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	TYPE OF DOC.	TECHNICAL SPECIFICATION			SIGN																			
	TITLE 7/9 SWG (10.98mm O.D) GS EARTH WIRE				DATE																			
					GROUP	TBEM																		
					W.O. No																			
	CUSTOMER	POWER GRID CORPORATION OF INDIA LIMITED																						
	PROJECT	Substation Package – Substation Package -SS01 for Construction of 765/400/220kV Bhuj Pool (New) S/S and Extension of 765kV Banaskantha S/S under Green Energy Corridors: Inter-State Transmission Scheme (ISTS) – Part C																						
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SECTION – I**SCOPE, SPECIFIC TECHNICAL REQUIREMENT AND QUANTITIES****1.0 SCOPE**

This technical specification covers the requirements of design, manufacture, testing at works, packing and dispatch of 7/9 SWG (10.98mm OD) GS earth wire.

The equipment is required for the following project.

Name of Customer : Power Grid Corporation of India Ltd.

Name of the Project : Substation Package – Substation Package -SS01 for Construction of 765/400/220kV **Bhuj Pool (New) S/S** and **Extension of 765kV Banaskantha S/S** under Green Energy Corridors: Inter-State Transmission Scheme (ISTS) – Part C

1.1 BILL OF QUANTITY

Sl. No	Description	BHUJ	BANASKANTHA
1.	7/9 SWG (10.98mm OD) GS earth wire	9 Km	2.5 Km

Note:

- The Qty may vary upto $\pm 30\%$ before placement of order.
- The Qty. May vary by $\pm 20\%$ during contract stage.

1.2 TYPE TESTING

Bidder shall submit valid type test reports (as per relevant IEC/IS Standard) for approval. The type test reports submitted shall be of tests conducted within last 10 years prior to the date of bid opening i.e. **07.04.2015**. The bidder should have conducted type test on identical or similar equipment/ components to those offered. In case type test reports are found to be technically unacceptable to BHEL/PGCIL, the type test shall be conducted without cost and delivery implication to BHEL.

1.3 QUALITY PLAN

Bidder to follow valid PGCIL approved Quality Plan as per PGCIL procedure. In case the bidder don't have PGCIL approved QP, it will be the bidder's responsibility to get its QP approved directly from the ultimate customer.

1.4 DRAWING/DOCUMENTS APPROVAL:

Standardized GTP of POWERGRID is enclosed as Annexure-E, no approval on GTP is required and inspection shall be carried out as per standardized GTP.

SECTION - (SE)
SWITCHYARD ERECTION

Substation Package - Substation Package -SS01 for Construction of 765/400/220kV **Bhuj Pool (New) S/S** and **Extension of 765kV Banaskantha S/S** under Green Energy Corridors: Inter-State Transmission Scheme (ISTS) - Part C

7/9 SWG (10.98mm O.D) GS earth wire

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4.0 Galvanised Steel Earth wire

4.1 Details of Earth wire

4.1.1 The galvanised steel earth wire shall generally conform to the specification of ACSR core wire as mentioned in IEC:60888/IS: 398 (Part-II)-1976 except where otherwise specified herein.

The contractor shall supply the earthwire as per the standard guaranteed technical particulars enclosed in Annexure-E of the technical specification, Section – Switchyard Erection and separate approval **for guaranteed technical particulars** is not required during detailed engineering.

4.2 Workmanship

SECTION - (SE)

SWITCHYARD ERECTION

- 4.2.1 All steel strands shall be smooth, uniform and free from all imperfections, such as spills and splits, die marks, scratches, abrasions and kinks after drawing and also after stranding.
- 4.2.2 The finished material shall have minimum brittleness as it will be subjected to appreciable vibration while in use.
- 4.2.3 The steel strands shall be hot dip galvanized and shall have minimum Zinc coating after stranding, as stipulated in guaranteed technical particulars attached with. The zinc coating shall be smooth, continuous, of uniform thickness, free from imperfections. The steel wire rod shall be of such quality and purity that, when drawn to the size of the strands specified and coated with zinc, the finished strands shall be of uniform quality and have the same properties and characteristics as prescribed in ASTM designation B498-74.
- 4.2.4 The steel strands shall be preformed and post formed in order to prevent spreading of strands while cutting of composite earth wire. Care shall be taken to avoid damage to galvanisation during preforming and postforming operation.
- 4.2.5 To avoid susceptibility towards wet storage stains (white rust), the finished material shall be provided with a protective coating of boiled linseed oil.

