

ESP-001- 2A Rev.00		PROJECT ENGINEERING & SYSTEMS DIVISION				Std. / Doc. Number	
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TECHNICAL SPECIFICATION FOR LT POWER CABLE FOR SIGNAL & TELECOMMUNICATION PURPOSE <table border="1"> <tr> <td>PROJECT</td><td colspan="5"> ELECTRIFICATION WORKS FOR BIRLANAGAR - ETAWAH, BHANDAI -UDL,FARRUKHABAD-SHIKOHABAD INCLUDING MAINPURI - ETAWAH SECTIONS OF NORTH CENTRAL RAILWAY 386 RKM/440 TKM </td></tr> </table>						PROJECT	ELECTRIFICATION WORKS FOR BIRLANAGAR - ETAWAH, BHANDAI -UDL,FARRUKHABAD-SHIKOHABAD INCLUDING MAINPURI - ETAWAH SECTIONS OF NORTH CENTRAL RAILWAY 386 RKM/440 TKM				
PROJECT	ELECTRIFICATION WORKS FOR BIRLANAGAR - ETAWAH, BHANDAI -UDL,FARRUKHABAD-SHIKOHABAD INCLUDING MAINPURI - ETAWAH SECTIONS OF NORTH CENTRAL RAILWAY 386 RKM/440 TKM										
Revisions:		Prepared by :	Checked by :	Approved by :	Date :						
Refer to record of revisions		T Subrahmanyam	K.Venkatesh	Abu Tahir Malick	28.02.2019						

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**1.0 INTENT OF SPECIFICATION:**

This specification governs the requirements of design, manufacture, testing and packing at manufacturer's work and delivery at site and complete in all respects of this specification.

2.0 TECHNICAL REQUIREMENTS:

All the technical requirements of LT Power cables shall be as per the enclosed specification with Document Number: IRS:S 63/2014 (Rev.4) & IS 1554-I and latest amendments as on 31st October 2018. Insulation requirement for the cables of this tender is Extruded XLPE. XLPE shall be supplied as per Annexure-02 of this specification.

3.0 MATERIAL CODES :

Bidder to offer material as per Price format in Annexure-1 and enquiry requirements.

4.0 DRUM LENGTH REQUIREMENTS:

Technical requirement of drums shall be as per above-mentioned specification and the drum length shall be 500 meters with tolerance of +2% and -2%.

5.0 DOCUMENTATION:**5.1 DRAWINGS, DATA AND MANUAL:****5.1.1 To be submitted along with bid**

a	Technical data sheets for information.
b	Cross sectional drawing of LT Power cable for information.
c	RDSO approval certificate for manufacture of cable.
d	Type Test Certificates for information.
e	RDSO Approved Quality Assurance plan.
f	Bidder shall furnish NO DEVIATION SHEET as per Cl.No 6.0 .
g	Check list for Bid Submission as per Cl.No 7.0
h	Duly filled unpriced price schedule as per Annexure-1

Document at Sl. no. a to d above shall be submitted in line with IRS:S 63/2014 (Rev.4), Annexure-2 of this specification & IS 1554-I and latest amendments as on 31st October 2018.

If Type Tests Certificates are not available for any size of cable, same shall be conducted by vendor at his own cost in any recognized laboratory in the presence of BHEL /BHELTPIA /RDSO /CORE. If in-house test facilities are to be used then the testing equipment's shall be calibrated (valid calibration certificates shall be produced during inspection) and traced back to National Calibration standards. The reports shall be submitted for BHEL's/RDSO/CORE approval before dispatch of the cables. There shall not be any delivery and commercial implications on account of this.

In case RDSO approval certificate as per RDSO specification as per IRS:S 63/2014 (Rev.4) & IS 1554-I and latest amendments as on 31st October 2018 is found not meeting the specification requirements, the bidder's offer will be rejected.

