

**Addendum - I for technical specification for
STATIC SYNCHRONOUS COMPENSATOR (STATCOM)
(GETCO / E / TS- STATCOM 045 / R1, Aug-2024)**



For technical specifications of **STATIC SYNCHRONOUS COMPENSATOR (STATCOM) (GETCO / E / TS- STATCOM 045 / R1, Aug-2024)** technical requirements shall be considered as follow.

SN	Clause no.	Description	Changes to be considered												
1.	2	Relevant Standard	To consider:												
		<table><tr><th>Item</th><th>Description</th><th>Standard Technical Spec reference for routine items</th></tr><tr><td>14</td><td>Cyber Security</td><td>IEC 62243</td></tr></table>	Item	Description	Standard Technical Spec reference for routine items	14	Cyber Security	IEC 62243	<table><tr><th>Item</th><th>Description</th><th>Standard Technical Spec reference for routine items</th></tr><tr><td>14</td><td>Cyber Security</td><td><u>IEC 62443</u></td></tr></table>	Item	Description	Standard Technical Spec reference for routine items	14	Cyber Security	<u>IEC 62443</u>
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2.	3	<p>Scope of Work</p> <p>- The total cumulative Capacitive (+ve) and Inductive (-ve) MVAR rated Capacity of STATCOM Station comprising of STATCOM, Coupling Transformer, Coupling Reactor or any filter (if applicable) shall be rated at 1 p.u. voltage, 1 p.u. frequency and 20 deg C ambient temperature at 220 kV Bus (Referred to as “Point of Common Coupling” or PCC).</p>	<p>To be consider:</p> <p>- The total cumulative Capacitive (+ve) and Inductive (-ve) MVAR rated Capacity of STATCOM Station comprising of STATCOM, Coupling Transformer, Coupling Reactor or any filter (if applicable) shall be rated at 1 p.u. voltage, 1 p.u. frequency and 50 deg C ambient temperature at 220 kV Bus (Referred to as “Point of Common Coupling” or PCC).</p> <p>- <u>New clause</u></p> <p><u>The Contractor shall carry out a detailed study on prevailing system conditions before interconnection of the STATCOM to assess the performance of the STATCOM. Parameters tuning to avoid any adverse impact on the grid with integration of the STATCOM shall also be identified and implemented.</u></p>												

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			<p><u>The contractor shall ensure interconnection study at the time of commissioning and shall also be responsible for tuning the POD as per relevant standards (e.g. IEEE 1052).</u></p> <p><u>The Contractor shall carry out tuning of Power Oscillation damping (POD) along with an interaction study with nearby HVDC/FACTS controllers if available.</u></p>						
3.	4	<p>Ambient Condition</p> <p>STATCOM Station should be designed to perform under the ambient conditions as specified in substation details annexure.</p>	<p>To be consider:</p> <p>STATCOM Station should be designed to perform at <u>50 Degrees C ambient temperature.</u></p>						
4.	5.1	<p>5.1 STATCOM Station Rating</p> <p>b) The nominal capacitive and inductive reactive power output of the STATCOM should be as defined at 1.0 p.u. ac bus voltage and nominal system frequency, and 20 °C ambient temperature. (Point A and Point B of figure-2)</p> <p>d) The STATCOM Station should continue to generate reactive power during temporary under voltage down to 33kV (0.15pu) for the duration 5 sec (Point C); the STATCOM system may be tripped (or blocked) if the under voltage persists for more than 5 sec.</p> <p>e) The STATCOM should continue to absorb reactive power during temporary over voltages in a controlled manner as per the following</p> <table><tr><td>Temporary Overvoltage (at PCC)</td><td>Duration</td></tr><tr><td>Up to 330kV (1.5PU)</td><td>10 seconds</td></tr><tr><td>up to 387 kV (1.76pu)</td><td>100 m sec</td></tr></table>	Temporary Overvoltage (at PCC)	Duration	Up to 330kV (1.5PU)	10 seconds	up to 387 kV (1.76pu)	100 m sec	<p>To consider:</p> <p>b) The nominal capacitive and inductive reactive power output of the STATCOM should be as defined at 1.0 p.u. ac bus voltage and nominal system frequency, and <u>50 °C</u> ambient temperature. (Point A and Point B of figure-2)</p> <p>d) The STATCOM Stations shall continue to <u>inject</u> reactive power during temporary under voltage down to 33 kV (0.15 pu) for the duration <u>0.3</u> sec (Point C) <u>and STATCOM behavior for voltages above 0.15 pu shall be as specified under section Annexure-II;</u> the STATCOM system may be tripped (or blocked) if the under voltage persists for <u>time limits specified under section Annexure-II.</u></p> <p>e) The STATCOM should continue to absorb reactive power during <u>HVRT condition</u> in a controlled manner as per the following</p>
Temporary Overvoltage (at PCC)	Duration								
Up to 330kV (1.5PU)	10 seconds								
up to 387 kV (1.76pu)	100 m sec								

