

## CABLE FOR SUBSTATION INSTALLATION

### 1. INTRODUCTION.

1.1 This E.I. cancels TELEPHONE General C 5001 and describes the type of cable used for substation installation work. For information on cable for exchange installation purposes see INTERNAL PLANT INSTALLATION Wires and Cables T 3016.

### 2. GENERAL.

2.1 P.V.C. sheathed cable with P.V.C. (Polyvinyl Chloride) insulated tinned copper conductors is the standard cable for internal use on substation installation work. The conductor weight is  $6\frac{1}{2}$  lb. (.020 "diam.", 25 S.W.G.). The colour of the sheath is cream for all sizes of cable.

2.2 The current standard colour codes for identification of wires are shown in Tables 2 and 4 of this E.I.

2.3 Flat P.V.C. cables and cables using wire identification colour codes other than those shown in Tables 2 and 4 have been superseded. Details of the colour codes of these superseded cables are contained in the relevant INTERNAL PLANT INSTALLATION E.I. referred to in para. 1.1, except for that applying to the more recent small sheathed cables up to and including 4 wire which are shown in Table 3 of this E.I.

### 3. CABLE SIZES.

3.1 The sizes of cables in general use for substation installation work are shown in Table 1.

Cable Size	Number of Units in Cable Core				Approx. External Diameter	Wire Identification Colour Code
	Single Wire Units	Pairs	Triples	Quads		
2 wire		1			0.13"	} See Section 4 and Table 2
3 wire			1		0.14"	
4 wire				1	0.16"	
11 wire	1	5			0.27"	
21 wire	1	10			0.33"	} See Section 5 and Table 4
42 wire		21			0.42"	
71 wire	1	35			0.53"	
101 wire	1	50			0.63"	
200 wire		100			0.90"	

TABLE 1. SIZES OF CABLES FOR SUBSTATION INSTALLATION USE.

4. SMALL CABLE SIZES (2, 3 AND 4 WIRE).

- 4.1 Two, three and four wire cables have a single colour on each conductor for wire identification. The colour code is shown in Table 2.
- 4.2 The conductors in the four wire cable are arranged in a quad formation, the diagonally opposite wires forming the pairs. The white and blue wires form 1 pair and the red and black wires the other. This configuration is shown in Fig. 1.

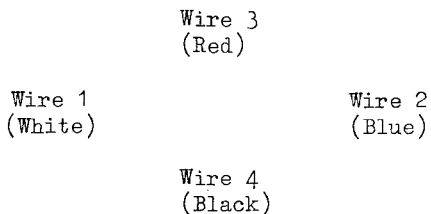


FIG. 1. QUAD FORMATION IN 4 WIRE CABLE.

Wire Number	Pair Number	Wire Leg	Cable Size		
			2 Wire	3 Wire	4 Wire
1	1	A	White	White	White
2	1	B	Blue	Blue	Blue
3	2	A		Red	Red
4	2	B			Black

COLOUR CODE FOR 2, 3 AND 4 WIRE CABLE.

TABLE 2.

- 4.3 To assist technical staff in calculating amounts of cable used in wiring subscribers services, it is expected that 2, 3 and 4 wire cable may be marked at intervals of one yard on the external sheath. The markings will consist of numerals commencing from 1 or 001 and finishing at 999. The starting and finishing number of each coil will be marked on the wrapping or label.
- 4.4 The colour code of 2, 3 and 4 wire cable purchased for some years immediately prior to 1962 is shown in Table 3. As four wire cable to this code has been manufactured with the wires quadded in two different sequences, a check of the lay is necessary to select the appropriate wires for association as pairs. In every case the diagonally opposite wires of the quad shall constitute each pair.

Type of Cable	Colours			
	1	2	3	4
2 wire	Black	Blue		
3 wire	Blue	Orange	Green	
4 wire	Blue	Orange	Green	Brown

COLOUR CODE FOR 2, 3 AND 4 WIRE CABLE PURCHASED PRIOR TO 1962.

TABLE 3.