5.1.2 To be submitted in 6 sets after award of contract

Sl. No.	Description
a	Completely filled in technical data sheets as per relevant formats given shall be furnished. Separately typed vendor datasheets are NOT acceptable.
b	Type Test Certificates for review
c	Cross sectional drawing of LT Power cable for information.
d	Storage Instruction including handling of material at Site

6 set of all Drawings & document shall be submitted as per IRS:S 63/2014 (Rev.4), Annexure-2 of this specification & IS 1554-I and latest amendments as on 31st October 2018 within 1 week time after release of LOI/PO whichever is earlier.



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BHEL shall provide comments/approval within 10 days of receipt of drawings. Vendor shall incorporate comments, if any, and submit revised drawings within 7 days for final approval. Vendor is responsible for completion of approval cycle and minimizing number of revisions.

6.0 NO DEVIATION FORMAT

ENQUIRY NUMBER _____ NAME OF BIDDER _____
ITEM _____ OFFER REF _____
NUMBER _____

S/N	Clause/ Spec Number	Description	Deviation	Nature of Deviation	Remarks
1					
2					
3					
4					
5					

NOTES:

1. **Technical offer of the bidder will be evaluated only on the basis of No Deviation Schedule. No**

Deviation Schedule constitutes this sheet (with these Notes) duly signed and stamped.

- As vendor is RDSO approved vendor, deviations are not accepted against RDSO standard specification, RDSO approved drawings & RDSO approved quality assurance plan. Accordingly, No deviation schedule shall be filled and submitted along with technical offer.
- No price implications shall be entertained by BHEL during technical scrutiny & order execution stage. Hence, in no case there will be consideration of price implications.
- Bidder to submit the "No Deviation Schedule" by writing "NO Deviations" in this format.
- If the "No Deviation Schedule" is not submitted along with the offer, the bidder's offer is likely to be rejected without any further interaction with the bidder.

SIGNATURE OF BIDDER _____

NAME _____

DESIGNATION _____

DATE _____

COMPANY SEAL

**7.0 GENERAL:****7.1 CHECKLIST FOR BID SUBMISSION****(TO BE FILLED BY BIDDER AND SUBMITTED ALONG WITH OFFER)**

Sl. No.	Description	Bidder Confirmation	Comments/ Remarks
1	Technical offer is conforming to technical specification PY55374 & its associated Annexures (if any), pre-bid clarifications (if any) etc., Bidder to confirm (Yes / No).		
2	Bidder confirms that they have read the provisions of the Deviation Schedule and have included the deviation Schedule in the Offer after agreeing to the said Provisions (Yes/No).		
3	Bidder confirms that Prices for all items have been Quoted. Unpriced & Priced Schedules are included in the Techno-commercial Offer and Priced Offer respectively.(Yes/NO)		

Notes: Offer received without affirmative confirmation against any of the above points may not be considered for evaluation.

(Signature and stamp of bidder with date)

7.2 Quantities mentioned are tentative requirement. Based on the actual requirement, quantity can be increased or decreased by about 15% on overall qty. Final BOQ will be informed before price bid opening. Unit rates quoted by bidder shall be applicable for the revised BOQ also.

TABLE -1: Material Codification

Var. No.	Material Description	BHEL Material Code
1	2Cx25 sqmm Aluminium XLPE cable	PY9755374000
2	2Cx50 sqmm Aluminium XLPE cable	PY9755374019
3	2Cx70 sqmm Aluminium XLPE cable	PY9755374027
4	2Cx150 sqmm Aluminium XLPE cable	PY9755374035

8.0 INSPECTION & TESTING

8.1 Stage & Final Inspection shall be done by Purchaser/CORE/RDSO/Third party appointed by Purchaser or End user as per approved QAP. Twenty days advance notice along with three sets of drawing approved by BHEL with factory test reports shall be furnished along with the inspection call.

8.2 Testing of LT Power cables for S&T purpose shall be as per IRS:S 63/2014 (Rev.4) & Annexure-2 of this specification & IS 1554-I and latest amendments as on 31st October 2018

8.3 Stage and final Inspection including document review shall be carried out by RDSO/CORE/ their representative and BHEL at vendor works as per RDSO approved QAP .

