SHAHID GHANDI COMMUNICATION CABLE CO.

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TECHNICAL SPECIFICTION FOR CONDUIT UNFILLED CABLE - SOLID INSULATION (CUC-S)

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SPECIFICATION FOR

CONDUT UNFILLED CABLE - SOLID INSULATION

1 - GENERAL

This specification details the construction of conduit unfilled telecommunications cables. The conductors are solid copper, covered with a solid plastic insulating compound. The insulated conductors are twisted into pairs which are stranded into subgroups or groups and which in turn are assembled into a cable core. A moisture resistant filling compound surrounds the insulated conductors and fills the interstices between pairs and groups. After the core is wrapped, the cable structure is completed with Aluminum and LDPE jacket. The cable is fully color coded so that each pair in the cable is Distinguishable from every other pair. The color coding provides different color combinations of insulation for each pair in a 25 pair group or (subgroup) and provides colored bindings to distinguish individual groups from each other.

2 - ASSOCIATED DOCUMENTS

This specification is in accordance with REA'ASTM (American society for testing and material), BS (British Standard Institute) , IP (Institute of Petroleum) and ISO (International Organization for Standardization) have been specified .

3 - TEMPERATURE AND ENVIRONMENT

The cables shall without detriment, perform suitably throughout a temperature range of –40 to +70 C. The cables shall suffer no deterioration from corrosive elements found naturally in the ground.

4 - CONDUCTOR

Each conductor is a solid wire of commercially pure annealed copper, smoothly drawn, circular in cross section, uniform in quality and free form defects. Conductors meet the quality requirements of ASTM B3. The maximum resistance for a cross section area of 1 mm^2 and a length of 1 km is 17.241 ohms when measured at 20±2 ºC. The nominal conductor diameters may be 0.4 to 0.9 mm.

5 - CONDUCTOR INSULATION

Each conductor is uniformly covered with solid polyethylene conforming to ASTM D-1248 Type III class B category 4 or 5 Grade E8. Insulation contains a suitable antioxidant system including a copper inhibitor.

The insulation will be uniform, smooth and The Eccentricity of the insulation according the procedure described in ASTM D-4565 is less than 0.1.

The insulation colors are in accordance with the following table:

TABLE (1)

PAIR NUMBER	CONDUCTOR A	CONDUCTOR B
1	White	Blue
2	White	Orange
3	White	Green
4	White	Brown
5	White	Grey
6	Red	Blue
7	Red	Orange
8	Red	Green
9	Red	Brown
10	Red	Grey
11	Black	Blue
12	Black	Orange
13	Black	Green
14	Black	Brown
15	Black	Grey
16	Yellow	Blue
17	Yellow	Orange
18	Yellow	Green
19	Yellow	Brown
20	Yellow	Grey
21	Violet	Blue
22	Violet	Orange
23	Violet	Green
24	Violet	Brown
25	Violet	Grey

6 - TWISTING

Two appropriately colored insulated conductors are uniformly twisted together to form a pair. The lays of all pairs are in the same direction and different for each pair in a unit.

7 - STRANDING

In cables having 25 pairs or less, the pairs colored according to the table (1) are stranded to form a cylindrical core. Stranding may be accomplished by using a concentric stranding or by using cross stranding where the pairs will change positions according to the change in direction of lay. In cables having more than 25 pairs the pairs colored according to table (1) form groups which are divided into two or more sub-groups according to tables (2). The colored binders are used for binding and identifying each group or subgroup according to tables (4, 5, and 6). Each cable of 100 pairs and larger will have one (1) percent of spare pairs up to a value of 20 pairs for any given cable size according to tables (3).

The cables constructions are in accordance with the following tables:

TABLE (2)

Number of pairs in cable	Number of pairs in subgroups or groups	CENTER LAYER	FIRST LAYER	SECOND LAYER
100	4×25	-	-	-
150	6×25	1	2-6	-
200	8×25	1-2	3-8	-
300	12×25	1-3	4-12	-
400	16×25	1	2-6	7-16
500	10×50	1-3	4-10	-
	20×25	1	2-6	7-20
600	6×100	1	2-6	-
800	8×100	1	2-8	-
900	9×100	1-3	4-9	-
1000	10×100	1-3	4-10	-
1200	12×100	1-3	4-12	-
1800	18×100	1	2-7	8-18
2400	24×100	1-3	4-12	13-24