4.3 Joints in Wires

There shall be no joints of any kind in the finished steel wire strand entering into the manufacture of the earth wire. There shall be no strand joints or strand splices in any length of the completed stranded earth wire.

4.4 Tolerances

The manufacturing tolerance to the extent of the limits as stipulated in guaranteed Technical Particulars attached with this specification shall only be permitted in the diameter of the individual steel strands and lay length of the earth wire.

4.5 Materials

4.5.1 Steel

The steel wire strands shall be drawn from high carbon steel rods and the chemical composition shall conform to the requirements as stipulated in Guaranteed Technical Particulars attached with.

4.5.2 Zinc

The zinc used for galvanising shall be electrolytic High Grade Zinc. It shall conform to and satisfy all the requirements of IS: 209 -1979.

4.6 Standard Length

- 4.6.1 The standard length of the earth wire shall be as stipulated in Guaranteed Technical Particulars attached with, with the specified tolerance on standard length.

4.8 TESTS

- 4.8.1 The following type, routine & acceptance tests and tests during manufacturing shall be carried out on the earthwire.

4.8.2 TYPE TESTS

SECTION - (SE)
SWITCHYARD ERECTION

In accordance with the stipulation of specification, the following type tests reports of the earthwire shall be submitted for approval as per clause 9.2 of Section - GTR.

- | | | | |
|----|--------------------|---|---------------------|
| a) | UTS test |) | |
| | |) | |
| b) | DC resistance test |) | As per Annexure - B |

4.8.3 ACCEPTANCE TESTS

- | | | | |
|----|---|---|--------------------------|
| a) | Visual check for joints, scratches etc. and length of Earthwire |) | |
| | |) | |
| | |) | |
| b) | Dimensional check |) | As per Annexure - B |
| | |) | |
| c) | Galvanising test |) | |
| | |) | |
| d) | Lay length check |) | |
| | |) | |
| e) | Torsion test |) | |
| | |) | |
| f) | Elongation test |) | |
| | |) | |
| g) | Wrap test |) | |
| | |) | |
| h) | DC resistance test |) | |
| | |) | |
| i) | Breaking load test |) | IS:398 (Part-III) - 1976 |
| | |) | |
| j) | Chemical Analysis of steel |) | |

4.8.4 ROUTINE TESTS

- | | |
|----|---|
| a) | Check that there are no cuts, fins etc. on the strands. |
| b) | Check for correctness of stranding. |

4.8.5 TESTS DURING MANUFACTURE

- | | | | |
|----|--|---|---------------------|
| a) | Chemical analysis of zinc used for galvanising |) | As per Annexure - B |
| | |) | |
| | |) | |
| b) | Chemical analysis of steel |) | |

SECTION - (SE)
SWITCHYARD ERECTION

ANNEXURE "B"

(Testing procedure for Galvanised Steel Earthwire)

1. UTS TEST

Circles perpendicular to the axis of the earthwire shall be marked at two places on a sample of earthwire of minimum 5m length suitably compressed with dead end clamps at either end. The load shall be increased at steady rate upto 50% of UTS and held for one minute. The circles drawn shall not be distorted due to relative movement of strands. Thereafter, the load shall be increased at a steady rate to 100% of UTS and held for one minute. The earthwire sample shall not fail during this period. The applied load shall then be increased until the failing load is reached and value recorded.

2. D.C. RESISTANCE TEST

On an earthwire sample of minimum 5m length, two contact clamps shall be fixed with a predetermined Bolt torque. The resistance shall be measured by a Kelvin double-bridge by placing the clamps initially zero meter and subsequently one meter apart. The test shall be repeated at least five times and the average value recorded. The value obtained shall be corrected to the value at 20°C shall conform to the requirements of this specification.

3. Visual check for joints, scratches etc. and length of earthwire

Earthwire drums shall be rewound in the presence of the inspector. The inspector shall visually check for joints, scratches etc. and see that the earthwire generally conforms to the requirements of this specification. The length of earthwire wound on the drum shall be measured with the help of counter meter during rewinding.

