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No. AEGCL/MD/AIIB/TENDER/2020/Extn-18 **Date: 05.07.2020**

CORRIGENDUM-VI

Tender Reference No : **AEGCL/MD/AIIB/PACKAGE-A/2020/02-B**
AEGCL/MD/AIIB/PACKAGE-A/2020/02-C

Name of Work: **1.** CONSTRUCTION OF 220/33 KV, 2X100 MVA GIS AT TWO LOCATIONS **(NAGAON-2 & CHAYGAON) AND ASSOCIATED LINES (PACKAGE-B)**
2. CONSTRUCTION OF 132/33 KV, 2X50 MVA GIS AT LOCATION **(BURHIGAON) AND ITS ASSOCIATED LINES (PACKAGE-C)**

TABLE-2

Sl No	Clause No.	As Existing	As Amended	Reference to Sl. No. of Response [Table 1] wherever applicable
	Volume II (Package B &C)			
1	11.5.5 TECHNICAL DATA SHEET FOR TRANSFORMERS of Volume II (Point No 17: STC)	25kA for 3 Sec for 250kVA, 500kVA & 1000kVA	31.5kA for 3 Sec for 250kVA, 500kVA & 1000kVA	203, 478
2	5.26.17 of Volume II	Portable and wheel/Trolley mounted Fire extinguisher with four sub clause a, b, c &d.	Portable and wheel/Trolley mounted Fire extinguisher for e) GIS Hall (4.5kG X 5 Nos. & 2kG X 5 Nos) f) 33kV Switchgear room (4.5kG 5 Nos).	831

			g) Officer Hostel (2kG X 5 Nos) h) Staff hostel (2kG X 5 Nos.) i) Security Barrack (2kG X 5 Nos) k) Security Booth (2kG X 2 Nos.) l) RE Residence (2kG X 2 Nos) m) Store Building (2kG X 2 Nos). For the above mentioned Qty. it shall be both DCP and CO2 type.	
3	Clause no 2.6.12 of Volume II for **(Package B)**	**220kV (Bus scheme: Double Bus)** **Present scope of works:** 1. ICTs: 220/33kV, 2x100MVA for each 2. ICT bays: 220kV 2 nos. for each substation 3. Line bays: 2 nos. at each substation i. LILO ing of 220kV Samaguri – Jawaharnagar D/C at Nagaon-2. ii. 220kV Azara-Boko S/C at Chaygaon ***d.*** Bus Coupler Bay: 1 no. for each substation **Space for future expansion (220kV):** 1. ICT bays: 2 nos. at each substation. 2. Line bays: 2 nos. at each	**220kV (Bus scheme: Double Bus)** **Present scope of works:** 1. ICTs: 220/33kV, 2x100MVA for each 2. ICT bays: 220kV 2 nos. for each substation 3. Line bays: 2 nos. at each substation i. Single Circuit LILO ing of 220kV Samaguri – Jawaharnagar D/C at Nagaon-2. ii. 220kV Azara-Boko S/C LILO at Chaygaon ***d.*** Bus Coupler Bay: 1 no. for each substation. 5 **Establishing of Remote end PLCC links with all its related works and accessories at both ends.** **Space for future expansion (220kV):** 1. ICT bays: 1 nos. at each substation. 2. Line bays: 6 nos. at each substation. **33 kV (Indoor VCB Panel)** **Present scope of works:** 1. ICTs: 2 nos. at each substation. 2. Line bays: 8 nos at each substation.	**299, 300, 368, 462**

		substation. **33 kV (Indoor VCB Panel)** **Present scope of works:** 1. ICTs: 2 nos. at each substation. 2. Line bays: 12 nos at each substation. 3. Bus Sectionalizer bays: 1 no. at each substation. **Space for future expansion (33kV):** 1. ICTs: 2 nos. at each substation. 2. Line bays: 12 nos at each substation. 3. Buscoupler: 1 no.	3. Bus Sectionalizer bays: 1 no. at each substation. 4. Station Service: 2 nos at each Substation 5. Bus PT: 2 nos at each Substation. **Space for future expansion (33kV):** 1. ICTs: 1 nos. at each substation. 2. Line bays: 4 nos at each substation. 3. Bus Sectionalizer: 1 no. at each Substation. 4. Bus PT: 1 no at each substation.	
4	Clause no 2.6.12 of Volume II for **(Package C)**	**132kV (Bus scheme: Main & Transfer Bus)** **Present scope of works:** 1. ICTs: 132/33kV, 2x50MVA 2. ICT bays: 132kV 2 nos. 3. Line bays: 2 nos. i. LILO ing of 132kV Sipajhar-Rowta S/C at Burhigaon. 4. Bus Coupler Bay: 1	**132kV (Bus scheme: Main & Transfer Bus)** **Present scope of works:** 1. ICTs: 132/33kV, 2x50MVA 2. ICT bays: 132kV 2 nos. 3. Line bays: 2 nos. i. LILO ing of 132kV Sipajhar-Rowta S/C at Burhigaon. 4. Bus Coupler Bay: 1 no. 5. **Establishing of Remote end PLCC links with all its related works and accessories at both ends.**	**299, 300, 368, 462**

		no. **Space for future expansion (220kV):** 1. ICT bays: 2 nos. 2. Line bays: 2 nos. **33 kV (Indoor VCB Panel)** **Present scope of works:** 1. ICTs: 2 nos. 2. Line bays: 6 nos. 3. Bus Sectionalizer bays: 1 no. **Space for future expansion (33kV):** 1. ICTs: 2 nos. 2. Line bays: 6 nos. 3. Buscoupler: 1 no.	**Space for future expansion (220kV):** 1. ICT bays: 1 nos. 2. Line bays: 6 nos. **33 kV (Indoor VCB Panel)** **Present scope of works:** 1. ICTs: 2 nos. 2. Line bays: 8 nos. 3. Bus Sectionalizer bays: 1 no. 4. Station Service: 2 Nos. 5. Bus PT: 2 nos. **Space for future expansion (33kV):** 1. ICTs: 1 no. 2. Line bays: 4 nos. 3. Bus Sectioalizer: 1 no. 4. Bus PT: 1 No.	
5	Clause 17.4.0 (ii)	**For 132 kV, 220 kV and 400 kV Class Power/Auto transformer:** Bidder should have successfully carried out Dynamic Short Circuit test on three phase bank of similar or higher MVA rated	**For 132 kV, 220 kV and 400 kV Class Power/Auto transformer:** Bidder should have successfully carried out Dynamic Short Circuit test on three phase bank of similar or higher MVA rated 400, 220 & 132 kV, Power/Auto transformer as on the date of bid opening and shall enclose the relevant Test Report	**444**

		400/220/33 kV or higher voltage class of Auto transformer as on the date of bid opening and shall enclose the relevant Test Report and certificate along with bid. Otherwise their bid shall be considered technically non responsive.	and certificate along with bid. *AEGCL shall accept type test report of higher MVA rating transformer of same voltage levels as that of the BID for evaluation purpose only. But atleast one out of the offered transformers covered under this package should be subjected to short circuit test and test report should be submitted to AEGCL in case of successful bidder.*	
6	Clause 17.9.1.3 of Volume II	The manufacturer shall provide all necessary information and calculations to demonstrate that the transformer meets the requirements for short circuit strength and durability. The latest recommendations of IEC **and** Cigre SC 12 shall be applied for short circuit withstand evaluation.	The manufacturer shall provide all necessary information and calculations to demonstrate that the transformer meets the requirements for short circuit strength and durability. The latest recommendations of IEC **or** Cigre SC 12 shall be applied for short circuit withstand evaluation.	445
7	Clause 14.43 of Volume II	One Bay level unit shall be provided for supervision and control of each 400KV, 220KV and 132kV bay (a bay comprises of one circuit breaker and associated disconnectors, earth switches and instrument	One Bay level unit shall be provided for supervision and control of each 400KV, 220KV , 132kV & 33kV bay (a bay comprises of one circuit breaker and associated disconnectors, earth switches and instrument transformer). The 33kV bus section isolator shall be controlled from the transformer LV side bay and same is the case for	504

		transformer). **For 33kV one BCU shall take care of control for two feeders.** The 33kV bus section isolator shall be controlled from the transformer LV side bay and same is the case for Bus PT Isolator which shall be controlled by Transformer LV side BCU. The Bay level unit shall be equipped with analogue and binary inputs/outputs for handling the control, status monitoring and analogue measurement functions. All bay level interlocks are to be incorporated in the Bay level unit so as to permit control from the Bay level unit/ local bay mimic panel, with all bay interlocks in place, during maintenance and commissioning or in case of contingencies when the Station HMI is out of service.	Bus PT Isolator which shall be controlled by Transformer LV side BCU. The Bay level unit shall be equipped with analogue and binary inputs/outputs for handling the control, status monitoring and analogue measurement functions. All bay level interlocks are to be incorporated in the Bay level unit so as to permit control from the Bay level unit/ local bay mimic panel, with all bay interlocks in place, during maintenance and commissioning or in case of contingencies when the Station HMI is out of service.	

