06.01.2023	00	GURANTEED TECHNICAL PARTICULARS	PRASAD	PRASAD		ANANTHAKUMAR
DATE	REV.NO	DESCRIPTION	DESIGN	DRAWN	CHECKED	APPROVED

BAJAJ
Bajaj Electricals Limited
Inspiring Trust

SUBMITTED BY:-

BAJAJ ELECTRICALS LIMITED, MUMBAI

ISSUED BY:- POWER GRID CORPORATION OF INDIA LTD

PROJECT: Transmission Line Package TW01 for removal of LILO of Bawana-Mandola 400kVD/C line at Maharanibagh S/S and extension of above LILO section from Maharanibagh upto Narela S/S to form 2x400kV D/C Maharanibagh-Narela Line onM/C tower using twin HTLS conductor, under "Transmission System Strengthening Scheme for evacuation of power from Solar Energy Zones in Rajasthan (8.1 GW) under Phase-II Part G1";

Specification No.:5002001861/TOWER/DOM/A02-CC CS -3.

LOA. NO:- **Supply : 5002001861/TOWER/DOM/A02-CC CS-3/NOA-I/NR1-150017; Dated : 22-Mar-2022. Service : 5002001861/TOWER/DOM/A02-CC CS-3/NOA-II/NR1-150018; Dated : 22-Mar-2022.**

	NAME	SIGN	DATE	TITLE:	SCALE:
DRWN	PRASAD	--	--	**GUARANTEED TECHNICAL PARTICULARS**	
CHKD		--	--		NTS
APPD	ANANTHAKUMAR	--	--		

DRG. NO. **ACSS 479/78** REV.

RELEASED FOR

PRELIMINARY	TENDER	INFORMATION	**APPROVAL**	CONSTRUCTION

Cust - I

पावरग्रिड

श्रेणी(I)
I. फेबीकेशन / निर्माण / हेतु अनुमोदित / जारी
II. फेबीकेशन / निर्माण / हेतु अनुमोदित / जारी। दर्शाये गई टिप्पणियों को सम्मिलित किया जाए / कृपया ओ.सी.सी. दस्तावेज अनुमोदनार्थ प्रस्तुत करें
III. टिप्पणियों सम्मिलित कर पुन: अनुमोदनार्थ प्रस्तुत करें
IV. सूचनार्थ एवं रिकार्ड हेतु।
V. अनुमोदित नहीं।

(हस्ताक्षर)
(पदनाम)
16.01.2023
(तिथि)

पावर ग्रिड कारपोरेशन ऑफ इंडिया लि॰ अभियांत्रिकी (उपकेन्द्र) गुड़गाँव, हरियाणा

GUARANTEED TECHNICAL PARTICULARS OF HTLS CONDUCTOR			
Sl.No	**Description**	**Unit**	**Value guaranteed by the Bidder**
1	Name & address of Manufacturer		Sterlite Power Transmission Ltd, India.
2.1	Type of HTLS Conductor (HTLS Technology)		ACSS – 479/78
2.2	Construction of conductor/ Designation of conductor as per IEC: 1089		Outer – Annealed aluminum (RW+TW) RW LAYER –15/4.967 mm TWLAYER–10/4.897*mm Inner Core –20 EHSA– (Extra high strength cladded steel)–19/2.28 mm
3.1	**PARTICULARS OF RAW MATERIALS**		
3.1	Outer Layers		
	a) Applicable Standard (if any)		ASTM B 609/ B 233
	b) Type of Aluminum alloy		Annealed Al. (1350-O Temper)
	c) Minimum purity of aluminum	%	99.50%
	d) Maximum Copper content	%	0.04 %
	e) Zirconium content		
	i) Maximum	%	N/A
	ii) Minimum	%	N/A
	e) Other elements		ASTM B 233
	i) ----------	%	Si: 0.10 (max)
	ii) ----------	%	Fe :0.40 (max) Mn:0.01 (max) Cr:0.01 (max) Zn:0.05 (max) B:0.05(max) G:0.03(max) Va +Ti:0.02(max) Other element, each, 0.03(max) Other element, total:0.1(max)
3.2	Inner Core		EN 50540
	a) Applicable Standard (if any)		b) 20 EHSA–(Extra high strength cladded steel)
	b) Material of core		
	c) Chemical composition of core		c)
	i) C	%	0.50 to 1.00
	ii) Mn		0.40 to 1.30
	iii) P		0.035, Max
	iv) S		0.045,Max
	v) Si		0.15 to 0.60

