make.
54		OPTCL to confirm how the circuit will complete from termination kit to Power Transformer	connection throgh ACSR jumper with adequate support arrangement
55	SLD/Price Sch.	The description of isolator arrangement in price schedule for transformer bay and line bay are same which differ in SLD OPTCL to confirm the exact requirement for the same	as per revised SLD
56	Layout/Price Sch.	OPTCL to Clarify the what No. Of EOT Crane is required the quantity is mismatching with Price schedule and Layout	One EOT crane in GIS Building
57	Price Sch.	OPTCL to provide the specification of Water hydrant system for fire fighting	as per standard spec

58	Clause No. C 1.2 of Specification,Pg. No. 6	OPTCL to confirm the requirement smoke detection and annunciation system the same is not reflecting in price schedule	Fallow the revised Price Schedule (Included in price schedule)
59		OPTCL to provide the specification of Air Conditioning and same to be included in price schedule	spilt AC as per requirement from reputed manufacturers
60		Pressurized ventilation system is required in GIS Room instead of providing Window Please clarify.	Accepted
61	Sl.No.8 Clause No. B.3 of specification, Pg No. 6	OPTCL to confirm the capacity of Station transformer the same is mismatching with Price schedule and Layout and specification	Station transformer 33/0.4kV, 250 kVA,
62		OPTCL to modify the GIS Building as marked area for GIS unloading is not possible	as per layout and site requirement
63		OPTCL to confirm supply source of EPAX system	from reputed vendor
64		OPTCL to clarify the significance of B/Z and CSE	B/Z - (Bus zone). CSE-Cable Sealing End
65		OPTCL to provide the specification of OPGW	not required
66		OPTCL to confirm the Control voltage in specification it is mentioned as 110V	Control system Voltage is 220 VOLT D.C
67	Clause No. 3.2.6 Specification,Pg. No. 18	OPTCL to provide the complete 132kV CT specification for this project	Tech Spec uploaded
68	Clause No. 3.2.7 Specification, Pg. No. 20	Bidder will follow the 132kV PT specification mentioned in specification, clause No.3.2.7 Please confirm	as per specification
69	Clause No. A.8 and B.1 of Specification, Pg. No. 6	OPTCL to confirm the requirement of AIS type 132kv and 33kv Surge arrestor GIS Encapsulated Surge arrestor as per specification	As per SLD & Tech Specification
70	Clause No. A.8 and B.2 of Specification, Pg. No. 6	OPTCL to confirm the requirement of AIS type Line 132kV CVT if it is required please incorporate the same in price schedule and clarify incoming line philosophy to GIS end	As per SLD & Tech Specification
71		OPTCL to provide the specification of main earth mat material details	as per IS
72		OPTCL to confirm the what soil resistivity to follow and if conventional method does not reach the soil resistivity then could we considered the chemical earthing for the same	There is no recommendation for chemical earthing
73	Price Sch.	OPTCL to add line item for Battery in price schedule if the same is required	48V D.C
74	Clause No. C.3 Specification ,Pg. No. 6	OPTCL to confirm the exact requirement of battery bank, in specification bidder to provide battery bank for PLCC the same is missing in price schedule	No PLCC
75	Sl. No.14	OPTCL to clarify the meaning of 33kV gantry accessories for 33kV outgoing feeder	Ref. Revised Price schedule
76	Clause No. 3.2.10.2 Specification ,Pg. No. 22	As per specification 1Cx800 sq mm HT cable used for connection between LV side of Transformer to 33kV GIS end but in price schedule 1Cx600 sq mm HT cable used for the same and 1Cx800 sq mm cable is used for HV side of Transformer to 132kV GIS end Please confirm	630 sq mm single core ,33kV

77	SLD/ Clause No. 6.4 of specification ,Pg. No. 33	In specification 33kV GIS is double Bus bar scheme and as per SLD the same is single Bus bar scheme OPTCL to confirm the exact requirement	Single Bus with sectonalizer
78		OPTCL to provide the complete specification of 33kV CT and PT details	Tech Spec uploaded
79	General	As per lay out cable arrangement below CR Panel should run through false floor that item is not in price schedule if OPTCL means the tray arrangemet hang form GIS room ceiling the same is not acceptable due to maintenance point of view.	control cables to be laid in cable trays
80	General	Type test: Further to the referred clause of tender, kindly consider that "Type Test Report of the manufacturer or its principal (holding company) shall be acceptable, if the manufacturer is of international repute".	As specified in Bid Document
81	General	On After sales Support, please clarify whether 'The GIS manufacturer should have (1) Prompt after sale service support having based in India (2) Having HV Testing Kit or not.	As specified in Bid Document
82	Cl: 4,Page 32 of 49	The 33kV GIS shall be suitable for continuous operation with a frequency of 50 Hz only.	As per Tech. Specification
83	Cl:5.2 , Page 32 of 49	As per Client Technical particulars clause no. 21 of 10.1 the busbar continuous Current Rating shall be at 40 Deg ambient & hence we have offered GIS at 40 deg ambient. If incase, the ambient envisaged is 50°C, the continuous current rating of 2000A busbar shall be 1862A and 1250A Circuit Breaker shall be 1164A.	THE TECH PARTICULARS TO BE AT 40 Deg Ambient.
84	Cl:6.4 ,Page 33 of 49	As per SLD the requirement is for Single Bus Bar & hence this caluse is not applicable.	details to be provided
85	Cl:8.1.3 , Page 34 of 49	Vacuum monitoring devices are not available for use in industry market & hence not in our scope of supply. Isolation of interrupter unit is possible through repair windows.	accepted
86	Cl:8.1.5-6, Page 34 of 49	A closing release shall operate correctly at all values of control voltage between 85% and 110% of the rated voltage.	"CLOSING" & "RELEASE" Operation Must Operate Correctly with in limit of Control Voltage
87	Cl:8.2.3-1,Page 35 of 49	In Medium Voltage GIS there is no Fast acting earth switch or grounding switch available. All the switch takes place in CB only, since the earthing of feeder takes place with 3 position swicth (ON-OFF-EARTH) in conjunction with CB which is more proven method & safety to personnel. Pls find the attached procedure for feeder earthing.	accepted
88	Cl:8.2.5-8,Page 36 of 49	Disconnector & Earthing switch is operated by motor operation & not be stored energy type. Completed operations are always ensure by means of reed contact & limit switches. This logic ensure no operation is possible if the disconnector or earthing switch is not fully engaged & also prohibit all further operations until complete contacts are made.	both motorised and manual operation is recommended
89	Cl:8.3 ,Page 37 of 49	CT's shall be Outercone bushing type tape wounded LT CT. Accuracy & Burden & Knee Point voltage details etc shall be calculated based on actual requirement during detail engineering.	As per Tech. Specification
90	Cl:10.3.1,Page 42 of 49	Each gas tank is provided with a gas density sensor which monitors the pressure of SF6 gas inside the gas compartment. In case of any unlikely event of leakage of gas, the sensor shall given an alarm of "low gas pressure" (set at pressure<120kPa). Additionally, we will provide 1 no temperature compensated manometer per switchboard for measurement of gas pressure.	agreed

91	Cl:10.5.1,Page 43 of 49	The offered switchgear is a segregated gas compartment construction i.e each gas compartment is segregated from each other. Also each panel vertical is also segregated from each other. Hence no separate barriers are required between compartments.	agreed
92	Cl:10.8,Page 43 of 49	Our ZX panels are provided with state-of-the-art plug-in type technology for coupling the panels & therefore no additional bellows/compensators are required to preserve the mechanical strength. Hence same is not offered.	agreed
93	Cl:7 (e),Page no. 32	Three Phase enclosed, Single Busbar system is considered.	agreed
94	Cl:8.5.1 (k),Page 41	Mimic shall be Olive green painted on the door.	agreed
95	Cl:8.1.1 -3 ,Page 33	Interrupter assemblies are of fixed type. Incase of fault the same can be rectified/replaced through repair windows provided for each cubicle.	agreed
96	General,General	Kindly clarify the requirement of Surge Arrestors in each module type & in which panel it is required	as per Tech Spec
97	General,General	Kindly provide us the cable data & number of runs per phase.	one cable per phase
98	SLD,SLD	Kindly furnish the detailed SLD with required rating for each feeder & no. of CT cores	Ref to 132 kV spec for rating of cable and select accordingly
99	Page 88 of 94	Typical SAS Architecture diagram provided as a part of technical specification is clearly not visible. We request you to provide the architecture diagram which is clearly visible.	uploaded
100	1.2 (Under 1.0 General),60 of 94	Our scope shall be limited upto ensuring the availability of data at RSCC. Engineering or modification of exisitng RSCC will not be in our scope. Necessary support required for integration will be extended by us.	agreed
101	4.1 (Under 4.0 System hardware),71 of 94	We understand that the requirement mentioned in this clauses are in general and not specifically applicable for this project as there are no future bays shown in the SLD. Please confirm.	Revised SLD uploaded
102	2.1 General system design,60 of 94	We understand that Air conditioned kisok mentioned in this clause not applicable as the Control & Relay Panels will be mounted in Control room building as specified under tender document : Kindly clarify.132_33 GIS Substation Layout	as specified GIS sub station layout
103	4.2 Bay level unit,73 of 94	We request you to furnish the "section project" mentioned in this clause. Incase of non availability of "section project" we shall be offering bay control units for the present bays only. Please confirm.	as per specification
104	3.1.2. Bay protection functions0,64 of 94	We shall offer combined Bay control cum protection IEDs (BCPUs) for 33kV meeting the specification requirement. Please confirm your acceptance for the same.	as per Tech. specification
105	3.1.1. Bay control functions,64 of 94	Local guided control is not available in the Bay Controller HMI. Operator's Assistance shall be part of station HMI.	as per Tech. specification
106	4.4 Extendibility in future,74 of 94	We shall provide necessary software tools only, software source code will not be provided as it is proprietary in nature and a property of ABB.	Protocol has to be submitted for future integration with other supplier.

107	12.0 RELIABILITY AND AVAILABILITY,82 of 94	Guaranteed Availability shall exclude peripehreal devices (functionally non-critical components) like Printer, Monitors, Keyboard, Mouse etc. Incase of redundant components like servers, Main 1/Main 2 IED etc. failure of one component will not be regarded as failure for Availability calculations.	as per Tech. specification
108	BPS ,BPS	We would request OPTCL to clarify on Sl No.10 and 11 of the BPS(Bid Price schedule), since the qty=8 mentioned against the particular line item is not matching with the no. of total bays.Hence for a better clarity we would request you to provide the break-up of BOQ with respect to Control and Relay Panels and SCADA for 132 and 33kV Feeder to be supplied under this contract.	refer the revised Price schedule
109	6.7,23 of 94	We would request OPTCL to revise the same as: 2 years of successful operation of (50% of Quantity of offered Relay) in any Utilities which has been already accepted by OPTCL.	amended
110	2.5.Panel Internal Wiring,7 of 94	Wiring shall be as mentioned below which is as per our manufacturing standard and meets the system requirement. - CT Circuits: 2.5 Sq mm - PT Circuits: 1.5 Sq mm - PT Circuits (Energy Metering) : 2.5 Sq mm - Control Circuits: 1.5 Sq mm Same has been accepted in all major utilities like PGCIL, NTPC etc including OPTCL. We request your acceptance for the same.	As per Tech. Specification and standards
111	2,2.1,2.2,2.3,2.4,2.15,2.16, 2.21,9,11.2,3 of 94	We understand that the requirement mentioned in these clauses are in general and not specifically applicable for this project as we are not offering any conventional control panels in the present scope. Control, Indication and measurements are part of Bay Control Unit as per the technical specification. Please confirm.	AS per Tech Specification
112	6.5, Serial No.2) & 3) ,18 of 94	As per this project we have cable feeders for both 132 and 33kV.Hence we understand now the protection philosophy shall be: 2)For 132kV level the concept of one Cable differential Protection and one backup directional O/C and E/F. 3) For 33kV level the concept of one Cable differential Protection with inbuilt backup directional O/C and E/F protection is acceptable.Kindly confirm.	As per standards refered for power system protection to be followed.bidder to submit the scheme for approval.
113	General,General	With respect to Line differential relays, please confirm whether we need to offer Relays for both Local end and Remote end in this package, if so please clarify the mounting of offered loose Relay at Remote in case of both 132 and 33kV.	not applecable
114	12.2,49 of 94	Kindly clarify whether we need to offer relay test kit as specified in this clause since same has not been called in the tender price schedule.If there is a requirement of Tool Kit then we understand the requirement as 1 Relay Tool Kit per Substation instead of 3 Sets.Please confirm	ref price schedule
115	11.3 (Serial 13,Line Protection Panel) & 11.4(Serial 3,Transformer Protection Panel),45 of 94	We are offering LBB as an inbuilt feature of Main Relays of Line feeder and Restricted Eart Fault Protection as an inbuilt feature of Main relay of Transformer Feeder. Please confirm	should be separate

116	Section-3/1.1/2	Request to accommodateNABL Accredited laboratories for type tests for Indian manufacturers.	amended
117	LOT-2/Schedule of rates & price/Schedule.2/item 1.10	The Hybrid equipment offered shall be suitable for 'Single main busbar' scheme as shown below SLD: Kindly confirm.	Two Bus system(Main & Transfer)
118	LOT-2/Schedule of rates & price/Schedule.2/item 1.10	As understood, the cable shall be terminated through outdoor type cable-to-ACSR conductor termination for connection to LA/PT required before Hybrid equipment. Hence, provision for cable connectivity is not envisaged to be provided in Hybrid module.	Cable connectivity required
119	Technical specification/4.2.2	In transportation condition, module shall be sent separately from the structure to avoid transportation damages and keep the transportation dimension minimum to be able to send in one transportation unit. Kindly confirm.	As per convinience of both.
120	Technical specification/4.2.9	Only three pole operating mechanism spring type shall be provided as per our standard design.	As per Tech. Specification
121	Technical specification/4.5.3/2	There is some mismatch between CT spec mentioned in this clause and in SLD of existing Berhampur s/s. Kindly confirm the CT specification to be provided in Hybrid module.	To follow any one as per required design
122	Technical specification/4.6	As required in clause 4.12.6, operation of the CB should be restricted below defined alarm threshold to protect CB against unsafe operation. Hence, CB should not be operated at atmospheric pressure. Kindly confirm.	agreed
123	Technical specification/4.15	The height of the structure shall be standardized &manufacturer specific in order to avoid re-engineering & delays. The drawing of the same shall be shared with OPTCL for approval during detail engineering in case of order. The height of the plinth may please be suitably adjusted in order to achieve required ground clearances.	as per specification and IS
124	Technical specification/4.16	The content of the nameplates arestandardized & pre-defined as per our standardpractice in order to avoid re-engineering & delays.The drawing of the same shall be sharedwith OPTCL during detail engineering for approval in the event of the order. Request to kindly accept the same.	as per specification and IS
125	Schedule of Rates & Price Package-I (Lot-2) Schedule-2 & Schedule - 4	Qty for 132 kV cables & accessories are not matching under schedule-2 (Supply) & Schedule-4 (services).Please advise the final quantities for Schedule-4 (Service) to be considered.	Fallow revised Price Schedule
126	Cl. 1.2 of Technical specification for 132 KV UG cable (Pkg-1 LoT-2)	IS: 7098 (Part-3)/93 has been referred but not included in Table of specifications. It should also be added in the table.	included

127	Cl. 1.3.1 of Technical specification for 132 KV UG cable (Pkg-1 LoT-2)	Poly-Aluminium laminated tape and corrugated aluminium sheath both are radial water barrier and are alternate to each other. Both are not provided simultaneously. In case of poly-aluminium tape design copper screen is provided to withstand the specified fault current. However, in case of corrugated aluminum sheath design, Aluminum sheath itself carry the desired fault current. In addition to this it also act as armour and additional inner sheath and armouring is not required. However, in case of Poly-Aluminum design, additional armour is provided if armor construction required. Hence, we recommend provision for corrugated aluminum sheath only in the specification. Accordingly the description of cable shall be as under: 132 KV (E) grade XLPE single core power cable conductor electrolytic grade copper of single length, with formation of stranded compacted circular conductor for size up to 800 Sqmm and segmental type for size above 800mm2 as per IEC-60228, tapped with semi conducting tap, shielded with extruded semi-conducting layer, insulated with dry gas cured cross linked polyethylene (XLPE) insulation, insulation screened with extruded semi- conducting layer, screened lapped with a combination of semi- conducting water swellable tape and Corrugated Aluminum sheathed and black HDPE ST7 with graphite coating or extruded conductive layer overall cable, confirming to IEC-standards for construction and also confirming to IS:7098 (Part-III)/1993 or any latest amendments thereof.	Corrugated Aluminum sheath
128	Cl. 1.5.2 of Technical specification for 132 KV UG cable (Pkg-1 LoT-2)	Minimum thickness conductor screen should be amended to read as 0.8 mm. instead of 0.55 mm. to meet requirement of IS: 7098 (Part-3)/93.	Follow the revised GTP
129	Cl. 1.5.3 of Technical specification for 132 KV UG cable (Pkg-1 LoT-2)	Nominal thickness of insulation should be amended to read as 18.0 mm. instead of 11.0 mm and tolerance on insulation should be amended to read as per IS: 7098/Pt-3/93 instead of IEC-60840 for conformance to IS: 7098/Part-3/93. (11.0 mm thickness is applicable for 66 kV grade cable)	Follow the revised GTP
130	Cl. 1.5.3.1 of Technical specification for 132 KV UG cable (Pkg-1 LoT-2)	The Stress level specified are for 66 kV voltage grade. For 132 kV cable the insulation thickness is required to be increased further as against 18.0 mm. specified in IS: 7098/Pt-3/1993, To meet the above requirement of stress level, for 132 KV. Hence, we request you to kindly review it. We recommend max. stress of 6.3 kV/mm instead of 6.0 kV/mm and 3.1 kV/mm instead of 3.0 kV/mm	Follow the revised GTP
131	Cl. 1.5.4 of Technical specification for 132 KV UG cable (Pkg-1 LoT-2)	As clarified against Cl No. 1.3.1 above for corrugated Aluminum sheath cable, the copper wire screen is not required. Hence, the following should be deleted from this clause. " Metallic screening shall be provided. The metallic screen shall be of copper wire having fault current capacity same as the conductor (31.5 KA for 1 sec)."	Follow the revised GTP
132	Cl. 1.5.5 of Technical specification for 132 KV UG cable (Pkg-1 LoT-2)	This clause should be amended as under. Inner Sheath/ Bedding: The inner sheath shall comprise of semi-conducting water swell able tape. The tape shall be applied over the extruded insulation screening to block and prevent moisture propagation in a longitudinal direction. The sheath shall be suitable to withstand the site conditions and the desired temperature. It should be of adequate thickness, consistent quality and free from all defects.	Follow the revised GTP

133	Cl. 1.5.7 of Technical specification for 132 KV UG cable (Pkg-1 LoT-2)	We recommend black outer sheath instead of Red / Yellow / Blue colour outer sheath. Since cable outer sheath have graphite coating / extruded semiconducting layer which is black, the coloured sheath will have no significance as sheath colour not be visible due to black outer layer. Also UV resistance of coloured PE sheath is very poor and it is liable to get cracked if exposed to direct sunlight due to UV radiation. Hence we strongly recommend black HDPE sheath.	Follow the revised GTP
134	Cl. 5.7.1(d) of Technical specification for 132 KV UG cable (Pkg-1 LoT-2)	We agree to the specified test requirement subject to ageing temp. 110 deg.c. instead of 135 deg.C. Please note that PE compound can not meet ageing requirement at 135 deg.c. for 240 hours.	Follow the revised GTP
135	Cl. 1.9 of Technical specification for 132 KV UG cable (Pkg-1 LoT-2)	These cables are supplied in non-returnable steel drums which are manufactured as per drum supplier's standard. Hence, reference of wooden drum to IS: 10418 is irrelevant.	"steel drums retunable"
136	Cl No. 7.1.1.3 of Technical specification for 132 KV UG cable (Pkg-1 LoT-2)	In case of rejection of Type test report for a particular equipment, request to accept the Type test report from CPRI, Bangalore or any other NABL approved Lab also.	Other NABL approved Lab also.
137	Cl No. 7.1.1.4 of Technical specification for 132 KV UG cable (Pkg-1 LoT-2)	The type test reports of the equipment shall be of the tests carried out either at the manufacturer's works having requisite facilities or at KEEMA, Netherlands, CESI, Milano, Italy or CPRI, Bangalore during the last ten (10) years period as on the date of bid opening. If any type test report is older than 10 years, the type tests will have to be repeated at Supplier's cost. Employer shall waive some of these tests in case of equipment / sub assemblies where the manufacturer can establish to the satisfaction of employer that such tests have already been carried out earlier or where the equipment have been proved in service. In such a case, manufacturer shall submit complete test reports along with necessary certification.	as per revised Tech. specification
138	Cl No. 7.3.6 of Technical specification for 132 KV UG cable (Pkg-1 LoT-2)	Please include the name of CPRI Bangalore for conducting the Short circuit test, which is a reputed Indian Govt. Lab in our country.	CPRI Bangalore Included
139	Guaranteed Technical particulars for 800 Sqmm & 630 Sqmm 132 cable with corrugated Aluminum sheath.	We have attached herewith the Guaranteed Technical Particulars of 800 Sqmm & 630 Sqmm,132 kV cable with Corrugated Aluminum sheath as per attached Annexure-B in line with the description given in the said Price schedule -2 forLot-2.	Ref revised GTP
140	Cl No.1.3.1,technical specification of 132 KV cable	We rqeuest you to confirm the exact cable construction that is required by you	Ref revised GTP

141	Cl No.1.5.11,technical specification of 132 KV cable	The easy hanbdling at site it is preferred drum length should not be more than 650 mtr more over the site requirement deceids the exact drum length as per the route requirement. Kindly confirm that 650 mtr max length will be acceptable	Ref revised GTP
142	Cl No.7.1.1.4,technical specification of 132 KV cable	As per specification Kema type test report is acceptable . But please confirm whether the type test from CPRI, Bangalore is also acceptable	CPRI Bangalore is also accepted
143	Cl No.7.3.6,technical specification of 132 KV cable	Please confirm whether this short cuircuit test can also be conducted at CPRI Banglore in presence of the employer's representative. This short cuircuit test should be on chargeable basis as item rate in price schedule.	CPRI Bangalore is also accepted
144	Cl No.1.9,technical specification of 132 KV cable	Please confirm that cables can be supplied in non returnable steel drum in order to prevent the damage during transit due to heavy weight of the cable as wooden drum could be risky	steel drums returnable
145	Cl No.1.3.4,technical specification of 132 KV cable	please specify the size of the bonding cable and co axial cable . Also please note that the supply of these items such as Bonding cable, coaxial cable, SVL Link Box is not available in the price schedule for billing purpose under supply . Please specify the qty and item in price schedule for supply and installtion	Follow the revised technical spec
146	Cl No.7.3.11 (iii),technical specification of 132 KV cable	Please specify wehther the AC Volatge test equipement shall be provided by OPTCL .Generally the 132 KV cable is charged and soak test is conducted for 24 hours .Is this acceptable in lieu of the AC voltage test. AC voltage test equipement is generally not available for testing at site.	same as Sl 36
147	Cl No.2.0.0.,technical specification of 132 KV cable	Please note that normally the 132 KV stright joints are not heat shrinkable or cold shrink type. Please confirm that premoulded type with stress cone of silicon rubber / EPDM material is acceptable .	premoulded ref revised tech spec
148	Cl No.2.0.0.,technical specification of 132 KV cable	Please note that normally the 132 Kvoutdoor terminations are not heat shrinkable or cold shrink type. Please confirm that oil filled or dry type outdoor terminations are acceptable .	oil filled sealing ends with polymeric insulation
149	Tech Spec Package - I, Lot - I, 132/33KV GIS Page-5 of 49	We will offer RAL 1013 shade. Please provide your acceptance.	follow revised tech spec
150	Page 5 of 49	The plan layout shows cable feeders, while here it is written that connection will be through busducts. Please clarify.	There is no provision of bus duct for this purpose
151	Page 12 of 49	we understand that density monitors and precision pressure guage are the same items. Please clarify	Tech. Spec. Stands
152	Page 19 of 49	CT shall be provided on one side of Circuit Breaker	Tech. Spec. Stands
153	Clause 3.2.18, Page 25 of 49	in 132KV bays, all the intrabay wiring is done at factory, hence extra space is not required for the cable trays mounted on the bays. Please confirm	Tech. Spec. Stands
154	Clause 3.2.24, Page 29 of 49	please confirm if the spares and tools mentioned against cl 3.2.24 is in addition to spares and tools mentioned against cl 3.2.12 and 3.2.13 of specification	3.2.12 & 3.2.13 is not applicable where as 3.2.14 included in price schedule.

155		Please clarify the requirement of Gas Handling Plant. Please also specify make and model of gas handling plant.	It is required to maintain the GAS in constant pressure and temperature for GIS s/s,as per IS
156		Test charges should be part of Service Schedule	not relevant
157	Bid Security	We are enclosing our comments on Bid Security Format. Request to accept the changes.	Not accepted
158	1.4	We will consider the following Accessories as a part of our supply : 1.Gas filling Trolley	Tech. Spec. Stands
159	3	Kindly Clarify whether buside or Line side arrester is required. We will consider the Bus side Surge arrester (3 Per Bus per Section). Incase of line side arrester is required please let us know the respective feeder.	Line side arrester is required
160	5.2	As MBB rating mentioned in specifications is different as in price schedule, request you to re confirm rating and desired ambient for the same. We have considered 1250A MBB rating at 40 deg C ambient	40 deg centigrade design temp
161	5.3	Request you to elaborate	Should have the flexibility for inter changing the bays
162	6.3	Each bay of GIS shall be 600mmx1650mm(widthxdepth) and side walls shall be 155mmx1650mm (widthxdepth). Request you to consider civil in line with same. Each switchboard shall have 2 numbers of sidewalls. Bus coupler shall be 2 panel execution.	Accepted
163	7-h	We will submit the unit prices for dummy panel.	No dummy pannel
164	8.1.1 - **3**	Withdrawl will required to open cable housing compartment and will need to interrupt the gas compartment.	No withdrawl system
165	8.1.3	Vacuum bottle healthiness can be checked by switching on off and by contact resistance measurement. Monitoring device cannot be provided.	Accepted
166	8.1.3	Same is not possible in GIS offering.	OK
167	8.1.5-6	A closing release shall operate correctly at all values of control voltage between 85% and 110% of the rated voltage. A shunt trip shall operate correctly of control supply voltage between 85% and 110% of rated voltage.	Ok
168	8.1.8	As breaker in GIS is fixed type, contacts of the same are not required to be replacable. VI tubes if required can be replaced.	It is okey
169	8.2.1	Offered GIS CB Panel bus side disconnector will have earth switch for cable earthing. There will be no separate lineside earth switch. Cable side earthing shall be achieved through breaker.	line side earth switch is required for more safety point of view.

170	8.2.2 -2	Offered Name plate will be as per Siemens standard.	it is ok
171	8.2.3 -3	Earth Switch is Motor driven and not stored energy operated.	both required
172	11-1	In attached Price schedule fault current rating given is 25kA. Kindly confirm the fault current rating.	As per technical spech
173	21	Painting will be as per manufacturer standard process.	It should meet IS
174	21	In attached Price schedule fault current rating given is 25kA. Kindly confirm the fault current rating.	as per tech spech
175	21	In attached Price schedule current rating given is 1250A. Kindly confirm the current rating.	as per tech spech
176	General	As copper is globally accepted material for busbars and also is recommended for 33KV GIS switchgear, our basic design is with copper and same is offered to meet your requirement more efficiently.	as per tech spech
177	General	Our type tested design is with Aluminium enclosure and same is offered	as per specification
178	General	All the high voltage current carrying conductors is recommended to be completely inside including interpanle busbar joints inside SF6 gas chamber to have a complete GIS unit.	as per standard design
179	ADB_OPSEAP_BoQ & Price Schedule-Package-I (LOT-1) Schedule No. 2 - Plant and Mandatory Spare Parts Supplied from within the Employer's Country Item No. 10 & 11	Please Clarify the BOQ	As per Tech Specification
180	ADB_OPSEAP_BoQ & Price Schedule-Package-I (LOT-1) Schedule No. 2 - Plant and Mandatory Spare Parts Supplied from within the Employer's Country Item No. 10	Please clarify the Requirement of Event Logger, We envisage that in Substation with Automation Event Logger is not required	As per Tech Specification
181		Section project is missing. Please provide to have scope clarity.	as per revised tech spec
182		We understand that our scope area is limited to the area shown i.e. 30.050m X 40.5m.Please confirm	as per layout and site requirement

183		We understand that dotted line is for boundary wall. Please confirm.	follow layout and land drawing
184		Approach road is not in our scope. Please confirm	approch road outside the s/s boundry is not in bidders scope.
185		Please provide us preliminary soil data for design purpose.	Soil Testing to be done during design stage
186		Building dimensions in the layout and specifications(Clause No. 1.4-Page 48 of 84) does not match. Please confirm which one to be considered.	As per plan and layout
187		Please confirm us the type of road to be constructed.	concrete road
188		We understand that brick drain shall be constructed on either side of road. Please clarify	as per Tech Specification "Civil Design"
189		Please provide us the details of rail cum road for transformers if required	required
190		We understand that no separate burnt oil pit is required for transformers. Please clarify.	Separate burnt oil pit is required
191	7	We understand that the scope will be restricted to Receipt, Unloading, Storage, Insurance and Preservation of Sub station equipment only.	As per bid doc
192	E17- Technical specification for 220 & 48V Battery and charger	We understand that 220V DC battery shall be lead acid plante type of rating 350AH(2sets) (in spec asked for one set 350AH and one set 645AH) common for 33kV and 132kV GIS system with one float charger and one float cum boost charger. For 48V DC battery shall be VRLA type of rating 300AH(2 sets) at 10hr discharge rate with 2 sets of float cum boost charger. Kindly confirm the same.	As per tech spech.
193	General	Please provide us the following : 1. Preliminary soil investigation 2. Contour Map and Proposed FGL (Finished Ground Level) w.r.t. EGL & EGL(Existing Ground level). 3. Lengths of Boundary wall,Fencing, Retaining wall,Roads,Drain as these are difficult to ascertain from Site Visit.	refer the land drawing, and Civil Price Schedule
194	22.2.11	We request you to provide us water and power supply at single point near the sub-station area.	bidders need to arrange
195		Please provide us the list/types of fruit and flower bearing plants to be planted.	as per site condition
196		We understand that no seperate burnt oil pit is required for transformers in switchyard. Kindly confirm.	Clarified at Sl.No-211
197	Layout Plan of 132/33kV GIS Sub-station(Indicative)	1) Kindly confirm that the present scope is limited to fence only. 2) 132kV GIS Building/Control Room- Dimensions shown are indicative only. Please confirm us that can we optimize the same as per the requirements.	Detail Engineering after award of Contract
198	General	We understand that land for labor colony/site office/storage shall be provided near the sub-station area. Kindly confirm.	bidders scope
199	General	Hindrance register shall be maintained at site.We shall be given sufficient extension against any natural calamities/hindrances etc. without any LD/Penalty.Kindly confirm the same.	bidders scope

200	Price schedule Package-I,Lot-I,Installation Boq	We can see ET transformer rating as 100 KVA in station layout.The same has been given as 315KVA station transformer in Price schedule and as 250 KVA in technical specifications .Kindly clarify whether both all the transformers are same or we should treat them differently.If all are referring to the same purpose Pls confirm the rating.	follow tech specification and revised price schedule
201	Layout Plan of 132/33kV GIS Sub-station(Indicative)	In attached layout power cable ducts have been given .Pls confirm whether cable trench will suffice the need.The same item has not been included in the price schedule.	cable trench is required.
202	Layout Plan of 132/33kV GIS Sub-station(Indicative)	Kindly confirm the location of fire fighting set in the layout as no indication for the same has been made in the layout.	as per suitable design
203	Price schedule Package-I,Lot-I,Installation Boq	Structures for outdoor equipments like LA,CSE etc are missing from the price schedule.	Fallow the revised price schedule
204	Page 6 of 49	As per SLD for 2 nos. of incomers no line surge arrestors are used and line PT's are considered inside GIS.But in technical spec Package -I,Lot-I surge arrestors and PT are asked for AIS type.Please clarify.	Fallow the SLD
205	Layout Plan of 132/33kV GIS Sub-station(Indicative)	As per SLD for transformer feeder 132 KV and 33 KV side PT is shown inside GIS but in Technical Spec Package-I,Lot-I we understand the PT requirement as AIS.Please clarify.	Bus PT in GIS, fallow the SLD
206	SLD	LA for 33 Kv side of transformer are shown in indicative layout.But we cannot find the same in SLD.Please confirm.	33 kV side LA is to be provided
207	SLD	There is a clause for GIS LA in technical spec Package-I,Lot-I.However, we do not envisage any GIS LA in SLD .Please confirm.	no LA for GIS S/s
208		As per our understanding there is no emergency supply envisaged through DG supply.Please confirm.	Battery Backup
209	SLD	We understand that there are 5 nos. of 33KV outgoing feeders,in which 2 nos are for station transformers.Please confirm and clarify the purpose of the remaining feeders.	5 nos outgoing feeder bays, 2 nos station transformer through Isolator arrangements,2 feeders remaining Spares
210	Price schedule Package-I,Lot-I,Installation Boq	Kindly confirm the required lux level and type of fixtures to be used in outdoor and indoor areas to be used.	Switch yard illumination specificaton to be followed
211		Referring the the tender SS Layout, it looks that we have to directly connect the 132kv cable to the GIS and Trafo since there is no place to install the 132kv GIS Bus Duct and SF6/AIR outdoor bushing. Please clarify	direct termination to GIS & transformer into cse
212		Please clarify	
213		The bidder can propose alternative layout to OPTCL subject the complying to the technical spec. Please clarify	Bidder may propose, subject to approval of OPTCL
214		Please furnish the GA & Dimensional drawings along with the technical parameters of these two Transformers.	**Supply of 40 MVA transformers are in OPTCL scope**

215		Please confirm if it is acceptable if Cable Manufacturer having manufacturing facilities in different countries under the same name who meets QR in all aspects can supply the cable system from any of their factories provided the Type, Design, Material and manufacturing process of the cable system is same as the one for which the type test reports are submitted	Bidding Document stands
216	132kv GIS Technical Specification	Referring the tender SS Layout, it looks that we have to directly connect the 132kv cable to the GIS and Trafo since there is no place to install the 132kv GIS Bus Duct and SF6/AIR outdoor bushing. Please clarify	connection throgh cable only
217	33kv GIS Switchgear Panel	Please clarify	As per tech spec
218	132/33kv Substation Layout Drawing LFA-2013-14	The bidder can propose alternative layout to OPTCL subject the complying to the technical spec. Please clarify	same as sl 239
219	132/33kv Power Transformer	Please furnish the GA & Dimensional drawings along with the technical parameters of these two Transformers	same as sl 240
220	Type test for GIS	it is internationally and as per IEC it is accpted if manufactorer has not changes design there is no need to repleat type test , we are requesting you please accept 5 years Type test	Type test with in 5 year accepted
221	Part I ,Section -6,Serial number 2.4.2(b) for Lot-2	The bidder must have successfully executed XLPE underground cable laying work at least of 50KM of EHV grade cable (66KV or higher voltage class) for any power utility.The bidder must furnish copies of the relevant certificate in proof of successful execution of the 66KV or higher voltage Cabling works which is duly signed by the competent authority of the client in the proof of successful operation of the above works from any power utility.	The refered clause is modified as follows; Execution of XLPE underground cable laying work at least of 50Km (cable length) of 110 kV or higher voltage class for any transmission utilities during the last 10 financial years preceding to the year of NIT.

