

# REQUEST FOR QUOTATION - ONLINE BIDDING



BHARAT HEAVY ELECTRICALS LIMITED  
Electronics Division  
PB No. 2606, Mysore Road Bangalore - 560026  
INDIA

RFQ NUMBER:  
SAKE000060

Due Date/Day: [REDACTED]  
Time [REDACTED]

RFQ DATE :  
[REDACTED]

MMI:PU:RF:003

Please submit your lowest quotation subject to our terms and conditions attached for the material mentioned below. "Quotation to be submitted in E Procurement portal only"

(for all correspondence)  
Purchase Executive : Santosh Kumar  
Phone : 8004939865  
Fax :  
E-mail: kumar.santosh@bhel.in

SI No.	Description	Qty	Unit	Delivery qty	Delivery Date
1	SA0482905247 CBL FRLS PVC 1100V;1 CORE;70 SQMM * HSN/SAC : 8544 Doc No.- ED28588 Rev - 09 Inspection / Test Report CABLE SIZE:70 SQ.MM STRANDS:360/0.5 CONDUCTOR: TINNED COPPER CORES:1 VOLTAGE:1100V INSULATION:FRLS PVC COLOUR OF INSULATION: BLACK  MARKING:- CABLE SIZE & VOLTAGE GRADE (BY EMBOSSING) - WORDFRLS @ 5M (BY EMBOSSING) - SEQUENTIAL MARKING @ 1 MTR REF.STANDARD: ED 28588 (FOR TECHNICAL SPEC)  ACCEPTANCE CRITERIA  SWEDISH CHIMNEY TEST AS PER SS 4241475 (F3 CATEGORY) AND ALL THE TESTS MENTIONED IN THE SPEC ED 28588	500	M	500	<span style="background-color: black; color: black;">[REDACTED]</span>
2	SA0653944306 CBL FRLS PVC SCRNGREY 1100V;2C;2.5SQMM * HSN/SAC : 9030 Inspection / Test Report CABLE	1,000	M	1,000	<span style="background-color: black; color: black;">[REDACTED]</span>

## NOTES:

- This RFQ is governed by:
    - INSTRUCTIONS TO BIDDERS/SELLERS and GENERAL CONDITIONS OF CONTRACT FOR PURCHASE available at <http://edn.bhel.com> (RFQ-PO Terms & Conditions)
    - Any other specific Terms and Conditions mentioned. of offers are required to furnish authorization letter for the same.
  - Tender Result can be viewed in the website.
- \* The HSN/SAC no mentioned against the line items in the RFQ are indicative only.

For and On behalf of BHEL.

Santosh Kumar  
Control Equipment

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Purchase Executive : Santosh Kumar  
Phone : 8004939865  
Fax :  
E-mail: kumar.santosh@bhel.in

SI No.	Description	Qty	Unit	Delivery qty	Delivery Date
	SIZE:2.5 SQ.MM STRANDS:0.26 CNDTR:TINNED CU CORES:2 VOLTAGE:1100V INSULATION:PVC SHEATH:FRLS PVC COVERING:SCRND COLOR OF INSULATION: RED & BLACK COLOR OF SHEATH: GREY REF STANDARD: ED28597 FRLS PROPERTIES REF STD: ED28586				

Total Number of Items - 2

- 1.
- 2.

## NOTES:

1. This RFQ is governed by:
    - a) INSTRUCTIONS TO BIDDERS/SELLERS and GENERAL CONDITIONS OF CONTRACT FOR PURCHASE available at <http://edn.bhel.com> (RFQ-PO Terms & Conditions)
    - b) Any other specific Terms and Conditions mentioned. of offers are required to furnish authorization letter for the same.
  2. Tender Result can be viewed in the website.
- \* The HSN/SAC no mentioned against the line items in the RFQ are indicative only.

For and On behalf of BHEL.

