

SHAHID GHANDI COMMUNICATION CABLE CO.

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**TECHNICAL SPECIFICATION FOR
CONDUIT FILLED CABLE - SOLID INSULATION
(CFC-S)**



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CONDUT FILLED CABLE - SOLID INSULATION**

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1 - GENERAL

This specification details the construction of conduit filled telecommunication 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 MDPE 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 from defects. Conductors meet the quality requirements of ASTM B3. The maximum resistance for a cross section area of 1 mm² and a length of 1 km is 17.241 ohms when measured at 20±2 °C. 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 A 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.

5-1-The insulation colors are in accordance with the following table (1).

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 all the cable sizes, the pairs colored according to the table (1). In cables having 25 pairs or less, the pairs 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 form a group when specified, the groups are divided into two or more sub-groups according to tables (2).

7-1-The cables constructions are in accordance with the following table (2).

TABLE (2)

Number of pairs in cable	Number of pairs in subgroups or groups	CENTER LAYER	FIRST LAYER	SECOND LAYER
<=20	Total pairs in one group	-	-	-
30	12+13+5	-	-	-
40	12+13+15	-	-	-
50	(12+13)+(12+13)	-	-	-
	2×25	-	-	-
70	(2×25)+20	-	-	-
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

NOTE: Can replace 12-13 subgroups with 25 pair groups for all cable construction.

7-2-The binder colors for subgroups are in accordance with the following table (3).

TABLE (3)

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

7-3-The binder colors for groups are in accordance with the following table (4).

TABLE (4)

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	1501-1600
17	Yellow-Orange	1601-1700
18	Yellow-Green	1701-1800

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7-4 – SPARE PAIRS

Each length of cable of 100 pairs and larger will have one (1) percent of spare pairs up to a value of 20 pairs. For 150 pair's cable, 2 spare pairs will be including. The spare pairs can be in any subgroup or group .The spare pair's colors according to tables (5).

The spare pair colors are in accordance with the following table (5).

TABLE (5)

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

8 - FILLING COMPOUND

The interstices between conductors, sub-groups and groups are filled with filling compound.

9 - 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 (Note: for cable sizes of less than 150 pairs the overlap will not be less than 5mm) .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.

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 than 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 II class C, category 4 or 5 grade J-3. The nominal jacket thickness will be according the following table (6). 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 (6).

TABLE (6)

Core Dia of cable in mm	Nominal Thickness of jacket in mm
Up to 20	1.6
20.1 - 30	1.8
30.1 - 35	2.1
35.1 - 45	2.3
45.1 - 55	2.5
55.1 and Larger	2.8

12 – IDENTIFICATION MARKING

Each length of the cable shall be permanently identified as to the manufacturer, year of manufacture, number of pairs, conductor size and cable type and number length marking. The marking will be printed on the outer jacket.

13 - ELECTRICAL PARAMETERS

TABLE (7)

PARAMETERS		UNIT	0.4 mm	0.6 mm	0.8mm	0.9 mm
Resistance	Max. Ind	Ω/km	147	65	36	29
	Max. Ave	Ω/km	139	62	35	28
Resistance Unbalance	Max. Ind	%	5	4.5	4.5	4.5
	Max. Ave	%	2	1.5	1.5	1.5
Dielectric Strength	Conductor to conductor	Kv/ 3 sec	2.8	3.5	4.5	4.5
	Conductor to ground	Kv/ 3 sec	15	15	15	15
Mutual Capacitance *	Max. Ind	Nf/km	57	57	57	57
	Ave	Nf/km	52 ± 2	52 ± 2	52 ± 2	52 ± 2
Capacitance Unbalance **	Pair to ground Max. Ind	Pk/km	2625	2625	2625	2625
	Pair to ground Max. Ave	Pk/km	574	574	574	574
	Pair to pair Max. Rms	Pk/km	45	45	45	45
Attenuation	Nom 1024 KHz	dB/Km	23.5	15.2		10.3
	Nom 1500 KHz	dB/Km	28	18.5		12.3
Crosstalk	Worst power-sum 1024	dB/Km	35	35		37
	Mean power-sum 1024	dB/Km	39	41		43
	Worst power-sum 3150	dB/Km	26	26		28
	Mean power-sum 3150	dB/Km	30	32		34

* For cables less than 12 pairs, Average 52 ± 4 and Maximum Individual 58 Nf/km.

