ASSAM ELECTRICITY GRID CORPORATION LIMITED
OFFICE OF THE MANAGING DIRECTOR
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No. AEGCL/MD/AIIB/TENDER/2020/Extn-20 **Date: 05.07.2020**

CORRIGENDUM-VI

Tender Reference No : **AEGCL/MD/AIIB/PACKAGE-L/2020/02-L**
Name of Work: **Augmentation of Existing Transmission lines Capacity (Three Lines) by High Temperature Low Sag (HTLS) (Package-L)**

TABLE-2

Sl. No.	Clause No. ITB/GCC/ SCC/Forms	As existing	As amended	Reference to Sl. No. of Response [Table 1] wherever applicable
1	Vol-II/Section-1/ Clause No.1.5.2	All Bids must be accompanied by the full Type Test Certificates of equipment offered. Such type test certificates shall be acceptable only if: - Tests are conducted in an independent and well-known testing laboratory, or Tests are conducted in manufacturer's own laboratory. In this case the laboratory must have ISO 9000 (or its equivalent) series certification	All Bids must be accompanied by the full Type Test Certificates of equipment offered. Such type test certificates shall be acceptable only if: - **Test are conducted in accredited laboratory (accredited based on ISO/IEC guide 25/17025 or EN 45001 by the National Accreditation body of the country where laboratory is located) or witnessed by the representative (s) of CTU or State Transmission Utility or witnessed by an ISO/IEC 17025 Accredited Laboratory. The accreditation shall be by an agency that is certified to ISO/IEC 17011 with an ILAC mutual**	b.2

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			recognition agreement. In the case of composite core conductors, the tests specified under clause 2.9.1 shall be carried out before stranding on as manufactured sample. As per revised ASTM B987M/B987M -17 values specified are before stranding so all tests on composite core are require to perform on as manufactured condition.	
2	Vol-II/Section-1/ Clause No.1.5.3	Test reports to be acceptable must be related directly to the materials offered.	Test reports to be acceptable must be of similar or same technology that is going to offered in the bid.	b.3
3	Vol-II/Section-1/ Clause No.1.5.4	Type Test Reports older than **five (5)** years on the date of Technical bid opening shall not be accepted.	Type Test Reports older than **seven (7)** years on the date of Technical bid opening shall not be accepted.	b.4
4	Vol-II/Section-2/ Clause No.2.1.4	The design of conductor shall be suitable for operation at a steady state conductor temperature experienced for AC current flow of 875 (132kV) and 1200 (220kV) Amperes under the above **ambient** **Condition**s based on ampacity calculations mentioned above. The bidder shall also indicate the maximum permissible conductor temperature for continuous operation without any deterioration of its electrical, mechanical & metallurgical properties. The bidder shall also furnish the maximum permissible conductor temperature for short-term operations including permissible duration of such short-term operation.	The design of conductor shall be suitable for operation at a steady state conductor temperature experienced for AC current flow of 875 (132kV) and 1200 (220kV) Amperes under the above **ambient** **Condition**s based on ampacity calculations mentioned above. The bidder shall also indicate the maximum permissible conductor temperature for continuous operation without any deterioration of its electrical, mechanical & metallurgical properties. The bidder shall also furnish the maximum permissible conductor temperature for short-term operations including permissible duration of such short-term operation. **Ambient conditions** Elevation above sea level= 150m	b.5

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			Ambient temperature: 45°C Solar Absorption coefficient=0.8 Solar radiation =1045watt/sq.m Emissivity constant-0.45 Wind velocity considering angle between wind and axis of conductor as 90°=0.56m/sec Effective angle of incidence of sun's rays=90°	
5	Vol-II/Section-2/ Clause No.2.1.6	ii) Approx. mass of complete conductor (kg/km) Less than or equal to 974kg/kM (132kV) &**1280 kg/km (220kV)**	ii) Approx mass of complete conductor Less than or equal to 974kg/kM (132kV) &**1621 kg/km (220kV)**	b.6
6	Vol-II/Section-2/ Clause No.2.2.1	i) Sag at maximum continuous operating temp (**corresponding to 1200 amperes and ambient conditions specified above**) ii) Tension at 32 deg C, full wind **(52 kg/m2**) not exceeding 70% of UTS of proposed conductor	i) Sag at maximum continuous operating temp **(corresponding to 875 and 1200 amperes and ambient conditions specified above)** ≤ 7.24 m (132kV) & 8.435 meters (220kV) ii**)** **(**a) Tension at 32°C full wind (165kg/m²) =5117.76 kg (for 132KV transmission line) (b) Tension at 32°C full wind (165kg/m²) =7328.4kg (for 220KV transmission line)	b.7
7	Vol-II/Section-2/ Clause No.2.3	Ohmic Loss and Liquidated damage for excessive losses: - Average ohmic losses (kW)= Loss load factor X Line length X no. of sub conductors X (continuous operating current)2 X AC resistance per km guaranteed by the bidder at temperature corresponding to continuous operating current under normal condition.	Ohmic Loss and Liquidated damage for excessive losses: - Average ohmic losses (kW)= Loss load factor X Line length X no. of sub conductors X (continuous operating current)2 X AC resistance per km guaranteed by the bidder at temperature corresponding to continuous operating current under normal condition. **For all three phases of one circuit of a**	b.8