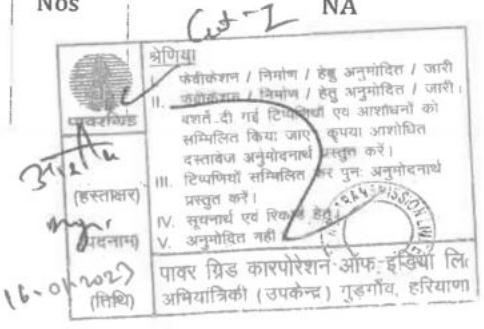
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पावरग्रिड
(हस्ताक्षर)
(पदनाम)
16.01.2023
(तिथि)

श्रेणियां
I. पोस्टीकेशन / निर्माण / हेतु अनुमोदित / जारी
II. पोस्टीकेशन / निर्माण / हेतु अनुमोदित / जारी बशर्ते कि गई टिप्पणियां एवं आशोधनों को सम्मिलित किया जाए। कृपया आशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. टिप्पणियों सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. सूचनार्थ एवं रिकार्ड हेतु।
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अभियांत्रिकी (उपकेन्द्र) गुड़गाँव, हरियाणा

3.3	Zinc used for galvanization of inner core (if applicable) a) Minimum purity of zinc	%	NA	
3.4	Chemical Composition of Misch Metal coating on core wires (if applicable) i) Zinc	%	NA	
	ii) Aluminium	%	NA	
	iii) Other elements	%	NA	
3.5	Aluminium used for Aluminium Cladding (if applicable)			
	a) Minimum purity of aluminium	%	99.5	
	b) Maximum Copper content	%	0.04	
4	**OUTER STRANDS AFTER STRANDING**			
4.1	Number of outer layers	Nos.	02	
4.2	Number of strands			
	a) 1st Layer from core	Nos	10 (Trapezoidal wire)	
	b) 2nd Layer from core	Nos	15 (Round wire)	
	c) 3rd Layer from core	Nos	NA	
4.3	Diameter of strands		**10 TW**	**15 RW**
	a) Nominal	mm	4.897*	4.967
	b) Maximum	mm	4.946*	5.016
	c) Minimum	mm	4.848*	4.917
4.4	Minimum Breaking load of strand		**10 TW**	**15 RW**
	a) Before stranding	kN	1.13	1.16
	b) After stranding	kN	1.07	1.10
4.5	Resistance of 1 m length of strand at 20 deg. C	Ohm	**10 TW**	**15 RW**
			1.482×10^{-3}	1.441×10^{-3}
4.6	Final Modulus of elasticity	Kg/mm2	5608	
4.7	Final Coefficient of linear expansion	Per°C	23×10^{-6}	
5	**INNER CORE STRANDS/ INNER CORE AFTER STRANDING**			
5.1	Number of layers in inner core (excluding central wire)		02	
5.2	Number of strands			
	a) 1st Layer from center (excluding central wire)	Nos	06	
	b) 2nd Layer from center	Nos	12	
	c) 3rd Layer from center	Nos	NA	



