

**AMENDMENT - II TO THE BIDDING DOCUMENT FOR ±800 KV, 6000 MW HVDC
MULTI-TERMINAL SYSTEM PACKAGE.**

S.No	TS Clause	Existing Clause	Amended Clause
1.	1.2 c) Page 3	Complete civil works like converter buildings, service building, indoor DC yard at Agra, transformer, tower and equipment foundations, auxiliary buildings, rail track, roads, structures etc.	REPLACE: Complete civil works like converter buildings, service building, indoor DC yard with humidity control at Agra, transformer, tower and equipment foundations, auxiliary buildings, rail track, roads, structures etc.
2.	1.2. A Page 3	.....At the two rectifier stations (Biswanath Chariali and Siliguri (New)), the main equipments shall be of identical design and ratings.	REPLACE: .....At the two rectifier stations (Biswanath Chariali and Kishanganj), the main equipments (Converter Transformer, thyristors valves, DC switchyard Equipments) shall be of identical design and ratings. However, DC Arrester rating shall be as per insulation co-ordination. Commutation circuit for DC switches shall be as per the requirement of the station.
3.	1.2. A.HVDC Part		ADD After second bullet: Alipurduar
4.	1.2. B Page 4	1. Biswanath Chariali Terminal (Refer SLD Fig. 5.1.1)	DELETE:

S.No	TS Clause	Existing Clause	Amended Clause
		<ul style="list-style-type: none"> 2 nos. 400kV line bays at Balipara(40kms from Biswanath Chariali) Changing Employer's two nos existing fixed shunt reactors to switchable shunt reactors in existing bays at Balipara 	<ul style="list-style-type: none"> 2 nos. 400kV line bays at Balipara(40kms from Biswanath Chariali) Changing Employer's two nos existing fixed shunt reactors to switchable shunt reactors in existing bays at Balipara
5.	1.2. B Page 4	<ul style="list-style-type: none"> 2nos 132 kV bays for LILO of Gophur-Depota 132kV single circuit lines 	REPLACE: <ul style="list-style-type: none"> 2nos 132 kV bays
6.	1.2. B Page 4	<p>1. Biswanath Chariali Terminal (Refer SLD Fig. 5.1.1)</p> <ul style="list-style-type: none"> 	<p>ADD:</p> <p>1. Biswanath Chariali Terminal (Refer SLD Fig. 5.1.1)</p> <ul style="list-style-type: none"> Two nos. 400kV, 80MVAR switch able shunt reactors with 400kV bays 2(Two) nos. 400kV Bus sectionalizing Bays Shifting of Existing PLCC equipments of Balipara - Ranganadi line from Balipara S/S to Biswnath Chariali S/S and commissioning of same at Biswanath Chariali S/S for Biswanath Chariali and Ranganadi line. <p>Supplying, erecting and commissioning of new PLCC equipments at Biswanath Chariali & Balipara stations for Biswanath Chariali and Balipara line.</p>

S.No	TS Clause	Existing Clause	Amended Clause
			<p>2. Agra Terminal(Refer SLD Fig 5.1.5)</p> <p>.....</p> <ul style="list-style-type: none"> • 4(Four) nos. 400kV Bus sectionalizing Bays • Re-location of Existing Sikar-I&II bays along with associated equipments to new location shown in SLD.
7.	1.2 B.1 Bullet 8&9 Page 4	<ul style="list-style-type: none"> • PLCC equipment for all 400kV and 132kV lines including the remote end • Complete substation automation equipment for all above bays 	<p>REPLACE:</p> <ul style="list-style-type: none"> • PLCC equipment for all 400kV and 132kV lines including the remote end. However, supply of wave trap for four lines Lower Subhansari I,II,III&IV at remote end(Lower Subhansari end) shall not be considered. • Complete substation automation equipment for all above bays and future bays as specified
8.	1.2 B.2 Bullet 6 Page 5	<ul style="list-style-type: none"> • Complete substation automation equipment for all above bays 	<p>REPLACE:</p> <ul style="list-style-type: none"> • Complete substation automation equipment for all above bays and future bays as specified
9.	1.2. B Page 5	<p><u>3. Siliguri (New) Terminal(refer SLD Fig 5.1.3)</u></p> <ul style="list-style-type: none"> • Two (2) nos. 315 MVA, 400/220/33kV 	<p>REPLACE:</p> <p><u>3. Alipurduar Terminal(refer SLD Fig 5.1.3)</u></p> <ul style="list-style-type: none"> • Two (2) nos. 315MVA, 400/220/33kV

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		Autotransformers.	<p>Auto Transformer along with associated 400 kV & 220 kV bays.</p> <ul style="list-style-type: none"> • 8 nos 400 kV bays for LILO of two no. of employers 400 kV Siliguri-Purnea(Bongoigaon) Double circuit line. • Two no. of 400 kV line bay for termination of one D/C line from New Melli (Bhutan) • Two no. of 400 kV line bay alongwith switchable line shunt reactor of 63 MVAR for termination of one D/C line from Mangan /Teesta III • Two nos. 420kV, 125 MVAr Bus reactors with 400kV Bays. • 4 no. of 220 kV line bay for LILO of Employer's Siliguri –Dalkhola(Birpara) 220 kV D/C line. • One no Bus coupler & one no. Transfer Bus Coupler bay at 220kV level. • One no of bus sectionalizer on each 400 kV bus • PLCC equipment for all 400kV and 220 kV lines including the remote end. However, supply of wave trap for two lines Bhutan generation-I&II at remote end(Bhutan generation-I&II end) shall not be considered. • Complete sub-station automation

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			equipment for all the above bays and future bays as specified.
10.	1.2.1.a) Page 5	All required AC-DC simulator, digital (computer) or other studies as defined in Section 4.13, 2.4.7 and all other related sections. One set of all actual controls shall be installed on the Employer's RTDS at Gurgaon for future use by the Employer.	REPLACE: All required AC-DC simulator, digital (computer) or other studies as defined in relevant Section of T.S.
11.	1.2.3.1.t Page 8	400 kV, 220kV and 132 kV circuit Breakers, isolators and earth switches.	ADD: All 400kV Switchgears for line bays including tie bays shall be rated for 3150Amps. Bus Sectionalizing Breaker shall be rated for 4000 Amps.
12.	1.2.3.5 (ii) Page 11	Type tests performed within seven (7) years from the date of first stage bid opening.	REPLACE: Type tests performed within five (5) years from the date of first stage bid opening.
13.	1.2.4.1.c Page 12	Site preparation including gravel filling including that of Employer's existing switchyard of Agra	Add: <ul style="list-style-type: none"> The estimated area for gravel filling in existing switchyard at Agra is 30000 sq meter. Leveling and site preparation before laying of PCC 30000 sq meter. Thickness of PCC (of ratio 1:5:10) layer 75 mm. Layer of cement slurry (ratio 1:6) to be

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			<p>laid over PCC before gravel spreading 30000 sq meter.</p> <ul style="list-style-type: none"> Thickness of gravel (Gravel of 40 mm nominal size) layer 100 mm.
14.	1.2.4.1.d) Page 12	Internal fencing of the stations and fence along the perimeter of fibre optic repeater stations and earth electrode stations. The boundary wall of the terminal stations shall be constructed by the Employer.	<p>REPLACE:</p> <p>Internal fencing of the stations, fence along the perimeter of fibre optic repeater stations and boundary wall along with gate and security guard hut surrounding the earth electrode stations shall be in the scope of bidder. However, the boundary wall of the terminal stations shall be constructed by the Employer.</p>
15.	1.2.4.2.c Page 14	Other buildings or enclosures found necessary as a result of detail design of the HVDC System, guard hut, security towers at Stations etc.	<p>REPLACE:</p> <p>Other buildings or enclosures found necessary as a result of detail design of the HVDC System, guard hut, at Stations etc</p>
16.	1.2.7.1 Last para Page 15	The spares should be available at site prior to commencement of trial operation.	<p>REPLACE:</p> <p>All the spares should be available at each Converter station site prior to commencement of trial operation. However minimum one set of the converter transformers shall be made available at each Converter station prior to commencement of trial operation</p>
17.	1.2.7.2 iv) Page 15	Smoothing Reactors- 1 no. of each type and rating	<p>REPLACE:</p> <p>Smoothing Reactors- 1 no. coil of each type and rating and minimum 25% of support</p>

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			insulators of each type.
18.	1.2.7.2 v, vi, vii, viii & xi) Page 15&16 - 1 no. of each type and rating	REPLACE: - 1 complete set of units to make one no. of each type and rating.
19.	1.2.7.2 ix) Page 16	HVAC Circuit Breakers alongwith operating mechanism a)Sectionalizing Breaker- 1 pole of each type and rating b)Diameter Breaker-1 pole of each type and rating c)Filter Breaker-3 Poles of each type and rating d)Line Breakers(If applicable as per scope)-3 poles of each type and rating	REPLACE: HVAC Circuit Breakers along with operating mechanism - 1 pole of each type and rating
20.	1.2.7.2 x) Page 16	HVAC Isolators with one grounding Switch- 2 poles of each type and rating along with operating mechanism	REPLACE: HVAC Isolators with one grounding Switch- 1 poles of each type and rating along with operating mechanism
21.	1.2.7.2 Page 16	New Spares Added	ADD: XX) Auto Transformer spares per station - As per Annexure-A xxi) Converter Transformer spares per station - As per Annexure-B xxii) Thyristors spares – As per Annexure – K

S.No	TS Clause	Existing Clause	Amended Clause
			Xxiii) Shunt Reactor spares per station- as per Annexure- L
22.	1.3.2.1 4 th Para Page 18	<p>.....</p> <p>Wherever the Employer intends to have Employers personnel stationed at the Contractor's office/works, the association/training of these engineers shall constitute 42 man months for which no extra price shall be quoted. The broad break up of man months shall be as follows:</p> <p>a) System engineering and design including application: 12</p> <p>b) Project engineering and equipment Specification: 12</p> <p>c) Operation and maintenance: 18</p> <p>.....</p>	<p>REPLACE:</p> <p>.....</p> <p>Wherever the Employer intends to have Employers personnel stationed at the Contractor's office/works, the association/training of these engineers shall constitute 80 man months for which no extra price shall be quoted. The broad break up of man months shall be as follows:</p> <p>a) System engineering and design including application: 24</p> <p>b) Project engineering and equipment Specification: 24</p> <p>c) Operation and maintenance: 32</p>
23.	1.3.3 Page 20	Computer Programs:	Clause stands DELETED
24.	1.3.5.2. 11) Page 25	It is the..... protocols.	<p>REPLACE:</p> <p>It is the Employers intention to monitor and operate HVDC station and the connected AC switchyards from a common control room in each HVDC station. The HVDC SCADA/OWS system shall have provision for control and monitoring of complete HVDC station and</p>