222	1.3.1 (Principal Parameters)	The construction specified vide this clause is not a standard construction is also not matching with construction given in Standard Technical Particulars available with Tender document. As per Technical Particulars, the construction is with copper wire screen and poly Aluminium laminate, therefore requirement of PE inner sheath and Corrugated Aluminium sheath armour is redundant. The description specified against this clause need to be amended to read as under in line Standard Technical Particulars. "132kV(e) grade XLPE single core power cable conductor electrolytic grade copper of single length with formation of compacted circular conductor for size up to 800 Sqmm and segmental type for sizes above 800 mm2 as per IEC 60228, taped with semiconducting tape, shielded with extruded semiconducting layer, insulated with dry gas cured cross linked polyethylene (XLPE) insulation, insulation screening with extruded semiconducting layer, taped with semiconducting water swellable tape, copper wire screened followed by open helix copper tape, taped with non conducting water swellable tape and poly-aluminium laminated tape followed by extruded HDPE (Type ST-7) outer sheath with graphite coating or extruded conductive layer overall, cable conforming to IEC standards and also conforming to IS 7098 (Part-III)/1993 or any latest amendments thereof.	CORRUGATED ALUMINUM SHEATH IS RECOMMENDED OVER POLY AL NO ARMOUR IS REQUIRD
223	1.5.1 (Conductor)	This clause of Technical specification is silent regarding water tightness in conductor, while according to S.No.7(i) of Standard Technical Particulars, the conductor should be longitudinally water tight. Kindly confirm whether conductor should be water tight or not.	It is longitududinally water tight
224	1.5.3 (Insulation)	This clause specified nominal insulation thickness as 11.0 mm while as per S.No. 9 (a) of standard Technical particulars the nominal thickness of XLPE insulation should be 18.0 mm, which is correct and is in line with IS 7098(III). Therefore nominal insulation thickness 11.0 mm specified in Technical specification should amended to 18.0 mm in line with standard Technical Particulars.	as per revised tech spec
225	1.5.3.2.b Insulation	The duration for ageing test for XLPE insulation should be 168 Hrs as per IEC 60840 instead of 240 Hrs specified in Technical specification.	as per revised tech spec
226	1.5.5 Inner sheath	Considering the construction specified in Standard Technical Particulars shall prevail, the inner sheath is redundant and should be deleted.	as per revised tech spec
227	1.5.6 Armour	Considering the construction specified in Standard Technical Particulars shall prevail, the corrugated aluminium sheath/armour is not relevant and should be deleted.	as per revised tech spec
228	1.5.6.1 Bedding Tape	The bedding tape specified against this clause shall not be applicable in case there is no corrugated aluminium sheath/armour.	as per revised tech spec
229	1.5.7.1(d) Outer sheath	The ageing temperature for Type ST-7 (HDPE) outer sheath should be 110 Deg C as per IEC 60804, instead of 135 Deg C specified against this clause	as per revised tech spec

230	1.14 ISO Accreditation & VCV Process	This clause calls for XLPE triple extrusion in VCV process. Request you to kindly also include CCV process which is Dry Cure & Dry Cool process, similar to VCV except the orientation of line is catenary. The CCV process is an established and proven process for XLPE triple extrusion for cables upto 400 kV grade and used worldwide. Allowing only VCV line will also limit the competition only and board may not get competitive quote.	as per revised tech spec
231	7.3.6 Short Circuit Test	It is not specified whether short circuit test is to be done on conductor or metallic screen. It seems to be applicable for metallic screen. Kindly confirm. The short circuit testing in Independent Testing Laboratory in India – Like CPRI/ERDA should be included.	Short Circuit test should be done for both.Type test in accediated lab is required.
232	132KV Cable drum length with tolerance for 800Sqmm & 630Sqmm cable	Requesting you to kindly clarify the maximum drum length can be offered along with the tolerance for 800 Sqmm& 630Sqmm cable.	Drum length should be 500 mtr
233	Type test of 132KV 800Sqmm & 630Sqmm cable	We are having type test of 132KV ,1000Sqmm Corrugated aluminium sheathed copper conductor cable of CPRI ,Bangalore. Kindly confirm whether it will be considered as valid type test report for the above tender.	acceptable
234	132KV Cable Accessories	But this specification is for cable accessories upto 33KV Cable. Please clarify the specification for 132KV Cable accessories. Kindly also give us the OPTCL approved make of cable accessories. Type test at CPRI, Bangalore within last five years for the above accessories will be considered as valid type test-Kindly confirm	Ref Specification uploaded
235	Make list required and specification required	Make list required of OPTCL for 132KV Bay structure ,Disc Insulator ,CVT ,Circuit Breaker(C.B), C.T, CVT,S.I, D.I, Control relay panel and 132KV Hybrid type Gas insulated Outdoor Feeder, Termination structure ,Gantry structure and Hardware fittings. Specification required for 132KV Hybrid GIS, 132KV Bay material ,Termination structure ,Bonding cable for the earthing of 132KV terminations ,Control Cable, Link boxes, Trefoil clamps. Please also mention the quantity of termination structure, Control relay panel, bonding cable, Disc Insulator ,CVT ,Circuit Breaker(C.B), C.T, CVT,S.I, D.I,132KV Bay structure and the materials for the extension of these bays.	refer revised price schedule
236	Civil Foundation drawings	Kindly provide the civil drawings of CVT,Circuit Breaker(C.B), C.T, CVT,S.I, 132KV Hybrid type Gas insulated Outdoor Feederand also 132kv Bay structure ,Cable termination structure	bidders should fallow standard design
237	Spare parts requirement	Kindly clarify in details regarding the mandatory spares parts required which should be supplied from India and abroad in BOQ schedule number(5).Kindly also clarify in details regarding design services,Installation and Other Services	ref price schedule
238		ROW scope is under bidder or OPTCLscope.Kindly confirm. National highway ,PWD permission ,Railway permission ,Forest clearance,Electrical license (ELBO),Local municipality permission ,Police station permissionin whose scope and the expenditure will be borne by bidder or OPTCL.Kindly confirm.	all RoW issues under bidders scope

239		Please confirm whether Supply order & Erection order will be separately released.	No, its a turn key project no separation
240		Kindly confirm regarding the bonding system required for the above 132KVCable	straight bonding at both ends
241		We are requesting you to kindly give us the sketch diagram (area wise)of 132KV underground Cable laying method ,RCC Slab with all the dimensions properly.	Laying as per Tech. Specification
242	Part – I Clause 1.5.6 page 6	Kindly clarify the material of radial Moisture barrier to be considered. Moreover, the Corrugated Aluminium will be the metallic sheath and not the armour as specified	as per revised tech spec
243	Part – I Cause 1.13 page 9; Part – II Clause 2.1.0 – Straight Through Joints, Clause 2.1.1	Heat Shrinkable type joints are not recommended for 132kV voltage grade cables. The pre-moulded type Joints are recommended for 132kV cable joints which are type tested and in service for more than 5 years.	Premoulded joints
244	Technical Specification Part – II Clause 2.1.4	Heat Shrinkable type Terminations are not recommended for 132kV voltage grade cables. The pre-moulded type Terminations are recommended for 132kV cable terminations which are type tested and in service for more than 5 years.	premoulded joints
245	Part – II Clause 7.1.0.1.1	We request you to amend the clause accepting the Type Test reports of CPRI Bangalore also apart from KEMA and CESI for the 132kV cable and cable accessories.	CPRI, Bangalore, accepted
246	Part 1 – Cl 1.3.1 6th	This is to be bare copper wire.	as per revised tech spec
247	Part 1 – Cl 1.3.1 8th.	Armouring cannot be corrugated but Aluminium sheath can be corrugated. Since armouring is required it is to be Aluminium Wire armoured.	as per revised tech spec
248	Part 1 – Cl 1.3.5	Clarification required whether 31.5 kA will be carried by screen & Armour separately or combined.	as per revised tech spec
249	Part 1 – Cl 1.5.3	With minm thickness of 11 mm (min) the stresses would be higher than the max specified. However in STP spec thickness is 18 mm (nom)/16.2 mm (min) the stresses can be maintained. Pl confirm Insulation thickness is 18mm (nom)/16.2mm (min)	as per revised tech spec
250	– Cl 7 Sub Cl – C both minm No of wires & wire dia specified.	As per IEC 60228/IS 8130 for conductors – minm no of wires specified but wire dia not specified. Request dia of wires to be omitted.	as per revised tech spec
251	In STP_132k – Cl 13 Sub Cl – b),d) & e) for screen wire dia, no of wires & lay specified.	Suggest this be left to the discretion of the mfr to provide for delivering the Earth fault current of 31.5 kA/sec.	as per revised tech spec
252	In STP_132k- After Cl – 16 Moisture barrier Outer sheath provided as per Cl-18 (Cl-17 being for clearance)	Specific confirmation reqd whether cable is Armoured or unarmoured.	no armouring is required,follow revised tech spec

253	Lot – 2 Part – I Clause 1.14	There are 3 processes in use for manufacture of 132kV XLPE Cable i.e., CCV, MDCV & VCV. All the three processes are in use worldwide and the cable are Type Tested in all categories. We manufacture the 132kV Cable with MDCV process and our cable manufactured by this process are in service since 1994, MDCV process, the process by which we manufacture our EHV cables is known as Mitsubishi Dainichi Continuous Vulcanizing Line and is an established process being used in Europe and Japan to manufacture continuously up to 500kV cables. Companies like M/s Nexans, Brugg Cable, Prysmian, Sud Kabel are having MDCV lines which are being used to manufacture 400 and 500kV higher size cables. Cables manufactured in MDCV lines have been successfully type Tested and PQ tested world over. We are enclosing the write-up on MDCV Process as an annexure to this letter. We request you to amend the clause by including the MDCV process also.	as per revised tech spec
254	Clause 2.4 for Lot – 2	We request you amend the requirement as “The bidder must have successfully executed XLPE underground cable laying work of at least 50 KM of 66kV or higher voltage class for any Transmission Utility.	Replied in Sl. No.221

TENDER NOTICE NO. : CPC- ICB Document No: OPTCL/ADB - OPSEAP /2014/Package-I (Lot- 1 & 2)

Sl. No	Reference	Bidders Queries	OPTCL Compliance
1	Section-III, Evaluation Criteria Clause No. 1.2.6 ,For LOT-1 &2	As per the reference clause it is mentioned that Bidder is required to apply for project license to the Secretary, ELBO, ODISHA by depositing the requisite fee before signing the contract agreement thus, these are to be taken into account by Bidder while submitting bids. wheather above license required for suject tender, if yes , we request you to provide approx. cost for obtaing license in order to icluding in bid price.	Yes, project license from the Secretary, ELBO, ODISHA is required for Transmission Project and HT license avaialble with the Contractor is required for Distribution project of the subject tender. Cost of securing the ELBO license may be obtained from the Office of the EIC-Cum- P&S.
2	Design Services For LOT-1 &2	As per the Schedule-3, design Services of price schedule is not applicable, We presume that all the structurals as well as Civil drawings required for the construction of substation shall be provided by the OPTCL. Kindly provide the same.	Standard structural as well as civil drawings shall be uploaded by OPTCL. However, detailed engineering at the time of execution based on the site condition is within the scope of the contractor.
3	Clause No. 27.10 SCC For LOT-1 &2	As per the reference clause, The critical components covered under the extended defect liability are Transformers, Switch gears, Relays, VCBs, CT & PT, AAA Conductor, XLPE Cables etc. Kindly breakdown these critical components separately for lot 1 and lot 2, in order to know the percent of reduction of the performance bond during the extended defect liability period.	Section-6 (Employer requirment) of the tender document, contains the list of major items to be supplied for Lot-1 & Lot-2. Accordingly, reduction of the performance bond during the extended defect liability period shall be determined depending upon the Price mentioned in the Price Schedule for such items.
4	Sl.No.3	Lot-2:132kV cabling works: a. It is indicated that the bidders having requisite capacity and the capability to execute the contract within the stipulated period of 18 months are advised to participate. b. As per Cl.No.13.2, Section-1-ITB, no alternatives to the Time Schedule are explicitly invited. c. Section-2-BDS, Preparation of Bids, ITB-13.2, Alternatives to the time schedule shall not be permitted. d. Section-3-EQC, Cl.No.1.2.2, i. – Time to complete the plant and services from the effective date specified in Article-3 of the Contract Agreement for determining time for completion of pre-commissioning activities is 18 months, otherwise as Cl.No.1.2.2, iii – Bids mentioning time schedule other than 18 months be considered as non responsive. e. Section-7-GCC, Cl.No.8, The contractor to commence work on the facilities within the period specified in SCC and without prejudice to GCC Sub-cluase 26.2 and proceed with the time schedule specified in Appendix-4-Time Schedule which indicates that 18 months for handing over of Line works and 24 months for contract closing. Request clarification, whether the total execution period is 24 months or 18 months.	The time to complete the plant and services is 15 months for Lot-1 & 18 months for Lot-2 from the effective date of the contract. Additionally, 06 months have been provided for Contract closing. This 06 months period is part of the defect liability period.

5	18 1.2.5 10.3 App-6	Clause calls for the "Single Responsibility" basis for the entire plant and services which includes the acquisition of all permits, approvals and licenses, ROW permissions etc., from various agencies such as NHAI, Railways, Forest Department, State PWD, State R&B, BSNL, Local Municipalities or panchayats, water department, ELBO-Odisha, PTCC, or any other statutory body/governmental agency, etc., for installation of 132kV cabling works. Further under Note of 1.2.5 of Sec-III, the cost or rate put in by the bidder if any, shall not be considered for the purpose of comparative evaluation, however, the same will be considered for total contract value for adopting 10% advance payment. Request clarification. Further, in line with activities outlined in Appendix-4-Time Schedule for the project, as such, this is not a part of the total activity. Request this scope be transferred to the Employer`s scope along with the required payment(s), provision of bank guarantees to the authorities wherever required. Request acceptance.	Notes to Section-3, Clause-1.2.5 stipulates that Cost of additional works, services, facilities etc., if any, other than those categorically specified to be provided by the Employer, shall be taken into account by Bidder while submitting bids. The cost of the same shall be in built into the Unit price of the BOQ of the price schedule. There is no contradiction so far as 10% advance payment is concerned as mentioned by the bidder which shall be guided as per Appendix 1 - Terms and Procedures of Payment. Appendix-4-Time Schedule for the project: The time to complete the plant and services is 15 months for Lot-1 & 18 months for Lot-2 from the effective date of the contract. The said period shall be considered for the purpose of payment(s) and provisions of Bank Guarantee.
6	18.3	The quantities of Mandatory Spares appear to be not included in the main quantities. Request clarification and also clarify, if the same is now indicated, will this be considered for bid evaluation or not.	The quantities of Mandatory Spares shall be separately uploaded as part of BOQ of the price schedule which shall be considered for bid evaluation.
7	18.6	Cl.No.18.6 (a) indicates that a bid submitted with an adjustable price quotation will be treated as non responsive and rejected. Since the tendered 132kV cables which are the major items in more than 150kms, request to accept the standard price variation formula for price adjustment in respect of cable components such as copper and aluminum/lead etc. Attached is the price variation formula of KPTCL for your consideration. Note: The KPTCL price variation formulae for 132kV cables is attached for your reference and for acceptance.	Tender clause shall stand.
8	39.5	Cl. No.39.5 indicates that if the bid, which results in the lowest evaluated bid price, is seriously unbalanced or front loaded in the opinion of the employer ----------, the employer may require that the amount of the performance security be increased at the expense of the bidder. Request to inform the employer`s engineer`s estimated cost of the LOT-2 along with the estimated values of the items in LOT-2.	At this the estiamted cost of Lot-2 can not be given.

9	42.2	Cl. No.42.2 indicates that the employer reserves the right to accept any of the deviations submitted in accordance with ITB 18.2 by the lowest evaluated bidder, at the price shown for the deviation in the bid. Cl. No. ITB 18.2 of Section-2, BDS specifies no deviations are allowed. Request clarification whether the additional price(s) for withdrawal of the deviation(s) is considered for bid evaluation or not along with the clarification whether deviations are allowed or not.	The Employer's right to accept any deviation under Clause no.42.2 of ITB is in accordance with clause no. 18.2 of the ITB. Since, clause 18.2 of ITB is modified in the BDS that no deviations are allowed, for the purpose of clause no. 42.2 the modified clause shall stand. Hence, there shall be no additional price for withdrawal of the deviation.
10	ITB 21.2	It is indicated as not applicable. Our understanding is that the bidder is required to submit Bid Security Only. Bidder is not required to submit Bid Securing Declaration. Request clarification.	The bidder is required to submit Bid Security in form of Bank Draft / Bank Guarantee. Bid security declaration is not acceptable.
11	ITB 34.1	The clause advices the bidders to ascertain on their own the availability of deemed export benefits. Request confirmations that the deemed export benefits are available against this bid and we note the requisite certificate/documents (Project Authority Certificate) will be issued by the employer.	The requisite certificate/documents (Project Authority Certificate) will be issued by the employer during the implementation of the project.
12	1.2.6 i	The clause indicates that the cost of mandatory spares, Operational maintenance equipment & spares and special tools & tackles shall be deemed to be included in the cost of plant. Hence, the same shall not be considered for the purpose of comparative evaluation. While normally the cost of maintenance equipment & spares or recommended spares is not considered for the purpose of comparative bid evaluation, but the cost of mandatory spares as defined by the employer is normally considered for the purpose of comparative evaluation. Since, no mandatory spares are indicated in the BOQ, in order to ensure a fair comparative evaluation, request provision of the quantities under mandatory spares in the BOQ suitably. Request clarification	The quantities of Mandatory Spares shall not be separately uploaded. However, the same shall form part of reivsed BOQ of the price schedule.
13	1.2.6 ii & iii	The clause indicates that the bidder is required to apply for project license to the secretary, ELBO, Odisha by depositing fee before signing the contract agreement, thus, these are to be taken into account by Bidder while submitting bids. Request clarification on our understanding that the successful bidder only is required to file a paper as a proof of applying to the Secretary, ELBO, Odisha by depositing fee for obtaining project license and valid electrical (HT) license before signing the contract agreement.	The successful bidder is required to submt the proof of appliaction with deposit challan applying to the Secretary, ELBO, Odisha for obtaining project license before signing the contract agreement. Valid Electrical (HT) license is required to be submitted at the time of submission of Bid. However, for execution of work the valid project license is required.
14	Annexure-II (i)	We read ICE mentioned as IEC.	"ICE" Typographic mistake, it is "IEC"
15	13.3.3	It indicates that the performance security shall be reduced by 50% on the date of the Operational acceptance. The security shall become zero or shall be reduced on pro-rata to the contract price of a part of the facilities for which a separate time for completion is provided, 18 months after completion of the facilities or 12 months after operational acceptance of the facilities whichever occurs first.	The clause 13.3.3 of SCC shall read as "The performance security shall be valid for 90 days over and above the work completion period".

16	14	It indicates that the taxes and duties treatment shall be discussed and finalized in the pre-bid meeting scheduled at your office on 21.03.2014. We inform that we shall be attending to this proposed pre-bid meeting.	The latest clause 14 on taxes and duties of SCC may please be refered.
17	**Missing Clauses**	**The following clauses are missing in this section of the tender documents.** **15, 16, 17, 18, 18.1, 18.2, 20, 21, 23, 24, 28, 29, 31, 32, 33, 34, 36, 37, 38, 40, 41, 42, 43, 44.** **Request confirmation, that they are deleted and have no relevance to this bid.**	These are not missing clauses. Rather, SCC contains only those clauses of GCC , where there is deviation to the GCC clause. Except for the clauses in the SCC, the clauses in the GCC are applicable to this tender.
18	19	It indicates that the matters relating to ESI, PF and HT Electrical License etc. w.r.t sub-contracting shall be discussed and finalized in the pre-bid meeting scheduled at your office on 21.03.2014. We inform that we shall be attending to this proposed pre-bid meeting.	The latest clause 19.1 on Sub-Contracting of SCC reads as follows "In case of the sub-contracting for the works by the contractor, the same shall be allowed with the prior approval of the employer subject to fulfilling the qualifying requirement for Sub-Contractor/Sub Manufacturer. In addition to the QR, these subcontractors must possess ESI, Provident Fund, and HT Electrical License".
19	Appendix - 8, Section-IX	Functional Guarantees: Request to provide Appendix – 8, since the same is not available in the tender documents.	Clause-1.2.4 of section-3 indicates that "No Functional Guarantees of the facilities are allowed". Hence, Appendix-8 is not applicable.
20		We request please accept If manufacturer already have engineers residing in India and if manufacturer submitting declaration with tender that they will tie up for service centre in India after award	Not acceptable
21		1) As per tender clause OPTCL is asking that **each partner** should have experience of GIS construction for lot 1 and 132 KV cable laying with bay for lot 2 in this case there is no meaning for joint venture as per our view it should be any one partner 2) In some parts of our country, the prevailing voltage levels are 110/115kv in place of 132kv.hence we request your confirmation for **erection experience** that voltage raring of 110kv or higher voltage will be considered because erection and laying system also for 110 KV and 132 KV is exactly same 3] as per tender bidder for underground cables should has experience for extension bay , since scope of bay is considerably very small portion of entire contract . we request you to delete bay experience in cable laying portion	SL. No.1:Tende clasue 2.4.1 General Experience is amended as: Joint Venture: All Partners Combined: must meet requirement, Each Partner: Not Applicable and One Partner: Not Applicable Sl. No.2: 132kV or higher voltage is replaced as 110kV or higher Voltage class. Sl. No.3: Clause: 2.4.1 General Experience is amended as: 110 kV underground Cabling work
22		1)As per tender bidder for underground cables should have experience for extension bay , since scope of bay is considerably very small portion of entire contract . we request you to delete bay experience in cable laying portion 2) Please accept experience for 110 KV UG cable laying any size because erection and laying system also for 110 KV and 132 KV is exactly same	Sl. No.1 & 2: Clause 2.4.1 General Experience is amended as: 110 kV underground Cabling work. The period of execution of works is modified as follows; -For General experience: 07 Fianancial Years preceding to the year of NIT. -For XLPE cable supply experience: 10 Financial years preceding to the year of NIT

23	Taxes & Duties	We understand form the bidding documents that Excise Duty is exempted for ADB funded project. I.e. for LOT-1 & LOT-2. Please clarify. If yes Please confirm the following. a) The required documents will be issued by OPTCL for claiming E.D benefits. b) Required PAC (Project authority certificate will be given by OPTCL to us. c) C- form will be provided by OPTCL for the transactions effected by us including sale in transit. d) Entry permit will be provided by OPTCL for supply of Goods. e) Entry tax will be reimbursed by OPTCL for which supplies are effected.	Yes. a. Duty exemption certificate obtained from the State Govt. of Odisha shall be circulated. b. Yes c. Yes d. Yes e. Yes, if the supply is from within the state the entry tax amount will be reimbursed. If Entry permit is provided by OPTCL for supply from outside the State, Entry Tax is to the account of OPTCL, Hence Entry tax amount shall not be reimbursed.
24	Taxes & Duties	Please confirm the following. 1) CST& VAT to be included in BPS separately and will not be considered for evaluation, but will be reimbursed to the bidders as per actuals. Please confirm. 2) Service tax to be included in BPS separately and will not be considered for evaluation, but will be reimbursed to the bidders as per actuals. Please confirm.	1) Yes, CST & VAT will be reimbursed to the contractor as per actual against documentary evidence (Tax Invoice). 2) Yes, Service will be reimbursed to the contractor as per actual against documentary evidence (Tax Invoice).

25	Taxes & Duties	As per SCC "The Taxes and Duties Treatment shall be discussed and finalized in the Pre-bid Meeting.Please Clarify the following: We understand that Employer shall bear and promptly pay all customs and import duties as well as other local taxes like VAT, CST, Goods and Service Tax(if implemented) on the plant and equipment specified in Schedule No.1 and Schedule No.2 & Schedule 4 for both Bought out as well as Direct Transactions also. Please confirm.	Please refer to clause-14 of SCC for taxes and duties, which reads as follows: 14.1 Concessional CST and Entry Tax: Concessional Sales Tax declaration forms, as admissible, would be issued to the contractor, on their request, by EMPLOYER for all items (as identified in the price schedule of the bid) to be supplied directly by the contractor and also in case of sourcing from Vendor through transit sales as may be permissible. In the event the EMPLOYER is required to issue Way bill, the EMPLOYER will be required to pay Entry Tax on materials entering in to the State. If the Contractor has quoted nil against the Entry Tax in their bid, in such a case the Entry Tax amount paid by the EMPLOYER shall be deducted from the Bill of Contractor. If the Contractor has quoted the Entry Tax in their bid, in such a case the Entry Tax amount shall not be released by the EMPLOYER. 14.2 The Service Tax at the applicable rate shall be released by the Employer to the Contractor on submission of TAx Invoice. The reverse charge mechanism as applicable for released of service tax to the contractor shall be effected. 14.3 Any changes in the rates of taxes & duties during the contractual period shall be to the account of the EMPLOYER.
26	Taxes & Duties	We understand that all taxes and duties will be paid by employer (for both direct and bought out transactions).Please confirm.	Please refer to clause-14 of SCC for payamnt of taxes and duties.
27	Taxes & Duties	We understand that No taxes and duties will be considered for evaluation (for both direct and bought out transactions).Please confirm.	Yes
28	Price variation	Supply of Huge quantity of 33 kV /11 kV & LT cables is under present scope. As you are aware, raw materials of cables like copper, Aluminum, XLPE etc. are very volatile commodities. Any variation either upward or downward the price impact is high to project.Providing Price variation will be beneficial for the Project as it will avoid Manufacturers in loading higher price considering the future increase in raw material rates and it enables bidder to quote at actuals thus making bid more competitive. Also any decrease in price same will be transferred to OPTCL. So we request OPTCL to provide Price Variation to main equipment's like Cables, CB, CT, CVT, Structures ,Transformers etc.	No price variation is allowed, since the project period is less than 18 months.

29	Payment terms	Please confirm the following. 1) 10% Advance : We request you to pay 10% advance on total contract price instead of total EXW amount. 2) 15% on Progressive payment : We understand that 15% progressive amount will be paid after issue of completion certificate. Please confirm that bidders can obtain completion certificates monthly, for commissioning of each Sub-station, Feeder/ cable estimates or each activity mentioned in BOQ.	Tender clause shall stand.
30	Payment terms	In continuation to the above please confirm that bidders are eligible for payments for completed works & delayed in commissioning for which reasons are not attributable to the bidder.	Tender clause shall stand.
31	Defect liability	As per the bidding documents we understand that the critical components covered under the extended defect liability are Transformers, Switch gears, Relays, VCBs, CT & PT, AAA Conductor, XLPE Cables etc. , and the period shall be a time span of five hundred and forty (540) days from the date of Completion of the Facilities (or any part thereof). The defect liability for other component of plant and services shall be one year from the date of Operational Acceptance of the Facilities.	Yes
32	Defect liability	In continuation to the above we understand that date of completion of facilities means- The day immediately after the initial commissioning of facilities and operational acceptance means- The day immediately after the initial commissioning and the load taken thereof. Please confirm.	Clause-1of GCC (Defination) shall apply to completion, intial commisioning and operation acceptance.
33	Annexure-I, Sl. No.(k)	Commercial Questionires- Acceptance of Important conditions , Sl. No.(k) The Contractor agrees to supply spare parts for a period of years: 20 years	Annexure-I, Sl. No.(k) shall stand deleted
34	Annexure-II, Sl. No.(k)	Technical Questionires- Acceptance of Important conditions , Sl. No.(k) The Contractor agrees to supply spare parts for a period of years: 20 years	Annexure-II, Sl. No.(k) shall stand deleted

Revised Section-3 (Package-I)

Section 3 - Evaluation and Qualification Criteria

1. Evaluation

2.4 Experience

Criteria	Compliance Requirements				Documents
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	
2.4.1 General Experience					
(i) **For Lot-1:** Experience under contracts in the role of contractor or subcontractor, for at least last Ten(10) years prior to the bid submission deadline covering following activities: Construction of 33 KV or higher Voltage GIS Sub-station. **(ii) For Lot-2:** Experience under contracts in the role of contractor or subcontractor, for at least last Ten (10) years prior to the bid submission deadline covering following activities: 33kV or higher voltage underground Cabling with Bay in respective GRID S/S. **Note:** The above facility (Both for Lot-1 & Lot-2) should be in satisfactory operation for at least 01 (one) year from the date of commissioning. To substantiate this requirement the performance certificate from user is required to be furnished.	must meet requirement	must meet requirement	must meet requirement	not applicable	Form EXP - 1

2.4.2 Specific Experience:

Criteria	Compliance Requirements				Documents
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	
Contracts of Similar or higher Size and Nature					
(i) For Lot-1 Experience as contractor or subcontractor have successfully erected, tested and commissioned at least 01 no. of 110/33kV or higher voltage class GIS-Grid Sub-station (having Transformer Capacity of 20 MVA or above) on EPC Contract / Turnkey Contract basis for any Transmission Utility during Last Ten (10) Financial Years preceding to the year of IFB **Note:** The above facility should be in satisfactory operation for at least 01 (one) year from the date of commissioning. To substantiate this requirement the performance certificate from user is required to be furnished.	must meet requirement	must meet requirement	Not applicable	must meet requirement	Form EXP - 2(a)
(ii) For Lot-2 : The bidder must have successfully executed XLPE underground Cable laying work at least of 50KM (Cable Length) of 110 kV or higher voltage class for any Transmission Utility during Last Ten (10) Financial Years preceding to the year of IFB. **Note:** The above facility should be in satisfactory operation for at least 01 (one) year from the date of commissioning. To substantiate this requirement the performance certificate from user is required to be furnished.	must meet requirement	must meet requirement	Not applicable	must meet requirement	Form EXP - 2(a)

Revised Section 6 –
Employer's Requirements

Under Clause-1:

Note: The Bidder shall provide details of proposed items of own manufactured equipment using the relevant Form in Section 4 (Bidding Forms). In the Equipment is not manufactured by the bidder, Manufacturers Authorization Certificate using the relevant Form in Section 4 (Bidding Forms)shall be furnished.

Note: Detail Technical specification mentioned in Volume-II of this tender.

Clause-7: Qualification of Subcontractors/Manufacturers:

Subcontractors/Manufacturers for the items described for following supply or services must meet the following minimum criteria, herein listed for that item. Failure to comply with this requirement will result in rejection of the Subcontractor/ Manufacturer.