** Only for cables more than 12 pairs.

14 - CABLE SIZES

Cables size for 0.4 mm is in accordance with the following table (14-A).

TABLE (14-A)

SIZE of CABLE	WEIGHT (kg/km)	DIAMETER (mm)	REEL LENGHT (m)
10 x 2 x 0.4	105	10	1010 - 1020
20 x 2 x 0.4	160	12	1010 - 1020
30 x 2 x 0.4	255	14	1010 - 1020
40 x 2 x 0.4	255	15	1010 - 1020
50 x 2 x 0.4	305	16	1010 - 1020
70 x 2 x 0.4	394	18	1010 - 1020
100 x 2 x 0.4	525	20	1010 - 1020
150 x 2 x 0.4	745	24	1010 - 1020
200 x 2 x 0.4	995	28	1010 - 1020
300 x 2 x 0.4	1410	33	1010 - 1020
400 x 2 x 0.4	1850	37	760 – 765
500 x 2 x 0.4	2330	42	760 – 765
600 x 2 x 0.4	2720	45	505 - 510
900 x 2 x 0.4	4000	54	255 - 260
1000 x 2 x 0.4	4370	56	255 - 260
1200 x 2 x 0.4	5400	63	255 - 260
1500 x 2 x 0.4	6675	70	255 - 260
1600 x 2 x 0.4	7095	72	255 - 260
1800 x 2 x 0.4	7950	76	255 - 260

Cables size for 0.6 mm is in accordance with the following table (14-B):

TABLE (14-B)

SIZE of CABLE	WEIGHT (kg/km)	DIAMETER (mm)	REEL LENGHT (m)
2 x 2 x 0.6	70	8	1010 - 1020
10 x 2 x 0.6	180	13	1010 - 1020
20 x 2 x 0.6	295	16	1010 - 1020
30 x 2 x 0.6	405	19	1010 - 1020
40 x 2 x 0.6	490	20	1010 - 1020
50 x 2 x 0.6	600	22	1010 - 1020
70 x 2 x 0.6	810	26	1010 - 1020
100 x 2 x 0.6	1100	29	1010 - 1020
150 x 2 x 0.6	1570	34	1010-1020
200 x 2 x 0.6	2150	41	760-765
300 x 2 x 0.6	3080	48	505 - 510
400 x 2 x 0.6	4020	55	505 - 510
500 x 2 x 0.6	5010	61	255 - 260
600 x 2 x 0.6	5950	66	255 - 260
1000 x 2 x 0.6	9550	82	255 - 260

Cables size for 0.8 mm is in accordance with the following table (14-C).

TABLE (14-C)

SIZE of CABLE	WEIGHT (kg/km)	DIAMETER (mm)	REEL LENGHT (m)
2 x 2 x 0.8	90	9	1010 - 1020
4 x 2 x 0.8	140	11	1010 - 1020
10 x 2 x 0.8	260	15	1010 - 1020
40 x 2 x 0.8	765	24	1010 - 1020

Cables size for 0.9 mm is in accordance with the following table (14-D).

TABLE (14-D)

SIZE of CABLE	WEIGHT (kg/km)	DIAMETER (mm)	REEL LENGHT (m)
10 x 2 x 0.9	335	17	1010 - 1020
20 x 2 x 0.9	575	22	1010 - 1020
30 x 2 x 0.9	815	26	1010 - 1020
40 x 2 x 0.9	1005	28	1010 - 1020
50 x 2 x 0.9	1240	31	1010 - 1020
70 x 2 x 0.9	1690	36	760 - 765
100 x 2 x 0.9	2340	42	760 - 765