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.			<p>connected AC Stations. The Contractor shall provide facility to operate and monitor the 132kV/220kV/400 kV/765kV (As applicable) lines and transformers in the AC switchyards at Agra, Biswanath Chariali and Kishanganj from the VPS provided in the HVDC control room. The Contractor shall supply all hardware, software, Bay control units(If required) and cabling etc. required for integration of Employers substation automation systems and the existing bays with conventional control system at Agra with HVDC SCADA. The HVDC SCADA at each converter station shall have provision of 5 nos spare HVAC diameters (one and half breaker scheme) for future use.. The future bays shall be based on Substation automation system compliant with IEC 61850 protocols.</p> <p>400 kV Agra S/S has 10 Nos. 400 kV lines with 5 shunt reactors and 1 Bus reactor, which have conventional control and protection panels. For automation of these existing bays the contractor shall provide necessary IEC 61850 compliant Bay Control Units and Protection IEDs. The integration of the existing and proposed IEC 61850 compliant IEDs with the HVDC SCADA shall be accomplished by extending the bay level IEC 61850 LAN to the HVDC SCADA. Contractor shall provide all necessary hardware and software for integrating these IEDs to the HVDC SCADA.</p>

S.No	TS Clause	Existing Clause	Amended Clause
25.	1.4.d) Page 27	The Employer shall design, supply, and construct the HVDC and electrode lines.	REPLACE: The Employer shall design supply, and construct the HVAC , HVDC and earth electrode lines.
26.	1.4 e) Page 27	However, the underground / overhead..... By the contractor.	REPLACE: Employer shall provide the required land for Repeater stations within the ten(10) kms radius from HVDC line. The OPGW from DC line to the repeater station shall be supplied and installed by the owner. However, the supply and erection of final fibre optic connection from terminal tower near repeater station to the equipment shall be in the scope of the contractor.
27.	2.4.1.9 Page 38	.....Criteria for Earthquake Resistant Design of Structures. Importance factor for the stations is 1.5 as per table no. 4 of IS-1893.	REPLACE: .....Criteria for Earthquake Resistant Design of Structures. Importance factor for the stations is 1.5 as per table no. 6 of IS-1893.
28.	2.4.3 line 4 & 8 Page 39	The reactive power exchange values to be maintained at the converter terminals are given in Table 2.4.3.1, 2.4.3.2 and 2.4.3.3. The Contractor may utilize the existing switchable Bus at the converter stations for reactive power requirement in Table 2.4.3.1, 2.4.3.2 and 2.4.3.3.	REPLACE: The reactive power exchange values to be maintained at the converter terminals are given in Table 2.4.3.1 and 2.4.3.2 . The Contractor may utilize the switchable Bus Reactors at the converter stations for reactive power exchange requirement as given in Table

S.No	TS Clause	Existing Clause	Amended Clause			
			2.4.3.1 and 2.4.3.2			
29.	2.4.3 Line 14 Page 39 which shall be suitably rated to meet the specified reactive exchange limits between minimum and maximum continuous DC power	REPLACE: which shall be suitably rated to meet the specified reactive exchange limits between 0.1pu and 1.0 pu DC Power			
30.	2.4.5 Table Page 40&41	Biswanath Chariali Table and Siliguri(New) Table	ADD NEW ROW at the end of tables: <table><tr><td>3.</td><td>From 3001 to 4000MW</td><td>The minimum SCR shall be maintained at 2.7</td></tr></table>	3.	From 3001 to 4000MW	The minimum SCR shall be maintained at 2.7
3.	From 3001 to 4000MW	The minimum SCR shall be maintained at 2.7				
31.	2.4.5 Para 2 Page 40	At both Biswanath Chariali, Siliguri (New) and Agra the maximum fundamental frequency short circuit current shall be taken as 40KA for one second at 420kV for purpose of design.	REPLACE: At Biswanath Chariali, Kishanganj and Agra stations the maximum fundamental frequency short circuit current shall be taken as 50 KA for one second at 420kV for purpose of design.			
32.	2.4.6.1 Page 42-44	AC System	Stands DELETED and Replaced by: The AC system harmonic impedances to be used for the calculation of AC filter performance shall be as per the Network Impedance Diagram as per ANNEXURE-C			
33.	2.4.8 Para 4 Page 46	The HVDC and electrode lines may cross and run parallel to each other and to HVAC lines. The Contractor shall take into account any possible inductive and capacitive coupling	REPLACE: The HVDC and electrode lines may cross and run parallel to each other and to HVAC lines. The Contractor shall take into account any			

S.No	TS Clause	Existing Clause	Amended Clause
		between these lines.	possible inductive and capacitive coupling between these lines. As per initial survey there is 100 km of parallel AC Lines with the HVDC line within a radial distance of 500 meters. However this data shall be confirmed by the Employer within one month of contract agreement in case of award.
34.	2.5 Page 46		ADD: Electrode Line Tower Figure as per Annexure – D
35.	3.2.9 Page 53	IEC-60871 Power Capacitors IEEE-18 Shunt Power Capacitors	REPLACE: IEC-60871 Shunt Capacitors
36.	3.4.1 Para 3 Page 68	One or more heaters shall be provided, with thermostats, to prevent condensation in any compartment. The heaters shall be suitable to maintain the compartment temperature at approximately 10 deg. C, above the outside air temperature	REPLACE: One or more heaters shall be provided, with thermostats or hygrostat , to prevent condensation in any compartment. The heaters shall be suitable to maintain the compartment temperature at approximately 10 deg. C, above the outside air temperature
37.	4.1.2 Para 1 Page 84	.....This voltage shall be maintained within ± 20 kV by tap changer and firing angle control for all power flows up to rated value or the low ambient continuous rating whichever is the larger for all ac bus bar voltages between 380 kV and 420 kV and for all ac system frequencies between 49.0 Hz and 50.5 Hz.	REPLACE: .....This voltage shall be maintained within ± 20 kV by tap changer. Tap changer range for Agra converter transformers shall be designed considering the more stringent requirement in line with T.S. clause 1.5. For this purpose 6000MW

S.No	TS Clause	Existing Clause	Amended Clause
.		.....	Power transfer shall be considered from Biswanath Chariali to Agra Firing angle control for all power flows up to rated value (3000/6000MW) for all ac bus bar voltages between 380 kV and 420 kV and for all ac system frequencies between 49.0 Hz and 50.5 Hz.
38.	4.1.2 Para 5 Page 86	In mono polar operation with metallic return, DC voltage shall not be below (714) kV at inverter end (taking rectifiers DC voltage as 820kV) with the AC system voltage above 380kV.	DELETE
39.	4.1.4 Page 86 & 87	Table	Refer Revised Table as per Annexure-G
40.	4.1.4 Page 87&88	Figure	Figures stand deleted.
41.	4.1.5 Para 1 Page 89	In Bipolar operation the instantaneous sum of the two pole powers shall determine the Multi-terminal power transmission.	REPLACE: In Bipolar operation the instantaneous sum of the four poles at BC & Alipur Duar powers shall determine the Multi-terminal power transmission.
42.	4.1.5 page 90	1. The overload above 1.0 pu continuous power rating..... Poles are operating.	REPLACE: 1. The overload above 1.0 pu continuous power rating..... Poles are operating. However, the overload of 1.33 pu shall be continuous without any reduction in the life of the any equipment.

S.No	TS Clause	Existing Clause	Amended Clause
43.	4.1.9.1 Para 2 Page 93	The Contractor shall provide suitable means to detect the change of short circuit levels in real time basis and take appropriate automatic measures to keep the operation in a smooth and controlled manner. The bidder shall describe in the bid the proposed strategy to detect the change in short circuit level.	DELETE
44.	4.1.9.3 Para 1, Page 94	.....Under asynchronous operation of Northern and Western-North-Eastern region, it shall be possible to operate the HVDC system in frequency control mode in which the power flow through the Multi- terminal to control the frequency.....of the other grid does not deviate beyond the specified band (Frequency band)	REPLACE: .....Under asynchronous operation of rectifier and inverter end ac system, it shall be possible to operate the HVDC system in frequency control mode in which the power flow through the Multi-terminal to control the frequency.....of the other grid does not deviate beyond the specified band (Frequency band 48.5 Hz to 51 Hz)
45.	4.3.1 Last para & all Bullets Page 111	The bidder shall submit..... for the following: Repetitive commutation failure Simultaneous And Agra Dynamic compensation device to achieve a target of less than 10% probability of commutation failure on the HVDC scheme for voltage reduction up to 15% on any of the phases of the AC commutating voltage at the inverter.	DELETE
46.	4.3.3 I st Bullet page	The reactive power interchange requirement as defined in section 2.4.3 and calculated as per	The reactive power interchange requirement as defined in section 2.4.3 and calculated as per

S.No	TS Clause	Existing Clause	Amended Clause
.	no 115	section 4.3.1 shall be made with the largest sub bank not available for service upto the rated capacity of the multi-terminal. For powers over the rated capacity and upto the two hour overload limits all reactive power sources (see bellow....) may be assumed to be available to meet reactive power exchange with the AC system.	section 4.3.1 shall be made with the largest sub bank not available for service upto the rated capacity of the multi-terminal. However, for power over the rated capacity and upto the two hour/continuous overload, limit may be fulfilled by taking additional reactive power support from AC network, after connecting all reactive power sources available in the station.
47.	4.3.3 2 nd bullet Page 115	.....when the fault results in the outage of the largest bank with one largest sub bank already out of service. The reactive power exchange limits may be crossed following the fault but the harmonic performance shall be met. In case a reactor or dynamic reactive compensation equipment has been installed it shall be provided as a 2x50% modular system	REPLACE: .....when the fault results in the outage of the largest bank with one largest sub bank from another bank already out of service. The reactive power exchange limits may be crossed following the fault but the harmonic performance (As per clause 4.10.5.2) shall be met. In case a reactor or dynamic reactive compensation equipment has been installed it shall be provided as a 2x50% modular system
48.	4.3.4 Para 1 Page 116	The filter bank fundamental frequency reactive power output shall be approximately 700MVar at 400kV and 50HZ.	REPLACE: The filter bank fundamental frequency reactive power output shall be not more than 720MVar for Biswanath Chariali and Kishanganj and 800 MVar for Agra at 400kV and 50HZ.
49.	4.3.4.1 Para 2 Page 116	.....a filter sub-bank and shunt reactor at nominal voltage of 400 kV and at nominal frequency at the terminals (per converter) shall be limited to the values given below: <ul style="list-style-type: none"> Between 0 to 1000MW shall not exceed 	REPLACE: .....a filter sub-bank and shunt reactor at nominal voltage of 400 kV and at nominal frequency at the terminals shall be limited to the values given below:

S.No	TS Clause	Existing Clause	Amended Clause
		120MVAR <ul style="list-style-type: none"> Between 1001- 3000MW shall not exceed 160MVAR 	<ul style="list-style-type: none"> Between 0 to 1000MW shall not exceed 125 MVAR for All stations Between 1001- 3000MW shall not exceed 165 MVAR for Biswanath Chariali and Kishanganj Between 1001 - 6000MW shall not exceed 200 MVAR for Agra
50.	4.4.4.3 Last Para Page 127	The neutral side insulation shall be designed with the capability for ungrounded operation at all rectifier terminals.	REPLACE: The neutral side insulation shall be designed with the capability for ungrounded operation at all rectifier terminals for ultimate specified configuration (i.e. considering future bipole capacity of 6000 MW).
51.	4.4.4.4 Para 2 Page 127	On electrode line, the insulation shall be co-ordinated with insulation level for electrode line which shall be insulated for 132 kV steady state DC voltage.	ADD: The LIWL and SIWL shall be 550kV and 450kV respectively for Earth Electrode line.
52.	4.4.5.2 2 nd Para Page 128	Outdoor bushings shall have a flash distance of not less than 12mm per KV of applied steady state DC voltage as defined in Clause 4.4.2.1 where the flash distance is the shortest distance between the bushing cap and the nearest ground plane.	REPLACE: Outdoor bushings shall have a flash distance of not less than 12mm per KV for vertical Bushings and 10.5 mm/kV for horizontal Bushing of applied steady state DC voltage as defined in Clause 4.4.2.1 where the flash distance is the shortest distance between the bushing cap and the nearest ground plane.