Santosh Kumar  
Control Equipment

1) SA0482905247--1C X70 SQ MM FRLS PVC CABLE

2) SA0653944306--- 2C X2.5 SQ MM PVC FRLS SCRNL CABLE

PQR for the above cables is as under:

**“VENDOR SHOULD BE REGISTERED SUPPLIER FOR BHEL-EDN”**

ಆಲ್ಬರ್ಟ್ ಬಾನರ್ಜಿ, ಸಿಬಿಐ ಮುಖ್ಯಮಂಡಳಿ/ಸಿ.ಸಿ.ಎಂ.ಎಂ-ಎಂಎಲ್‌ಬೆಂಗಳೂರು  
ಆಲ್ಬರ್ಟ್ ಬಾನರ್ಜಿ, ವರಿಷ್ಠ ಪ್ರವಹಕರಸಿ.ಸಿ.ಆರ್.ಪಿ.ಇಂಜಿನಿಯರ್  
ALBERT BANERJEE, SR. MANAGER/CCIP-ENGINEER TO  
BHEL-EDN, MYSURU ROAD, BENGALURU-560026

BHEL PLANT STANDARD ED 28600  
 A4 - 15 ELECTRONICS DIVISION REVNO 03  
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### REVISION HISTORY SHEET

REV NO	DATE	NATURE OF CHANGE	REASONS	PREPARED BY	APPROVED BY
00	24/09/2009	FIRST ISSUE	--	PGADE	BSV
01	03/09/2010	Table -1 SI No. 11 TO 14 added	ED 28599 withdrawn	PGADE	MS
02	11/05/2011	Revision history reasons in Rev 01 to be ignored.	Typographical error	PGADE	MS
03	22/09/2017	2.0 (e) & 10.5 revised	IEEE-383 withdrawn for flammability test	BKD	NV

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APPROVED:  
M.SIVARAMAIAH



PREPARED: — **D** = DATE:  
PRAVEEN GADE ES Group 11/05/2011

**PVC INSULATED SINGLE CORE COPPER CABLE WITH FRLS PROPERTIES****1.0 GENERAL:**

This specification governs the quality of flame retardant low smoke (FRLS) polyvinyl chloride (PVC) insulated single core (unsheathed) tinned copper cable

- a) For operation up to a voltage of 600 volts and temperature of 70°C for cables size 0.5 mm<sup>2</sup> as per Table-1.
- b) For operation up to a voltage of 1100 volts and temperature of 70°C for cables size other than 0.5 mm<sup>2</sup> as per Table-1.

**2.0 COMPLIANCE WITH NATIONAL /INTERNATIONAL STANDARDS:**

Assistance has been taken from

- a) IS:694 Specification for insulated cables for working voltages up to and including 1100 volts
- b) VDE-0207 Part-4 for voltage rating.
- c) IS-10810 Test Methods for cables
- d) VDE-0815 for High Voltage Test
- e) IEC-60332-1 for flammability test

**3.0 SIZES:**

Sizes shall be as per Table-1.

**4.0 CONDUCTOR:**

- 4.1 The conductor shall be composed of tinned annealed high conductivity copper wire with electrical and mechanical properties in accordance with IS:8130. The details of the conductor shall be as per Table-1.
- 4.2 The resistance of the conductor at 20° C shall not exceed the appropriate maximum value given in the Table-1. The conductor resistance measured for a length of 25 cm and compared with the resistance of the conductor without any joint shall be not more than 5 % of the resistance of adjacent conductor.
- 4.3 Whenever a conductor is broken, the supplier can join the same by welding or brazing process only. Tensile strength of such joined conductor shall be not less than 90 % of the value of the conductor without joint.

REVISIONS: 03

APPROVED :  
M.SIVARAMAIAH



PREPARED :  ISSUED: DATE:  
PRAVEEN GADE ES Group 11/05/2011

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## 5.0 INSULATION:

- 5.1 The insulation shall be provided with polyvinylchloride compound conforming to the requirements of type-YM1 as per VDE 0207 Part-5 & shall be of FRLS type.
- 5.2 The average thickness of insulation shall not be less than the nominal value (ti) specified in Table-1. The smallest of the measured values of thickness of insulation shall not fall below the nominal value (ti in mm) specified in Table-1 by more than  $0.1 \text{ mm} + 0.1 \cdot ti$ .
- 5.3 Insulation shall be applied over the conductor by extrusion method, in such a way that it fits closely on the conductor and shall be possible to remove it easily, without damage to the conductor.
- 5.4 Joining of core insulation material is not acceptable and repair work on insulation of core also is not acceptable.
- 5.5 Colour of Insulation: Colour of insulation shall be as specified in the order.

## 6.0 MARKING: The cable shall be marked at every one meter length for sizes including & above 1.5 Sq.mm with the following:

- Manufacturer's Name :
- Voltage grade :
- Size :
- Type : FRLS

Progressive marking over the length of the cable at every one meter length of the cable.