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			transmission line Average Ohmic loss (kW) = Loss Load Factor × **3** for double circuit× Line Length × No. of sub conductors per bundle × (Continuous operating current specified by utility)2 × AC Resistance corresponding to continuous operating current specified by utility For 132KV 1. Loss Load factor **0.53** 2. Continuous operating current **437A** For 220KV 1. Loss Load factor **0.53** 2. Continuous operating current **900A**	
8	Vol-II/Section-2/ Clause No.2.5.4	Composite Carbon Core There shall be no joint of any kind in the finished core entering into the manufacture of the strand. There shall also be no joints or splices in any length of the completed stranded core.	Composite Carbon Core There shall be no joint of any kind in the finished Composite carbon core entering into the manufacture of the strand. There shall also be no joints or splices in any length of the complete core.	b.9
9	Vol-II/Section-2/ Clause No.2.5.5	Tolerances Manufacturing tolerances on the dimensions to the extent of one percent **(±1%)** shall be permitted for individual strands and the complete conductor. Add: For composite cores, the manufacturing tolerance shall be +/- 0.05 mm of the stated nominal value. This change makes the requirement consistent with ASTM	Tolerances Manufacturing tolerances on the dimensions to the extent of one percent **(±1%)** shall be permitted for individual strands and the complete conductor. For composite cores, the manufacturing tolerance shall be **+/- 0.05 mm** of the stated nominal value.	b.10

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<table>
<tr><td></td><td></td><td>B987 Section 12.3.</td><td></td><td></td></tr>
<tr><td>10</td><td>Vol-II/Section-2/ Clause No.2.9.1</td><td>TypeTests

Type Tests on Stranded Conductor/ Stranded wire

The following tests shall be conducted once on sample/samples of conductor from each manufacturing facility:

<table><tr><td></td><td>On complete Conductor</td><td></td></tr><tr><td>a)</td><td>DC resistance test on stranded conductor</td><td>: As per Annexure-A</td></tr><tr><td>b)</td><td>UTS test on stranded conductor</td><td>: As per Annexure-A</td></tr><tr><td>c)</td><td>Stress- Strain test on stranded conductor and core at room temperature</td><td>: IEC 1089</td></tr><tr><td>d)</td><td>Stress-strain test on stranded conductor and core at elevated temperature</td><td>: As per Annexure-A</td></tr><tr><td>e)</td><td>High temperature endurance & creep test on stranded conductor</td><td>: As per Annexure-A
&
: IEC 1089</td></tr><tr><td>f)</td><td>Sheaves Test</td><td>As per Annexure-A</td></tr><tr><td>g)</td><td>Axial Impact Test</td><td>: As per</td></tr></table></td><td>TypeTests

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The following tests shall be conducted once on sample/samples of conductor from each manufacturing facility:

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&
: IEC 1089</td></tr><tr><td>f)</td><td>Sheaves Test</td><td>As per Annexure-A</td></tr><tr><td>g)</td><td>Axial Impact Test</td><td>: As per</td></tr></table></td><td>b.12</td></tr>
</table>

h)	Radial Crush Test	: As per Annexure-A
i)	Torsional Ductility Test	: As per Annexure-A
j)	Aeolian Vibration Test`	: As per Annexure-A
k)	Temperature Cycle Test	: As per Annexure-A
l)	Corona Extinction Voltage Test	: As per Annexure-A
m)	Radio Interference Voltage Test	: As per Annexure-A
(ii)	**On Conductor Strand/core**	
a)	Heat resistance test on Aluminium Alloy strands or core	: As per Annexure-A
b)	Bending test on composite core	As per ASTM B987
c)	Compression test on core	: As per Annexure-A
d)	Coefficient of linear expansion on core/core strands	: As per Annexure-A
e)	Strand Brittle fracture test for Carbon fibre composite core only.	: As per Annexure-A

		Annexure-A
h)	Radial Crush Test	: As per Annexure-A
i)	Torsional Ductility Test	: As per Annexure-A
j)	Aeolian Vibration Test`	: As per Annexure-A
k)	Temperature Cycle Test	: As per Annexure-A
l)	Corona Extinction Voltage Test	: As per Annexure-A
m)	Radio Interference Voltage Test	: As per Annexure-A
(ii)	**On Conductor Strand/core**	
a)	Heat resistance test on Aluminium Alloy strands	: As per Annexure-A
b)	Bending test on composite core	As per ASTM B987
c)	Compression test on core	: As per Annexure-A
d)	Coefficient of linear expansion on core/core strands	: As per Annexure-A

Type tests specified under clause no. 2.9.1 shall not be required to be carried out if a valid test

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		Type tests specified under clause no. 2.9.1 shall not be required to be carried out if a valid test certificate is available for the offered design, i.e., tests conducted earlier (not more than 5 years old at the time of bid opening) should have been conducted in accredited laboratory (accredited based on ISO/IEC guide 25/17025 or EN 45001 by the National Accreditation body of the country where laboratory is located) or witnessed by the representative (s) of CTU or State Transmission Utility. In the case of composite core conductors, the tests specified under clause 2.9.1 shall be carried out before stranding on as manufactured sample. In the event of any discrepancy in the test report (i.e., any test report not applicable due to any design/ material/manufacturing process change including substitution of components or due to non- compliance with the requirement stipulated in the Technical Specification) the tests shall be conducted by the Contractor at no extra cost to the Employer/ Employer/ Employer.	tests conducted earlier (not more than 7 years old at the time of bid opening) should have been conducted in accredited laboratory (accredited based on ISO/IEC guide 25/17025 or EN 45001 by the National Accreditation body of the country where laboratory is located) or witnessed by the representative (s) of CTU or State Transmission Utility or witnessed by an ISO/IEC 17025 Accredited Laboratory. The accreditation shall be by an agency that is certified to ISO/IEC 17011 with an ILAC mutual recognition agreement. In the case of composite core conductors, the tests specified under clause 2.9.1 shall be carried out before stranding on as manufactured sample. As per revised ASTM B987M/B987M -17 values specified are before stranding so all tests on composite core are require to perform on as manufactured condition. In the event of any discrepancy in the test report (i.e., any test report not applicable due to any design/ material/manufacturing process change including substitution of components or due to non- compliance with the requirement stipulated in the Technical Specification) the tests shall be conducted by the Contractor at no extra cost to the Employer/ Employer/ Employer.	
11	Vol-II/Section-2/ Clause	c) Dimensional check on core strands and Aluminium Alloy strands	c) Dimensional check on composite core (should be performed before stranding)	b.13