4. TORSION TEST

The minimum number of twists which a single steel strand shall withstand during torsion test shall be eighteen for a length equal to 100 times the standard diameter of the strand. In case the test sample length is less or more than 100 times the standard diameter of the strand, the minimum number of twists will be proportionate to the length and if number comes in the fraction then it will be rounded off to next higher whole number.

5. DIMENSIONAL CHECK

The individual strands shall be dimensionally checked to ensure that they conform to the requirements of this specification.

6. LAY LENGTH CHECK

The lay length shall be checked to ensure that they conform to the requirements of this specification.

7. GALVANISING TEST

SECTION - (SE)
SWITCHYARD ERECTION

The test procedure shall as specified in IS:4826-1968. The material shall conform to the requirements of this specification. The adherence of zinc shall be checked by wrapping around a mandrel four times the diameter of steel wire.

8. CHEMICAL ANALYSIS OF ZINC USED FOR GALVANIZING

Samples taken from zinc ingots shall be chemically/spectrographically analysed. The same shall be in conformity to the requirements stated in this specification.

9. CHEMICAL ANALYSIS OF STEEL

Samples taken from steel ingots/coils/strands shall be chemically/spectrographically analysed. The same shall be in conformity to the requirements stated in this specification.

**SECTION - (SE)
SWITCHYARD ERECTION**

ANNEXURE-E

Sl.	Description	Unit	ACSR ZEBRA	ACSR PANTHER
		km		
c)	Maximum	kg/km	1653	993
5.13	Modulus of Elasticity	Kg/sq. mm		8158
5.14	Co-efficient of Linear Expansion	Per Deg. C	19.3×10^{-6}	17.8×10^{-6}
5.15	Minimum Corona Extinction Voltage	KV (rms)	154	92
5.16	RIV at 1 Mhz	Micro volts	Less than 1000 at 154 kV (rms)	Less than 500 at 92 kV (rms)
6.0	Drum Dimensions		Generally conforms to IS:1778	
a)	Flange Diameter	mm	1850	1850
b)	Traverse width	mm	925	925
c)	Barrel Diameter	mm	650	650
d)	Flange thickness	mm	50x50	50x50

1.2

Guaranteed technical particulars of Galvanised Steel Earthwire

	Description	Unit	Standard Values
1.0	Raw Materials		
1.1	Steel wires / rods		
a)	Carbon	%	Not more than 0.55
b)	Manganese	%	0.40 to 0.90
c)	Phosphorous	%	Not more than 0.04
d)	Sulphur	%	Not more than 0.04
e)	Silicon	%	0.15 to 0.35
1.2	Zinc		
a)	Minimum purity of Zinc	%	99.95
2.0	Steel strands		
2.1	Diameter		
a)	Nominal	mm	3.66
b)	Maximum	mm	3.74
c)	Minimum	mm	3.58
2.2.	Minimum breaking load of strand		
a)	After stranding	KN	10.58
2.3	Galvanising		
a)	Minimum weight of zinc coating per sq.m. after stranding	gms.	275
b)	Minimum number of dips that the galvanized strand can withstand	Nos.	3 dips of 1 minute and

SECTION - (SE)
SWITCHYARD ERECTION

ANNEXURE-E

	in the standard preece test		one dip of ½ minute
c)	Minimum number of twists in a gauge length equal to 100 times diameter of wire which the strand can withstand in the torsion test, after stranding	Nos.	18
3.0	Stranded Earth wire		
3.1	UTS of Earth wire	KN	68.4 (min.)
3.2	Lay length of outer steel layer		
a)	Standard	mm	181
b)	Maximum	mm	198
c)	Minimum	mm	165
3.3	Maximum DC resistance of earth wire at 20° C	Ohm/km	3.375
3.4	Standard length of earth wire	M	2000 or actual quantity whichever is less.
3.5	Tolerance on standard length	%	±5
3.6	Direction of lay for outside layer		Right hand
3.7	Linear mass		
a)	Standard	Kg/km	583
b)	Maximum	Kg/km	552
c)	Minimum	Kg/km	600
3.8	Overall diameter	mm	10.98