## 7.0 OVERALL DIAMETER:

The mean overall diameter shall not exceed the maximum overall diameter specified in Table-1.

## 8.0 ELECTRICAL TESTS:

### 8.1 HIGH VOLTAGE TEST:

8.1.1 High voltage test at room temperature (Routine test) as per IS:694. The cable shall withstand an AC voltage of 3 kV (rms)

8.1.2 High voltage test (Water Immersion Test-AC Test) (Type and acceptance Test) as per IS:694. The cable shall withstand an AC voltage of 3 kV (rms)

8.2 SPARK TEST: IS 694, Clause 16.4 (Routine Test) : Test Voltage 5 KV RMS  
( In process Test by manufacturer, verification of Test report by BHEL )

8.3 Insulation Resistance: (IS:5831) (Routine) : Insulation resistance test shall be carried out at 500 volt D.C. The value of volume resistivity when calculated from the measured insulation resistance value shall not be less than  $1.0 \times 10^{13}$  Ohm-cm at  $27^{\circ}\text{C}$  and  $1.0 \times 10^{10}$  Ohm-cm at  $70^{\circ}\text{C}$ .

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#### 9.0 PHYSICAL TEST ON INSULATION (Type Test):

Tensile strength, Elongation at break, Heat aging, Heat shock, Shrinkage, Cold bend and Cold impact test shall meet the requirements of Type - A of IS: 5831.

#### 10.0 TESTS FOR FRLS PROPERTIES (Routine Test):

- |  |  |           |
|--|--|-----------|
| 10.1 Oxygen Index Test(OI)   |  |           |
| Minimum oxygen index at 25 deg C as per ASTM-D-2863  |  | 29        |
| 10.2 Temperature Index Test  |  |           |
| Minimum temperature Index at OI=21 calculating by method of extrapolation as per ASTM-D-2863 & BICC handbook |  | 250 deg C |
| 10.3 Hcl Acid Gas Estimation:  |  |           |
| Maximum acid gas generation by weight as per IEC-60754 Part I  |  | 20%       |
| 10.4 Smoke Density Test  |  |           |
| Maximum smoke density rating as per ASTM-D-2843  |  | 60%       |
| 10.5 Flammability Tests  |  |           |
| As per IEC-60332-1   |  |           |
| 10.6 Thermal Heat Stability Test   |  |           |
| At 200 deg C for minimum of 80 minutes as per IEC-60811 P3   |  |           |
| 10.7 Swedish Chimney test as per SEN-SS 424 1475 class F3  |  |           |

#### 11.0 INSPECTION:

- 11.1 Supplier shall furnish compliance to core stage internal inspection certificate and other internal test reports before offering for final inspection.

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## 12.0 TEST CERTIFICATE:

Three copies of **Type & Routine test** certificates shall be supplied (Routine test certificate shall be furnished for each batch) giving the following information:

- ED 28600 : FRLS PVC insulated Single core copper cable
- Material code number :
- BHEL Order number :
- Size and length of cable :
- Batch / lot number :

Test results obtained for all the properties and dimensional tolerances as per the specification. Supplier shall certify in the test certificate that the cable supplied does not have any joints in the insulation.

Type test certificate shall be considered valid for a period of three years from the date of test certificate. These tests shall be valid at the time of placement of purchase order. However if the type test requirement is specifically mentioned in the purchase order, the same has to be conducted as per purchase order terms.

## 13.0 PACKING AND MARKING:

13.1 **Packing:** Unless otherwise specified in the Purchase order, the cable shall be supplied on non-returnable bobbins as detailed in Table -1 in one piece without joints. If the manufacturer so desires he may supply upto 10 percent of a type in random lengths provided that each bobbin contains not more than four pieces, the minimum length of any one piece being not less than 20 meters. Both the flanges of such bobbin shall show the length of each individual piece and its position on the bobbin. The bobbins shall be packed and labeled. To prevent moisture entry, free ends of the cable to be sealed with plastic caps.