**10.0 PACKING & DISPATCH**

9.1 Packing and Dispatch of LT Power cable for S&T purpose shall be as per IRS:S 63/2014 (Rev.4), Annexure-2 of this specification & IS 1554-I and latest amendments as on 31st October 2018

11.0 PACKAGE EXECUTION SCHEDULE

Sl. No.	Event	Schedule
		Vendor Drawings
1	Drawings/Data Sheet submission	Within 1 week from P.O. date and the drawing/data sheet shall be in line with the specification.
2	BHEL Comments/Approval for Manufacture Clearance	Within 1 week from receipt of the "Drawings in line with Specification"
3	Revised Drawings submission	Within 1 week from BHEL's comments date
4	BHEL Approval	Within 1 week from receipt of the revised Drawings

However, it's vendor responsibility to ensure the cycle time reduction for the submission of drawing and submission of drawing inline with the specification.

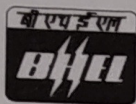
12.0 TECHNICAL DATA SHEET**S.No. Description**

1. Cable size
2. BHEL material code
3. Cable code
4. Applicable standards:
5. Name of vendor
6. Voltage Grade
7. Maximum conductor temperature under Normal operating conditions :
8. Maximum conductor temperature under Short circuit conditions :
9. Permissible voltage variation:
10. Permissible frequency variation:
11. Combined voltage & frequency variation
12. **Conductor :**
 - a. Conductor material :
 - b. Size (sq.mm) Nominal(Main/Neutral)
 - c. No.of wires & diameter of each wire (No/mm)
 - d. Shape of conductor
 - e. Maximum DC resistance of conductor at 20deg.C
13. **Insulation:**
 - a. Insulation Material
 - b. Insulation Type
 - c. Extruded (Yes/No)
 - d. Thickness of insulation(Nominal)(mm)(Main/Neutral) :
14. Core identification:
15. Calculated dia over laid up cores:
16. **Inner sheath :**



- a. Material
- b. Type
- c. Minimum Thickness
- d. Extruded: Yes.
- e. Calculated diameter of cable :
under armour(as per IS:10462)
- 17. Armouring :**
- a. Material :
- b. Type of armour :
- c. Nominal dia of armour:
- d. No.of armour wires/strips:
- e. DC resistance of armour
18. Nominal diameter of cable under :
outer sheath
19. Calculated diameter of cable under :
outer sheath
20. **Outer sheath** :
- a. Material
- b. Type
- c. Minimum Thickness:
- d. Extruded: Yes
21. Nominal outer diameter of cable :
22. Calculated outer diameter of cable:
23. Tolerance on outer diameter :
24. Electrical parameters:
- a. AC resistance at 90 deg.C:
- b. Cable reactance:
- c. Cable impedance:
25. Short circuit rating of conductor for the
Duration of 1 sec(kA)
26. Maximum drum length of cable:
27. Continuous current rating for standard IS conditions laid direct (amps)
- a. In ground (ground temp of 30 deg.C)
- b. In duct (ground temp of 30 deg.C)
- c. In air (ambient temp of 40 deg.C)
28. Embossing on outer sheath:
29. Total I²R losses(watts/meter/phase),
When cable laid in ground.
30. No. of end caps:
31. Tests to be conducted:
32. Current carrying capacity(in air at 40°C) :
(in ground at 30°C)
33. Derating factor for cable current carrying :
carrying for different method of laying

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RECORD OF REVISIONS

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PRICE FORMAT

(ANNEXURE-1 TO SPECIFICATION PY55374 REV01)