8	Clause 14.5.5 of Volume II	For 33kV feeder, panel shall be of simplex type and it should accommodate **two** 33kV feeders in a single cubicle i.e. **Dual type** and one BCU will control **both** the 33kV feeders.	For 33kV feeder, panel shall be of simplex type and it should accommodate **one** 33kV feeder in a single cubicle and **one** BCU will control **single** 33kV feeder.	504
9	Clause 14.14.2 & 14.18.3 of Volume II of Volume II	ABT Meter: Accuracy Class: **0.2** Class & The meter shall be capable of data transmission to Gateway as well.	ABT Meter: Accuracy Class: **0.2s** Class & The meter shall be capable of data transmission to Gateway in IEC61850 protocol.	490, 577, 806
10	Clause 1.1.2 System parameter of Volume II	Minimum creepage distance @ **25 mm**/KV	Minimum creepage distance @ **31 mm**/KV	404, 647
11	Clause 16.3.1.20 I	**EARTHING OF GIS** The earthing system shall be based on a multi-point design ensuring the protection in case of indirect contact (Touch or step voltages, in case of system fault) and transient phenomena in case of lightning or switching operations. Earthing conductors shall allow fault with short circuit current for **at least 1 sec**. Separate	**EARTHING OF GIS** The earthing system shall be based on a multi-point design ensuring the protection in case of indirect contact (Touch or step voltages, in case of system fault) and transient phenomena in case of lightning or switching operations. Earthing conductors shall allow fault with short circuit current for **at least 3 sec**. Separate ground strips to short circuit flanges and earthing switches are not allowed. Grounding switches shall be connected to ground through the enclosure. Individual ground leads for the ground switches are not allowed.	**437**

		ground strips to short circuit flanges and earthing switches are not allowed. Grounding switches shall be connected to ground through the enclosure. Individual ground leads for the ground switches are not allowed.		
12	Clause 11.1.1 (a) of Volume	Design, manufacture, testing at manufacturer's works and supply of 1000KVA, 500KVA and 250KVA 33/0.415 kV Auxiliary Power transformers with all fittings and accessories as specified.	Design, manufacture, testing at manufacturer's works and supply of 1000KVA, 500KVA and 250KVA 33/0.415 kV Auxiliary Power transformers **(Energy Efficiency level 3)** with all fittings and accessories as specified.	477, 561
13	Clause 16.3.2.3 of Volume II: **MAINTENANCE EARTHING SWITCH (GROUNDING SWITCHES)**	The maintenance earthing switches shall be located as shown in the single line diagram.	The maintenance earthing switches shall be located as shown in the single line diagram. Also, in addition to this, all the bus side disconnector switch of each bay shall have maintenance earthing switches towards the bus. The manufacturer shall have their own design without major variation of the technical specification.	414
14	Clause No 9.19 Table (a)	Short time current rating: **25 kA** for 3 Sec	Short time current rating: **31.5 kA** for 3 Sec	330
15	Volume II Technical specification 5.13	5.13 CABLE AND PIPE TRENCHES	5.13 CABLE AND PIPE TRENCHES The spacing shall be as per attached drawing	827

16	Volume II Technical specification 5.17 (a)	a) INTER LOCKING CONCRETE BLOCK PAVEMENT (ICBP) BLOCK ROAD: The side shoulder of all the roads shall be with kerb stone at two sides. The kerb stones shall be painted yellow and black alternatively. In case of switch yard road **(concrete road)** the shoulder would be compacted earth 600 mm wide on the sides of the road. The inter locking concrete block pavement (ICBP) block road shall have minimum 80 mm thick. Below it 150 mm thick water bound macadam (WBM) in two equal layers of 75 mm each at the bottom and minimum 200mm granular sub-base.	a) INTER LOCKING CONCRETE BLOCK PAVEMENT (ICBP) BLOCK ROAD: The side shoulder of all the roads shall be with kerb stone at two sides. The kerb stones shall be painted yellow and black alternatively. In case of switch yard road the shoulder would be compacted earth 600 mm wide on the sides of the road. The inter locking concrete block pavement (ICBP) block road shall have minimum 80 mm thick. Below it 150 mm thick water bound macadam (WBM) in two equal layers of 75 mm each at the bottom and minimum 200mm granular sub-base.	390, 391, 747
17	Clause No 7.27 **EARTHING SYSTEM**	Electrical measurements of the subsoil at various depths up to 20 meters shall be made at the site of each substation in order to determine the layered effects of the ground from which the effective ground resistivity and hence the expected resistance of the proposed earth grid system may be predicted. Wenner's 4 – Electrode method as per IEEE-	Electrical measurements of the subsoil at various depths up to 20 meters shall be made at the site of each substation in order to determine the layered effects of the ground from which the effective ground resistivity and hence the expected resistance of the proposed earth grid system may be predicted. Wenner's 4 – Electrode method as per IEEE-Std. 81 may be followed for measurement of earth resistivity. The earthing system shall comprise a mesh grid formed by hot dip 9tilize9ed iron flat bar (GI flat) of **75 X 12**	525

		Std. 81 may be followed for measurement of earth resistivity. The earthing system shall comprise a mesh grid formed by hot dip 10tilize10ed iron flat bar (GI flat) of 75 X **10 mm** (for 220/132 KV & 132/33 KV) and 40 mm MS rod (for 400 KV) buried directly in the ground and arranged so as to 10tilize fully the available site area.	**mm**(for 220/132 KV & 132/33 KV) and 40 mm MS rod (for 400 KV) buried directly in the ground and arranged so as to 10tilize fully the available site area.	
18	17.6.1.3 of Chapter 17 Volume II Sr No 4 **Rating 50 MVA 132/33kV**	No Load loss: 25kW Load loss: 95kW I2R Loss: 76kW Stray +Eddy loss: 20kW Aux Loss: 3kW	**No Load loss: 25kW** **Load loss: 125 kW** **I2R Loss: 105 kW** **Stray +Eddy loss: 20kW** **Aux Loss: 3kW**	**686**
19	Clause 2.6.3 of chapter 2 Volume II	Survey, Erection, testing at site (SAT), Includes installation of HT cables between the Transformers and 33kV panels, switchgears, commissioning of GIS with all related civil works and earthing works as per this tender specification and Bill of quantities. Installation of structures / foundations for mounting of transformer with all necessary civil works. The works include	Survey, Erection, testing at site (SAT), Includes installation of HT cables between the Transformers and 33kV panels, switchgears, commissioning of GIS with all related civil works and earthing works as per this tender specification and Bill of quantities. Installation of structures / foundations for mounting of transformer with all necessary approvals / sanctions from local regulatory authorities viz. forest, municipality and all other related civil administration.	**171, 182**

		all charges and expenses associated with securing necessary approvals / sanctions from local regulatory authorities viz. forest, municipality and all other related civil administration. Necessary survey including check and detail survey for Transmission lines. Design of tower foundation, stringing etc. **THE STRUCTURAL MEMBERS OF THE TRANSMISSION TOWERS AND FOUNDATION SHALL BE DESIGNED BY A REPUTED STRUCTURAL DESIGN ORGANISATION OR RESEARCH INSTITUTE OF EARTHQUAKE IN ZONE V. THE DETAILS WILL BE APPROVED BY A THIRD PARTY ENGAGED BY THE BIDDER. THE COSTS OF ENGAGING THESE CONSULTANTS SHALL BE INCLUDED IN THE RELEVANT ITEMS. BIDDER SHALL SUBMIT A PANEL**	Necessary survey including check and detail survey for Transmission lines. Design of tower foundation, stringing etc.	

		OF MINIMUM 3 DESIGN CONSULTANT AND THIRD-PARTY CONSULTANT FOR EACH ACTIVITY. THE CONSULTANTS SHALL HAVE A MINIMUM OF 10 YEARS EXPERIENCE IN THE REQUIREMENTS SPECIFIED IN THIS DOCUMENT. HOWEVER, THE OVERALL CONSIDERATION OF THE ABOVE CLAUSE SHALL DEPEND ON THE COMPLETE DISCRETION OF AEGCL.		
20	Chapter 16, Clause 16.4 of Volume II	GUARANTEED TECHNICAL PARTICULARS: **SF6 TO AIR BUSHINGS** Sl NO 2: Rated Current (Amps): 400kV-2000/3150 as applicable. 220kV- 1600 132kV-600 **GIS GENERAL TECHNICAL PARTICULARS** Sl No 11: Rated Normal Current at Site (A) - 3150A	GUARANTEED TECHNICAL PARTICULARS: **SF6 TO AIR BUSHINGS** Sl NO 2: Rated Current (Amps): 400kV-4000. 220kV- 3150. 132kV-2000. **GIS GENERAL TECHNICAL PARTICULARS** Sl No 11: Rated Normal Current at Site (A) 400kV-4000. 220kV- 3150. 132kV-2000.	**657**