13.2 **Marking:** The plastic label which is securely attached on both sides to the bobbin shall have the following information:

- ED 28600 : FRLS PVC insulated single core copper cable
- Voltage Grade :
- Material code number :
- BHEL order no. :
- Manufacturer's / Supplier's Name :
- Size :
- Length :
- Weight :
- Batch / Lot No. / Year :

## 13.3 ACCEPTANCE CRITERIA:

- 1) Verification w.r.t TABLE-1
- 2) Witnessing of Routine test
- 3) Verification of test reports
- 4) Verification of Type test reports/ Witness of Type test as per PO terms
- 5) Packing and Marking



**TABLE - 1**

Sl. No	Conductor cross sectional area. nominal	Diameter of wires in conductor. maximum.	Diameter of bunched conductor maximum.	Conductor resistance at 20 Deg C. maximum.	Insulation Thickness nominal	Overall dia. max	packing length per bobbin	Bobbin type
	Sq. mm	mm	mm	ohms/KM	mm	mm	meters	
1	0.50	0.21	0.93	40.1	0.6	2.5	1000	Plastic
2	0.75	0.21	1.14	26.7	0.6	2.7	1000	Plastic
3	1.00	0.21	1.32	20.0	0.6	2.8	1000	Plastic
4	1.50	0.26	1.60	13.7	0.6	3.1	500	Plastic
5	2.50	0.26	2.00	8.21	0.7	3.8	500	Plastic
6	4.00	0.31	2.60	5.09	0.8	4.8	300	Plastic/ Plywood
7	6.00	0.31	3.60	3.39	0.8	6.3	300	Plastic/ Plywood
8	10.00	0.41	4.60	1.95	1.0	7.6	100	Plastic/ Plywood
9	16.00	0.41	5.70	1.24	1.0	8.8	100	Plastic/ Plywood
10	25.00	0.41	7.10	0.795	1.2	11.0	100	Plastic/ Plywood
11	50.00	0.41	10.30	0.393	1.4	14.5	100	Plastic/ Plywood
12	70.00	0.51	12.40	0.277	1.4	17.0	100	Plastic/ Plywood
13	95.00	0.51	14.50	0.210	1.6	19.0	100	Plastic/ Plywood
14	150.00	0.51	18.00	0.132	1.8	23.5	100	Plastic/ Plywood

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REVISION HISTORY SHEET

REV NO	DATE	NATURE OF CHANGE	REASONS	PREPARED BY	APPROVED BY
00	18/08/92	1st ISSUE	-	PKS,AV,MRV	N.J
01	18/09/93	CL 5.4	F.B. FROM MPC	SHG	"
02	20/10/93	CL 9.3.2	F.B. FROM MPC	"	"
03	28/03/94	Totally Revised	Ref.stds Reissued	"	"
04	17/05/95	Frls properties corrected. IEC ref std changed	F.B from engg. IEC-811 superceds IEC-540	"	"
05	13/10/99	Cl 9.8 altered	F.B from supplier	SHG	N.S
06	22/02/00	Cl.9.1 Revised	F.B From MM	KS	NS
07	21/06/03	Cl.12.1&12.2 Revised	F.B.From MA	HRN	NS
08	22/01/09	Generally Revised	Committee review	HRN	MTR
09	01/02/13	TABLE-1 REVISED IS ref changed Generally revd.	Internal Review	HRN	MS

APPROVED :  
M.SHIVARAMIAH

PREPARED : HRN  
ISSUED : STDS GROUP  
DATE : 12/02/13

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BHEL PLANT STANDARD ED 28588  
ELECTRONICS DIVISION REV NO 09  
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PAGE 1 OF 4  
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PVC INSULATED (General purpose & FRLSH) HEAVY DUTY COPPER CABLE  
<1100 VOLTS AC.

- 1.0 GENERAL:**  
This standard is for cables size 1.5 to 1000 sq mm for conductor  
Temperature <70 Deg.C for general purpose & <85 Deg.C for FRLHS.
- 2.0 COMPLIANCE WITH NATIONAL STANDARD:**  
IS:1554 Part-1 "Specification for PVC insulated (Heavy  
duty) Electrical cables working voltage <1100 AC.
- 3.0 SIZES:**  
As per Table-1.
- 4.0 CONDUCTOR: Copper Complying to IS:613**
- 4.1** The conductor shall be of tinned annealed or bare conductor (ATC  
or ABC as specified in order) high conductivity copper wire with  
electrical and mechanical properties in accordance with IS:8130 .
- 4.2** Minimum number of wires & Max resistance of the conductor shall be  
as per IS 8130
- 5.0 INSULATION:**
- 5.1** PVC General Purpose -Type A or FRLSH- Type C
- 5.2** Thickness of insulation & tolerance shall be as per IS:1554 P1
- 5.5** Colour of Insulation: as specified in the order.
- 5.6** MARKING: The cable shall be marked at every one meter length for:
- Manufacturer's Name:  
Voltage grade : 1100 V  
Size :  
Type : General Purpose or FRLSH ( as per order)  
Sequential marking for cables >6 sq mm.
- 6.0 ELECTRICAL TESTS:**
- 6.1 HIGH VOLTAGE TEST:**
- 6.1.1** High voltage test (at room temperature) (Routine test):  
IS:1554(P1), Cl.16.2.