S.No	TS Clause	Existing Clause			Amended Clause												
53.	4.4.6.2 Table Page 128	Insulator type	Rectifiers	Inverter	REPLACE: <table><tr><td>Insulator type</td><td>Rectifiers</td><td>Inverter</td></tr><tr><td>Outdoor Porcelain Insulators.</td><td>50mm/kV</td><td>60mm/kV</td></tr><tr><td>Outdoor Silicone rubber insulators. and bushings *</td><td>50mm/kV *</td><td>50mm/kV*</td></tr><tr><td>Indoor DC yard (If provided)</td><td>NA</td><td>43mm/kV</td></tr></table> <p>* Leakage distances less than 50 mm/kV shall be acceptable for:</p> <ul style="list-style-type: none">• outdoor silicone rubber bushings due to manufacturing limitations and• HVDC equipments requiring necessary internal/external insulation co-ordination. <p>Necessary justification for leakage distance less than 50mm/kV shall be furnished during detailed engineering subject to the approval of the employer. However, leakage distance of less than 45mm/kV shall not be acceptable and all equipment support insulators including BPIs shall have a leakage distance of not less than 50 mm/kV.</p>	Insulator type	Rectifiers	Inverter	Outdoor Porcelain Insulators.	50mm/kV	60mm/kV	Outdoor Silicone rubber insulators. and bushings *	50mm/kV *	50mm/kV*	Indoor DC yard (If provided)	NA	43mm/kV
		Insulator type	Rectifiers	Inverter													
		Outdoor Porcelain Insulators.	50mm/kV	60mm/kV													
		Outdoor Silicone rubber insulators. and bushings *	50mm/kV *	50mm/kV*													
		Indoor DC yard (If provided)	NA	43mm/kV													
		Indoor Porcelain/Composite for valve hall	20mm/kV	20mm/kV													
Indoor DC yard	NA	43mm/kV															
Outdoor Porcelain Insulators/Bushings	50mm/kV	60mm/kV															
Outdoor Silicone rubber insulators/Bushings	50mm/kV	50mm/kV															

S.No	TS Clause	Existing Clause	Amended Clause
54.	4.4.6	The specified.....insulator basis only.	Add: Bidder may propose indoor DC switchyard arrangement or outdoor arrangement or combination of indoor & outdoor DC switchyard to fulfill the probability of flashover mentioned above. The requirements of indoor DC switchyard are specified in the relevant section of T.S.
55.	4.5.2.1 t) Page 134	For DC current measurement, transducer failures that could lead to bipole trip at any converter station, two physically separate DC current transformer units shall be provided. The output of these DCCTs shall be independently fed to redundant protection and control systems so that mal-operation of one DCCT shall not lead to bipole outage.	DELETE
56.	4.5.2.1 v) page 134	The control shall minimize commutation.....Converter station.	REPLACE: AC system faults, which may transiently dip AC voltage on any one or more phases up to 15% shall not cause repetitive commutation failures(one commutation failure may occur) for the operating conditions defined in this specification.
57.	4.5.3 Page 137	The protection equipments shall be designed.....similar principle shall be employed. Main and backup protections shall be fed by separate CT secondary. In the case of DCCTs, the main protection of system A & Back up of system B and main of system B and backup of system A may each be considered as a single group and fed from	REPLACE: The protection equipments shall be designed.....similar principle shall be employed. All protection trips due to equipment failure shall result in a lockout trip-requiring manual reset. All protection trips shall be separately alarmed.

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		separate DCCTs. All protection trips due to equipment failure shall result in a lockout trip-requiring manual reset. All protection trips shall be separately alarmed.	
58.	4.5.3.1 Page 138	ADD New Bullets	ADD after 2nd bullet on Page 138: <ul style="list-style-type: none"> • High Voltage DC Bus differential protection • Neutral DC bus differential protection • HVDC line differential protection • Converter differential protection
59.	4.5.3.3 Page 142	ADD new Bullet	ADD after 6th bullet on page 142: <ul style="list-style-type: none"> • Each Filter Sub bank shall be provided with 400kV current transformer for realising differential protection each filter sub-bank. • Filter sub bank de-tuning supervision. • Backup of main filter sub bank shall be realised through duplicated filter sub bank protections.
60.	4.5.3.8.1 f) Page 144	For line fault clearing sequences, the fault deionization time setting shall be adjustable to a preset value between 50ms and one second, and the number of allowable restarts shall be adjustable between 0 and 2 for full voltage restarts followed by 2 reduced voltage restarts. The settings shall be coordinated with the multi-terminal configuration and the arresters shall be rated accordingly.	REPLACE: For line fault clearing sequences, the fault deionization time setting shall be adjustable to a preset value between 50ms and one second, and the number of allowable restarts shall be adjustable between 0 and 2 for full voltage (at overload power) restarts followed by 0 to 3 reduced voltage restarts, However total restart attempt shall be limited to a

S.No	TS Clause	Existing Clause	Amended Clause
			maximum of 3. The settings shall be coordinated with the multi-terminal configuration and the arresters shall be rated accordingly. For mono-polar Metallic return, minimum one restart attempts shall be considered at full voltage & current corresponding to 1.33pu. DC reduced voltage restart shall be possible even when there is no telecommunication between rectifier(s) and inverter stations.
61.	4.5.7 Page149 & 150	RTDS	REPLACE: ANNEXURE-O
62.	4.5.9.2 b) Para 2 Page 154	The multi- terminal-I and multi- terminal-II DC neutrals shall be interconnected at Agra HVDC station through DC breakers. The bidder has to provide necessary interlocking and indications for this breaker as shown below.	REPLACE: The neutrals of the two bipoles shall be connected at the Agra electrode station. However, facility shall be provided at inverter station DC yard to connect the two neutrals through two manually operated disconnectors in series, which shall normally be in open position. Refer revised figure – electrode line arrangement at Agra converter station
63.	4.6.1.3 Bullet 1 Page 177	Video Projection system (VPS) shall be of at least 2X14, each unit of 67" size built with seam less screen DLP technology with SVGA+ resolution of at least 1400X1050	REPLACE: The bidder should quote specific Make and Model of the item being offered for VPS.

S.No	TS Clause	Existing Clause	Amended Clause
		pixels..... shall be less than 0.8mm.	Video Projection system (VPS) shall be of at least 2 (R) X14 (C) , each unit of 67" diagonal size built with DLP technology with SXGA+ resolution of at least 1400X1050 pixel. Seams shall be less than 0.8mm.
64.	4.6.1.3 Bullet 5 Page 177	Shall have brightness of at least 700ANSI Lumens and contrast ratio of 300:1 .	REPLACE: Shall have brightness of at least 600ANSI using single lamp and at least 1100 using dual lamp and contrast ratio of minimum 1800:1 .
65.	4.6.1.3 Page 177		ADD: Back up VPS at Agra shall be similar to main VPS.
66.	4.6.1.3 Page 177	STATION CONTROL FACILITIES	ADD: Each Projection cube shall have dual lamp, with No mechanical movement during lamp switch (either of the lamp or of any other part like mirror or prism) over when one lamp fails. The average expected life shall be min 8000 hrs for each lamp. The lamps used should be variable power lamps to address the display at various required power levels. If required, it should be possible to switch ON both the lamps simultaneously to get a brighter picture at least 1.2-1.4 times than with the single lamp. This may be required when both lamps are towards the end of their life and light of single lamp is not sufficient for projecting clear picture.

S.No	TS Clause	Existing Clause	Amended Clause
			<p>The VPS should have settings for brightness control to match the brightness of the various projection modules to get a fully uniform display wall.</p> <p>The cube system should have rear access only for the maintenance purposes to avoid any misalignment of the screens in the front.</p> <p>It should be possible to combine individual cubes to form a large display wall by stacking more such cubes horizontally and vertically to make a big display and selecting the controller with the right optional cards without any additional costs of integration or any other mechanical costs.</p> <p>The VPS supplier should have their own manufacturing facility in India for the completed final product with direct presence for after sales & support offices in India.</p> <p>The VPS supplier should have experience of supplying to 24x7 operation in a similar application in India.</p> <p>Each cube should have diagnostic LED's to aid in diagnosing any fault in the cubes.</p> <p>Each VPS system of 2 (R) x 14 (C) shall be connected to a controller which will make it behave as one logical screen</p>

S.No	TS Clause	Existing Clause	Amended Clause
			<p>The controller shall have at least 28 DVI inputs to be shown simultaneously.</p> <p>The controller should be integrated with real time network streaming decoder to provide mirror images of the workstations in the control room through the LAN in Real Time.</p> <p>The controller should be interfaced with the cubes with DVI outputs.</p> <p>The real time network decoder should have RJ-45 as input for LAN and compatible with TCP/IP, UDP and DHCP. It should also have a decoding frame rate of 1-30 fps adjustable. The color depth should be 24 bit with progressive scanning.</p> <p>The decoder should offer a 4:3 aspect ratio output and should also support audio output.</p> <p>The controller should be based on Windows XP/Vista to support 28 or more cubes.</p>
67.	4.6.8.1 Para 1,line 3 Page 217	Siliguri (New) shall have two sets online fault locator equipments,..... towards Biswanath Chariali	<p>REPLACE:</p> <p>Kishanganj shall have two standalone sets of online fault locator systems,..... towards Biswanath Chariali</p>

S.No	TS Clause	Existing Clause	Amended Clause
68.	4.7.1 Para 5 Page 223	The Communication between RTU (i.e. RCI Serial interface ports from HVDC SCADA system at Biswanath Chariali, Siliguri (New) and Agra) and the respective RLDCs shall be provided by Employer.	REPLACE: The Communication between RTU (i.e. RCI Serial interface ports from HVDC SCADA system at Biswanath Chariali, Kishanganj and Agra) and the respective RLDCs shall be provided by Employer. However, RTU shall be in the scope of contractor. Technical specification of RTU shall be given to successful bidder.
69.	4.7.1 Page 222	Table	REFER: ANNEXURE-H
70.	4.10.4.4 Para 1 Page 254	The AC Impedance which shall be assumed for the calculation of individual harmonic distortion, Dn, shall be that value lying any where within the line/circle impedance diagram(s) which results in the largest value of Dn at each harmonic considered individually. The circle/line impedance..... by the contractor.	REPLACE: The AC Impedance which shall be assumed for the calculation of individual harmonic distortion, Dn, shall be that value lying any where within the line/circle impedance diagram(s) which results in the largest value of Dn at each harmonic considered individually.
71.	4.10.5.2 Para 1 Page 255	In all modes of operation, except either..... to meet the performance.	REPLACE: In all Modes of operation, except the reduced dc line voltage modes, the performance requirement shall be met up to rated power (1.0 pu bipolar) with one larger size filter sub-bank and one characteristic harmonic sub-bank(largest) being out of service. In case..... to meet the performance.