Item No.	Description of Item	Minimum Criteria to be met
1	Supply of all items as per BOQ.	At least 50% of the total BOQ quantity of the major items (identified) should have been supplied during last five (05) financial years preceding to the year of IFB.
	Lot – 1: (A) Gas Insulated equipment to be used in GIS.	
	1. 132kV Gas Insulated Switchgears Module	
	2.Bus Pts in 132 KV side	
	3.Bus Pts in 33 KV side	
	4.Gas insulated Bus bar	
	5.33kV Gas Insulated Switchgears Module	
	6.Protection control and sub-station automation system with IEC 61850.	
	(B) Equipment to be used in AIS:	
	1. Surge Arrester. (132 & 33 KV side)	
	2. Line Capacitor Voltage Transformer: 132 KV side.	
	Lot - 2	
	1. 132 kV cable XLPE insulated 800 Sq mm single core.	
2	Construction of XLPE Cable laying work	Execution of 33KV or above XLPE Cable laying work for at least five (05) Km (Cable Length) without HDD methodology and for at least one (01) Km (Cable Length) through HDD methodology.

Note: The bidder shall furnish the documentary evidence to meet the above criteria. Besides, Subcontractor/ Manufacturer should have valid relevant license as applicable to the contractor. In case the bidder does not have HDD experience, bidder shall provide Authorisation from HDD Subcontractor using the form provided in Section 4.

In the case of a Bidders, who do not who do not manufacture or otherwise produce major items of supply under the contract, the Bidder shall provide the manufacturer's authorization, using the form provided in Section 4 (Bidding Forms), showing that the Bidder has been duly authorized by the manufacturer or producer of the related plant and equipment or component to supply and install that item under this contract. The Bidder is responsible for ensuring that the manufacturer or producer complies with the requirements of ITB 4 and 5 and meets the minimum criteria listed for respective items. In the event of non-compliance, bid shall be rejected.

ODISHA POWER TRANSMISSION CORPORATION LIMITED

ODISHA POWER SECTOR EMERGENCY ASSISTANCE PROJECT

(PACKAGE – I, LOT – 2)

Technical Specification
For 132kV UG Cable

TECHNICAL SPECIFICATION FOR 132 kV XLPE (CROSS LINKED POLYETHYLENE) INSULATED POWER CABLE:

1.1 SCOPE

1.1.1 The scope under this section covers design, manufacturer, testing, packing, supply, delivery and laying of 132kV XLPE, insulated power cable including integrated testing and commissioning, technical support, supervision of maintenance, training of Employer's staff and documentation for a complete System necessary to deliver the requirements of this Specification.

1.2 STANDARDS:

Unless otherwise specified, the cables shall conform, in all respects, to IS7098(P3/93) and IEC60840 with latest amendment or latest edition for cross linked polyethylene insulated Corrugated Aluminium Sheath and HDPE outer sheathed cable for working voltage of 132 kV.

The following standard specifications of latest version updated to as on date of opening of this bid document will govern supply, laying testing and commissioning of cables and their accessories that are being used in this Contract. In case of conflict between such codes and/ or standards and the specification, the specifications shall govern.

Sr. No	Title of Specification	Specification No.
1	Cross linked polyethylene insulated Thermoplastic sheathed cables	IS7098(P3)/93 IEC: 60840, IEC: 62067
2	Conductors for insulated cables.	IS8130/84
3	Test on cable over Sheath which have a special protective function and are applied by extrusion	IEC 60229
4	HDPE pipes	BIS 4984
5	Power cables with extruded insulation and their accessories for rated voltage above 30 kV and up to 150 kV- Test Methods & requirements	IEC 60840

Sr. No	Title of Specification	Specification No.
6	Power Cables with extruded insulation and their accessories for rated voltages above 150kV.	IEC: 62067
7	Impulse test on cables & their accessories.	IEC 60230
8	Cyclic and emergency rating of cable	IEC 60852-2
9	Common test methods for insulating and sheathing material of electrical cables.	IEC 60811
10	Electric test methods for Electric cables – Test methods for Partial Discharge measurements on lengths of extruded power cables.	IEC 60885

1.3 PRINCIPAL PARAMETERS:

1.3.1 132 KV (E) grade XLPE single core power cable conductor electrolytic grade copper of single length, with formation of stranded compacted circular conductor for size up to 800 Sqmm and Compacted type for size above 630mm2 as per IEC-60228, tapped with semi conducting tape, shielded with extruded semi-conducting layer, insulated with dry gas cured cross linked polyethylene (XLPE) insulation, insulation screened with extruded semi- conducting layer, lapped with a combination of semi- conducting water swell able and corrugated aluminium sheath. Black HDPE ST7 outer sheath with graphite coating or extruded semi conductive layer overall cable, confirming to IS:7098 (Part-III)/1993 or any latest amendments thereof.

1.3.2 Outer sheathing should be designed to afford high degree of mechanical protection and should also be heat, oil chemicals and weather resistant.

1.3.3 The cable should be suitable for laying in covered trenches and/or underground for outdoor

1.3.4 The sheath/screen bonding system shall provide a continuous current path through the cable sheath and jointing kits and shall be bonded. The bonding ends shall be suitably earthed as per approved configuration/design. The sheath voltage under full load condition shall not exceed the voltage specified/allowed in relevant standard for safety of personal as well as satisfactory working of cable. Sheath shall be solidly grounded at suitable location. Bidder must indicate details of configuration proposed along with sufficiency calculation with the bid so as to limit induced voltage of sheath within 65V.

1.3.5 **CABLE PARAMETERS**

Sr. No.	System Particulars	132kV
i)	Voltage Grade (Uo/U)	76/132
ii)	No. of Cores	Single
iii)	Size (mm^2)	630mm^2, 800mm^2
iv)	Nominal system voltage KV	132
v)	Highest system voltage KV	145
vi)	System Frequency Hz	50
vii)	Variation in Frequency	± 3%
viii)	Fault level individually for i) Conductor ii) Aluminium Sheath	 31.5 KA for1sec 31.5 KA for 1sec
ix)	Maximum allowable temperature	
	a) Design continuous operation at rated full load current, the max, temp. of conductor shall not exceed.^{0}C	90
	b) The conductor temperature after a short circuit for 1.0 sec shall not exceed. ^{0}C	250
x)	Basic insulation level (1.2/50 Micro Second Wave)	625 KVP
xi)	1-min. power frequency withstand voltage (rms)	275 KV
xii)	System earthing	Effectively earthed

1.4 **OPERATION CHARACTERISTICS:**

a) Three-phase feeders, each consisting of 1 runs of 3 Single core cables, feed power at 132 kV

b) In normal situation, each cable will have to be designed to carry a continuous current, to deliver a rated power of Transformers and its designed overload.

c) The cable should be designed for a suitable current carrying capacity under normal situation, and which will cater for the above overload capabilities also, will be required.

1.5 **GENERAL TECHNICAL REQUIREMENTS**:

1.5.1 **CONDUCTOR:**

The cable conductor shall be made from electrolytic grade copper with formation as stranded compacted circular conductor for size upto 800 sqmm as per IS8130/84

for the size above 800mm^2.The conductor shall confirm to IS:8130/1984.

1.5.2 **CONDUCOTR SCREEN:**

A Conductor screen made of semiconducting compound shall be provided over the conductor, by extrusion. The extruded coat shall be continuous, with a constant mean depth, without bump, perfectly adhering to the insulation envelope. A semiconducting tape(s) shall be provided below the extruded semi-conducting conductor screen to prevent penetration of the compound into the underlying conductor. The conductor having a semi-conducting screen shall ensure perfectly smooth profile and avoid stress concentration. The conductor screen shall be extruded in the same operation as the insulation; the semi-conducting polymer shall be cross-linked. Minimum thickness of the conductor screen shall be 1.5 mm. The electric resistivity of the conductor screen shall not be more than 5000 Ω cm at 20ºC and not more than 25000 Ω cm at the working rated temperature.

1.5.3 **INSULATION:**

The Insulation envelope shall be of cross-linked polyethylene (XLPE) insulation applied by extrusion should be suitable for 132kV system voltage. The nominal thickness of insulation shall not be less than 18 mm, subject to tolerances as per IS7098(P3)/93. The manufacturing process shall ensure that the Insulation shall be applied by extrusion and vulcanized using dry curing process to form a compact homogenous body free from micro voids and contaminants. The insulation compound shall be of high quality, heat, moisture, ozone and corona resistant. The insulation shall be concentric with conductorwithstand mechanical and thermal stressed under steady state and transient operating conditions. The extrusion method should give very smooth interface between semi-conducting screen and insulation.

1.5.3.1 The voltage gradient in the rated working conditions shall be

a) equal to or less than 6kV/mm at the level of internal semiconductor.
b) Equal to or less than 3kV/mm at the level of external semiconductor

1.5.3.2 The Physical mechanical characteristics shall be as follow:

Should confirm to parameters given in IS 7098(P3)/93and other related IS

1.5.3.3 The insulation envelope shall comply with the hot set tests :

As per IS 7098(P3)/93 Stipultions

1.5.4 **INSULATION SCREEN:**

To confine electrical field to the insulation, non-magnetic semi- conducting shield shall be put over the insulation. The insulation shield shall be extruded in the same operation as the conductor shield and the insulation by suitable extrusion process (triple extrusion). The XLPE insulation shield should be bonded type. Metallic screening shall be provided. The metallic sheath/screen if applicable shall be of copper wire having fault current capacity same as the conductor (31.5KA for 1-sec).

1.5.4 INNER SHEATH:

The inner sheath shall comprise of extruded corrugated Aluminium. The tape shall be applied over the extruded insulation screening to block and prevent moisture propagation in a longitudinal direction. The sheath shall be suitable to withstand the site conditions and the desired temperature. It should be of adequate thickness, consistent quality and free from all defects.

1.5.6 **METALIC SHEATH:**

Metallic sheath shall be of Corrugated Aluminum sheath metallic sheath will replace armour and should be capable of withstanding fault current(31.5 KA for 1 sec)

In the case of metallic sheath of Corrugated Aluminum sheath the bidder shall submit the calculation of area of aluminium sheath in this support.

1.5.6.1 **BEDDING TAPE**

The bedding shall be anti corrosive/ rodent layer of protection.

1.5.7 **OUTER SHEATH:**

The outer sheath shall be extruded black in colour or similar (as per phase). Suitable semi conducting layer coated on black HDPE ST7 with graphite coating or extruded conductive layer confirming to IEC: 60840, shall be applied over aluminium sheath with suitable additives to prevent attack by rodents and termites. The outer sheath should have embossing at every one meter for Supplier Name, manufacturer name, DMRC, Voltage grade etc.

5.7.1 The Mechanical Characteristics of outer HDPE Sheath shall be as follow :

It should be confirm to IS 7098(part-3)/93 or any other standard applicable for HDPE sheath

5.7.2 The variation is the difference between the medium value obtained after ageing and the medium value without ageing, expressed in percentage of the last.

1.5.8 CONSTRUCTION:

1.5.8.1 All materials used in the manufacture of cable shall be new unused and of finest quality. All materials should comply with the applicable provision of the tests of the specification. IS, IEC, Indian Electricity Rules, Indian Electricity Act and any other applicable statutory provisions rules and regulations.

1.5.9 **CURRENT RATING:**

The cable will have current ratings and de-rating factors as per IS or any other relevant standard IEC.

1.5.9.1 The one-second short circuit rating values each for conductor, screen & 'Al' sheath shall be furnished and shall be subject to the purchaser's approval.

1.5.9.2 The current ratings shall be based on maximum conductor temperature of 90 deg. C with ambient site condition specified for continuous operation at the rated current.

1.5.9.3 SIZE:

The size of cable shall be 132 kV Single Core,Cu 800 sq mm and 630sq mm.

1.5.10 OPERATION:

1.5.10.1Cables shall be capable of satisfactory operation under a power supply system frequency variation of plus minus 3% voltage variation of plus, minus 10% and combined frequency voltage variation of 10% (absolute sum).

1.5.10.2 Cable shall be suitable for laying in ducts or buried under ground.

1.5.10.3 Cable shall have heat and moisture resistance properties. These shall be of type and design with proven record on transmission network service.

1.5.11 LENGHTS: The cable shall be supplied in standard drum lengths as below:

Size of cable	**Standard Drum Length**
a) Single Core,800sqmm, 630sqmm,	500 meters $\pm$ 5% tolerance and $\pm$ 2% overall tolerance in total quantity of cable.

1.5.11 **INDENTIFICATION MARKING:**

Identification of cables shall be provided externally at three meters' intervals to identify as under:-

i) 'Name of Manufacture'
ii) 'Year of manufacture'
iii) 'Voltage grade' to be embossed at the interval of one meter-length. The identification, embossing shall be done only on the outersheath. Name of purchaser shall also be embossed.

1.6.0 TESTS

1.6.1 Type Tests

The equipment offered should be type tested. Type test report should not be more than five years old, reckoned from the date of bid opening, in respect of the following tests,
carried out in accordance with ISS-7098/IEC-871, from Govt./Govt. approved test house, shall be submitted along with bid:

i) Physical tests for insulation and outer sheath.
ii) Bending test.
iii) Di-electrical power factor test.
iv) Heating cycle test followed by di-electrical power factor as a function of voltage and partial discharge test.
v) Impulse withstand test.

The remaining type test report as per clause 3 of ISS-7098/ IEC-871/ IEC-60840 shall be submitted by the successful bidder within three months from the date of placement of order. These type test reports shall be from Govt./Govt. approved test house and shall not be more than five years old, reckoned from the date of placement of order. The failure to do so will be considered as a breach of contract.

1.6.2 ROUTINE TESTS AND ACCEPTANCE TESTS

All routine and acceptance tests shall be carried as per relevant ISS in the presence of Employer's representative

1.7 INSPECTION

The material shall be inspected and tested before dispatch by an authorised representative of the Owner in respect of quality. The inspecting officer shall also satisfy himself about the correctness of length of cables. In case the supplier is not in a position to get these tests carried out at his works, such tests may be got carried out by him at any Govt. recognized test agency at his own expense.

1.8 TEST CERTIFICATES

The supplier shall supply test certificates from a Govt. agency in respect of quality as per IS:7098(part-II) 1985 with latest amendments thereof for approval of the purchaser.

1.9 PACKING

The cable shall be supplied in returnable steel drum as per IS:10418:1982 so constructed, as to enable the cable to be transported on each drum. The cable wound on such drum shall be one continuous length. The ends of cables shall be sealed by means of non-hygroscopic sealing material.

1.10 MARKING

The marking on the drum shall have the following information: -

a) Reference to Indian Standard & cable code.
b) Name of the manufacturer & trade name.
c) Nominal cross section area of conductor for the cables.
d) Number of core.
e) Sequential No. at each meter.
f) Type of the cable & voltage for which it is suitable.
g) Length of cable on the drum.
h) Approximate gross weight.
i) Net weight of the cable.
j) Drum identification number.
k) P.O. No. and date.
l) Consignee's name with designation.
m) Year of manufacture.

1.11 DRAWINGS & INSTRUCTION MANUAL

The tenderer shall supply the following drawings with the tender: -

i) Detailed drawing of the cable showing conductor, screening insulation, Al sheathing, outer sheath etc.
ii) Detailed drawing showing jointing of cable and sealing of end boxes.

Copies of instruction manuals for testing, installation jointing operation and maintenance of cables shall also be submitted with the offer for reference of the purchaser.

1.12 TECHNICAL & GUARANTEED PARTICULARS:

The tenderer shall furnish guaranteed technical particulars as per the tender specification. Particulars, which are subject to guarantee, shall be clearly marked. Offer not containing this information will not be considered.

1.13 TERMINATION KITS AND STRAIGHT THROUGH JOINTS

The entire necessary Straight through joints and Sealing Ends wet type for 132 kV shall be supplied and erected. The Straight through joints and Sealing Ends wherever required shall be Pre -moulded Type or equivalent, of reputed make with shear head type mechanical connectors of proven technology & make.

1.14 ISO Accreditation

The cable shall be manufactured by a company having ISO accreditation for quality. The manufacturing process of XLPE cable shall consist of conductor screen, insulation & insulation screen shall be extruded in a single process.(triple extrusion) and cross linked by VCV Process (Vertical Continuous Vulcanization process) dry curing technology to ensure homogeneity and absence of micro voids. The cables shall be manufactured by “Dry Curing” Process. It is mandatory that bidder should submit Plant Installation Certificate for VCV Line and for Metallic sheath machineries indicating the year of installation and other details along with bid

The Employer may decide to visit the works of cable manufacturer to confirm the manufacturing process mentioned.

PART II

TECHNICAL SPECIFICATION FOR LAYING, TESTING AND COMMISSIONING OF 132kV XLPE UNDERGROUND POWER CABLE

SECTION-1
SPECIFICATION FOR LAYING OF CABLE

1.1 GENERAL

1.1.2 The Cable Laying works shall be executed according to the rules of the Art pertaining to professional grade and generally in compliance with International Standards and Indian Standards.

1.1.3 The EHV Cables between the Power Supply Authorities Substation and the DMRC RSS shall be laid in ground depending upon the site conditions of the selected route, any of the following paying conditions, may be adopted.

1.1.4 Cable Laying Cases

Case 1 - Direct buried, with all cables laid in flat formation.

Case 2 – Direct buried, with the cables (3) of each circuit laid in trefoil formation and side by side in one trench, leaving at least a gap of 250mm in between.

Case 3 – Laid in underground duct.

Case 4 – Laid in Trench less piping.

Case 5 – Laid in abutment crossing

Case 6 – Laid in Rail Track crossing

Case 7 – Laid in Air, supported on piers/walls, for nallah-crossing

1.1.5 Details of Case 2 :

The trench for carrying the cables shall be at least 1.8m deep and 1.1m wide, which may vary as per site conditions with the approval of employer. Each of the feeder shall consist of 3 single-core cables, and laid in trefoil formation. Cables shall be laid at a depth of 1.37m below the ground level and over the virgin bed of the trench. Trench is to be filled with riddled soil upto a point of 250mm from the bed. Warning concrete slabs of at least 50mm thickness shall then be laid above the sand. Trench shall then be filled with earth upto a depth of 300 mm below the ground level. A warning net shall then be laid above the earth filling (at 300 mm depth below the ground level). A warning tape shall also be laid appropriately with Purchaser's Name marked on it. The top space of 300 mm shall be suitably filled with compacted Boulder and Bitumen/Jelly and given a final finish matching the surroundings. The cables shall be tied through locking belts after 2 meters each for keeping the cables intact in case of trefoil formation. At locations, where there is change of level of laying, the cables shall be tied through locking belts after 1 meter each.

1.1.6 Details of Case 3

In specific locations, the Employer may require the cables to be laid in underground ducts. The underground ducts shall be laid where road construction or formation is under construction or where water logging stretch is expected or as per the specific site condition.

1.1.7 Details of Case 4 & 6

On all road/rail crossings and at other specific locations, cable laying shall be through trenchless drilling and the cables shall be passed through High Density Polyethylene (HDPE) Pipes of appropriate diameter and thickness (Case-4). One spare HDPE pipe shall be laid for each feeder of 3 cables at the road/rail crossings.

1.1.8 Details of Case 5 & 7

On all abutment crossing or in air, supported on piers/walls, for Nallah crossing and at other specific locations, cable laying shall be on the galvanized steel structures which can withstand wind velocity of 260kmph, supported on piers and have sufficient structural strength. The minimum average weight of zinc coating should be 1000g/m2 (RDSO). The cables should be well protected by providing GI sheet of thickness 8mm at least fastened with nuts and bolts & tag welded on all sides to be protected from any pilferages. The arrangement shall render cable absolutely safe from any natural calamity. The cable shall not be exposed or get affected due to stray fire caused in the vicinity. Indicative arrangement is shown in the drawing.

1.1.9 Spare Cables and Pipes

When cables are laid in pipes, in addition to the pipes carrying the cables, at least one spare pipe, without cable shall also be provided. In the case cables laid in underground ducts (Case 3) and cables laid in Trenchless piping (Case 4), spare HDPE pipes, one for each circuit, shall be provided. In addition to pipes for power cables, 2 additional pipes, each of not less than 100 mm dia, shall be provided to carry control and monitoring cables, one operational and one spare (As indicated in the Interfacing Requirements, other cables such as optic fibre cables for control and monitoring, tele-communication etc, supplied by other Suppliers).

1.1.10 **Cable protection at changeover location**

The cable path, when changing from buried in ground to underground duct or trenchless piping shall be adequately protected by proper sealing in concrete or other suitable means of sufficient mechanical strength to avoid cable from suffering damage due to heat/fire/water ingress etc.

1.1.11 **Pulling Chambers**

Not required.

1.1.12 **Route Markers**

The route shall be appropriately marked by suitable retro-reflective cable markers, at suitable intervals and positions of straight through joints shall be indicated by suitable boards.

2.0.0 CABLE ACCESSORIES AND BONDING

2.1.0 Straight Through Joints

2.1.1 The straight through Joints should be Pre-moulded type of proven technology and make, suitable for underground buried cables.

2.1.2 The product should be type tested as per IEC /KEMA specifications

2.1.3 GENERAL SPECIFICATIONS

a. The product offered should be proven and should be in use in India for a minimum period of 5 years for the same voltage class. List of past supplies in India to be furnished. Performance certificates to be submitted along with the offer.

b. The product offered should have unlimited shelf life.

c. Offers should be supported with type test certificates from test laboratories of repute, as per IEC/ KEMA specifications, failing which the offers shall be ignored.

2.1.4 General Specifications for Joints and Terminations for 132 kV XLPE Cables

The Terminations (Outdoor Sealing ends) and Straight Through Joints for 132 kV cables shall be of 'Pre-moulded, type of proven technology and make, suitable for 132 kV (E) grade or higher, Single core 800 sqmm & 630 sqmm, XLPE Insulated, Aluminium sheathed cables. The Indoor termination for use in the GIS Substation.

2.2.0 Bonding

2.2.1 Suitable bonding methods viz., Single End, Both End, mid point shall be used.

3.0.0 TESTING AND INSPECTION

3.1.0 TYPE-TESTS

3.1.1 General

All the equipment which are used for this work shall be of proven design and standards to achieve a very high level of reliability in service. An equipment is considered to be proven if it is in successful operation at least for a period of two years. Irrespective of the fact that the summary of type test reports was submitted for 132kV (E) or higher grade Single core, XLPE insulated, Copper conductor Aluminium Sheathed cable along with the bid, the Supplier shall furnish a summary of type test reports for all the equipment listed below except those equipment which are yet to be type tested being under development within three (3) months period from the date of signing the contract.

3.1.2 Pre-moulded type or cold shrink type of proven technology and make straight through joint suitable for 132 kV (E) grade Single Core 800 sqmm or 630 sqmm size XLPE insulated cable with Aluminum sheath.

3.1.3 Reputed make cable Sealing end (Wet) type terminations (indoor & outdoor) suitable for 132 kV (E) grade

3.1.4 The cable and cable accessories intended to be used for this work shall be

(i) Type-tested within the last five (5) years period prior to the date of bid opening. (ii) Proven in service for at least two (2) years as on the date of bid opening.

3.1.5 Submission of Performance Certificates

As a proof of satisfactory performance of following equipments during last two years from the bidder /JV partner /sub Supplier from whom Bidder intends to supply them.

3.1.6 Pre-moulded type with proven technology straight through joint suitable for 132 kV (E) grade or above grade, Single Core 800 sqmm and 630 sqmm or above size XLPE insulated cable with Aluminum sheath.

3.1.7 Sealing end (outdoor or GIS) Cable terminations (indoor & outdoor) suitable for 132 kV (E) grade

3.2.1 Type Test Results

Summary of type test results of the above mentioned equipment will be in the following format:

Sl.No.	Equipment	Manufactured By	Rating	Governing specification for type test	Name of type test	Month/ Year conducted	Testing Lab/Testing House/In House	Result/ Remark

3.2.2 If the type tests of any equipment being supplied for this work are not yet conducted by the Supplier then all the type tests as per the relevant IEC shall be conducted at his expense in the presence of employer's representative either at manufacturer's works having requisite facilities and approved by independent laboratory like KEEMA, Netherland or CESI Italy, or at KEEMA, Netherlands or CESI, Milano, Italy.

3.2.3 Details of 'Make of Cables/Accessories

The bidder shall submit to the employer the proposed "make" of all the above equipment in the bid form along with other details such as rating, quantity in use, place of installation number of years in satisfactory operation, summary of type test reports of required rating of 132kV or higher grade, Aluminum/copper conductor, XLPE insulated, Aluminum or Copper sheath cable along with the bid so as to decide the 'make' of the items. Based on the information thus furnished the employer shall decide the 'make' of the items to be used for the work. The plant & equipment being supplied against this bid shall conform to relevant IEC standards.

3.2.4 Rejection of Type Test Report

When the Employer rejects any specific type test report for a particular equipment stating the grounds for such rejection, the Supplier shall re-conduct the relevant type tests as per the specification in the presence of Employer's representatives before the item is supplied by him. Such type test shall be conducted by the Supplier at his own expense at the manufacturer's works approved by KEMA Netherland or CESI Italy in the presence of Employer's

representative.

3.2.5 Type Test Reports

The type test reports of the equipment shall be of the tests carried out at any accredited laboratory during the last five (5) years period as on the date of bid opening. If any type test report is older than 5 years, the type tests will have to be repeated at Supplier's cost. Employer shall waive some of these tests in case of equipment / sub assemblies where the manufacturer can establish to the satisfaction of employer that such tests have already been carried out earlier or where the equipment have been proved in service. In such a case, manufacturer shall submit complete test reports along with necessary certification.

3.2.6 ROUTINE TESTS

Routine tests shall comprise of visual inspection of the items and all the routine tests as per specification. All these tests shall be conducted in the presence of Employer's nominated representative at the manufacturer's works. Routine test shall be carried out as per specification ICE 60840 latest version.

3.2.6.1 General

The following tests shall be carried out on each manufactured length of cable:

a) Partial discharge test (see 5.2.2);

b) Voltage test (see 5.2.3);

c) Electrical test on over sheath of the cable, if required (see 5.2.4).

3.2.6.2 The order in which these tests are carried out is at the discretion of the manufacturer. The main insulation of each prefabricated necessary shall undergo partial discharge (see 5.2.2) and voltage (see 5.2.3) tests according to either 1), 2) or 3) below:

1) On accessories installed on cable;

2) By using a host accessory into which a component of an accessory is substituted for test;

3) By using a simulated accessory rig in which the electrical stress environment of a main insulation component is reproduced.

3.2.6.3 In cases 2) and 3), the test voltage shall be selected to obtain electrical stresses at least the same as those on the component in a complete accessory when subjected to the test voltages specified in 5.2.2 and 5.2.3

3.2.6.4 NOTE: The main insulation of prefabricated accessories consists of the components that come in direct contact with the cable insulation and are necessary to control the electric stress distribution in the accessory. Examples are pre-moulded or pre-cast elastomer or filled epoxy resin insulating components that may be used singly or jointly to provide the necessary insulation or screening of accessories.

3.2.7 Partial discharge test

The partial discharge test shall be carried out in accordance with IEC 60885-3 for cables, except that the sensitivity as defined in IEC 60885-3 shall be 10pC or better. Testing of accessories follows the same principles, but the sensitivity shall be 5pC or better. The test voltage shall be raised gradually to and held at 1.75 Uo for 10 s and then slowly reduced to 1.5 Uo There shall

be no detectable discharge exceeding the declared sensitivity from the test object at 1.5 Uo.

3.2.8 Voltage test

The voltage test shall be made at ambient temperature using an alternating test voltage at power frequency. The test voltage shall be raised gradually to 2.5 Uo) and then be held for 30 min between the conductor and metallic screen/sheath. No breakdown of the insulation shall occur 60840 @ IEC: 2004 Electrical test on over sheath of the cable When the test is required by the particular contract, the cable over sheath shall be subjected to the electrical test specified in Clause 3 of IEC 60229.

3.3.0 Acceptance tests

3.3.1 General

Acceptance tests for the power cable & its accessories shall be carried out wherever the same is mentioned in the relevant specification governing the cable and its accessories. All the acceptance tests as mentioned in the governing specification to which the product is manufactured shall be conducted in the presence of Employer's nominated representative by the Supplier at their manufacturing works. The following tests shall be carried out on samples which, for the tests in terms b) and g), may be drum lengths of cable, taken to represent batches:

a) Conductor examination (see 5.3.4);

b) Measurement of electrical resistance of conductor and of metallic screen (see 5.3.5);

c) Measurement of thickness of insulation and over sheath

d) Measurement of thickness of metallic sheath

e) Measurement of diameters, if required

f) Hot set test for XLPE, EPR and HEPR insulations Measurement of capacitance

Measurement of density of HDPE insulation

g) Water penetration test, if applicable

h) Tests on components of cables with a longitudinally applied metal foil

3.3.2 Frequency of tests

The sample tests in items a) to h) of 5.3.1 shall be carried out on one length from each batch (manufacturing series) of the same type and cross-section of cable, but shall be limited to not more than 10% of the number of lengths in any contract, rounded to the nearest whole number. The frequency of the tests in items I) and j) of 5.3.1 shall be in accordance with agreed quality control procedures. In the absence of such an agreement, one test shall be made for contracts with a cable length above 20 km.

3.3.3 Repetition of tests

If the sample from any length selected for the tests falls in any of the tests in 5.3.1, further samples shall be taken from two further lengths of the same batch and subjected to the same tests as those in which the original sample failed. If both additional samples pass the tests, the other cables in the batch from which they were taken shall be regarded as having complied with the requirements of this standard. If either fail, this batch of cables shall be regarded as having failed to comply.

3.3.4 Conductor examination

Compliance with the requirements of IEC 60228 for conductor construction, or the declared construction, shall be checked by inspection and measurement when practicable. Measurement of electrical resistance of conductor and metallic screen The cable length, or a sample thereof, shall be placed in the test room, which shall be maintained at a reasonably constant temperature for at least 12 h before the test. If there is a doubt that the conductor or metallic screen temperature is not the same as the room temperature, the resistance shall be measure after the cable has been in the test room for 24 h. Alternatively, the resistance can be measured on a sample of conductor or metallic screen, conditioned for at least 1 h in a temperature controlled liquid bath.

3.3.5 Additional Acceptance Tests

The following additional acceptance tests shall be carried out.

1. Additional acceptance tests (1 sample/offered lot) shall be carried out for Ovality & Eccentricity.
2. Tensile strength and Elongation on insulation and over sheath before and after ageing and Thermal Stability on outer sheath of power cable.
3. finish and length measurement shall be carried on one length of each size of offered lot of power cables.

3.3.6 Short Circuit Test :

Short Circuit test for Power Cables will be conducted by the Supplier on the cable at Manufacturer's works having requisite facilities approved by KEMA Netherlands or CESI Italy or at KEEMA, Netherlands or CESI Milano, Italy or accredited lab & shall be witnessed by the Employer's authorized representative.

3.3.7 TEST CERTIFICATES

Three copies of the test certificates of successful type tests if any carried out on cables and cable accessories shall be furnished to the Employer within fifteen days after completion of such type tests. Three copies of successful acceptance & routine tests carried out on cables and cable accessories and the certificate of inspection issued by the Employer's representative shall be furnished within 15 days, after the completion of tests by the Employer's representative.

3.3.8 RESPONSIBILITY OF SUPPLIER FOR DELIVERY/SUPPLY

(a) All defects detected as a result of testing / inspection shall be rectified by the manufacturer at his own expense and shall be documented and corrected prior to shipment. If in opinion of Employer, a repeat of the test is required after such rectification, this shall also be carried out at the expense of the Supplier.

(b) No cable / accessory shall be supplied until Employer has inspected the same to his satisfaction and accepted. However, such inspection and/or acceptance certificate shall not relieve the Supplier of his responsibility for furnishing the cables and cable accessories conforming to the requirements of the contract nor prejudice any claim, right or privilege which the Employer may have because of the use of defective or unsatisfactory items. Should the Employer waive the right to inspect any item, such waiver shall be obtained by the Supplier from the Employer in writing and such a waival shall not relieve the Supplier in anyway from his obligation under the contract.

(c) Only after obtaining clearance from the Employer, the Supplier shall despatch the items to

site.

3.3.9 INSPECTION OF ERECTION WORK

All erection work will be subject to inspection by the Employer or his representative to ensure that the work is done in accordance with the specification and approved drawing.

3.3.10 INSPECTION AND TESTS OF COMPLETELY LAID CABLE

3.3.10.1 General

As soon as the work is completed and ready for inspection and testing, the Supplier shall advise the Employer in writing. Tests will be carried out by the Employer jointly with the Supplier. Testing equipments and staff required for the tests shall be provided by the Supplier free of charge. The Supplier shall take full responsibility for these tests interalia his other responsibilities. The Supplier shall notify the manufacturer of cable and cable accessories regarding likely date of pre-commissioning tests, one month in advance so that their representative may be available at site at the time of conducting the tests. It shall be Supplier's responsibility to ensure that the cable and it's accessories are commissioned as per laid down procedures.

3.3.11 Pre commissioning Tests for the facility as a whole The following site tests shall be conducted on a completed power cable installation as per specification IEC 60840 latest version.

(i) Visual Inspection and Continuity Check Visual inspection shall include check for satisfactory workmanship Continuity check shall be carried out on the cable to ensure that the cable is continuous.