PROJECT:		BHEL ENQUIRY NO.:										
CUSTOMER: M/s		ITEM: LT POWER CABLE FOR SIGNAL & TELECOMMUNICATION PURPOSE										
SUPPLIER: M/s		QUOTATION REF. NO. & DATE:										
BREAK UP OF EPS PRICE BID OF LT POWER CABLE FOR SIGNAL & TELECOMMUNICATION PURPOSE												
THESE COLUMNS SHALL APPEAR AND SHALL BE FILLED IN EPS BID ALSO												
LIST OF ITEMS	SL. NO.	DESCRIPTION 1	HSN CODE (8 DIGIT)	QTY. in meter	MU	UNIT PRICE for Line ITEM (RS.) [Ex-Works]	TOTAL PRICE (RS.) [Ex-Works]	P&F Charges (In Rs. OR in % OR Inclusive)	Freight Charges (In Rs. OR in % OR Inclusive)	Total Price (in Rs.)	GST (%)	GST Amount (in Rs.)
			(A)	(B)	(E)	(F)	(G) = (FxB)	(H)	(I)	(J) = (G)+(H)+(I)	(K)	(L)
1		MATERIAL CODE: PY9755374000: 2Cx25 sqmm Aluminium XLPE cable		15000	meter							
2		MATERIAL CODE:PY9755374019: 2Cx50 sqmm Aluminium XLPE cable		2000	meter							
3		MATERIAL CODE: PY9755374027: 2Cx70 sqmm Aluminium XLPE cable		105000	meter							
4		MATERIAL CODE: PY9755374035: 2Cx150 sqmm Aluminium XLPE cable		4800	meter							
NOTES:												
i) THE TENDER SHALL BE EVALUATED ON OVERALL L1 BASIS EXCLUDING GST.												
ii) BIDDER TO ATTACH UN-PRICED BID WITHOUT DISCLOSING RATES/ PRICE BUT MENTIONING ONLY 'QUOTED' AGAINST EACH ITEM IN PART-1. AND PRICE BID SHALL BE FILLED IN THE ABC PROCURE SYSTEM ALONG WITH THIS BREAK UP TO BE ATTACHED IN PART-2 BID.												
iii) IF ANY ITEM IS LEFT 'BLANK' OR 'UNQUOTED' FOR A PACKAGE IN THE UN-PRICED BID, THE OFFER WILL BE LIABLE FOR REJECTION.												
iv) VENDOR SHALL ALSO FILL UP 8-DIGIT HSN CODE AGAINST EACH OF THE ITEM IN THE UN-PRICED PRICE FORMAT .												



ANNEXURE-2 TO PY55374 REV 00

ADDITIONAL REQUIREMENTS

To

Specification no. IRS S 63:2014 Rev. 4

PVC insulated underground, unscreened cable for Railway Signaling

NOTE: All the clause numbers mentioned in this annexure refers to the Clause numbers of RDSO specification IRS S 63:2014 Rev 04.

This Annexure is issued for utilizing Cross-linked Polyethylene (XLPE) material as an insulation material in place of PVC, in Cables used for Railway Signaling covered by the mentioned specification.

Insulation:

3.2.7 Insulation material shall be cross-linked polyethylene (XLPE) as per Table-1 of IS 7098-I except for the following:

- i. Tensile Strength: 150 Kg/sqcm(min.)
- v.b. Shrinkage: 2 Percent (Max.)
- Viii: High Voltage Test: No Break Down
- ix: IR test: 5000 Mega-Ohm(KM)
- x: Water Immersion Test: No Break down.

3.2.7.1

Applicable for power cable only	Applicable for Signalling Cable only
The value of insulation resistance of each core shall not be less than 5000Megohm/km at ambient temp.	The value of insulation resistance of each core shall not be less 10,000Meg-ohm/km at ambient temp.

3.2.7.2 The average thickness of the insulation shall not be less than the nominal value t_1 as specified in **Table 3 of IS 7098-I**. Negative tolerance on Insulation as per IS 7098-I is not acceptable.

5.2. TYPE TESTS :

5.2.2 Following tests under type tests are included for **XLPE** insulation in addition to tests mentioned under Cl. 5.2 of IRS S : 63:2014 Rev 04.

