

परियोजना
इंजीनियरिंग
प्रबंधन
Project Engineering
Management

भारत हेवी इलेक्ट्रिकल्स लिमिटेड
(भारत सरकार का उपक्रम)
Bharat Heavy Electricals Limited
(A Govt. of India Undertaking)



Date: 19/06/2019

PROJECT: - 5x800 MW YADADRI TPS
PACKAGE: -LT XLPE POWER CABLE
ENQUIRY NO.: E-6097/2018 Dtd. 03.01.2019

Ref: 1. BHEL Tender Enquiry No.: - E-6097/2018 Dtd. 03.01.2019

CORRIGENDUM-15

1. Clause no. 9 of NIT may be read as:
PVC is applicable for the subject package. PVC Formula and factors shall be as per Annexure-I (Enclosed herewith corrigendum 15).
2. Clause no. 21 of NIT may be read as:
For this procurement, Public Procurement (Preference to Make in India), Order 2017 dated 15.06.2017 & 28.05.2018 and subsequent Orders issued by the respective Nodal Ministry shall be applicable even if issued after issue of the NIT but before finalization of contract/ PO/WO against the NIT. In the event of any Nodal Ministry prescribing higher or lower percentage of purchase preference and / or local content in respect of this procurement, same shall be applicable. Vendors are requested to go through the above mentioned orders and confirm the following:"
The local supplier at the time of tender, bidding or solicitation shall be required to provide a certificate from the statutory auditor or cost auditor of the company (in the case of companies) or from a practicing cost accountant or practicing chartered accountant (in respect of suppliers other than companies) giving the percentage of local content.

Regards

NAINA SINGH
MANAGER/PG-II

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भारत INDIA

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PRICE VARIATION FORMULA FOR CABLES-ANNEXURE-I
LT XLPE POWER CABLES
5X800 MW YADADRI TPS

1. Prices shall be variable as per Price Variation Formula (Formula NO. D & E of enclosed IEEMA CIRCULAR NO. IEEMA (PVC)/CABLE(R-1)/2017). The price variation shall be limited to +20% of Total ex-Works Prices actual supplied (cable size wise) and –ve price variation shall be unlimited. Rates for working out price variation shall be as per rates published by IEEMA.

SL NO	CABLE SIZE	APPLICABLE PVC FORMULAE WITH FACTORS
A	1.1 KV, Al conductor, XLPE insulated, Galvanised Steel Round Wire Armoured for multi-core cables, Non Magnetic Hard drawn Aluminium Round Wire Armoured conforming to H4 grade for single core cables, INNER SHEATH Extruded FRLSH PVC compound conforming to type ST2 of IS: 5831 for multicore cable & no inner sheath for single core cables, OVERALL SHEATH: Extruded FRLSH PVC compound conforming to type ST2 of IS: 5831 & black in colour.	
A.1	1C-400 Sq. mm XLPE-Al(A) FRLS	Formula NO. D of enclosed IEEMA CIRCULAR NO. IEEMA (PVC)/CABLE(R-1)/2017
A.2	1C-630 Sq. mm XLPE-Al(A) FRLS	
A.3	1C-35 Sq. mm XLPE-Al(A) FRLS	
A.4	1C-120 Sq. mm XLPE-Al(A) FRLS	
A.5	2C-10 Sq. mm XLPE-Al(A) FRLS	
A.6	2C-25 Sq. mm XLPE-Al(A) FRLS	
A.7	2C-95 Sq. mm XLPE-Al(A) FRLS	
A.8	3C-10 Sq. mm XLPE-Al(A) FRLS	
A.9	3C-25 Sq. mm XLPE-Al(A) FRLS	
A.10	3C-50 Sq. mm XLPE-Al(A) FRLS	
A.11	3C-95 Sq. mm XLPE-Al(A) FRLS	
A.12	3C-185 Sq. mm XLPE-Al(A) FRLS	
A.13	3C-240 Sq. mm XLPE-Al(A) FRLS	
A.14	3.5C-25 Sq. mm XLPE-Al(A) FRLS	
A.15	3.5C-50 Sq. mm XLPE-Al(A) FRLS	
A.16	3.5C-95 Sq. mm XLPE-Al(A) FRLS	
A.17	3.5C-185 Sq. mm XLPE-Al(A) FRLS	
A.18	4C-10 Sq. mm XLPE-Al(A) FRLS	
B	1.1 KV Cu conductor, XLPE insulated, Galvanised Steel Round Wire Armoured for multi-core cables, Non Magnetic Hard drawn Aluminium Round Wire Armoured conforming to H4 grade for single core cables, INNER SHEATH Extruded FRLSH PVC compound conforming to type ST2 of IS: 5831 for multicore cable & no inner sheath for single core cables, OVERALL SHEATH: Extruded FRLSH PVC compound conforming to type ST2 of IS: 5831 & black in colour.	
B.1	2C-2.5 Sq. mm XLPE-Cu(A) FRLS	Formula NO. E of enclosed IEEMA CIRCULAR NO. IEEMA (PVC)/CABLE(R-1)/2017
B.2	3C-2.5 Sq. mm XLPE-Cu(A) FRLS	
B.3	2CX6 Sq. mm XLPE-Cu(A) FRLS	