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		<table><tr><td>up to 440 kV (2.0pu)</td><td>50 m sec</td></tr></table> <p>STATCOM Station may be tripped or blocked if the respective temporary over voltages as mentioned above persists for more than its respective mentioned duration.</p>	up to 440 kV (2.0pu)	50 m sec	<table><tr><th><u>Nominal Voltage (pu)</u></th><th><u>Minimum time for remaining connected to the Grid</u></th></tr><tr><td><u>V > 1.50</u></td><td><u>Instantaneous trip</u></td></tr><tr><td><u>1.50 ≥ V > 1.30</u></td><td><u>100 Milli seconds</u></td></tr><tr><td><u>1.30 ≥ V > 1.10</u></td><td><u>10 Seconds</u></td></tr><tr><td><u>V ≤ 1.10</u></td><td><u>Continuous</u></td></tr></table> <p>STATCOM Station may be tripped or blocked if the respective temporary over voltages as mentioned above persists for more than its respective mentioned duration.</p>	<u>Nominal Voltage (pu)</u>	<u>Minimum time for remaining connected to the Grid</u>	<u>V > 1.50</u>	<u>Instantaneous trip</u>	<u>1.50 ≥ V > 1.30</u>	<u>100 Milli seconds</u>	<u>1.30 ≥ V > 1.10</u>	<u>10 Seconds</u>	<u>V ≤ 1.10</u>	<u>Continuous</u>
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5.	6.1.1	<p>Control Objectives</p> <p>The control system shall control the STATCOM required under this technical specification, as well as any existing switchable capacitor and reactor banks installed.</p> <p>Operation logic for the breakers, disconnectors and earth-switches in the STATCOM Station shall also be incorporated in the control system. The control shall be programmable and shall have sufficient scope and flexibility to permit re-programming according to future changes/addition in the power system. The operator interface must be integrated in a latest version of Windows environment.</p>	<p>To consider</p> <p>The control system shall control the STATCOM required under this technical specification, as well as any existing switchable capacitor and reactor banks installed.</p> <p>Operation logic for the breakers, disconnectors and earth-switches in the STATCOM Station shall also be incorporated in the control system. The control shall be programmable and shall have sufficient scope and flexibility <u>(software programming margin of at least 20%)</u> to permit re-programming according to future changes/addition in the power system. The operator interface must be integrated in a latest version of Windows environment.</p>												
6.	6.1.2.6	<p>Damping of Power Oscillations</p> <p>The STATCOM shall provide necessary damping to power oscillations by modulating its output in its entire range based on measured active power or rate of change of frequency at the 220kV bus. The damping controller would track local area</p>	<p>Damping of Power Oscillations</p> <p>The STATCOM shall provide necessary damping to power oscillations by modulating its output in its entire range based on measured active power or rate of change of frequency at the 220kV bus. The damping controller would track local area oscillations as well as wide area oscillations and control would</p>												