REVISIONS: 09

APPROVED:  
M. SHIVARAMIAH

PREPARED: ISSUED: DATE:  
HRN . STDS.GROUP. 12/02/13

6.1.2 High voltage test (Water Immersion Test) (routine Test): IS:1554 (P1), Cl.16.3.1

7.0 Insulation Resistance: (IS:5831) (Acceptance test)

7.1 Conductor Resistance: (IS:8130) (Acceptance test)

8.0 PHYSICAL TEST ON INSULATION (Type Test): IS:1554 (P1) & IS5831  
Tensile strength, Elongation at break, Heat aging, Heat shock, Shrinkage.

**Cold bend and Cold impact test-ref IS10810 Part 20 & 21**

#### **9.0 TESTS FOR FRLS PROPERTIES Category-C2 (Routine Test)**

9.1 Oxygen Index Test (OI) as per IS1554 (P1), 16.5

9.2 Temperature Index Test: IS1554 (P1), 16.10

9.3 Halogen acid (HCl): As per IS1554 (P1), 16.9

9.4 Smoke Density Test: Smoke density rating as per IS1554 (P1), 16.11

9.5 Flammability Tests: IS:1554 (P1)-16.4 and

a) As per IEC-60332 - 1

b) As per IEC-60332 - 3

c) As per IEEE-383 (Vertical tray flame test)

9.6 Fire Resistance Test

On finished cables as per IS-5831

9.7 Thermal Heat Stability Test

At 200 deg C for minimum of 80 minutes as per IS:5831

9.8 Anti termite and Rodent Properties

The presence of lead naphthionate and sodium Napthionate on outer sheath should be certified by the supplier with a certificate.

10.0 INSPECTION:

Supplier shall furnish compliance to core stage internal inspection certificate and other internal test reports before offering for final inspection.

11.0 TEST CERTIFICATE:

Three copies of **Type & Routine test** certificates shall be supplied (Routine test certificate shall be furnished for each batch) giving the following information:

ED 28588: PVC insulated single core copper cable 1100 volts.

Material code number :

BHEL Order number :

Size and length of cable:

Batch / lot number :

Test results obtained for all the properties and dimensional tolerances as per the specification. Supplier shall certify in the test certificate that the cable supplied does not have any joints in the insulation.

Type test certificate shall be considered valid for a period of three years from the date of test .

These tests shall be valid at the time of placement of purchase order. However if the type test requirement is specifically mentioned in the purchase order, the same has to be conducted as per purchase order terms.

12.0 PACKING AND MARKING:

12.1 Packing: Unless otherwise specified in the Purchase order, the cable shall be supplied on non-returnable plastic (ABS) bobbins.

If the manufacturer so desires he may supply upto 10 percent of a type in random lengths provided that each bobbin contains 100 metres consisting of not more than four pieces, the minimum length of any one piece being not less than 20 metres. Both the flanges of such bobbin shall show the length of each individual piece and its position on the reel. The bobbins shall be packed and labeled. To prevent moisture entry, free ends of the cable to be sealed with plastic caps.

12.2 Marking: The label which is securely attached to the bobbin shall have the following information:

ED 28588: FRLSH PVC INSULATED SINGLE CORE ANNEALED TINNED COPPER CABLE UNSHEATHED (GRADE <1100 VOLTS AC).

Material code number :

BHEL order no. :

Manufacturer's / Supplier's Name:

Size :

Length :

Weight :

Batch / Lot No. :

### 12.3 ACCEPTANCE CRITERIA:

- 1) Verification w.r.t TABLE-1
- 2) Witnessing of Routine test, Acceptance test
- 3) Verification of test reports
- 4) Packing and Marking