S.No	TS Clause	Existing Clause	Amended Clause
72.	4.10.6.4 Page 257 & 258	At 3 rd and 5 th Harmonics the increase in current to be allowed shall be calculated based on the assumption that the distortion shall be expressed as a Thevenin source of 0.7% at each harmonic behind source impedance as calculated by the Contractor. The most onerous value shall be assumed. The Low order filter shall be assumed to be connected while calculating the system contribution for 3 rd and 5 th Harmonics and the corresponding distortion levels.	REPLACE: At 3 rd and 5 th Harmonics the increase in current to be allowed shall be calculated based on the assumption that the existing distortion shall be considered as 2% with respect to nominal voltage at converter Bus. This is to be considered for 3rd and 5th harmonic Filter component rating.
73.	4.11.1 Page 259	The contractor shall provide dc side harmonic filters designed for 6000MW at each converter station, hereafter.....at each converter station.	REPLACE: The contractor shall provide dc side harmonic filters designed for 3000MW for each bipole, hereafter.....at Agra converter station.
74.	4.11.2.1 Para 5 Page 261	The contractor may..... shall be increased.	REPLACE: The bidder shall provide DC filter dis-connector switches which are capable of connecting or disconnecting DC filter with the pole energized on load up to maximum DC voltage without interruption/reduction of power in the related pole.
75.	4.11.3.5 Para 3 Page 268	When operating in balanced bipolar mode, up to the rated power of 1.0 pu, the value of I _{eq} shall not exceed the value given above for mono-polar ground return mode, up to the rated power, with any one (as chosen by the Employer) switchable harmonic filter branch or	REPLACE: In balanced bipolar mode the converter operation shall differ by the maximum extent permitted by equipment and measurement tolerances.

S.No	TS Clause	Existing Clause	Amended Clause
		low voltage connected filter or surge capacitor branch out of service. In balanced bipolar mode the converter operation shall differ by the maximum extent permitted by equipment and measurement tolerances.	
76.	4.11.3.5 Bullet 2nd Page 269	Bipolar operation with DC filter out of service and operation up to the 6000MW.	REPLACE: Bipolar operation with DC filter out of service and operation up to the 3000MW.
77.	4.11.4 Last para Page 270	The harmonic impedance..... between nominal and $\pm 10\%$.	ADD: Actual line length to be considered as specified in Clause 2.4.8(1728 \pm 10 kMs)
78.	4.12.2 a) Page 271	.....shall not exceed 100micro volt/m under fair weather conditions at any point. <ul style="list-style-type: none"> • outside the station fence and • 500 meters or more from the nearest bus connecting the valve to the converter transformers within the station and 	REPLACE: .....shall not exceed 100micro volt/m under fair weather conditions at any point outside station fence which are: <ul style="list-style-type: none"> • 500 meters or more from the nearest bus connecting the valve to the converter transformers within the station. and
79.	4.12.3 Page 273	Radio Interference Voltage (RIV), measured at a phase to ground voltage of 266 kV rms and at a frequency of 1 MHz , shall be less than 1000 microvolt	REPLACE: Maximum radio interference voltage for frequency between 0.5 MHz to 2 MHz at 1.1 times of maximum DC voltage for 800 kV DC system, 266 kV RMS for 400 kV system and 156 kV RMS for 220 kV system and 92 kV RMS

S.No	TS Clause	Existing Clause	Amended Clause
			for 132 kV system shall be 2500, 1000, 1000 and 500 micro Volt respectively.
80.	4.13.3 xii. F) Page 283	f. Fast Power Reversal	DELETE
81.	4.14.1.9.a) Para 2	765KV, 400kV & 220kV line	REPLACE: 400kV & 220kV Line
82.	4.15.5.c) Page 311	The line trap .....Radio interference voltage for 420/245/132 kV shall not exceed 500 micro volts at 266/163/97 kV (rms) respectively.	DELETE
83.	5.2 Para 5		ADD: The resultant space after shifting the existing Sikar-1&2 bays as shown in SLD for Agra S/S may be utilized by the bidder for location of filters, if required.
84.	5.2.1. Page 2	TABLE 2 nd Row 2 MT per sub-conductor per phase for 400kV line	REPLACE: 2 MT per sub-conductor in case of Twin Conductor per phase for 400kV 1MT per sub-Conductor in case of Quad Conductor per phase for 400kV
85.	5.3.1 Page 4	Each bipole of the multi terminal HVDC system shall be with..... ground return mode operation.	ADD: All modes of operation defined in section 4.1.4 shall also be possible.

S.No	TS Clause	Existing Clause	Amended Clause
86.	5.3.2 Last line Page 5	A typical SLD for the DC yard drawing no. ENGG/HVDC/AGRA/SLD	REPLACE: Please refer revised DC SLD Drawing no. ENGG/HVDC/AGRA/SLD Rev-01 and Drawing "Typical conceptual switching KG to BC MR while KG -AG in bipolar mode".
87.	5.4.4 Para 2 Page 9	The total electric field including space charge at ground level shall not exceed 20kV/m in the DC yard.	REPLACE: The total electric field excluding space charge at ground level shall not exceed 20kV/m in the DC yard.
88.	5.5.2.2 D Page 11	Detail of grounding system ITEM SIZE Material Pipe 100mm -- Cast Iron 13 mm Earth -----or better electrode	Detail of grounding system ITEM SIZE Material Pipe 40 mm dia Galvanized Steel Earth 3000mm long electrode (In Treated earth pit) As per IS
89.	TS clause 5.5.2.7.C	An additional ground mat not less than 600 X 600 mm comprising closely spaced (150 X 150 mm grid, 300 mm deep) conductor during operation of ground switch.	REPLACE: An additional ground mat not less than 1500 X 1500 mm comprising closely spaced (300 X 300 mm grid, 300 mm deep) conductor during operation of ground switch.
90.	5.6.1 Para 2	The lightning protection scheme shall be designed by the Contractor using the latest version of the electro geometric model (EGM).	REPLACE: The lightning protection scheme shall be

S.No	TS Clause	Existing Clause	Amended Clause
	Page 17	Detailed calculations demonstrating the adequacy of the proposed shielding shall be submitted to the Employer for approval prior to the overhead shielding design being finalized.	designed by the Contractor using the latest version of the electro geometric model (EGM) or Razevig method. Detailed calculations demonstrating the adequacy of the proposed shielding shall be submitted to the Employer for approval prior to the overhead shielding design being finalized.
91.	Page 19		ADD NEW CLAUSE: TS CLAUSE 6.0- As per Annexure-F
92.	6.4.2.2 a) Page 52	...the transformer shall be able to operate at full load for atleast ten (10) minutes and the hot spot temperature (calculated) shall not exceed 150°C	REPLCAE: ...the transformer shall be able to operate at full rated load for atleast ten (10) minutes and the hot spot temperature (calculated) shall not exceed the calculated hot spot temperature.
93.	6.4.2.2 b) Page 52	The transformer shall be capable of being operated on any tapping at the rated MVA with voltage variation of +-10% in the equivalent voltage of the tapping.	REPLACE: The transformer shall be able to operate at 10% overvoltage or 10% over-current on every tapping without harmful effects on the transformer.
94.	6.4.2.2 k) Page 53	The same type of oil as per clause 6.4.6.10 shall be used for impregnation factory tests and continuous operation at site. The Impregnation and testing shall be done with fresh oil for each transformer.	REPLACE: The same type of oil as per clause 6.4.6.10 shall be used for impregnation, factory tests and continuous operation at site.
95.	6.4.6.9.g	The thickness of inter-disc or inter-turn	REPLACE: The thickness of inter-disc or inter-turn

S.No	TS Clause	Existing Clause	Amended Clause
	Page 62	segments provided for horizontal oil flow shall be at least 4 mm.	segments provided for horizontal oil flow shall be such that oil can flow freely to all parts of the winding
96.	6.4.6.10 Para 1 Page 62	The insulating oil used for Impregnation, oil filling and topping up shall be virgin Napthenic-based Nitro-10XN generally conforming to IEC-60296 supplied by NYNAS SWEDEN. Oil shall be supplied directly from NYNAS. Oil samples shall be tested as follows:	REPLACE: The Oil used shall be pure inhibited mineral oil, clean & free from matters which are likely to impair its insulating properties. Oil should meet the requirement of ANNEXURE-Q and shall also conform to IEC-60296. Oil samples shall be tested as follows:
97.	6.4.6.14 Last line Page 64	All the Bushings shall be of silicon rubber housing.	REPLACE: All the Valve Side Bushings shall be of dry type/ SF6 gas filled silicon rubber type insulator.
98.	6.4.6.19 Para 1 Page 65	All the converter transformers.....HVDC SCADA system	REPLACE: All the converter transformers (each single phase unit), including the spare units shall have dedicated online continuous monitoring of at least the following fault gases in transformer oil: <ol style="list-style-type: none"> 1. Oxygen (O2) 2. Nitrogen(N2) 3. Hydrogen(H2) 4. Carbon Monoxide(CO) 5. Carbon Dioxide(Co2) 6. Methane (CH4) 7. Ethane(C2H5) 8. Ethylene(C2H4) 9. Accetylene(C2H2) 10.Moisture content

