CABLE SPLICING—GENERAL
MULTIUNIT PULP-INSULATED
CD-TYPE CABLES

CONTENTS PAGE

1. GENERAL

1.01 This section covers the description and splicing of CD-type *m*ulti*u*nit *p*ulp-insulated (MUP) cables and pseudo-MUP unit cables.

1.02 This section is reissued to leave the cable design of 22-gauge pulp cable virtually unchanged but to explain a method used to gain MUP's advantage of instant 25-pair group recognition with a modified splicing procedure called "pseudo-MUP splicing." Since this reissue is a general revision, no revision arrows have been used to denote significant changes.

1.03 CD-series MUP cables are available as ***standard cables.***

1.04 ***Standard CD-Series Cables:*** These cables are furnished in the following pair sizes and gauges:

22-gauge—600, 900, 1200

24-gauge—900, 1200, 1500, 1800

26-gauge—900, 1200, 1500, 1800, 2100, 2400, 2700, 3000, 3600.

Printed in U.S.A.

1.05 ***Conductor Insulation:*** The annealed copper conductors are insulated with wood pulp applied directly to the wires. A new tougher pulp insulation (TUFPULP) is being applied to 26-gauge cable. TUFPULP looks identical to standard pulp insulation, but can readily be distinguished by the splicer because, unlike standard pulp, the insulation will not unravel or strip from the conductor. TUFPULP insulation is compatible with all connectors approved for standard pulp.

1.06 MUP cables are available with stalpeth, PASP, lead, poly-jacketed lead, bonded alvyn, or steampeth sheath and outer protections as covered in the 626 Division of the Bell System Practices.

2. DEFINITIONS

2.01 The following definitions are included to clarify the meaning of several terms used in this and related sections covering CD-series cables:

Cable Size—MUP cable size designations are the same as the guaranteed number of pairs—namely 600, etc, through 3600.

Multiunit—An assembly of 100 or 50 pairs held together by ***two colored*** plastic binders (see Part 3).

Primary Unit—An assembly of 25, 13, or 12 pairs which are held together by a ***single colored*** binder (see Part 3).

Splicing Group—In MUP cable the individual multiunit of 100 or 50 pairs is comprised of four primary units. The primary units allow MUP cable to be broken down to 25, 13, or 12 pairs for the basic splicing group (see Part 3).

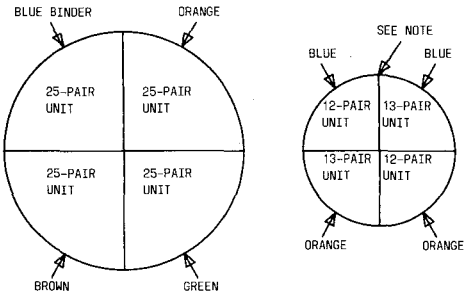
Pseudo-MUP Splicing Group—The standard unit in 22-gauge MUP cable has 50 pairs. Pseudo-MUP splicing is a method whereby the 50-pair standard unit is segregated, by pair color, to 25-pair groups to gain MUP's advantage of instant 25-pair group recognition (see Part 4).

Extra Pairs (Interstitial Pairs)—One or more color-coded pairs included in the cable to ensure meeting the Western Electric Company, Inc., guarantee.

Tip and Ring—The ring side of each pair is colored (solid) throughout its length by a dye mixed in the pulp before application to the conductor. The tip conductor of the pair is insulated with natural color pulp. Narrow bands of stain are applied to some of the tip wires to distinguish the length of pair twist during manufacture.

3. MULTIUNIT LAY-UP

3.01 The MUP cable design breaks former 24- and 26-gauge standard AD-type pulp 100- or 50-pair concentrically constructed units into multiunits comprised of ***four 25-pair primary units for 100-pair multiunits*** and ***two 12-pair and two 13-pair primary units for 50-pair multiunits*** (Fig. 1). For 100-pair multiunits, the four primary units have blue, orange, green, and brown binder colors. For the 50-pair multiunits of 24- and 26-gauge MUP cables, there are two 12-pair primary units—one with a blue binder, the



NOTE:
SEE ILLUSTRATION SHOWING 50-PAIR MULTIUNIT LAYUPS OF 1500-PAIR MUP CABLE FOR ONE EXCEPTION OF UNIT BINDER COLORS.