5.3	Diameter a) Nominal b) Maximum c) Minimum	 mm mm mm	 2.280 2.320 2.240
5.4	Minimum Breaking load of strand/core a) Before stranding. b) After stranding	 kN kN	 6.86 6.52
5.5	Resistance of 1 m length of strand at 20 deg. C	Ohm	--
5.6	Final Modulus of elasticity	Kg/sq. mm	16519
5.7	Final coefficient of linear expansion	Per° C	13.0×10^{-6}
5.8	Minimum elongation of strand for a gauge length of 250 mm	%	--
5.9	Min. number of torsions	Nos	-- --
5.10	**Aluminum cladding of ~~INVAR~~ steel core**		
	a) Thickness of cladding		
	i) Maximum	mm	-
	ii) Minimum	mm	0.132
	b) Minimum no. of twists in a guage length equal to 100 times diameter of wire which the strands can withstand in the torsion test	-	20 Before stranding 18 after stranding
	c) Minimum elongation of strand for a gauge length of 250 mm	%	1.5% (at break)
	d) Resistance of 1m length of strand at 20 deg. C	Ohm	21.52×10^{-3}
5.11	**Galvanising/ Misch Metal coating (if applicable)**		
	a. Minimum mass of zinc / Misch metal coating per sqm. of uncoated wire surface.	g/m^2	NA
	b) Minimum mass of Misch metal coating per sqm. of uncoated wire surface (if applicable).	Nos	NA
	c) Min. no. of twists which a single strand shall withstand during torsion test for a length equal to 100times dia of wire after stranding.	Nos	NA
	d) Minimum elongation of strand for a gauge length of 250 mm	%	NA
6	**FILLER (if applicable)**		
6.1	Type & Designation of Filler		NA
6.2	Chemical composition of Filler		NA
6.3	Mass of Filler	Kg/Km	NA

पावरग्रिड
(हस्ताक्षर)
(पदनाम)
16/01/2023
(तिथि)

श्रेणियां
I. फेब्रीकेशन / निर्माण / हेतु अनुमोदित / जारी
II. फेब्रीकेशन / निर्माण / हेतु अनुमोदित / जारी परन्तु दी गई टिप्पणियों एवं आशोधनों को सम्मिलित किया जाए। कृपया आशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. टिप्पणियां सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
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पावर ग्रिड कारपोरेशन ऑफ इंडिया लि.
अभियांत्रिकी (उपकेन्द्र) गुड़गाँव, हरियाणा

7	**COMPLETE HTLS CONDUCTOR**	EN 50540		
7.1	Cross section drawing of the offered conductor enclosed	Yes/No	Yes (ANNEXURE A)	
7.1.1	Cross section area of annealed aluminium	mm^2	478.98	
7.1.2	Cross section area of Core	mm^2	77.57	
7.1.3	Cross section area of the complete conductor	mm^2	556.55	
7.2	Diameter of conductor a) Nominal b) Maximum c) Minimum	 mm mm mm	 29.80 30.10 29.50	
7.3	UTS (minimum) of Conductor	KN	157.91	
7.3.1	UTS (minimum) of Core	kN	130.32	
7.3.2	UTS (Minimum) of conductor at elevated temp.	KN	110.5	
7.4	**Lay ratio of conductor**		**Max.**	**Min.**
	a) 1st layer from center (excluding central wire) 6 wire layer		26	16
	b) 2nd Layer 12 wire steel layer		22	14
	c) 3rd Layer – 10TW Wire Annealed Aluminium Layer		16	10
	d) 4th Layer – 15 Wire Aluminium Layer		14	10
7.5	DC resistance of conductor at 20°C	Ohm/ km	0.05552	
7.6	Final Modulus of elasticity			
	a) Upto transition temperature	Kg/sq. mm	7129	
	b) Above transition temperature	Kg/sq. mm	16519	
7.7	Coefficient of linear expansion			
	a) Up-to transition temperature	Per deg C	19.77×10^{-6}	
	b) Above transition temperature	Per deg C	13.00×10^{-6}	
7.8	Calculation for transition temperature enclosed	Yes/ No	Yes	
7.9	Transition temperature (corresponding to 400 m ruling span and tension at ruling condition as per 7.19)	DegC	105	
7.10	Minimum Corona Extinction Voltage (line to ground) under Dry condition	kV(rms)	320	
7.11	RIV at 1MHz and 305 kV (rms) under dry conditions	Micro-volts	Below 1000 micro volts	

Cont. 7

पावरग्रिड (हस्ताक्षर) (पदनाम) 16.01.2023 (तिथि)

श्रेणि.....
I. फेबीकेशन / निर्माण / टेस्ट अनुमोदित / जारी
II. फेबीकेशन / निर्माण / टेस्ट अनुमोदित / जारी, बशर्ते कि नई टिप्पणियां एवं आशोधनों को सम्मिलित किया जाए। कृपया अशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. टिप्पणियों सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
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पावर ग्रिड कारपोरेशन ऑफ इंडिया लि. अभियांत्रिकी (उपकेन्द्र) गुड़गाँव, हरियाणा