21	Chapter 39 (Additional chapter in Volume II) for Package B & C	Not existing	Additional chapter on **"SPECIFICATION FOR DESIGN AND FEBRICATION OF SUBSTATION STEEL STRUCTURES"** (Attached as Annexure A)	**401, 758**
22	16.3.2.9 of volume II	LOCAL CONTROL CUBICLE (STAND ALONE TYPE):	**LOCAL CONTROL CUBICLE (STAND ALONE/INTEGRATED TYPE):**	**982**
23	9.7.4 of volume II	SL no (iii) Rated current: (9) 2000/2500 Amps for transformers & Bus section. (b) 1600/1250 Amps for outgoing	SL no (iii) Rated current: (9) 2500 Amps for transformers & Bus section. **(b) 1600 Amps for outgoing**	**204, 331**
24	9.4.6 of volume II	Sl no (iii) Total height of the switchgear panels may not exceed 2600 mm.	Sl no (iii) **Total height of the switchgear panels shall not exceed 3300 mm.**	**205**
25	14.31 of volume II	These relays shall be of numeric, single/multi pole, directional /non-directional type with or without high set element as specified. ix) shall be draw out type	These relays shall be of numeric, single/multi pole, directional /non-directional type with high set element as specified. **ix) delete**	**227, 228, 229**
26	**BOQ**	**Original BOQ**	**The BOQ has been modified.**	**239, 315, 326, 369**
		Volume I (Package B &C)		
27	Clause no 13.3.3 of SCC	**For GIS equipment**	**For GIS equipment** the contractor shall have to	**97**

	Volume I	**manufactured and supplied from aboard,** the contractor shall have to extend the Performance BG within one month prior to expiry of the Performance BG furnished for the main contract to cover the extended guarantee period plus two months as part of the contract performance to cover the Contractor's extended defect liability in accordance with the provision in the SCC, pursuant to GCC Subclause 27.10. Extended guarantee for the GIS equipment shall be for five (5) years beyond the defect liability period of the contract . The amount of the BG shall be 20% of the GIS equipment cost and shall be in Non-Judiciary stamp papers of worth minimum Rs. 100/- However, BG period may be split up subject to the condition that BG would be extended from time to time to cover the warranty period. Moreover, before one month (i.e. 30 days) of expiry of the BG, renewal is to be done by the contractor,	extend the Performance BG within one month prior to expiry of the Performance BG furnished for the main contract to cover the extended guarantee period plus two months as part of the contract performance to cover the Contractor's extended defect liability in accordance with the provision in the SCC, pursuant to GCC Subclause 27.10. Extended guarantee for the GIS equipment shall be for five (5) years beyond the defect liability period of the contract . The amount of the BG shall be 20% of the GIS equipment cost and shall be in Non-Judiciary stamp papers of worth minimum Rs. 100/- However, BG period may be split up subject to the condition that BG would be extended from time to time to cover the warranty period. Moreover, before one month (i.e. 30 days) of expiry of the BG, renewal is to be done by the contractor, otherwise revocation would be done by AEGCL within claim period. The performance security shall not be reduced on the date of the Operational Acceptance.	

		otherwise revocation would be done by AEGCL within claim period. The performance security shall not be reduced on the date of the Operational Acceptance.		
28	**Volume 1:** **Section 2:** **Tender Data Sheet (TDS):** **ITT 4.1(b)**	Maximum number of Partners in a Joint Venture/Consortium for a Package is limited to **TWO (02)** only including the lead partner	Maximum number of Partners in a Joint Venture/Consortium for a Package is limited to **THREE (03)** only including the lead partner	117
29	Volume 1: Section 3, **All the tables** under Clause No. 2.2,2.3 and 2.4, Compliance Requirement	**Joint Venture (maximum 2 parties** **allowed including lead bidder)**	**Joint Venture (maximum 3 parties** **allowed including lead partner)**	117
	Section 9: Contract Forms, Appendix 1: Terms and Procedures of Payment, (A) Terms of Payment			
	Schedule No. 1 & 2 - Plant and Mandatory Spare Parts Supplied from Abroad and Within the Employer's Country respectively.			
30	**A. Advance Payment.:**	The advance will be adjusted at the rate of **25% of the advance amount** from each subsequent bill till the complete amount of advance is adjusted.	The advance will be adjusted at the rate of **10% of the taxable invoice value** from each subsequent bill till the complete amount of advance is adjusted.	44
31	**B. Progressive payments for supply items**:	1. Within 60 (sixty) days from the date of submission of the invoice against supply, **not more than 60% (sixty percent)** payment of the total supply invoice value would be made, on receipt and acceptance of materials in full and good	1.Within 60 (sixty) days from the date of submission of the invoice against supply, **not more than 60% (sixty percent)** of the total supply invoice value of that particular item would be made, on receipt and acceptance of materials in full and good conditions (Subject to availability of fund). However, GST amount on invoice	44, 45, 47, 58, 60, 63, 87

		conditions (Subject to availability of fund). However, GST amount on invoice would be paid 100% or as per Govt. Rules. 2. Maximum **20 (twenty) Nos. of progressive summary supply invoice** would be entertained. 3. Remaining **40% (forty percent)** retention amount would be released subject to fulfilment of the following conditions – (a) **50% of balance supply amount** would be paid on completion of **50% of the total erection works** of the project as per Schedule 4 (Tender Forms). (b) Remaining **50% of the supply** amount would be paid on completion of **100% erection, testing, commissioning and stringing activities** of the project as per schedule 4 (Tender Forms), which must be certified by the	would be paid 100% or as per Govt. Rules. **2.Deleted** 3. Remaining **40% (forty percent) retention** amount of that item would be released subject to fulfillment of the following conditions – a) **20%** supply amount would be paid on completion of 50% of the total erection works of that particular item. b) **Next 10%** of the supply amount of that supply item would be payable on completion of **100% of the total erection, testing, commissioning** works of that particular item. c) Within 60 (sixty) days after receipt of invoice out of remaining 10% of the supply amount **5%** would be paid upon issue of the **Completion Certificate,** and balance **5%** upon issue of the **Operational Acceptance Certificate** as per clause 25, 26 & 27 of GCC, which should be certified by the Project Authority	

		Project Authority.		
	Schedule No. 4 – Installation, ESMP and Other Services (Installation, commissioning and stringing services including Civil Works)			
32	**A. Progressive payments for Erection Works:**	1. Within 60 (sixty) days from the date of submission of invoice against foundation, erection & civil works, not more than 80% (eighty percent) of the total verified invoice would be made. However, GST amount on invoice would be paid 100% or as per Govt. Rules. 2. Maximum 10 (ten) Nos. of progressive summary erection invoice/ bill would be entertained during entire erection work. 3. The 1st progressive erection invoice/ bill would be entertained on completion of 10% of total erection cost of the project as per Schedule 4 (Tender Forms). 4. Maximum 8 (eight) Nos. of additional progressive erection invoice/ bill would be entertained. Minimum value of each invoice should be 10% of the total ordered value for foundation, erection and civil work. 5. Remaining 20% of the	1. Within 60 (sixty) days from the date of submission of invoice against foundation, erection & civil works, not more than **90% (Ninety percent) of the total verified invoice would be made.** However, GST amount on invoice would be paid 100% or as per Govt. Rules. 2. Deleted. 3. Deleted. 4. Deleted. 5. Within 60 (sixty) days after receipt of invoice out of remaining 10% of the supply amount **5%** would be paid upon issue of the **Completion Certificate** and balance **5%** upon issue of the **Operational Acceptance Certificate** as per clause 25, 26 & 27 of GCC, which should be certified by the Project Authority.	44, 48, 58, 60, 63, 87, 146

		erection value would be paid on successful completion of 100% erection, testing, commissioning and stringing activities and operational acceptance of the project as per clause 25, 26 & 27 of GCC, which should be certified by the Project Authority.		
	Section 3: Evaluation and Qualification Criteria of Volume I (Package B)			
33	**Volume 1: Section 3 Clause No. 2.3.2, Average Annual Turnover**	Minimum average annual turnover of **17 million US$ (Seventeen million US$) or INR 126 crore (One hundred Twenty Six crore)**	Minimum average annual turnover of **10.7 million US$ (Ten point Seven million US$) or INR 76 core (Rupees Seventy-Six crore)**	123
34	**Volume 1:Section 3 Clause No. 2.3.3, Financial Resources** For Single Entities:	The Tenderer must demonstrate that its financial resources defined in FIN-3, less its financial obligations for its current contract commitments defined in FIN-4, meet or exceed the total requirement for the Subject Contract of **US$ 3m (Three million US$) or INR 22 Crore (Twenty-Two Crore)**	The Tenderer must demonstrate that its financial resources defined in FIN-3, less its financial obligations for its current contract commitments defined in FIN-4, meet or exceed the total requirement for the Subject Contract of **US$ 2.1 m (Two point one million US$) or INR 14 Crore (Rupees Fourteen Crore).**	
35	**Volume 1:Section 3 Clause No. 2.3.3, Financial Resources For Joint Ventures**	Point No. 1 and 2	Deleted	