1.3

Guaranteed Technical Parameters of Aluminum Tube

A. GTP for 3" IPS & 4" IPS AL. TUBE

Sl. No.	Description	3" AL. TUBE	4" AL. TUBE
1.	Size	3" IPS (EH Type)	4" IPS (EH Type)
2.	Material	Aluminium Alloy 6101 T6 conforms to 63401 WP (range 2) of IS 5082 : 1998	
3.	Chemical Composition		
i)	Cu		0.05 Max
ii)	Mg		0.4 to 0.9
iii)	Si		0.3 to 0.7
iv)	Fe		0.5 Max
v)	Mn		0.03 Max
Vi)	Al		Remainder
4.	Outer diameter	88.90 mm	114.2 mm
5.	Tolerance on outer diameter	+2.2 mm, - 0.0 mm	+2.2 mm, - 0.0 mm
6.	Thickness	7.62 mm	8.51 mm
7.	Tolerance on thickness	+2.2 mm, - 0.0 mm	+2.2 mm, - 0.0 mm
8.	Cross-sectional area	1945.76 sq.mm	2825.61 sq.mm
9.	Weight	5.25 kg/m	7.7 kg/m
10.	Moment of Inertia	1621589.99 mm ⁴	3972577.97 mm ⁴
11.	Section Modulus	86481.21 mm ³	69572.29 mm ³

SECTION-3

PROJECT DETAILS & GENERAL SPECIFICATION

SITE INFORMATION

	Particular	Details
a)	Owner	POWERGRID
b)	Customer	POWERGRID
c)	Project Title	Substation Package – Substation Package -SS01 for Construction of 765/400/220kV Bhuj Pool (New) S/S and Extension of 765kV Banaskantha S/S under Green Energy Corridors: Inter-State Transmission Scheme (ISTS) – Part C.
d)	Location	Bhuj, Gujrat Banaskantha , Gujrat
e)	Transport Facilities	ROAD/TRAIN, For Bhuj Nearest Rail Head: Bhuj ROAD/TRAIN, For Banaskantha Nearest Rail Head: Palanpur
SITE CONDITIONS		
a)	Max. ambient air temp.	50°C
b)	Min. ambient air temp.	0°C
c)	Max. design ambient temp.	50°C
d)	Design reference temp.	50°C

e)	Average Humidity	Max. 100%
f)	Special corrosion conditions	No
g)	Solar Radiation	1.2kW/sqmtr
h)	Atmospheric UV radiation	High
i)	Altitude above sea level	Less than 1000meter
j)	Pollution Severity	High Pollution level (31mm/kV) For BHUJ High Pollution (25mm/kV) for Banaskantha
k)	Seismic Zone	As per the seismic zone defined in the relevant BIS / IEC-62271-300 but not less than 0.3g horizontal
WIND DATA		
	Wind velocity	As per IS
	Average No. of thunderstorm days per annum	As per IS
Main Electrical Parameters:		
	Fault Levels:	765kV: 50kA for 1 sec 400kV: 63kA for 1 sec 220kV: 40kA for 1 sec
	Creepage Distance	31mm/kV for 765kV/400kV/220kV BHUJ S/S 25mm/kV for Extn. of 765kV Banaskantha S/S

TECHNICAL CHECK LIST

(INFORMATION TO BE FURNISHED WITH OFFER)

RETURN THIS CHECKLIST AS THE PART OF THE OFFER DULY SIGNED BY THEM.

S.No.		Confirmation Yes/No	Remarks
1.	Compliance to Power grid GTP enclosed(Refer Annexure-E) with specification		
2.	Powergrid approved valid Manufacturing Plan (pls mention date till it is valid)		
3.	Powergrid approved type test report (pls check the date of validity wrt to dated 07.04.2015)		

Date:

Place:

Phone:

Fax:

E-mail:

Mobile:

Website:

ANNEXURE - 1

SCHEDULE OF TECHNICAL DEVIATIONS

Bidder shall list below all technical deviation clause wise w.r.t. tender specifications:

S.No.	Page No.	Clause No.	Deviation	Reason / Justification
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Any deviation not specifically brought out in this section shall not be admissible for any commercial implication at later stage. Except to the technical deviations listed in this schedule, bidder's offer shall be considered in full compliance to the tender specifications irrespective of any such deviation indicated / taken elsewhere in the submitted offer.

Date:

Tenderer's Stamp & Signature