7.12	Maximum permissible conductor temperature for continuous operation	Deg C	210
7.13	Maximum permissible conductor temperature for short term operation	Deg C	250
7.13 a.)	Permissible duration of above short-term operation	Hrs	10,000 Hrs (Over the life of the conductor)
7.14	Steady state conductor temperature at conductor current of 1596 A and under Ambient conditions detailed in Clause 1.2.1 of Section-II of the Technical Specification (Vol-II)	Deg C	180.87 (ANNEXURE C)
7.14 A.	Conductor core temperature corresponding to the designed maximum temperature of conductor	Deg C	193.41 (ANNEXURE C)
7.15	AC resistance at maximum continuous operating temperature corresponding to specified maximum operating current (1596 A under ambient condition enclosed as per Clause 1.2.1 of Section-II of the Technical Specification)	Ohm/km	0.0922 (ANNEXURE D)
7.16	Details of Creep characteristic for HTLS conductor enclosed (as per Clause 1.4.3 of Section-IXB of the Technical Specification (Vol-II))	Yes / No	Yes (Submitted along with complete type test report no. CT/ 063/ 22-23)
7.19 Sag Tension Calculation for Normal tower (Mentioned tension values are Horizontal tension values as per enclosed report Attachment 1)			
7.19.1	Sag Tension Calculation enclosed (clause 1.4 of Sec-II of TS)	Yes/ No	YES (ATTACHMENT 1 - for ruling span 400 mtr)
7.19.2	Tension at 32 deg. C & no wind	Kg	3486
7.19.3	Sag at maximum continuous operating temperature (corresponding to current of 1596 A and Ambient conditions detailed in Clause 1.4 of Section-II of the Technical Specification (Vol-II))	Meters	15.44
7.19.4	Sag of HTLS Conductor for ruling span at minimum temp (0 deg C) and no wind condition (m)	Meters	9.62

Cat-I

पावरग्रिड
(हस्ताक्षर)
(पदनाम)
16-01-2023
(तिथि)

श्रेणियां
I. फेरीफेकेशन / निर्माण / हेतु अनुमोदित / जारी
II. फेरीफेकेशन / निर्माण / हेतु अनुमोदित / जारी
वर्शन में गई टिप्पणियों एवं आशोधनों को सम्मिलित किया जाए। कृपया आशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. टिप्पणियों सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. सूचनार्थ एवं रिकार्ड हेतु।
V. अनुमोदित नहीं।

पावर ग्रिड कारपोरेशन ऑफ इंडिया लि.
अभियांत्रिकी (उपकेन्द्र) गुड़गाँव, हरियाणा

7.19.5	Tension at 32°C and full wind condition:- Top circuit (Multi ckt - Normal Tower)		
	Top- 217 Kg/m2 wind pressure	Kgf	8083
	Middle-213 Kg/m2 wind pressure	Kgf	8001
	Bottom-207 Kg/m2 wind pressure	Kgf	7876
	Tension at 32°C and full wind condition: - Bottom circuit (Multi ckt - Normal Tower)		
	Top-200 Kg/m2 wind pressure	Kgf	7730
	Middle-193 Kg/m2 wind pressure	Kgf	7582
	Bottom-184 Kg/m2 wind pressure	Kgf	7389
7.19.6	Tension at transition temperature	kg	2713
7.19.2 Sag Tension Calculation for Narrow based tower (Mentioned tension values are Horizontal tension values as per enclosed report Attachment 2)			
7.19.2.1	Tension at 32 deg. C & no wind	Kg	3486
7.19.2.2	Sag at maximum continuous operating temperature (corresponding to current of 1596 A and Ambient conditions detailed in Clause 1.4 of Section-II of the Technical Specification (Vol-II))	Mtr	15.44
7.19.2.3	Sag of HTLS Conductor for ruling span at minimum temp (0 deg C) and no wind condition (m)	Mtr	9.62
7.19.2.4	Tension at 32°C and full wind condition:- 218 Kg/m2 wind pressure	Kg	8103
7.20	Tension at transition temperature	kg	2713