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	No.2.9.2	f) Torsion and Elongation tests on composite core g) Breaking load test on core strands and Aluminium/Aluminium Alloy strands	f) Torsion and Elongation tests on composite core (should be performed before stranding) g) Breaking load test on composite core (should be performed before stranding).	
12	Vol-II/Section-2/ Clause No.2.9.3	(c) Chemical analysis of core strands/composite core	(c) Chemical analysis of core strands/composite core **(This Test is Not Mandatory)**	b.14
13	Vol-II/Section-2/ Clause No.2.16	Service centre in India: If any manufacturer is from outside INDIA, they must have their service centre and **calibration facilities** in India.	Service centre in India: If any manufacturer is from outside INDIA, they must have their service centre in India.	b.15
14	Vol-II/Section-2/Annexure-A(Test on Conductors)/ Clause No.1.5	Stress-strain test at elevatedtemperature Stress-strain test as per IEC-1089 shall be conducted keeping conductor temperature at designed maximum temperature	Stress-strain test at elevatedtemperature Stress-strain test as per IEC-1089 shall be conducted on stranded conductor and core at elevated temperature.	b.16
15	Vol-II/Section-2/Annexure-A(Test on Conductors)/ Clause No.1.6	**High Temperature endurance & creeptest** Twoconductorsamplesoflengthequaltoatleast100X d+2Xa(where,distheconductordiameter andaisthedistancebetweentheendfittingandthegaugelength)shallbestrungattensionequalto 25 % of conductor UTS. The distance, a, shall be at least 25 % of the gauge length or 2 m whichever is the smaller. The conductor samples shall be subjected to tests as indicatedbelow: On one of the conductor samples, the conductor temperature shall be maintained at 20 deg C for 1000 hours. The elongation/creep strain of the conductor during this period shall be measured and recorded at end of 1 hour, 10-hour, 100 hour and subsequently	**High Temperature endurance & creeptest** Twoconductorsamplesoflengthequaltoatleast100X d+2Xa(where,distheconductordiameter andaisthedistancebetweentheendfittingandthegauge length)shallbestrungattensionequalto 25 % of conductor UTS. The distance, a, shall be at least 25 % of the gauge length or 2 m whichever is the smaller. The conductor samples shall be subjected to tests as indicatedbelow: On one of the conductor samples, the conductor temperature shall be maintained at 20 deg C for 1000 hours. The elongation/creep strain of the conductor during this period shall be measured and recorded at end of 1 hour, 10-hour, 100 hour and	b.17

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		every 100-hour upto 1000 hours' time period. (On other conductor sample, the conductor temperature shall be increased to design maximum temperature in steps of 20 deg. C and thermal elongation of the conductor sample shall be measured & recorded at each step. The temperature shall be held at each step for sufficient duration for stabilization of temperature. Further, the temperature of the conductor shall be maintained at maximum continuous operating temperature (+10 Deg. C) for 1000 hours. The elongation/creep strain of the conductor during this period shall be measured and recorded at end of 1 hour, 10-hour, 100 hour and subsequently every 100-hour upto 1000 hours' time period. After completion of the above, the core of the conductor sample shall be subjected to UTS test as mentioned above at clause 1.1 of Annexure-A. The conductor core shall withstand a load equivalent to 95 % of UTS. In case of polymer composite core conductor, the flexural strength & glass transition temperature of the core shall also be evaluated and the same shall not be degraded by more than 10 % over the initial value. The supplier shall plot the thermal elongation with temperature. The supplier shall furnish details of creep characteristic in respect of the conducted based on laboratory test and other laboratory investigations/ experimental conducted on similar type of conductor and shall indicate creep strain values corresponding to 1 month, 6 month, 1 year, 10 year & 20 year creep at	subsequently every 100-hour upto 1000 hours' time period. On other conductor sample, the conductor temperature shall be increased to design maximum temperature in steps of 20 deg. C and thermal elongation of the conductor sample shall be measured & recorded at each step. The temperature shall be held at each step for sufficient duration for stabilization of temperature. Further, the temperature of the conductor shall be maintained at maximum continuous operating temperature **(±2.5 Deg.** C) for 1000 hours. The elongation/creep strain of the conductor during this period shall be measured and recorded at end of 1 hour, 10- hour, 100hour and subsequently every 100-hour upto 1000 hours' time period. After completion of the above, the core of the conductor sample shall be subjected to UTS test as mentioned above at clause 1.1 of Annexure-A. The conductor core shall withstand a load equivalent to 95 % of UTS. In case of polymer composite core conductor, the flexural strength & glass transition temperature of the core shall also be evaluated and the same shall not be degraded by more than 10 % over the **value specified in GTP by bidder**. The supplier shall plot the thermal elongation with temperature. Make temperature tolerance in line with High Temperature test. The supplier shall furnish details of creep	

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		everyday tension & continuous designed temperature as well as room temperature.	laboratory test and other laboratory investigations/ experimental conducted on similar type of conductor and shall indicate creep strain values corresponding to 1 month, 6 month, 1 year, 10 year & 20 year creep at everyday tension & continuous designed temperature as well as room temperature.	
16	Vol-II/Section-2/Annexure-A(Test on Conductors)/ Clause No.1.10	Torsional DuctilityTest Theconductorsampleof10-15mshallbeloadedto25%ofUTSandthenrotatedin increasingsteps of+/-180deg.Incaseofcompositecoreconductors,after4 rotationsoraftersepara tionofaluminium strands,thealuminiumwiresshallbecutandremove dfromtheconductorandtheexposedcoreshall be twisted and shall withstand upto 16rotations.	Torsional DuctilityTest The conductor sample of minimum 1500 times diameter of conductor core shall be loaded to 20%of UTS and then rotated in increasing steps of +/-180 deg. The entire conductor shall withstand at least 16 such rotation and there shall not be any damage to Aluminium Alloy or core wires. In case of composite core conductors, after 4 rotations or after separation of aluminium strands, the aluminium wires shall be cut and removed from the conductor and the exposed core shall be twisted and shall withstand up to 16 rotations. Specify test sample length in reference of diameter of conductor core. Also, test tension should be 20% and not 25%..	b.18
17	Vol-II/Section-2/Annexure-A(Test on Conductors)/ Clause No.1.24	**Torsion and Elongation Tests on CompositeCore** In case of composite core HTLS conductor, the following procedure shall be applicable: - **Elongation Test**: - The elongation of the composite core sample at shall be determined using extensometer.Theloadalongthecoreshallbegraduallyinc reased.Theelongationachievedon reachingthetensilestrengthofthecoreshallnotbelessthant	**Torsion and Elongation Tests on CompositeCore** In case of composite core HTLS conductor, the following procedure shall be applicable: - **Elongation Test**: - The elongation of the composite core sample at shall be determined using extensometer.Theloadalongthecoreshallbegradually increased.Theelongationachievedon	b.20