36		Point No. 3: The Joint Venture must demonstrate that the combined financial resources of all partners defined in FIN-3, less all the partners' total financial obligations for the current contract commitments defined in FIN-4, meet or exceed the total requirement of **US$ 3m (Three million US$) or INR 22 Crore (Twenty-Two Crore)**	Point No. 3: The Joint Venture must demonstrate that the combined financial resources of all partners defined in FIN-3, less all the partners' total financial obligations for the current contract commitments defined in FIN-4, meet or exceed the total requirement of **US$ 2.1 m (Two point one million US$) or INR 14 Crore (Rupees Fourteen Crore) whereas the lead partners shall have to meet minimum 55% and each partners 25% of the criteria.**	
37	**Section 3: Clause 2.4.1 (a)Contracts of Similar Size and Nature**	Participation as an EPC contractor, Joint Venture partner, **Part A for Gas insulated Substation (GIS):** must have successfully executed and commissioned **at least 2(two) no. of GIS of 220kV Voltage level as that of the current Bid or must have successfully executed and commissioned at least 1 (one) no. of GIS of higher voltage level than that of the current Bid** on Turnkey Contract basis including Engineering, Design, Supply, Execution and Commissioning	Participation as an EPC contractor, Joint Venture partner, **Part A for Gas insulated Substation (GIS):** must have successfully executed and commissioned **at least 1(One) no. of GIS of 220kV or higher Voltage level** on Turnkey Contract basis including Engineering, Design, Supply, Execution and Commissioning with minimum Five (5) No. of bays in each Substation for any Power Transmission utilities during **last 10 (Ten) years** reckoned from the original date of bid submission. The above work should have been under successful operation# for a minimum period of Two (2) years reckoned from the date of bid submission. The Commissioning of substations shall mean complete design, supply of equipment's, all civil	118, 167

		with minimum Five (5) No. of bays in each Substation for any Power Transmission utilities during **last 7 (Seven) years** reckoned from the original date of bid submission. The above work should have been under successful operation# for a minimum period of Two (2) years reckoned from the date of bid submission. The Commissioning of substations shall mean complete design, supply of equipment's, all civil works, erection of all bays and super structures and charging of the substation.	works, erection of all bays and super structures and charging of the substation.	
38		**Part B:** **FOR A BID OF 220KV TRANSMISSION LINE:** **The Bidder** must have in-house design , manufacturing & testing facilities for Transmission Line Tower and successfully commissioned at least 30 ckt km of length of 220kV (or above level) for a	**Part B:** **FOR A BID OF 220KV TRANSMISSION LINE:** **The Bidder or the manufacturer** must have in-house design , manufacturing & testing facilities for Transmission Line Tower and successfully commissioned **at least 15 ckt km of length of 132kV (or above level)** for a single project, including design of tower & foundations, type testing of towers, supply of materials erection,	119, 127, 140, 67

		single project, or must have commissioned at least 30 ckt km of length of 132kV (or above level) for a single project including design of tower & foundations, type testing of towers, supply of materials erection, testing & commissioning on Turnkey Contract basis for any Power Transmission utilities during last 7 (Seven) years reckoned from the **date of bid submission.** The above work should have been under successful operation# for a minimum period of two years reckoned from the date of bid submission. # *Satisfactory operation means certificate issued by the Employer certifying the operation without adverse remark. In case bidder is a holding company, the technical experience referred above shall be of that holding company only (ie., excluding its subsidiary/group companies). In case bidder is a subsidiary of a holding company, the technical experience referred above shall*	testing & commissioning on Turnkey Contract basis for any Power Transmission utilities during last **7 (Seven) years** reckoned from the **date of bid submission.** The above work should have been under successful operation# for a minimum period of two years reckoned from the date of bid submission. # *Satisfactory operation means certificate issued by the Employer certifying the operation without adverse remark. In case bidder is a holding company, the technical experience referred above shall be of that holding company only (ie., excluding its subsidiary/group companies). In case bidder is a subsidiary of a holding company, the technical experience referred above shall be of that subsidiary company only (i.e., excluding its holding company).* The proof for the above experience shall be submitted along with the bid. The bidder as Single entity must meet all requirement of Part A and B. **In case of JV, all the partner combined must meet all requirement of Part A and B. Requirement for each partner is not applicable.**	

		be of that subsidiary company only (i.e., excluding its holding company). The proof for the above experience shall be submitted along with the bid.		
	Section 3: Clause 2.4.1 (a)Contracts of Similar Size and Nature: Compliance Requirement			
39	Each **P**artner	Must meet the criteria of either Part A or Part B. In the event of the lead partner Meeting both the criteria in Part A & Part B, then the other JV partner need not have to necessarily meet any of the criteria in Part A or Part B.	**Not Applicable**	
40	Lead Partner	Must meet the criteria for either Part A or Part B or both.	**Not Applicable**	
41	Section 3: Evaluation and Qualification Criteria Clause 2.4.2 Table A	a. Erection, pre-commissioning tests and commissioning of GIS equipment (220 kV and above voltage class) including Auto/Power Transformers and Control and Relay panel, SAS and should have 2 years performance	a. Erection, pre-commissioning tests and commissioning of GIS equipment (220 kV and above voltage class) including Auto/Power Transformers and Control and Relay panel, SAS and should have 2 years performance within last **ten (10)** years period. In addition to the above point (a), if a bidder has	126, 128, 150

		within last **seven (7) years** period.	supplied, erected, tested and commissioned the Auto / Power Transformer for AIS / GIS Substation or if a bidder has the experience of installation, Testing and Commissioning of Generator transformers of same or higher MVA and voltage rating as that of the bid, the same shall be also considered at par with Auto / Power Transformer.	
42	**Section 3: Evaluation and Qualification Criteria** 2.5 (a) Manufacturers/Subcontractor: GIS	I. The Bidder should have designed, supplied, erected, tested and commissioned on supply cum erection basis at least three (3) GIS installations of 220kV or above voltage level in India during last 7 years having minimum 3 (three) nos. complete GIS Breaker Bays and which should be under satisfactory operation for at least two (2) year as on the originally schedule date of bid opening (Certificate of original customer to be submitted). II. The GIS manufacturer must have well established testing (including High Voltage Testing) & Service faculty in India or an authorized agent in India to perform these activities, so that competent service	I. The **GIS Manufacturer** should have designed, supplied, erected, tested and commissioned on supply cum erection basis at least three (3) GIS installations of 220kV or above voltage level in India during last 7 years having minimum 3 (three) nos. complete GIS Breaker Bays and which should be under satisfactory operation for at least two (2) year as on the originally schedule date of bid opening (Certificate of original customer to be submitted). II. **No Change.** III. The Manufacturer shall have to furnish type test report of SF6 gas insulated sub-station equipment duly Designed, Manufactured, tested (as per IEC standard) which, shall not be older than Ten (10) years, as on date of bid opening. The language of the type test report should be in English. Type Test should have been conducted at any of the following internationally accredited testing laboratories, (a) KEMA (Holland)	115, 120, 122, 146

		engineer(s) can be deputed within 100 hours from the time of incidence reporting. The agreement between GIS manufacturer & the authorized agent shall be submitted along the Technical BID. III. The Manufacturer shall have to furnish type test report of SF6 gas insulated sub-station equipment duly Designed, Manufactured, tested (as per IEC standard) which, shall not be older than Ten (10) years, as on date of bid opening. The language of the type test report should be in English. Type Test should have been conducted at any of the following internationally reputed testing laboratories, (a) KEMA (Holland) (b) CESI (Italy) (c)) CERDA (France) (d) PHELA (Germany) (e) KERI (S. Korea) (f)) CPRI/ERDA (India) IV. The bidder/manufacturer shall not be currently debarred/blacklisted nationally or internationally from any of the state, central and Govt. or	(b) CESI (Italy) (c)) CERDA (France) (d) PHELA (Germany) (e) KERI (S. Korea) (f)) CPRI/ERDA (India) **(g) Intertek (ASTA), UK** **(h) ESEF ASEFA, France** **(i) JSTC, Japan** **(j) SATS Norway** **(k) STLNA, USA** **(l) VEIKI, Hungary** **(m) FGH (Germany)** **(n) VOLTA (France).** **The testing Laboratory shall be accepted only if international accreditation certificate is furnished.** **In case the type test reports are older than 10 years and there is no change in design of the GIS equipment, the manufacturer shall provide an undertaking declaring that there has not been any change of design of the GIS equipment intended to be supply** **In case any subcomponent of GIS equipment is tested by the sub suppliers, the manufacturer shall submit such test report along with the certificate of the laboratory from the appropriate accreditation authority.** (IV) The bidder/manufacturer shall not be currently debarred/blacklisted nationally or	