Note: Each cable of 100 pairs and larger will have one (1) percent of spare pairs up to a value of 20 pairs for any given cable size according to tables (3)
The spare pair colors are in accordance with the following table:

TABLE (3)

SPARE PAIR NUMBER	CONDUCTOR A	CONDUCTOR B
1	White	Red
2	White	Black
3	White	Yellow
4	White	Violet
5	Red	Black
6	Red	Yellow
7	Red	Violet
8	Black	Yellow
9	Black	Violet
10	Yellow	Violet
11	Blue	Orange
12	Blue	Green
13	Blue	Brown
14	Blue	Grey
15	Orange	Green
16	Orange	Brown
17	Orange	Grey
18	Green	Brown
19	Green	Grey
20	Brown	Grey

The binder colors for subgroup (25 pair) are in accordance with the following table:

TABLE (4)

Subgroup No.	Color of binding	Pair count
1	White-Blue	1-25
2	White-Orange	26-50
3	White-Green	51-75
4	White-Brown	76-100
5	White-Grey	101-125
6	Red-Blue	126-150
7	Red-Orange	151-175
8	Red-Green	176-200
9	Red-Brown	201-225
10	Red- Grey	226-250
11	Black-Blue	251-275
12	Black-Orange	276-300
13	Black-Green	301-325
14	Black-Brown	326-350
15	Black-Grey	351-375
16	Yellow-Blue	376-400
17	Yellow-Orange	401-425
18	Yellow-Green	426-450
19	Yellow-Brown	451-475
20	Yellow- Grey	476-500
21	Violet-Blue	501-525
22	Violet-Orange	526-550
23	Violet-Green	551-575
24	Violet-Brown	576-600

The binder colors for group are in accordance with the following table

TABLE (5)

Group No.	Color of binding	Pair count
1	White-Blue	1-100
2	White-Orange	101-200
3	White-Green	201-300
4	White-Brown	301-400
5	White-Grey	401-500
6	Red-Blue	501-600
7	Red-Orange	601-700
8	Red-Green	701-800
9	Red-Brown	801-900
10	Red- Grey	901-1000
11	Black-Blue	1001-1100
12	Black-Orange	1101-1200
13	Black-Green	1201-1300
14	Black-Brown	1301-1400

15	Black-Grey	1401-1500
16	Yellow-Blue	1051-1600
17	Yellow-Orange	1601-1700
18	Yellow-Green	1701-1800
19	Yellow-Brown	1801-1900
20	Yellow- Grey	1901-2000
21	Violet-Blue	2001-2100
22	Violet-Orange	2101-2200
23	Violet-Green	2201-2300
24	Violet-Brown	2301-2400

The binder colors for subgroup (100 and more than 100 pair) are in accordance with the following table:

TABLE (6)

Subgroup No.	Color of binding	Pair count
1	White -Blue	1-25
2	White - Orange	26-50
3	White -Green	51-75
4	White -Brown	76-100
5	White - Grey	101-125
6	Red -Blue	126-150
7	Red - Orange	151-175
8	Red -Green	176-200
9	Red - Brown	201-225
10	Red - Grey	226-250
11	Black- Blue	251-275
12	Black-Orange	276-300
13	Black- Green	301-325
14	Black-Brown	326-350
15	Black- Grey	351-375
16	Yellow- Blue	376-400
17	Yellow-Orange	401-425
18	Yellow-Green	426-450
19	Yellow-Brown	451-475
20	Yellow- Grey	476-500
21	Violet-Blue	501-525
22	Violet-Orange	526-550
23	Violet-Green	551-575
24	Violet-Brown	576-600

8 - CORE WRAP

The core is completely covered with one layer of non-hygroscopic non-wicking, dielectric tape. The tape may be applied helically or longitudinally and have a minimum over lap of 30% of the width of the wrapping or 10 mm whichever is the least .The core wrap provide a sufficient heat barrier to prevent visible evidence of conductor insulation deformation or adhesion between conductors caused by adverse heat transfer during the jacketing operation .

9 – INNER JACKET

A black polyethylene jacket in accordance with ASTM D-1248 type I class C category 4 or 5 grade J-3 . The nominal jacket thickness should be 1.4 mm. The average thickness at any cross section shall not be less than 90% and minimum spot thickness shall not be less than 70% of the nominal thickness.