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		oscillations as well as wide area oscillations and control would include several loops each focused on different frequency.	include several loops each focused on different frequency. <u>Bidder shall ensure the damping of oscillation as per relevant standards. (e.g. IEEE 1052).</u>
7.	6.1.3, (Pg.9 & 10)	<p>Under Voltage Strategy:</p> <p>It is essential that the STATCOM Station operates in a robust manner when transmission system under voltages appears. For transmission system voltages down to <u>0.15 pu</u>, the STATCOM units must operate unrestricted, producing its rated capacitive current. The STATCOM must be designed to operate at transmission system under voltage, even considering that severe voltage unbalance can appear. The STATCOM must not be restricted by short term negative sequence voltages up to 1.5%, appearing in conjunction with under voltages. The bidder shall provide at the time of detailed engineering, a plot of the STATCOM output versus different AC voltage unbalances.</p> <p>Transmission system under voltages below 0.15 pu can appear in conjunction with transmission system faults. The STATCOM must ride through during faults and post fault under voltages. The minimum trip delay for the STATCOM Station, upon complete loss of the transmission system voltage shall not be less than 5 seconds. If station AC auxiliary power distribution is affected, critical loads must be fed from DC station batteries, UPS without tripping the STATCOM Station. Adequate capacity must be kept in DC station batteries, UPS to feed critical loads for smooth operation of the STATCOM Station facility. There must be</p>	<p>To consider:</p> <p>It is essential that the STATCOM Station operates in a robust manner when transmission system under voltages appears. <u>In case of single phase or three phase faults, the STATCOM units must operate unrestricted, producing its rated capacitive current for transmission system voltages down to 0.15 pu In case of two phase fault, STATCOM shall be capable to produce rated capacitive current at least down to 0.3 pu, however, it shall be designed to operate up to 0.15 pu.</u> The STATCOM must be designed to operate at transmission system under voltage, even considering that severe voltage unbalances can appear. The STATCOM must not be restricted by short term negative sequence voltages up to 1.5%, appearing in conjunction with under voltages. The bidder shall provide at the time of detailed engineering, a plot of the STATCOM output versus different AC voltage unbalances.</p> <p>Transmission system under voltages below 0.15 pu will appear in conjunction with transmission system faults. The STATCOM must ride through during faults and post fault under voltages. The minimum trip delay for the STATCOM Station, upon complete loss of the transmission system voltage shall not be less than 5 seconds. If station AC auxiliary power distribution is affected, critical loads must be fed from DC station batteries, UPS without</p>

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		<p>redundant station battery system with each station battery system capable of delivering 100% load.</p> <p>At under voltage conditions for the transmission system voltage, special control strategies are activated which override the normal control modes presented above. Normally if the voltage is low, the output from the STATCOM will be capacitive. If the voltage in all three phases goes below a level specified by the Bidder, but not greater than 0.15 pu, a special under voltage strategy may be activated that controls the STATCOM output to 0 Mvar. As soon as the voltage goes higher than 0.15 pu, the under voltage strategy shall be deactivated and the normal control will be in operation.</p> <p>The STATCOM Station must not be tripped or shutdown automatically for under voltages for duration specified in 5.1c. STATCOM Station must continue to operate at AC system Voltage at any or all the phase dips up to - 0.15 pu.</p>	<p>tripping the STATCOM Station. Adequate capacity must be kept in DC station batteries, UPS to feed critical loads for the smooth operation of the STATCOM Station facility. There must be redundant station battery system with each station battery system capable of delivering 100% load.</p> <p>At under voltage conditions for the transmission system voltage, special control strategies are activated which override the normal control modes presented above. Normally if the voltage is low, the output from the STATCOM will be capacitive. If the voltage in all three phases goes below a level, but not greater than 0.15 pu, a special under voltage strategy may be activated that controls the STATCOM output to 0 MVAR. As soon as the voltage goes higher than 0 0.15 pu, the under voltage strategy is deactivated and the normal control will be in operation.</p> <p>The STATCOM Station must not be tripped or shut down automatically for under voltages for duration specified in 5.1c. STATCOM Station must continue to operate at AC system Voltage at any or all the phases dips down to 0.15 pu.</p>
8.	6.1.4, d)	<p>Over Voltage Strategy</p> <p>d) The contractor shall demonstrate to the satisfaction of the Employer that STATCOM Station will not excite ferro-resonance and sub-synchronous oscillation in the AC system.</p>	<p>To consider:</p> <p>d) The Bidder shall demonstrate to the satisfaction of the Employer that STATCOM Station will not excite ferro-resonance and sub-synchronous oscillation in the AC system. <u>This shall be verified by measuring ferro-resonance and sub-synchronous oscillations in the AC system at time of commissioning. If STATCOM Station is found to excite ferro-resonance and sub-synchronous oscillation in the AC system, then bidder shall take all necessary corrective measures to mitigate them.</u></p>