(ii) DC voltage test of the over sheath The test shall be conducted as per Clause 15.1 of IEC 60840.

(iii) AC voltage test for the installation. The test shall be conducted as per Clause 15.2 of IEC 60840.

(iv) the insulation resistance of the cable shall be checked before & after the HV test on cable. The core resistance shall be measured and the value corrected in accordance with clause 5 of IEC 60228.

(v) The cable must be discharged on completion of DC High Voltage Test and the cable shall be kept earthed until it is put into service. The values obtained during these tests shall be in conformity with the values obtained during inspection of the materials at the manufacturer's works.

3.3.12 PROFORMA FOR TESTS

The Supplier shall submit the results of tests in quadruplicate in an approved proforma within 7 days from the date of completion of the tests but before actual commissioning of the cable. The proforma shall be developed by the Supplier and got approved from Employer within three (3) months from the effective date of the contract.

ODISHA POWER TRANSMISSION CORPORATION LIMITED

ODISHA POWER SECTOR EMERGENCY ASSISTANCE PROJECT

(PACKAGE – I, LOT – 2)

Technical Specification
For 132kV UG Cable

TECHNICAL SPECIFICATION FOR 132 kV XLPE (CROSS LINKED POLYETHYLENE) INSULATED POWER CABLE:

1.1 SCOPE

1.1.1 The scope under this section covers design, manufacturer, testing, packing, supply, delivery and laying of 132kV XLPE, insulated power cable including integrated testing and commissioning, technical support, supervision of maintenance, training of Employer's staff and documentation for a complete System necessary to deliver the requirements of this Specification.

1.2 STANDARDS:

Unless otherwise specified, the cables shall conform, in all respects, to IS7098(P3/93) and IEC60840 with latest amendment or latest edition for cross linked polyethylene insulated Corrugated Aluminium Sheath and HDPE outer sheathed cable for working voltage of 132 kV.

The following standard specifications of latest version updated to as on date of opening of this bid document will govern supply, laying testing and commissioning of cables and their accessories that are being used in this Contract. In case of conflict between such codes and/ or standards and the specification, the specifications shall govern.

Sr. No	Title of Specification	Specification No.
1	Cross linked polyethylene insulated Thermoplastic sheathed cables	IS7098(P3)/93 IEC: 60840, IEC: 62067
2	Conductors for insulated cables.	IS8130/84
3	Test on cable over Sheath which have a special protective function and are applied by extrusion	IEC 60229
4	HDPE pipes	BIS 4984
5	Power cables with extruded insulation and their accessories for rated voltage above 30 kV and up to 150 kV- Test Methods & requirements	IEC 60840

Sr. No	Title of Specification	Specification No.
6	Power Cables with extruded insulation and their accessories for rated voltages above 150kV.	IEC: 62067
7	Impulse test on cables & their accessories.	IEC 60230
8	Cyclic and emergency rating of cable	IEC 60852-2
9	Common test methods for insulating and sheathing material of electrical cables.	IEC 60811
10	Electric test methods for Electric cables – Test methods for Partial Discharge measurements on lengths of extruded power cables.	IEC 60885

1.3 PRINCIPAL PARAMETERS:

1.3.1 132 KV (E) grade XLPE single core power cable conductor electrolytic grade copper of single length, with formation of stranded compacted circular conductor for size up to 800 Sqmm and Compacted type for size above 630mm2 as per IEC-60228, tapped with semi conducting tape, shielded with extruded semi-conducting layer, insulated with dry gas cured cross linked polyethylene (XLPE) insulation, insulation screened with extruded semi- conducting layer, lapped with a combination of semi- conducting water swell able and corrugated aluminium sheath. Black HDPE ST7 outer sheath with graphite coating or extruded semi conductive layer overall cable, confirming to IS:7098 (Part-III)/1993 or any latest amendments thereof.

1.3.2 Outer sheathing should be designed to afford high degree of mechanical protection and should also be heat, oil chemicals and weather resistant.

1.3.3 The cable should be suitable for laying in covered trenches and/or underground for outdoor

1.3.4 The sheath/screen bonding system shall provide a continuous current path through the cable sheath and jointing kits and shall be bonded. The bonding ends shall be suitably earthed as per approved configuration/design. The sheath voltage under full load condition shall not exceed the voltage specified/allowed in relevant standard for safety of personal as well as satisfactory working of cable. Sheath shall be solidly grounded at suitable location. Bidder must indicate details of configuration proposed along with sufficiency calculation with the bid so as to limit induced voltage of sheath within 65V.

1.3.5 **CABLE PARAMETERS**

Sr. No.	System Particulars	132kV
i)	Voltage Grade (Uo/U)	76/132
ii)	No. of Cores	Single
iii)	Size (mm^2)	630mm^2, 800mm^2
iv)	Nominal system voltage KV	132
v)	Highest system voltage KV	145
vi)	System Frequency Hz	50
vii)	Variation in Frequency	± 3%
viii)	Fault level individually for i) Conductor ii) Aluminium Sheath	 31.5 KA for1sec 31.5 KA for 1sec
ix)	Maximum allowable temperature	
	a) Design continuous operation at rated full load current, the max, temp. of conductor shall not exceed.^{0}C	90
	b) The conductor temperature after a short circuit for 1.0 sec shall not exceed. ^{0}C	250
x)	Basic insulation level (1.2/50 Micro Second Wave)	625 KVP
xi)	1-min. power frequency withstand voltage (rms)	275 KV
xii)	System earthing	Effectively earthed

1.4 **OPERATION CHARACTERISTICS:**

a) Three-phase feeders, each consisting of 1 runs of 3 Single core cables, feed power at 132 kV

b) In normal situation, each cable will have to be designed to carry a continuous current, to deliver a rated power of Transformers and its designed overload.

c) The cable should be designed for a suitable current carrying capacity under normal situation, and which will cater for the above overload capabilities also, will be required.

1.5 **GENERAL TECHNICAL REQUIREMENTS**:

1.5.1 **CONDUCTOR:**

The cable conductor shall be made from electrolytic grade copper with formation as stranded compacted circular conductor for size upto 800 sqmm as per IS8130/84

for the size above 800mm^2.The conductor shall confirm to IS:8130/1984.

1.5.2 **CONDUCOTR SCREEN:**

A Conductor screen made of semiconducting compound shall be provided over the conductor, by extrusion. The extruded coat shall be continuous, with a constant mean depth, without bump, perfectly adhering to the insulation envelope. A semiconducting tape(s) shall be provided below the extruded semi-conducting conductor screen to prevent penetration of the compound into the underlying conductor. The conductor having a semi-conducting screen shall ensure perfectly smooth profile and avoid stress concentration. The conductor screen shall be extruded in the same operation as the insulation; the semi-conducting polymer shall be cross-linked. Minimum thickness of the conductor screen shall be 1.5 mm. The electric resistivity of the conductor screen shall not be more than 5000 Ω cm at 20ºC and not more than 25000 Ω cm at the working rated temperature.

1.5.3 **INSULATION:**

The Insulation envelope shall be of cross-linked polyethylene (XLPE) insulation applied by extrusion should be suitable for 132kV system voltage. The nominal thickness of insulation shall not be less than 18 mm, subject to tolerances as per IS7098(P3)/93. The manufacturing process shall ensure that the Insulation shall be applied by extrusion and vulcanized using dry curing process to form a compact homogenous body free from micro voids and contaminants. The insulation compound shall be of high quality, heat, moisture, ozone and corona resistant. The insulation shall be concentric with conductorwithstand mechanical and thermal stressed under steady state and transient operating conditions. The extrusion method should give very smooth interface between semi-conducting screen and insulation.

1.5.3.1 The voltage gradient in the rated working conditions shall be

a) equal to or less than 6kV/mm at the level of internal semiconductor.
b) Equal to or less than 3kV/mm at the level of external semiconductor

1.5.3.2 The Physical mechanical characteristics shall be as follow:

Should confirm to parameters given in IS 7098(P3)/93and other related IS

1.5.3.3 The insulation envelope shall comply with the hot set tests :

As per IS 7098(P3)/93 Stipultions

1.5.4 **INSULATION SCREEN:**

To confine electrical field to the insulation, non-magnetic semi- conducting shield shall be put over the insulation. The insulation shield shall be extruded in the same operation as the conductor shield and the insulation by suitable extrusion process (triple extrusion). The XLPE insulation shield should be bonded type. Metallic screening shall be provided. The metallic sheath/screen if applicable shall be of copper wire having fault current capacity same as the conductor (31.5KA for 1-sec).

1.5.4 INNER SHEATH:

The inner sheath shall comprise of extruded corrugated Aluminium. The tape shall be applied over the extruded insulation screening to block and prevent moisture propagation in a longitudinal direction. The sheath shall be suitable to withstand the site conditions and the desired temperature. It should be of adequate thickness, consistent quality and free from all defects.

1.5.6 **METALIC SHEATH:**

Metallic sheath shall be of Corrugated Aluminum sheath metallic sheath will replace armour and should be capable of withstanding fault current(31.5 KA for 1 sec)

In the case of metallic sheath of Corrugated Aluminum sheath the bidder shall submit the calculation of area of aluminium sheath in this support.

1.5.6.1 **BEDDING TAPE**

The bedding shall be anti corrosive/ rodent layer of protection.

1.5.7 **OUTER SHEATH:**

The outer sheath shall be extruded black in colour or similar (as per phase). Suitable semi conducting layer coated on black HDPE ST7 with graphite coating or extruded conductive layer confirming to IEC: 60840, shall be applied over aluminium sheath with suitable additives to prevent attack by rodents and termites. The outer sheath should have embossing at every one meter for Supplier Name, manufacturer name, DMRC, Voltage grade etc.

5.7.1 The Mechanical Characteristics of outer HDPE Sheath shall be as follow :

It should be confirm to IS 7098(part-3)/93 or any other standard applicable for HDPE sheath

5.7.2 The variation is the difference between the medium value obtained after ageing and the medium value without ageing, expressed in percentage of the last.

1.5.8 CONSTRUCTION:

1.5.8.1 All materials used in the manufacture of cable shall be new unused and of finest quality. All materials should comply with the applicable provision of the tests of the specification. IS, IEC, Indian Electricity Rules, Indian Electricity Act and any other applicable statutory provisions rules and regulations.

1.5.9 **CURRENT RATING:**

The cable will have current ratings and de-rating factors as per IS or any other relevant standard IEC.

1.5.9.1 The one-second short circuit rating values each for conductor, screen & 'Al' sheath shall be furnished and shall be subject to the purchaser's approval.

1.5.9.2 The current ratings shall be based on maximum conductor temperature of 90 deg. C with ambient site condition specified for continuous operation at the rated current.

1.5.9.3 SIZE:

The size of cable shall be 132 kV Single Core,Cu 800 sq mm and 630sq mm.

1.5.10 OPERATION:

1.5.10.1Cables shall be capable of satisfactory operation under a power supply system frequency variation of plus minus 3% voltage variation of plus, minus 10% and combined frequency voltage variation of 10% (absolute sum).

1.5.10.2 Cable shall be suitable for laying in ducts or buried under ground.

1.5.10.3 Cable shall have heat and moisture resistance properties. These shall be of type and design with proven record on transmission network service.

1.5.11 LENGHTS: The cable shall be supplied in standard drum lengths as below:

Size of cable	**Standard Drum Length**
a) Single Core,800sqmm, 630sqmm,	500 meters $\pm$ 5% tolerance and $\pm$ 2% overall tolerance in total quantity of cable.

1.5.11 **INDENTIFICATION MARKING:**

Identification of cables shall be provided externally at three meters' intervals to identify as under:-

i) 'Name of Manufacture'
ii) 'Year of manufacture'
iii) 'Voltage grade' to be embossed at the interval of one meter-length. The identification, embossing shall be done only on the outersheath. Name of purchaser shall also be embossed.

1.6.0 TESTS

1.6.1 Type Tests

The equipment offered should be type tested. Type test report should not be more than five years old, reckoned from the date of bid opening, in respect of the following tests,
carried out in accordance with ISS-7098/IEC-871, from Govt./Govt. approved test house, shall be submitted along with bid:

i) Physical tests for insulation and outer sheath.
ii) Bending test.
iii) Di-electrical power factor test.
iv) Heating cycle test followed by di-electrical power factor as a function of voltage and partial discharge test.
v) Impulse withstand test.

The remaining type test report as per clause 3 of ISS-7098/ IEC-871/ IEC-60840 shall be submitted by the successful bidder within three months from the date of placement of order. These type test reports shall be from Govt./Govt. approved test house and shall not be more than five years old, reckoned from the date of placement of order. The failure to do so will be considered as a breach of contract.

1.6.2 ROUTINE TESTS AND ACCEPTANCE TESTS

All routine and acceptance tests shall be carried as per relevant ISS in the presence of Employer's representative

1.7 INSPECTION

The material shall be inspected and tested before dispatch by an authorised representative of the Owner in respect of quality. The inspecting officer shall also satisfy himself about the correctness of length of cables. In case the supplier is not in a position to get these tests carried out at his works, such tests may be got carried out by him at any Govt. recognized test agency at his own expense.

1.8 TEST CERTIFICATES

The supplier shall supply test certificates from a Govt. agency in respect of quality as per IS:7098(part-II) 1985 with latest amendments thereof for approval of the purchaser.

1.9 PACKING

The cable shall be supplied in returnable steel drum as per IS:10418:1982 so constructed, as to enable the cable to be transported on each drum. The cable wound on such drum shall be one continuous length. The ends of cables shall be sealed by means of non-hygroscopic sealing material.

1.10 MARKING

The marking on the drum shall have the following information: -

a) Reference to Indian Standard & cable code.
b) Name of the manufacturer & trade name.
c) Nominal cross section area of conductor for the cables.
d) Number of core.
e) Sequential No. at each meter.
f) Type of the cable & voltage for which it is suitable.
g) Length of cable on the drum.
h) Approximate gross weight.
i) Net weight of the cable.
j) Drum identification number.
k) P.O. No. and date.
l) Consignee's name with designation.
m) Year of manufacture.

1.11 DRAWINGS & INSTRUCTION MANUAL

The tenderer shall supply the following drawings with the tender: -

i) Detailed drawing of the cable showing conductor, screening insulation, Al sheathing, outer sheath etc.
ii) Detailed drawing showing jointing of cable and sealing of end boxes.

Copies of instruction manuals for testing, installation jointing operation and maintenance of cables shall also be submitted with the offer for reference of the purchaser.

1.12 TECHNICAL & GUARANTEED PARTICULARS:

The tenderer shall furnish guaranteed technical particulars as per the tender specification. Particulars, which are subject to guarantee, shall be clearly marked. Offer not containing this information will not be considered.

1.13 TERMINATION KITS AND STRAIGHT THROUGH JOINTS

The entire necessary Straight through joints and Sealing Ends wet type for 132 kV shall be supplied and erected. The Straight through joints and Sealing Ends wherever required shall be Pre -moulded Type or equivalent, of reputed make with shear head type mechanical connectors of proven technology & make.

1.14 ISO Accreditation

The cable shall be manufactured by a company having ISO accreditation for quality. The manufacturing process of XLPE cable shall consist of conductor screen, insulation & insulation screen shall be extruded in a single process.(triple extrusion) and cross linked by VCV Process (Vertical Continuous Vulcanization process) dry curing technology to ensure homogeneity and absence of micro voids. The cables shall be manufactured by “Dry Curing” Process. It is mandatory that bidder should submit Plant Installation Certificate for VCV Line and for Metallic sheath machineries indicating the year of installation and other details along with bid

The Employer may decide to visit the works of cable manufacturer to confirm the manufacturing process mentioned.

PART II

TECHNICAL SPECIFICATION FOR LAYING, TESTING AND COMMISSIONING OF 132kV XLPE UNDERGROUND POWER CABLE

SECTION-1
SPECIFICATION FOR LAYING OF CABLE

1.1 GENERAL

1.1.2 The Cable Laying works shall be executed according to the rules of the Art pertaining to professional grade and generally in compliance with International Standards and Indian Standards.

1.1.3 The EHV Cables between the Power Supply Authorities Substation and the DMRC RSS shall be laid in ground depending upon the site conditions of the selected route, any of the following paying conditions, may be adopted.

1.1.4 Cable Laying Cases

Case 1 - Direct buried, with all cables laid in flat formation.

Case 2 – Direct buried, with the cables (3) of each circuit laid in trefoil formation and side by side in one trench, leaving at least a gap of 250mm in between.

Case 3 – Laid in underground duct.

Case 4 – Laid in Trench less piping.

Case 5 – Laid in abutment crossing

Case 6 – Laid in Rail Track crossing

Case 7 – Laid in Air, supported on piers/walls, for nallah-crossing

1.1.5 Details of Case 2 :

The trench for carrying the cables shall be at least 1.8m deep and 1.1m wide, which may vary as per site conditions with the approval of employer. Each of the feeder shall consist of 3 single-core cables, and laid in trefoil formation. Cables shall be laid at a depth of 1.37m below the ground level and over the virgin bed of the trench. Trench is to be filled with riddled soil upto a point of 250mm from the bed. Warning concrete slabs of at least 50mm thickness shall then be laid above the sand. Trench shall then be filled with earth upto a depth of 300 mm below the ground level. A warning net shall then be laid above the earth filling (at 300 mm depth below the ground level). A warning tape shall also be laid appropriately with Purchaser's Name marked on it. The top space of 300 mm shall be suitably filled with compacted Boulder and Bitumen/Jelly and given a final finish matching the surroundings. The cables shall be tied through locking belts after 2 meters each for keeping the cables intact in case of trefoil formation. At locations, where there is change of level of laying, the cables shall be tied through locking belts after 1 meter each.

1.1.6 Details of Case 3

In specific locations, the Employer may require the cables to be laid in underground ducts. The underground ducts shall be laid where road construction or formation is under construction or where water logging stretch is expected or as per the specific site condition.

1.1.7 Details of Case 4 & 6

On all road/rail crossings and at other specific locations, cable laying shall be through trenchless drilling and the cables shall be passed through High Density Polyethylene (HDPE) Pipes of appropriate diameter and thickness (Case-4). One spare HDPE pipe shall be laid for each feeder of 3 cables at the road/rail crossings.

1.1.8 Details of Case 5 & 7

On all abutment crossing or in air, supported on piers/walls, for Nallah crossing and at other specific locations, cable laying shall be on the galvanized steel structures which can withstand wind velocity of 260kmph, supported on piers and have sufficient structural strength. The minimum average weight of zinc coating should be 1000g/m2 (RDSO). The cables should be well protected by providing GI sheet of thickness 8mm at least fastened with nuts and bolts & tag welded on all sides to be protected from any pilferages. The arrangement shall render cable absolutely safe from any natural calamity. The cable shall not be exposed or get affected due to stray fire caused in the vicinity. Indicative arrangement is shown in the drawing.

1.1.9 Spare Cables and Pipes

When cables are laid in pipes, in addition to the pipes carrying the cables, at least one spare pipe, without cable shall also be provided. In the case cables laid in underground ducts (Case 3) and cables laid in Trenchless piping (Case 4), spare HDPE pipes, one for each circuit, shall be provided. In addition to pipes for power cables, 2 additional pipes, each of not less than 100 mm dia, shall be provided to carry control and monitoring cables, one operational and one spare (As indicated in the Interfacing Requirements, other cables such as optic fibre cables for control and monitoring, tele-communication etc, supplied by other Suppliers).

1.1.10 **Cable protection at changeover location**

The cable path, when changing from buried in ground to underground duct or trenchless piping shall be adequately protected by proper sealing in concrete or other suitable means of sufficient mechanical strength to avoid cable from suffering damage due to heat/fire/water ingress etc.

1.1.11 **Pulling Chambers**

Not required.

1.1.12 **Route Markers**

The route shall be appropriately marked by suitable retro-reflective cable markers, at suitable intervals and positions of straight through joints shall be indicated by suitable boards.

2.0.0 CABLE ACCESSORIES AND BONDING

2.1.0 Straight Through Joints

2.1.1 The straight through Joints should be Pre-moulded type of proven technology and make, suitable for underground buried cables.

2.1.2 The product should be type tested as per IEC /KEMA specifications

2.1.3 GENERAL SPECIFICATIONS

a. The product offered should be proven and should be in use in India for a minimum period of 5 years for the same voltage class. List of past supplies in India to be furnished. Performance certificates to be submitted along with the offer.

b. The product offered should have unlimited shelf life.

c. Offers should be supported with type test certificates from test laboratories of repute, as per IEC/ KEMA specifications, failing which the offers shall be ignored.

2.1.4 General Specifications for Joints and Terminations for 132 kV XLPE Cables

The Terminations (Outdoor Sealing ends) and Straight Through Joints for 132 kV cables shall be of 'Pre-moulded, type of proven technology and make, suitable for 132 kV (E) grade or higher, Single core 800 sqmm & 630 sqmm, XLPE Insulated, Aluminium sheathed cables. The Indoor termination for use in the GIS Substation.

2.2.0 Bonding

2.2.1 Suitable bonding methods viz., Single End, Both End, mid point shall be used.

3.0.0 TESTING AND INSPECTION

3.1.0 TYPE-TESTS

3.1.1 General

All the equipment which are used for this work shall be of proven design and standards to achieve a very high level of reliability in service. An equipment is considered to be proven if it is in successful operation at least for a period of two years. Irrespective of the fact that the summary of type test reports was submitted for 132kV (E) or higher grade Single core, XLPE insulated, Copper conductor Aluminium Sheathed cable along with the bid, the Supplier shall furnish a summary of type test reports for all the equipment listed below except those equipment which are yet to be type tested being under development within three (3) months period from the date of signing the contract.

3.1.2 Pre-moulded type or cold shrink type of proven technology and make straight through joint suitable for 132 kV (E) grade Single Core 800 sqmm or 630 sqmm size XLPE insulated cable with Aluminum sheath.

3.1.3 Reputed make cable Sealing end (Wet) type terminations (indoor & outdoor) suitable for 132 kV (E) grade

3.1.4 The cable and cable accessories intended to be used for this work shall be

(i) Type-tested within the last five (5) years period prior to the date of bid opening. (ii) Proven in service for at least two (2) years as on the date of bid opening.

3.1.5 Submission of Performance Certificates

As a proof of satisfactory performance of following equipments during last two years from the bidder /JV partner /sub Supplier from whom Bidder intends to supply them.

3.1.6 Pre-moulded type with proven technology straight through joint suitable for 132 kV (E) grade or above grade, Single Core 800 sqmm and 630 sqmm or above size XLPE insulated cable with Aluminum sheath.

3.1.7 Sealing end (outdoor or GIS) Cable terminations (indoor & outdoor) suitable for 132 kV (E) grade

3.2.1 Type Test Results

Summary of type test results of the above mentioned equipment will be in the following format:

Sl.No.	Equipment	Manufactured By	Rating	Governing specification for type test	Name of type test	Month/ Year conducted	Testing Lab/Testing House/In House	Result/ Remark

3.2.2 If the type tests of any equipment being supplied for this work are not yet conducted by the Supplier then all the type tests as per the relevant IEC shall be conducted at his expense in the presence of employer's representative either at manufacturer's works having requisite facilities and approved by independent laboratory like KEEMA, Netherland or CESI Italy, or at KEEMA, Netherlands or CESI, Milano, Italy.

3.2.3 Details of 'Make of Cables/Accessories

The bidder shall submit to the employer the proposed "make" of all the above equipment in the bid form along with other details such as rating, quantity in use, place of installation number of years in satisfactory operation, summary of type test reports of required rating of 132kV or higher grade, Aluminum/copper conductor, XLPE insulated, Aluminum or Copper sheath cable along with the bid so as to decide the 'make' of the items. Based on the information thus furnished the employer shall decide the 'make' of the items to be used for the work. The plant & equipment being supplied against this bid shall conform to relevant IEC standards.

3.2.4 Rejection of Type Test Report

When the Employer rejects any specific type test report for a particular equipment stating the grounds for such rejection, the Supplier shall re-conduct the relevant type tests as per the specification in the presence of Employer's representatives before the item is supplied by him. Such type test shall be conducted by the Supplier at his own expense at the manufacturer's works approved by KEMA Netherland or CESI Italy in the presence of Employer's

representative.

3.2.5 Type Test Reports

The type test reports of the equipment shall be of the tests carried out at any accredited laboratory during the last five (5) years period as on the date of bid opening. If any type test report is older than 5 years, the type tests will have to be repeated at Supplier's cost. Employer shall waive some of these tests in case of equipment / sub assemblies where the manufacturer can establish to the satisfaction of employer that such tests have already been carried out earlier or where the equipment have been proved in service. In such a case, manufacturer shall submit complete test reports along with necessary certification.

3.2.6 ROUTINE TESTS

Routine tests shall comprise of visual inspection of the items and all the routine tests as per specification. All these tests shall be conducted in the presence of Employer's nominated representative at the manufacturer's works. Routine test shall be carried out as per specification ICE 60840 latest version.

3.2.6.1 General

The following tests shall be carried out on each manufactured length of cable:

a) Partial discharge test (see 5.2.2);

b) Voltage test (see 5.2.3);

c) Electrical test on over sheath of the cable, if required (see 5.2.4).

3.2.6.2 The order in which these tests are carried out is at the discretion of the manufacturer. The main insulation of each prefabricated necessary shall undergo partial discharge (see 5.2.2) and voltage (see 5.2.3) tests according to either 1), 2) or 3) below:

1) On accessories installed on cable;

2) By using a host accessory into which a component of an accessory is substituted for test;

3) By using a simulated accessory rig in which the electrical stress environment of a main insulation component is reproduced.

3.2.6.3 In cases 2) and 3), the test voltage shall be selected to obtain electrical stresses at least the same as those on the component in a complete accessory when subjected to the test voltages specified in 5.2.2 and 5.2.3

3.2.6.4 NOTE: The main insulation of prefabricated accessories consists of the components that come in direct contact with the cable insulation and are necessary to control the electric stress distribution in the accessory. Examples are pre-moulded or pre-cast elastomer or filled epoxy resin insulating components that may be used singly or jointly to provide the necessary insulation or screening of accessories.

3.2.7 Partial discharge test

The partial discharge test shall be carried out in accordance with IEC 60885-3 for cables, except that the sensitivity as defined in IEC 60885-3 shall be 10pC or better. Testing of accessories follows the same principles, but the sensitivity shall be 5pC or better. The test voltage shall be raised gradually to and held at 1.75 Uo for 10 s and then slowly reduced to 1.5 Uo There shall

be no detectable discharge exceeding the declared sensitivity from the test object at 1.5 Uo.

3.2.8 Voltage test

The voltage test shall be made at ambient temperature using an alternating test voltage at power frequency. The test voltage shall be raised gradually to 2.5 Uo) and then be held for 30 min between the conductor and metallic screen/sheath. No breakdown of the insulation shall occur 60840 @ IEC: 2004 Electrical test on over sheath of the cable When the test is required by the particular contract, the cable over sheath shall be subjected to the electrical test specified in Clause 3 of IEC 60229.

3.3.0 Acceptance tests

3.3.1 General

Acceptance tests for the power cable & its accessories shall be carried out wherever the same is mentioned in the relevant specification governing the cable and its accessories. All the acceptance tests as mentioned in the governing specification to which the product is manufactured shall be conducted in the presence of Employer's nominated representative by the Supplier at their manufacturing works. The following tests shall be carried out on samples which, for the tests in terms b) and g), may be drum lengths of cable, taken to represent batches:

a) Conductor examination (see 5.3.4);

b) Measurement of electrical resistance of conductor and of metallic screen (see 5.3.5);

c) Measurement of thickness of insulation and over sheath

d) Measurement of thickness of metallic sheath

e) Measurement of diameters, if required

f) Hot set test for XLPE, EPR and HEPR insulations Measurement of capacitance

Measurement of density of HDPE insulation

g) Water penetration test, if applicable

h) Tests on components of cables with a longitudinally applied metal foil

3.3.2 Frequency of tests

The sample tests in items a) to h) of 5.3.1 shall be carried out on one length from each batch (manufacturing series) of the same type and cross-section of cable, but shall be limited to not more than 10% of the number of lengths in any contract, rounded to the nearest whole number. The frequency of the tests in items I) and j) of 5.3.1 shall be in accordance with agreed quality control procedures. In the absence of such an agreement, one test shall be made for contracts with a cable length above 20 km.

3.3.3 Repetition of tests

If the sample from any length selected for the tests falls in any of the tests in 5.3.1, further samples shall be taken from two further lengths of the same batch and subjected to the same tests as those in which the original sample failed. If both additional samples pass the tests, the other cables in the batch from which they were taken shall be regarded as having complied with the requirements of this standard. If either fail, this batch of cables shall be regarded as having failed to comply.

3.3.4 Conductor examination

Compliance with the requirements of IEC 60228 for conductor construction, or the declared construction, shall be checked by inspection and measurement when practicable. Measurement of electrical resistance of conductor and metallic screen The cable length, or a sample thereof, shall be placed in the test room, which shall be maintained at a reasonably constant temperature for at least 12 h before the test. If there is a doubt that the conductor or metallic screen temperature is not the same as the room temperature, the resistance shall be measure after the cable has been in the test room for 24 h. Alternatively, the resistance can be measured on a sample of conductor or metallic screen, conditioned for at least 1 h in a temperature controlled liquid bath.

3.3.5 Additional Acceptance Tests

The following additional acceptance tests shall be carried out.

1. Additional acceptance tests (1 sample/offered lot) shall be carried out for Ovality & Eccentricity.
2. Tensile strength and Elongation on insulation and over sheath before and after ageing and Thermal Stability on outer sheath of power cable.
3. finish and length measurement shall be carried on one length of each size of offered lot of power cables.

3.3.6 Short Circuit Test :

Short Circuit test for Power Cables will be conducted by the Supplier on the cable at Manufacturer's works having requisite facilities approved by KEMA Netherlands or CESI Italy or at KEEMA, Netherlands or CESI Milano, Italy or accredited lab & shall be witnessed by the Employer's authorized representative.

3.3.7 TEST CERTIFICATES

Three copies of the test certificates of successful type tests if any carried out on cables and cable accessories shall be furnished to the Employer within fifteen days after completion of such type tests. Three copies of successful acceptance & routine tests carried out on cables and cable accessories and the certificate of inspection issued by the Employer's representative shall be furnished within 15 days, after the completion of tests by the Employer's representative.

3.3.8 RESPONSIBILITY OF SUPPLIER FOR DELIVERY/SUPPLY

(a) All defects detected as a result of testing / inspection shall be rectified by the manufacturer at his own expense and shall be documented and corrected prior to shipment. If in opinion of Employer, a repeat of the test is required after such rectification, this shall also be carried out at the expense of the Supplier.

(b) No cable / accessory shall be supplied until Employer has inspected the same to his satisfaction and accepted. However, such inspection and/or acceptance certificate shall not relieve the Supplier of his responsibility for furnishing the cables and cable accessories conforming to the requirements of the contract nor prejudice any claim, right or privilege which the Employer may have because of the use of defective or unsatisfactory items. Should the Employer waive the right to inspect any item, such waiver shall be obtained by the Supplier from the Employer in writing and such a waival shall not relieve the Supplier in anyway from his obligation under the contract.

(c) Only after obtaining clearance from the Employer, the Supplier shall despatch the items to

site.

3.3.9 INSPECTION OF ERECTION WORK

All erection work will be subject to inspection by the Employer or his representative to ensure that the work is done in accordance with the specification and approved drawing.

3.3.10 INSPECTION AND TESTS OF COMPLETELY LAID CABLE

3.3.10.1 General

As soon as the work is completed and ready for inspection and testing, the Supplier shall advise the Employer in writing. Tests will be carried out by the Employer jointly with the Supplier. Testing equipments and staff required for the tests shall be provided by the Supplier free of charge. The Supplier shall take full responsibility for these tests interalia his other responsibilities. The Supplier shall notify the manufacturer of cable and cable accessories regarding likely date of pre-commissioning tests, one month in advance so that their representative may be available at site at the time of conducting the tests. It shall be Supplier's responsibility to ensure that the cable and it's accessories are commissioned as per laid down procedures.

3.3.11 Pre commissioning Tests for the facility as a whole The following site tests shall be conducted on a completed power cable installation as per specification IEC 60840 latest version.

(i) Visual Inspection and Continuity Check Visual inspection shall include check for satisfactory workmanship Continuity check shall be carried out on the cable to ensure that the cable is continuous.

(ii) DC voltage test of the over sheath The test shall be conducted as per Clause 15.1 of IEC 60840.

(iii) AC voltage test for the installation. The test shall be conducted as per Clause 15.2 of IEC 60840.

(iv) the insulation resistance of the cable shall be checked before & after the HV test on cable. The core resistance shall be measured and the value corrected in accordance with clause 5 of IEC 60228.

(v) The cable must be discharged on completion of DC High Voltage Test and the cable shall be kept earthed until it is put into service. The values obtained during these tests shall be in conformity with the values obtained during inspection of the materials at the manufacturer's works.

3.3.12 PROFORMA FOR TESTS

The Supplier shall submit the results of tests in quadruplicate in an approved proforma within 7 days from the date of completion of the tests but before actual commissioning of the cable. The proforma shall be developed by the Supplier and got approved from Employer within three (3) months from the effective date of the contract.

