TECHNICAL SPECIFICATION FOR

CONTROL AND POWER CABLES

1. SCOPE

This specification covers the testing and performance requirements of power and control cables for installation on the Distribution System of OPTCL.

The equipment offered shall have been successfully type tested and the design shall have been in satisfactory operation for a period not less than two years on the date of bid opening. Compliance shall be demonstrated by submitting with the bid, (i) authenticated copies of the type test reports and (ii) performance certificates from the users.

The power and control cables shall conform in all respects to highest standards of engineering, design, workmanship, this specification and the latest revisions of relevant standards at the time of offer and the Project Manager shall have the power to reject any work or material, which, in his judgment, is not in full accordance therewith.

2. STANDARDS

Except where modified by this specification, the power and control cables shall be designed, manufactured and tested in accordance with the latest editions of the following standards.

IEC / ISO	Indian Standard	Title
IEC 811	IS-18-10810:1982	Testing cables
IEC 502	IS-7098:1985 (part 2)	LT and 3.3 - 33kVXLPE cables
IEC 502	IS - 1554:1988 (part 1)	PVC Cables .65/1.IkV
IEC 227	IS - 5819 :1970	Short circuit ratings for PVC cables
IEC 228	15-8130:1984	Conductors for insulated cables
IEC 502	IS - 6474: 1984	XLPE Cables
IEC 502		Extruded solid dielectric insulated power cables for rated voltages from 1kV to 30kV
IEC 540	IS - 5831: 1984	Test Methods for insulation and sheaths of electric cables and cords
IEC 287		Calculation of the continuous current rating of cables.
	IS - 3975 : 1979	Mild steel wires, strips and tapes for armoring of cables

The Bidder may propose alternative standards, provided it is demonstrated that they give a degree of quality and performance equivalent to or better than the referenced standards. Acceptability of any alternative standard is at the discretion of the Project Manager. The Bidder shall furnish a copy of the alternative standard proposed along with his bid. If the alternative standard is in a language other than English, an English translation shall be submitted with the standard. In the case of conflict the order of precedence shall be 1) IEC or ISO Standards, 2) Indian Standards, 3) other alternative standards.

This list is not to be considered exhaustive and reference to a particular standard or recommendation in this Specification does not relieve the Contractor of the necessity of providing the goods complying with other relevant standards or recommendations. All power and control cables to be used in the OPTCL distribution system shall be of the cross-linked polyethelene (XLPE) or polyvinyl chloride (PVC) insulated with PVC sheathing types.

3. 1.1KV POLYVINYL CHLORIDE (PVC) INSULATED CABLES

3.1 RATED VOLTAGE AND TEMPERATURE

The rated voltage of the cable shall be l.1 kV and the maximum operating voltage shall not exceed 110% of the rated voltage.
These cables are suitable for use where the combination of ambient temperature and temperature rise due to load results in a conductor temperature shall not exceeding 70°C* under normal operation and 160°C under short circuit conditions.
*See 13.2.4 for heat resisting and general purpose applications.

3.2. CABLE DESIGN

3.2.1 **ALL LV Power cable shall be of PVC insulation armoured type.**
The conductors shall be of Flexibility Class 2 as per IS - 8130: 1984.

3.2.2. Cross-Sectional area of reduced Neutral Conductors:

Nominal cross-sectional area of main conductor (mm2)	25	35	50	70	95	120	150	185	240	300	400	500	630
Cross-sctional area of reduced neutral conductor (mm^2)	16	16	25	35	50	70	70	95	120	150	185	240	300

3.3. Conductor screening not required

3.4. Insulation

The insulation shall be of Polyvinyl Chloride (PVC) compound. The 'General Purpose' **Type A shall be used for the L V Power cables and 'Heat Resisting' Type C for Control cable. Both shall conform to the requirements of IS - 5831: 1984.**

Type of Insulation	Normal Continuous Operation	Short Circuit Operation
General Purpose	70°C	160°C
Heat Resisting	85°C	160°C

The PVC insulation shall be applied by extrusion and the average thickness of insulation shall not be less than the specified nominal value and the maximum value not more than 0.lmm plus 0.1 of nominal and as specified in IS - 1554(part 1): 1988. The insulation shall be applied so that it fits closely on to the conductor and it shall be possible to remove it without damage to the conductor.

