ANNEXURE-TQR

TECHNICAL QUALIFICATION REQUIREMENT

Name of Project: 1X660MW SAGARDIGHI UNIT5 PROJECT

Name of Customer: WBPDCL KOLKATA

Name of Item: **GALVANISED STEEL SHIELD WIRE**

TECHNICAL QUALIFICATION REQUIREMENT
Bidder should have offered material from manufacturer who has manufactured and supplied at least 2 KM of Galvanised steel Shield wire during the last 5 years from the original scheduled date of bid opening.

SUPPORTING DOCUMENTS TO BE SUBMITTED BY BIDDER ALONG WITH TECHNICAL BID		
Sr	**Required Criteria**	**Supporting Documents**
1	Manufacturing	Approved GTP / Approved Quality Plan / Factory Inspection Test Report etc. of offered item
2	Supply	PO / Dispatch clearance / LR / Material Receipt certificate at site / etc. of offered item
3	Type Test	TTR approval from customer / Type Test Report etc. establishing successful type tested design

18/08/2022

JINTU GOGOI
Dy. MANAGER-TBEM

18/08/2022

SHOBHNA SINGH
Sr. MANAGER-TBEM

18/08/2022

SANJEEV K. SRIVASTAVA
Sr. DGM-TBEM

STANDARD TECHNICAL SPECIFICATION
for

Galvanised steel shield wire

SPECIFICATION NO: TB-STD-316-021
REVISION: 0
DATE: 04.08.2022

BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS GROUP
NOIDA, UP (INDIA) – 201305

	Prepared by	Checked by	Approved by
Name	Shobhna Singh	Sanjeev Shrivastava/ Vivek Kapil	Aruna Gulati
Signature	Shobhna	Sanjeev	3/20/11
Date	05/08/22	05/08/22	5/8/12

INDEX

Section-I: Scope, Bill of Quantities & Specific Technical Requirements

1.0 PURPOSE

This specification is intended for finalization of [redacted] contract between BHEL TBG and bidder. Standard technical details as indicated in the specification shall be agreed upon between BHEL TBG and bidder. Project specific technical detail shall be made available to the bidder along with project enquiry.

2.0 SCOPE

This technical specification covers the requirements of design, manufacture, inspection and testing at manufacture's works, proper packing and delivery to site of **Galvanised steel Shield wire** conforming to this specification.

It is not the intent to specify herein all the details of design & manufacture of material. However, the material shall conform in all respects to high standard of design, engineering & workmanship and shall be capable of performing in continuous commercial operation at site condition.

Technical requirements of Galvanised steel Shield wire are indicated in Section-II.

No deviation from the requirements specified in various clauses of this specification shall be allowed. A duly signed & stamped certificate to this effect shall have to be furnished along with the offer in the format of as provided in the NIT document. Bidder shall mandatorily submit the format along with the offer and in case the certificate is not submitted, the offer will be deemed to be considered as without any technical deviations.

3.0 BILL OF QUANTITIES

Refer **ANNEXURE-BOQ.**

Note:

1. The bidder to quote for items as per unpriced price schedule attached with NIT. **The quantity as mentioned in the BOQ** [redacted]
2. Quantity variation as per NIT terms & condition.
3. [redacted]
4. **Unit price of Galvanised steel Shield wire should be inclusive of non-returnable wooden drum.**

4.0 DOCUMENTS & DRAWINGS TO BE SUBMITTED

Bidders shall submit following documents duly signed and sealed as the part of their technical offer for evaluation,

(i) UNPRICED BOQ mentioning "QUOTED" against each item as per format given with NIT.
(ii) Documents for meeting the TECHNICAL QUALIFICATION REQUIREMENT
(iii) NIL Technical Deviations Certificate as per format given with NIT.

After placement of project specific Purchase order BHEL will provide project site information within one-week time.

Following documents shall be submitted for specific project requirement after placement of order for the approval of BHEL/Customer,

Sl. no.	Drawing / Document Description	Document no.	Document Type	First Submission	Resubmission
1	Technical Data Sheet (to be submitted for all projects except POWERGRID projects)	[redacted]	Primary	Within 2 weeks of PO	Within 1 week of comments
2	Quality Plan	[redacted]	Primary	Within 2 week of PO	Within 1 week of comments
3	Routine & Acceptance Test Reports	[redacted]	Secondary	Within 1 week of test conduction	--

Notes

1. Approval on Primary documents is essential for providing manufacturing clearance.
2. The bidder/ manufacturer may note that all re-submissions must incorporate all comments given in the prior submission by the Purchaser. Adequate justification for not incorporating the same must be submitted, failing which the submitted documents may be returned.