Fig. 1—Primary Unit Binder Colors of 100- and 50-Pair CDM and CDT Multiunits (24 and 26 Gauge)

other orange. . .and two 13-pair primary units. . .again, one with a blue, the other an orange binder. The one exception to the 50-pair multiunit lay-up is shown in Fig. 2 for 1500-pair CDM and CDT 24- and 26-gauge MUP cable.

3.02 All CDM and CDT MUP cable 100-pair multiunits (Fig. 3) and all CDM and CDT MUP cable 50-pair multiunits (Fig. 4) have the same pair lay-ups. All multiunits of each pair size look alike.

3.03 The two colored plastic binders wrapped around each multiunit indicate the color of the multiunit for the purpose of establishing the pair count.

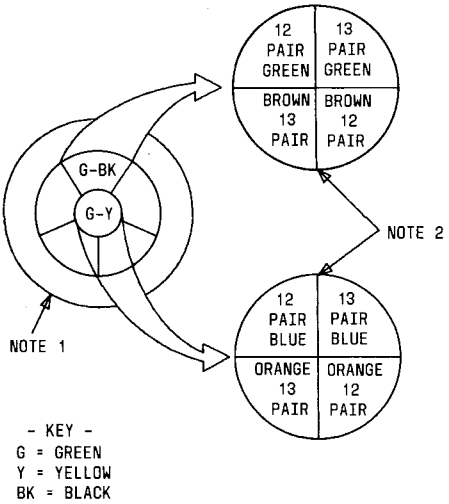
3.04 The multiunit binders are color coded for manfacturing reasons and to identify the layer position of the multiunits. ***Standard MUP cable lay-ups*** are shown in Fig. 5 (24- and 26-gauge).

4. PSEUDO-MUP LAY-UP (22-GAUGE CABLE)

4.01 The 22-gauge pseudo-MUP cable will be coded CDA so that the letter "C" will indicate MUP capabilities.

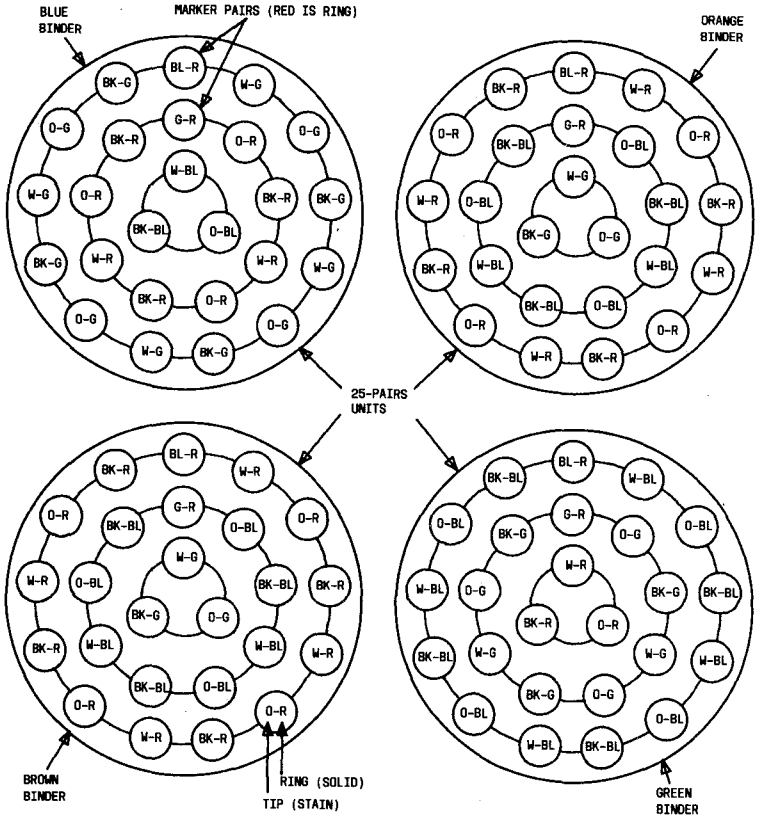
4.02 The standard unit in 22-gauge cable has 50 pairs. Of these pairs, 25 have the same color insulation and can be treated as a group like a MUP unit. For example, a "green" unit has 20 green-white pairs in its outside layer and 5 green-white pairs in the first layer around the differently colored single pair center (Fig. 6). The remaining 25 pairs have blue-white or red-white insulation. A comparable situation exists in "blue" and "red" units.

4.03 The core of 22-gauge pulp cable will use two plastic binders on each unit. One binder will repeat the unit color of green or red or blue. The second binder will indicate layer—yellow for the outside layer of units, black for the next inside layer, then yellow again. (See Fig. 7.)