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9.	6.4	<p>6.4 Broadband Interference</p> <p>6.4.1 Radio Interference</p> <p>a) With the STATCOM Station operating at any load up to rated value and within the design range of firing angle, the radio interference level from electromagnetic or electrostatic inductions generated by the STATCOM station shall not exceed 100 micro-volts/m, under fair weather conditions, at any point outside the station fence. The RIL criteria shall be achieved at all frequencies within the range of 150KHz to 300MHz and with the STATCOM operation at any level up to and including rated value, the design shall provide correcting measures, should the specified design not being realized in the final installation.</p>	<p>To consider:</p> <p>6.4.1 Radio Interference</p> <p>a) With the STATCOM Station operating at any load up to rated value and within the design range of firing angle, the radio interference level from electromagnetic or electrostatic inductions generated by the STATCOM station shall not exceed 100 micro-volts/m, under fair weather conditions, at <u>500 m away from STATCOM fence or boundary the substation whichever is higher.</u> The RIL criteria shall be achieved at all frequencies within the range of 150KHz to 300MHz and with the STATCOM operation at any level up to and including rated value, the design shall provide correcting measures, should the specified design not being realized in the final installation. <u>In case of any third party complaints about the radio interference, suitable measures shall be implemented by the Bidder.</u></p>
10.	6.6	<p>6.6 Loss Requirement</p> <p>6.6.1 For bid evaluation purposes the losses will NOT be evaluated. The bidder must guarantee the total losses of STATCOM Station, be less than 1% of the reactive power output individually at its inductive limit and capacitive limit for the cumulative highest reactive power output of STATCOM Station at PCC with worse combination of manufacturing tolerances. For the purpose of total loss measurements, it should be assumed that ambient temperature is 20°C, the PCC voltage & frequency is 1 per unit, and the slope setting is 1 %. The STATCOM Station may not operate at these conditions, but they provide a common base.</p>	<p>To consider:</p> <p>6.6.1 For bid evaluation purposes the losses will NOT be evaluated. The bidder must guarantee the total losses of STATCOM Station, be less than <u>1.5%</u> of the reactive power output individually at its inductive limit and capacitive limit for the cumulative highest reactive power output of STATCOM Station at PCC with worse combination of manufacturing tolerances. For the purpose of total loss measurements, it should be assumed that ambient temperature is 20°C, the PCC voltage & frequency is 1 per unit, and the slope setting is 1 %. The STATCOM Station may not operate at these conditions, but they provide a common base.</p>