3.5. Insulation Screening not required

3.6. Core Identification and Laying Up of Cores

3.5 core cables shall be identified by colouring of the PVC insulation and multi core by numbers as per IS- 1 554 (part 1): 1988

In multi-core cables, the cores shall be laid up together with a suitable lay as recommended in IS - 1554 (Part 1): 1988. The layers shall have successive right and left hand lays with the outermost layer having a right hand lay.

3.7. Inner Sheath

The laid up cores of the 3.5, 4 and multi core cables shall be covered with an inner sheath made of thermoplastic material (PVC) applied by extrusion.

The thickness of the sheath shall conform to IEC 502/IS - 1554: 1988. Single core cables shall have no inner sheath.

3.8. Armouring only the 3.5 core LV cables will be armoured. The armour shall be applied helically in a layer of steel wires over the inner sheath of the cable. The armour shall consist of round or flat steel wires and comply with the requirements of IEC 502/IS - 1554: 1988. The steel wires shall comply with IS - 3975:

3.9. Outer Sheath

An outer sheath of polyvinyl chloride (PVC) shall be applied over the armour wires (where fitted). The sheath shall be embossed at regular intervals as per the Cable Identification clause of this specification and the minimum thickness and properties shall comply with the requirements of IEC 502/IS - 1554: 1988. The outer sheath for cables with general purpose insulation shall be of the type ST1 PVC compound and for cables with heat resisting insulation type ST2 PVC compound conforming to the requirements of IEC 502/IS - 5831: 1984.

The outer serving shall incorporate an effective anti-termite barrier and shall be capable of withstanding a l0kV DC test voltage for five minutes after installation and annually thereafter.

Cables shall be installed as a single four core cable or three single phase cables plus neutral in a close trefoil formation.

Current ratings shall be calculated in accordance with IEC 287 "Calculation of the continuous current rating of cables with 100% load factor".

3.10. Conductor Sizes

3.11. Cable Drum Length

The cable shall be supplied in 500metre lengths.

4. CABLE IDENTIFICATION

The manufacturer's and Employer's name or trade mark, the voltage grade, cable designation and year of manufacture shall be indented or embossed along the whole

length of the cable. The indentation or embossing shall only done on the outer sheath. The alphanumerical character size shall be not less than 20% of the circumference of the cable and be legible.
The following code shall be used to designate cables:

Constituent	Code Letter
Aluminium conductor	A
XLPE insulation	2X
PVC insulation	Y
Steel round wire armour	W
Non-magnetic round wire armour	Wa
Steel strip armour	F
Non-magnetic strip armour	Fa
Double steel round wire armour	WW
Double steel strip armour	FF
PVC outer sheath	Y

Note: No code letter is required for copper conductor

5. SAMPLING OF CABLES

5.1. Lot

In any consignment the cables of the same size manufactured under essentially similar conditions of production shall be grouped together to constitute a lot.

5.2. Scale of Sampling

Samples shall be taken and tested from each lot to ascertain the conformity of the lot to specification.

The samples shall be taken at random. In order to achieve random selection the procedure for selection detailed in IS - 4905: 1968 shall be followed.

6. NUMBER OF TESTS AND CRITERION FOR CONFORMITY

Suitable lengths of test samples shall be taken from each of the selected drums. These samples shall be subjected to each of the acceptance tests. A test sample shall be classed as defective if it fails any of the acceptance tests. If the number of defective samples is less than or equal to the corresponding number given in 8.3 the lot shall be declared as conforming to the requirements of acceptance test.

7. TESTS ON 1.1 KV PVC INSULATED CABLES

7.1. Type Tests

Certification of type tests already completed by independent test laboratories shall be presented with the bid for each cable type. These tests shall be carried out in accordance with the requirements of IS -8130: 1984/IEC 502, IS - 5831:1984/IEC 540 and IEC 811 unless otherwise specified.