5. ELEVEN WIRE CABLE AND LARGER.

- 5.1 Eleven wire and larger sizes of cable are arranged in twinned pairs plus in some cases an additional spare wire. They are colour coded according to the standard code which is detailed in Table 4.
- 5.2 When using these cables, the white wire or its equivalent must always be used for the positive or A leg of the pair and the coloured wire must be used for the negative or B leg.
- 5.3 A wire or nylon thread may be included under the cable sheath in such a manner that it can be used for longitudinal stripping of the cable.

Pair Number	Wire 1 (A leg)	Wire 2 (B leg)	Notes
1	White	Blue	1. For cables with more than 20 pairs the colours of wire 2 are repeated as for pairs 1 to 20. The colour of wire 1 changes as follows :-  21- 40 pairs - yellow 41- 60 pairs - black 61- 80 pairs - violet 81-100 pairs - red.  2. The colour of the spare wire in 11, 21, 71 and 101 wire cable is Red-White.
2	"	Orange	
3	"	Green	
4	"	Brown	
5	"	Slate	
6	"	Blue-White	
7	"	Blue-Orange	
8	"	Blue-Green	
9	"	Blue-Brown	
10	"	Blue-Slate	
11	"	Orange-White	
12	"	Orange-Green	
13	"	Orange-Brown	
14	"	Orange-Slate	
15	"	Green-White	
16	"	Green-Brown	
17	"	Green-Slate	
18	"	Brown-White	
19	"	Brown-Slate	
20	"	Slate-White	

TABLE 4. STANDARD COLOUR CODE FOR 11 WIRE CABLE AND LARGER.

## 6. GENERAL PRECAUTIONS.

- 6.1 At high ambient temperatures, P.V.C. tends to flow away from points of pressure, with consequent lowering of insulation resistance. Therefore, tight clamping and sewing of P.V.C. cables and tight lacing of insulated conductors should be avoided. However, cables in vertical runs must be fixed tightly enough to prevent movement of the cables.
- 6.2 The insulation must not be coated with nitro-cellulose lacquer under any circumstance. The insulated conductors must not be waxed.
- 6.3 To prevent accidental damage to the insulation by heat, care must be taken that the soldering bit does not touch the insulation. The soldering bit should not be applied to the tags longer than is necessary to make a satisfactory joint or to remove a wire. This precaution is of particular importance when any subsequent resoldering work is being undertaken. It is also essential that the insulated wire does not touch any tag except the one on which it is terminated. Whenever possible a sequence of soldering should be followed whereby wires are not laid past a tag until soldering on that tag has been completed.

## 7. STRIPPING METHODS.

- 7.1 The following procedure is to be observed when stripping the sheath from 2-wire, 3-wire and 4-wire cable :-
  - (i) Using a sharp penknife, a cut is made around the sheath at approximately 1" from the end. The 1" portion of the sheath is removed exposing the insulated conductors.
  - (ii) A longitudinal slit of approximately  $\frac{1}{2}$ " in length is made in the sheath and the sheath peeled from the conductors.
  - (iii) The peeled portion of sheath is gripped firmly with pliers at each side of the slit. The exposed conductors are held firmly, either between finger and thumb or with a second pair of pliers. By exerting a firm pressure on the conductor against the sheath, the sheath may be stripped from the conductor for the required length.
  - (iv) Using diagonal cutting pliers the length of sheath removed in operation (iii) is cut away and the butt neatly trimmed.
- 7.2 There are a number of special tools available to facilitate the removal of sheath from cable larger than 4-wire. They are used either to make a longitudinal cut or tear in the cable sheath so that the sheath can be readily peeled off. A shallow circular cut is made at the butt with a pocket knife or circular cutting tool to finally remove the sheath.

If a special tool is not available the sheath can be removed in short sections by making a shallow circular cut around the cable, flexing the cable slightly at this cut until the sheath breaks away, and finally sliding the sheath from the cable core. The length of sheath which can be removed in each operation will depend on the cable size. Where a rip cord is incorporated in the cable this should be used for stripping (see para. 5.3).

E N D.