Chapter – E4

SWITCHGEAR FOR GIS/AIS

TECHNICAL SPECIFICATION

For

PART – A 33 KV Indoor Switchgear for GIS

PART – A.1 33 KV Indoor Switchgear panel for GIS and AIS

PART – B 11 KV Indoor Switchgear panel for AIS

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PART – A

Technical Specification

For

33 kV Gas Insulated Switchgear (GIS)

TECHNICAL SPECIFICATION FOR 33kV GAS INSULATED SWITCHGEAR

1.0 SCOPE:

This specification covers the technical requirements of design, manufacture, testing at manufacturer's works, packing, forwarding of 33kV Gas Insulated Indoor switchgear complete with all accessories for trouble free and efficient performance including supply, design, manufacture, and factory production, testing, supervision of installation and commissioning of SF_6 gas-insulated vacuum circuit breaker switchgear and associated equipment.

2.0 STANDARDS:

Switchgear	IEC 62271-200 / EN 62271-200
Switchgear	IEC 60694 / EN 60694
Behaviour in the event of internal faults	IEC 62271-200 / EN 62271-200
Three-position disconnector and disconnector	IEC 62271-102 / EN 62271-102
Busbar earthing switch	IEC 62271-102 / EN 62271-102
Circuit-breaker	IEC62271-100/EN 62271-100
Current transformer	IEC 60044-1 / EN 60044-1
Voltage transformer	IEC 60044-2 / EN 60044-2
Voltage detection systems	IEC 61243-5
Protection against accidental contact, foreign Objects and water	IEC 60529 / EN 60529
Installation	HD 637 S1

3.0 DESIGN CRITERIA:

3.1 OPERATING CONDITIONS:

Operating Conditions according to	IEC 60694 / EN 60694
Temperature of ambient air:	
Maximum value	50 °C

3.2 RATED NORMAL CURRENT:

The rated normal currents of components are stated in the Technical data and shall be valid for design ambient temperature of 50° C.

3.3 INTERNAL ARC FAULT:

Classifications to IEC 62271-200
Partition class- PM
Internal arc classification - AFL (Authorised person access permitted from front & lateral side) for the panels with no rear access required.

3.4 INSULATING GAS:

Insulating gas Type Sulphur hexafluoride (SF6)

Design pressure at 20 °C For 36 kV Class - 0.05 MPa to 0.1 MPa

4.0 TECHNICAL DATA

4.1 BUS RATING:

33 kV GIS, 25 kA 3s, Single Bus Bar 800 A @ max. 50 °C

4.2 REQUIRED TECHNICAL PARAMETER:

Busbar System	Single busbar
Electrical Data:	
Rated voltage	36 kV

Rated operating voltage	33 kV
Rated frequency [Hz]	50
Rated power-frequency withstand voltage	70 kV
Rated lightning impulse withstand voltage	170 kV
Rated short-time withstand current	25 kA
Rated short-circuit duration	3 s
Rated peak current	62.5kA
Rated operating current busbar	800 A
Degree of Protection:	
Main circuits	IP 65
Drives	IP 3X
Cable connection compartment	IP 3X
Low voltage cabinet	IP 4X
Auxiliary Voltage:	
Control	48 V DC
Motor	48 V DC
Protection system	48 V DC
Remote control	48 V DC

Socket/lighting/heating 230 V AC

IAC Classification acc. to IEC 62271-200

Classification IAC

AFL

Internal arc 25 kA 1 s

Dimensions:

Cubicle width max.

600mm

Cubicle depth maximum

2000 mm

Cubicle height max.

2500 mm

Properties:

Pressure relief duct Not Required

SF6 pressure control

IDIS

Voltage Indication System

IVIS

Control panel

mechanical

Mech. Operation

Closed door

Operation

5.0 DESIGN FEATURES OF SF_6 GAS INSULATED SWITCHGEAR:

GIS Circuit Breaker shall be of fixed type enclosed in the SF6 gas tank. Withdrawablel facility is not applicable in case of GIS Switchgear.

5.1 GENERAL DESCRIPTION:

The SF6 insulated switchgear shall be type-tested and of pre-fabricated metal construction.

The offered Indoor GIS shall have VCB, Three Position Disconnecting Switch and Bus Bars shall be enclosed in SF_6 Gas

Single panels, each built up from a modular range of separate functional units, can be combined to produce the specified switchgear configuration. The modular units comprise:

A) Standard basic module:

Incorporating the vacuum circuit-breaker

B) Floor-pan module, flange-mounted to the lower part of the basic module, with:

- A wide range of cable connection options, appliance couplers for outer cone-type cable connection systems
- Current transformers (toroidal type)

C) Cable compartment.

A metal-enclosed, air insulated or gas insulated compartment, with:

- Cable support for single and multiple cable installation
- Sufficient space for installation circuit-breaker and three-position switch drives are to be designed with mechanical interrogation interlocks and shall include all necessary auxiliary devices (auxiliary switches, releases etc.)

The three-position disconnector (ON-OFF-EARTH) is to be designed with separate manual and/or motorized drives for the disconnector and earth switch functions.

All switching device drives shall be located outside of the gas compartments, for easy access. Under normal operating conditions for indoor switchgear units in

accordance with IEC 50594 and when complying with the specified number of operations, no maintenance is required.

5.2 FUNCTIONAL COMPARTMENT:

- Circuit-breaker compartment – Gas insulated
- Busbar compartment – Gas insulated
- Cable connection / transformer clad compartment are to be equipped with individual pressure relief devices - Air Insulated or gas insulated

5.3 SWITCHGEAR OPERATOR INTERFACES REQUIREMENTS:

- A standard mechanical user interface, ergonomically Positioned at a convenient height**. It must be visible directly without opening of doors etc.**
- The user interface comprises all the mechanical, panel-related interfaces and continuous interrogating interlocks.
- **All the basic mechanical ON/OFF of CB, Isolator & earth switch operation, manual spring charge of CB must be possible without opening the door to ensure the operator safety.**
- **Mechanical mimic directly linked to mechanism should be provided at the panel front door.**
- The basic switchgear unit is to be designed for suitable free-standing installation within a switch room.
- The Interlocking shall be as per IEC.

5.4 FUNCTIONAL INTUITIVE OPERATOR INTERFACE DESIGN

The SF6 Gas insulated switchgear shall be characterized especially by the following operating features:

- Ergonomic operability
- Logical operation
- Logical function states
- Good visual communication of the overall function and operating states
- Optimum operator guidance
- All operations can be performed optionally via a motor-operated mechanism

The mechanical control panel is located at an optimum height for operation and arranged in a recessed position on the switchgear front. Thus, the operating area is clearly visible while no control elements protrude from the switchgear front. The position of the individual elements has been selected according to their function, i.e. according to their allocation to the corresponding device functions. The elements which form part of a switching device, such as position indicators, crank ports or mechanical push buttons, are visually linked by a specific pattern and integrated in a mimic diagram. Mechanical operation is performed the same way as with the habitual operation with stationary switching devices. Separate control elements and mechanical switch position indicators are available for the following functions:

- Circuit-breaker ON - OFF
- Disconnector ON – OFF-EARTH

5.5. BUSBAR / PANEL CONNECTIONS:

The gas-insulated busbar sections of the single panels shall be connected via single-pole solid-insulated connection elements which allows for easy exchange of a cubicle without SF6 works. Busbar connection to be designed in such a way that no adjacent panels must be moved or opened for exchange of a panel.

Busbar couplings between adjacent panels should be designed with a minimized quantity of electrical sealing joints.

5.6 GAS COMPARTMENT TECHNOLOGY:

A Temperature Compensated Gas Monitoring Device shall be provided on the offered GIS to constantly monitor the Gas Pressure inside the Gas Tank.

By design there should be no need for gas works during the whole time on site, not even for exchanging a centre panel or extending the switchgear at later stage, e.g. no gas handling shall be necessary during the anticipated service life of the switchgear, under normal operating conditions. (The gas-filled clad compartments are to be designed to be maintenance-free and hermetically sealed pressure systems in accordance with IEC 62271-200).

The switchgear panels shall be filled with gas and checked for leakage in the factory. For a proper recycling / emergency replacement, a gas valve in gas compartment has to be provided. In addition, the standard tools for filling the SF6 Gas also have to be provided.

All the live parts including the VCB, Three position Disconnector, and main busbar shall be encapsulated in stainless steel enclosure filled with SF6 gas.

5.7 INSTALLATION FACILITY:

The panels are to be delivered to site as factory assembled and routine tested units. After linking the panels (or panel assemblies) by the busbar connection system and connection of the power and control cables the system should be ready for operation. No gas filling is required at site during bus bar connection & installation.

6.0 CIRCUIT BREAKERS:

The three-pole vacuum circuit breaker with its maintenance-free vacuum interrupters is installed horizontally in the gas compartment.

The CB shall be spring operated, motor charged, and manually released spring closing mechanism with three pole simultaneous operations. The speed of closing operation shall be independent of the hand-operating lever. The indicating device shall be **mechanical type directly linked to the mechanism & shall show the OPEN and CLOSE position of breaker visible from front of the cubicle.** The spring charging time of the motor shall not exceed **20sec** in case of Vacuum Circuit Breaker. The "TRIP" and "CLOSE" coils shall be of reliable design and low consumption.

The Breakers shall be capable of Making & Breaking the short time current in accordance with the requirement of IEC 62271-100 and latest amendment thereof. The continuous current rating of breaker shall not be less than 630 A for outgoing feeders and incomer feeders. **Ratings are IN-Panel at 50 Deg C design ambient.**

Comprehensive interlocking system to prevent any dangerous or inadvertent operation shall be provided. Two stage gas **density** alarm and lockout system with local and remote indication shall be provided.

Emergency **mechanical trip push button on each CB shall be provided on panel front & shall be accessible.**

Spring charge indication to be provided.

The vacuum circuit-breakers are to be equipped with

- Spring-stored-energy operating mechanism with motor, auto-reclosing
- Mechanical OPEN and CLOSE buttons
- 1 closing solenoid
- 1 shunt release
- Operating cycle counter

- Auxiliary switch with at least 6NO + 6NC available
- Auxiliary switch for "spring charged" signal

The circuit-breaker has to control at least **10,000 Make-Break cycles (One operating cycle of making & Breaking) operations at rated current or 100 breaking operations at rated short-circuit** breaking current without maintenance. The mechanical life of the vacuum interrupter has to comprise at least **20,000** operating cycles**.**

The operating mechanism must be maintenance-free without time limit up to 10,000 operating cycles.

7.0 ISOLATORS AND EARTHING SWITCHES:

Isolators or isolators combined with earthing switches (3 position switches) shall be motor operated. In cases of emergency, manual operation must be possible.

The earthing position for all 3 phases must be visible via a mechanical position indicator (MIMIC) directly connected to the drive shaft on panel front Fascia.

The mechanical operation of isolator / 3 position disconnector switch must be possible with door closed for operator safety.

8.0 INSTRUMENT TRANSFORMERS:

Only Conventional inductive voltage and current transformers according to IEC 60044-1 and IEC 60044-2 or electronic current and voltage transformers to IEC 60044-7 and IEC60044-8 or a combination of both are acceptable. Current & voltage Sensors are **not** acceptable.

8.1 CURRENT TRANSFORMERS:

The **current transformers** shall be toroidal-current transformers. The Current Transformers shall be located outside the Gas Compartment.

The transformer ratio, the accuracy class and the performance load to be selected to suit the application requirements.

Outgoing Feeder Variant

Toroidal type Current Transformer

CT Primary Current: 400-200 A

CT Secondary Current: 1-1-1A

Core 1: Cl-0.2 / 15 VA,

Core 2: Cl-5P20 / 15 VA.

Core3: Cl-5P20 / 15 VA

Incomer Feeder Variant

Toroidal type Current Transformer

CT Primary Current: 400-200 A

CT secondary Current: 1-1-1A

Core 1: Cl-0.2 / 15 VA

Core 2: Cl-5P20 / 15 VA

Core 3: Cl-5P20 / 15 VA

(CT burden shall be provided as per relay and metering requirement and bidder to substantiate this with suitable calculations during detail engineering with CT/ VT Burden calculation)

9.0 MECHANICAL SAFETY INTERLOCKING FEATURES:

Internal mechanical interlocks of the panel

- With the circuit-breaker closed, the interrogation slide is locked for the disconnector and the earthing switch. (Restriction to the insertion of Hand Crank for Disconnector-Earth Switch when CB is ON)

- The interrogation slide always releases one insertion opening only (disconnector or earthing switch), or both of them are locked. (To ensure that either Disconnector- or Earth Switch operating at a time)

- The crank for the disconnector and earthing switches can only be removed in its appropriate end position.

- When the crank on the disconnector or earthing switch is still in place, or when the interrogation slide is open, the following components are locked:
  - ON push button of circuit breaker
  - ON pulse is interrupted

10.0 PROTECTION & CONTROL SYSTEM:

Following functions shall be available in the Protection Relay

Incomer & Outgoing Feeders

Current protection (Directional & Non-directional feeder Protection)

* Over current instantaneous (50)
* Over current IDMT (51)
* Earth fault instantaneous (50N)
* Earth fault IDMT (51N)
* Directional Earth fault IDMT (67)
* Directional over Current IDMT (67)
* Auto Reclosure – 4 Shots

11.0 BUS IVT

33kV Bus IVT shall be housed in a separate Panel and it shall be air insulated.

Voltage protection (Bus VTs shall be Part of Feeder Protection relay)

* Overvoltage (59)
* Under voltage (27)
* Frequency Relay (81 O/U)

Outgoing Feeder (Separate Relays to be provided for Trafo Differential & Over Current & Earth fault)

Differential protection (For Transformer Feeders) in addition to the above

* Differential protection for transformer (87T)
* Restricted earth-fault for transformer (87N)

Other protections and related functions (Part of Numerical Relay)

* Lock-out (86)
* Trip circuit supervision (95)

11.1 COMMUNICATION PROTOCOL:

The protection relay shall have communication protocol on IEC 61850 Protocol.

12.0 TESTS:

All tests shall be carried out according to relevant IEC standards.

12.1 TYPE TESTS

The metal-enclosed switchgear is to be type tested at a recognized and internationally well-reputed test laboratory. Type test certificates shall be available for verification as evidence of successful completion of type tests.

The switchgear furnished under this specification shall be fully tested and documented by certified production test reports in accordance with IEC 62271-200.

12.2 ROUTINE TESTS

Tests shall be carried out according to IEC requirements. The following minimum tests apply:

- Wiring and function tests
- Equipment verification tests
- Low voltage circuit insulation test
- High voltage power frequency test

12.3 FACTORY INSPECTION TESTS

Notification for factory tests along with list of proposed tests shall be submitted as required.

12.4 SITE TESTS

The site tests shall include the following:

- Power frequency withstand test (at 80% of the rated power frequency withstand voltage)

- Insulation resistance
- Functional test of the fully installed and wired equipment delivered.

13.0 BASIC Technical Requirements of 33KV Cubicle GIS, Schedule Of GTP of 33KV GIS FOR BREAKERS / PANELS, Schedule of GTPS for 33KV CURRENT TRANSFORMERS, Schedule of GTP for 33KV POTENTIAL TRANSFORMERS, Schedule of GTP for NUMERICAL RELAYS are furnished in **Chapter E-21**.

PART –A.1

33 KV Indoor Switcgear panel for GIS and AIS

Technical Specification for 33 KV Indoor Switcgear panel for GIS and AIS

1.0 SCOPE:

This specification covers design, engineering, manufacture, testing, and inspection of 33 KV indoor Switchgear panel (provided with Vacuum circuit Breaker, CT, IVT, Disconnector etc) for use in the 33/11KV primary substations under the distribution networks. 33 KV Switchgear . The 33kV GIS Switchgear shall be with a Disconnector.

In case of AIS Switchgear there shall not be any Disconnector. There shall be separate Indoor Panel for IVT.The equipments must be type tested.

1.1 Description of the switchgear panels for GIS & AIS.

Indoor switchgears for GIS/AIS should be provided in a cubicle, which shall be erected inside a building. Separate switchgear panels for 33 KV GIS & AIS and 11 KV AIS system to be considered.
Care should be taken during manufacturing of the same as the equipment like VCB, Disconnector switches, CT & IVT are to be installed in the panel individually.

The 33kV GIS Switchgear shall be with a Disconnector and AIS Switchgear without any Disconnector.There shall be separate Indoor Panel for IVT.

Vibration is inevitable as mechanical operation for closing the VCB & disconnectors may cause problem and its performance will be affected.

In 33 KV GIS panel SF6 gas will be filled as insulation at 0.3 bar relative pressure to ensure insulation and breaking operation. Sealed for life,the enclosure shall meet the "sealed pressure system" criterion in accordance with the IEC 62271-1. The manufacturer shall confirm that the maximum leakage rate is lower than 0.1% per year.

2.0 STANDARDS:

Expect where modified by this specification, the circuit breakers and the accessories shall be designed, manufactured and tested in accordance with latest editions of the following standards.

IEC/ISO/BS	IS	Subject
IEC:56 **IEC:62271-100 &** 200		High voltage alternating current circuit breakersgeneral Requirement.
IEC:694	IS : 12729	Common clauses of high voltage switch-gear and control gear standards (for voltage exceeding 1000 V).
IEC:60	IS : 9135	High Voltage testing techniques.
I EC:427	IS:13516	Method of synthetic testing of HV .A.0 circuit breakers.
IEC: 1233		HV. AC. Circuit breakers- inductive load switching.
IEC: 17A/CD:474		HV. AC. Circuit breakers- capacitive switching.
IEC:529	IS: 13947	Degree of protection provided by enclosure.
IEC:137	IS: 2099	Insulating bushing for A.C. voltages above 1000V
IEC:233	IS : 5621	Hollow insulators for use in electrical equipment & testing.
IEC:273	IS: 5350	Characteristics of indoor and outdoor post insulators for systems with nominal voltages greater than 1000V.
IEC:815	IS: 13134	Guide for selection of insulators in respect of polluted conditions.
IEC: 34	IS : 996	A.0 motors
ISO:1460 BS:729	IS:2629	Hot dip galvanizing
	IS:2633	Method of testing uniformity of zinc coated articles.
	IS: 5	Colour for ready missed paints and enamels
	IS: 6005	Code of practice for phosphating or iron and steel.

IEC: 227	IS:1554	P.V.0 Insulated cables for voltages up to and including 1100 Volt.
IEC:269	IS:13703	Low voltage fuses for voltages not exceeding 1000volt.
ISO:800	IS:1300	Phenolic moulding materials.
	IS:13118	Guide for uniform marking and identification of
IEC: 185	IS: 2705	Current transformers.
IEC: 296	IS: 335	Specification for unused insulating oil for transformer and switchgear.
IEC:186	IS: 3156	Potential transformers.
CBIP Technical Report No. 88 revised July,	Specification for AC Static	

CBIP Technical Report No. 88 revised July, 1996 read with amendment issued (April, 99, September, 99 and also any other amendment thereafter): Specification for AC Static Electrical Energy Meter.

3.0 TYPE OF SWITCHGEAR PANEL

The switchgear boards shall be indoor metal clad, single front, single tier, fully compartmentalized construction comprising of a row of free standing, floor mounted panels. Each circuit shall have a separate vertical panel with distinct compartments for circuit breaker, main bus bars, current transformers cum cable compartment and low voltage compartment. Each compartment of individual cubicle shall be segregated by earth metallic sheet. Cubicle should be type tested for internal arc in all three compartments for 25KA for 1sec as per IEC 62271-200.

4.0 TYPE OF SHEET STEEL & CUBICLE.

The cubicle shall be of bolted construction with minimum thickness of 3.0mm for load bearing & cable entry gland plate portion and for other non-load bearing members such as inter compartment partition etc can be of 2.0 mm. Sheet steel used for fabrication shall be cold rolled carbon annealed only and fabrication shall be done through CNC turret punch press and CNC bending machine. Sheet steel shall be of aluzinc material without painting or CRCA. All covers & doors shall be of folded design type with viewing window at rear cover (box type) of polycarbonate.

5.0 CIRCUIT BREAKER (VCB): 33 KV

The AIS circuit breaker (VCB) shall be mounted on Withdrawable truck, which shall roll out horizontally from service position to isolated position with ease and it shall also be possible to take out the breaker truck from cubicle smoothly on to the floor. It is preferred to provide with guides for withdrawal and insertion of truck into the cubicle with ball bearing arrangement on the top of the truck. Circuit breaker shall be of vacuum only and the truck shall have distinct '**SERVICE**' and '**TEST**' position. Special multi point hinged locking arrangement shall be provided to prevent opening of door in the event of internal arc in breaker compartment. Isolation shall be horizontal.

The GIS Circuit Breaker shall be of fixed type enclosed in the SF6 gas tank. Withdrawablel facility is not applicable in case of GIS Switchgear.

All the three interrupters of individual phases shall be fully encapsulated Circuit breaker shall be vacuum type only. No separate fiberglass sheet barrier to be used.

It shall be operated through a common motor wound spring charged mechanism with electrical release coil for closing and shunt trip coil for tripping. Operating mechanism must have manual charging, closing and tripping facility with the provision locking facility in push to close & push to trip mechanical push button.

The mechanism shall be such that motor will automatically recharge the mechanism springs after a closing operation enabling breaker to perform OCO operation. The charging time of motor shall be less than 15 secs, making it suitable for rapid auto reclosing duty. Mechanical push to trip button shall be provided for manual tripping with front door closed. All the 'MS' components of circuit breaker mechanism shall be treated properly with passivation for longer life even in adverse climatic condition. Yellow passivation shall not be acceptable. All mechanism springs shall be powder coated. Plating on mechanism spring is not acceptable .The normal current rating of circuit breaker shall be 630 Ampere, SCC 25 KA for 3 Sec with duty cycle of 0-0.3 Sec- CO-3 min-CO & Bus-bar shall be 800 Amp for Indoor Switchgear irrespective of AIS & GIS and the same shall also be indicated in panel name plate. The mechanism and the connected interrupters shall satisfy the mechanical endurance requirements of IEC:62271 - 100 & 200and all additional requirements specified herein.

5.1 **Interrupting media Vacuum:**

In AIS vacuum circuit breakers, facilities shall be provided for monitoring the contract erosion and any change in contact gap. The vacuum bottles shall be easily replaceable on site and the

mechanism shall be conveniently adjustable to permit resetting the contact gap. The current rating of the vacuum interrupters shall be 630Amp.

In case of GIS, the VCB is Fixed type and shall be Mounted inside the stainless tank insulted with SF6 Gas. The Stainless Tank is sealed for Life time and Vacuum bottles are to be replaced by changing the gas, when required. The current rating of the vacuum interrupters shall be 630Amp.

The vacuum circuit breaker poles shall be sealed to prevent contamination of the spaces surrounding the interrupters. The bidder shall demonstrate how this is achieved by supplying technical details with the bid.

The circuit breakers shall be fitted with spring mechanism type. The inherent design of the circuit breakers shall be such that they shall satisfactorily perform all test duties and interrupt out-of-phase current and produce very low over voltage **(<2.5 p.u)** on all switching circuits, capacitive and inductive to IEC:62271 - 100 & 200 and other associated standards mentioned in the clause of this specification.

5.2 **Basic Technical Requirements of 33 KV VCB**

Sl. No	**Particulars**	**Requirements**
1	Service type	Indoor
2	No. of Poles	3
3	Nominal system voltage	33KV
4	Highest system voltage	36KV
5	Rated normal current at 50°C	
i)	For Bus-bar	800A
ii)	For Interrupter	630A
iii)	For Outgoing Feeders/ For Incomer & Bus	630A
6	Rated short circuit breaking current (rms)	25KA
7	Rated short circuit making current (peak)	**62.5 kA**
8	Rated short time current withstand capability for 3 sec.	25KA(Panel)/25KA (Interrupter)
9.	Rated insulation level:	
i)	One minute power frequency withstand voltage to earth (wet and dry) rms	70KV

ii)	Impulse withstand voltage to earth with 1.2/50µsec, wave of +ve and —ve polarity	170KV
10	First — pole — to clear factor	1.5
11	Rated operating sequence (for auto reclosing)	0-0.3 Sec- CO-3 min-CO
12	Maximum break time	3 cycles
13	Rated out of phase breaking current	25% of the symmetrical short circuit breaking current
14	Maximum pole scatter	10 mili seconds
15	Rated Auxiliary supply for spring charge motor, lamp & heater circuit.	230V A.C
16	Rated supply voltage for trip/close coil	48V D.C
17	No load line/cable breaking current capacity	25A
18	No load transformer breaking current capacity	25A
19	Minimum creepage distance (mm)	**900 mm ****
20	Minimum protected creepage distance (mm)	**As Per IS**

** Not required for Indoor Switch Gear

6.0 OPERATING MECHANISM

General

6.1 The operating mechanism of the circuit breaker shall be motor wound spring charged type. It shall be electrically and mechanically trip free with anti-pumping device (as per IEC:694 definition). All working parts in the mechanism shall be of corrosion resistant material. Self-lubricating, wearing resistant bearings shall be provided in the mechanism.

6.2 The mechanism shall fully close the circuit breaker and sustain it in the closed position against the forces of the rated making current and shall fully open the circuit breaker without undue contact bounce at a speed commensurate with that shown by tests to be necessary to achieve the rated breaking capacity in accordance with IEC:56 or IS:13118. The mechanism shall be capable of being locked in either the open or closed position. The mechanism shall be capable of fully closing and opening again after the auto-reclose time interval specified as 0.3 second in this specification.

6.3 **Spring mechanism (In case of Spring Charged VCB)**

6.3.1 The spring operating mechanism shall be with spring charging motor, openingand closing springs with limit switches and all accessories necessary for automatic charging. In normal operation, recharging of the operating springs shall commence immediately and automatically upon completion of the closing operation so that a complete sequence of closing and opening operation should be possible.

6.3.2 It shall be possible to hand charge the operating spring with the circuit breaker in either the open or closed position conveniently from the ground level. Closure whilst a spring charging operation is in progress shall be prevented and release of the springs shall not be possible until they are fully charged.

6.3.3 The state of charge of the operating springs shall be indicated by a mechanical device showing **'SPRING CHARGED'** when closing spring is fully charged and operation is permissible and **'SPRING FREE'** when closing spring is not fully charged and the operation is not possible. Provision shall be made for remote electrical indication of 'Spring Charged' and 'Spring Free' conditions.

6.3.4 The operating mechanism shall be such that the failure of any auxiliary spring shall not cause tripping or closing the circuit breaker but shall not prevent tripping against trip command.

6.3.5 Closing action of the circuit breaker shall charge the opening spring ready for tripping. From the close position with spring charged, one open-close-open operation shall be possible without recharging the spring.

7.0 Operation and controls

The breaker shall normally be operated by electrical control with electrical tripping by **2 Nos.shunt trip coil.** Provision shall be made for local electrical operation and mechanical operation.

The following facilities shall be provided in the circuit breaker local control cabinet:

- ON/NEUTRAL/ OFF control switch or ON and OFF push buttons. The push buttons shall be momentary contract type with rear terminal connections. The close push button shall be of green colour and the open push button red colour. There shall be separate switch for

electrical operation of the VCB.

- MECHANICAL EMERGENCY TRIP DEVICE: suitable for manual operation in the event of failure of electrical supplies. **The device shall be accessible without opening any access doors and distinctly labeled.** It shall be shrouded and protected against inadvertent operation.
- Means shall be provided for manual operation of these circuit breakers during failure of auxiliary power in addition to electrical operation.

Means shall be provided to prevent the mechanism from responding to a close signal when the trip coil is energized or to reclosing from a sustained close signal either opening due to a trip signal or failure to hold in the closed position.

The circuit breaker shall be able to perform 10,000 operating cycles at no load in accordance with IEC:17A/474/CD for circuit breakers for auto reclosing duties.

8.0 Motor

The motor for spring charging shall be single phase 230 Volt A. C motor. Continuous motor rating shall be at least ten percent above the maximum load demand of the driven equipment. It shall remain within its rated capacity at all operating points that will arise in service. It shall be protected by MCB. The motor shall comply with IEC: 34 or IS:996.

9.0 THERMAL RATING OF SWITCHGEAR

All current carrying parts including breaker Relay shall be governed by IEC 62271-1. All isolating contacts shall be silver plated.

10.0 AUXILIARY POWER SUPPLY:

The operating mechanism shall be suitable to operate with the following auxiliary Power supplies.

a) 230V,50Hz Single phase A.C- For spring charging motor
b)DC supply 48 Volts- For close and open coils.

The DC supply shall be from **Battery Bank.**

The mechanism shall be designed to operate satisfactorily despite fluctuations of Auxiliary power supplies as under:

AC supply: Voltage from 85% to 115% of normal voltage
Frequency: from -5% to +3% in variation of normal frequency
DC supply: Voltage for voltage variation of Tripping : 70% - 110%)
for voltage variation of Closing : 85% - 110%)

11.0 INTERLOCKS

Circuit breaker can be inserted only in open position. Likewise circuit breaker in closed position cannot be withdrawn. Attempt to draw out closed breaker shall not trip the breaker.

For AIS, the circuit breaker shall operate only in one of the three defined positions i.e. service, test and isolated. The breaker shall not close in any of the intermediate positions.

For GIS, the 3-position of the DISCONNECTOR switch shall be ON-OFF-EARTH.

The circuit breaker cannot be inserted into service position till auxiliary contacts are made. Similarly interlock shall prevent auxiliary contacts from being disconnected, if circuit breaker is in service position.

12.0 SAFETY SHUTTERS

For AIS, Safety shutters shall be metallic and shall be provided to cover up the fixed High voltage contacts on bus bar and cable sides when the truck is moved to Test / isolated position. The shutters shall move automatically through a Linkage with the movement of the truck and shall be of gravity fall type only. It shall be possible to padlock shutters individually, i.e on withdrawl of the breakers the shutters shall automatically operate to cover the contacts. Further, all the compartments are electrically & mechanically segregated from each other.Hence it is possible to work on the busbar compartment being completely isolated from the breaker compartment. There shall be positive indications for TEST/SERVICE position; However isolated position is indicative by the open door itself. But, 33kV GIS is Fixed Type and Mounted inside the stainless tank insulted with SF6 Gas. The Stainless Tank is sealed for Life time.

For GIS, Safety shutters are not applicable.

13.0 FIXED ISOLATING CONTACTS

Switch gear cubicle shall have seal off bushing arrangement between the circuit breaker compartment and bus bar / C.T. cum cable compartment, i.e. the fixed isolating contacts shall be embedded in Epoxy Resign Cast bushing so the these act as seal off bushing to prevent transfer of arc from one compartment to the other in the event of internal arc within the cubicle & must be tested for internal arc 25 kA for 1 sec in all three HV compartments as per new IEC 62271-200.

But, 33kV GIS is Fixed Type and Mounted inside the stainless tank insulted with SF6 Gas. The Stainless Tank is sealed for Life time.

14.0 AUXILIARY SWITCH AND AUXILIARY PLUG &SOCKET

There shall be minimum 6NO and 6NC contacts in breaker auxiliary switch (10 amps DC rating) and shall be provided in each circuit breaker. However, additional contact shall be made available by using Contact Multiplier Relay/Contact Multiplication Relay.

15.0 ELECTRICAL & MECHANICAL POSITION INDICATION.

In addition to mechanical position indication in breaker for test and service position, electrical indication shall also be provided through limit switch. There shall be minimum 2NO +2 NC contacts available in each position for electrical indication and for any other interlocking purpose.

16.0 CURRENT TRANSFORMER

Current transformers, three per circuit breaker, shall be of indoor, single phase,resin cast and shall comply with IEC:185 and IS:2705, suitable for operation in hot and humid atmospheric conditions described in service condition. They shall be mounted inside the Panel.

16.1 Core

16.1.1 High grad non- ageing cold rolled grain oriented (CRGO M4 or better grade) silicon steel of low hysteresis loss and permeability shall be used for the core so as to ensure specified accuracy at both normal and over currents. The flux density shall be limited to ensure that there is no saturation during normal service.

16.1.2 The instrument security factor of the core shall be low enough so as not to cause damage to the instruments in the event of maximum short circuit current.

16.2 Windings

16.2.1 The secondary windings shall be made of electrolytic copper with suitable insulation. The conductor shall be of adequate cross- section so as to limit the temperature rise even during short circuit conditions. The insulation of windings and connections shall be free from composition liable to soften, coze, shrink or collapse during service.

16.2.2 Polarity shall be indelibly marked on each current transformer and at the lead and termination at associated terminal blocks. CTs with multi ratio winding shall be clearly tabulated to show the connections required for different ratios. Similar numbers shall be marked on terminal block arrangement and wiring diagram. Apart from the above marking and those to be provided as per IEC 185 or IS 2705, other markings shall be provided in consultation with owner.

16.2.3 The continuous current rating of the primary winding shall be one hundred and **twenty** percent of the normal rated current.

16.2.4 Secondary windings of current transformers shall be used for metering,instrumentation and protection and shall be rated for continuous current of one hundred and **twenty** percent of normal rated current of primary winding.
Current transformers shall be three core window/bar primary for higher rating or wound primary for lower rating. Maximum VA burden shall be of 15 VA and shall be rated for full short circuit current 25 KA for 3 second. Out of three cores one Core having 0.2 class (Metering) & other two cores having 5P20 (Protection) class accuracy.