Type testing of 33kV, l lkV and 1.1 kV cables shall include the following:

	Test	**Requirement Reference**	**Test Method as a Part of IS-10810/IEC 811**
(a)	**Tests on conductor**		
	Annealing test (copper)	IS-8130: 1984/IEC 502	1
	Tensile test (aluminum)	IS-8130: 1984/IEC 502	2
	Wrapping test (aluminum)	IS-8130: 1984/IEC 502	3
	Resistance test	IS-8130: 1984/IEC 502	5
(b)	**Tests for Armour wires/strips**	IS - 3975: 1979/IEC 502	36 - 42
(c)	**Tests for thickness of insulation and sheath**	IS-5831:1984/IEC 540	6
(d)	**Physical tests for Insulation**		
	Tensile strength and elongation at break	IS-5831:1984/IEC 540	7
	Ageing in air oven	IS-5831:1984/IEC 540	11
	Hot test	IS-5831:1984/IEC 540	30
	Shrinkage test	IS-5831:1984/IEC 540	12
	Water absorption (gravimetric)	IS-5831:1984/IEC 540	33
(e)	**Physical tests for outer sheath**		
	Tensile strength and elongation at break	IS-5831: 1984/IEC 540	7
	Ageing in air oven	IS-5831: 1984/IEC 540	11
	Shrinkage test	IS-5831: 1984/IEC 540	12
	Hot deformation	IS-5831: 1984/IEC 540	15
	Loss of mass in air oven	IS-5831: 1984/IEC540	10
	Heat shock	IS-5831: 1984/IEC540	14
	Thermal stability	IS-5831: 1984 IEC 540 IS-5831: 1984 Appendix B	
(f)	**Partial discharge test (11 and 33kV only)**	Section 8.2 of this specification	46
(g)	**Bending test (11 and 33kV only)**	Section 8.3 of this specification	50
(h)	**Dielectric power factor test (11 and 33kV only)** As a function of voltage As a function of temperature	Section 8.4 of this specification	48
(j)	**Insulation resistance (volume resistivity) test**	IS-8130: 1984/IEC502	43
(k)	**Heating cycle test (11 and 33kV only)**	Section 8.5 of this specification	49

(l)	**Impulse withstand test (11 and 33kV only)**	Section 8.6 of this specification	47
(m)	**High voltage test**	Section 8.6 of this specification	45
(n)	**Flammability test**	Section 8.7 of this specification	53

Tests (g), (h), (j), (1) and (m) are only applicable to screened cables.

Notwithstanding the conditions of the above paragraph the following tests on screened 11 and 33kV cables shall be performed successively on the same test sample of completed cable.

1. Partial discharge test
2. Bending test followed by partial discharge test
3. Dielectric power factor as a function of voltage
4. Dielectric power factor as a function of temperature
5. Heating cycle test followed by dielectric power factor as a function of voltage and partial discharge tests
6. Impulse withstand test
7. High voltage test

If a sample fails in test number 7, one more sample shall be taken for this test, preceded by tests 2 and 5

7.2. Acceptance Tests

The following shall constitute acceptance tests:

- Tensile test (aluminum)
- Annealing test (copper)
- Wrapping test
- Conductor resistance test
- Test for thickness of insulation and sheath
- Hot set test for insulation*
- Tensile strength and elongation at break test for insulation and outer sheath
- Partial discharge test (for screened cables only)**
- High voltage test
- Insulation resistance (volume resistivity) test.

• XLPE insulation only

** test to be completed on full drum of cable

7.3. Routine Tests

Routine tests shall be carried out on all of the cable on a particular order. These tests shall be carried out in accordance with the requirements of IS - 8130: 1984/IEC 502 and IS - 5831:1984/IEC 540 unless otherwise specified.

The following shall constitute routine tests.

- Conductor resistance test
- Partial discharge test (for 1 IkV and 33kV screened cables only)*
- High voltage test

* test to be completed on full drum of cable

7.4. Optional Test

Cold impact test for outer sheath (IS - 5831 - 1984), which shall be completed at the discretion of the Project Manager and at the same time as test at low temperature for PVC as stipulated in the section on special tests.

7.5. Special tests

Special tests shall be carried out at the Inspecting officer's discretion on a number of cable samples selected by the Inspecting officer from the contract consignment. The test shall be carried out on 10% of the production lengths of a production batch of the same cable type, but at least one production length. Special tests shall be carried out in accordance with the requirements of IEC 502 and IEC 540 unless otherwise specified.

The following special tests shall be included:

- Conductor Examination (IEC-228)
- Check of Dimensions
- 4-Hour High Voltage Test for 11 kV and 33kV Cables only
- Test at low temperature for PVC

8. DETAILS OF TESTS

8.1. General

Unless otherwise stated, the tests shall be carried out in accordance with the appropriate part of IS -10810/IEC 502: 1994 and the additional requirements as detailed in this specification.

8.2. Partial Discharge Test

Partial discharge tests shall only be made on cables insulated with XLPE of rated voltages above 1.9/3.3kV.