		undertaking department. V . The Bidder/GIS manufacturer shall furnish performance guarantee for an amount of 20% of the ex-works cost of GIS equipment(s) for a period of five (5) years after completion of the defect liability period. This performance guarantee shall be in addition to Contract Performance Guarantee to be submitted by the bidder to cover the Contractor's extended defect liability in accordance with the provision in the SCC, pursuant to GCC Subclause 27.10.	internationally from any of the state, central and Govt. or undertaking department **as on date of bid submission.** (V). The Bidder shall furnish performance guarantee for an amount of 20% of the ex-works cost of GIS equipment(s) for a period of five (5) years after completion of the defect liability period. This performance guarantee shall be in addition to Contract Performance Guarantee to be submitted by the bidder to cover the Contractor's extended defect liability in accordance with the provision in the SCC, pursuant to GCC Subclause 27.10. ***If the bidder is not the manufacturer, the agreement between the bidder and the GIS manufacturer containing the terms and conditions pertaining to this performance guarantee for 20% of the ex-works cost of GIS equipment(s) for a period of five (5) years after completion of the defect liability period shall be submitted to AEGCL 3 months prior to the expiry of the defect liability period.*** ***(VI) A GIS manufacturer who on its own does not meet the requirement as specified in clause No.(I & III) above, but has established production line in India for manufacturing of SF6 Gas Insulated switchgear (GIS) based on technological support of its parent company (Holding Company) can also be considered provided that they (Parent company) have manufactured, type tested (as per IEC standard)***	

			of such equipment & with the following stipulation :- ***a) manufacturer's parent company (Holding Company) has manufactured, type tested (as per IEC standard).*** ***(b) The parent company (Holding Company) meets qualifying requirements stipulated under clause no. (I & III) above.*** ***(c) The manufacturer furnishes followings:-*** ***i. An undertaking (jointly with the parent company (Holding company) to guarantee quality, timely supply, performance and warranty obligations for a period of Five (05) years as specified for the equipment(s) in the parent company's (Holding Company) letter head, which is required to be submitted at the time of signing/execution of the contract agreement .*** ***ii. Such manufacturer should submit valid collaboration agreement for technology transfer / license to design, manufacture, test and supply GIS equipment(s) in India at the time of bidding.*** ***iii. Shall meet clause V above.***	
	Section 3: Evaluation and Qualification Criteria of Volume I (Package C)			

43	**Volume 1: Section 3 Clause No. 2.3.2, Average Annual Turnover**	Minimum average annual turnover of **8 million US$ (Eight million US$) or INR 61 core (Sixty One crore)**	Minimum average annual turnover of **5 million US$ (Five million US$) or INR 35 core (rupees Thirty-five crore)**	123
44	**Volume 1:Section 3 Clause No. 2.3.3, Financial Resources** For Single Entities:	The Tenderer must demonstrate that its financial resources defined in FIN-3, less its financial obligations for its current contract commitments defined in FIN-4, meet or exceed the total requirement for the Subject Contract of **US$ 1.65m (One point Six five million US$) or INR 12 Crore (Twenty Crore)**	The Tenderer must demonstrate that its financial resources defined in FIN-3, less its financial obligations for its current contract commitments defined in FIN-4, meet or exceed the total requirement for the Subject Contract of **US$ 0.98 m (Point Nine Eight million US$) or INR 7 Crore (Rupees Seven Crore).**	
45	**Volume 1:Section 3 Clause No. 2.3.3, Financial Resources** **For Joint Ventures**	Point No. 1 and 2	Deleted	
46	**For Joint Ventures**	Point No. 3: The Joint Venture must demonstrate that the combined financial resources of all partners defined in FIN-3, less all the partners' total financial obligations for the current contract commitments defined in FIN-4, meet or exceed the total requirement of **US$ 1.65m (One point Six five million US$) or**	Point No. 3: The Joint Venture must demonstrate that the combined financial resources of all partners defined in FIN-3, less all the partners' total financial obligations for the current contract commitments defined in FIN-4, meet or exceed the total requirement of **US$ 0.98 m (Point Nine Eight million US$) or INR 7 Crore (Rupees Seven Crore) whereas the lead partners shall have to meet minimum 55% and each partners**	

		INR 12 Crore (Twenty Crore)	**25% of the criteria.**	
47	**Section 3: Clause 2.4.1 (a)Contracts of Similar Size and Nature**	Participation as an EPC contractor, Joint Venture partner, **Part A for Gas insulated Substation (GIS):** must have successfully executed and commissioned at least 2(two) no. of GIS of 132kV Voltage level as that of the current Bid or must have successfully executed and commissioned at least 1 (one) no. of GIS of higher voltage level than that of the current Bid on Turnkey Contract basis including Engineering, Design, Supply, Execution and Commissioning with minimum Five (5) No. of bays in each Substation for any Power Transmission utilities during last 7 (Seven) years reckoned from the original date of bid submission. The above work should have been under successful operation# for a minimum period of Two (2) years reckoned from the date of bid submission.	Participation as an EPC contractor, Joint Venture partner, **Part A for Gas insulated Substation (GIS):** must have successfully executed and commissioned **at least 1(One) no. of GIS of 132kV or higher Voltage level** on Turnkey Contract basis including Engineering, Design, Supply, Execution and Commissioning with minimum Five (5) No. of bays in each Substation for any Power Transmission utilities during **last 10 (Ten) years** reckoned from the original date of bid submission. The above work should have been under successful operation# for a minimum period of Two (2) years reckoned from the date of bid submission. The Commissioning of substations shall mean complete design, supply of equipment's, all civil works, erection of all bays and super structures and charging of the substation.	118, 165

		The Commissioning of substations shall mean complete design, supply of equipment's, all civil works, erection of all bays and super structures and charging of the substation.		
48		**Part B:** **FOR A BID OF 132KV TRANSMISSION LINE:** **The Bidder** must have in-house design , manufacturing & testing facilities for Transmission Line Tower and successfully commissioned at least **30 ckt km of length of 220kV** (or above level) for a single project, or must have commissioned at least **30 ckt** km of length of 132kV (or above level) for a single project including design of tower & foundations, type testing of towers, supply of materials erection, testing & commissioning on Turnkey	**Part B:** **FOR A BID OF 132KV TRANSMISSION LINE:** **The Bidder or the manufacturer** must have in-house design , manufacturing & testing facilities for Transmission Line Tower and successfully commissioned at least **15 ckt km** of length of **132kV (or above level)** for a single project, including design of tower & foundations, type testing of towers, supply of materials erection, testing & commissioning on Turnkey Contract basis for any Power Transmission utilities during last **7 (Seven) years** reckoned from the **date of bid submission.** The above work should have been under successful operation# for a minimum period of two years reckoned from the date of bid submission. *# Satisfactory operation means certificate issued*	119, 127, 140, 165

		Contract basis for any Power Transmission utilities during last 7 (Seven) years reckoned from the **date of bid submission.** The above work should have been under successful operation# for a minimum period of two years reckoned from the date of bid submission. *# Satisfactory operation means certificate issued by the Employer certifying the operation without adverse remark. In case bidder is a holding company, the technical experience referred above shall be of that holding company only (ie., excluding its subsidiary/group companies). In case bidder is a subsidiary of a holding company, the technical experience referred above shall be of that subsidiary company only (i.e., excluding its holding company).* The proof for the above experience shall be submitted	*by the Employer certifying the operation without adverse remark. In case bidder is a holding company, the technical experience referred above shall be of that holding company only (ie., excluding its subsidiary/group companies). In case bidder is a subsidiary of a holding company, the technical experience referred above shall be of that subsidiary company only (i.e., excluding its holding company).* The proof for the above experience shall be submitted along with the bid. The bidder as Single entity must meet all requirement of Part A and B. **In case of JV, all the partner combined must meet all requirement of Part A and B. Requirement for each partner is not applicable.**	

		along with the bid.		
	Section 3: Clause 2.4.1 (a)Contracts of Similar Size and Nature: Compliance Requirement			
49	Each **P**artner	Must meet the criteria of either Part A or Part B. In the event of the lead partner Meeting both the criteria in Part A & Part B, then the other JV partner need not have to necessarily meet any of the criteria in Part A or Part B.	**Not Applicable**	
50	Lead Partner	Must meet the criteria for either Part A or Part B or both.	**Not Applicable**	
51	Section 3: Evaluation and Qualification Criteria Clause 2.4.2 Table A	a. Erection, pre-commissioning tests and commissioning of GIS equipment (220 kV and above voltage class) including Auto/Power Transformers and Control and Relay panel, SAS and should have 2 years performance within last **seven (7) years** period.	a. Erection, pre-commissioning tests and commissioning of GIS equipment (220 kV and above voltage class) including Auto/Power Transformers and Control and Relay panel, SAS and should have 2 years performance within last **ten (10)** years period In addition to the above point (a), if a bidder has supplied, erected, tested and commissioned the Auto / Power Transformer for AIS / GIS Substation or if a bidder has the experience of installation, Testing and Commissioning of Generator transformers of same or higher MVA and voltage rating as that of the bid, the same shall	126, 128, 150