Current Ratio: 400-200/1-1-1 Amp
No. of Cores: 03
Burden: 15 VA for each core

Technical Requirements

Sl. No	**Particulars**	**Requirements**	
1	Function	To control 33 KV Feeder & HV side of 33/11KV power transformers of ratings between 3.15MVA to 12.5MVA	
2	Requirement	The CTs in the 33 KV Indoor VCB switchgear panel should have three cores as follows.	
3	Transformation Ratio	Category- A (For TFR) 400-200/1-1-1-A	Category- B (For Feeder) 400-200/1-1-1 A
4	Rated Burden (VA)	Core:1: 15 VA , Core:2: 15 VA, Core:3:15 VA	Core:1: 15 VA , Core:2: 15 VA, Core:3:15 VA

5	Class of Accuracy	Core:1: 0.2 , Core:2: 5P20, Core:3: 5P20	Core:1: 0.2 , Core:2: 5P20, Core:3: 5P20
6	Instrument Security Factor	Core- 1:- <5	Core- 1:- <5
7	Purpose	Core:1: Metering , Core:2: Differential, Core:3:O/C& E/F & REF	Core:1: Metering , Core:2: Spare Core:3:O/C& E/F & REF
8	Rated/Highest syatem Voltage	33/36 KV	
9	Short Time Rating	25KA rms for 3 seconds	
10	Power frequency 1 min voltage withstand level/ Insulation Level: -Impulse Voltage1.2/50 µs wave withstand level -	**70 KV/170KV**	

17.0 Tests

The CTs shall be tested in accordance with the requirements of the type tests and routine tests as per the latest issues IEC:185 or IS:2705.The tests to be conducted shall include:

17.1**Type Tests:**

Type tested equipment/materials are acceptable. Type tests should have been conducted in last five years. The Type Test must have been as per OPTCL requirement. If OPTCL desires another type test, it has to be conducted. In such case OPTCL will bear the transportation of equipment/material and type test charges.

- Lightning impulse voltage:
- Power frequency wet withstand voltage;
- Temperature rise;
- Short time current;
- Composite error;
- Accuracy test (for measuring core);
- Instrument security current (for measuring core);

17.2 **Routine tests**

- Verification of terminal marking and polarity;
- Power frequency dry withstand test on primary windings;
- Power frequency dry withstand test on secondary windings;
- Power frequency dry withstand test between sections;
- Over voltage inter-turn test;
- Composite error;
- Turn ratio;
- Accuracy test (for measuring core);
- Current error and phase displacement (for protection core);
- Knee point voltage and magnetizing current test (for PS class);Secondary winding resistance (for PS class).

17.0 IVT:

The 33 KV Indoor voltage transformers are required to meet the following basic technical requirements (Reference standards: IEC:186, IS:3156 and associated standards listed in the specification):

Sl. No	**Particulars**	**Requirements**
1	Type	Single phase
2	Nominal system voltage, phase to phase	33 KV
3	Application	Instrumentation, Metering and Protection
4	Number of secondary windings	2
5	Rated normal burden*-(Core-I/II)	Each Core shall be 15VA
6	Rated primary voltage	33000V/√3
7	Rated secondary voltage	110V/√3-110V/√3
8	Class of accuracy-(Core-I/II)	0.2/3P
9	Rated insulation level: (Primary winding) (Phase to earth)	
i)	One minute power frequency withstand voltage to earth rms	70KV

ii)	Impulse withstand voltage to earth with 1.2/50 µ sec wave of +ve and —ve polarity (peak)	170KV
10	One minute power frequency withstand voltage of secondary winding (rms)	
	Between phase to earth	3KV
	Between sections	3KV
11	Rated voltage factor	
	Continuous	1.2
	For 30 seconds	1.5

* The burden indicated is the minimum acceptable to the Employer. The Contractor shall ensure that the rated outputs of the voltage transformers are adequate to meet at least 120 percent of the connected load (burden).

18.0 **GENERAL FOR IVT**

18.1

The voltage transformers to be supplied under this specification shall be Epoxy Resin Cast of Indoor type with 3nos single phase in a separate Panel complying with IEC:185 and IS:3156, suitable for operation in hot and humid atmospheric conditions described in this document.

18.2 **Duty requirement**

33 KV Voltage transformer for all the indicating instruments and measuring meters in the primary substation on 33 KV side. It shall be of indoor, 1-Phase or 3- phase **Epoxy Resin Cast type** Complying to IEC 185.

18.3 **Core**

High grade non-ageing cold rolled grain oriented (CRGO-M4 or better) silicone steel of low hysteresis loss and permeability shall be used for core so as to ensure accuracy at both normal and or over Voltages. The flux density shall be limited to 1.6 Tesla at normal voltage and frequency. There shall be no saturation at any stage during operation.

The instrument security factor of the core shall be low enough so as not to cause damage to the instruments in the event of maximum short circuit current or over voltages.

18.4 **Windings**

The primary and secondary windings shall be electrolytic copper of high purity and conductivity and covered with double paper insulation. The conductor shall be of adequate cross-section so as to limit the temperature rise even during maximum over voltages.

The insulation of windings and connections shall be free from composition liable to soften, ooze, shrink or collapse during service.

18.5 The secondary windings of the voltage transformers shall also be suitable for continuous over voltage corresponding to the maximum system voltage at the primary winding. The winding supports shall be suitably reinforced to withstand normal handling and the thermal and dynamic stresses during operation without damage.

18.6 The voltage transformer secondary circuits will be taken out to form the star point and earthed at one point outside the voltage transformers.

18.7 Both primary and secondary winding terminals shall be clearly and indelibly marked to show polarity in accordance with IEC:186. The connections required for different secondary windings in case of multi-winding voltage transformers shall be clearly indicated in terminal blocks and the wiring diagrams.

18.8 **Fuse protection in IVT**

For AIS, The Primary winding shall be protected by HRC Fuses in suitable holder, designed by the manufacturers. The secondary windings shall be protected by HRC cartridge fuses in fuse holder consisting of carriers and bases. The carriers and bases shall be of high grade flame retarding and non-hygroscopic moulded insulating materials with hard glass surface. Each fuse shall be identified with engraved plastic label. Potential Transformer shall be 3nos single phase & there shall be two cores. One core having 0.2 Class (Metering) & other having 3P Class (Protection). **Bus IVT shall be in a separate Panel with extended Bus bar. Digital display voltmeter shall be installed on IVT panel.**

For GIS, Fuse Protection in is not applicable, since the IVT's are directly Plug-in type with disconnecting switch.

19.0 TEST AND INSPECTIONS

19.1 The voltage transformers shall be tested in accordance with the requirements of the type tests and routine tests as provided in the latest issues of IEC:186 or IS:3516.

The tests to be conducted shall include;

19.2 **Type tests:**

- Lightning impulse voltage test;
- High voltage power frequency wet withstand voltage;
- Temperature rise test;
- Short circuit withstand capability test;
- Determination of limits of voltage error and phase displacement

19.3 **Routine tests:**

- Verification of terminal marking and polarity;
- Power frequency withstand tests on primary winding;
- Power frequency dry withstand tests on secondary winding;
- Power frequency withstand tests between sections;
- Determination of limits of voltage errors and phase displacement;
- Insulating Resistance measurement.
- Partial discharge measurement.

Voltage Ratio: 33000/√3 / 110/√3-110/√3.
No. of Cores: 03
Burden: 15VA for Metering, 15 VA for protection & 15VA for Spare

20.0 PRESSURE DISCHARGE FLAPS

Pressure discharge flaps shall be provided at the top in all high voltage compartments for the exit of hot gases in the event of internal arc in any of the compartments.

21.0 BUSBARS

Bus bar material shall be of high conductivity electrolytic copper only and accessibility of the same shall be from top only. All bus bars shall be tubular /rectangular design insulated with heat shrinkable BPTM compound sleeves and joints shall have sufficient clearances in order to meet the BIL (70kV RMS and 170 kVp) withstand. Phase identification shall be made at the end by coloured tape.

Note: - In GIS switchgear, Busbars, VCB, Disconnector shall be in the SF6 Gas chamber. The bus bar shall not be solid insulated.

22.0 EARTH BUS

There shall be a continuous copper bus at the bottom of the panel. Earth bus shall be robust and shall be capable of carrying full short circuit current 25 KA for 1 second. Doors, covers and all non-current carrying metallic parts shall be earthed through flexible copper breading of adequate size. This also includes instrument casing and cable armour which are also connected to the earth bus. Earth bus must be tested for 25 KA for 1 sec.

23.0 BUS & CABLE EARTHING

Each feeder shall be provided with fault make type **Earth** switch duly interlocked with circuit breaker. Unless the breaker is tripped & brought to test position, the earthing switch cannot be operated. Earth Switch should be fully type tested for STC withstand of 25kA for 1 seconds.

24.0 CABLE COMPARTMENT

It shall be at the rear side with rear bolted box type back covers. There shall be an inspection window at the rear back cover enabling operator to have visual inspection without opening back cover in live condition. Viewing window at the rear side shall be of poly carbonate only and shall be tested for internal arc. The gland plate of cable chamber shall be of minimum 3mm thickness MS sheet in two halves section.
Sufficient headroom of maximum 750 mm shall be provided for cable termination.

For GIS, the GIS Cable compartment cover is interlocked with disconnector switch & CB. Therefore, unless the earth switch & CB is closed we cannot open the cable compartment door which ensures more saftey.

25.0 LOW VOLTAGE COMPARTMENT

Low voltage compartment shall be mounted at the front on the top of breaker compartment and shall also have hinged type of door. All wiring shall be routed through PVC ducts and shall be terminated on to stud type terminal with plastic cover. For current transformer terminal shall be disconnecting link type only. The wire shall be of 1.1KV grade and suitable for 2KVrms for 1 minute power frequency high voltage.

26.0 CONTROL AND POWER CABLE ENTRY

Control cable entry shall be from front and there should be a possibility of terminating to LV chamber from both right hand and left hand side. Power cable entry shall be from rear bottom. Provision shall be available for entry of power cable from rear bottom.

The CR Panel (Instrument Chamber) should be mounted on top of the VCBPanel.

Control panel **(inbuilt)** with protective relay and meter shall be provided by the supplier suitable for above breakers. The equipment shall have protection scheme with the following relays:

27.0 PROTECTION RELAYS FOR FEEDER:

The offered relays shall be multifunction numerical type only. The aux relays for lockout, transfer fault indication etc can be electro-mechanical type. All Numerical relays shall have minimum following features

- Relay shall be IEC 61850 compliant Numerical & suitable for 1A secondary CT current & 110 V IVT secondary supply.

27.1 Over current & Earth fault relay:

- Relay shall have 3 phase directional and non-direction (site selectable feature) over current and earth fault protection. It shall have three stages with first stage programmable as IDMT or DT. The second and third stages shall be programmable as DT or instantaneous.

- Relay shall have thermal overload protection.
- Relay shall have negative sequence over current protection.
- Relay shall have adoptive & creative logics for meeting the requirement
- Relay shall have 4 shots auto reclose function built-in
- Relay shall be with under and over voltage protection elements provided
- Relay shall have under frequency protection facility at least two stages.

Details are given below separately:

28.0 PROTECTION RELAYS FOR TRANSFORMER:

The offered relays shall be multifunction numerical type only. The aux relays for lockout, transfer fault indication etc can be electro-mechanical type. All Numerical relays shall have minimum following features

- Relay shall be IEC 61850 compliant Numerical & suitable for 1A secondary CT current & 110 V IVT secondary supply.

28.1 Over current & Earth fault relay:

- Relay shall have 3 phase directional and non-direction (site selectable feature) over current and earth fault protection. It shall have three stages with first stage programmable as IDMT or DT. The second and third stages shall be programmable as DT or instantaneous.
- Relay shall have thermal overload protection.
- Relay shall have negative sequence over current protection.
- Relay shall have adoptive & creative logics for meeting the requirement
- Relay shall have 4 shots auto reclose function built-in
- Relay shall be with under and over voltage protection elements provided
- Relay shall have under frequency protection facility atleast two stages.
-

Details are given below separately:

28.2 **Transformer Differential Relay:**

The Transformer Differential protection relay shall consist of two winding protection, two REF protections, V/F protection etc.Differential protection besides REF protection is required for 3.15MVA, 5.0MVA & 8.0MVA Transformer. Over Fluxing Protection is standard protection of transformers. The input to this relay is the secondary IVT supply. However setting will be decided at the time of commissioning.

Details are given below separately:

28.3 **Specification for Numerical Directional & Non-Directional Over Current and Earth Fault Protection.**

28.3.1. **General**

A comprehensive communicable numerical protection should be offered by the relay. High level of security should be built-in the relay to avoid any mal operation causing over protection of the system or any non-operation of the relay causing under protection. Should have flexibility to customize the relay for intended applications as may be desired at site, in other words the relay should not have very limited features rendering it equipment specific. The relay should have high immunity to electrical and electromagnetic interference and also continuous supervision of hardware and software should be done to ensure enhanced system reliability and availability, the relay should have auto diagnostic fault indication to facilitate fault location and repair after detection of internal relay fault. The compulsory features required by the relay to be fulfilled are listed as below

28.3.2. **Application**

The relay will be required for applications where time graded Directional & Non-Directional (site selectable feature) o/c and e/f protection is required. The Directional & Non-Directional (site selectable feature) earth fault protection should provide suitable sensitivity for most systems where the earth fault current is limited. Typically the relay should be applied for all incoming transformers, capacitors and plant feeders for any application. The relay should be designed in such a way that it operates for a wide range of AC and DC auxiliary power supplies.

28.3.3 **General requirements**

The relay in addition to protection and control should display and store all parameters necessary for post fault analysis. The relay shall have a back light LCD display. It shall be possible to view the measurement values. The relay shall record all the events affecting the relay performance. All the time stamped data should be available via a RS232 serial communication port for access locally and/or remotely via a computer. All the events, faults and disturbance records shall be extracted via a RS485 /RS232/USB/RJ45(Ethernet)serial port.

28.3.4 **Operating Principle**

The sampling frequency of the digital/analogue converter should be synchronised to power frequency by suitable frequency tracking methods to improve both accuracy of measurement and harmonic rejection. The relay should necessarily have software filtering to prevent induced ac signals in the external wiring causing operation of logic inputs.

28.3.5. **Functional Description**

a) Directional O/C protection:

The relay should have 4 independent time delayed Directional O/C stages which can be selectable either as directional or non-directional. MTA shall be adjustable anywhere within -180 degrees to + 179 degrees. The first and second stages shall be programmable to have either a DMT characteristics or IDMT characteristics (as per IEEE/IEC Standards for O/C Relay, Stage- 1 & 2 can be used either a DT or IDMT characteristics & 3rd & 4th Stage shall be with Instantaneous Definite Time. However, directional or non-directional features are site selectable) described as follows,

1. The low set phase current should start when the current of any phase exceeds the set value.

The first and the second current stage shall have a current setting range of 0.10 - 4.00 In and time setting range of 0.06 sec to 300 sec.

2. The Third, fourth stage of protection shall be with instantaneous operation or DT having a current setting range as 0.1 to 20 I_n and a time delay of 0.06 sec to 300 sec for stage III and IV. These stages may have the flexibility to be configured for a busbar protection scheme using blocking logic at a later date. Facility available in the relays for this flexibility may be highlighted.

b) Directional Earth fault protection:

The relay should have at least 2 independent time delayed Directional/Non –Directional E/F stages suitable for networks with different earthing types(solidly earthed, resistive earthed, Petersen coil earthed systems).The relay shall also be suitable where ever a selective and sensitive earth fault protection is needed. It shall also be possible to detect intermittent earth faults. MTA shall be adjustable anywhere within -180 degrees to + 179 degrees. The first and second stage shall be programmable to have either a DT characteristics or IDMT characteristics described as follows:

The low set phase current should start when the current of any phase exceeds the set value. For E/F Relay, Stage- 1 & 2 can be used either a DT or IDMT characteristics. 3rd & 4th Stage shall be with Instantaneous Definite Time. However, directional or non-directional features are site selectable.

Both the stages Shall have a current setting range of 0.01 to 8 Io_N and time setting range of 0.1 sec to 300 sec. The lower setting is critical to take care of systems which have low earth fault currents. Additionally there shall be four non-directional earth fault stages where the first stage can be programmed either to IDMT or DT and the rest 3 stages shall be of definite time type.

c) Sensitive Earth Fault/Restricted Earth Fault.

The relay shall have five CT input to take care of transformers applications where Restricted Earth fault and standby earth fault is required. It shall be possible to either measure the value of neutral current through available C.T I/Ps or derive it internally within the relay and use the same for applications as described above. The Relay shall be able to accept input from Core balance current transformer to detect earth faults of very low amplitude. The setting range shall be settable to a minimum of 0.005 Amps. The relay shall have restricted earth fault protection feature of high Impedance type.

d) Over Voltage & Under Voltage

If the system goes for very high under and over voltages in case of Supply or Load unbalance it shall be possible to grade the system for Voltage protections. Relay shall have 3 under voltage stages and 3 over voltage stages respectively.

e) Residual voltage protection:

The relay shall have at least 2 residual voltage stages in order to give an unselective backup for existing earth fault protection. The stages shall have a setting range of 1 – 60 % U0N with a time delay settable from 0.3 – 300.0s (in steps of 0.1 s).

f) Under frequency/Over Frequency /ROCOF:

The relay shall have four frequency stages out of which it shall be possible to program at least 2 of them to under or over frequency to be suitable for various load sharing applications. The under frequency stages shall be settable any where within a frequency range of 40.0 - 60.0 Hz. With the flexibility to block any mal operation on event on under voltage. All stages shall be of definite time type with a setting range of 0.10) – 300.0 s (in steps of 0.02 s).
The relay shall also have the facility to detect a rate of change of frequency for load shedding applications , to speed up operation time in over- and under-frequency situations and to detect loss of grid. Pick up setting shall be settable from 0.2 – 10.0 Hz/s (step 0.1 Hz/s).

g) The relay in addition to the above basic function should also provide the following functions,

1. The relay should have the protection feature which allows the relay to trip the upstream circuit breaker when a local breaker failure condition is detected and should be energised both from operation of the relay or by an external trip.
2. The relay shall also have the feature of auto reclosure with independently programmable dead time and reclaim time for each shot. The function shall be programmable for at least 4 shots of auto reclosure.
3. The relay should measure the following standard quantities,

i.) It shall be possible to view the current voltage phasors as well in the graphical mimic display. However, MIMIC display is not mandatory.
ii.) Phase current(Positive, negative and zero sequence currents)
iii.) Phase Voltage(Positive, negative and zero sequence voltages)
iv.) Neutral current
v.) Frequency
vi.) Active and Reactive Power
vii.) Power factor
viii.) Harmonics of current and voltages which shall be possible to view as a diagram on the display. Display of harmonics in relay is not mandatory.

ix.) Relay should be able to measure the true RMS value up to 15th harmonics

4. The relay shall have atleast two independent setting groups. The relay shall automatically switch from one setting group to another depending on system conditions (such as failure of incomer supply, which causes fault level to decrease etc.)

5. The relay shall have a facility to have communication on IEC61850 protocol through redundant rear port **(i.e. RJ45 or FO)** for SAS connectivity without use of any external converter. Further, the test levels of EMI as indicated in IEC 61850 shall be applicable to these. The relay shall support peer to peer communication.

The relays shall generate GOOSE messages as per IEC 61850 standards for interlocking/tripping and also to ensure interoperability with third party relays.

a) Necessary user friendly configuration tool shall be provided to configure the relays. It should be compatible with SCL/SCD files generated by a third party system.
b) Goose signals shall be freely configurable for any kind of signals using graphic tool/user friendly software.

Bidder shall also ensure adequate hardware.

7. The Relay shall have facility for Time synchronization on IRIG B or SNTP port.

h. Relay hardware:

The relay should be modular type. It will be installed on the top of the switchgear panel. Standard terminal blocks should be located at the rear of the relay providing connections for all input and output circuits.

i. Output relays:

The relay should have up to 2-CT inputs. They should provide atleast 6 optically isolated inputs and atleast 7 programmable outputs. They should be arranged in response to any or all of the available functions by suitably setting the output relays. The protection and control function to which these relays respond should be selectable via the menu system of the relay. One output relay shall be permanently assigned for self-supervision.

H. The Relay shall also have the following functionality/Features..

* Thermal overload protection.

Negative sequence over current.

Permanent Self-Test.

x.) Circuit breaker maintenance information.

xi.) Broken conductor detection by measuring I_2/I_1 .

xii.) Cold load pickup function to change the settings when the protected object is connected to a network i.e., at starting allowing the set value being lower than the connected inrush current.

xiii.) The relay shall also have the feature of Inrush blocking through 2nd harmonic detection.

xiv.) Disturbance recorder & Event recorder facilities.8 fault records shall be possible in each protection stage.

xv.) Front RS232/USB port for communication to LAPTOP .

xvi.) The relay shall have a facility for C.T. Supervision, P.T. Supervision and Trip Circuit Supervision.

Relay shall support customer-defined programmable logic for Boolean signals. It shall be possible to form equations using AND, OR, NOT gates.

29.0 Detail on Differential Protection:

a) Transformer differential protection scheme shall be of numerical relay (low impedance type) suitable for two winding Transformer.
b) Shall be triple pole type with faulty phase identification/indication.
c) Shall have an operating time not greater than 30ms at 5 times the rated current.
d) Shall have three instantaneous high set over current units.
e) Shall have an adjustable bias setting range of 10 – 50%.
f) Suitable for rated 1 amp current.
g) Shall have 2nd harmonics or other inrush restraint features and also should be stable under normal over fluxing conditions. Magnetizing inrush inrush features shall not be achieved any intentional time delay.
h) Shall have an operating current setting of 15% or less.
I) Shall have an internal feature of the relays to take care of the angle and ratio correction.
j) Shall have provision of self monitoring and diagnostic feature.
k) Shall have provision of recording features to record graphic from of instantaneous values during faults and disturbances for the pre and post fault period and during running conditions.
l) Current in all the windings in separate analog channels and voltage in one channel.

The disturbance recorder shall have the facility to record the following external digital channel signals apart from the digital signals pertaining to differential relay.

* REF protection operated.
* HV breaker status

*LV breaker status.
* Buchholz /OLTC Buchholz /PRV alarm/trip.
* WTI/OTI alarm/trip
* MOG alarm

Necessary hardware and software for automatic up-loading the data captured by disturbance recorder to the personal computer. Downloading from the relay memory to the computer memory will be done.

The relay shall have three stages of definite time overcurrent protection as backup operating with separate measuring systems for the evaluation of the three phase currents, the negative sequence current and the residual current.

In addition the relay shall have three stages of Inverse time overcurrent protection operating on the basis of one measuring system each for the three phase currents ,the negative sequence current and the residual current.

Shall have feature of two nos. of independent REF protection for two winding power transformers.

This function should be provided to maximize the sensitivity of the protection of earth faults. The REF function should be a Low impedance element. The REF function should be able to share CT's with the biased differential function. As in traditional REF protections, the function should respond only to the fundamental frequency component of the currents.

Shall have feature of v/f protection of different stage setting.

1. over fluxing protection to suit the transformer.
2. Wide range of setting to suit the worst condition of the highest system voltage and worst system frequency).
3. Alarm and trip setting separately.
4. Thermal slope setting.

Shall be numerical type and shall have continuous self-monitoring and diagnostic feature.

29.1 **Additional Protection Function**

1, Differential Unit protection (87) which includes

*****Three phase differential protection

*****Digital correction of vector group and Ratio

*** Homopolar DC component relay** filter, which is used to remove the Homopolar component from the phase currents is DC component and the relay shall have the filter component.

*****Instantaneous Differential Trip.

***** 2^{nd} and 5^{th} harmonic restraint features**.**

2, Restricted Earth Fault Protection (87G)

3, Current Unbalance (46), which protects against current unbalances resulting from anomalies in the power system or unbalanced loads.

4, Thermal image (49), which protects the transformer against damage resulting from heating up during overloads.
5, Breaker Failure Protection(50BF),Which verifies the breaker correct actuation for clearing a fault,otherwise, the trip of the necessary breakers to clear that fault
6, Phase over current protection (3*50/51) with time delayed and two instantaneous levels, as a backup protection for Transformer external faults, if external faults are not cleared by primary protections
7, Over Excitation protection (V/Hz) (24) with two independent levels, which prevents transformers from at a greater flow density than that for which they were designed. And also avoiding heating and consequent damage in the transformer due to over excitation.
8, Over Excitation protection (5^{th} harmonic)
9, Neutral Earth fault with time delayed and Instantaneous for each winding as for backup protection
10, Frequency protection (81O/U)
11, Over Voltage protection (59)
12, Ground Over current Protection (50G/51N), which act as an over current function by using the current measured at the grounding of the power transformer, being its function to detect faults to earth.

29.2 **Automatisms**

1, The user can configure up to 15 logic signals that can be assigned to output relays, Led's or input for protection functions blocking features.
2, A lockout relay (86) function is needed. Relay programme with this function will act when differential unit acts (At instantaneous) so that they can be used as a locking device for breaker close circuits.

29.3 **Monitoring Functions**

1, Breaker monitoring needed
2, Trip and close circuit supervision needed for detecting any anomalies in the circuit with the open or close.
3,The unit temperature measurement supervision needed. (to know transformer oil and winding temperature, which is optional)
4,The Battery voltage (DC supply) supervision needed.

29.4 **Data Acquisition Functions**

I. The following Measurements should be available
- *****Current in each winding (A)
- *****Average current in each winding (A)
- *****Differential current (A)
- *****Voltage (KV)
- *****Frequency (Hz)

29.5 **Oscillograph data recorder**

I. All the units should needed an Oscillograph data recorder with the next characteristics,

*****Each Record comprises the samples from analog signals and the status of 32 selectable digital signals

***16** or more samples per cycle.

*****Configurable pickup.

*****Records in non volatile memory.

*****The disturbances are collected and exported in COMTRADE format.

II**.** Event Recording:

The relay should store minimum 8 numbers or more last events in a nonvolatile memory, which can retrieved from a PC with the following data,

*****Date and time of the Event.

*****Descriptive text of Event.

*****Values of Electrical parameters.

III. A queue of minimum **8 disturbance** records is stored in the nonvolatile memory.

IV. Fault Recorder

Minimum **5** or more faults are stored in the nonvolatile memory, with the following data

*****Date and time of the fault pickup, beginning and end.

*****Prefault and fault values of electrical parameters.

*****Duration and Type of Fault.

*****Level of Electrical parameters at the faults occurrence time.

V. Time synchronization Via communication***** Via demodulated IRIG-B/ SNTP input

VI. Setting Group

Independent setting groups should be available.

VII. Communication Ports

As indicated above .

29.6 **Other technical characteristics**

*Have self diagnostic feature and watchdog output.

*Have front RS232 port/usb port and rear Redundant port remote communications. The communication shall be on **IEC61850**

*Closed terminal needed for **06 CT input** for differential (LV & HV side of Transformer), **02 CT input** (HV & LV neutral of Transformer) for REF and three voltage input (for over fluxing protection, PT supply from LV/HV side).

* Have programmable minimum of **5** digital Inputs, **minimum of 8** digital outputs, minimum **of 13** numbers programmable led .

* Necessary latest version /communication software should be supplied for configuration, setting modification, event analysis, and scada communication.

*Programmable system frequency should be 50 Hz and operating range should be fn = +/-5HZ.

*The contact of the relay shall have the following Minimum rating.

Make and carry continuously	:	5A
Make and carry for minimum 1Sec.	:	30A

* Current balancing transformers, shall form a part of the relay. The successful Bidder shall furnish sufficient data to prove stability of the equipment up to 10 times full load through fault current. Interposing C.Ts if necessary for current balancing shall be within the scope of supply. I.C.Ts shall be of universal type of setting different ratios.

30.0 OVER FLUXING RELAY:(V/f)

(a)Suitable relay with v/f characteristics shall be provided to defeat the over fluxing condition of the transformer.

(b)The relay shall be a separate electromechanical relay to be connected in parallel to the over fluxing relay, if, available in any of the numerical relay i.e. if the same software is available in the numerical differential protection relay.

(c) Shall have inverse time characteristics, matching with transformer over fluxing withstand capability curve. The input to this relay is the secondary IVT supply. However setting will be decided at the time of commissioning.

(d)shall provide an independent ‘alarm’ with the time delay continuously adjustable between 0.1 to 6.0 seconds at values of v/f between 100% to 130 % of rated values.

(e)Tripping time shall be governed by v/f Vs time characteristic of the relay.

(f) have a set of characteristics for various time multiplier settings. The maximum operating time of the relay shall not exceed 3 seconds and 1.5 seconds at v/f values of 1.4 and 4.5 times, the rated values, respectively.

(g)Have an accuracy of operating time , better than +/-10 %.

31.0 TESTS

Following tests as indicated should have been conducted for the above relays:

31.1 **Soak test:**

All solid state equipment/system shall be subject to the Hot Soak Test as a routine test in accordance with the procedure detailed in the following paragraph.

All solid state equipment shall be burn-in tested for minimum of 120 hours continuously under operational conditions. During the last 48 hours of testing, the ambient temperature of the test chamber shall be 50C. The temperature of the interior shall not exceed 65C.

31.2 **Type tests:**

1. Impulse voltage withstand test as per Clause 6.1 of IS 8686 (for a test voltage appropriate to Class III as per Clause 3.2 of IS-8686).

2. High Frequency Disturbance test as per Clause 5.2 of IS 8686 (for a test voltage appropriate to Class III as per Clause 3.2 of IS 8686).Type tests listed under IEC-Technical Committees recommendation `TEC-57' (IEC 61850 – Communications, IEC 60255 - Insulation / Dielectric / EMC / Mechanical / Enviornmental etc) and functional type tests listed under **CIGRE Study Committee 34** (Protection) Report on simulator, Network analyser or PTL as applicable.

31.3 **Routine tests:** Contact insulation resistance test as per Clause 10.5 of IS-3231.

Insulation withstand capability as per Clause 10.5 of IS-3231 on all AC/DC relays.

32.0 MULTIFUNCTION METER

GENERAL: Multifunction Meter will be installed on the top of the switchgear panel.

1. Each bay should be provided with a multifunction meter having following features:-
2. Features: By level monitoring of all electrical parameters of V,I,ϕ,cosϕ,Hz,KVA,KVAR,KW & KWH.True RMS measurement
3. Accuracy: 0.2.
4. User selectable display ranges. (CT/PT).
5. Auto scrolling/Manual display

6. RS 485 communication port with MODBUS RTU protocol. Compatible for data logging & SCADA application.
7. Inbuilt Real time clock with calendar.
8. 3phase,4 wire,3 element or as per requirement.(to be decided during detail Engineering).
9. Quadrant of operation: 04 Quadrant.
10. Display: Bright red 7-segment LED display.
11. HMI: Through Front panel tactile keys.
12. Indication: Phase voltage, Phase current ,Line voltage, Frequency, Power factor, KVA,KVAR,KW,KVAH,KVARH,KWH.
13. Voltage input: 63.5/110V
14. Current Input: 1 A
15. Auxiliary supply: 85-250 V AC or 48 V DC
16. VA burden: 15VA
17. Frequency Range: 45 to 55 Hz
18. Power factor range: 0.1 lag -1 -0.1 lead
19. Over voltage: 130% continuously & 200% for 30 sec
20. Over current: 2 times continuous, 20 times for 1 sec.
21. Response time: 200 ms
22. Class of accuracy: 0.2s as per IEC 60687, IS 14697
23. Complies to EMI: IEC 61000-4-5,3,4
24. Display resolution: upto 1 decimal
25.Output: Two communication port with optical isolation. RS 485 communication port with MODBUS RTU protocol.
26.CT shorting provision should be there.
27.Mounting: Flush panel mounting.
28. Dimensions:144X144 mm
29.Ambient condition: working: 0-55 deg cent,5-95% RH.

32.1

(a) A flag operated master trip relay should be provided (48 V DC with N/C contact in series with the relay coil): Electromechanical relay having sufficient output contact (N/O & N/C) should be available for interlock, indication & other SCADA purpose.

(b) Other electromechanical auxiliary relays as required as per the scheme to be provided.

(for contact multiplication, Transformer trouble shooting like Oil temp al & trip, Winding temp Al & Trip, Bucholtz Alarm & Trip, MOG alarm, PRV Trip etc)

(c) A 12 Window static annunciator with Test, Accept & Reset arrangement and with Buzzer & Bell.

32.2 Test terminal Blocks- Test terminal Block need be provided for testing meters in test position.

32.3 Indication Lamp(24DC LED type)	Red- Breaker 'ON' Green Breaker 'OFF' Amber- Breaker 'AUTO TRIP' Blue- Spring charge indication. White-Healthy Trip illuminated push bottom switch

33.0 Panel wiring and accessories.

Wiring: Each panel shall be supplied with all internal wiring complete.

33.1 Panel wiring shall be suitably bunched and clamp for neat appearance. The conductors used for wiring purpose shall be **PVC** insulated 1100 volt grade semi- flexible heat resistant, flame retardant and vermin proof electrolytic copper cable conforming to IEC:227, 502 or IS:1554. The wiring shall be securely supported and taken though PVC through PVC troughs. Each wire shall be continuous from end to end without any joint in between. All panel wiring shall be capable of withstanding a voltage of 2KV AC 50Hz for one minute.