PRICE VARIATION FORMULA FOR CABLES-ANNEXURE-I
LT XLPE POWER CABLES
5X800 MW YADADRI TPS

2. Base date for prices:

Initial Price (As per IEEMA)

Base date shall be 1st working day of the previous month to the date of issue of Tender Enquiry.

Final Price (As per IEEMA)

The first working day of month, one month prior to the date on which cable is notified as being ready for inspection i.e. TPIA inspection call raise on web portal.

3. PVC shall be payable within contractual delivery period (including any extension thereto).

Enclosure: Formula NO. D & E along with factors of IEEMA CIRCULAR NO. IEEMA (PVC)/CABLE(R-1)/2017

IEEMA (PVC)/CABLE(R-1)/2017

Effective from: 1st November 2017

Price variation formulae for 'Power Cables'

✓ A. Aluminum conductor PVC insulated 1.1 kV power cables

$$✓ P = P_o + AIF (AL - ALo) + CCFAI (PVCc - PVCco) + FeF (Fe - Feo)$$

For unarmoured multicore cables (without steel armour); FeF = 0

Table References:

- ✓ ALP Aluminium conductor in single core unarmoured & multicore cables
- ✓ P1 Aluminium conductor aluminium armour in single core armoured cables
- ✓ P2 PVC compound
- ✓ P3 Steel armour

✓ B. Copper conductor PVC insulated 1.1 kV power cables

$$P = P_o + CuF (Cu - Cuo) + CCFCu (PVCc - PVCco) + FeF (Fe - Feo) + AIF (Al - ALo) ✓$$

For steel armoured cables; AIF = 0 For aluminium armoured cables; FeF = 0

For unarmoured cables; FeF, AIF = 0

Tables References:

- ✓ CUP Copper conductor
- ✓ P2 PVC compound
- ✓ P3 Steel armour
- ✓ P4 Aluminium armour

C. Copper conductor PVC insulated 1.1 kV control cables

$$P = P_o + CuF (Cu - Cuo) + CCFCu (PVCc - PVCco) + FeF (Fe - Feo) ✓$$

For unarmoured cables; FeF = 0

Tables References:

- ✓ CUC Copper conductor
- ✓ P5 PVC compound
- ✓ P6 Steel armour

✓ D. Aluminum conductor XLPE insulated 1.1 kV power cables

$$P = P_o + AIF (AL - ALo) + XLFAL (CC - Cco) + CCFAI (PVCc - PVCco) + FeF (Fe - Feo) ✓$$

For unarmoured multicore cables (without steel armour); FeF = 0

Table References:

- ALP Aluminium conductor in single core unarmoured & multicore cables
- P1 Aluminium conductor aluminium armour in single core armoured cables
- L2 Polymer (CCFAI)
- P3 Steel armour
- XL1 XLPE Compound (XLFAL)

E. Copper conductor XLPE insulated 1.1 kV power cables

$$P = P_o + CuF (Cu - Cuo) + XLFCU (CC - Cco) + CCFCu (PVCc - PVCco) + FeF (Fe - Feo) + AIF (Al - ALo)$$