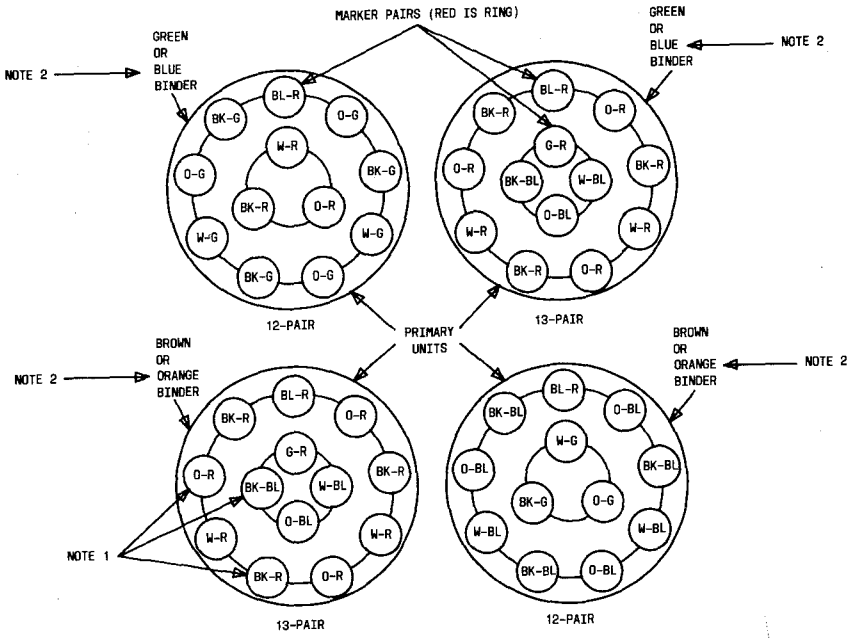
NOTES:
1. EXCEPT FOR THE TWO 50-PAIR MULTIUNITS SHOWN, ALL OTHER MULTIUNITS ARE 100 PAIRS EACH.
2. INITIAL 1500 PAIR MUP CABLES USED BLUE, ORANGE, GREEN AND BROWN BINDER PRIMARY UNITS FOR BOTH 50 PAIR MULTIUNITS.

Fig. 2—Lay-Up of CDM and CDT 1500-Pair Cable



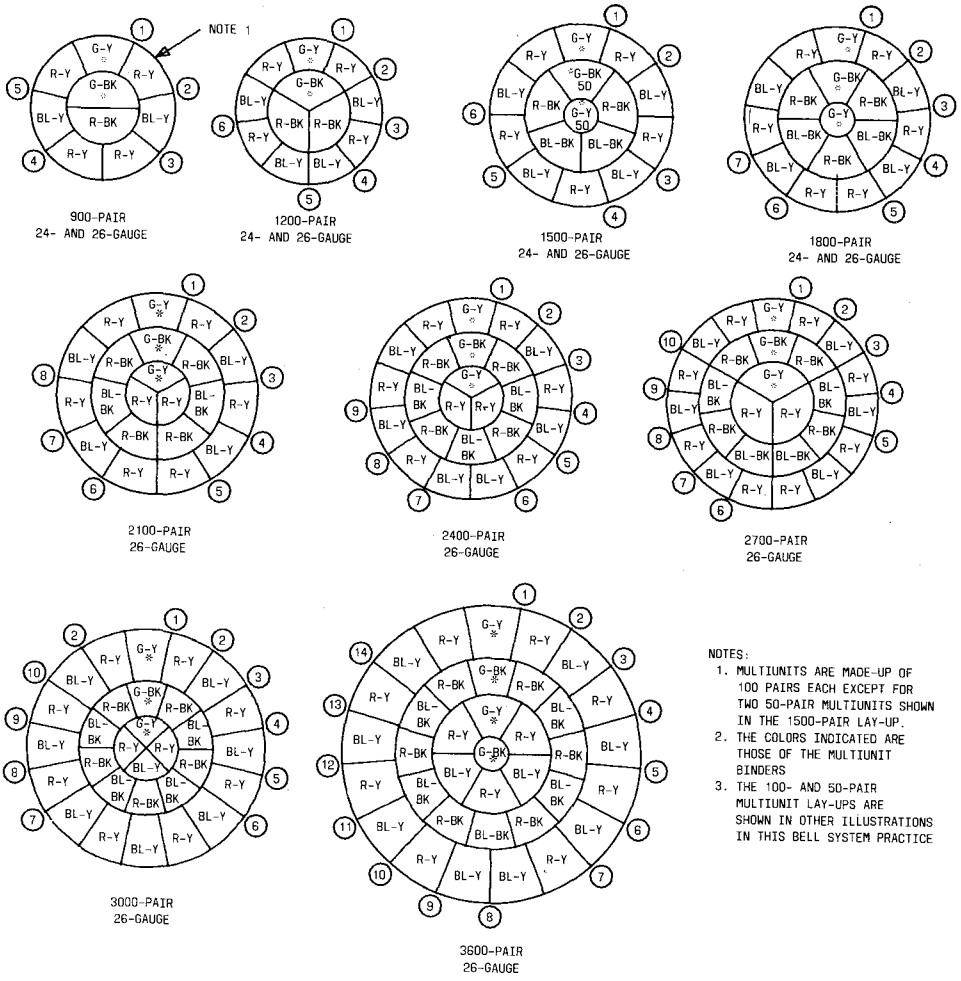
NOTE: ORANGE AND BLACK ARE STAIN COLORS ON WHITE INSULATION