5.0 TECHNICAL QUALIFYING REQUIREMENT & EXPERIENCE

Technical qualifying criteria is as per Annexure-TQR attached herewith.

6.0 TYPE TESTING

The bidder shall submit the type tests reports for the tests conducted on the equipment(s) identical or similar to those to be supplied under this contract and the test(s) should have been conducted at an independent laboratory not earlier than ten (10) years from the date of original scheduled date of bid opening. If any type test report is found to be technically unacceptable, such type test(s) shall be conducted by the bidder without any cost and delivery implication to BHEL/customer.

The type test (s) as per section-II shall be carried out in line with procedure mentioned in the detailed technical specification.

All acceptance, routine tests and tests during manufacture as per relevant standards and specification shall be deemed to be included in the bidder's scope.

7.0 QUALITY ASSURANCE, TESTING & INSPECTION

7.1 At contract stage, the successful bidder shall submit the Quality Plan (QP) for approval of BHEL/ end customer. **BHEL standard quality plan is enclosed as TBQM-STD-SHW**. The standard QP enclosed is for reference purpose and project specific approval shall be given only after project specific purchase order placement. In case the bidder has reference Quality Plan agreed with end customer, same can be submitted for specific project after award of contract for approval/ extension from BHEL/customer. There shall not be any commercial implication to BHEL on account of changes in Quality Plan (QP) during contract stage.

7.2 All materials shall be procured, manufactured, inspected and tested by vendor/ sub-vendor as per approved Quality Plan (QP). The supplier shall perform all tests necessary to ensure that the material and workmanship conform to the relevant standards and comply with the

requirements of the specification.

7.3 The supplier shall perform all routine and acceptance tests during manufacturing as per requirement of the specification. The material shall be offered for inspection by BHEL/customer in accordance with agreed Quality Plan (QP) with 1 Week advance information. Commercial implications, if any for all these tests shall be deemed to be included in the bid price.

8.0 PACKING AND MARKING

The material shall be packed to ensure protection against damage during transit, storage for prolonged periods and handling.

The drum shall be properly marked as per following details,

1. Name & Address of Consignee
2. Purchase Order Number with Date
3. Name of Supplier
4. Description of Materials along with size/ length etc.

9.0 ABBREVIATIONS USED

NIT: Notice Inviting Tender
QP: Quality Plan
BOQ: Bill of Quantities
IS: Indian Standard
IEC: International electro-technical commission

ANNEXURE-BOQ

BILL OF QUNATITIES:

SL NO	DESCRIPTION	QUNATITY	UNIT
1	7/8 GI SHIELD WIRE	1.2	KM

QUALITY PLAN

ITEM : GI SHIELD WIRE	QP NO : TBQM-STD-SHW REV: 01 DATE : Page 1 of 4	PROJECT : PACKAGE /CONTRACT : CONTRACTOR : BHEL

S.NO.	COMPONENT / OPERATION	CHARACTERISTIC CHECKED	CATEGORY	TYPE OF CHECK	EXTENT OF CHECK	REFERNCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	D	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	D	10	11	12	13
A. RAW MATERIAL													
1	High Carbon Steel wire rod	Chemical Composition	Major	Chem.	4 samples / heat / lot	IS 7904 & BHEL Specification / GTP	IS 7904 & BHEL Specification / GTP	Mfr TC	Y	M		C,N	a) Wire Rod to be taken from BHEL approved Sources. b) Co-relation of Material Test Certificates to be maintained
		Dimensions including diameter & ovality	Major	Physical	-do-	-do-	-do-	-do-	Y	M		C,N	
		Physical tests -UTS -Elongation -% redn. in area -Cleanliness & smoothness	-do-	Visual / physical	-do-	-do-	-do-	-do-	Y	M		C,N	
		Microstructure -structure -Grain size -Inclusion rating -Surface defect	-do-	Visual / Metallurgical	3 samples / heat / lot	-do-	-do-	-do-	Y	M		C,N	
		Decarburisation	-do-	Visual / Metallurgical	3 samples / heat / lot	-do-	-do-	-do-	Y	M		C,N	
2.	Electrolytic Zinc	Chemical composition	Major	Chemical	1 sample / 50 MT lot	IS 209	IS 209 Purity of 99.5 % min.	Supplier TC	Y	M		C,N	Co-relation of Material Test Certificates to be maintained

BHEL SIGN & SEAL	LEGEND : M – SUPPLIER / SUB SUPPLIER P – PERFORMED BY C - BHEL / NOMINATED INSPECTION AGENCY W – WITNESSED BY N – CUSTOMER /CUSTOMER NOMINATED AGENCY V – VERIFICATION BY CHP- CUSTOMER HOLD POINT TC – TEST CERTIFICATE IR- INSPECTION REPORT JIR – JOINT INSPECTION REPORT	APPROVED BY SIGN & SEAL