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		hevalueguaranteedintheGTP. **Torsion Test:** The purpose of the test is to determine the resilience of the composite core to twisting and to show that after the composite core has experienced the prescribed twisting, it will not crack or have a loss in tensile strength due to the twisting. A sample length that is 170 times thediameterofthecompositecorebeingtestedismountedi nthegrippingfixtures.Onegripshall then be fixed so that it does not twist and the other end shall be twisted a full 360 degrees and then fixed in this position for 2 minutes. Once the twist time is completed, the core is untwisted an inspected for any crazing or other damage. If no damage is observed, the composite core is thentensiletestedtofailureandthe finalloadrecorded.Forthetesttobeaccepted,thecomposit e coremustwithstandatleast100%ofitsratedtensilestrength .Twosamplesneedtobecompleted in order to satisfy the testingrequirement.	reachingthetensilestrengthofthecoreshallnotbelessth anthevalueguaranteedintheGTP. **Torsion Test: -** The purpose of the test is to determine the resilience of the composite core to twisting and to show that after the composite core has experienced the prescribed twisting, it will not crack or have a loss in tensile strength due to the twisting. For Standard and High Strength Grade composite cores as per ASTM B987 Table 2, samples should be long enough to have a gauge length between the gripping fixtures 170 times the diameter of the composite core being tested. For core lengths less than 170 times the core OD, rotate the core to maintain the same rotation to length ratio. For Extra High Strength Grade composite core as per ASTM B987 Table 2, samples should be long enough to have a gauge length between the gripping fixtures that is 340 times the diameter of the composite core being tested. For core lengths less than 340 times the core OD, rotate the core to maintain the same rotation to length ratio. One grip shall then be fixed so that it does not twist and the other end shall be twisted a full 360 degrees and then fixed in this position for 2 minutes. Once the twist time is completed, the core is untwisted an inspected for any crazing or other damage. If no damage is observed, the composite core is then tensile tested to failure and the final load recorded. For the test to be accepted, the composite core must withstand at least 100% of its rated tensile strength. Two samples need to be completed in order to	

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			satisfy the testing requirement	
18	Vol-II/Section-2/Annexure-A(Test on Conductors)/ Clause No.1.31	Glass Transition Temperature Test (for polymer composite coreonly) Test method shall be as per ASTM D7028, A Standard Test Method for Glass Transition Temperature of Polymer Matrix Composites by Dynamic Mechanical Analysis. The glass transition temperature shall be greater than the maximum continuous operating temperature of the offered Composite Carbon Core HTLS Conductor+ 35 deg C.	Glass Transition Temperature Test (for polymer composite coreonly) For composite cores, the breaking load shall be performed as described in Section 9 of ASTM B987. Test method shall be as per ASTM D7028, A Standard Test Method for Glass Transition Temperature of Polymer Matrix Composites by Dynamic Mechanical Analysis. The glass transition temperature shall be greater than **the maximum continuous operating temperature of the offered HTLS conductor +25 ° C, and the Tg measured as the peak in the Loss Modulus curve (as per ASTM B987.**	b.21
19	Vol-II/Section-2/Annexure-A(Test on Conductors)/ Clause No.1.32	**Flexural Strength Test (for polymer composite core only)** Test method shall be as per ASTM D7264, ASTM D4475 or ISO 14125.	**Flexural Strength Test (for polymer composite core only)** Test method shall be as per ASTM D7264, ASTM D4475 or ISO 14125. **The Flexural Strength shall not be less than the guaranteed average minimum value before stranding shall be listed in the GTP.**	b.22
20	Vol-II/Section-2/Annexure-A(Test on Conductors)/ Clause No.1.33	**Bending Test on Composite Core:** A composite core sample shall be wrapped 180 degree around a cylindrical mandrel, and the specimen brought to 15 % of the rated tensile strength of the composite core and held for 1 min. The mandrel diameter shall be not more than 50 times the dia of composite core. After completion of the test, the core shall withstand UTS test and dye penetration test.	**Bending Test on Composite Core:** Bending test on polymer composite core (CFC) shall be performed as per ASTM B987/B987M-17 on polymer composite core samples taken from composite core manufacturing facility from the same reel being supplied to conductor manufacturer subject to proper traceability of the same at the conductor manufacturers works. Alternatively,	b.23