Fig. 3—Cross Section of 100-Pair Multiunit (MUP Design) for CDM and CDT Cables Only



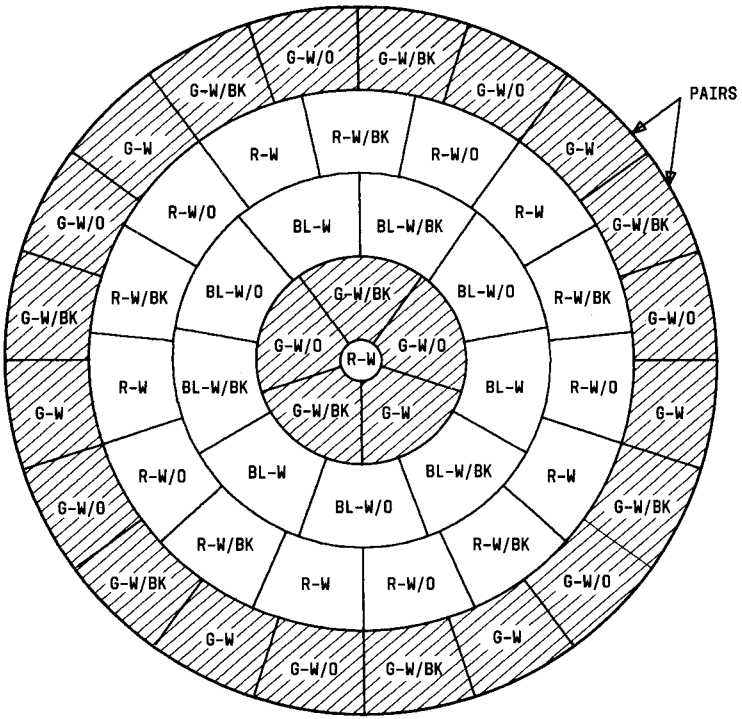
NOTES:
1. ORANGE AND BLACK ARE STAIN COLORS ON WHITE INSULATION
2. BLUE AND ORANGE GROUPS ARE IN 300 PAIR CABLES ONLY
3. IN 1500 PAIR CABLES, THE GROUPS ARE: BLUE-BLUE, ORANGE-ORANGE, AND GREEN-GREEN, BROWN-BROWN

Fig. 4—Cross Section of 50-Pair Multiunit (MUP Design) for CDM and CDT Cables Only



NOTES:
1. MULTIUNITS ARE MADE-UP OF 100 PAIRS EACH EXCEPT FOR TWO 50-PAIR MULTIUNITS SHOWN IN THE 1500-PAIR LAY-UP.
2. THE COLORS INDICATED ARE THOSE OF THE MULTIUNIT BINDERS
3. THE 100- AND 50-PAIR MULTIUNIT LAY-UPS ARE SHOWN IN OTHER ILLUSTRATIONS IN THIS BELL SYSTEM PRACTICE

Fig. 5—CDM and CDT Cable Lay-Ups (24 and 26 Gauge)