			be also considered at par with Auto / Power Transformer.	
52	**Section 3: Evaluation and Qualification Criteria** 2.5 (a) Manufacturers/Subcontractor: GIS	**I.** The Bidder should have designed, supplied, erected, tested and commissioned on supply cum erection basis at least three (3) GIS installations of 132kV or above voltage level in India during last 7 years having minimum 3 (three) nos. complete GIS Breaker Bays and which should be under satisfactory operation for at least two (2) year as on the originally schedule date of bid opening (Certificate of original customer to be submitted). **II.** The GIS manufacturer must have well established testing (including High Voltage Testing) & Service faculty in India or an authorized agent in India to perform these activities, so that competent service engineer(s) can be deputed	I. The **GIS Manufacturer** should have designed, supplied, erected, tested and commissioned on supply cum erection basis at least three (3) GIS installations of 132kV or above voltage level in India during last 7 years having minimum 3 (three) nos. complete GIS Breaker Bays and which should be under satisfactory operation for at least two (2) year as on the originally schedule date of bid opening (Certificate of original customer to be submitted). II. **No Change.** III. The Manufacturer shall have to furnish type test report of SF6 gas insulated sub-station equipment duly Designed, Manufactured, tested (as per IEC standard) which, shall not be older than Ten (10) years, as on date of bid opening. The language of the type test report should be in English. Type Test should have been conducted at any of the following internationally accredited testing laboratories, (a) KEMA (Holland) (b) CESI (Italy) (c)) CERDA (France) (d) PHELA (Germany) (e) KERI (S. Korea) (f)) CPRI/ERDA (India) **(g) Intertek (ASTA), UK**	115, 120, 122

		within 100 hours from the time of incidence reporting. The agreement between GIS manufacturer & the authorized agent shall be submitted along the Technical BID. **III.** The Manufacturer shall have to furnish type test report of SF6 gas insulated sub-station equipment duly Designed, Manufactured, tested (as per IEC standard) which, shall not be older than Ten (10) years, as on date of bid opening. **The language of the type test report should be in English.** Type Test should have been conducted at any of the following internationally reputed testing laboratories, (a) KEMA (Holland) (b) CESI (Italy) (c) CERDA (France) (d) PHELA (Germany) (e) KERI (S. Korea)	**(h) ESEF ASEFA, France** **(i) JSTC, Japan** **(j) SATS Norway** **(k) STLNA, USA** **(l) VEIKI, Hungary** **(m) FGH (Germany)** **(n) VOLTA (France).** **The testing Laboratory shall be accepted only if international accreditation certificate is furnished.** **In case the type test reports are older than 10 years and there is no change in design of the GIS equipment, the manufacturer shall provide an undertaking declaring that there has not been any change of design of the GIS equipment intended to be supply** **In case any subcomponent of GIS equipment is tested by the sub suppliers, the manufacturer shall submit such test report along with the certificate of the laboratory from the appropriate accreditation authority.** (IV) The bidder/manufacturer shall not be currently debarred/blacklisted nationally or internationally from any of the state, central and Govt. or undertaking department **as on date of bid submission.** (V). The Bidder shall furnish performance guarantee for an amount of 20% of the ex-works	

		(f) CPRI/ERDA (India) **IV.** The bidder/manufacturer shall not be currently debarred/blacklisted nationally or internationally from any of the state, central and Govt. or undertaking department. V . The Bidder/GIS manufacturer shall furnish performance guarantee for an amount of 20% of the ex-works cost of GIS equipment(s) for a period of five (5) years after completion of the defect liability period. This performance guarantee shall be in addition to Contract Performance Guarantee to be submitted by the bidder to cover the Contractor's extended defect liability in accordance with the provision in the SCC, pursuant to GCC Subclause 27.10.	cost of GIS equipment(s) for a period of five (5) years after completion of the defect liability period. This performance guarantee shall be in addition to Contract Performance Guarantee to be submitted by the bidder to cover the Contractor's extended defect liability in accordance with the provision in the SCC, pursuant to GCC Subclause 27.10. ***If the bidder is not the manufacturer, the agreement between the bidder and the GIS manufacturer containing the terms and conditions pertaining to this performance guarantee for 20% of the ex-works cost of GIS equipment(s) for a period of five (5) years after completion of the defect liability period shall be submitted to AEGCL 3 months prior to the expiry of the defect liability period.*** ***(VI) A GIS manufacturer who on its own does not meet the requirement as specified in clause No.(I & III) above, but has established production line in India for manufacturing of SF6 Gas Insulated switchgear (GIS) based on technological support of its parent company (Holding Company) can also be considered provided that they (Parent company) have manufactured, type tested (as per IEC standard) of such equipment & with the following stipulation :-*** ***a) manufacturer's parent company (Holding Company) has manufactured, type tested (as per IEC standard).***	

			(b) The parent company (Holding Company) meets qualifying requirements stipulated under clause no. (I & III) above. ***(c) The manufacturer furnishes followings:-*** ***i. An undertaking (jointly with the parent company (Holding company) to guarantee quality, timely supply, performance and warranty obligations for a period of Five (05) years as specified for the equipment(s) in the parent company's (Holding Company) letter head, which is required to be submitted at the time of signing/execution of the contract agreement .*** ***ii. Such manufacturer should submit valid collaboration agreement for technology transfer / license to design, manufacture, test and supply GIS equipment(s) in India at the time of bidding.*** ***iii. Shall meet clause V above.***	
53	**17.14.0 Bushing of Volume II**	420kV, 245 kV and 145 kV bushings shall be oil filled condenser type & 36 KV bushings shall be of porcelain.	420kV, 245 kV and 145 kV bushings shall be RIP bushing & 36 KV bushings shall be of porcelain or oil communicating type.	448

Note:
1. ***Please refer to the modified/corrected BOQ in the e-tender portal (uploaded along with this minute.)***
2. ***All drawings are indicative and for tender purpose only.***
3. ***Additional drawings are attached.***

SD/-
(Project Director)AIIB
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Annexure A:

Chapter 39 (Additional Chapter in Volume II)

SPECIFICATION FOR DESIGN AND FEBRICATION OF SUBSTATION STEEL STRUCTURES

39.1.0 SCOPE

39.1.1 The scope of this section covers specifications for fabrication, proto-assembly, supply and erection of galvanised steel structures for towers, girders, lightning masts and equipment support structures. Towers, girders and lightning masts shall be lattice type structure fabricated from structural steel conforming to IS 2062 (latest*).* All equipment support structures shall be fabricated from GI pipe conforming to YST 22 or of higher grade as per IS 806.

39.1.2 Support structure for Circuit breaker and Isolators is not standardized and shall be designed by the Contractor and approved by the Employer. Any other structures of 400kV, 220 kV, 132kV and 33kV class-necessary to complete the substation to complete the work in all respects shall be designed by the contractor.

39.1.3 The scope shall include supply and erection of all types of structures including bolts, nuts, washers, hangers, shackles, clamps ant-climbing devices, bird guards, step bolts, inserts in concrete, gusset plates, equipment mounting bolts, structure earthing bolts, foundation bolts, spring washers, fixing plates, ground mounted marshaling boxes (AC/DC Marshaling box & equipment control cabinets), structure mounted marshaling boxes and any other items as required to complete the job.

39.1.4 The connection of all structures to their foundations shall be by base plates and embedded anchor/foundation bolts. All steel structures and anchor/foundation bolts shall be fully galvanized. The weight of the zinc coating shall be at least 0.610 kg/m2 for anchor bolts / foundation bolts and for structural members. One additional nut shall be provided below the base plate which may be used for the purpose of levelling.

39.1.5 In case of equipment support structure, Contractor may require to change the dimensions to match the equipment bus bar height and to match the mounting arrangement of a particular equipment. Further suitable modification shall be carried out in the drawings of equipment support structures by the Contractor in order to suit fixation of accessories such as marshalling boxes, MOM boxes, Control Cabinets, Junction box, surge counter, etc. in the standard structure fabrication drawings. The Contractor will make these changes without any price implication. The final drawings of mounting structures shall be submitted to Employer for approval.

39.2.0 MATERIALS

39.2.1 Structural Steel

The structures shall be of structural steel conforming to any of the grade, as appropriate, of IS 2062 (latest edition) Steel conforming IS 8500 may also be used.

Medium and high strength structural steels with known properties conforming to any other national or international standards may also be used.

39.2.2 Bolts

Bolts used shall conform to IS12427 or bolts of property class 4.6 conforming to IS 6639 may also be used.

High strength bolts, if used (only with steel conforming to IS 8500) shall conform to property class 8.8 of IS 3757.

Foundation Bolts shall conform to IS 5624.

Step bolts shall conform to IS 10238

39.2.3 Nuts

Nuts shall conform to IS 1363 (Part 3). The mechanical properties shall conform to property class 4 or 5 as the case may be as specified in IS 1367 (Part 6) except that the proof stress for nuts of property class 5 shall be as given in IS 12427.

Nuts to be used with high strength bolts shall conform to IS 6623.

39.2.4 Washers

Washers shall conform to IS 2016. Heavy washers shall conform to IS 6610. Spring washers shall conform to type B of IS 3663

Washers to be used with high strength bolts and nuts shall conform to IS 6649.

39.2.5 Galvanisation

Structural members, plain and heavy washers shall be galvanized in accordance with the provisions of IS 4759.

Spring washers shall be hot dip galvanized as per service grade 4 of IS 4759 or IS 1537.