QUALITY PLAN

ITEM : GI SHIELD WIRE	QP NO : TBQM-STD-SHW REV: 01 DATE : Page 2 of 4	PROJECT : PACKAGE /CONTRACT : CONTRACTOR : BHEL

S.NO.	COMPONENT / OPERATION	CHARACTERISTIC CHECKED	CATEGORY	TYPE OF CHECK	EXTENT OF CHECK	REFERNCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD		AGENCY			REMARKS
										P	W	V	
1	2	3	4	5	6	7	8	9	D	10	11	12	13
		-do- of bath sample	Major	Chemical	1 sample / day	IS 209	IS 209 Purity of 98.5 %	TC of TPI lab	Y	M		C	
B	FINAL INSPECTION & TESTING												
1.0	ACCEPATANCE TESTS ON COMPOSITE GALV. STRANDED STEEL WIRE												
1.1		Overall dia of composite galvanized stranded steel wire	Major	Measurement	One sample from every 10 drums or part thereof	IS: 2141	Appd GTP / IS 2141	Test certificate	Y	M	C,N		
1.2		No. of strand & their dia.	Major	Measurement	One sample from every 10 drums or part thereof	IS: 2141	Appd GTP / IS 2141	Test certificate	Y	M	C,N		
1.3		Total area of cross a section	Major	Calculation	"	IS: 2141	Appd GTP / IS 2141	Test certificate	Y	M	C,N		

BHEL SIGN & SEAL	LEGEND : M – SUPPLIER / SUB SUPPLIER P – PERFORMED BY C - BHEL / NOMINATED INSPECTION AGENCY W – WITNESSED BY N – CUSTOMER /CUSTOMER NOMINATED AGENCY V – VERIFICATION BY CHP- CUSTOMER HOLD POINT TC – TEST CERTIFICATE IR- INSPECTION REPORT JIR – JOINT INSPECTION REPORT	APPROVED BY SIGN & SEAL

QUALITY PLAN

ITEM : GI SHIELD WIRE	QP NO : TBQM-STD-SHW REV: 01 DATE : Page 3 of 4	PROJECT : PACKAGE /CONTRACT : CONTRACTOR : BHEL

S.NO.	COMPONENT / OPERATION	CHARACTERISTIC CHECKED	CATEGORY	TYPE OF CHECK	EXTENT OF CHECK	REFERNCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD		AGENCY			REMARKS
										P	W	V	
1	2	3	4	5	6	7	8	9	D	10	11	12	13
1.4		Lay length & Direction	Major	Measurements	One sample from every 10 drums or part thereof	IS: 2141	Appd GTP / IS 2141	Test certificate	Y	M	C,N		
1.5		Breaking load of composite galvanized stranded steel wire	Major	Mechanical	"	"	Appd GTP / IS 2141	Test certificate	Y	M	C,N		
1.6		Elongation of composite galvanized stranded steel wire	Major	Measurement	"	"	Appd GTP / IS 2141	Test certificate	Y	M	C,N		
1.7		D.C. Resistance on composite galvanized stranded steel wire	Major	Electrical	"	"	Appd GTP / IS 2141	Test certificate	Y	M	C,N		
2.0	ACCEPTANCE TESTS ON INDIVIDUAL GALVANIZED STEEL WIRE												
2.1		PREECE test (Uniformity of zinc coating)	Major	Chemical	One sample from	IS:4826	1 min x 3 dip & ½ minute x 1 dip. At the end	Test certificates	Y	M	C C,N		

BHEL SIGN & SEAL	LEGEND : M – SUPPLIER / SUB SUPPLIER P – PERFORMED BY C - BHEL / NOMINATED INSPECTION AGENCY W – WITNESSED BY N – CUSTOMER /CUSTOMER NOMINATED AGENCY V – VERIFICATION BY CHP- CUSTOMER HOLD POINT TC – TEST CERTIFICATE IR- INSPECTION REPORT JIR – JOINT INSPECTION REPORT	APPROVED BY SIGN & SEAL