TABLE-1

SL. NO.	CONDUCTOR CROSS-SECTIONAL AREA.	NUMBER OF WIRES IN CONDUCTOR. MINIMUM	CONDUCTOR RESISTANCE AT 20°C. MAXIMUM	INSULATION THICKNESS MINIMUM
-	sq.mm	nos	Ohms/km	mm
1	1.50	3	12.2	0.8
2	2.50	3	7.56	0.9
3	4.00	7	4.7	1.0
4	6.00	7	3.11	1.0
5	10.00	7	1.84	1.0
6	16.00	7	1.16	1.0
7	25.00	7	0.734	1.2
8	35.00	7	0.529	1.2
9	50.00	19	0.391	1.4
10	70.00	19	0.270	1.4
11	95.00	19	0.195	1.6
12	120.00	37	0.154	1.6
11	150.00	37	0.126	1.8
13	300.00	61	0.0607	2.4
16	630.00	91	0.0286	3.4

REVISION HISTORY SHEET

REV NO	DATE	NATURE OF CHANGE	REASONS	PREPARED BY	APPROVED BY
00	09/04/92	1st ISSUE	-	RR,AV	N.J
01		SUPERSEDES CN 75934	Revised	SHG	"
02	12/02/93	CL 5.5 TABLE 2	Revised	"	"
03	21/09/93	CHANGE IN TITLE	F.B. FROM MPC	"	"
04	29/03/94	Totally Revised	Ref.stds Reissued	SHG	N.J
05	15/07/94	Table item Added	F.B From Pes/Gce	SHG	N.J
06	17/10/94	CL 8.6 Revised	F.B From Mpc	SHG	N.J
07	05/03/97	MATL.CODE ADDED & UNDER CL.7.1 SCREEN DEATILS GIVEN	F.B. FROM MPC	SHG	N.S
08	12/09/97	SCREEN DETAILS FROM CL.7.1 REMOVED	F.B.FROM MPC	SHG	N.S
09	28/10/97	CL.2 & SL.NO.9 IN TABLE 1 &13 IN TABLE 2ADDED	JSS 51002 SUPERSEDED BY 510034	SHG	N.S
10	30/11/02	REAFFIRMATION	-	CCR	NS
11	24/06/03	Cl.15.1&15.2 Revised	F.B.From MA	HRN	NS
12	10/03/09	Generally Revised	Committee Revised	HRN	MTR

APPROVED :  
M.THARAK RAJ

PREPARED : ISSUED : DATE :  
HRN STDS GROUP 10/03/09

PVC INSULATED SCREENED/SHIELDED COPPER CABLE  
(GRADE UP TO 1100 VOLTS).

1.0 GENERAL:

This specification governs the quality of Polyvinyl chloride (PVC) insulated screened/shielded tinned copper cable for operation up to a voltage of 1100 volts and temperature of 70° C.

2.0 COMPLIANCE WITH NATIONAL STANDARDS:

Assistance has been taken from IS:5026 (part-1) "Specification for Radio frequency cables" and JSS 51034 "Detail specification for miniature electric cables".

3.0 SIZES:

Sizes shall be as per Table-1.

4.0 CONDUCTOR:

4.1 The conductor shall be composed of tinned annealed high conductivity copper wire with electrical and mechanical properties in accordance with IS:8130. The details of the conductor shall be as per Table-1.

4.2 The resistance of the conductor at 20° C shall not exceed the appropriate maximum value given in the Table-1. The conductor resistance measured for a length of 25 cm and compared with the resistance of the conductor without any joint shall be not more than 5 % of the resistance of adjacent conductor.

4.3 Whenever a conductor is broken, the supplier can join the same by welding or brazing process only. Tensile strength of such joined conductor shall be not less than 90 % of the value of the conductor without joint.

REV 12

APPROVED:  
M.THARAK RAJ.

PREPARED: ISSUED: DATE:  
HRN. STDS.GROUP. 10-03-09.



5.0 INSULATION:

5.1 The insulation shall be provided with polyvinylchloride compound conforming to the requirements of Type-A compound of IS:5831.

5.2 The thickness of insulation shall be as per Table-2. Compliance shall be checked by the method specified in IS:10810 (part-6).

5.3 Insulation shall be applied over the conductor by extrusion method, in such a way that it fits closely on the conductor and shall be possible to remove it easily, without damage to the conductor.

5.4 Joining of core insulation material is not acceptable and repair work on insulation of core also is not acceptable.

5.5 Colour of Insulation:

1 core: Red,Black,Yellow,Blue,White or Grey.

2 core: Red & Black or Black & White.

3 core: Red,Yellow,Blue or Black,White & Red.

4 core: Red,Yellow,Blue,Black or Black,White,Red & Green.