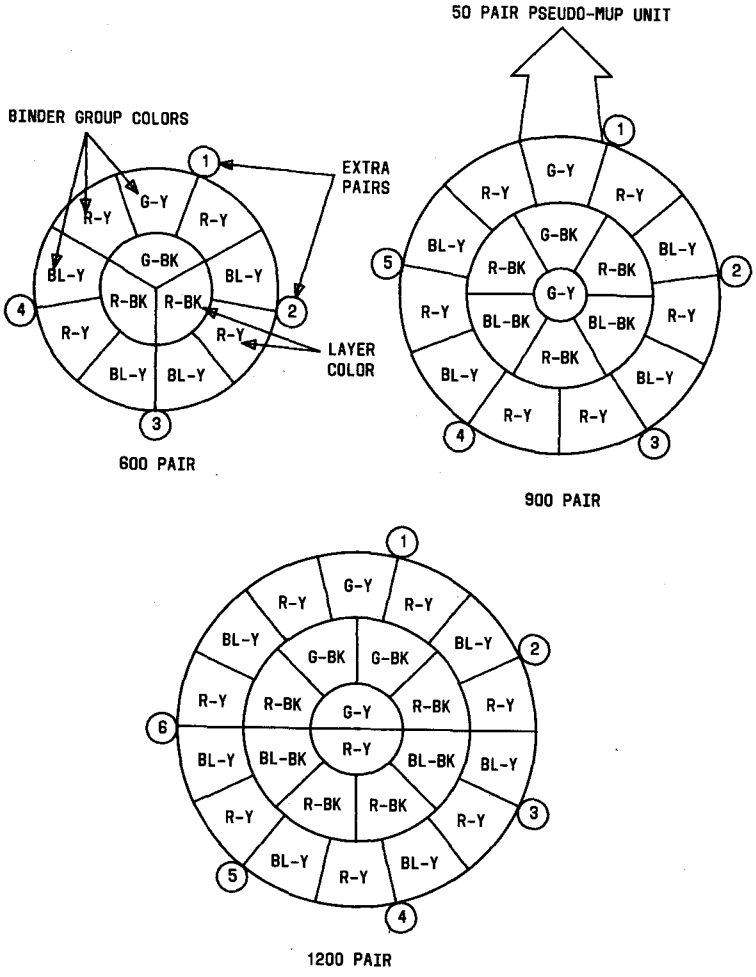


INSULATION COLORS

G = GREEN
R = RED
BL = BLUE
W = WHITE (NATURAL) WITH NO STAIN
W/O = WHITE WITH ORANGE STAIN
W/BK = WHITE WITH BLACK STAIN

NOTES:
1. ORANGE AND BLACK ARE STAIN COLORS ON WHITE INSULATION
2. RED UNIT WILL HAVE RED PAIRS IN CROSS HATCHED LOCATIONS
3. BLUE UNIT WILL HAVE BLUE PAIRS IN CROSS HATCHED LOCATIONS
4. CROSS HATCHED PAIRS REPRESENT THE LOW HALF OF THE UNIT PAIR COUNT

Fig. 6—Cross Section of 50-Pair Pseudo MUP Unit (22 Gauge—Green Unit)



- KEY -

G = GREEN UNIT BINDER
R = RED UNIT BINDER
B = BLUE UNIT BINDER
Y = YELLOW LAYER BINDER
BK = BLACK LAYER BINDER

Fig. 7—CDA Pseudo MUP Cable Lay-Up (22 Gauge)

4.04 In "pseudo-MUP" splicing with modular connectors when a "green" unit is being spliced, the 25 green-white pairs are dressed into the first splicing module, randomly, and the splice completed with the 25 green-white pairs from the corresponding unit in the other cable, again with random placement. These 25 pairs are taken as the low half of the units pair count. The remaining 25 pairs, colored blue-white and red-white, are randomly spliced together in a second module to give the high half of the unit count. Pairs are spliced tip to tip and ring to ring.

4.05 When a "red" unit is being spliced, the low half of the unit count will be given by 25 red-white pairs and the high half with the remaining 25 blue-white and green-white pairs.

4.06 When a "blue" unit is being spliced, the low half of the count will be given by 25 blue-white pairs and the high half with the remaining 25 green-white and red-white pairs.

4.07 Where individual wire connectors are used for splicing, the corresponding pseudo-MUP splice is achieved by separately bundling and marking the two 25-pair groups from each unit.

4.08 For CDA cables with CONECS (***CON***nectorized ***E***xchange ***C***able ***S***ystem), the factory preterminated ends will always be pseudo-MUP.

New runs of CDA cable must be consistently pseudo-MUP spliced from the outset.