C.T. I

पावरग्रिड

श्रेणी (I)
II. फेब्रीकेशन / निर्माण / हेतु अनुमोदित / जारी, वर्शन की गई टिप्पणियों एवं आशोधनों को सम्मिलित किया जाए। कृपया आशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. टिप्पणियों सम्मिलित कर पुनः अनुमोदनार्थ प्रस्तुत करें।
IV. सूचनार्थ एवं रिकार्ड हेतु।
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(हस्ताक्षर)
(पदनाम)
16.01.2023
(तिथि)

पावर ग्रिड कारपोरेशन ऑफ इंडिया लि.
अभियांत्रिकी (उपकेन्द्र) गुड़गाँव, हरियाणा।

7.21	Direction of lay for outside layer		Right Hand
7.22	Linear mass of the Conductor		
	a) Standard	Kg/km	1840.3
	b) Maximum	Kg/km	1877.1
	c) Minimum	Kg/km	1803.5
7.23	Standard length of conductor	m	2400
7.24	Maximum length of conductor that can be offered as Single length	m	2520
7.25	Tolerance on standard length of conductor	%	± 5
7.26	Drum is as per specification	Yes/No	Yes
7.27	No. of cold pressure butt welding equipment available at works	Nos.	4

Note : *- TW equivalent diameter of strand can be calculated by complete conductor weight method as per ASTM B-263, based on the total aluminium area, we can calculate individual area/ Diameter of strands. (i.e. TW Al. area / No. of TW Al. strands).

Date – 06.01.2023
Place – Silvassa

(Signature).....
(Printed name) ANANTHAKUMAR R
(Designation)AVP-NEW PRODUCT DEVELOPMENT
(Common Seal) .....

Cat-I

पावरग्रिड

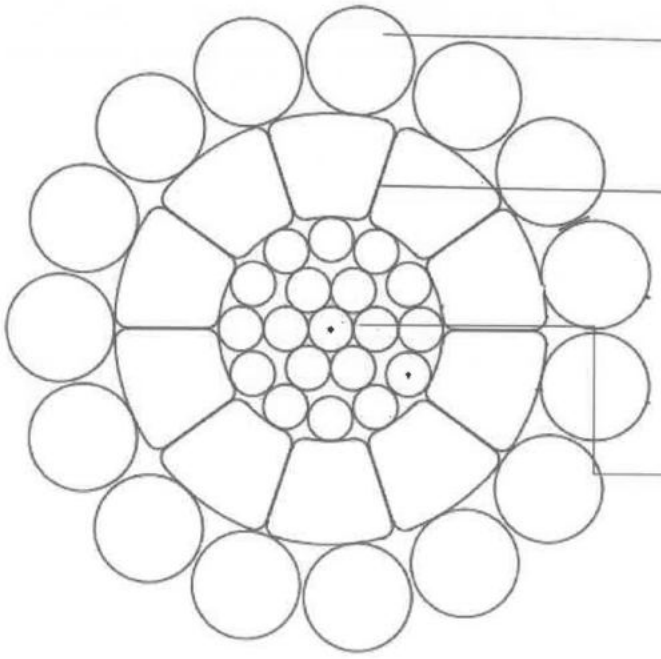
श्रेणियां
I. फेब्रीकेशन / निर्माण / हेतु अनुमोदित / जारी
II. फेब्रीकेशन / निर्माण / हेतु अनुमोदित / जारी दर्शाई गई टिप्पणियों एवं आशोधनों को सम्मिलित किया जाए। कृपया आशोधित दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
III. टिप्पणियों सम्मिलित कर पुन: अनुमोदनार्थ प्रस्तुत करें।
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(हस्ताक्षर)
(पदनाम)
16.01.2023 (तिथि)

पावर ग्रिड कारपोरेशन ऑफ इंडिया लि.
अभियांत्रिकी (उपकेन्द्र) गुडगाँव, हरियाणा

ANNEXURE - A
CROSS SECTION DRAWING

ACSS – 479/78



OUTER LAYER – ROUND WIRE – 15 (RW) / 4.967 mm

INNER LAYER – TRAPEZOIDAL WIRE 10 (TW) /19.314 sq.mm (4.897*mm equivalent dia.)

20 EHSA–(Extra high strength cladded steel – 19/2.28 mm

← Overall diameter - 29.80 ± 1% mm →