2X7 core: The colour of the twisted pairs shall be Red-Black, Red-Green,Red-Grey,Red-White,Red-Blue,Red-Brown & Red-Yellow.

5.6 Laying-up of cores:

The cores shall be laid-up together with a suitable lay, the outermost layer shall have right hand lay and the successive layers shall be laid with opposite lay, where necessary, the interstices shall be filled with PVC compound. The recommended plan for lay-up of cores shall be according to Table-3 of IS:1554 (part-1).

6.0 INNER SHEATH:

6.1 The inner sheath shall be provided with polyester film tape

6.2 The thickness of inner sheath shall be 0.025 mm (minimum).

6.3 The inner sheath shall be applied over the laid-up cores in such a manner that each turn of the tape shall overlap the preceding turn. The tape shall not adhere to the cores and the individual cores shall be readily separable.

7.0 SCREEN:

7.1 The screen shall be composed of tinned annealed high conductivity copper wire with electrical and mechanical properties in accordance with IS:8130. The construction shall as per JSS 51034.

8.0 OUTER SHEATH:

8.1 The outer sheath shall be provided with polyvinylchloride compound conforming to the requirements of Type-ST1 compound of IS:5831.

8.2 The thickness of outer sheath shall be as per Table-2. Compliance shall be checked by the method specified in IS:10810 (part-6).

8.3 Outer sheath shall be applied over the screen by extrusion method and shall be possible to remove it easily, without damage to the screen.

8.4 Joining of sheath material is not acceptable and repair work on sheath also is not acceptable.

8.5 Colour of outer sheath:

The colour of outer sheath shall be Grey.

8.6 MARKING: The cable shall be marked at every one metre length with the following for OD  $\geq$  3.1mm size.

Manufacturer's Name:

Voltage grade :

Size :

Progressive marking over the length of the cable at every one metre length of the cable.

9.0 OVERALL DIAMETER:

The mean overall diameter shall not exceed the maximum overall diameter specified in Table-1. Compliance shall be

checked in line with clause 11.2 of BS:6231.

10.0 ELECTRICAL TESTS:

10.1 HIGH VOLTAGE TEST: IS:10810 (part-45): (Routine test)

100 volts grade :1500 V RMS (Minimum)  
250/440 volts grade :2000 V RMS (Minimum)  
1100 volts grade :3000 V RMS (Minimum)

10.2 Spark Test: IS:10810 (part-44) (Routine test)

100 volts grade :4000 V RMS  
250/440 volts grade :6000 V RMS  
1100 volts grade :10000 V RMS

10.3 Insulation Resistance: (IS:5831) (Routine test)

Insulation resistance test shall be carried out at 500 volt DC. The value of volume resistivity when calculated from the measured insulation resistance value shall not be less than  $1.0 \times 10^{13}$  Ohm-cm at 27°C and  $1.0 \times 10^{10}$  Ohm-cm at 70°C.

11.0 PHYSICAL TEST ON INSULATION (Type test):

Tensile strength, elongation at break, Heat aging, heat shock and shrinkage test shall meet the requirements of Type - A of IS:5831.

12.0 PHYSICAL TEST ON SHEATH (Type test):

Tensile strength, elongation at break, Heat aging, heat shock and shrinkage test shall meet the requirements of Type - ST1 of IS:5831.

13.0 INSPECTION:

Supplier shall furnish compliance to core stage internal inspection certificate and other internal test reports before offering for final inspection.

#### 14.0 TEST CERTIFICATE:

Three copies of Type & Routine test certificates shall be supplied (Routine test certificate shall be furnished for each batch) giving the following information:

ED 28597: PVC insulated screened/shielded copper cable  
(grade up to 1100 volts)  
Material code number :  
BHEL Order number :  
Size and length of cable:  
Batch / lot number :  
Test results obtained for all the properties and dimensional tolerances as per the specification. Supplier shall certify in the test certificate that the cable supplied does not have any joints in the insulation.

Type test certificate shall be considered valid for a period of three years from the date of test certificate. These tests shall be valid at the time of placement of purchase order. However if the type test requirement is specifically mentioned in the purchase order, the same has to be conducted as per purchase order terms.