For steel armoured cables; AIF = 0 For aluminium armoured cables; FeF = 0



IEEMA (PVC)/CABLE(R-1)/2017

Effective from: 1st November 2017

For unarmoured cables; FeF, AIF = 0

Tables References:

✓CUP	Copper conductor
L2	Polymer (CCFCu)
P3	Steel armour
✓P4	Aluminium armour
XL1	XLPE Compound (XLFCu)

F. Copper conductor XLPE insulated 1.1 kV control cables

$$P = P_o + CuF(Cu - Cu_o) + XLFCU(CC-Cco) + CCFCu(PVCC-PVCco) + FeF(Fe-Fe_o)$$

For unarmoured cables; FeF = 0

Tables References:

✓CUC	Copper conductor
P5	PVC compound
P6	Steel armour
XL2	XLPE Compound

✓ G. For Aluminium conductor XLPE insulated 3.3 to 33 kV power cables

$$P = P_o + AIF(Al - Al_o) + XLFAL(CC-Cco) + CCFAI(PVCC - PVCco) + FeF(Fe - Fe_o)$$

For unarmoured multicore cables (without steel armour); FeF = 0

Table References:

ALP	Aluminium conductor in single core unarmoured & multicore cables
H1	Aluminium conductor + aluminium armour in single core armoured cables
H2	Polymer
H3/H5	Steel armour (Flat/Round)
XL3/XL4	XLPE Compound (Single core /Multicore)

✓ H. Copper conductor XLPE insulated 3.3 to 33 kV power cables

$$P = P_o + CuF(Cu - Cu_o) + XLFCU(CC-Cco) + CCFCu(PVCC - PVCco) + FeF(Fe - Fe_o) + AIF(Al - Al_o)$$

For steel armoured cables; AIF = 0 For aluminium armoured cables; FeF = 0

For unarmoured cables; FeF, AIF = 0

Table References:

✓CUP	Copper conductor
✓H2	Polymer
✓H3/H5	Steel armour (Flat/Round)
✓H4	Aluminium armour
✓XL3/XL4	XLPE Compound (Single core /Multicore)

I. Copper conductor XLPE insulated 1.0 and 1.5 kV Solar PV DC cables

$$P = P_o + CuF(Cu - Cu_o)$$

Table CUsdc Copper Conductor


Authorized Signatory

✓ TABLE ALP

VARIATION FACTOR FOR ALUMINIUM (AIF)
POWER CABLES WITH ALUMINIUM CONDUCTOR
(EXCLUDING SINGLE CORE ARMoured CABLES)

Nominal Cross Sectional Area (in Sq. mm.)	1 core	2 core	3 core	3.5 core	4 core
2.5	0.007	0.014	0.021	-	0.028
4	0.011	0.023	0.034	-	0.046
6	0.017	0.034	0.052	-	0.069
10	0.029	0.053	0.087	-	0.116
16	0.046	0.091	0.137	-	0.183
25/16	0.073	0.146	0.219	0.262	0.292
35/16	0.101	0.202	0.302	0.345	0.404
50/25	0.137	0.273	0.410	0.478	0.547
70/35	0.197	0.395	0.593	0.687	0.791
95/50	0.274	0.548	0.821	0.949	1.095
120/70	0.346	0.691	1.035	1.221	1.382
150/70	0.425	0.853	1.279	1.464	1.706
185/95	0.533	1.070	1.605	1.861	2.140
225/120	0.655	1.310	1.965	2.287	2.620
240/120	0.703	1.400	2.099	2.421	2.799
300/150	0.879	1.757	2.635	3.033	3.514
400/185	1.126	2.249	3.374	3.873	4.498
500	1.418	2.838	4.256	-	5.675
630	1.828	3.663	5.494	-	7.326
800	2.340	4.679	7.018	-	9.357
1000	2.951	5.890	8.834	-	11.779