5. EXTRA PAIR LOCATION AND IDENTIFICATION

5.01 ***Extra Pairs:*** The extra pairs in CD-type cables are located in the spaces (interstices) between multiunits of the outer layer. The crosstalk coupling between these interstitial pairs and those in the multiunits is comparable to that of pairs in different multiunits. In splicing adjacent lengths of cable containing factory defects, carrier crosstalk due to the ***wandering pair*** effect can be minimized by appropriate use of the interstitial pairs. The recommended method of splicing is outlined in paragraph 8.01.

5.02 ***Extra Pair Color Code:*** A color code has been provided for ten different extra pairs as shown in Table A. The red-blue extra pair

TABLE A

EXTRA PAIR COLORS

PAIR NO.	STANDARD CODE
1	Red-blue[1]
2 or 11	Green-white
3 or 12	Red-white
4 or 13	Blue-white
5 or 14	Green-white/black stain
6 or 15	Red-white/black stain
7 or 16	Blue-white/black stain
8 or 17	Green-white/orange stain
9 or 18	Red-white/orange stain
10 or 19	Blue-white/orange stain

Note 1: Red-blue pair is used once as a spare pair in each cable.

(Pair No. 1) is used only once as a spare pair in any given cable. Where provided, the remaining extra pairs (No. 2 through No. 10) are used in the color sequence as shown and are distributed as symetrically as possible. Where it is necessary to place more than one pair in an interstice, the color-coded pairs are sequential. In cables where it is necessary to include more than ten extra pairs to make up for defects, the color code shown for Pairs No. 2 through 10 is repeated in sequence.

6. ARRANGEMENT OF MULTIUNITS

6.01 ***Core Lay-Ups:*** The arrangements of the multiunits, colors of the multiunit binders, typical locations of extra pairs, and other details for the various sizes are shown in Fig. 5 and 6.

7. PAIR COUNT

7.01 If the cable terminates in two central offices (interoffice trunks), one of the offices should be selected as the reference office for determining the direction of counting.

7.02 The pair count of MUP cable is determined in the following way.

(1) ***Multiunit Count:***

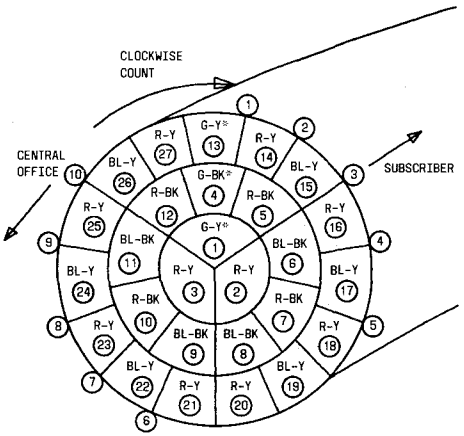
(a) Depending upon pair size, the green-yellow or green-black multiunit in the center is the ***starting multiunit*** with the lowest count.

(b) The green-yellow or green-black multiunit in any layer is the ***marker multiunit*** for that layer and has the lowest count in the layer.

(c) ***Looking away from*** the ***central office,*** the count proceeds in a ***clockwise direction*** starting with the appropriate green-yellow or green-black multiunit in the center.

(d) ***Looking toward*** the ***central office, the count proceeds in a counterclockwise direction*** starting with the appropriate green-yellow or green-black multiunit in the center.

(e) Figure 8 illustrates the multiunit count using the binder colors to determine the count sequence in a 2700-pair MUP cable.



NOTE:
THE COLORS INDICATED ARE THOSE OF THE MULTIUNIT BINDERS.

Fig. 8—Multiunit Counting Sequence for 2700-Pair MUP Cable

(2) ***Primary Unit Count*** (MUP Cable):

(a) The primary unit binders (Fig. 1) allow 100- and 50-pair groups to be further broken down as shown in Table B.

The breakdown in count (Table B) is possible only if primary unit integrity is maintained during splicing of a cable run.

(3) ***Primary Unit Count*** (Pseudo-MUP Cable):

(a) The primary unit binders of "pseudo-MUP" 50-pair groups allow the cable count to be established in accordance with Table C.

TABLE B

MUP UNIT BREAKDOWN

PRIMARY UNIT BINDER COLOR	GROUP COUNT
Blue	01-25
Orange	26-50
Green	51-75
Brown	76-100

Note: Also applies to the 50-pair multiunits in 1500-pair, 24- and 26-gauge MUP cables.