39.2.6 Other Materials

Other materials used in the construction of the supporting structures shall conform to appropriate Indian Standards wherever available.

39.3.0 DESIGN REQUIREMENTS FOR STRUCTURES

39.3.1 This clause and sub-clauses shall be referred only for structures for which design is in the scope of Contractor.

39.3.2 For design of steel structures loads such as dead loads, live loads, wind loads etc. shall be based on IS:875,Parts I to V.

39.3.3 For materials and permissible stresses IS:802, Part-I, Section-2 shall be followed in general. However, additional requirements given in following paragraphs shall be also considered.

39.3.4 Minimum thickness of galvanized tower member shall be as follows:

ITEM	Minimum thickness in mm
Leg members, Ground wire Peak members/	5

other load carrying members	
Other Members and Redundant members	4

39.3.5 Maximum slenderness ratios for leg members, other stressed members and redundant members for compression force shall be as per IS-802.

39.3.6 Minimum distance from hole center to edge shall be 1.5 x bolt diameter. Minimum distance between center to center of holes shall be 2.5 x bolt diameter.

39.3.7 All bolts shall be M16 or higher as per design requirement.

39.3.8 **Step Bolts:** In order to facilitate inspection and maintenance, the structures shall be provided with climbing devices. Each tower shall be provided with M16 step bolts 175mm long spaced not more than 450mm apart, staggered on faces on one leg extending from about 0.5 meters above plinth level to the top of the tower. The step bolt shall conform to IS: 10238.

39.4.0 Design Parameters

All structures shall be designed for the worst combination of dead loads, live loads, wind loads as per code IS:875, seismic forces as per code IS:1893, loads due to deviation of conductor, load due to unbalanced tension in conductor, torsional load due to unbalanced vertical and horizontal forces, erection loads, short circuit forces including "snatch" in the case of bundled conductors etc. Short circuit forces shall be calculated considering a fault level of 40 kA, 50kA, 63kA or as applicable. IEC-60865 may be followed for evaluation of short circuit forces.

All Pipe support structures used for supporting equipments shall be designed for the worst combination of dead loads, erection load. Wind load/seismic forces, short circuit forces and operating forces acting on the equipment and associated bus bars as per IS:806. The material specification shall be as per IS: 1161 read in conjunction with IS: 806.

39.4.1.1 Switchyard structures such as columns, beams and equipment mounting structures shall be designed as per IS 802 but for loading combinations specified hereunder. Computation of wind loading on structural members, conductors, insulators, etc and other parameters shall be as specified in IS 802 except otherwise specified in this Specification.

39.4.1.2 The switchyard structures shall be designed for following loads considered acting simultaneously:

(i) Wire tension
(ii) Wind Load
(iii) Short Circuit Forces

(iv) Weight of supported wires, insulators, equipment etc and self-weight of structures.

An additional load of 3000 N shall be considered acting for weight of lineman and tools. For beams this 3000 N load shall be considered acting at middle of the beam.

39.4.1.3 The design shall be checked for following two loading conditions:

39.4.1.4 The design shall be checked for following two loading conditions:

(A) Normal Conditions (all wires intact)

Under this condition, the loads shall be taken as under:

(i) Wire Tension:- Maximum Wire tension as specified in Clause 39.4.3

(ii) Wind Load:- Loads due to 100% Design Wind Pressure (after accounting for drag coefficient and gust factor) on structures, wires, insulators, equipment etc. Design wind pressure shall be as per Clause 39.4.2

(iii) Short Circuit Forces: Loading due to a 3 phase short circuit current of 63kA, 50kA, 40 kA and 31.5 kA shall be considered for 400kV, 220 KV,132 kV and 33 kV respectively subject to minimum of 10% of maximum wire tension as considered in (i) above.

(iv) Dead Weight:- All dead loads mentioned in Clause 39.4.1.2 (iv) shall be considered. Conductor and shield wire weight shall be calculated using spans as per Clause 39.4.4.

(B) Broken Wire Condition

Under this condition design shall be checked with all wires broken on one side and load shall be as under:

(i) Wire Tension:- Wire tension for intact wires shall be taken as 100% of Clause 39.4.1.4 (A) (i). For broken wires it shall be taken as zero.

(ii) Wind Load:-Same wind load as calculated in Clause 39.4.1.4 (A) (ii) shall be considered.

(iii) Short Circuit Forces:- Short circuit forces shall be considered only for intact wires.

(iv) Dead Weight: - Same dead load as calculated in Clause 39.4.1.4 (A) (iv) shall be considered.

39.4.2 **Design Wind Pressure**

The Design Wind pressure for the purpose of this Specification shall be taken as 793 N/m^2. This wind pressure corresponds to Terrain Category 2 and Reliability Level 1 as per IS 802 (Part 1/Section 1).

39.4.3 **Wire Tensions**

For design purpose tension in each power and shield wires shall be taken as under

a. For Power Conductors

(i) 400/220 kV Switchyard →10000 N for each conductor between Line gantry and Dead End Tower of Transmission Line.
→8000 N for each Bus Bar conductor and other jumpers/jack buses.

(ii) 132 kV and 33 kV switchyard. →8000 N for each conductors between Line gantries and Dead End Tower of Transmission Line.
→6000 N for each Bus Bar conductor and other jumpers/jack buses.

b. For Shield Wires

(i) 400kV, 220 KV,132 kV and 33 kV Switchyard. →6000 N for shield wire between Line gantry and Dead End Tower of Transmission Line.
→5000 N for shield wires at other Location.

Note: Structures with earth peak shall assume to have two earth wires for design purpose in broken wire condition.

39.4.4 **Spans**

Following Spans shall be considered in design of all structures as applicable:-

a). Line gantries (structures to terminate lines):

(i) For 400, 220, 132, Switchyard: →200 Meter, wind span
→150 Meter, weight span

(ii) For 33 KV Switchyard: →75 Meter, wind & weight span.

b). All other Structures

(i) For 400 KV Switchyard: →75 Meter, wind & weight span
(ii) For 220 KV Switchyard: →75 Meter, wind & weight span
(iii) For 132 KV Switchyard: →50 Meter, wind & weight span
(iv) For 33 KV Switchyard: →20 Meter, wind & weight span.

39.4.5 **Deviation Angle**

The design of line gantries shall only be checked for a maximum deviation angle of 30^0 from normal at center of gantries to Dead End Tower.

39.4.6 **Conductors and Shield Wires**

A) Following sizes of power conductors ***if not otherwise specified in the drawings,*** shall be used for design of structures:

a). For 400 kV switchyard:- As indicated in layout drawings.

b). For 220 kV switchyard:-

(i) ACSR 'MOOSE' conductor (two conductors per phase) for Drop Downs, Jumpers and Connection Between Equipments.

c). For 132 kV switchyard:-

(i) ACSR 'MOOSE' conductor (two conductors per phase) for Drop Downs, Jumpers and Connection Between Equipments.

d). For 33 kV switchyard:-

(i) ACSR 'PANTHER' conductor (One conductors per phase) for Connections between equipments and outgoing feeder till the 33kV Outgoing feeder Gantry.

B) For protection against direct lightning G.I. wires of size 7/3.66 mm conforming to IS 2241 shall be considered for all switch yards.

Terminal/line take off gantries shall be designed for a minimum conductor tension of 4 metric tonnes per phase for 400kV, 2 metric tonnes per phase for 220kV and 1 metric tonne per phase for 132 kV or as per requirements whichever is higher . The distance between terminal gantry and dead end tower shall be taken as 200 metres for 400/220kV and 100m for 132KV. The design of these terminal gantries shall also be checked considering +/- 30 deg deviation of conductor in both vertical and horizontal planes. For other gantries the structural layout requirements shall be adopted in design.

The beams shall be connected with towers/ columns by bolted joints.

Wherever luminaries are proposed to be fixed on gantries, the proper loading for the same shall be considered while designing. Also holes for fixing the brackets for luminaries should be provided wherever required.

Foundation bolts shall be designed for the loads for which the structures are designed.

Height of Lightning masts shall be as per approved structure layout and designed for diagonal wind condition. Lightning masts shall be provided with platforms for mounting lighting fixtures and a structural steel ladder within its base up to the level of platform. The ladder shall be provided with protection rings. The platforms shall also have protection railing. The details of lighting fixtures would be as per the approved drawings.

39.5.0 DESIGN DRAWINGS AND DOCUMENTS

As and where asked for the relevant drawings for all the towers, beams and equipment mounting structures shall be furnished by the Contractor to the Employer which shall include structural/erection drawings, shop fabrication drawings, Bill of Materials, foundation-working drawings.

The structural/erection drawings, Bill of materials and shop fabrication drawings for all the structures shall be submitted in four copies and will be finally approved by the Employer. The fabrication shall be taken up from the approved shop drawings. The overall responsibility of fabricating structure members correctly lies with the Contractor only and the Contractor shall ensure that all the members can be fitted while erecting without any undue strain on them.