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			supplier may carry out bending test on polymer composite core (CFC) samples taken at the conductor manufacturing facility before or stranding. Bending test on polymer composite core (CFC) of these samples shall also be performed as per ASTM B987/B987M- 17, and the diameter of cylindrical mandrel shall be as following: For high strength grade CFC – 60 times the diameter of CFC For Extra high strength grade CFC – 70 times the diameter of CFC.	
21	Vol-II/Section-2/Annexure-A(Test on Conductors)/ Clause No.1.34	**Chemical Analysis of Aluminium/ Aluminium Alloy and Composite core/ INVAR Core Wires.** Samples taken from the Aluminium /Aluminium Alloy and core coils/ strands shall be chemically/spectrographically analyzed. The same shall be in conformity to the particulars guaranteed by the bidder so as to meet the requirements stated in this Specification	**Chemical Analysis of Aluminium/ Aluminium Alloy / INVAR Core Wires.** Samples taken from the Aluminium /Aluminium Alloy and core coils/ strands shall be chemically/spectrographically analyzed. The same shall be in conformity to the particulars guaranteed by the bidder so as to meet the requirements stated in this Specification	b.24
22	Vol-II/Section-3(A)&(B)/ Clause No.3.3	**SUSPENSION CLAMP** The suspension clamps shall be made of malleable iron or aluminium alloy, hot dip galvanised and shall be suitable to accommodate the conductor together with one set of standard preformed armour rods. Suitable sheet aluminium liners shall be provided. The suspension clamps shall be designed to avoid any possibility of deforming or damaging the conductor. The lips shall be rounded off and the seating and the bell mouths shall be smooth to avoid corona and radio interference noises. The suspension clamps shall be suitable to carry the bottom part of the arcing horn and	**SUSPENSION CLAMP** The suspension clamps shall be made of malleable iron or aluminium alloy, hot dip galvanised and shall be suitable to accommodate the conductor together with one set of standard preformed armour rods. Suitable sheet aluminium liners shall be provided. The suspension clamps shall be designed to avoid any possibility of deforming or damaging the conductor. The lips shall be rounded off and the seating and the bell mouths shall be smooth to avoid corona and radio interference noises. The suspension clamps shall be suitable to carry the	b.25

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		to receive the fittings of the long rod porcelain insulator/insulator string. The suspension clamps shall be such that the conductor should not slip at a load of 25% of the breaking load of the conductor. The ultimate strength of the clamp for vertical load shall not be less than the failing load of the Insulators	bottom part of the arcing horn and to receive the fittings of the long rod porcelain insulator/insulator string. The suspension clamp shall be vertically suspended by means of some flexible attachment. A suitable length of the specified conductor shall be fixed in the clamp with bolts and nuts tightened with the specified torque. A load shall then be gradually applied at one end of the conductor and the value of the load at which the conductor in the clamp begins to slip shall be noted. The conductor should not slip at a load of 8 percent of the breaking load of the conductor. The slip strength shall not exceed 15 percent of the breaking load of the conductor. For the purpose of this test, the breaking load of the conductor shall be taken as the value given in the relevant conductor specifications. In addition the Slip strength shall be as per IS 2486(Part I) as specified in page no 78 of Voll II technical specification.	
23	Vol-II/Section-3(A) & (B)/ Clause No.3.15.3	The length and diameter of each rod shall be furnished by the bidder in the GTP. The tolerance in length of the rods between the longest and shortest rod in complete set should be within the limits specified in relevant Indian/International Standards. The ends of armour rod shall be parrot billed.	The length and diameter of each rod shall be furnished by the bidder in the GTP. The tolerance in length of the rods between the longest and shortest rod in complete set should be within the limits specified in relevant Indian/International Standards. **The ends of armour rod shall be ball ended.**	b.26
24	Vol-II/Section-3(A) & (B)/ Clause No.3.16.3	Die compression areas shall be clearly marked on each dead-end assembly designed for continuous die compressions and shall bear the words 'COMPRESS FIRST' suitably inscribed near the point on each assembly where the compression begins. If the dead-	Die compression areas shall be clearly marked on each dead-end assembly designed for continuous die compressions and shall bear the words 'COMPRESS FIRST' suitably inscribed near the point on each assembly where the compression	b.27

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		end assembly is designed for intermittent die compressions it shall bear identification marks 'COMPRESSION ZONE' AND 'NON-COMPRESSION ZONE' distinctly with arrow marks showing the direction of compressions and knurling marks showing the end of the zones. The letters, number and other markings on the finished clamp shall be distinct and legible. The dimensions of dead-end assembly before & after compression alongwith tolerances shall be guaranteed in the relevant schedules of the bid and shall be decided by the manufacturer so as to suit the conductor size & conform to electrical & mechanical requirement stipulated in the specification. These shall be guaranteed in the relevant schedules of bid.	begins. If the dead-end assembly is designed for intermittent die compressions it shall bear identification marks 'COMPRESSION ZONE' AND 'NON- COMPRESSION ZONE' distinctly with arrow marks showing the direction of compressions and knurling marks showing the end of the zones. The letters, number and other markings on the finished clamp shall be distinct and legible. The dimensions of dead-end assembly before & after compression alongwith tolerances shall be guaranteed in the relevant schedules of the bid and shall be decided by the manufacturer so as to suit the conductor size & conform to electrical & mechanical requirement stipulated in the specification. These shall be guaranteed in the relevant schedules of bid. **Dead end assembly compression shall be made as per the installation instruction.**	
25	Vol- II, Section 3(A) & 3(B), Annexure B1, Clause 1.10	Heating cycle test Heating cycle test shall be performed in accordance with IS 2486 (Part-I) with following modifications: - i) Temperature of conductor during each cycle: 40 deg. C above designed maximum operating temperature of the conductor. ii) Number of cycle: 100 iii) Slip strength test shall also be carried out after heating cycle test.	Heating cycle test shall be performed in accordance with IS 2486 (Part-I) with following modifications: - i) Temperature of conductor during each cycle: 40 deg. C above designed maximum operating temperature of the conductor, but not to exceed the maximum use temperature of the conductor. ii) Number of cycle: 100 iii) Slip strength test shall also be carried out after heating cycle test.	b.28
26	Vol- II, Section 3(A) & 3(B), Annexure B1,	Mid Span compression joint for conductor a. Slip Strength Test The fitting compressed on conductor shall not be less	Mid Span compression joint for conductor a. Slip Strength Test The fitting compressed on conductor shall not be	b.29