S.No	TS Clause	Existing Clause	Amended Clause
			<p>The instrument should be controlled by a fully embedded processor with over 2 years of data at a default sampling rate of 6-hourly, stored internally.</p> <p>Modules should be available for connection via RS232, RS485, ETHERNET, PSTN modem and GSM or CDMA wireless Modems.</p> <p>Input oil temperature range: upto 120deg.</p> <p>With discrete sampling, there shall be No averaging of DGA results.</p> <p>The data shall be transmitted to a remote computer located in control room (using Standard software). The integrated alarm function can be triggered on specific gas levels. Six alarms setting screens or scenarios should be available for each oil circuit, which can set alarms based on the level of eight Gases. TDCG and moisture, and rates of change for each gas. The alarm results of each screen are independent of the other circuits & Alarm setting screens.</p>
99.	6.4.6.19 Para 3 page 66	One (1) no. portable multigas analyzer MYRKOS or Morgan Schaffer make or better with all accessories shall also be supplied to each converter station. The Calisto Access or other software shall be supplied at each terminal and	One (1) no. portable multigas analyzer with all accessories shall also be supplied to each converter station. Necessary software shall be supplied at each terminal and shall be integrated with HVDC SCADA. This shall be

S.No	TS Clause	Existing Clause	Amended Clause
		shall be integrated with HVDC SCADA.	<p>having following features:</p> <p>A) Portable dissolved gas analyzer shall be provided with wide detection ranges with excellent accuracy for all fault gases. For calibration of the equipment it should not use any consumable gas / liquid.</p> <p>B) The following gases should automatically be Detected :</p> <ol style="list-style-type: none"> 1. Oxygen (O₂) 1. Nitrogen(N₂) 2. Hydrogen(H₂) 3. Carbon Monoxide(CO) 4. Carbon Dioxide(CO₂) 5. Methane (CH₄) 6. Ethane(C₂H₅) 7. Ethylene(C₂H₄) 8. Acetylene(C₂H₂) <p>And water content test should be there. Ability to test the gas samples taken from the BUCHOLZs Relay.</p> <p>C) DGA Diagnostics Includes DGA diagnostics algorithms- Rogers' Ratio , Duvai's Triangle and IEEE Key gas. Also user settable CAUTION and WARNING Thresholds on all gases.</p> <p>PC Software: Should include PC software package to allow storage, exporting,</p>

S.No	TS Clause	Existing Clause	Amended Clause
			<p>trending and analysis of results.</p> <p>D) Should have;. Step by step operation. Up to 20000 records stored in internal Memory. Inbuilt Thermal Printer to take hard copy of results on site. Touch screen controls for easy operation. It should have USB digital output port.</p> <p>The system shall be Portable and rugged Comes in a transit case, suitable for operation in substation environment.</p> <p>Oil sample Volume : 50ml Gas Sample Volume : 5ml</p>
100.	6.4.8.2 b) Page 67	The current diverting contacts shall be housed in a separate chamber not communicating with the main tank of the transformer. Transition resistors and voltage limiting resistors shall also be housed separately from transformer tank. Suitably rated MOV shall be installed across each tap.	<p>REPLACE:</p> <p>The current diverting contacts shall be housed in a separate chamber. Suitably rated MOV shall be installed across each tap.</p>
101.	6.4.9.1.e) Page 69	Oil pumps shall be provided for each unit cooler. Necessary measures shall be taken to prevent mal-operation of Buchholz relay when all oil pumps are simultaneously put into service. The pump shall be so designed that upon failure of power supply to the pump motor, the pump impeller shall not limit the natural circulation of oil.	<p>REPLACE:</p> <p>Oil pumps shall be provided for each unit cooler. Necessary measures shall be taken to prevent mal-operation of Buchholz relay when all oil pumps are simultaneously put into service.</p>

S.No	TS Clause	Existing Clause	Amended Clause
102.	6.4.14.2. a) Bullet 10 Page 76	Polarity reversal including partial discharge measurements as per test levels specified in clause 10.4.4 of IEC 61378-2. However the duration of the polarity reversal test for each positive and negative cycle shall be minimum of 6 hours and total test shall not be less than 15 hours.	REPLACE: Polarity reversal including partial discharge measurements as per test levels and duration specified in clause 10.4.4 of IEC 61378-2.
103.	6.4.14.2 Last bullet Page 76	.....Partial discharge shall be less than 100pC for the test duration.	PD shall be less than 300PC as per IEC, However, Negative tolerance as indicated in IEC shall not be allowed.
104.	6.4.14.2 Page 77	12 hour, 110% overvoltage test at.....in accordance with IEC61378-2	REPLACE: 2 hour, 110% overvoltage test at.....in accordance with IEC61378-2
105.	6.5.1 Pgae 82	Only air insulated type smoothing reactors shall be supplied.	REPLACE: Only air insulated type naturally cooled smoothing reactors shall be supplied.
106.	6.5.3 Page 83		ADD: In addition Any other test specified in IEC 60076-6 shall also be conducted.
107.	6.5.3.2.1 Page 83	Temperature rise test	ADD: 2 nd harmonic current shall be considered for calculation of the equivalent test current for

S.No	TS Clause	Existing Clause	Amended Clause
			temperature rise test.
108.	6.6.3.3 Page 88	..... the Employer's approval extrapolated values and documentation for the reference temperature of 33°C, equal to the annual mean dry bulb temperature. The capacitors shall be suitable for outdoor installation.	REPLACE: the Employer's approval extrapolated values and documentation for the reference temperature of 30°C , equal to the annual mean dry bulb temperature. The capacitors shall be suitable for outdoor installation.
109.	6.6.3.4.a) Page 90	The rated voltage U_r for approval.	REPLACE: The rated voltage U_r of an AC filter capacitor bank shall be defined as: $U_r = U_h + \sqrt{\sum_{n=1}^{50} U_n^2}$ Where U_h = Fundamental frequency rms voltage (or the greatest individual harmonic voltage) U_n = N^{th} harmonic frequency rms voltage ($n \neq 1$ or the individual harmonic order with the greatest voltage) Which can appear across the capacitor bank for steady state under the most onerous conditions of the ac bus voltage, dc load and filter detuning. Calculations establishing the conformity of the design to the guaranteed availability shall be furnished by the contractor to the Employer for approval.

110.	6.6.4.2.1.c) Page 94	Measurement of Inductance	REPLACE: Test shall be performed as per IEC-60076-6.
111.	6.6.5.2.2 b) Page 98	If modules are tested the test voltage shall be defined as follows: $U_{test} = k * U/2n$ Where, U = lightning impulse withstand voltage for the complete resistor	REPLACE: If modules are tested the test voltage shall be defined as follows: $U_{test} = k * U/2n$ (for resistors with midpoint connected housing) $U_{test} = k * U/n$ (for resistors without midpoint connected housing) Where, U = test voltage for the complete resistor
112.	6.7.2.2 Page 100	Capacitor fuses	ADD: at the end of the para In case of fuse less capacitors no two internal capacitor elements shall come directly in parallel to each other.
113.	6.7.2.3 Page 100	CAPACITOR UNIT FAILURE PROTECTION	DELETE
114.	6.7.2.5 e) Page 101	The rated ac kVAr of the capacitor unit shall be defined as the kVAr at rated frequency which results in the same maximum hot spot temperature as defined in (d) above. Method for verification may be suggested by the Contractor	REPLACE: The equivalent ac kVAr of the capacitor unit shall be defined as the kVAr at rated frequency which results in the same maximum hot spot temperature as defined in (d) above. Method for verification may be suggested by the Contractor
115.	6.7.2.5.f) Page 101	..... UACR= rated ac voltage as defined in Clause 6.7.2.5(b) above.	REPLACE:

			$\sqrt{2} \cdot U_{ACR}$ = rated ac voltage as defined in Clause 6.7.2.5(b) above.
116.	6.8.1 Para 4 Page 106	The switches which are current interrupting or making devices shall also comply with the requirements, as specified in Clause 6.12, HVAC Circuit Breakers.	ADD: The switches which are current interrupting or making devices shall generally comply with the requirements, as specified in Clause 6.12, HVAC Circuit Breakers (as appropriate to DC switches). Further, Neutral Bus Grounding Switches shall have on load switching capabilities. All High voltage HSS (High speed switches) and neutral DC switches (NBS, NBGS, GRTS & MRTB) shall be provided with current measuring devices and all neutral DC switches with suitable auxiliary current commutation Circuit.
117.	6.8.3.1 Page 107	The switches shall be tested in accordance with the requirements of the applicable standards and will include at least the following additional tests:	REPLACE: The switches shall be tested in accordance with the requirements of the applicable standards and will include at least the following additional tests(As applicable):
118.	6.8.3.1.1 Page 107	e) Short time current test h) wind pressure test j) Commutation test	DELETE
119.	6.8.3.1.1 Page 108	Type tests on Switches	ADD: j) Over pressure test on breaking element
120.	6.8.3.1.2 Page 108	Routine tests on Switches	DELETE: P) Over pressure test on breaking element
121.	6.9.2	For 800 kV DC, except for smoothing reactor support insulator, all other equipment and	AMENDED: For 800 kV DC outdoor equipment support

	Para 4 Page 110	support insulator shall be of silicon rubber. However, in case of support insulator of 800 kV smoothing reactor, porcelain type insulators shall be acceptable.	insulator shall be of silicon rubber. However, porcelain support insulators for smoothing reactor & HVDC disconnectors shall be acceptable.
122.	6.9.4.3 Para 1 Page 111	An outdoor bushing or insulator of each type shall be subjected to a wet withstand test using negative polarity of 1.5 times its maximum rated dc voltage for 60 minutes with water applied according to the requirements of IEC 60060-1.	REPLACE: An outdoor bushing or insulator of each type shall be subjected to a wet withstand test as per Clause 10.2.2 of IEC 62199 with water applied according to the requirements of IEC 60060-1.
123.	6.10.2.2.1.c Page 115	Dielectric tests on complete divider unit	REPLACE: Dielectric tests on complete divider unit as per T.S. clause 6.9 & 6.11
124.	6.10.2.2.2 page 115		Add point g): Dry DC withstand test with voltage level and time as per T.S. clause 6.9.
125.	6.10.3.2.2.b .1 page 120	DC dry withstands test and internal partial discharge test.	REPLACE: DC dry withstands test and internal partial discharge test with voltage level and time as per T.S. clause 6.9
126.	6.10.3.3.12) Page 120 6.10.3.3.2 3) Page 122	ACCURACY TEST: New para Added	ADD at beginning of last Para : The accuracy test shall be done upto maximum overload current on the complete DCCT including shunt. Beyond this value and upto 600% of I_n , the contractor shall suggest a suitable method for verifying the accuracy.
127.	6.11.2.2.7	For 420 kV class CT's the rated extended	REPLACE:

	Page 124	primary current of the CT's shall be 200% of rated primary on all except (one) highest tap ratio. On the highest tap ratio, the rated extended primary current shall be 120%.	For 420 kV class CT's the rated extended primary current of the CT's shall be 200% of rated primary on all except (one) highest tap ratio. On the highest tap ratio, the rated extended primary current shall be 120% for line bays.
128.	6.11.5 Page 129	The technical parameters..... Of the contractor.	ADD: However, technical parameters of CTs for 400, 220, 132 kV lines and ICT shall be as per Annexure-E.
129.	6.11.3.1.b)& 6.11.3.2.b Page 128 6.12.11.1 page 145	Seismic withstand verification	REPLACE: Seismic withstand verification by calculation
130.	6.12.2.5	The Contractor shall provide controlled or point-on-wave switching for synchronous closing of converter transformer and shunt capacitor/ ac filter sub-bank circuit breakers. Controlled or point-on-wave switching shall take into account the transformer residual flux and shall be implemented with a view to minimizing the effect of inrush currents during transformer Energization. Controlled or point-on-wave switching on capacitor/ ac filter banks shall be applied to limit the effect of switching transients including	Add after first para: However, all Circuit breaker used for converter transformer at inverter station shall have both PIR and controlled or point-on-wave switching.

		those during back-to-back switching.	
131.	6.13.5 Page 160	The Contractor shall determine the technical parameters of the isolators/earth switches. The following table lists the technical parameters of the circuit breakers generally used by the Employer and are given for the information of the Contractor.	REPLACE: The Contractor shall determine the technical parameters of the isolators/earth switches. The following table lists the technical parameters of the isolators/Earthing switch generally used by the Employer and are given for the information of the Contractor
132.	6.15.2.4 Page 167	Each type of bushing..... also be conducted.	ADD: Additional type tests to be carried out if joint is provided in bushing as follows: 1. Mechanical Bonding test at Jointed Section 2. Tracking and Erosion Test(IEC-60587) 3. Water diffusion Test(Samples to be taken from jointed area) 4. 4. Gas leakage test followed by Mechanical tests at the Joint area
133.	6.15.3.5.e Page 172	e) Vibration test:	DELETE
134.	6.16.7 m) & n)		REPLACE: m) Modular Multi-diameter Cable sealing system consisting of frames, blocks and accessories to be installed wherever the electrical / instrumentation /

			<p>communication cables underground and over-ground enter or leave bay kiosks / control rooms / substations. Cable sealing to be with Multi-diameter type peel-able roxylon blocks of different sizes (20: 4mm to 14.5 mm ,30 : 10mm to 25 mm ,40: 21.5mm to 34.5mm , 60: 28mm to 54 mm , 90: 48mm to 71 mm , 120 : 67.5mm to 99 mm) to be provided for simple, easy and quick to assemble & re-assemble. 30% spare block on the frame to be provided with usable Multi-diameter blocks with center plug, so that these spare blocks can be used for expansion in future for wide range of cables, solid blocks should not be used on frame. Cable sealing system should have been type tested for fire / water / smoke tightness and supplier shall have local presence by way of full infrastructure having service support, training support and stocks support and also have necessary sales support for any change / extension in future. Frames & stay-plate material should be galvanized steel and for compression single piece wedge with galvanized steel bolts should be used.</p> <p>n) Not Used</p>
135.	6.17.2 Page 189	Figure 6.17 B&C- Siliguri(New) Converter station	Figure Revised

136.	6.17.9.1 page 192 last sentence	Refer schematic diagram for 220 V and 48V DC systems respectively.	DELETE
137.	Figure 6.17.9.1 Page 193	Figure	Figure deleted.
138.	6.17.11 Page 195	ADD new 5 th bullet	ADD as 5th bullet on page 195: ●UPS having back up time of 3 hours and connected with the station batteries shall also be acceptable. Station batteries shall be rated accordingly.
139.	6.18.2.1 page 200	The dc Batteries shall be VRLA (Valve Regulated Lead-Acid) type ...discharge type.	REPLACE: The DC Batteries shall be PLANTE Plate type....discharge type as per Annexure-M
140.	6.18.2.12 Last line Page 203	.....The battery sets shall have a minimum expected life of 20 years at float operation.	REPLACE: .....The battery sets shall have a minimum expected life as per relevant IEC.
141.	6.19.1 Para 4 Page 211	One no. DG set shall be provided for each pole per station. Each DG set shall have rating of not less than the total power required for essential load of same pole.	REPLACE: One no. generator set shall be provided for each pole per station. At Agra, CNG operated generator set to be provided. Each generator set shall have rating of not less than the total power required for essential load of same pole.

142.	6.19.4.3. vi) Page 217	Any other control and indication may recommend.	REPLACE: vi) Synchronising unit for uninterrupted return to normal after a power failure and for uninterrupted load test of the generator Set.
143.	6.19.4.3.v) Page 218	Speed and voltage control of DG Set	DELETED
144.	6.20.4 Last para Page 221	..... The degree of Protection shall be IP52.	REPLACE: .....The degree of protection shall be IP42.
145.	6.20.5.1 Para 1 Page 221	..... and those located inside shall have a degree of Protection shall be IP52 as per IS 13947:Part 1.	REPLACE: and those located inside shall have a degree of Protection shall be IP42.
146.	6.22.1	The contractor shall Other facilities due to the electrode.	REPLACE: The bidder shall suggest/evolve the Mitigation measures, if any, required outside the earth electrode station which are not attributable to defective design of electrode. These measures shall however be implemented by employer
147.	6.22.2 2 nd Bullet Page 239	Studies shall also be carried out for necessary mitigation measures against the corrosion of nearby pipelines due to ground return current.	REPLACE: Studies shall also be carried out for necessary mitigation measures to check the corrosion of nearby pipe lines Up to 5kms due to ground return current.
148.	6.22.4.2 Page 242	ADD AFTER 1 st Sentence	ADD: Manual operated disconnectors shall be provided for isolation of these sub-electrodes

			for maintenance.
149.	6.22.4.3 Para 2 Page 242	The temperature on the surface of the sub electrode shall not be higher than 90Degree centigrade for rated operation when operating at 50 deg. Centigrade ambient temperature. The maximum seasonal ambient temperature of the soil at the depth of the electrode subtracted from 90 Deg. Cetn. Shall be used for the design temperature rise of the electrode.	REPLACE: Reviewing Soil Resistivity report (shallow) at BC and KG, Vertical type Earth Electrode shall be provided. Minimum depth of the Electrode shall be 60 meter. The Boiling temperature of water shall be decided during detailed engineering as per IEC/CIGRE guidelines.
150.	6.22.7.c Page 243	Neutral DC current measurement in nearby power transformers (66kV and above), generator neutrals & Converter transformers during unbalance and ground return mode of operation.	REPLACE: Neutral DC current measurement and mitigation measures in Converter transformers & other transformers located within the converter station premises including Employer's Switchyard during unbalance and ground return mode of operation.
151.	6.23.6 Page 273	..... The contractor shall however determine and increase the tertiary winding rating as required to suit the auxiliary power requirements of the HVDC station.	REPLACE: The contractor shall select the rating of tertiary winding as required to suit the auxiliary power requirements of the HVDC station considering the up-gradation of HVDC terminal from 3000MW to 6000MW at BC & KG.
152.	6.23.6 Page 276	400/132/33 kV Transformer GTP 9. HV/LV Impedance - 60% 10. IV/LV Impedance - 45%	REPLACE: 9. HV/LV Impedance - 45% 10. IV/LV Impedance - 30%
153.	6.23.6 B22 Page 278	400/132/33 kV Transformer GTP	REPLACE: 400/132/33 kV Transformer GTP

		22. Bushing Minimum total creepage distance for 145kV is shown as 6125mm.	..... 22. Bushing Minimum total creepage distance for 145kV shall be as 3625mm.
154.	7.1.1.g) Page 1	Valve module handling equipment	REPLACE: Valve module handling and transportation equipment
155.	7.1.1 J. Page 1	Motor/Hydraulic..... of outdoor equipment.	REPLACE: Self propelled Articulated boom type man lift suitable to access for maintaining the highest installed equipment in AC/DC Yard ADD: k. Suitable maintenance tools and arrangement for lifting heavy equipments in valve cooling system/room, Pump house and mechanical workshop shall be provided. L. 2 nos. Battery operated Golf Carts per converter station suitable to carrying 500 kG weight & 2 nos. battery operated fork lifter per converter station suitable to move 500 kG and lift up to 6 feet. Battery back up time should have continuous rating for 3 hours.
156.	7.3.2.f		ADD: The technical specification for three phase UPS alongwith technical particulars to be furnished as per Annexure-I
157.	7.3.3.4 Para 1	ADD in para 1	ADD: All the stations shall have dry type coolers.

	Page 6		
158.	7.3.3.4 2 nd para Page 6	..... Whenever the ambient temperature exceeds 40°C.....	REPLACE: Whenever the ambient temperature exceeds 44°C at Agra and 35°C at BC and KG or during overload
159.	7.3.3.15 2 nd para Page 9	Besides these detection method..... of HVDC terminal.	REPLACE: Besides these detection methods, alarm for frequent make up and for long make up when automatic make-up of cooling water is used , generated by..... Of HVDC Terminal.
160.	7.4.3.1.1 second para page 10	The ventilation system shall be a closed cycle with fresh air intake limited to a maximum of 2% of the total air requirement. Once through ventilation system will not be acceptable. Dampers used in the ventilation system shall be normally closed and will be opened under high pressure/emergency conditions only. To ensure that the air being supplied.....	The ventilation system shall be a closed cycle with fresh air intake limited to a maximum of 20% of the total air requirement. Once through ventilation system will not be acceptable. Exhaust Dampers in the valve hall shall be normally closed and will be opened under high pressure/emergency conditions only. To ensure that the air being supplied.....
161.	7.4.3.1.1 last para Page 11	.... The pressure inside valve hall shall be at least 7 mm of water Column over the pressure outside the valve hall for total duration of test.	REPLACE: the pressure inside valve hall shall be at least 3 mm of water Column over the pressure outside the valve hall for total duration of test.
162.	7.4.3.1.2 Page 11	Ventilation system for indoor DC yard	REPLACE: In Indoor DC switchyard air shall be re-circulated at least once every 4(four) hours. However the pressure inside DC yard shall be 1 mm of water column over the pressure outside the dc Yard.
163.	7.5.4.2 Page 22 Ist	An independent....for air sampling. The design of the VESDA..... Shall be actuated	REPLACE: ANNEXURE-N

	and IInd para		
164.	7.5.4.2 Page 23	In addition, a secondary fire detector using UV sensor to detect .....necessary redundancy	REPLACE: Suitable VESDA detector to detect the flashover inside the Valve Hall to be provided.
165.	7.5.4.3 2 nd para Page 23	The smoke detectors shall be plug-in type, with two ionization chambers and shall have..... maximum corrosion resistance.	REPLACE: At least two smoke detectors employing different principle of detection shall be provided in each fire zone. The smoke detectors shall be plug in type.
166.	7.5.4.3 last para page 23	The indoor DC yard.....necessary redundancy.	REPLACE: Suitable nos of VESDA detectors to detect the flashover/early smoke inside the Valve Hall to be provided. The VESDA for indoor DC yard shall be inline with that of Valve hall.
167.	7.5.5.2 2 nd para Page 31	....The effective reach of CO2 gas jet release shall be sufficient to fight small fires that could develop in a valve structure (up to top level)	REPLACE: ....The effective reach of CO2 gas jet release shall be sufficient to fight small fires that could develop in a valve structure
168.	7.6.1 Last bullet Page 33	Detection of RF generation inside the indoor DC yard	DELETE
169.	7.6.6 Page 38 to 44	CCTV	REPLACE With ANNEXURE-P
170.	7.11.5		TS CLAUSE STANDS DELETED
171.	8.2.3.1	The Contractor shall collect undisturbed	REPLACE:

	3rd Para page 55	samples of 100/75 mm diameter 450 mm long from the bore holes at intervals of 2.5 m and every change of stratum starting from 1.0_m below ground level onwards in clayey strata.	The Contractor shall collect undisturbed samples of 100/75 mm diameter 450 mm long from the bore holes at intervals of 2.5 m and every change of stratum starting from 0.5 m below ground level onwards in clayey strata.
172.	8.2.3.4 para 2 page 56	Undisturbed tube samples shall be collected at 1.0 m and 2.5m depths from natural ground level for carrying out laboratory tests	REPLACE: Undisturbed tube samples shall be collected at 0.5 m and 2.5m depths from natural ground level for carrying out laboratory tests
173.	8.3.5.1.1 page 62	"One Test" shall be conducted for every 500 cu.m	REPLACE: "One sieve analysis test" shall be conducted for every 500 cu.m
174.	8.3.5.1 .2 Para 5 page 64	Over the prepared sub grade, 75mm thick base layer of cement concrete in 1:5:10 (1 cement: 5 fine sand: 10 burnt brick aggregate) shall be provided ...in the engineering drawing.	REPLACE: Over the prepared sub grade, 75mm thick base layer of cement concrete in 1:4:8 (1 cement: 4 fine sand: 8 burnt brick aggregate/ stone aggregate) shall be provided... in the engineering drawing. ADD: In case acceptable quality of burnt brick aggregate is not available in any of the locations stone aggregate shall be used without any financial implication to POWERGRID
175.	8.3.5.1 .2 Para 5	The above slope shall be provided at the top of base layer of cement concrete <u>in 24</u>	REPLACE: The above slope shall be provided at the top of base layer of cement concrete.

	page 64	<u>hours after laying of the cement concrete</u>	
176.	8.3.7.1 (iii) page 65	Open surface rectangular brick drains having minimum 400mm width and .....shall be provided.	REPLACE: Open surface rectangular brick drains having minimum 400mm width and .....shall be provided. The base of the brick drain shall be in two layers. A layer of 100 mm thick 1:2:4 of PCC shall be laid over a layer of 40 mm thick 1:4:8 mix laid over well compacted earth.
177.	8.3.7.1 (v) page 65	Open surface drains shall be constructed .....1:4:8 (1 cement: 4coarse sand: 8 stone aggregate 20mm nominal size.)	DELETE: (v)
178.	8.4.1.2 page 69	Concrete shall conform to the requirements mentioned in CPWD specification and all the tests shall be conducted as mentioned in Standard field quality plan appended with the specification. A minimum grade of M20 concrete shall be used for all structural/load bearing members. Nominal mix by volume 1:1.5:3 (1cement: 1.5 coarse sand: 3stone aggregate 20mm nominal size) shall be used for all RCC works. Higher grades of concrete can be allowed if Contractor carries out mix design and installs a batching plant or arranges the concrete from a approved ready mix concrete	REPLACE: Reinforced Concrete shall conform to the requirements mentioned in IS 456 (latest version). A minimum grade of M 25 concrete shall be used for all structural/load bearing members for all RCC works in the terminal stations. Only weigh batching shall be allowed for design mix concretes. <u>ADD:</u> All the tests shall be conducted as mentioned in the IS 456 for design mix concretes and will supersede the relevant sections of Standard field quality plan appended with the specification.

		supplier	In case of repeater stations where the concrete volume is very small nominal mix conforming to CPWD specification may be used.
179.	8.4.1.3 page 70	Where the site is inclined, the foundation height shall be adjusted to maintain the exact level of the top of structures to compensate such slopes	DELETE:
180.	8.4.1.4 PAGE 70	The switchyard foundations plinth and building plinth shall be minimum 300 mm and 500 mm above finished ground level respectively	REPLACE: The switchyard foundations plinth and building plinth shall be minimum 300 mm and 750 mm above finished ground level respectively
181.	8.4.1.6 PAGE 70	Concrete made with ordinary Portland cement shall be of shuttering. Portland pozzolone / slag...approval of Employer.	REPLACE: Concrete made with Portland Pozzolana or slag cements cement shall be..... of shuttering. In case of encountering of aggressive soils and sub soil water OPC/PPC Sulphate resisting cement shall be used for foundations as per the provisions of IS 456
182.	8.4.2.3 page 70	Cold twisted deformed bars (Fe=415 N/mm ²).....reinforcement. However, in .....per IS: 456 (latest).	REPLACE: Cold twisted deformed bars (Fe=415 N/mm ²) ...reinforcement. In line with provisions of IS 13920 high strength deformed steel bars, produced by thermo-mechanical treatment process, of grades Fe 500 & Fe 550, having

			elongation more than 14.5% and conforming to other requirements of IS 1786:1985 may also be used for the reinforcement. However, in .....per IS: 456 (latest).
183.	8.4.2.8 page 71	All foundations shall rest below virgin .....specific approval of the Employer	REPLACE: All foundations shall extend to a depth of atleast 500 mm below virgin ground level as stipulated in IS 1904. For small structures like minor foundations of marshalling kiosks, fire fighting pipe line pylon supports, fencing posts, cable trenches, drains, etc., coming in filled up soil this stipulation shall not be applicable. In such cases a layer of 200 mm thickness of stone ballast filled with local sand shall be provided on compacted soil layer (minimum 95% compaction) before laying PCC
184.	8.4.2 page 73		ADD: .24 Equipment foundations shall be designed for a factor of safety of 2.2 for normal and 1.65 for short circuit condition
185.	8.5.1 page 75	RCC trenches and pre-cast removable concrete covers (with lifting arrangement) shall be designed to withstand loads of 1000 kg/m ² earth pressure	REPLACE: RCC trenches and pre-cast removable concrete covers (with lifting arrangement) shall be designed to withstand surcharge loads of 1000 kg/m ² earth pressure

186.	8.5.2 page 75	Trenches shall be of reinforced cement concrete, having minimum M-20 grade...	REPLACE: Trenches shall be of reinforced cement concrete, having minimum M-25 grade...
187.	8.7.2 Para 1 Page 81		ADD: However, the firewalls around transformers shall have a minimum fire resistance of 4 hours as per IE rules.
188.	8.7.3 para 3 page 81	The firewall shall be made of reinforced concrete (M-20 grade), as per the system requirements	REPLACE: The firewall shall be made of reinforced concrete (M-25 grade), as per the system requirements
189.	8.8.2 page 84		ADD: .10 Soft copies of designs and drawings shall be submitted for approval along with hard copies for all structures. Single user package of licensed soft ware shall be provided for checking the drawings and designs
190.	8.9.2 a) page 85	Chain link fence fabric (without galvanization) in accordance to IS:2721	REPLACE: Galvanised Chain link fence fabric in accordance to IS:2721:2003
191.	8.9.2 d. v) page 87	Fence fabric panel shall be fixed to the post by 4 nos. MS flat each of 50x6, 75 long through 2 nos. of bolts (12 diameters) on each flat	REPLACE: Fence fabric panel shall be fixed to the post by 4 nos. GI flat each of 50x6, 75 long through 2 nos. of bolts (12 diameters)

			on each flat.
192.	8.9.2 d. vi) page 87		DELETE:
193.	8.9.2 f) page 87	Electrode station Fencing: .....There shall be nine parallel horizontal lines of barbed wire	REPLACE: Repeater Station Fencing: .....There shall be nine parallel horizontal lines of galvanized barbed wire.....
194.	8.10.1.5.2 page 91	Structural design calculations and drawings (including construction/fabrication) for all reinforced concrete and structural steel structures	REPLACE: Structural design calculations and drawings(including construction/fabrication) both hard and soft copies for all reinforced concrete and structural steel structures
195.	8.10.1.6 para 3 page 92	Ground floor slab of buildings shall be of RCC of M20 grade, minimum....	REPLACE: Ground floor slab of buildings shall be of RCC of M25 grade, minimum....
196.	8.10.2.5 page 96		ADD AT LAST PARA: A closed circuit television (CCTV) Surveillance system shall be provided for vigilance in each valve hall. The CCTV System shall consist of four remotely controlled video cameras per valve hall, two monitors, a keyboard and a control cabinet including required Quad Units and a Video Matrix Switcher. The keyboard

			shall be used to control the cameras and to control what pictures are shown on the different monitors. The pictures from each valve hall shall be displayed on a 21" quad monitor located in the operator control room. The quad monitor shall facilitate display of all four images simultaneously on the monitor or any single image by choice. The monitors and the digital keyboard shall be located in the operator control room.
197.	8.10.3.5 Page 101		REPLACE EXISTING CLAUSE: INDOOR DC YARD AT AGRA The indoor DC yard building shall be built adjacent to the valve hall. Suitable lifting and shifting arrangements for equipments shall be made available inside the building. The floor of the indoor DC yard shall have a heavy duty floor slab suitable for movement of heavy equipment.
198.	8.10.4.1.6 2 nd Para page 103	The above specified RCC approach shall be with M 15 grade....	REPLACE: The above specified RCC approach shall be with M 25 grade
199.	8.10.4.3.6 page 105	.....RCC pre-cast units of minimum M-20 grade as per IS-456.	REPLACE: ...RCC pre-cast units of minimum M-25 grade as per IS-456.
200.	8.10.4.6.1	All the doors, windows and ventilators of	REPLACE:

	page 106	buildings and windows/ventilators provided on the outer face shall be of aluminium	All the doors, windows and ventilators of buildings and windows/ventilators provided on the outer face shall be of heavy duty aluminium sections.
201.	8.10.4.6.4 page 106	All windows shall be of aluminium frame	REPLACE: All windows shall be of heavy duty aluminium frame
202.	8.11.1 page 109	Dense concrete with controlled water cement ratio preferably 0.45 shall be used	REPLACE: Dense concrete with controlled water cement ratio preferably 0.45 (As per IS 456) shall be used
203.	8.11.1 2nd Para page 109	For all civil works covered under this specification, nominal mix by volume batching. The relationship of grade.....	REPLACE: For all civil works covered under this specification design mix concrete is intended in conformity to IS 456. However, in case of repeater station work where, nominal mix by volume batching as per CPWD specification is intended the relationship of grade of....
204.	8.11.1 para 3 page 109	The material specification, workmanship and acceptance criteria shall be as per relevant clauses of CPWD specification and approved Field Quality Plan	REPLACE: The material specification, workmanship and acceptance criteria shall be as per the provisions of IS 456:2000 In case of nominal mixes relevant clauses of CPWD specifications shall be adopted. Approved Field Quality Plan shall be followed for adherence to quality norms