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11.	6.7.1	Arrestors <table><tr><td></td><td>SIWL</td><td>LIWL</td></tr><tr><td>All equipment including Transformer Bushing and winding</td><td>1050 kVp</td><td>850 kVp</td></tr></table>		SIWL	LIWL	All equipment including Transformer Bushing and winding	1050 kVp	850 kVp	To be considered <table><tr><td></td><td>SIWL</td><td>LIWL</td></tr><tr><td>All equipment <u>except</u> Transformer Bushing and winding</td><td><u>N.A.</u></td><td><u>1050 kVp</u></td></tr></table>		SIWL	LIWL	All equipment <u>except</u> Transformer Bushing and winding	<u>N.A.</u>	<u>1050 kVp</u>
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All equipment <u>except</u> Transformer Bushing and winding	<u>N.A.</u>	<u>1050 kVp</u>													
12.	6.8.6	Availability Requirement <p>The calculated availability of the system considered on the annual basis shall be equal to or exceed the following target values. Also subject to terms and conditions specified the availability per year averaged during the five year guaranteed availability period considering both forced and scheduled outages for maintenance shall be equal to or exceed the values guaranteed by the contractor.</p> <p>Minimum availability requirement of complete STATCOM Station</p> <table><tr><td>Design target for STATCOM Station*</td><td>Guaranteed for STATCOM Station*</td></tr><tr><td>99%</td><td>98%</td></tr></table> <p>*Note: In case of more than one STATCOM Station at a Single Substation in a contract, availability referred is the average availability calculated for those STATCOM Stations.</p> <p>The outages of STATCOM Station capacity caused by the failure of equipment outside the scope of the contractor shall not be considered for calculation of availability and reliability guarantee. However, such outage shall be restricted to</p> <ol style="list-style-type: none">1) Complete loss of 220 kV supply (at PCC)2) Human Error.	Design target for STATCOM Station*	Guaranteed for STATCOM Station*	99%	98%	Availability Requirement <p>The calculated availability of the system considered on the annual basis shall be equal to or exceed the following target values. <u>The bidder shall be fully responsible for ensuring that the STATCOM station consistently achieves the specified annual average availability requirements during guarantee period.</u></p> <p>Minimum availability requirement of complete STATCOM Station</p> <table><tr><td>Design target for STATCOM Station*</td><td>Guaranteed for STATCOM Station*</td></tr><tr><td>99%</td><td>98%</td></tr></table> <p>*Note: In case of more than one STATCOM Station at a Single Substation in a contract, availability referred is the average availability calculated for those STATCOM Stations.</p> <p>The outages of STATCOM Station capacity caused by the failure of equipment outside the scope of the Bidder shall not be considered for calculation of availability and reliability guarantee. However, such outage shall be restricted to</p> <ol style="list-style-type: none">1) Complete loss of 220 kV supply (at PCC)2) Human Error.	Design target for STATCOM Station*	Guaranteed for STATCOM Station*	99%	98%				
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SN	Clause no.	Description	Changes to be considered									
		<p>Circumstances causing curtailment of STATCOM Station capacity that will be included in reliability and availability assessment and which can lead to forced outages shall include but not be limited to the following:</p> <p>a) Failure of equipment b) Mal-operation of control and protection system c) Failure to start d) Reduction in capacity.</p>	<p>Circumstances causing curtailment of STATCOM Station capacity that will be included in reliability and availability assessment and which can lead to forced outages shall include but not be limited to the following:</p> <p>a) Failure of equipment b) Mal-operation of control and protection system c) Failure to start d) Reduction in capacity.</p>									
13.	6.8.7	<p>Reliability Requirement</p> <p>a) Reliability In the assessment of reliability, the following events shall also be considered to constitute a STATCOM Station outage:</p> <p>i. A STATCOM Station shut down. ii. A reduction of STATCOM Station capacity due to outage of any component of STATCOM Station</p> <p>The calculated reliability of the complete STATCOM Station shall be equal to or exceed the following design target values. Also subject to the terms and conditions specified, the reliability per year shall be equal to or exceed the guaranteed values stated in the Contract.</p> <p>The period over which the guarantee is to be in effect, is five years commencing six months after acceptance of the complete system. The operation of the STATCOM will be monitored during the five-year period to determine whether it meets the guarantee. The total numbers of Forced Outage per year for STATCOM Station shall not exceed the following values:</p> <table><tr><td></td><td>Design target for STATCOM Station*</td><td>Max acceptable Guaranteed Value</td></tr></table>		Design target for STATCOM Station*	Max acceptable Guaranteed Value	<p>To be considered</p> <p>a) Reliability In the assessment of reliability, the following events shall also be considered to constitute a STATCOM Station outage:</p> <p>i. A STATCOM Station shut down. ii. A reduction of STATCOM Station capacity due to outage of any component of STATCOM Station</p> <p>The calculated reliability of the complete STATCOM Station shall be equal to or exceed the following design target values. <u>The bidder shall be fully responsible for ensuring that the STATCOM station consistently achieves the specified reliability requirements during guarantee period.</u></p> <p>The total numbers of Forced Outage per year for STATCOM Station shall not exceed the following values:</p> <table><tr><td></td><td>Design target for STATCOM Station*</td><td>Max acceptable Guaranteed Value for each STATCOM station</td></tr><tr><td>Total number of Forced Outage</td><td>3 X Nos of STATCOM Station</td><td>5 X Nos of STATCOM station</td></tr></table>		Design target for STATCOM Station*	Max acceptable Guaranteed Value for each STATCOM station	Total number of Forced Outage	3 X Nos of STATCOM Station	5 X Nos of STATCOM station
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SN	Clause no.	Description			Changes to be considered
				for each STATCOM station	
		Total number of Forced Outage	3 X Nos of STATCOM Station	5 X Nos of STATCOM station	
14.	6.8.8	Guaranteed Failure Rate of Sub modules. The maximum annual guaranteed failure rate of sub module (including all component and electronic) shall not exceed 1.0% per STATCOM.			Guaranteed Failure Rate of Sub modules. The maximum annual guaranteed failure rate of sub module (including all component and electronic) shall not exceed 1.0% per STATCOM. <u>The failure rate shall not include failures directly attributable to operation and maintenance errors.</u>
15.	8.1.7	Test on STATCOM Unit Valve All applicable tests i.e. Operational Type Tests (except Short-circuit test), Dielectric Type Tests & Test for valve insensitivity to electromagnetic disturbance shall be done as per latest edition of IEC 62927. Partial Discharge test shall be done during routine test of each sub module without DC Capacitor in addition to other routine/production tests specified in IEC 62927.			Test on STATCOM Unit Valve All applicable tests i.e. Operational Type Tests (except Short-circuit test), Dielectric Type Tests & Test for valve insensitivity to electromagnetic disturbance shall be done as per latest edition of IEC 62927.
16.	8.3.2	m) List of typical Protection functions for STATCOM Station STATCOM TRF HV Bay Protection: i. Biased Differential protection(87T) ii. Bus bar Differential Protection (87BB) by integrating in existing Bus Bar iii. REF protection (64) iv. Directional Overcurrent & Ground over current protection (67, 67N) v. Breaker failure protection (50 LBB) vi. Over flux protection (HV)			List of typical Protection functions for STATCOM Station STATCOM TRF HV Bay Protection: i. Biased Differential protection(87T) ii. Bus bar Differential Protection (87BB) by integrating in existing Bus Bar iii. REF protection (64) iv. Directional Overcurrent & Ground over current protection (67, 67N) v. Breaker failure protection (50 LBB) vi. Over flux protection (HV)