Applicable for power cable only	Applicable for Signalling Cable only
The following shall constitute type tests	The following shall constitute type tests
(i) Tensile strength & % before ageing (Cl:5.10.1.2)	(i) Tensile strength & % elongation before elongation ageing (Cl:5.10.1.2)
(ii) % variation in Tensile strength & elongation after ageing (Cl:5.10.1.2)	(ii) % variation in Tensile strength & Elongation after ageing (Cl:5.10.1.2)
(iii) Hot Set test (Cl:5.10.13)	(iii) Hot Set test (Cl:5.10.13)
(iv) Shrinkage test (Cl:5.10.2.2)	(iv) Shrinkage test (Cl:5.10.2.2)
	(v) Water absorption (gravimetric) Test (Cl:5.10.14)



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| (v) Water absorption (gravimetric) test (Cl:5.10.14) | (vi) High Voltage test (Cl:5.10.15) |
| | (vii) Insulation Resistance test (Cl:5.10.16) |
| (vi) High Voltage test (Cl:5.10.15) | |
| (vii) Insulation Resistance test (Cl:5.10.16) | (viii) Water Immersion test (Cl:5.10.17) |
| (viii) Water Immersion test (Cl:5.10.17) | (ix) Volume Resistivity test (Cl:5.10.18) |
| (ix) Volume Resistivity test (Cl:5.10.18) | |

5.2.3 Following tests under type tests mentioned in Cl: 5.2 of IRS S : 63:2014 Rev 04 are not to be carried out on **XLPE** insulation.

Applicable for power cable only

- (i) Tensile strength and elongation at break before and after ageing (5.10.1)(i)
- (ii) Hot Deformation test (5.10.3)
- (iii) Loss of Mass test (5.10.4)
- (iv) Colour Fastness to Day-Light Exposure (5.10.5)
- (v) Colour Fastness To Water (5.10.6)
- (vi) Bleeding and Blooming test (5.10.7)
- (vii) Cold Bend test (5.10.8)
- (viii) Heat Shock test (5.10.10)
- (ix) Thermal Stability test (5.10.11)
- (x) Specific Gravity test (5.10.12)



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5.3. ACCEPTANCE TESTS

5.3.4 Following tests under acceptance tests are included for XLPE insulation in addition to tests mentioned under Cl. 5.3 of IRS S : 63:2014 Rev 04.

The following shall constitute acceptance tests

- (i) Tensile strength & % elongation before ageing (Cl:5.10.1.2)
- (ii) % variation in Tensile strength & elongation after ageing (Cl:5.10.1.2)
- (iii) Hot Set test (Cl:5.10.13)
- (iv) Shrinkage test (Cl:5.10.2.2)
- (v) Water absorption (gravimetric) test (Cl:5.10.14)
- (vi) High Voltage test (Cl:5.10.15)
- (vii) Insulation Resistance test (Cl:5.10.16)
- (viii) Water Immersion test (Cl:5.10.17)
- (ix) Volume Resistivity test (Cl: 5.10.18)

5.3.5 Following tests under acceptance tests mentioned in Cl: 5.3 of IRS S : 63:2014 Rev 04. are not to be carried out on **XLPE** insulation.

Applicable for power cable only

- (i) Tensile strength and elongation at break before and after ageing break before and after ageing (5.10.1)(i)
- (ii) Specific Gravity test (5.10.12)

5.4. ROUTINE TESTS

5.4.1 Following tests under routine tests are additionally included for XLPE insulation

- (i) High Voltage test (Cl:5.10.15) all drums
- (ii) Insulation Resistance test (Cl:5.10.16) all cores
- (iii) Volume Resistivity test (Cl:5.10.18) - all cores
- (iv) T.S. and percentage elongation of insulation (Cl:5.10.1.2)
100% upto 10 cores, 10+50% of the core in excess of 10 (specimen shall cover all colours).
- (v) Hot Set test (Cl:5.10.13)

5.10.1 TENSILE STRENGTH AND ELONGATION

5.10.1.1 Tensile strength and elongation at break (For PVC insulation & Sheath) (for power & Signalling cable) - This test shall be conducted in accordance with IS: 10810 (Part -7). The material shall fulfil the requirements indicated below:

	Insulation	Inner & Outer Sheath
a) Before Ageing:		
1) Min. Tensile strength, kg / cm ²	150	150



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2) Min. elongation percentage	150	200
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b) After ageing in air oven at $80 \pm 2^\circ\text{C}$ for 168 hours:

1) Min. tensile strength kg / cm ²	150	150
2) Min. elongation percentage	150	200

The maximum variation after ageing shall be within $\pm 20\%$ of the values obtained before ageing. For tests before and after ageing, samples shall be from the same drum in case of sheaths, and from the same core in case of insulation.