For multicore cables, the test shall be carried out on all insulated cores, the voltage being applied between each conductor and the metallic screen.

The magnitude of the partial discharge at a test voltage equal to 1.5Uo shall not exceed 20pC for XLPE and 40pC for PVC, where Uo is the power frequency voltage between the conductor and earth or J metallic screen.

8.3. Bending Test

The diameter of the test cylinder shall be 20 (d +D) ± 5% for single core cables and 15 (d+D) ± 5% for multicores, where D is the overall diameter of the completed cable in millimetres and d is the diameter of the conductor. After completing the bending operations, the test samples shall be subjected to partial discharge measurements in accordance with the requirements of this specification.

8.4. Dielectric Power Factor Test

13.4.1. Tan δ as a Function of Voltage

For cables of rated voltage 1.1 kV and above

The measured value of tan δ at Uo shall not exceed 0.004 and the increment of tan δ between 0.5 Uo and 2 Uo shall not be more than 0.002.

13.4.2. Tan δ as a Function of Temperature For cables of rated voltage 1.1 kV and above

The measured value of tan 8 shall not exceed 0.004 at ambient temperature and 0.008 at 90°C for XLPE cables.

8.5. Heating Cycle Test

The sample which has been subjected to previous tests shall be laid out on the floor of the test room and subjected to heating cycles by passing alternating current through the conductor until the conductor reaches a steady temperature 10°C above the maximum rated temperature of the insulation in normal operation. After the third cycle the sample shall subjected to a dielectric power factor as a function of voltage and partial discharge test.

8.6. High Voltage Test

8.6.1. Type/Acceptance Test
The cable shall withstand, without breakdown, at ambient temperature, an ac voltage equal to 3Uo, when applied to the sample between the conductor and screen/armour (and between conductors in the case of unscreened cable). The voltage shall be gradually increased to the specified value and maintained for a period of 4 hours.
If while testing, interruption occurs during the 4 hour period the test shall be prolonged by the same extent. If the interruption period exceeds 30 minutes the test shall be repeated.

8.6.2. Routine Test
Single core screened cables, shall withstand, without any failure, the test voltages given in this specification for a period of five minutes between the conductor and metallic screen.
Single core unscreened cables shall be immersed in water at room temperature for one hour and the test voltage then applied for 5 minutes between the conductor and water.
Multicore cables with individually screened cores, the test voltage shall be applied for 5 minutes between each conductor and the metallic screen or covering.

Multicore cables without individually screened cores, the test voltage shall be applied for 5 minutes in succession between each insulated conductor and all the other conductors and metallic coverings, if any.

8.6.3. Test Voltages
The power frequency test voltage shall be 2.5 Uo + 2kV for cables at rated voltages, up to and including 3.8/6.6kV, and 2.5 Uo for cables at higher rated voltages.
Values of single phase test voltage for the standard rated voltages are as given in the following table:

Voltage Grade kV	Test Voltage	
	Between conductors and screen/armour kV(rms)	Between conductors kV(rms)
0.65/1.1	3	3

If, for three core cables, the voltage test is carried out with a three phase transformer, the test voltage between the phases shall be 1.732 times the values given in the above table.

When a DC voltage is used, the applied voltage shall be 2.4 times the power frequency test voltage. In all instances no breakdown of the insulation shall occur.

8.7. Flammability Test

The period for which the cable shall burn after the removal of the flame shall not exceed 60 seconds and the unaffected portion (uncharred) from the lower edge of the top clamp shall be at least 50mm.

9. COMPLIANCE WITH SPECIFICATION

The power and control cables shall comply in all respects with the requirements of this specification. However, any minor departure from the provisions of the specification shall be disclosed at the time of bidding in the Non Compliance Schedule in this document.

10. COMPLIANCE WITH REGULATIONS

All the equipment shall comply in all respects with the Indian Regulations and Acts in force.
The equipment and connections shall be designed and arranged to minimize the risk of fire and any damage which might be caused in the event of fire.

11. QUALITY ASSURANCE, INSPECTION AND TESTING

11.1 Quality Plans

The Contractor shall draw up for each section of the work Quality Plans which shall be submitted to the Project Manager for approval at least two weeks prior to the commencement of work on the particular section. Each Quality Plan shall set out the activities in a logical sequence and, unless advised otherwise, shall include the following:
• An outline of the proposed work and programme sequence;
• The structure of the Contractor's organisation for the Contract;

• The duties and responsibilities assigned to staff ensuring quality of work for the Contract;
• Hold and Notification Points;
• Submission of engineering documents required by the specification;
• The inspection of materials and components on receipt;
• Reference to the Contractor's Work Procedures appropriate to each activity;
• Inspection during fabrication/construction;
• Final inspection and test.