33.2 Cable and wire for connections within the switchgear and between the switchgear and terminal blocks shall have a minimum temperature rating of 90 degree Celsius. The size of the conductors for panel wiring shall be not less than 2.5mm^2. For CT secondary wiring, two such wires shall be used in parallel.

33.3 **Panel wiring protection**

The panels shall be equipped with links and HRC cartridge fuses conforming to IEC:269 or IS:13703 in 1100 Volt grade phenolic moulded fuse holder consisting of fuse carrier and base or miniature circuit breakers conforming to IEC:947-2 or IS:13947-2 at appropriate locations. The carriers and bases shall be made of high grade flame retardant and non hygroscopic phenolic moulded material with hard glass surface. Each fuse or MCB shall be identified with engraved plastic label.

33.4 In general, fuses and MCBs shall be limited to the minimum required for safety.
The protection scheme shall include fuses for VT secondary circuits and DC supply to each panel and fuses for MCB for spring charging motor and incoming AC supply.

34.0 Terminal blocks

Terminal blocks of brass studs rated for 10 amps continuous current,1100volt. DC grade covered by moulded insulating materials with adequate electrical clearances shall be provided for terminating the panel wiring and outgoing connections. The termination shall be made by crimping lugs or bare conductor with insulating sleeves at ends. The arrangement can be horizontal or vertical as per standard practice adopted by the manufacturer. All terminals must be numbered and wire termination provided with numbered ferrules for identification. All numbering and marking including those in wiring diagram shall follow the guidelines provided in IS:11353. All circuit breaker auxiliary contracts including spare contacts shall be wired to the terminal blocks. Ten percent spare terminals shall be provided.

35.0 Colour and numbering

The wiring used for 230V AC supply for illumination lamp, panel heater and other devices shall be coloured. The colour of wires connecting directly to Earth shall be green. CT & PT connection wires shall be of R, Y & B colour. Engraved core identification plastic ferrules marked to correspond with the panel wiring diagram shall be fixed at both ends of each wire. Ferrules shall fit tightly on the wire and shall not fall off when the fire is disconnected from the terminal block. Number 6 and 9, if used shall be under scored to enable differentiation.

36.0 Circuit diagram

A durable copy of the circuit wiring diagram shall be affixed to the inner side of the door of the switchgear compartment. Labels shall be provided inside the compartment to describe the functions of the various items of equipment.

The scope of the supply shall include the panel mounting foundation bolts, nuts and washers necessary for making the supporting.

37.0 DISCONNECTORS (In GIS Panel):

Disconnector shall be provided in the GIS Switchgear panel. There shall be interlock with the VCB.
Rating: 630A.
SCC: 25 KA for 3 sec.

Internal Arc 25 kA 1 sec
Material: Electrolyte copper.

38.0 AUXILIARY SUPPLY

Control supply for closing and tripping shall be 48 Volts D.C.through external battery source. 230 Volts single phase A.C. supply shall also be available for the operation of spring charging motor and cubicle space heater.

39.0 DIMENSION

The dimension for **33kV GIS** shall not exceed

600mm (Width) X 2000mm (Depth) X2500mm (Height)

The dimension for **33kV AIS** shall not exceed

1200mm (Width) X3200mm (Depth) X 2700mm (Height)

The dimension for **11kV AIS** shall not exceed

800 mm(Width)X2100mm(Depth)X2500mm (Height)

40.0 TYPE TEST OF THE 33 KV SWITCH GEAR (VCB) PANEL.

Following type test reports shall be submitted during the detailed Engineering and approval of drawings.

All short circuit duties including single phase and double line to ground as per IEC62271-100 or as per latest amended IEC.

- **Short time rating for 3 seconds** as per IEC 62271-100,62271-200 or as per latest amended IEC.
- **Temperature rise test** as per IEC 62271-200 or as per latest amended IEC.
- **Capacitor bank switching** for 400A minimum & cable charging 25 A test as per IEC 62271-100 For test duties 1 to 4 or as per latest amended IEC.
- **Degree of protection test** as per IEC 62271-200 or as per latest amended IEC.
- **Lightning impulse voltage test** as per IEC 62271-100 , 62271-200 or as per latest amended IEC.
- **Internal arc test of 25 kA 1sec** in all the three high voltage compartments as per IEC 62271-200 or as per latest amended IEC.

41.0 QUALIFYING REQUIREMENT.

The equipment offered shall be procured from short listed vendor at E-23 and shall have been successfully Type Tested during last five years on the date of bid opening. The **front page** of the Type Test report showing the evidences of the tests, duly signed by the bidder shall be uploaded alongwith the bid.

The following Type tests of VCB should have done:

1) Short Time withstand current
2) Temperature Rise
3) Lightning Impluse Test
4) Internal Arc Test
5) Make & Break Test duties
6) Power frequency voltage test
7) Partial discharge test,
8) Resistance measurement test
9) Tightness test
10)Closing characteristic test
11) Opening Characteristic tests

The VCB shall be of **M2, C2 & E2 duty class.**

PART - B

TECHNICAL SPECIFICATION
FOR
11KV INDOOR VACCUM CIRCUIT BREAKER

1.0 REQUIREMENTS

This specification covers design, engineering, manufacture, testing, and inspection of 11 KV indoor Air Insulated Switchgear Panel (provided with Vacuum circuit Breaker, CT, IVT etc) for use in the 33/11KV primary substations under the distribution networks. 11 KV Switchgear (Vacuum breakers, CT & IVT. The 11KV side shall be of AIS switchgear irrespective of AIS / GIS S/S. Hence, there shall not be any Disconnector on 11kV side Indoor switch gear. There shall be separate Indoor Panels (2nos.) for IVT at 11kV side. The equipments must be type tested.

1.1 Description of the switchgear panels for 11 KV AIS.

Indoor switchgears for AIS should be provided in a cubicle, which shall be erected inside a building. Separate switchgear panels for feeder & transformer of 11 KV AIS system are to be considered. Care should be taken during manufacturing of the same as the equipment like VCB, Disconnector switches, CT & IVT are to be installed in the panel individually. The 11KV side shall be of AIS switchgear irrespective of AIS / GIS S/S. Hence there shall not be any Disconnector on 11kV side Indoor switch gear. There shall be separate Indoor Panels (2nos.) for IVT at 11kV side. Vibration is inevitable as mechanical operation for closing the VCB & disconnectors may cause problem and its performance will be affected.

The circuit breakers switchgear panels to be supplied against this specification shall be required to control the LV side of 33/11 KV power transformers in the primary sub-stations and also the incoming 11KV feeders or the outgoing feeders in these sub-stations. The switchgear panels shall be suitable for 3 phase 50Hz solidly grounded neutral system and shall have normal current carrying capacity of 630 Amp & Bus-bar shall be 1250A Amp for Indoor Switchgear irrespective of AIS and symmetrical short circuit breaking capability as mentioned hereunder.

2.0 STANDARDS:

Expect where modified by this specification, the circuit breakers and the accessories shall be designed, manufactured and tested in accordance with latest editions of the following standards.

IEC/ISO/BS	IS	Subject
IEC:56 IEC: 62271-100 & 200		High voltage alternating current circuit breakersgeneral Requirement.
IEC:694	IS : 12729	Common clauses of high voltage switch-gear and control gear standards (for voltage exceeding 1000 V).
IEC:60	IS : 9135	High Voltage testing techniques.

I EC:427	IS:13516	Method of synthetic testing of HV .A.C circuit breakers.
IEC: 1233		HV. AC. Circuit breakers- inductive load switching.
IEC: 17A/CD:474		HV. AC. Circuit breakers- capacitive switching.
IEC:529	IS: 13947	Degree of protection provided by enclosure.
IEC:137	IS: 2099	Insulating bushing for A.C. voltages above 1000V
IEC:233	IS : 5621	Hollow insulators for use in electrical equipment & testing.
IEC:273	IS: 5350	Characteristics of indoor and outdoor post insulators for systems with nominal voltages greater than 1000V.
IEC:815	IS: 13134	Guide for selection of insulators in respect of polluted conditions.
IEC: 34	IS : 996	A.C motors
ISO:1460 BS:729	IS:2629	Hot dip galvanizing
	IS:2633	Method of testing uniformity of zinc coated articles.
	IS: 5	Colour for ready missed paints and enamels
	IS: 6005	Code of practice for phosphating or iron and steel.
IEC: 227	IS:1554	P.V.C Insulated cables for voltages up to and including 1100 Volt.
IEC:269	IS:13703	Low voltage fuses for voltages not exceeding 1000volt.
ISO:800	IS:1300	Phenolic moulding materials.
	IS:13118	Guide for uniform marking and identification of conductors and apparatus terminals.
IEC: 185	IS: 2705	Current transformers.
IEC: 296	IS: 335	Specification for unused insulating oil for transformer and switchgear.
IEC:186	IS: 3156	Potential transformers.
CBIP Technical Report No. 88 revised July, 1996 read with amendment issued (April, 99, September, 99 and also any other amendment thereafter)	Specification for AC Static Electrical Energy Meter.	

CBIP Technical Report No. 88 revised July, 1996 read with amendment issued (April, 99, September, 99 and also any other amendment thereafter): Specification for AC Static Electrical Energy Meter.

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3.0 BASIC TECHNICAL REQUIREMENTS:

The vacuum circuit breakers shall comply to E2, M2 and C2 category and are required to meet the following basic technical requirements.
(Reference standards IEC:62271 - 100 & 200 or as per latest amended IEC and associated standards listed in this specification.

Basic Technical Requirements

Sl. No	Particulars	Requirements
1	Service type	Indoor
2	No. of Poles	3
3	Nominal system voltage	11KV
4	Highest system voltage	12KV
5	Rated normal current at 50°C	
	For Bus-bar	1250A
	For Interrupter	630A
	For Outgoing Feeders/ For Incomer & Bus Sections	630A
6	Rated short circuit breaking current (rms)	25KA
7	Rated short circuit making current (peak)	62.5 kA
8	Rated short time current withstand capability for 3 sec.	25KA(Panel)/25KA
9.	Rated insulation level:	
	One minute power frequency withstand voltage to earth (wet and dry) rms	28KV
	Impulse withstand voltage to earth with 1.2/50 µsec, wave of +ve and —ve polarity (Peak)	75KV
10	First — pole — to clear factor	1.5
11	Rated operating sequence (for auto reclosing)	0-0.3 Sec- CO-3 min-CO
12	Maximum break time	3 cycles
13	Rated out of phase breaking current	25% of the symmetrical short circuit breaking current
14	Maximum pole scatter	10 mili seconds
15	Rated Auxiliary supply for spring charge motor, lamp & heater circuit.	230V A.C
16	Rated supply voltage for trip/close coil	48 V D.C
17	Minimum creepage distance (mm)	As Per IS
18	Minimum protected creepage distance (mm)	As Per IS

4.0 SYSTEM CONDITIONS:

The breakers are to be suitable for indoor operation. Please refer chapter E3 of Technical Specification on SYSTEM conditions.

5.0 11 KV VACUUM CIRCUIT BREAKERS

5.1 GENERAL

The circuit breakers mounted on a withdrawable truck for AIS along with CT, Control & relay Panels shall be suitable for indoor installations with vacuum as interrupting

media incorporating separate interrupters of 630A rating for each phase mounted on single frame. Internal Arc withstand for 11kV & 33kV VCB must be 25kA for 3 sec. There is no line PT in the scope. Bus IVT will be in a separate Panel. There shall be a common drive mechanism actuating for interrupters, which must work in synchronism. These shall be a common drive mechanism actuating the interrupters, which must work in synchronism. These breakers shall be provided with suitable local control while provision shall be made for remote control. All the signals going in DCS shall be through hardwire.

5.2 The entire circuit breaker with its operating mechanism shall be mounted on a **horizontal draw out type chassis/ trolley inserted into a floor standing sheet steel** (Withdrawable truck for AIS) enclosure suitable for withstanding electromagnetic/ electro-dynamic forces of both symmetrical and asymmetrical faults. It shall have plug- in off load type isolating main and auxiliary contacts with all necessary safety features, door limit switch etc.

5.3 The vacuum circuit breaker panels shall be enclosed in sheet steel independent floor mounting cubicle made of 3 mm thick **CRCA Sheet** / **Alu-Zinc** material for outer walls including cable entry gland plate and 2 mm thick for non-load bearing partition/ inside walls suitable for coupling with identical units on either sides to form switchboard. The circuit breaker panel shall be such that when the withdrawable part is being removed the metal shutters can be opened with a lever, for an example to inspect the mating contracts or locked with a padlock. The upper portion (access to the Bushbar) and the lower portion (access to the termination compartment) can be unscrewed with the metal shutters closed. This makes it possible to work in the Busbar compartment with the termination compartment fully partitioned off, and vice versa. The breaker shall be provided with **three** distinct positions namely **Service, Test** and **Isolate.**

5.4 The circuit breakers shall be fitted with spring mechanism type. The inherent design of the circuit breakers shall be such that they shall satisfactorily perform all test duties and interrupt out-of-phase current and produce very low over voltage **(<2.5 pu**) on all switching circuits, capacitive and inductive to IEC:62271 - 100 & 200and other associated standards mentioned in the clause of this specification.

5.5 The **connecting terminal for Cables** shall have silver plating of at least **10** micron thickness. The design of the circuit breaker shall be such that inspection and replacement of contracts, coils, vacuum bottles and any worn or damaged components can be carried out quickly and with ease. The contact gaps shall be adjustable to allow for wear.

5.6 The mechanism and the connected interrupters shall satisfy the mechanical endurance requirements of IEC: 62271 - 100 & 200 or as per latest amended IEC and all additional requirements specified herein.

6.0 Interrupting media (Vacuum):

6.1 In vacuum circuit breakers, facilities shall be provided for monitoring the contract erosion and any change in contact gap. The vacuum bottles shall be easily replaceable on site and the mechanism shall be conveniently adjustable to permit

resetting the contact gap. The current rating of the vacuum interrupters shall be 630Amp.

6.2 The vacuum circuit breaker poles shall be sealed to prevent contamination of the spaces surrounding the interrupters. The bidder shall demonstrate how this is achieved by supplying technical details with the bid.

7.0 Auxiliary contacts

7.1 Auxiliary contacts (6NO + 6NC) of 48 Volt D.C grade and 10 amps DC rating shall be provided in each circuit breaker. However, additional contact shall be made available by using contact multiplier relay/Contact multiplication relay can be used.

8.0 Indication

8.1

A mechanically operated circuit breaker position indicator of non-corroding material shall be provided in a location visible from the operating side of the breaker without the necessity to open the mechanism door. The word 'OFF' in white letter on green background shall be used to indicate that the breaker is in the opening position and the word 'ON' in white letters on a red background to indicate that the breaker is in the closed position. The drive for the device shall be positive in both directions and provision shall be made for local and remote electrical indication.

8.2 Indication of spring charging condition shall be provided as mentioned in this Specification. Mechanical counters to record the number of closing operations shall be provided for each circuit breaker mechanism.

9.0 Operation and controls

9.1 The breaker shall normally be operated by electrical control with electrical tripping by **2 Nos.shunt trip coil.** Provision shall be made for local electrical operation and mechanical operation. There shall be a separate switch for electrical operation of the VCB.

9.2 The following facilities shall be provided in the circuit breaker local control cabinet:

- ON/NEUTRAL/ OFF control switch or ON and OFF push buttons. The push buttons shall be momentary contract type with rear terminal connections. The close push button shall be of green colour and the open push button red colour. There shall be a separate switch for electrical operation of the VCB.

- MECHANICAL EMERGENCY TRIP DEVICE: suitable for manual operation in the event of failure of electrical supplies. **The device**

shall be accessible without opening any access doors and distinctly labeled. It shall be shrouded and protected against inadvertent operation.

- Means shall be provided for manual operation of these circuit breakers during failure of auxiliary power in addition to electrical operation.

9.2 Means shall be provided to prevent the mechanism from responding to a close signal when the trip coil is energized or to reclosing from a sustained close signal either opening due to a trip signal or failure to hold in the closed position.

9.3 The circuit breaker shall be able to perform 10,000 operating cycles at no load in accordance with IEC:17A/474/CD for circuit breakers for auto reclosing duties.

10.0 CURRENT TRANSFORMERS

10.1 Current transformers, three per circuit breaker, shall be of indoor, single phase, resin cast and shall comply with IEC:185 and IS:2705, suitable for operation in hot and humid atmospheric conditions described in service condition. They shall be mounted inside the panel. The Class of insulation for CT's shall be CLASS E or better. The CT/PT's shall be cast Epoxy Resin Cast type and shall be either window or would type.

10.2 Core

10.2.1 High grad non- ageing cold rolled grain oriented (CRGO M4 or better grade) silicon steel of low hysteresis loss and permeability shall be used for the core so as to ensure specified accuracy at both normal and over currents. The flux density shall be limited to ensure that there is no saturation during normal service.

10.2.2 The instrument security factor of the core shall be low enough so as not to cause damage to the instruments in the event of maximum short circuit current.

10.3 Windings

10.3.1 The secondary windings shall be made of electrolytic copper with suitable insulation. The conductor shall be of adequate cross- section so as to limit the temperature rise even during short circuit conditions. The insulation of windings and connections shall be free from composition liable to soften, coze, shrink or collapse during service.

10.3.2 Polarity shall be indelibly marked on each current transformer and at the lead and termination at associated terminal blocks. CTs with multi ratio winding shall be clearly tabulated to show the connections required for different ratios. Similar numbers shall be marked on terminal block arrangement and wiring diagram. Apart from the above marking and those to be provided as

per IEC 185 or IS 2705, other markings shall be provided in consultation with owner.

10.3.3 The continuous current rating of the primary winding shall be one hundred and **twenty** percent of the normal rated current.

10.3.4 Secondary windings of current transformers shall be used for metering,Instrumentation and protection and shall be rated for continuous current of one hundred and **twenty** percent of normal rated current of primary winding.

Current transformers shall be three core window/bar primary for higher rating or wound primary for lower rating. Maximum VA burden shall be of 15 VA and shall be rated for full short circuit current 25 KA for 3 second. Out of three cores one Core having 0.2 class (Metering) & other two cores having 5P20 (Protection) class accuracy.

10.3.5. FEEDER PANEL:
Current Ratio: 400-200/1-1-1 Amp
No. of Cores: 03
Burden: 15 VA for each core

10.3.6 TRANSFORMER PANEL:
Current Ratio: 400-200/1-1-1 Amp
No. of Cores: 03
Burden: 15 VA for each core

11.0 Fittings and accessories

11.1 Fittings and accessories listed below shall be supplied with each current transformer:

- Bimetallic connectors suitable for connecting 185-400mm^2 XLPE insulated Aluminimum Cables.
- Two earthing terminals and strips with necessary nut, bolts and washers;
- Name and rating plate;
- LV terminals with connection diagram:
- Mounting nuts, bolts and washers;

11.2 Any other fittings deemed essential by the Supplier shall also be supplied with each current transformer.

11.3 Basic technical requirement for CT's

Knee Point Voltage shall be 400V for both 33kV & 11kV CT.
Maximum excitation current at Vk=25mA.

Ratings: The CTs shall conform to the following ratings and other particulars of the circuit breakers:

Technical Requirements

Sl. No	Particulars	Requirements	
1	Function	To control 11 KV Feeder & LV side of 33/11KV power transformers of ratings between 3.15MVA to 12.5MVA	
2	Requirement	The CTs in the 11 KV Indoor VCB switchgear panel should have three cores as follows.	
3	Transformation Ratio	Category- A (For TFR) 400 - 200/1-1-1-A	Category- B (For Feeder) 400-200/1-1-1 A
4	Rated Burden (VA)	Core:1: 15 VA , Core:2: 15 VA, Core:3:15 VA	Core:1: 15 VA , Core:2: 15 VA, Core:3:15 VA
5	Class of Accuracy	Core:1: 0.2 , Core:2: 5P20, Core:3: 5P20	Core:1: 0.2 , Core:2: 5P20, Core:3: 5P20
6	Instrument Security Factor	Core- 1:- <5	Core- 1:- <5
7	Purpose	Core:1: Metering , Core:2: Differential, Core:3:O/C& E/F & REF	Core:1: Metering , Core:2: Spare Core:3:O/C& E/F & REF
8	Rated/Highest syatem Voltage	11/12 KV	
9	Short Time Rating	25 KA rms for 3 seconds	
10	Power frequency 1 min voltage withstand level/ Insulation Level: -Impulse Voltage1.2/50 µs wave withstand level -	**28 KV/75KVp**	

12.0 Tests

12.1 The CTs shall be tested in accordance with the requirements of the type tests and routine tests as per the latest issues IEC:185 or IS:2705.

The tests to be conducted shall include:

12.2 Type Tests:

- Lightning impulse voltage:
- Power frequency wet withstand voltage;
- Temperature rise;

- Short time current;
- Composite error;
- Accuracy test (for measuring core);
- Instrument security current (for measuring core);

12.3 Routine tests

- Verification of terminal marking and polarity;
- Power frequency dry withstand test on primary windings
- Power frequency dry withstand test on secondary windings
- Power frequency dry withstand test between sections;
- Over voltage inter-turn test;
- Composite error;
- Turn ratio;
- Accuracy test (for measuring core);
- Current error and phase displacement (for protection core);
- Knee point voltage and magnetizing current test (for PS class);
- Secondary winding resistance (for PS class).

13.0 POTENTIAL TRANSFORMER

13.1 BASIC TECHNICAL REQIREMENTS**

The 11 KV Indoor voltage transformers are required to meet the following basic technical requirements (Reference standards: IEC:186, IS:3156 and associated standards listed in the specification):

Sl. No	Particulars	Requirements
1	Type	Single phase
2	Nominal system voltage, phase to phase	11 KV
3	Application	Instrumentation, Metering and Protection
4	Number of secondary windings	1
5	Rated normal burden*	**15VA** for each Core
6	Rated primary voltage	11000/√3
7	Rated secondary voltage	110V/√3-110V/√3
8	Class of accuracy	0.2/3P
9	Rated insulation level: (Primary winding)	
iii)	One minute power frequency withstand	28KV
iv)	Impulse withstand voltage to earth with	75KV
10	One minute power frequency withstand	
	Between phase to earth	3KV
	Between sections	3KV
11	Rated voltage factor	
	Continuous	1.2
	For 30 seconds	1.5

* The burden indicated is the minimum acceptable to the Employer. The Contractor shall ensure that the rated outputs of the voltage transformers are adequate to meet at least 120 percent of the connected load (burden).

****There is no line PT. Bus IVT (PT) will be in separate panel. Burden will be 15VA for each Core.**

13.2 GENERAL

The voltage transformers to be supplied under this specification shall be of Indoor, single phase Epoxy Resign Cast type complying with IEC:185 and IS:3156 suitable for operation in hot and humid atmospheric conditions described in this document.

13.3 Duty requirement

13.3.1 11 KV Voltage transformer for all the indicating instruments and measuring meters in the primary substation on 11KV side. It shall be of indoor, 1-Phase or 3- phase Epoxy Resign Cast type.

13.4 Core

13.4.1 High grade non-ageing cold rolled grain oriented (CRGO-M4 or better) silicone steel of low hysteresis loss and permeability shall be used for core so as to ensure accuracy at both normal and or over Voltages. The flux density shall be limited to 1.6 Tesla at normal voltage and frequency. There shall be no saturation at any stage during operation.

13.4.2 The instrument security factor of the core shall be low enough so as not to cause damage to the instruments in the event of maximum short circuit current or over voltages.

13.5 Windings

13.5.1 The primary and secondary windings shall be electrolytic copper of high purity and conductivity and covered with double paper insulation. The conductor shall be of adequate cross-section so as to limit the temperature rise even during maximum over voltages.

13.5.2 The insulation of windings and connections shall be free from composition liable to soften, ooze, shrink or collapse during service.

13.5.3 The secondary windings of the voltage transformers shall also be suitable for continuous over voltage corresponding to the maximum system voltage at the primary winding. The winding supports shall be suitably reinforced to withstand normal handling and the thermal and dynamic stresses during operation without damage.

13.5.4 The voltage transformer secondary circuits will be taken out to form the star point and earthed at one point outside the voltage transformers.

13.5.5 Both primary and secondary winding terminals shall be clearly and indelibly marked to show polarity in accordance with IEC:186. The connections required for different secondary windings in case of multi-winding voltage transformers shall be clearly indicated in terminal blocks and the wiring diagrams.

14.0 Fitting and Accessories

14.1 Fittings and accessories listed below shall be supplied with each voltage transformer:

- HV terminals;
- Two earthing terminals with necessary nuts, bolts and washers;
- Name and rating plate;
- Secondary terminal box with LV terminal connections;
- Mounting nuts, bolts and washers;
- L.V HRC cartridge fuses for the protection of secondary winding;
- HV HRC cartridge fuses for the protection of Primary winding

14.2 Any other fitting deemed essential by the contractor shall also be supplied along with each voltage transformer:

14.3 The name and rating plate shall contain all the particulars as provided in IEC:186 and also the name of the employer and year of manufacture. They shall comply with the clause termed label in this specification.

15.0 Fuse protection

The Primary winding shall be protected by HRC Fuses in suitable holder designed by the manufacturers.

15.1 The secondary windings shall be protected by HRC cartridge fuses in fuse holder consisting of carriers and bases. The carriers and bases shall be of high grade flame retarding and non-hygroscopic moulded insulating materials with hard glass surface. Each fuse shall be identified with engraved plastic label.

16.0 Circuit diagram

16.1 A durable copy of the circuit wiring diagram shall be affixed to the inner side of the terminal box cover. Labels shall be provided inside the cover to describe the functions of various items of equipment.

17.0 TERMINATION

17.1 The equipment shall be supplied with HV electrical connection terminals of a size and rating appropriate for all the duties, including overload duty specified for the equipment. The terminals shall be of the bi-metallic type.

18.0 EARTHING TERMINAL

18.1 Two earthling terminals complete with necessary hardware shall be provided on each voltage transformer for connection to earth continuity conductors of the Employer. They shall be of electroplated brass and of adequate size to carry the earth fault current.

18.2 The earthing terminals shall be identified by means of appropriate symbol marked in a legible and indelible manner adjacent to the terminals.

19.0 TEST AND INSPECTIONS

19.1 The voltage transformers shall be tested in accordance with the requirements of the type tests and routine tests as provided in the latest issues of IEC:186 or IS:3516.

Type tested equipment/materials are acceptable. Type tests should have been conducted in last five years. The Type Test must have been as per OPTCL requirement. If OPTCL desires another type test, it has to be conducted. In such case OPTCL will bear the transportation of equipment/material and type test charges.

The tests to be conducted shall include;

19.2 **Type tests:**

- Lightning impulse voltage test;
- High voltage power frequency wet withstand voltage;
- Temperature rise test;
- Short circuit withstand capability test;
- Determination of limits of voltage error and phase displacement.

19.3 **Routine tests:**

- Verification of terminal marking and polarity;
- Power frequency withstand tests on primary winding;
- Power frequency dry withstand tests on secondary winding;
- Power frequency withstand tests between sections;
- Determination of limits of voltage errors and phase displacement;
- Insulating Resistance measurement.
- Partial discharge measurement.

19.4 **TEMPERATURE RISE**

The temperature rise of any part of the voltage transformer under continuous operating and exposed in the direct rays of the sun shall not exceed the permissible limits as provided in IEC publication 186 or IS:3156. These shall not be exceeded when corrected for the difference between the ambinent temperature at site and the ambient temperature specified in the standard 62271-200/100, with silver plate joint. The correction proposed shall be stated in the bid.

20.0 PROTECTIVE RELAY & CONTROL PANEL

20.1 The CR Panel (Instrument Chamber) should be mounted on top of the VCB Panel.

Control panel **(inbuilt)** with protective relay and meter shall be provided by the supplier suitable for above breakers. The equipment shall have protection scheme with the following relays:

(i) Triple pole IDMTL type combined over current (3Nos) & Earth fault (1No) relay (Draw out type) preferably Communicable numerical relay of reputed make with supporting Protocol IEC:61850 and that should be type tested with IEC protocol 61850**.**

The detailed Specification are as indicated in 33 KV indoor switchgear panel (Sl No. 14)

21.0 MULTIFUNCTION METER

GENERAL

1. Each bay should be provided with a multifunction meter having following features:-
2. Features: By level monitoring of all electrical parameters of V,I,Φ,cosΦ,Hz,KVA,KVAR,KW & KWH.True RMS measurement
3. Accuracy: 0.2.
4. User selectable display ranges. (CT/PT).
5. Auto scrolling/Manual display
6. RS 485 communication port with MODBUS RTU protocol. Compatible for data logging & SCADA application.
7. Inbuilt Real time clock with calendar.
8. 3phase,4 wire,3 element or as per requirement.(to be decided during detail Engineering).
9. Quadrant of operation: 04 Quadrant.
10. Display: Bright red 7-segment LED display.
11. HMI: Through Front panel tactile keys.
12. Indication: Phase voltage, Phase current ,Line voltage, Frequency, Power factor, KVA,KVAR,KW,KVAH,KVARH,KWH.
13. Voltage input: 63.5/110V
14. Current Input: 1 A
15. Auxiliary supply: 85-250 V AC or 48 V DC
16. VA burden: 15VA
17. Frequency Range: 45 to 55 Hz
18. Power factor range: 0.1 lag -1 -0.1 lead
19. Over voltage: 130% continuously & 200% for 30 sec
20. Over current: 2 times continuous, 20 times for 1 sec.
21. Response time: 200 ms
22. Class of accuracy: 0.2s as per IEC 60687, IS 14697
23. Complies to EMI: IEC 61000-4-5,3,4
24. Display resolution: upto 1 decimal
25. Output: Two communication port with optical isolation. RS 485 communication port with MODBUS RTU protocol.
26. CT shorting provision should be there.
27. Mounting: Flush panel mounting.
28. Dimensions:144X144 mm
29. Ambient condition: working: 0-55 deg cent,5-95% RH.

22.1
(a) A flag operated master trip relay should be provided (48 V DC with N/C contact in series with the relay coil): Electromechanical relay having sufficient output contact (N/O & N/C) should be available for interlock, indication & other SCADA purpose.
(b) Other electromechanical auxiliary relays as required as per the scheme to be provided.
(for contact multiplication, Transformer trouble shooting like Oil temp al & trip, Winding temp Al & Trip, Bucholtz Alarm & Trip, MOG alarm, PRV Trip etc)
(c) A 12 Window static annunciator with Test, Accept & Reset arrangement and with Buzzer & Bell.

(i)Test terminal Blocks- Test terminal Block need be provided for testing meters in test position.

ii) Indication Lamp(24DC LED type)
Red- Breaker 'ON'
Green Breaker 'OFF'
Amber- Breaker 'AUTO TRIP'
Blue- Spring charge indication.
White-Healthy Trip illuminated push bottom switch

22.2 **In Built Control- Relay Panel in the In Door VCB (Mounted on the Top of VCB Panel)**

22.0 Panel wiring and accessories.

22.1 **Wiring**

Each panel shall be supplied with all internal wiring complete.

22.2 Panel wiring shall be suitably bunched and clamp for neat appearance. The conductors used for wiring purpose shall be **PVC** insulated 1100 volt grade semi- flexible heat resistant, flame retardant and vermin proof electrolytic copper cable conforming to IEC:227, 502 or IS:1554. The wiring shall be securely supported and taken though PVC through PVC troughs. Each wire shall be continuous from end to end without any joint in between. All panel wiring shall be capable of withstanding a voltage of 2KV AC 50Hz for one minute.

22.3 Cable and wire for connections within the switchgear and between the switchgear and terminal blocks shall have a minimum temperature rating of 90 degree Celsius. The size of the conductors for panel wiring shall not be less than 2.5mm^2. For CT secondary wiring, two such wires shall be used in parallel. CT, PT & all other control wiring shall be 2.5 Sq mm.

22.4 **Panel wiring protection**

The panels shall be equipped with links and HRC cartridge fuses conforming to IEC:269 or IS:13703 in 1100 Volt grade phenolic moulded fuse holder consisting of fuse carrier and base or miniature circuit breakers conforming to IEC:947-2 or IS:13947-2 at appropriate locations. The carriers and bases shall be made of high grade flame retardant and non hygroscopic phenolic

moulded material with hard glass surface. Each fuse or MCB shall be identified with engraved plastic label.

22.5 In general, fuses and MCBs shall be limited to the minimum required for safety.

The protection scheme shall include fuses for VT secondary circuits and DC supply to each panel and fuses for MCB for spring charging motor and incoming AC supply.

23.0 Terminal blocks

23.1 Terminal blocks of brass studs rated for 10 amps continuous current, 1100 volt DC grade covered by moulded insulating materials with adequate electrical clearances shall be provided for terminating the panel wiring and outgoing connections. The termination shall be made by crimping lugs or bare conductor with insulating sleeves at ends. The arrangement can be horizontal or vertical as per standard practice adopted by the manufacturer. All terminals must be numbered and wire termination provided with numbered ferrules for identification. All numbering and marking including those in wiring diagram shall follow the guidelines provided in IS:11353. All circuit breaker auxiliary contracts including spare contacts shall be wired to the terminal blocks. Ten percent spare terminals shall be provided.