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		<p>vii. Transformer trouble trip relays viii. Transformer Fire Protection STATCOM TRF MV Bay Protection: i. Ground overcurrent protection(51N), used with neutral Grounding Transformer ii. Under/Over Voltage (27/ 59Ph-Ph) protection iii. Directional Overcurrent and Ground Over current protection (67, 67N) iv. Over voltage (Open Delta) protection v. Breaker failure protection (50 LBB) vi. Any other specific protection recommended by OEM STATCOM Branch Protection: i. Redundant STATCOM Valve Differential protection (87 ST) ii. Redundant Reactor Differential Protection (87R) iii. Overload protection (49) iv. Over current protection inside delta (50,51) v. Negative phase sequence protection (46) vi. STATCOM branch over current protection (50, 51, 50N,51N) vii. Other protection for STATCOM system and Valve assembly envisaged by bidder for reliable and secure operation.</p> <ul style="list-style-type: none"> The protection functions listed above are minimum set of function to be provided by the contractor and any additional protection required to fulfill the requirement of protection system shall be provided by the contractor. Protection System for the STATCOM valve portion of the STATCOM station shall be provided in the redundant controllers to isolate the STATCOM valve during internal overload/overvoltage, ground fault etc. 	<p>vii. Transformer trouble trip relays viii. Transformer Fire Protection STATCOM TRF MV Bay Protection: i. Ground overcurrent protection(51N), used with neutral Grounding Transformer ii. Under/Over Voltage (27/ 59Ph-Ph) protection iii. Directional Overcurrent and Ground Over current protection (67, 67N) iv. Over voltage (Open Delta) protection v. Breaker failure protection (50 LBB) vi. Any other specific protection recommended by OEM STATCOM Branch Protection: i. Redundant STATCOM Valve Differential protection (87 ST) ii. Redundant Reactor Differential Protection (87R) iii. Overload protection (49) iv. Over current protection inside delta (50,51) v. Negative phase sequence protection (46) vi. STATCOM branch over current protection (50, 51, 50N,51N) vii. Other protection for STATCOM system and Valve assembly envisaged by bidder for reliable and secure operation.</p> <ul style="list-style-type: none"> <u>The protection functions listed above represent the typical protection requirements for the STATCOM system. The contractor may propose improved, optimized or additional protection functions based on their design philosophy and engineering practices. The final protection scheme shall be reviewed and finalized during the detailed engineering stage.</u> Protection System for the STATCOM valve portion of the STATCOM station shall be provided in the redundant controllers to isolate the STATCOM valve during internal overload/overvoltage, ground fault etc.