11.2 Inspection and testing

The OPTCL inspecting officer shall have free entry at all times, while work on the contract is being performed, to all parts of the manufacturer's works which concern the processing of the equipment ordered. The manufacturer shall afford the Project Manager without charge, all reasonable facilities to assure that the equipment being furnished is in accordance with this specification.

The equipment shall successfully pass all the type tests, acceptance tests and routine tests referred to in the section on Tests and those listed in the most recent edition of the standards given in this specification.

The Project Manager reserves the right to reject an item of equipment if the test results do not comply with the values specified or with the data given in the technical data schedule.

Type tests shall be carried out at an independent testing laboratory or be witnessed by a representative of such laboratory or some other representative acceptable to the Project Manager. Routine and acceptance tests shall be carried out by the Contractor at no extra charge at the manufacturer's works.

Type Test certificates shall be submitted with the bid for evaluation. The requirement for additional type tests will be at the discretion of the Project Manager.

The Project Manager may witness routine, acceptance and type tests. In order to facilitate this, the Contractor shall give the Project Manager a minimum of four weeks notice that the material is ready for testing. If the Project Manager does not indicate his intention to participate in the testing, the manufacturer may proceed with the tests and shall furnish the results thereof to the Project Manager.

Full details of the proposed methods of testing, including connection diagrams, shall be submitted to the Project Manager by the Contractor for approval, at least one month before testing.

All costs in connection with the testing, including any necessary re-testing, shall be borne by the Contractor, who shall provide the Project Manager with all the test facilities which the latter may require, free of charge. The Project Manager shall have the right to select the samples for test and shall also have the right to assure that the testing apparatus is correct. Measuring apparatus for routine tests shall be calibrated at the expense of the Contractor at an approved laboratory and shall be approved by the Project Manager.

The Contractor shall be responsible for the proper testing of the materials supplied by sub-contractors to the same extent as if the materials were completed or supplied by the Contractor.

Any cost incurred by the Project Manager in connection with inspection and re-testing as a result of failure of the equipment under test or damage during transport or off-loading shall be to the account of the Contractor.

The Contractor shall submit to the Project Manager five signed copies of the test certificates, giving the results of the tests as required. No materials shall be dispatched until the test certificates have been received by the Project Manager and the Contractor has been informed that they are acceptable.
The test certificates must show the actual values obtained from the tests, in the units used in this specification, and not merely confirm that the requirements have been met.
In the case of components for which specific type tests or routine tests are not given in this specification, the Contractor shall include a list of the tests normally required for these components. All materials used in the Contract shall withstand and shall be certified to have satisfactorily passed such tests.
No inspection or lack of inspection or passing by the Project Manager's Representative of equipment or materials whether supplied by the Contractor or sub-contractor, shall relieve the Contractor from his liability to complete the contract works in accordance with the contract or exonerate him from any of his guarantees.

11.3. Guarantee

The Contractor shall guarantee the following:

- Quality and strength of materials used;
- Satisfactory operation during the guarantee period for a period of at least 36 [Thirty six] months from the last date of delivery (In case of delivery in multiple stages, the last date of delivery of each stage delivery shall be considered for this purpose).

12. PACKING AND SHIPPING

12.1. Packing

The cable shall be wound on strong drums or reels capable of withstanding all normal transportation and handling. Each length of cable shall be durably sealed before shipment to prevent ingress of moisture. The drums, reels or coils shall be lagged or covered with suitable material to provide physical protection for the cable during transit and during storage and handling operations.
In the case of steel drums adequate precautions shall be taken to prevent damage being caused by direct contact between the cable sheath and the steel. These precautions shall be subject to the approval of the Project Manager.
If wooden drums are used then the wood shall be treated to prevent deterioration from attack by termites and fungi.
Each drum or reel shall carry or be marked with the following information:

- Individual serial number
- Employer's name
- Destination
- Contract Number
- Manufacturer's Name
- Year of Manufacture
- Cable Size and Type
- Length of Conductor (meters)
- Net and Gross Mass of Conductor (kg)
- All necessary slinging and stacking instructions.
- Destination;
- Contractor's name;
- Name and address of Contractor's agent in Odisha;
- Country of origin;

The direction of rolling as indicated by an arrow shall be marked on a flange.