10 - ALUMINUM SHIELD

An aluminum tape with copolymer coating on both sides will be applied longitudinally with an adequate overlap for the cables with a core diameter of 20mm or less the overlap will be 3mm minimum and for the cables with a core diameter greater them 20mm the overlap will be 6mm minimum. The Aluminum thickness is 200 micron and the copolymer coating on each side has the thickness about 38 microns.

11 - OUTER JACKET

A black polyethylene jacket in accordance with ASTM D-1248 type I class C category 4 or 5 grade J-3. The nominal jacket thickness will be according the following table (7). The average thickness at any cross section shall not be less than 90% and minimum spot thickness shall not be less than 70% of the nominal thickness.

The nominal jacket thickness is in accordance with the following table

TABLE (7)

Core Dia of cable in mm	Thickness of jacket in mm
Up to 20	1.5
20.1 - 30	1.8
30.1 - 35	2
35.1 – 45	2.3
45.1 - 55	2.5
55.1 and larger	2.8

12 - ELECTRICAL PARAMETERS

TABLE (8)

PARAMETERS		UNIT	0.4 mm	0.6 mm
Resistance	**Max. Ind**	**W/km**	**147**	**65**
	Max. Ave	**W/km**	**139**	**62**
Resistance Unbalance	**Max. Ind**	**%**	**5**	**4.5**
	Max. Ave	**%**	**2**	**1.5**
Dielectric Strength	**Conductor to conductor**	**Kv/ 3 sec**	**2.8**	**4.5**
	Conductor to ground	**Kv/ 3 sec**	**15**	**15**
Mutual Capacitance	**Max. Ind**	**Nf/km**	**57**	**57**
	*** Ave**	**Nf/km**	**52 ± 2**	**52 ± 2**
Capacitance Unbalance	**Pair to ground Max. Ind**	**Pk/km**	**2625**	**2625**
	Pair to ground Max. Ave	**Pk/km**	**574**	**574**
	Pair to pair Max. Ind	**Pk/km**	**145**	**145**
	Pair to pair Max. Rms	**Pk/km**	**45**	**45**
Attenuation	**Ave 1024 KHz**	**dB/Km**	**25.7**	**17.3**
	Ave 1500 KHz	**dB/Km**	**31.2**	**21**
Crosstalk	**Worst power-sum 1024**	**dB/Km**	**35**	**35**
	Mean power-sum 1024	**dB/Km**	**39**	**41**
	Worst power-sum 3150	**dB/Km**	**26**	**26**
	Mean power-sum 3150	**dB/Km**	**30**	**32**

* For cables less than 12 pairs 52 ± 4

13 - CABLE SIZES

Cables size for 0.4 mm is in accordance with the following table:

TABLE (13-A)

SIZE of CABLE	WEIGHT (kg/km)	DIAMETER (mm)	REEL LENGHT (m)
100 x 2 x 0.4	480	20	1010 - 1020
150 x 2 x 0.4	655	23	1010 - 1020
200 x 2 x 0.4	830	26	1010 - 1020
300 x 2 x 0.4	1195	31	760 – 765
400 x 2 x 0.4	1525	34	505 - 510
500 x 2 x 0.4	1890	38	505 - 510
600 x 2 x 0.4	2205	40	255 - 260
1000 x 2 x 0.4	3535	50	255 - 260
1200 x 2 x 0.4	4215	55	255 - 260
1800 x 2 x 0.4	6195	66	255 - 260
2400 x 2 x 0.4	8080	75	255 - 260

Cables size for 0.6 mm is in accordance with the following table:

TABLE (13-B)

SIZE of CABLE	WEIGHT (kg/km)	DIAMETER (mm)	REEL LENGHT (m)
100 x 2 x 0.6	930	28	1010 - 1020
150 x 2 x 0.6	1315	33	760 - 765
200 x 2 x 0.6	1680	37	505 - 510
300 x 2 x 0.6	2465	44	505 - 510
400 x 2 x 0.6	3185	50	255 - 260
500 x 2 x 0.6	3935	55	255 - 260
600 x 2 x 0.6	4600	56	255 - 260
1000 x 2 x 0.6	7445	71	255 - 260
1200 x 2 x 0.6	8840	77	255 - 260
1800 x 2 x 0.6	13005	93	255 - 260
2400 x 2 x 0.6	17075	106	255 - 260