205.	9.3.6 Page 124	New Para Added	ADD new para at the end of Cl. 9.3.6: h) All the system tests shall be performed by realising the grounding first at Earth Electrode Station and Secondly with grounding at converter station.
206.	9.5 Page 130	The test equipments....shall be properly adjusted & calibrated.	The test equipments....shall be properly adjusted & calibrated and performance demonstrated at site. In order to address issue of warranty / after sales services, Single sub-vendor supplying all test equipments shall be preferred.
207.	9.5.1 from page 131 to 148	Table from item no 1 to 36	REPLACE: Annexure-J
208.	9.5.1 Page 148		ADD at the end of TS clause 9.5.1, Page 148: Operation and Maintenance Equipment 37. Off line Fault locator as per Cl. 4.6.8 38. LCM as per Cl. 6.3.4 39.Tools and plant for transformer as per 6.4.5 40.Set of trolleys as per 6.4.6.2 41. Portable Multigas analyser as per cl. 6.4.6.19 42. Tools for CB and leak detector as per cl. 6.12.6 43. Battery Tools as per Cl 6.18.2.13 44. Mobile treatment plant as per Cl 7.7.2 45. Dynamic Contact Resistance Measurement Kit
209.	11.2 Last para	The above guarantees shall be given by the Contractor on bipole basis, i.e. for Biswanath Chariali-Agra and Siliguri (New)-Agra	ADD: Except when in one polarity there is an outage of one pole of a rectifier and an overlapping

	Page 169	separately. The penalties specified shall also be on the basis of each Bipole separately.	outage in the same polarity pole of the inverter of the other bipole. In such a case the unavailability shall be counted with 50% in each of the bipole.
210.	11.5.1 Para 2 Page 173		ADD: Reliability and Availability shall be determined for HVDC station and excludes extra conventional AC switchyard, auto-transformer etc. included in scope of this Contract.
211.	11.5.1 Para 3 Page 173	..... on a complete bipole basis for all.....	REPLACE: .....on each complete bipole basis for all.....
212.	11.5.2 Para 1 Line 1 Page 175	.... Of the complete bipole basis....	REPLACE: .....Of each of the complete bipole basis
213.	11.7.1 Para 1, line 6 Page 176	..... after successful completion of trial operation of complete multi-terminal HVDC systems.	REPLACE: after successful completion of trial operation of respective Bipole HVDC systems.
214.	11.8.1, 11.8.2 & 11.8.3 Page 180 to 182	AVAILABILITY REQUIREMENT	REPLACE: 11.8 AVAILABILITY REQUIREMENT The following availability requirements shall be guaranteed by the bidder for each bipole separately:

			<table><tr><td>Forced Energy Unavailability (FEU)</td><td>≤0.7%</td></tr><tr><td>Energy Availability (EA)</td><td>≥97%</td></tr></table> <p>The above shall be calculated for the each complete bipole, considered on a 12 (consecutive) month’s basis.</p> <p>The availability requirements (FEU & EA) of each complete bipole shall be monitored during the availability guarantee period. A preventative maintenance check shall be carried out immediately before the start of the said period.</p> <p>The Employer shall maintain records of the number and duration of forced and scheduled outages, and the amount of HVDC system capacity reduction resulting from each outage. The effect of overload capability of the HVDC system shall not be considered.</p> <p>Classification of outages into transient, forced and scheduled outages shall be in accordance with definitions given in Clause 11.4.1.</p> <p>If the FEU and Energy Availability levels achieved do not meet the guarantees specified, the Contractor shall make a thorough analysis of the causes and take appropriate remedial action to improve the performance. Implementation of corrective actions shall be subjected to the approval of the</p>	Forced Energy Unavailability (FEU)	≤0.7%	Energy Availability (EA)	≥97%
Forced Energy Unavailability (FEU)	≤0.7%						
Energy Availability (EA)	≥97%						

			<p>Employer. All costs towards such implementation of corrective actions shall be borne by the Contractor. All scheduled outages thereby required shall be included in the calculation of the scheduled outage times for the affected pole or poles unless any other mutual agreement has been reached between the Employer and Contractor. The fulfillment of the Availability Guarantees shall be as follows:</p> <p>i) <u>Forced Energy Unavailability (FEU):</u></p> <p>For fulfillment of the Forced Energy Unavailability (FEU), the following shall apply:</p> <ol style="list-style-type: none"> 1. The Forced Energy Unavailability (FEU) shall be calculated for each year for three years continuously and if FEU is $\leq 0.7\%$ for each year, then the FEU guarantee shall be considered as fulfilled. 2. If the FEU is above the guaranteed value for any year(s), the guarantee period shall be extended for the year(s) (maximum three years) in which FEU is greater than 0.7%. If at the end of the extended year(s), the FEU in the best three years (out of total period including extended year(s)) is $\leq 0.7\%$, the FEU guarantee shall be considered as fulfilled.
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			<p>3. If the FEU as referred under (2) is not fulfilled, the Contractor shall correct all design deficiencies and equipment defects at no cost to the Employer.</p> <p>4. After correction of such deficiencies and defects,</p> <p>i) If the average annual FEU calculated over a further two year period (excluding the previous years and the period for correcting the deficiencies) is $\leq 0.7\%$, then the FEU guarantee shall be considered as fulfilled.</p> <p>ii) If the average annual FEU calculated over the two year period for each bipole (excluding the previous years and the period for correcting deficiencies) is $\leq 2\%$, then the FEU guarantee shall be considered as fulfilled. However the Contractor shall pay to Employer liquidated damages calculated as given below:</p> <p>Liquidated damages = Rs. 45 Million for each 0.1 % or part thereof for FEU greater than 0.7%. Compensation shall be paid up to maximum Rs. 450 Million for not meeting the guaranteed FEU.</p> <p>ii) <u>Energy Availability (EA)</u></p> <p>1. Annual energy availability shall be</p>
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			<p>calculated for each year for three years continuously and if energy availability is $\geq 97\%$ for each year, then the availability guarantee shall be considered as fulfilled.</p> <p>2. If the annual energy availability is below the guaranteed value for any year(s), the guarantee period shall be extended for the year(s) (Maximum three years) in which annual energy availability is less than 97%. If at the end of the extended year(s), the energy availability in the best three years (out of total period including extended year(s)) is $\geq 97\%$, the availability guarantee shall be considered as fulfilled.</p> <p>3. If the annual energy availability as referred under (2) is not fulfilled, the Contractor shall correct all design deficiencies and equipment defects at no cost to the Employer.</p> <p>4. After correction of such deficiencies and defects,</p> <p>i) If the average annual energy availability calculated over a further two year period (excluding the previous years and the period for correcting the deficiencies) is $\geq 97\%$, then the availability guarantee shall be considered as fulfilled.</p> <p>ii) If the average annual energy</p>
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			<p>availability calculated over the two year period for each bipole (excluding the previous years and the period for correcting deficiencies) is $\geq 96\%$, then the availability guarantee shall be considered as fulfilled. However the Contractor shall pay to Employer liquidated damages calculated as given below:</p> <p>Liquidated damages = Rs. 45 Million for each 0.1 % or part thereof for average availability below 97%. Compensation shall be paid up to maximum Rs. 450 Million for not meeting the guaranteed energy availability.</p> <p>5. In case average annual energy availability for each bipole as described in Para (4) above, is found to be below 96% the Contractor shall replace the plant/equipment as identified by the Employer at no cost to the Employer. In case of default, the Employer may reject the plant and recover the amount paid to the Contractor as per relevant clauses of GCC.</p>
215.	11.8.3 Para 2 page 182	The availability of overload capacity and capability shall be 99.9%	<p>REPLACE: The availability of overload capacity and capability shall be 99.8%</p>

	Para 3	The penalty for not meeting Average availability below 99.9%	The penalty for not meeting Average availability below 99.8%
216.	11.10.1 Page 186	Added losses for Shunt Reactor	ADD: FOR 420kV REACTOR LOSSES: INR 400,000 per KW
217.	11.12.1	The maximum annual guaranteed thyristor failure rate shall not exceed 0.2%.	The maximum annual guaranteed thyristor failure rate shall not exceed 0.2% per 12 pulse valve group.
218.	11.13 TITLE	CAPACITOR FAILURE RATE GUARANTEE	REPLACE: AC/DC FILTER CAPACITOR FAILURE RATE GUARANTEE
219.	11.13.1 Page 189	The maximum guaranteed annual capacitor failure rate shall not exceed 0.15%. The capacitor shall be considered as failed if its Capacitance value varies more than $\pm 5\%$ of the name plate value..... with in the tolerance limit.	REPLACE: The maximum guaranteed annual capacitor failure rate shall not exceed 0.15% except first unit failure. The capacitor shall be considered as failed if its Capacitance value varies more than $\pm 5\%$ of the (actual measured) name plate value..... with in the tolerance limit.
220.	11.13 Last para	For low voltage capacitors, for every failure of capacitor up to the availability reliability period, double the number of failed capacitors shall be provided.	REPLACE: For low voltage capacitors, for every failure of capacitor (After first two unit of each type, or 50% of spare units; which ever is lower) up to the availability reliability period, double the number of failed capacitors shall be provided.
221.	11.14 Page 190	The contractor shall and shall provide the required mitigation measures to reduce the number of flashover within guaranteed value.	REPLACE: Bidder may propose indoor DC yard arrangement or outdoor arrangement or Combination of indoor & Outdoor DC yard to fulfill the guaranteed flashover requirement as

			<p>follows:</p> <p>The Contractor shall guarantee that there shall be not more than two pollution related flashovers per Bipole in a year in the DC yard. The number of flashovers shall be monitored on a bipole basis over a period of three years starting at the end of six months following trial operation of each bipole of the multi terminal HVDC system. If the number of flashovers during these three years is within the guaranteed value, the guarantee shall be considered as fulfilled otherwise the guarantee period shall be extended by one more year. If the number of flashovers for three out of the four years, disregarding the year (any consecutive 12 months) with the highest number of flashovers is equal to or lower than the guaranteed value then flashover guarantee is considered to be fulfilled. If the number of flashovers averaged over the best three years is still above the guaranteed value, the Contractor shall provide the required mitigation measures to reduce the number of flashover within the guaranteed value. After the necessary mitigation measures, the flashovers shall be monitored for a further period of two years and if the average number of flashovers averaged over the two years are within the guaranteed value, the flashover guarantee would be considered as fulfilled. If the number of flashovers is still above the guaranteed value, then it shall be dealt as per GCC clause F "Guarantee and Liability".</p>
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