12.2. Shipping

The Contractor shall be responsible for the shipping of all cables, drums and reels supplied from abroad to the ports of entry and for the transport of all goods to the various specified destinations including customs clearance, offloading, warehousing and insurance.

The Contractor shall inform himself fully as to all relevant transport facilities and requirements and loading gauges and ensure that the equipment as packed for transport shall conform to these limitations. The Contractor shall also be responsible for verifying the access facilities specified.

The Contractor shall be responsible for the transportation of all loads associated with the contract works and shall take all reasonable steps to prevent any highways or bridges from being damaged by his traffic and shall select routes, choose and use vehicles and restrict and distribute loads so that the risk of damage shall be avoided. The Contractor shall immediately report to the Project Manager any claims made against the Contractor arising out of alleged damage to a highway or bridge.

All items of equipment shall be securely clamped against movement to ensure safe transit from the manufacturer's facilities to the specified destinations (work sites.)

The Contractor shall advise the storage requirements for any plant and equipment that may be delivered to the Project Manager's stores. The Contractor shall be required to accept responsibility for the advice given in so far as these arrangements may have a bearing on the behavior of the equipment in subsequent service.

Remarks:-

a) All the LV Power Cable shall be PVC insulated armoured Aluminum Cable.

b) All the Control Cable shall be PVC insulated unarmored heat resisting type-C.

Schedule of Guaranteed Technical Particulars for Control Cable.
(To Furnished by the Bidder)

ITEM NO.	DESCRIPTION	UNITS	BIDDERS OFFER
1	Standard to which the cable conforms	IS-1554/IEC 502	
2	Catalogue Number	-	
3	Conductor Material	-	
4	Conductor strands	Number	
5	Conductor shape	-	
6	Conductor cross sectional area	mm^2	
7	Outer diameter of conductor	mm	
8	Number of Cores	-	
9.	Reduced neutral conductor cross sectional area.	mm^2	
10.	Insulation Material	-	
11.	Minimum thickness of Insulation	mm	
12.	Nominal thickness of Insulation	mm	
13.	Outer diameter of over insulation	mm	
14.	Nominal thickness of inner sheathing	mm	
15.	Sheath Material	-	
16.	Type of armouring.	-	
17.	Number and diameter/size of armour wires/strips.	No./mm	
18.	Minimum outer sheath thickness	Mm	
19.	Nominal outer sheath thickness	Mm	
20.	Overall diameter of Cables	Mm	
21.	Minimum Bending Radius	Mm	
22.	Cable identification	-	

23.	Rated Voltage per IEC 502/IS-1554	kV	
24.	Conductor DC Resistance per Km at 20^0 C	ohm/km	
25.	Conductor AC resistance per km. at 20^0 C and 50 Hz.	ohm/km	
26.	Maximum continuous rating of cable in the conditions outlined in clause-4: system conditions.	A	
27.	Minimum insulation resistance per km. at 90^0 C.	ohm/km	
28.	Maximum permissible continuous conductor temperature.	^{o}C	
29.	Maximum permissible continuous outer sheath temperature.	C	
30.	DC test voltage for 15 mins. After installation.	KV	
31.	Delivery length per drum.	M	
32.	Weight of conductor per km.	Kg/km	
33.	Weight of cable per km.	Kg/km	
34.	Gross weight of full cable drum.	Kg	
35.	Outer diameter of cable drum.	Mm	
36.	Width of cable drum.	Mm	
37.	Maximum permissible cable pulling tension.	Kg	
38.	Maximum permissible cable side wall pressure.	Kg	
39.	Manufacturer's name.	-	
40.	Country of origin.	-	

Schedule of Guaranteed Technical Particulars for Power Cable.
(To be furnished by the Bidder)

The particulars given in this schedule will be binding upon the contractor and must be departed from without the written permission of the General Manager / Competent authority.