TABLE C

Pseudo-MUP UNIT BREAKDOWN

Pseudo-MUP BINDER GROUP COLOR	PAIR COLOR	PAIR COUNT
Green	Green/White	Low Half of Pair Count (01-25)
	Blue/White	High Half of Pair Count (26-50)
	Red/White	
Red	Red/White	Low Half of Pair Count (01-25)
	Blue/White	High Half of Pair Count (26-50)
	Green/White	
Blue	Blue/White	Low Half of Pair Count (01-25)
	Red/White	High Half of Pair Count (26-50)
	Green/White	

Note: Applies to 22-gauge CD-series cables only.

8. PAIR GROUPINGS FOR SPLICING

8.01 The usual procedure in splicing multiunits (including primary units), defective pairs, extra pairs, etc, is as follows.

(1) ***Multiunits and Primary Units:***

(a) The integrity of multiunits should be maintained (Fig. 9) at straight splices by joining 50- to 50- and 100- to 100-pair multiunits.

(b) Within a multiunit, the primary units should be spliced color-to-color binder groups (Fig. 10).

(c) Within a primary unit, pairs should be ***randomly spliced*** to avoid electrical degradations that result from systematic additions of capacitance unbalances.

(d) At junctions of cables having units or multiunits of different sizes (or at branch splices), the detail plan should specify the splicing arrangement of units or multiunits. Usually the arrangement will be such that successively counted (sheath count) smaller units or primary units can be joined to the larger units or multiunits (two 25-pair to a 50-pair unit or multiunit; four 25-pair to a 100-pair unit or multiunit; etc) so that 100-pair sheath count groups will be kept intact.

(2) ***Defective Pairs:***

(a) Cables having factory defects are painted red at each end at the factory to indicate that the ends require special attention. It is important to avoid losing the identity of the defective pairs which are identified as shown in Section 632-020-105.

(b) If one of the painted ends has been cut off, thereby losing the factory marking of defective, it will be necessary to locate defective pairs by testing from the factory-sealed end where the defective pairs are marked.

(c) Defective pairs should be cleared and sleeved at each end of the section involved. Locating and handling defective pairs are covered in Section 632-020-200.

(3) ***Extra Pairs:***

(a) ***Substitution of Extra Pairs:*** Multiunits having factory defective pairs should be made good by substituting ***in the section involved*** one or more of the extra pairs.

(b) In 24- and 26-gauge cables, the extra pairs can be used in numerical order according to color code. (See Fig. 5 and Table A.)

(c) Any extra pairs not used as substitutes for defective pairs should be made continuous through the splice by joining color to color.

9. MARKING MODULES AT SPLICES

9.01 When splicing MUP cables with modular connectors, it is recommended that the modules be marked with a felt-tip pen on the cap of the module, indicating the cable sheath count contained in that 25-pair module.

9.02 Any of the marking methods shown in Fig. 11 will prove advantageous when rearranging splices or when trouble-shooting.