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17.	8.5	Air Core Reactors (For STATCOM) . . g) All terminals shall be either tin plated or silver plated.	To be consider: g) All terminals shall be tin-plated, silver-plated, <u>or an equivalent corrosion-resistant conductive plating such as nickel, subject to GETCO approval.</u>
18.	8.13	Valve Hall and STATCOM control building Complete Valve Hall and STATCOM control building (with foundation, cable trenches, plumbing, lighting, fire protection and electrical outlets as well as facilities for ambient temperature and humidity control, as required) to accommodate IGBT valves, its cooling system, control and monitoring system, protection system, AC-DC auxiliary systems, service rooms, workshop, document/library shall be in the scope of this tender.	To be consider: Complete Valve Hall and STATCOM control building (with foundation, cable trenches, plumbing, lighting, fire protection and electrical outlets as well as facilities for ambient temperature and humidity control, as required) to accommodate IGBT valves, its cooling system, control and monitoring system, protection system, AC-DC auxiliary systems, service rooms, workshop, document/library shall be in the scope of this tender. <u>The STATCOM Station shall be provided with Air conditioning system as per requirement.</u> 1) <u>AC System (Except Valve Hall):</u> <u>Air condition system shall be provided for the following rooms in the STATCOM Building:</u> <u>a) Control and Relay room</u> <u>b) Battery room</u> <u>c) Conference Room</u> <u>d) Store cum workshop</u> <u>e) Cooling system room</u> <u>f) Lobby</u>

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			<p><u>Capacity and quantity of the AC units shall be decided based on heat load calculation and redundancy requirement.</u></p> <p>2) <u>Air-Conditioning System for Valve hall:</u></p> <p><u>Air-Conditioning shall be provided for each Valve room for maintaining the following inside conditions round the year:</u></p> <p><u>DBT - 35 °C (Maximum) Relative Humidity (RH) - 60% (Maximum)</u></p> <p><u>The system shall be designed for an outside ambient temperature of 50 °C. Based on the above system design and parameters for valve room the AC system shall comprise “AHU and Air cooled DX Condensing units” with one Main and one Standby unit for each room. The system shall be designed for 24 Hours, 365 Days of the year operation to maintain the inside temperatures of the Valve Hall for proper operation of the critical equipment. The air-cooled condensing unit shall be designed for continuous duty.</u></p>
19.	15	<p>Operation and AMC</p> <ul style="list-style-type: none"> The operation of STATCOM during first 6 months of the guarantee period after taking over of the system shall be done by supplier jointly with GETCO. The maintenance of the STATCOM for initial period of 5 years (excluding guarantee period) after successfully commissioning shall be carried out by supplier. 	<p>Operation and AMC</p> <ul style="list-style-type: none"> The operation of STATCOM during first 6 months of the guarantee period after taking over of the system shall be done by supplier jointly with GETCO. The maintenance of the STATCOM for initial period of 5 years (excluding guarantee period) after successfully commissioning shall be carried out by supplier.