Sl.No.	Description.	
1	System voltage	
2	Make of cable	
3	Type of cable.	
4	IS or other specification to which the cable is manufactured.	
5	Conductor material and its grade	
6	i) Number of wires in each conductor in nos. ii) Nominal dia of wire dia each conductor in No. X mm	
7	No.of cores and nomi8nal cross sectional area of each conductor in No. X sq.mm	
8	Shape of conductors.	
9	Core identification.	
10	Material used for insulation	
11	Total thickness of insuloation used over each conductor in mm.	
12	Specific insulation resistance of dielectric ohm-cum.	
13	Maximum thermal resistivity of dielectric in electric measure (i.e. difference in C between opposite faces of a cm. Cube of the dielectric to transfer 1 Watt of heat).	
14	Type width and thickness of screen -mm a) Conductor b) Insulation.	
15	Type of extrusion /cuing process	
16	Minimum thickness of Inner Sheath	
17	Material used for Inner Sheath.	
18	Method of application of Inner Sheath	
19	Minimum thickness of Outer Sheath in mm	
20	Material used for Outer Sheath	
21	Type and size (i.e. Nominal diameter of armour wire) of Armouring in sq.mm.	
22	Total cross sectional area of Armouring in sq.mm	
23	Calculated diameter over laying up cores (calculated as per fictitious method to IS 10462 Part-I) in mm.	
24	Calculated diameter of cable over inner sheath in mm (calculated as per IS 10462 Part-I)	
25	Calculated diameter of cable over armouring (as per fictitious method to IS 10462 Part-I) in mm.	
26	Approximate overall diameter of cable in mm.	

27	Approximate total weight of Aluminum conductor in 1000 mtrs. Length of finished cable in Kgs.	
28	Max. thermal resistivity of outer sheath in electrical measure (i.e. difference in C between opposite face of cm. Cube of the dielectric to cause transfer of 1 watt of heath).	
29	Total length of cable for each drum in meters.	
30	Total weight of each drum length of cable in Kg.	
31	Total weight of each drum length of cable with drum	
32	Size of each drum.	
33	No.of years the design of the cable offered is in service.	
34	Continuous safe current carrying capacity for following conditions for a single cable- a) Ground temperature b) Thermal resiistivity of soil 120 C cm/w c) Depth of layuing 1070 mm.	
35	Continuous current rating in air at 40 C.	
36	Maximum permissible temperature rise of the conductor for continuous capacity.	
37	Current density under conditions stipulated in 34 above a) Duct b) Air c) Ground	
38	Insulation resistance- Meg. Ohms. Per 1000 Metres of finished cable at 20 C	
39	Coductor resistance =-ohmsper 1000 Meters of finished cable at 20 C	
40	Conductor reactance0 Ohms per 1000 Meters of finished cable at 20C	
41	Specific inductive capacity Micro-farads per 1000 Meters of finished cable at 20 C	
42	Impulse level.	
43	Positive sequence impedance of cable peer 1000 meters in ohms.	
44	Negative sequence impedance of cable per 1000 meters in ohms.	
45	Zero sequence impedance of cable per 1000 meters in ohms.	
46	Maximum allowable asymmetrical fault current to earth for 1 sec.	
47	Maximum allowable symmetrical short circuit current for a duration of one second.	

Signature of the_____

SCHEDULE OF QUANTITY.
(Annexure-I).

DETAIL LIST CONTROL CABLE AND DELIVERY SCHEDULE

Procurement of supply of Control Cables		UOM	Total Qty.	Schedule delivery
Description	size			
Lot-I Control cable	2C X 2.5 mm² stranded copper control cable	Kms	17.407	04(Four) months from date of PO
	3C X 2.5 mm² stranded copper control cable	Kms	10.000	
	4C X 2.5 mm² stranded copper control cable	Kms	120.000	
	4C X 4 mm² stranded copper control cable	Kms	73.850	
	7C X 2.5 mm² stranded copper control cable	Kms	71.005	
	9C X 2.5 mm² stranded copper control cable	Kms	46.741	
	10C X 2.5 mm² stranded copper control cable	Kms	47.590	
	12C X 2.5 mm² stranded copper control cable	Kms	48.400	
	19C X 2.5 mm² stranded copper control cable	Kms	4.303	
Lot-II: Power cable	3 & 1/2 CX 25 mm2	Kms	22.913	04(Four) months from date of PO.
	3 & 1/2 CX 95 mm2	Kms	7.012	
	3 & 1/2 CX 120 mm2	Kms	0.986	
	3 & 1/2 CX 185 mm2	Kms	0.550	
	3 & 1/2 CX 300 mm2	Kms	4.248	
	1 C X 1000 mm2	Kms	1.000	