QUALITY PLAN

ITEM : GI SHIELD WIRE	QP NO : TBQM-STD-SHW REV: 01 DATE : Page 4 of 4	PROJECT : PACKAGE /CONTRACT : CONTRACTOR : BHEL

S.NO.	COMPONENT / OPERATION	CHARACTERISTIC CHECKED	CATEGORY	TYPE OF CHECK	EXTENT OF CHECK	REFERNCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD		AGENCY			REMARKS
										P	W	V	
1	2	3	4	5	6	7	8	9	D	10	11	12	13
					every 10 drums of part thereof		of specified no. of dips the specimen shall not show any deposit of copper upon base metal						
2.2		Weight of zinc coating	Major	Chemical	"	"	Min. 275 gms/ sq.mtr.	Test certificates	Y	M	C,N		
2.3		Adhesion test	Minor	Mechanical	"	"	The zinc coating shall remain adherent to the steel wire when wound 10 turns on a mandrel having dia. equal to 6 times the dia. of the wire	Test certificates	Y	M	C,N		
2.4		Chemical Analysis of Steel	Major	Chemical	"	"	Appd GTP / IS 2141/Tech Spec		Y	M	C,N		

NOTE: LATEST EDITION OF IS CODE SHALL BE FOLLOWED.

BHEL SIGN & SEAL	LEGEND : M – SUPPLIER / SUB SUPPLIER P – PERFORMED BY C - BHEL / NOMINATED INSPECTION AGENCY W – WITNESSED BY N – CUSTOMER /CUSTOMER NOMINATED AGENCY V – VERIFICATION BY CHP- CUSTOMER HOLD POINT TC – TEST CERTIFICATE IR- INSPECTION REPORT JIR – JOINT INSPECTION REPORT	APPROVED BY SIGN & SEAL

Section 2: Detailed Technical Requirements for Material under Scope of Supplies

1.0 SCOPE

This section covers the standard technical requirements of the Galvanised steel Shield wire .

2.0 APPLICABLE STANDARDS

The Galvanised steel Shield wire shall strictly conform to the following Indian and International standards, as appropriate,

IS: 398 (Part-II):1976 Aluminium conductors for overhead transmission purposes
IEC: 61089/IS 398 (Part-V) Aluminium conductors galvanized Steel reinforced
IS 2629:1990 Recommended practice for hot dip galvanizing on iron and steel.
IS 4826:1992 Hot dip galvanized coatings on round steel wires
IS 2633:1992 Method for testing uniformity of coating of zinc--coated articles.
IS 6745: 1990 Methods for determination of mass of Zinc coating on zinc coated iron and steel articles
IS 8263:1990 Methods for radio interference test
IS 1778:1980 Reels and drums for bare conductors
IS 1521:1991 Method for tensile testing of steel wire

3.0 TECHNICAL REQUIREMENTS & CONSTRUCTIONAL DETAILS

3.1 Details of Earth wire

3.1.1 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 guaranteed technical particulars given hereunder. For POWERGRID project, separate approval **for guaranteed technical particulars** is not required during detailed engineering.

3.2 Workmanship

3.2.1 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.
3.2.2 The finished material shall have minimum brittleness as it will be subjected to appreciable vibration while in use.
3.2.3 The steel strands shall be hot dip qalvanised and shall have minimum Zinc coating after stranding, as stipulated in guaranteed technical particulars attached herewith. 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.
3.2.4 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.
3.2.5 To avoid susceptibility towards wet storage stains (white rust), the finished material shall be provided with a protective coating of boiled linseed oil.

3.3 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.

3.4 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.

3.5 Materials

3.5.1 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.

3.5.2 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.

3.6 Standard Length

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

3.7 TESTS

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

3.7.2 TYPE TESTS

In accordance with the stipulation of specification, the following type tests reports of the earthwire shall be submitted for approval:

a)	UTS test	As per Annexure - A
b)	DC resistance test	

3.7.3 ACCEPTANCE TESTS

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

3.7.4 ROUTINE TESTS

a) Check that there are no cuts, fins etc. on the strands.

b) Check for correctness of stranding.

3.7.5 TESTS DURING MANUFACTURE

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

4.0 GUARANTEED TECHNICAL PARTICULARS

S. no.	Description	Unit	Standard Values	
			7/9 SWG	7/8 SWG
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	4.00
b)	Maximum	mm	3.74	4.08
c)	Minimum	mm	3.58	3.92
2.2.	**Minimum breaking load of strand**			
a)	After stranding	KN	10.58	11.7
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 in the standard preece test	Nos.	3 dips of 1 minute and 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 (min.)**	KN	68.4	77.7
3.2	**Lay length of outer steel layer**			
a)	Standard	mm	181	180
b)	Maximum	mm	198	216
c)	Minimum	mm	165	144
3.3	**Maximum DC resistance of earth wire at 20° C**	Ohm/km	3.375	2.09

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	687
b)	Maximum	Kg/km	552	719
c)	Minimum	Kg/km	600	663
3.8	**Overall diameter**	mm	10.98	12

Annexure-A

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

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.