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	Clause 2.1	than one meter in length. The test shall be carried out as per IS:2121 (Part-ii)-1981 clause 6-4 except that the load shall be steadily increased to 95% of minimum ultimate tensile strength of conductor and retained for one minute at this load. There shall be no movement of the conductor relative to the fittings and no failure of the fit tings during this one-minute period. b. Heating Cycle Test Heating cycle test shall be performed in accordance with IS 2121 (Part-II-1981) with following modifications: - i. Temperature of conductor during each cycle: 40 deg. C above designed maximum operating temperature of the conductor. ii. Number of cycles: 100 iii. Slip strength test shall also be carried out after heating cycle test.	less than one meter in length. The test shall be carried out as per IS:2121 (Part-ii)-1981 clause 6-4 except that the load shall be steadily increased to 95% of minimum ultimate tensile strength of conductor and retained for one minute at this load. There shall be no movement of the conductor relative to the fittings and no failure of the fit tings during this one-minute period. b. Heating Cycle Test Heating cycle test shall be performed in accordance with IS 2121 (Part-II-1981) with following modifications: - i. Temperature of conductor during each cycle: 40 deg. C above designed maximum operating temperature of the conductor, but not to exceed the maximum use temperature of the conductor. ii. Number of cycles: 100 iii. Slip strength test shall also be carried out after heating cycle test.	
27	Vol- II, Section 4, Clause 4.8.1B	c) Switching surge voltage withstand test under wet condition h) Salt –Fog pollution withstand test	(c) Switching surge voltage withstand test under wet condition is not applicable for 132KV and 220KV Voltage level. (d) Salt Fog pollution withstand test is not applicable.	b.30
28	Vol- II, Section 4, Annexure D, Clause 1.3	**Voltage Distribution test** The voltage across each insulator unit shall be measured by sphere gap method. The result obtain shall be converted into percentage. The voltage across any disc shall not exceed 9% for suspension insulator strings and 10% for tension insulator strings.	**Voltage Distribution test** The voltage across each insulator unit shall be measured by sphere gap method. The result obtain shall be converted into percentage. Value of Voltage distribution test i)for 132KV- 21% for suspension String and 22% for Tension string ii) For 220KV-13% for suspension and 14% for	b.31

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<table>
<tr><td></td><td></td><td></td><td>Tension string</td><td></td></tr>
<tr><td>29</td><td>Vol- II, Section 1, Clause 1.2.1</td><td>v. Long rod porcelain insulators or string insulators.</td><td>v.
(A) For 132KV Gossaigaon-Gauripur transmission line Insulator used shall be of long rod porcelain Insulator.
(B) For 132KV Salakati-Dhaligaon and 220KV Mirza –Sarusajai transmission line Anti Fog string Insulator shall be used.</td><td></td></tr>
<tr><td>30</td><td>Vol- II, Section 4, Clause 4.2.2</td><td>DIMENSION AND STRENGTH OF THE INSULATORS:
The size of long rod porcelain/disc insulator, minimum creepage distance, number to be used in different type of strings, their electromechanical strength and mechanical strength of insulator string along with hardware fittings shall be as follows:
a. For Long rod Insulators (For both Suspension and Tension)
<table>
<tr><th>Sl. no.</th><th>Type of string</th><th>Minimum creepage distance(mm)</th><th>Electro mechanical strength of insulator disc(kN)</th><th>Mechanical strength of insulator string along with hardware fittings(k</th></tr>
</table></td><td>DIMENSION AND STRENGTH OF THE INSULATORS:
The size of anti fog disc insulator, minimum creepage distance, number to be used in different type of strings, their electromechanical strength and mechanical strength of insulator string along with hardware fittings shall be as given in Annexure E.</td><td>b.32</td></tr>
</table>

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			N)	
1	Single Suspension	3625	90	90
2	Double Suspension	3625	90	180
3	Single tension	3625	120	120
4	Double tension	3625	120	240

31	BoQ	Original BoQ uploaded in the e-tender portal containing sheets: Supply_Pkg L_HTLS, Erection_Pkg L_HTLS, BoQ1	Modified BoQ uploaded in the e-tender portal containing sheets: Supply_Pkg L_HTLS, Erection_Pkg L_HTLS, BoQ1	b.38
32	Vol- II, Section 4, Clause 4.1.1	This Section of the specification covers design, manufacture, testing, inspection, packing and dispatch of suspension and tension long rod porcelain/string insulator assemblies consists of ball and socket type porcelain disc insulator for a three phase, 50Hz, effectively earthed D/C 220 kV transmission lines to be restringing with HTLS conductor. Ball and socket type long rod porcelain/disc insulator and insulator string shall be suitable for HTLS conductor and to be supplied for satisfactory performance of complete conductor system for continuous operation at the designed maximum temperature specified by them for the conductor.	This Section of the specification covers design, manufacture, testing, inspection, packing and dispatch of suspension and tension long rod porcelain/string insulator assemblies consists of ball and socket type porcelain disc insulator for a three phase, 50Hz, effectively earthed (D/C) / (S/C) 220 kV and 132kV transmission lines to be restringing with HTLS conductor. Ball and socket type long rod porcelain/disc insulator and insulator string shall be suitable for HTLS conductor and to be supplied for satisfactory performance of complete conductor system for continuous operation at the designed maximum temperature specified by them for the conductor.	
33	Vol-II, Section 4,	AC Salt-fog pollution withstandtest Please review and confirm the requirement of Salinity	AC Salt-fog pollution withstandtest Please review and confirm the requirement of	b.33

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<table>
<tr><td></td><td>Clause 1.5</td><td></td><td>Salinity level for Disc Insulators to decide design parameters. (This Test is Not Mandatory)</td><td></td></tr>
<tr><td>34</td><td>Vol-I/Section-3/ Clause No.2.5.1</td><td>Subcontractors/manufacturers for the following major items of supply must meet the following minimum criteria, herein listed for that item.