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39.5.1.1 The Contractor shall furnish design, drawing and Bill of Materials and shop manufacturing drawings for every member to the Employer for approval after award of the Contract. The design drawing should indicate not only profile, but section, numbers and sizes of bolts and details of typical joints. In case Employer feels that any design drawing, BOM are to be modified even after its approval, Contractor shall modify the designs & drawings and resubmit the design drawing, BOM as required in the specification.

39.5.1.2 The fabrication drawings to be prepared and furnished by the Contractor shall be based on the design approved by the Employer. These fabrication drawings shall indicate complete details of fabrication and erection including all erection splicing details and typical fabrication splicing details, lacing details, weld sizes and lengths. Bolt details and all customary details in accordance with standard structural engineering practice whether or not given by the Employer. The fabrication drawings shall be submitted to the Employer. Proto shall be made only after approval of fabrication drawings.

39.5.1.3 Such approval shall, however, not relieve the Contractor of his responsibility for the safety of the structure and good connections and any loss or damage occurring due to defective fabrication, design or workmanship shall be borne by the Contractor.

39.5.1.4 The Mass fabrication work shall start only after the final approval to the proto corrected Fabrication drawing is accorded by the Employer.

39.6.0 ACCESSORIES

39.6.1 **Step Bolts**

Each column/tower shall be provided with step bolts conforming to IS: 10238 of not less than 16mm diameter and 175mm long spaced not more than 450mm apart and extending from 0.5 meters above the plinth level to the top. Each step bolt shall be provided with two nuts on one end to fasten the bolt securely to the tower and button head at the other end to prevent the feet from slipping away. The step bolts shall be capable of withstanding a vertical load not less than 1.5 KN.

39.6.2 **Insulator Strings and Conductor Clamps Attachments**

(i) Double suspension and tension insulator string assemblies (for 400kV, 220kV and 132kV) and Single suspension and tension insulator string assemblies (for 33kV) shall be used for jumpering and connection between the equipments.For the attachment of Suspension Insulator string, a suitable strain plate of sufficient thickness for transferring the load to the tower body shall be provided. To achieve requisite clearances, if the design calls for providing extra D-shackles, link plate etc. before connecting the insulator string the insulator string the same shall be supplied by the Contractor.

(ii) At tension points strain plates of suitable dimensions placed on the beams, shall be provided for taking the hooks or D-shackles of the tension insulator strings. To achieve requisite clearances, if the design calls for providing extra D-shackles, link plate etc. before connecting the insulator string the same shall be supplied by the Contractor.

39.6.3 **Earthwire Clamps Attachment**

i. **Suspension Clamp**
The detailed drawing shall be submitted by the Contractor for Employer's approval. The Contractor shall also supply U- bolts, D-shackles wherever required.

ii. **Tension Clamps**
Earth-wire peaks of tension towers shall be provided with suitable plates to accommodate the shackle of tension clamps. The contractor shall also supply the U-bolts wherever required and take Employer's approval for details of the attachments before the mass fabrication.

39.7.0 FABRICATION

39.7.1 The fabrication of substation steel structures shall be in conformity with the following:

(i). Except where hereinafter modified, details of fabrication shall conform to IS: 802 (Part-II) or the relevant international standards.
(ii). The tower structures shall be accurately fabricated to connect together easily at site without any undue strain on the bolts.
(iii). No angle member shall have the two leg flanges brought together by closing the angle.

(iv). The diameter of the hole shall be equal to the diameter of bolt plus 1.5mm.
(v). The structure shall be designed so that all parts shall be accessible for inspection and cleaning. Drain holes shall be provided at all points where pockets of depression are likely to hold water.
(vi). All identical parts shall be made strictly inter-changeable. All steel sections before any work are done on them shall be carefully levelled, straightened and made true to detailed drawings by methods which will not injure the materials so that when assembled, the adjacent matching surfaces are in close contact throughout. No rough edges shall be permitted in the entire structure.

39.7.2 Drilling and Punching

(i). Before any cutting work is started, all steel sections shall be carefully strengthened and trued by pressure and not by hammering. They shall again be trued after being punched and drilled.
(ii). Holes for bolts shall be' drilled or punched with a jig but drilled holes shall he preferred. The punching may be adopted for thickness up to 16mm. Tolerances regarding punch holes are as follows:
(iii). Holes must be perfectly circular and no tolerances in this respect are permissible.
(iv). The maximum allowable difference in diameter of the holes on the two sides of plates or angle is 0.8mm. i.e. the allowable taper in a punched holes should not exceed 0.8 mm on diameter.
(v). Holes must be square with the plates or angles and have their walls parallel.
(vi). All burrs left by drills or punch shall be removed completely. When the tower members are in position the holes shall be truly opposite to each other. Drilling or reaming to enlarge holes shall not be permitted.

39.7.3 Erection mark

Each individual member shall have erection mark conforming to the component number given to it in the fabrication drawings. The mark shall be marked with marking dies of 16mm size before galvanizing and shall be legible after galvanizing,

39.8.0 FOUNDATION BOLTS

39.8.1 Foundation bolts for the towers and equipment supporting structures and elsewhere shall be embedded in first stage concrete while the foundation is cast. The Contractor shall ensure the proper alignment of these bolts to match the holes in the base plate.

39.8.2 The Contractor shall be responsible for the correct alignment and levelling of all steel work on site to ensure that the towers/structures are plumb.

39.8.3 All foundation bolts for lattice structure, pipe structure are to be supplied by the Contractor.

39.8.4 All foundation bolts shall be fully galvanised so as to achieve 0.61 kg. per Sq.m. of Zinc Coating as per specifications.

39.8.5 All foundation bolts shall conform to IS 5624 but the material, however shall be MS conforming to IS: 2062.

39.9.0 GALVANIZING AND PAINTING

39.9.1 Galvanising of the various members of the structures shall be done only after all works of sawing, shearing, drilling, filing, bending and matching are completed. Galvanising shall be done by the hot dip process as recommended in IS: 2629 or other such authoritative international standards and shall produce a smooth, clean and uniform coating of not less than 610 gm per square meter. The preparation for galvanising and the galvanising process itself must not affect adversely the mechanical properties of the treated materials.

39.9.2 All assembly bolts shall be thoroughly hot dip galvanized after threading. Threads shall be of a depth sufficient to allow for the galvanized coating, which must not be excessive at the root of the threads, so that the nut shall turn easily on the completed bolts without excessive looseness. The nut threads shall not be galvanized, but oiled only.

39.9.3 The outside surface shall be galvanised. Sample of galvanised materials shall be supplied to the galvanising test set out in IS 729 or other such authoritative international standards.

39.10.0 EARTHING

39.10.1 To keep provision in the structures for earthing, holes shall be drilled on two diagonally opposite legs of the towers/columns/mounting structures. The holes shall be suitable for bolting GI strips of size mentioned elsewhere in this specification (Vol II) and shall be such that the lower hole is about 350 mm above the ground level, clear of the concrete muffing, for connecting the earthing strip.

39.11.0 TEST AND TEST CERTIFICATE

39.11.1 Each consignment ready for transportation shall be offered to AEGCL for inspection before dispatch giving a minimum time of not less than 30 days. Samples of fabricated structure materials shall be subjected to following tests: -

a. Steel: The structural steel shall conform to IS 226 and IS 8500, BS 4360-1068 or ISO / R 630 other such authoritative international standards. Manufacturer's test certificate shall be submitted for all used steel.
b. Galvanising: The galvanising shall be as per IS 2633 or BS 729 other such authoritative international standards. Zinc coating over the galvanised surfaces shall not be less than 610 gm per square meter.
c. Bolts and nuts: Manufacturer's test certificate as per standard practice shall be submitted.

39.11.2 ***Test at Contractor's Premises***

39.11.2.1 The contractor shall fabricate one specimen structure of each type as soon as possible after placement of order and before starting the bulk fabrication of the structures ordered. It shall be assembled on a foundation as nearly similar as practicable to site and tested with suitable test loads as per specified broken wire condition, multiplied by the corresponding factor of safety to ensure that the design and fabrication complies with the requirements. Each structure shall be capable of withstanding the above-mentioned tests without any injury or any permanent deflection at any part. If any member is found to be weak or damaged the design should be suitably modified and the tower re-tested.

39.11.2.2 After the first lot of the structures manufactured, the members forming one structure of each type shall be selected at random from the lots of similar member and assembled in exactly the same manner as to be done at site. The structure then shall be set on foundation as nearly similar as practicable to site and tested with equivalent test load for which the structure has been designed.

39.11.2.3 No structure or any member thereof, which failed under the test shall be supplied.

39.12.0 MODE OF MEASUREMENT

39.12.1.1 The measurement of all lattice and pipe structures for towers, beams, equipment support structure etc. shall be made in numbers for each type of structures. This will include foundation bolts and nuts and therefore no separate payment shall be made for the same. The unit rate quoted for each type of structure shall be inclusive of supply, fabrication, galvanizing, erection, nuts, bolts, wastages etc. complete. Nothing extra shall be payable for substitution necessitated due to non-availability of section. Nothing extra shall be payable for modifications or steel added to suit the contractors fixing arrangements for accessories etc.