5.10.1.2 Tensile strength and elongation (For XLPE insulation) (For Power & Signalling cable): The material shall fulfil the requirements indicated below:

Requirement

a) Before Ageing :

1) Min. Tensile strength, Kg/cm ²	150
2) Min. elongation percentage	200

b) After ageing in air oven at $135 \pm 3^\circ\text{C}$, the maximum variation after ageing shall be within $\pm 25\%$ of the values obtained before ageing.

5.10.2 SHRINKAGE TEST**5.10.2.1 For PVC Insulation & sheath**

This test shall be conducted in accordance with IS: 10810 (Part- 12). The insulation or sheath shrinkage shall not exceed 2% of the original length. During the test no cracks shall occur in the insulation or sheath.

5.10.2.2 For XLPE Insulation

This test shall be conducted in accordance with IS: 10810 (Part- 12)-1984. Test temperature shall be $130 \pm 3^\circ\text{C}$. The shrinkage shall not exceed 2% of the original length. During the test no cracks shall occur in the insulation.

5.10.13 HOT SET TEST

The test shall be conducted on insulation in accordance with IS: 10810 (Part-30). Specified values shall be as per Cl: 3.2.7 (iv).

5.10.14 WATER ABSORPTION TEST (GRAVIMETRIC)

The test shall be conducted in accordance with IS:10810 (Part-33). Specified values shall be as per Cl: 3.2.7 (vi)

5.10.15 HIGH VOLTAGE TEST

This test shall be tested as per Cl:5.12 of IRS:S-63/2014 .



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5.10.16 INSULATION RESISTANCE TEST

This test shall be tested as per Cl:5.13 of IRS:S-63/2014 .Specified values shall be as per Cl:3.2.7.1

5.10.17 WATER IMMERSION TEST

This test shall be tested as per Cl:5.14 of IRS:S-63/2014 .

5.10.18 VOLUME RESISTIVITY TEST

The test shall be conducted in accordance with IS: 10810 (Part-43) .Specified values shall be as per CL.No 3.2.7(vii)

8.0 Information to be supplied by the purchaser:

8.5.1 Type of Insulation required (PVC or Cross Linked Polyethylene (XLPE))

Table- 12 (i)

SAMPLING PLAN FOR ACCEPTANCE TEST (CLAUSE 7 IRS:S-63/2014)
(APPLICABLE FOR POWER CABLES ONLY)

Following Smapling plan is included for XLPE insulation in addition to sampling plan given in Table 10 (i) of IRS: S-63/2014 Rev 04

Sl. No. (1)	Test (2)	Sample Size (No. Of Drums) (3)	No. Of Test Pieces To Be Taken From Each Sample (4)
1.	T.S & % Elongation of Insulation (5.10.12)	10% subject to min.2 samples from each lot.	100% upto 12 cores. 12+20% of the cores in excess of 12 (Specimen shall cover all colours)
2.	Ageing test of insulation (5.10.1.2)	4%(out of 10% for physical test) subject to min. 2 drums	Two samples of cores of each colour from each sampled drum
3	Shrinkage test for insulation (5.10.2.2)	- do -	One sample of core of each colour from each sampled drum.
4.	Hot Set test (CL:5.10.13)	10% subject to min. 2 samples from each lot.	One sample of core of each colour from each sampled drum.(Min. 4 sample)
5.	Water Absorption test (CL:5.10.14)	-do-	One sample of core of each colour from each sampled drum.(Min. 3 sample)
6.	Volume Resistivity test (CL:5.10.18)	25% subject to minimum 2 drums.	All cores.