Failure to comply with this requirement will result in rejection of the subcontractor/manufacturer.

<table><tr><th>Item No.</th><th>Description of Item</th><th>Minimum Criteria to be met</th></tr><tr><td>1</td><td>Manufacture of HTLS (Composite carbon core equivalent to ACSR Panther Conductor)</td><td rowspan="2">If the bidder is a manufacturer of listed item, the bidder must have designed, manufactured; type tested, supplied the listed equipment, which are in successful operation for at least five (5) years as on the date of bid opening.
Or
If the bidder is not an original</td></tr><tr><td>2</td><td>Manufacture of long rod/disc insulators suitable for stringing of above mentioned</td></tr></table></td><td>Subcontractors/manufacturers for the following major items of supply must meet the following minimum criteria, herein listed for that item.

Failure to comply with this requirement will result in rejection of the subcontractor/manufacturer.

<table><tr><th>Item No.</th><th>Description of Item</th><th>Minimum Criteria to be met</th></tr><tr><td>1</td><td>Manufacture of HTLS (Composite carbon core equivalent to ACSR Panther Conductor)</td><td rowspan="2">If the bidder is a manufacturer of listed item, the bidder must have designed, manufactured; type tested, supplied the listed equipment, which are in successful operation for at least three (3) years as on the date of bid opening.
Or</td></tr><tr><td>2</td><td>Manufacture of long rod/disc insulators suitable for stringing of</td></tr></table></td><td>a.1</td></tr>
</table>

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			HTLS conductor.	manufacturer of the listed items , the bidder shall provide manufacturer's authorization, type test reports of the listed items which are in successful operation for at least five (5) years as on the date of bid opening. The bidder/manufacturer should list such works executed to substantiate the requirement of this Clause using ***Form EXP-2 along with performance certificate from a power utility company in India***.		above mentioned HTLS conductor.	If the bidder is not an original manufacturer of the listed items , the bidder shall provide manufacturer's authorization, type test reports of the listed items which are in successful operation for at least three (3) years as on the date of bid opening. The bidder/manufacturer should list such works executed to substantiate the requirement of this Clause using ***Form EXP-2 along with performance***	
			3.	Manufacture of hardware fitting suitable for above mentioned HTLS conductor		3.	Manufacture of hardware fitting suitable for above mentioned HTLS conductor	

NOTE: The bidder complying above requirements must submit with his bid the following documents to substantiate the requirements of this clause:

(i) Manufacturer must have production facility in

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		India. **(ii)** Manufacturer's authorization (duly notarised), using the form provided in Section 2 (Bidding Forms). The Bidder is responsible for ensuring that the manufacturer or producer complies with the requirements of bidding document and meets the minimum criteria listed above for that item. **(iii)** Full type test certificate. **(iv)** Manufacturer's experience list. **(v)** Recent performance certificate from past clients. Performance & Completion certificates should be recent & must not be older than 3 (three) years on the date of opening of the technical bid.	<table><tr><td></td><td></td><td>***power utility company in India***.</td></tr></table> *NOTE: The bidder complying above requirements must submit with his bid the following documents to substantiate the requirements of this clause:* **(i)** Manufacturer must have production facility in India. **(ii)** Manufacturer's authorization (duly notarised), using the form provided in Section 2 (Bidding Forms). The Bidder is responsible for ensuring that the manufacturer or producer complies with the requirements of bidding document and meets the minimum criteria listed above for that item. **(iii)** Full type test certificate. **(iv)** Manufacturer's experience list. **(v)** Recent performance certificate from past clients. Performance & Completion certificates should be recent & must not be older than 3 (three) years on the date of opening of the technical bid.	

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35	**Clause 2.3.2 of Section 3 Volume I**	**Average Annual Turnover**		Table 3
36	**Clause 2.3.3 of Section 3 Volume I**	**Financial Resources**		Table 4
	Section 9: Contract Forms, Appendix 1: Terms and Procedures of Payment, (A) Terms of Payment			
	Schedule No. 1 & 2 - Plant and Mandatory Spare Parts Supplied from Abroad and Within the Employer's Country respectively.			
37	**A. Advance Payment.:**	The advance will be adjusted at the rate of **25% of the advance amount** from each subsequent bill till the complete amount of advance is adjust.	The advance will be adjusted at the rate of **10% of the taxable invoice value** from each subsequent bill till the complete amount of advance is adjust.	
38	**B. Progressive payments for supply items:**	1. Within 60 (sixty) days from the date of submission of the invoice against supply, **not more than 60% (sixty percent)** payment of the total supply invoice value would be made, on receipt and acceptance of materials in full and good conditions (Subject to availability of fund). However, GST amount on invoice would be paid 100% or as per Govt. Rules. 2. Maximum **20 (twenty) Nos. of progressive summary supplyinvoice** would be entertained. 3. Remaining **40% (forty percent)** retention amount would be released subject to fulfilment of the following conditions – (a) **50% of balance supply amount** would be paid on completion of **50% of the total erection works** of the project as per Schedule 4 (Tender Forms).	1.Within 60 (sixty) days from the date of submission of the invoice against supply, **not more than 60% (sixty percent)** of the total supply invoice value of that particular item would be made, on receipt and acceptance of materials in full and good conditions (Subject to availability of fund). However, GST amount on invoice would be paid 100% or as per Govt. Rules. **2.Deleted** 3. Remaining **40% (forty percent) retention** amount of that item would be released subject to fulfillment of the following conditions – a) **20%** supply amount would be paid on completion of 50% of the total erection works of that particular item. b) **Next 10%** of the supply amount of that supply item would be payable on completion of **100% of the total erection, testing, commissioning** works of that particular item.	