SN	Clause no.	Description	Changes to be considered
		<ul style="list-style-type: none"> The maintenance includes corrective, preventive and breakdown maintenance. During guarantee period, GETCO will do only cleaning and up keeping. Any maintenance during guarantee period, if required, shall be done by bidder and five years maintenance period shall start from the expiry of guarantee period of two years after taking over the system Bidder shall have to mandatorily quote rates of Operation and AMC in price schedule. In absence of above, bid may be liable to be rejected. 	<ul style="list-style-type: none"> The maintenance includes corrective, preventive and breakdown maintenance. During guarantee period, GETCO will do only cleaning and up keeping. Any maintenance (<u>including supply of spare</u>) during guarantee period, if required, shall be done by bidder and five years maintenance period shall start from the expiry of guarantee period of two years after taking over the system. <u>The detailed scope of maintenance during 5 years is as under.</u> <ol style="list-style-type: none"> <u>The scope includes: Complete STATCOM system (i.e. Valve unit, IGBT, Capacitor, Cooling system, UPS/UMD, AHU, STATCOM Control, Automation and Protection systems, LT AC-DC Auxiliaries, SCADA System components, Peripherals,</u> <u>The scope excludes: Switchyard, Primary equipments (i.e. Coupling transformer, CT-PT-LA Breaker, Air cored reactor, LT Transformer etc.) However, it includes bye pass switch/breaker (if provided)</u> <u>For preventive maintenance: Respective Bidder shall have to depute his conversant representative as per the OEM scheduled plan. Based on the written request from bidder, made in advance, GETCO will provide necessary site access, utilities & related assistance including unskilled manpower, lifting equipment, safety clearances etc. to enable the bidder to perform preventive maintenance activities. However, special tools/equipments required if any shall be in the scope of bidder.</u> <u>For corrective/breakdown maintenance: GETCO will intimate the Bidder and accordingly, Bidder shall have to depute their conversant representative immediately.</u>

SN	Clause no.	Description	Changes to be considered												
			<p><u>Based on the written request from bidder, made in advance, GETCO will provide necessary site access, utilities & related assistance including unskilled manpower, lifting equipment, safety clearances etc. to enable the Bidder to perform preventive maintenance activities. However, special tools/equipments required if any shall be in the scope of bidder</u></p> <p>e. <u>Spares: During preventive, corrective or break down maintenance, bidder has to provide necessary spares. The Bidder shall supply maintenance spare parts as per the approved Spare Parts List at the approved unit rates submitted at time of commissioning and accepted by GETCO. Billing for supplied spares shall be on an actual consumption basis, supported by delivery receipts and purchaser's acceptance, and invoiced separately from regular maintenance services.</u></p> <ul style="list-style-type: none"> Bidder shall have to mandatorily quote rates of Operation and AMC in price schedule. In absence of above, bid may be liable to be rejected. 												
20.	Annexure – II	<p>Table – 1</p> <table> <tr> <th>Sr. no.</th><th>Power System Characteristic</th><th>Value</th><th>Unit</th></tr> <tr> <td>6</td><td>Minimum short ac system voltage, line to line</td><td>33</td><td>kV</td></tr> <tr> <td>7</td><td>Maximum Duration of item 6</td><td>5</td><td>Sec</td></tr> </table>	Sr. no.	Power System Characteristic	Value	Unit	6	Minimum short ac system voltage, line to line	33	kV	7	Maximum Duration of item 6	5	Sec	Sr. no. 6 & 7 clause shall be considered deleted.
Sr. no.	Power System Characteristic	Value	Unit												
6	Minimum short ac system voltage, line to line	33	kV												
7	Maximum Duration of item 6	5	Sec												

SN	Clause no.	Description	Changes to be considered
21.	Annexure-II	-	<p>New clause</p> <p><u>The STATCOMs shall remain connected to the grid and shall be able to operate at rated reactive power capability when voltage at the interconnection point, on single phase or three phases dips up to the level depicted by the thick lines in the following curve (for specified time) and up to at least 0.3 p.u. in case of two phase faults:</u></p> <p><u>VT : Actual Voltage; Vn: Nominal Voltage</u></p> 