IEEMA (PVC)/CABLE(R-1)/2017

 Effective from: 1st November 217

TABLE CUP

 VARIATION FACTOR FOR COPPER CONDUCTOR (CUF)
 POWER CABLES WITH COPPER CONDUCTOR

Nominal Cross Sectional Area (in Sq. mm.)	1 core	2 core	3 core	3.5 core	4 core
2.5	0.023	0.046	0.069	-	0.092
4	0.036	0.076	0.112	-	0.151
6	0.056	0.112	0.171	-	0.227
10	0.095	0.174	0.286	-	0.382
16	0.151	0.299	0.451	-	0.602
25/16	0.240	0.480	0.720	0.862	0.960
35/16	0.332	0.664	0.993	1.135	1.329
50/25	0.451	0.898	1.348	1.572	1.799
70/35	0.648	1.299	1.950	2.260	2.602
95/50	0.901	1.802	2.700	3.121	3.601
120/70	1.138	2.273	3.407	4.016	4.545
150/70	1.398	2.806	4.207	4.815	5.611
185/95	1.753	3.519	5.279	6.121	7.038
225/120	2.154	4.309	6.463	7.522	8.617
240/120	2.312	4.605	6.904	7.963	9.206
300/150	2.891	5.779	8.667	9.976	11.558
400/185	3.703	7.397	11.097	12.738	14.794
500	4.664	9.334	13.998	-	18.665
630	6.012	12.048	18.070	-	24.095
800	7.696	15.389	23.082	-	30.775
✓ 1000	9.706	19.372	29.055	-	38.741 ✓

 ✓ TABLE CU_{sd}c

 VARIATION FACTOR FOR COPPER CONDUCTOR (CUF)
 1.0 & 1.5KV Solar PV DC Cables with Copper Conductor

Cable Size in sq.mm.	Copper content in MT/km
2.5	0.023
4	0.038
6	0.058
10	0.090

IEEMA (PVC)/CABLE(R-1)/2017

Effective from: 1st November 2017

TABLE P1

VARIATION FACTOR FOR ALUMINIUM (AIF)
ALUMINIUM ARMoured SINGLE CORE PVC INSULATED 1.1 KV CABLES

Nominal cross sectional area (in Sq.mm)	Aluminium factor for Aluminium armoured cable with aluminium conductor
4	0.0685
6	0.0795
10	0.1017
16	0.1303
25	0.1693
35	0.2090
50	0.2597
70	0.3360
95	0.4567
120	0.5443
150	0.6427
185	0.7743
240	0.9737
300	1.2582
400	1.5502
500	1.8958
630	2.3650
800	2.9306
1000	3.7666

IEEMA (PVC)/CABLE(R-1)/2017
TABLE P3 (Additional)

Effective from: 1st November 2017

VARIATION FACTOR FOR ROUND WIRE 'W' STEEL (FeF)
PVC INSULATED 1.1 KV POWER CABLES WITH COPPER/ALUMINIUM CONDUCTOR

Nominal Cross Sectional Area (in sq. mm)	2 Core	3 Core	3.5 Core	4 Core
1.5	0.247	0.259		0.288
2.5	0.273	0.289		0.329
4	0.305	0.335		0.363
6	0.348	0.363		0.407
10	0.392	0.407		0.533
16	0.439	0.523	0.014	0.573
25	0.526	0.625	0.664	0.685
35	0.591	0.685	0.729	0.761
50	0.661	0.790	0.864	1.108
70	0.745	1.122	1.200	1.256
95	1.085	1.286	1.376	1.443
120	1.147	1.386	1.479	1.562
150	1.267	1.526	1.684	2.173
185	1.403	2.090	2.315	2.421
240	1.994	2.397	2.641	2.722
300	2.180	2.642	3.670	3.842
400	2.987	3.728	4.126	4.292
500	3.517	4.226	5.958	6.301
630	4.774	6.018	6.737	7.141

IEEMA (PVC)/CABLE(R-1)/2017

Effective from: 1st November 217

TABLE P4

VARIATION FACTOR FOR ALUMINIUM (AIF)
PVC INSULATED 1.1 KV POWER CABLES WITH COPPER CONDUCTOR

Nominal Cross Sectional Area (in Sq. mm)	Aluminium Factor for Aluminium armoured cable with copper conductor
4	0.058
6	0.063
10	0.073
16	0.084
25	0.096
35	0.108
50	0.123
70	0.139
95	0.183
120	0.198
150	0.218
185	0.241
240	0.271
300	0.379
400	0.424
500	0.478
630	0.537
800	0.591
1000	0.816