#### 15.0 PACKING AND MARKING:

15.1 Packing: Unless otherwise specified in the Purchase order, the cable shall be supplied on non-returnable plastic bobbins each carrying 100 metres in one piece without joints. If the manufacturer so desires he may supply upto 10 percent of a type in random lengths provided that each bobbin contains 100 metres consisting of not more than four pieces, the minimum length of any one piece being not less than 20 metres. Both the flanges of such bobbin shall show the length of each individual piece and its position on the reel. The bobbins shall be packed and labeled. To prevent moisture entry, free ends of the cable to be sealed with plastic caps.

15.2 Marking: The label which is securely attached to the bobbin shall have the following information:  
ED 28597: PVC insulated screened/shielded copper cable  
(grade up to 1100 volts)  
Material code number :  
BHEL order no. :  
Manufacturer's / Supplier's Name:  
Size :  
Length :  
Weight :  
Batch / Lot No. :

15.3 ACCEPTANCE CRITERIA:

- 1) Verification as per Table- 1 & 2
- 2) Witnessing of routine tests
- 3) Packing and marking
- 4) Verification of Test reports

TABLE-1

SL NO	NO.OF CORES	CONDUCTOR CROSS-SECTIONAL AREA.	DIAMETER OF WIRES IN CONDUCTOR	DIAMETER OF BUNCHED CONDUCTOR	CONDUCTOR RESISTANCE AT 20°C.	VOLTAGE GRADE
		NOMINAL (sq.mm)	MAXIMUM (mm)	MAXIMUM (mm)	MAXIMUM (Ohms/km)	(V RMS)
1	1	0.75	0.21	1.14	26.7	250/440
2	1	1.5	0.26	1.60	13.7	1100
3	2	0.75	0.21	1.14	26.7	250/440
4	2	2.5	0.26	2.00	8.21	1100
5	3	0.5	0.21	0.93	44.01	250/440
6	4	2.5	0.26	2.00	8.21	1100
7	2X7	0.5	0.21	0.93	40.1	100
8	1	6.0	0.31	3.60	3.39	1100
9	2x8	0.5	0.20	10.0	40.1	100

TABLE-2

SL NO	NO.OF CORES	SIZE	INSULATION THICKNESS	CORE DIAMETER	OUTER SHEATH THICKNESS	OVERALL DIAMETER	CODE NO.
		(sq.mm)	MIN. MAX. (mm)	(mm)	MIN. MAX. (mm)	MAXIMUM (mm)	
1*	1	0.75	0.38-0.418	2.0 <sup>+</sup> / <sub>-</sub> 0.05	0.6-0.72	4.0	CN9075904070
2	1	1.5	0.60-0.660	3.1 <sup>+</sup> / <sub>-</sub> 0.05	0.8-0.96	6.0	CN9075934025
3	2	0.75	0.38-0.418	2.0 <sup>+</sup> / <sub>-</sub> 0.05	0.9-1.08	7.2	CN9075904029
4	2	2.5	0.70-0.770	3.8 <sup>+</sup> / <sub>-</sub> 0.05	1.0-1.2	13.0	CN9075934033
5	3	0.5	0.38-0.418	1.8 <sup>+</sup> / <sub>-</sub> 0.05	0.9-1.08	7.2	CN9075904037
6	4	2.5	0.70-0.770	3.8 <sup>+</sup> / <sub>-</sub> 0.05	1.0-1.2	14.5	CN9075934041
7	2X7	0.5	0.38-0.418	1.8 <sup>+</sup> / <sub>-</sub> 0.05	0.9-1.08	11.0	CN9075934076
8	4	0.75	0.38-0.418	2.0 <sup>+</sup> / <sub>-</sub> 0.05	0.9-1.08	8.5	CN9075981031
9	3	0.75	0.38-0.418	2.0 <sup>+</sup> / <sub>-</sub> 0.05	0.9-1.08	7.7	CN9075981023
10	2	0.75	0.38-0.418	2.0 <sup>+</sup> / <sub>-</sub> 0.05	0.9-1.08	7.2	CN9075981015
11	1	6.0	0.80-0.820	6.3 <sup>+</sup> / <sub>-</sub> 0.05	0.8-0.96	8.0	CU2854497015
12	1	0.75	WITH-DRAWN				CN9075904134
13	2x8	0.50	0.38-0.418	1.8 <sup>+</sup> / <sub>-</sub> 0.05	0.9-1.08	15.0	CN9075915020

Color of Insulation: \* GREY      Sheath: \* BLACK

SL.NO.	COLOUR CODE
08	BLACK, WHITE, RED, GREEN
09	BLACK, WHITE, RED
10	BLACK, WHITE