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		be paid on completion of **100% erection, testing, commissioning and stringing activities** of the project as per schedule 4 (Tender Forms), which must be certified by the Project Authority.	b) within 60 (sixty) days after receipt of invoice out of remaining 10% of the supply amount **5%** would be paid upon issue of the **Completion Certificate** and balance **5%** upon issue of the **Operational Acceptance Certificate** as per clause 25, 26 & 27 of GCC, which should be certified by the Project Authority	
	Schedule No. 4 – Installation, ESMP and Other Services (Installation, commissioning and stringing services including Civil Works)			
40	**A. Progressive payments for Erection Works:**	1. Within 60 (sixty) days from the date of submission of invoice against foundation, erection & civil works, not more than 80% (eighty percent) of the total verified invoice would be made. However, GST amount on invoice would be paid 100% or as per Govt. Rules. 2. Maximum 10 (ten) Nos. of progressive summary erection invoice/ bill would be entertained during entire erection work. 3. The 1st progressive erection invoice/ bill would be entertained on completion of 10% of total erection cost of the project as per Schedule4 (Tender Forms). 4. Maximum 8 (eight) Nos. of additional progressive erection invoice/ bill would be entertained. Minimum value of each invoice should be 10% of the total ordered value for foundation, erection and civil work. 5. Remaining 20% of the erection value would be paid	1. Within 60 (sixty) days from the date of submission of invoice against foundation, erection & civil works, not more than 90% (Ninety percent) of the total verified invoice would be made. However, GST amount on invoice would be paid 100% or as per Govt. Rules. 2. Deleted. 3. Deleted. 4. Deleted. 5. Within 60 (sixty) days after receipt of invoice out of remaining 10% of the supply amount **5%** would be paid upon issue of the **Completion Certificate** and balance **5%** upon issue of the **Operational Acceptance Certificate** as per clause 25, 26 & 27 of GCC, which should be certified by the Project Authority.	8, 34,

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		on successful completion of 100% erection, testing, commissioning and stringing activities and operational acceptance of the project as per clause 25, 26 & 27 of GCC, which should be certified by the Project Authority.		
41	**ITT 4.1**	**Maximum number of Partners in a Joint Venture/Consortium for a Package is limited to TWO (02) only including the lead partner.**	**Maximum number of Partners in a Joint Venture/Consortium for a Package is limited to THREE (03) only including the lead partner.**	

Note:

1. ***Please refer to the modified BOQ in the e-tender portal (uploaded along with this minute.)***

Table 3:
2.3.2 Average Annual Turnover (Revised)

Criteria	Compliance Requirements				Documents
Requirement	**Single Entity**	**Joint Venture (maximum 3 parties allowed including lead bidder)**			**Submission Requirements**
		All Partners Combined	**Each Partner**	**One Partner (Lead Partner)**	

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Minimum average annual turnover of **₹ 71 crore (Rupees Seventy-OneCrore)**calculated as total certified payments received for contracts in progress or completed, within the **last three (3)** years.	Must meet requirement	Must meet requirement	must meet 25% of the requirement	must meet 55% of the requirement	Form FIN - 2

Note:

1. The bidder has to furnish the certificate from the chartered Accountant (CA) registered in India certifying the Project related Annual turnover of the company only (excluding its Associated Companies on Standalone Basis) based on audited accounts of the last five financial years. In case the bidder has executed any project in joint venture/consortium, the project related turnover certified by the chartered Accountant (CA) registered in India should reflect his share of the project related turnover only.

2. In case of Joint Venture/consortium, the bidder shall be furnished independently by each partner duly certified by Chartered Accountant (CA) registered in India

Table 4:
2.3.3 Financial Resources(Revised)

Criteria	**Compliance Requirements**				**Documents**
Requirement	**Single Entity**	**Joint Venture**			**Submission Requirements**
		All Partners Combined	**Each Partner**	**One Partner (Lead partner)**	
For Single Entities:	Must meet	Not	Not	Not	Form FIN – 3 and Form FIN

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resources defined in FIN-3, less its financial obligations for its current contract commitments defined in FIN-4, meet or exceed the total requirement for the Subject Contract. The minimum cash flow shall be **₹ 14Crore (Rupees Fourteen Crore).**					
The Joint Venture must demonstrate that the combined financial resources of all partners defined in FIN-3, less all the partners' total financial obligations for the current contract commitments defined in FIN-4, meet or exceed the total requirement of be **₹ 14Crore (Rupees Fourteen Crore) whereas the lead partners shall have to meet minimum 55% and each partners 25 % of the criteria.**	Not applicable	Must meet requirement	must meet minimum 25% of the requirement	must meet minimum 55% of the requirement	Form Fin-3 and Form FIN-4

Sd/-
Project Director(AIIB)
Assam Electricity Grid Corporation Limited
Bijulee Bhawan, Paltanbazar, Guwahati-781001

ANNEXURE – E

4.2.2 DIMENSION AND STRENGTH OF THE INSULATORS:

The size of anti-fog disc insulator, minimum creepage distance, number to be used in different type of strings, their electromechanical strength and mechanical strength of insulator string along with hardware fittings shall be as follows:

a. For anti-fog Disc Insulator

Sl.no.	Type of string	Size of disc insulator(mm)	Minimum creepage distance of single Disc(mm)	No. of standard discs	Electromechanical strength of insulator disc(kN)	Mechanical strength of insulator string along with hardware fittings(kN)
1	Single 'I' Suspension	255x145	430	1x9	70	70
2	Single 'I' Suspension pilot	255x145	430	1x9	70	70
3	Double Suspension	255x145	430	2x9	70	140
4	Single tension	255x145	430	1x10	120	120
5	Double tension	255x145	430	2x10	120	240

b. For Long rod Insulators(For both Suspension and Tension)

Sl.no.	**Type of string**	**Size of long rod insulator(mm)**	**Minimum creepage distance(mm)**	**Electromechanical strength of insulator disc(kN)**	**Mechanical strength of insulator string along with hardware fittings(kN)**
1	Single Suspension	1305	3625	90	90
2	Single tension	1450	3625	120	120
3	Double tension	1450	3625	120	240