24.0 Colour and numbering

The wiring used for 230V AC supply for illumination lamp, panel heater and other devices shall be coloured. The colour of wires connecting directly to Earth shall be green. CT & PT connection wires shall be of R, Y & B colour.

24.1 Engraved core identification plastic ferrules marked to correspond with the panel wiring diagram shall be fixed at both ends of each wire. Ferrules shall fit tightly on the wire and shall not fall off when the fire is disconnected from the terminal block. Number 6 and 9, if used shall be under scored to enable differentiation.

25.0 Circuit diagram

26.1 **A durable copy of the circuit wiring diagram shall be affixed to the inner side of the door of the switchgear compartment. Labels shall be provided inside the compartment to describe the functions of the various items of equipment.**

26.2 The scope of the supply shall include the panel mounting foundation bolts, nuts and washers necessary for making the supporting.

26.0 OPERATING MECHANISM

26.1 General

26.1.1 The operating mechanism of the circuit breaker shall be motor wound spring charged type. It shall be electrically and mechanically trip free with anti pumping device (as per IEC:694 definition). All working parts in the mechanism shall be of corrosion resistant material. Self lubricating, wearing resistant bearings shall be provided in the mechanism.

26.1.2 The mechanism shall fully close the circuit breaker and sustain it in the closed position against the forces of the rated making current and shall fully open the circuit breaker without undue contact bounce at a speed commensurate with that shown by tests to be necessary to achieve the rated breaking capacity in accordance with IEC:56 or IS:13118. The mechanism shall be capable of being locked in either the open or closed position. The mechanism shall be capable of fully closing and opening again after the auto-reclose time interval specified as 0.3 second in this specification.

26.2 Spring mechanism (In case of Spring Charged VCB)

26.2.1 The spring operating mechanism shall be with spring charging motor, opening and closing springs with limit switches and all accessories necessary for automatic charging. In normal operation, recharging of the operating springs shall commence immediately and automatically upon completion of the closing operation so that a complete sequence of closing and opening operation should be possible.

26.2.2 It shall be possible to hand charge the operating spring with the circuit breaker in either the open or closed position conveniently from the ground level. Closure whilst a spring charging operation is in progress shall be prevented and release of the springs shall not be possible until they are fully charged.

26.2.3 The state of charge of the operating springs shall be indicated by a mechanical device showing **'SPRING CHARGED'** when closing spring is fully charged and operation is permissible and **'SPRING FREE'** when closing spring is not fully charged and the operation is not possible. Provision shall be made for remote electrical indication of 'Spring Charged' and 'Spring Free' conditions.

26.2.4 The operating mechanism shall be such that the failure of any auxiliary spring shall not cause tripping or closing the circuit breaker but shall not prevent tripping against trip command.

26.2.5 Closing action of the circuit breaker shall charge the opening spring ready for tripping. From the close position with spring charged, one open-close-open operation shall be possible without recharging the spring.

26.3 Motor

The motor for spring charging shall be single phase 230 Volt A. C motor. Continuous motor rating shall be at least ten percent above the maximum load demand of the driven equipment. It shall remain within its rated capacity at all operating points that will arise in service. It shall be protected by MCB. The motor shall comply with IEC:34 or IS:996.

26.4 **AUXILIARY POWER SUPPLY**

26.4.1 The operating mechanism shall be suitable to operate with the following auxiliary power supplies.

a) 230V,50Hz Single phase For spring charging motor AC

b) DC supply 24 Volts- For close and open coils.

26.5 The DC supply shall be from **Battery Bank.**

26.6 The mechanism shall be designed to operate satisfactorily despite fluctuations of auxiliary power supplies as under:

AC supply: Voltage	From 85% to 115% of normal voltage
Frequency variation	From -5% to +3% in variation
DC supply: Voltage	for voltage variation of Tripping : 70% - 110%)
	for voltage variation of Closing : 85% - 110%)

26.7 Temperature Rise test:

The temperature rise and the maximum temperature of any part of the circuit breaker under continuous load condition and exposed in the direct rays of the sun shall not exceed the permissible limits as provided in Table V of IEC publication 694 or table 4 of IS:12729. These limits shall not be exceeded when corrected for the difference between the ambient temperature at site and the ambient temperature specified in the standard. The correction proposed shall be stated in the tender.

27.0 TESTS

27.1 **Type and routine tests**

The circuit breakers shall be subjected to routine and type tests in accordance with the standards listed in this specification including the following IEC and IS standards with the latest amendments:

- Circuit breakerIEC:62271 - 100 & 200and relevant other standards
- Porcelain insulator IEC:233 and IS:5621 and relevant other standards

The tests shall include but not limited to the following:

27.2 **Short circuit tests**

The circuit breaker shall satisfactorily perform the out of phase and short circuit duties specified in **IEC:62271-100 & 200,** IEC:17A(Sect.)438 and IEC:17A/CD/474 and IS:13516.

The circuit breaker shall be capable of performing at least twenty five (25) open operations at the rated short circuit current before maintenance or inspection is required.

27.3 **Dielectric tests**

At zero gauge loss of vacuum inside the interrupter chamber, the open contracts shall withstand continuously, the rated phase to ground voltage and it shall be possible to break normal current in these conditions. During the dielectric type tests, no flashover external or internal shall be acceptable.

The circuit breakers shall be subjected to a power frequency AC voltage test for one minute in dry and wet conditions and there shall be no external flash over to earth.

27.4 **Mechanical endurance**

In addition to the requirements of IEC:56, an extended mechanical endurance test is required to show that the circuit breaker is capable of at least 10,000 operations at no load in accordance with IEC:17A/474/CD or as per latest amended IEC. Between the specified test series in IEC:17A/474/CD, some maintenance such as lubrication and mechanical adjustment is allowed and shall be performed in accordance with manufacturer's instructions. Change of contracts is not permitted.

27.5 **Duty requirement tests**

Apart from auto-reclosing and the other duties mentioned above, the breakers shall be able to perform the following duties for which type tests are to be conducted as per IEC:56 or IS:13118.

1. Breaking the steady and the transient magnetising current of the transformer.
2. Breaking 25% of rated fault current at twice the rated voltage as per IEC/IS.
3. Cable charging breaking current.
4. Single capacitor bank breaking current.
5. Capacitor bank in rush making current.

Test for the resistance of the main circuit shall also be conducted.

27.6 **Temperature rise test**

Temperature rise test is to be conducted on the circuit breaker and the accessories in accordance with **IEC:62271-100 & 200 or latest amended IEC.** The temperature rise shall be limited as per this specification.

28.0 PERFORMANCE REQUIREMENTS

The supplier shall declare the circuit breaker opening and closing times at 120 percent, 100 percent and 70 per cent of the rated voltage of the opening and closing devices when measured at the terminals of the trip and closing coils. The minimum make break time at rated voltage and total break time of the CB shall be stated. The total break time must not exceed 60m. sec.

29.0 EARTHING

29.1 All metal parts not intended for carrying current or not alive shall be connected to duplicate earthing system and suitable electroplated brass earthing terminals shall be provided on each circuit breaker in conformity with **IEC:62271-100 & 200.** Suitable identification mark for the earth terminals shall be provided adjacent to the terminal.

29.2 The size of the earth continuity conductor shall be large enough to reduce the potential rise of the metal frame of the breaker in the even of fault to minimum but in any case not more than 10V. The size of the conductor shall also be adequate to restrict the temperature rise without causing any damage to the earth connection in the case of fault. No riveted joints in the earth conducting path shall be permissible and only bolted joints of adequate size shall be provided with nuts, bolts and plain spring washers. The surfaces to be jointed shall be perfectly flat without any unevenness to ensure that there is no contact resistance.

29.3 An earth busbar of copper strip shall be provided inside the local control cabinet to which all earthing connections must be made. The earth busbar shall be terminated into two electroplated brass earthing terminals of adequate size with nuts, bolts and washers for connecting to earth continuity conductor mentioned above.

30.0 QUALIFYING REQUIREMENT.

The equipment offered shall be procured from short listed vendor at E-23 and shall have been successfully Type Tested during last five years on the date of bid opening. The **front page** of the Type Test report showing the evidences of the tests, duly signed by the bidder shall be uploaded alongwith the bid.

The following Type tests of VCB should have done:

1) Short Time withstand current
2) Temperature Rise
3) Lightning Impluse Test

4) Internal Arc Test
5) Make & Break Test duties
6) Power frequency voltage test
7) Partial discharge test,
8) Resistance measurement test
9) Tightness test
10)Closing characteristic test
11) Opening Characteristic tests

The VCB shall be of **M2, C2 & E2 duty class.**

Technical specification of HDPE pipes

HDPE Pipes should conform to IS : 4984 – 1995. The following are the specifications:

PIPE	For LT/HT	FOR EHT
Outer Diameter	160 mm	315 mm
Mat. Grade	PE 63	PE 80
Pressure Rating	PN 6	PN 6
Wall Thickness	11.2mm to 12.5mm	17.9mm to 20mm

STANDARD TECHNICAL PARTICULARS FOR
1-CORE 132 KV XLPE CABLE

1.	Type of Cable	:	132kV XLPE Cable
2.	Standard according to which cable is manufactured	:	IS 7098(P-3)/98
3.	Standard according to which cable is tested	:	IEC 60840 OR IS 7098(P-3)/93 AS PREFERED
4.	Rated Voltage (Uo/U)	:	76/132 kV
5.	Impulse Withstand Voltage 1.2/50 micro-second wave	:	650 kVp
6.	Power Frequency Withstand Voltage	:	190 kVrms (30 minutes)
7.	Conductor		
	a) Material	:	Plain Annealed Copper
	b) Grade	:	Electrical Grade
	c) Nominal Cross-sectional area	:	800 sq.mm.
	d) Minimum No. of wire & dia. of wire (Approx.)	:	53 (Min.) / 4.720 mm (for 55-W) (Approx.) or 3.850 mm (for 81-W) (Approx.)
	e) Flexibility Class as per IEC 60228	:	Class 2
	f) Shape of Conductor	:	Circular Compacted
	g) Maximum dielectric stress at the conductor	:	As per design
	h) Approx. overall diameter	:	34 mm
	i) Longitudinally moisture barrier of conductor	:	Yes, with water swellable yarn and Semi-conductive water swellable tape applied with 50% overlap
8.	Conductor Screen		
	a) Material & type	:	Semi-conductive XLPE
	b) Nominal thickness	:	1.50 mm
	c) Minimum average thickness	:	1.50 mm
	d) Max. dielectric stress at conductor screen	:	6.0 kV/mm
9.	XLPE Insulation		
	a) Thickness of insulation & tolerance	:	18.0 mm (Nominal)
		:	16.2 mm (Minimum Spot)
	b) Minimum insulation resistance at 90^{o}C conductor temperature	:	$1x10^{12}$ ohm-cm
	c) Designed maximum dielectric stress at insulation surface	:	3.08 kV/mm
	d) Dia. over XLPE insulation	:	74.2 mm (Approx.)
10.	Insulation Screen		
	a) Material & type	:	Extruded Semi-conductive
	b) Nominal thickness	:	XLPE
	c) Minimum average thickness	:	1.00 mm
			1.00 mm

11. Nominal dia. Over insulation screen	:	75.5 mm (Approx.)
12. Conducting Longitudinal Moisture Barrier over Insulation screen		
a) Material	:	Semi-conductive water swellable tape applied with 50% overlap
b) Nominal thickness	:	0.3 mm (Approx.)
13. Concentric Metallic Sheath	:	Corrugated Al sheath with Anti rodent treatment
14. Radial Moisture Barrier over Non-Conducting Longitudinal Moisture Barrier Corrugated Al anti rode		
a) Material	:	Extruded Corrugated Aluminium Sheath
b) Nominal thickness		1.9 mm
c) Anti Corrosion Coating	:	Yes
15. Nominal redial clearance allowed under radial moisture barrier	:	1.0mm
16. Protective outer serving		
a) Type of composition	:	Black HDPE ST7 with graphite coating or extruded conductive layer
b) Nominal thickness & tolerance	:	3.8 mm (Nominal) 3.13 mm (Minimum Spot)
c) Test Voltage at Works	:	25kVdc for 1 min
17. Nominal overall dia. of completed single core cable	:	As it comes following the above measurement
18. Nominal weight per metre of complete cable	:	On actual as per design
19. Short circuit capacities with maximum allowable conductor temperature at the commencement		
a) 0.5 second duration	:	161.88 kA
b) 1 second duration	:	114.47 kA
c) 2 second duration	:	80.94 kA
d) 3 second duration	:	66.09 kA

20.Minimum bending redius for cable laying		
a) Direct burial in ground	:	20 times
b) In ducts / pipes	:	the
c) On racks	:	Overall
d) At Terminations (with former)	:	dia of the cable
21.Maximum D.C. resistance of conductor per km. at 20°C	:	0.0221 ohm/km at 20°C
22. Maximum A.C. resistance of conductor per km. at 90°C (Trefoil laying)	:	0.0321 ohm/km
23.Equivalent star reactance per km of 3-Phase circuits at 50 Hz.	:	0.120 ohm/km
24.Maximum electrostatic capacitance per km of cable		0.213×10^{-6} F/km
25.Maximum charging current	:	5.10 A/km
26.Maximum continuous current carrying capacity per cable installed in ground (Both ends of the circuit bonded & earthed) (Ground Temp 30°C, Depth 1.37 m, Rho 1.5 °C-m/W)	:	624 A
27.Maximum continuous current carrying capacity per cable when drawn into pipes (Both ends of the circuit bonded & earthed) (Ground Temp 30°C, Depth 1.37 m, Rho 1.5 °C-m/W)	:	607 A
28.Short time current carrying capacity which will permit a further 10% overload for two hours (Both ends of the circuit bonded & earthed)		983 A
29.Short time current carrying capacity which will permit a further 10% overload for two hours, but with cables drawn into pipes (Both ends of the circuit bonded & earthed)		993 A
30Maximum Power Factor of charging kVA of cable when laid direct in the ground at normal voltage and frequency at conductor temperature of 15, 30, 45, 65 & 95 °C		0.001
31.Maximum dielectric power loss of cable per km of 3-Phase circuit laid direct in ground at normal voltage, frequency and maximum conductor temperature		1167 W/km (3-Phase)
32.Maximum Power Factor of charging kVA of cable at normal frequency and at a conductor temperature of 20°C and at 0.5, 1.0, 1.5, 2.0 times nominal voltage		Maximum increment between $0.5U_o$ and $2.0U_o$ not exceed 0.001

33.Sheath Loss of cable per km of 3-Phase circuit at normal voltage, frequency at maximum continuous current rating		
e) Laid direct in ground (item 30 above)	:	7.41 kW/km
f) Drawn into ducts/pipes	:	6.4 kW/km
34.Impedance per km of 3-Phase circuit at 50 Hz and maximum conductor temperature		
g) Positive & Negative sequence impedance	:	0.0321 + j 0.120 ohm/km
h) Zero sequence impedance	:	0.104 + j 0.0493 ohm/km
35.Maximum partial discharge at appropriate Test Voltage (mention Test Voltage)	:	10 pC at $1.5U_o$
36. Phase to ground characteristic impedance at 50 to 200 kHz (Screening factor)	:	43.1
37. a) Nominal drum length of cable with Poly-Al Sheathing		500 m per drum
b) Tolerance		$\pm$ 5% of Nominal drum length
c) Sealing & Pulling Eye		Cable to be sealed properly after manufacturing pulling eye to be fixed at "A"end .pulling eye should be mechanically strong enough so that the pulling of cable should be free from safety hazard.
38.Appropriate shipping weight and size of Steel drums	:	8.5 MT (Gross weight per drum) Approx. Steel reel 257 x 220 cm (Approx.)

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Note : Bidder to furnish fault current calculation with supportive data to indicate that the sheath will allow fault current without any damage/ deformation.

STANDARD TECHNICAL PARTICULARS FOR

1-CORE 132 KV XLPE CABLE

1.	Type of Cable	:	132kV XLPE Cable
2.	Standard according to which cable is manufactured	:	IS 7098(P3)/93
3.	Standard according to which cable is tested	:	IEC 60840 /IS7098(P3)/93 As Preferred
4.	Rated Voltage (Uo/U)	:	76/132 kV
5.	Impulse Withstand Voltage 1.2/50 micro-second wave	:	650 kVp
6.	Power Frequency Withstand Voltage	:	190 kVrms (30 minutes)
7.	Conductor		
	a) Material	:	Plain Annealed Copper
	b) Grade	:	Electrical Grade
	c) Nominal Cross-sectional area	:	630 sq.mm.
	d) Minimum No. of wire & dia. of wire (Approx.)	:	53 (Min.) / 4.720 mm (for 55-W) (Approx.) or 3.850 mm (for 81-W) (Approx.)
	e) Flexibility Class as per IEC 60228	:	Class 2
	f) Shape of Conductor	:	Circular Compacted
	g) Maximum dielectric stress at the conductor	:	As per design
	h) Approx. overall diameter	:	29.8 mm
	i) Longitudinally moisture barrier of conductor	:	Yes, with water swellable yarn and Semi-conductive water swellable tape applied with 50% overlap
8.	Conductor Screen		
	a) Material & type	:	Semi-conductive XLPE
	b) Nominal thickness	:	1.50 mm
	c) Minimum average thickness	:	1.50 mm
	d) Max. dielectric stress at conductor screen	:	6.0 kV/mm
9.	XLPE Insulation		
	a) Thickness of insulation & tolerance	:	18.0 mm (Nominal)
		:	16.2 mm (Minimum Spot)
	b) Minimum insulation resistance at 90°C conductor temperature	:	$1x10^{12}$ ohm -cm
	c) Designed maximum dielectric stress at insulation surface	:	3.08 kV/mm
	d) Dia. over XLPE insulation	:	70 mm (Approx.)
10.	Insulation Screen		
	a) Material & type	:	Extruded -Semi-
	b) Nominal thickness	:	conductive XLPE
	c) Minimum average thickness	:	1.00 mm
			1.00 mm

11.	Nominal dia. Over insulation screen	:	72.5 mm (Approx.)
12.	Conducting Longitudinal Moisture Barrier over Insulation screen		
	a) Material	:	Semi-conductive water swellable tape applied with 50% overlap
	b) Nominal thickness	:	0.3 mm (Approx.)
13.	Concentric Metallic Sheath		
	a) Material & Type	:	Corrugated Al with anti rodent treatment
14.	Radial Moisture Barrier over Non-Conducting Longitudinal Moisture Barrier		Extruded ,Corrugated Al sheath
	a) Material	:	1.9 mm
	b) Nominal thickness		Yes
	c) Anti Corrosion Coating	:	
15.	Nominal redial clearance allowed under radial moisture barrier	:	1.0 mm
16.	Protective outer serving		Black HDPE ST7 with graphite coating or extruded conductive layer
	a) Type of composition	:	3.8 mm (Nominal) 3.13 mm (Minimum Spot)
	b) Nominal thickness & tolerance	:	25kVdc for 1 min
	c) Test Voltage at Works	:	
17.	Nominal overall dia. of completed single core cable	:	As it comes following the above measurements
18.	Nominal weight per metre of complete cable	:	On actual as per the design
19.	Short circuit capacities with maximum allowable conductor temperature at the commencement		
	a) 0.5 second duration	:	127.49 kA
	b) 1 second duration	:	90.14 kA
	c) 2 second duration	:	63.73 kA
	d) 3 second duration	:	52.04 kA

20. Minimum bending radius for cable laying		
a) Direct burial in ground	:	20 times
b) In ducts / pipes	:	the over
c) On racks	:	all dia of
d) At Terminations (with former)	:	the cable
21. Maximum D.C. resistance of conductor per km. at 20°C	:	0.0283 ohm/km at 20°C
22. Maximum A.C. resistance of conductor per km. at 90°C (Trefoil laying)	:	0.040 ohm/km
23. Equivalent star reactance per km of 3-Phase circuits at 50 Hz.	:	0.110 ohm/km
24. Maximum electrostatic capacitance per km of cable	:	0.175×10^{-6} F/km
25. Maximum charging current	:	5.10 A/km
26. Maximum continuous current carrying capacity per cable installed in ground (Both ends of the circuit bonded & earthed) (Ground Temp 30°C, Depth 1.37 m, Rho 1.5 °C-m/W)	:	574 A
27. Maximum continuous current carrying capacity per cable when drawn into pipes (Both ends of the circuit bonded & earthed) (Ground Temp 30°C, Depth 1.37 m, Rho 1.5 °C-m/W)	:	559 A
28. Short time current carrying capacity which will permit a further 10% overload for two hours (Both ends of the circuit bonded & earthed)	:	773 A
29. Short time current carrying capacity which will permit a further 10% overload for two hours, but with cables drawn into pipes (Both ends of the circuit bonded & earthed)	:	703 A
30. Maximum Power Factor of charging kVA of cable when laid direct in the ground at normal voltage and frequency at conductor temperature of 15, 30, 45, 65 & 95 °C	:	0.001
31. Maximum dielectric power loss of cable per km of 3-Phase circuit laid direct in ground at normal voltage, frequency and maximum conductor temperature	:	1167 W/km (3-Phase)
32. Maximum Power Factor of charging kVA of cable at normal frequency and at a conductor temperature of 20°C and at 0.5, 1.0, 1.5, 2.0 times nominal voltage	:	Maximum increment between $0.5U_o$ and $2.0U_o$ not exceed 0.001

33.	Sheath Loss of cable per km of 3-Phase circuit at normal voltage, frequency at maximum continuous current rating		
	a) Laid direct in ground (item 30 above)	:	7.41 kW/km
	b) Drawn into ducts/pipes	:	6.4 kW/km
34.	Impedance per km of 3-Phase circuit at 50 Hz and maximum conductor temperature		
	a) Positive & Negative sequence impedance	:	0.040 + j 0.110 ohm/km
	b) Zero sequence impedance	:	0.104 + j 0.0493 ohm/km
35.	Maximum partial discharge at appropriate Test Voltage (mention Test Voltage)	:	10 pC at $1.5U_o$
36.	a) Phase to ground characteristic impedance at 50 to 200 kHz (Screening factor)	:	43.1
37.	a) Nominal drum length of cable with Poly-Al Sheathing	:	500 m per drum
	b) Tolerance		$\pm$ 5% of Nominal drum length
	c)Sealing and Pulling eye:	:	Cable ends to be Sealed Properly after manufacturing and pulling eye to be fixed at "A"end. Pulling eye should be strong enough so that the pulling of cable will be free from safety hazard.
38.	Appropriate shipping weight and size of Steel drums	:	8.5 MT (Gross weight per drum) Approx. Steel reel 257 x 220 cm (Approx.)

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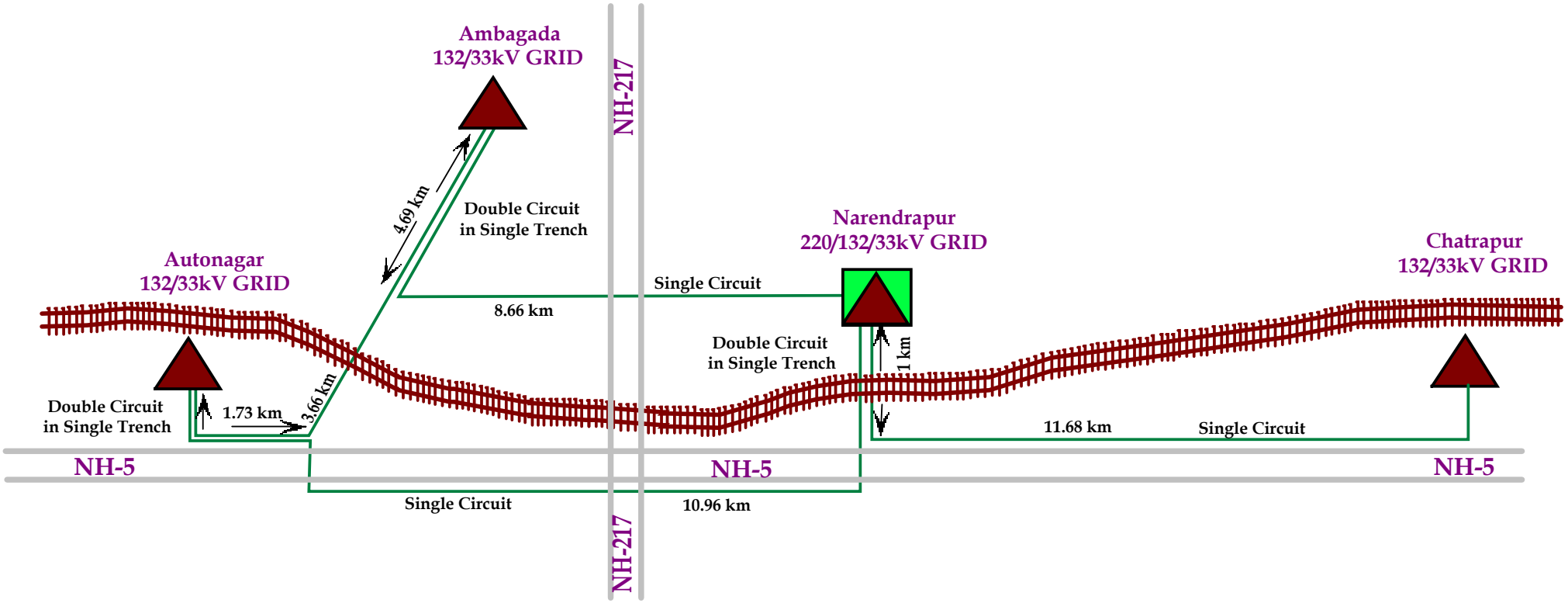
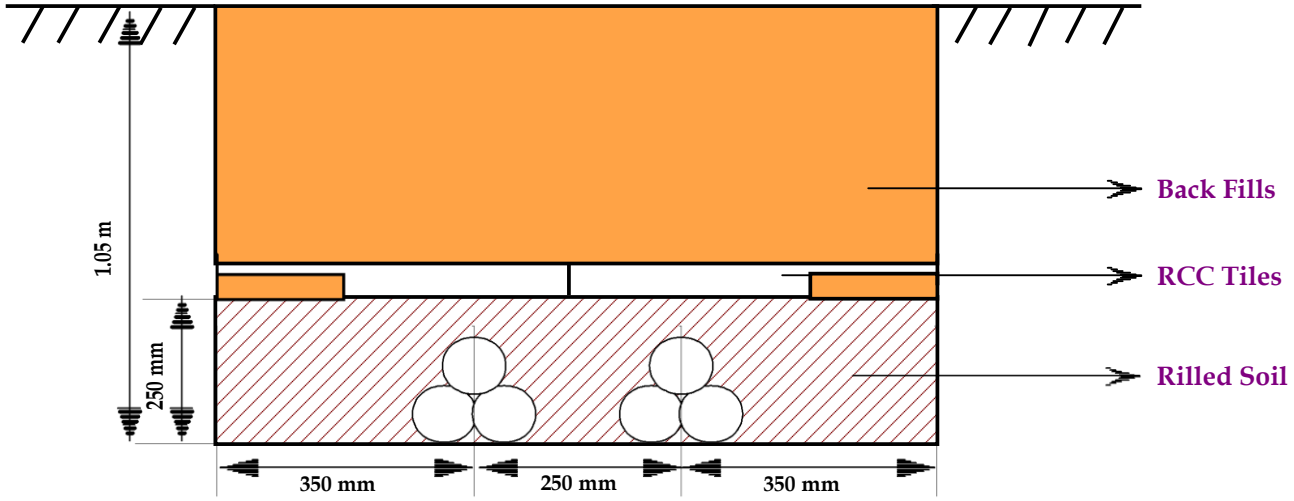
Note : Bidder to furnish fault current calculation with supportive data to indicate that the sheath will allow fault current without any damage/ deformation.

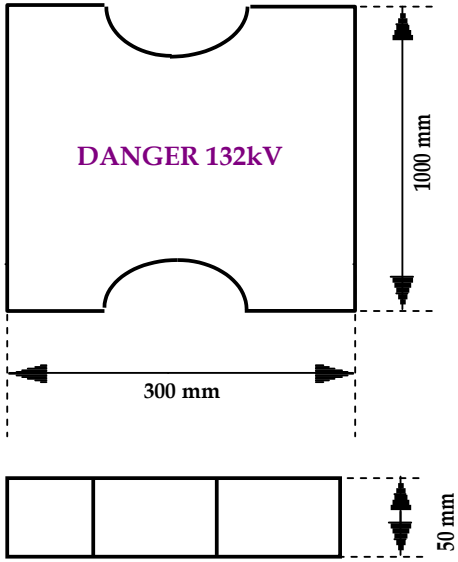
CABLE TRENCH ROUTE SLD

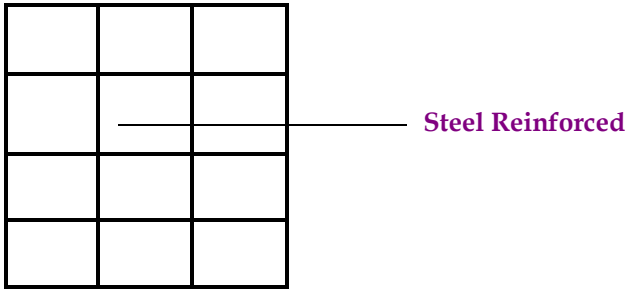


Prepared By:- PRDC

132kV DOUBLE CIRCUIT LAYING ARRANGEMENT

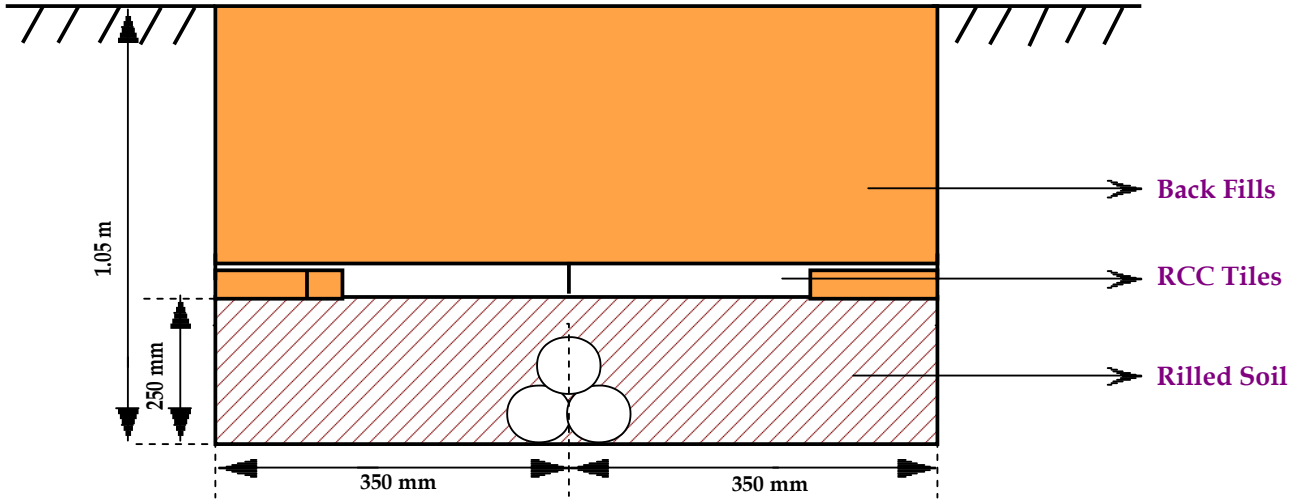


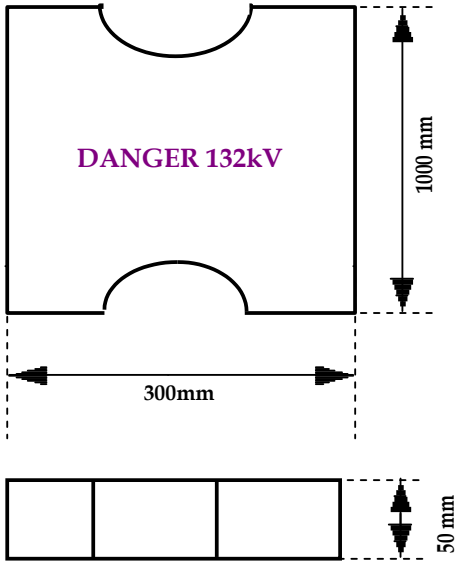


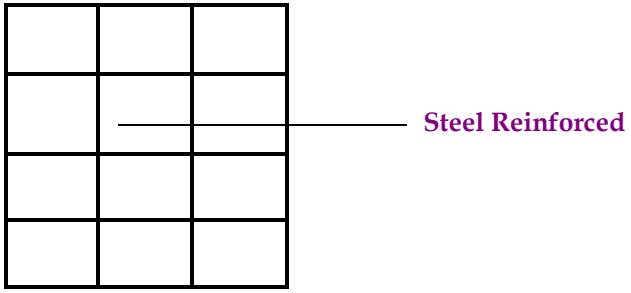


Prepared By:- OPTCL

132kV SINGLE CIRCUIT LAYING ARRANGEMENT







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