9.03 Nonmodular MUP cable splices might also be tagged for furture identification.

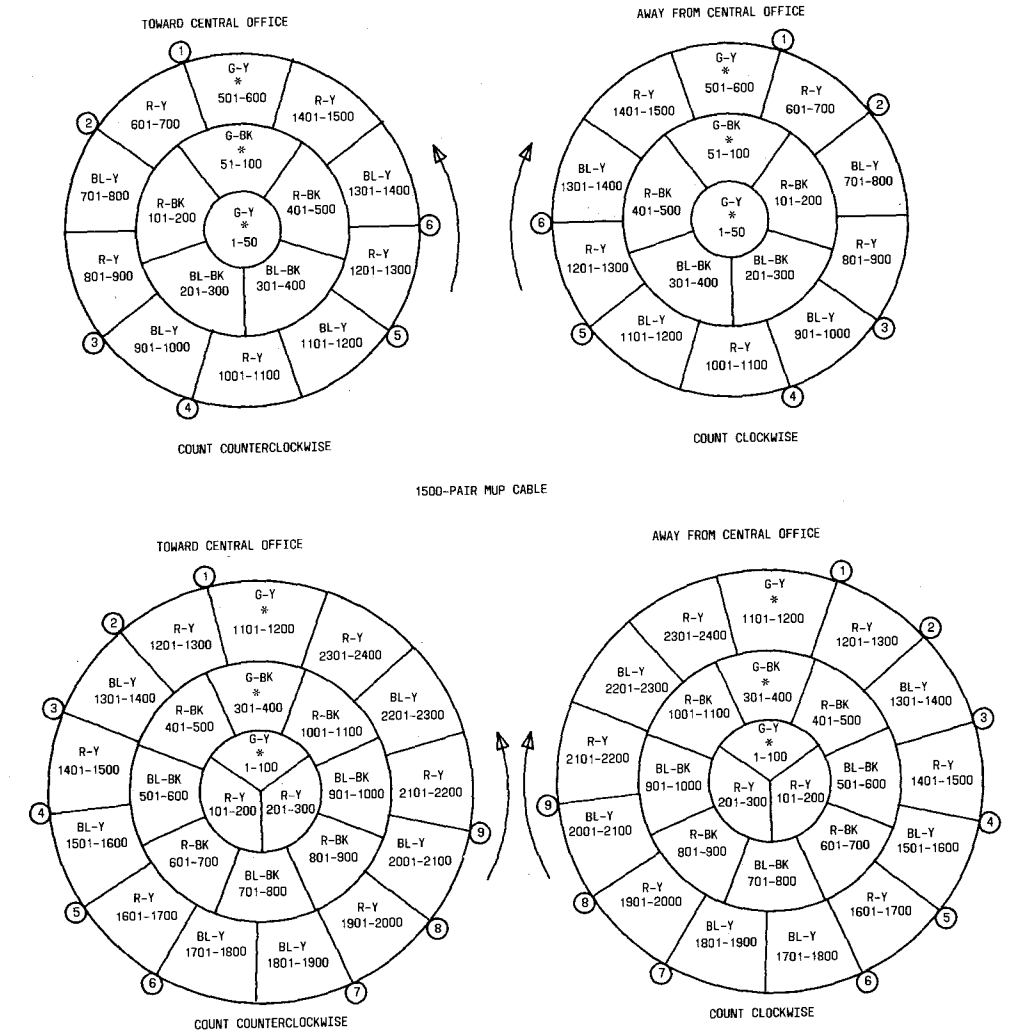


Fig. 9—Cable Count—Typical Straight Splice

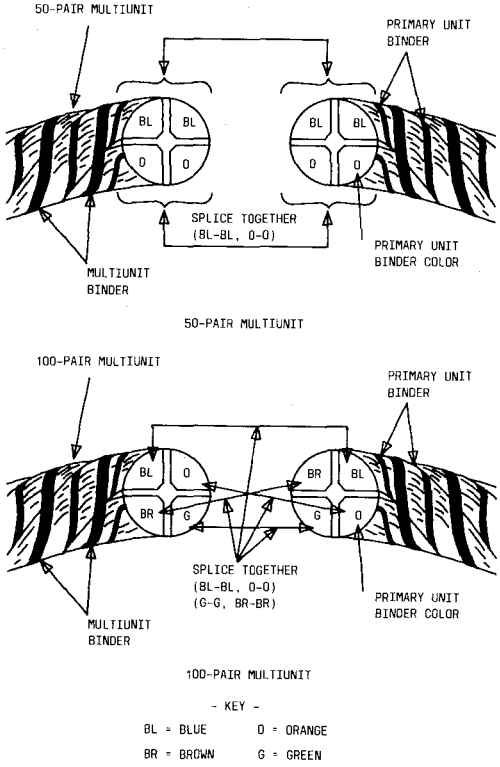


Fig. 10—Color-to-Color Splicing of MUP Primary Units

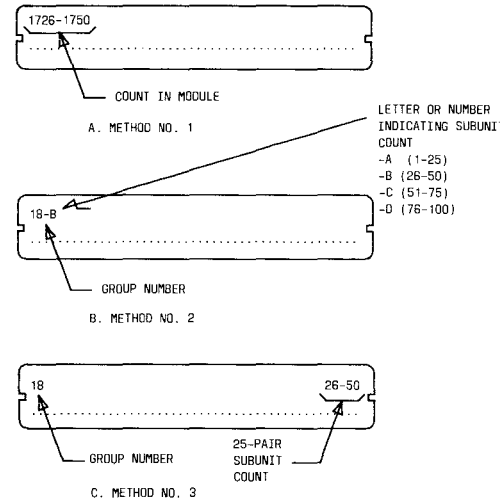


Fig. 11—Various Methods for Marking Module

10. INTERFACING WITH AD-TYPE CABLES

10.01 There will be occasions when MUP must be spliced to AD-type pulp facilities. A typical splice is shown in Fig. 12.

10.02 Except for cable section replacement, it is recommended that the counts in the AD-type pulp cable be sufficiently identified to segregate the count by primary unit binder color in the MUP cable; ie, to get X01-X25 in blue binder primary unit, X26-X50 in the orange binder primary unit, etc, of the MUP cable. The only additional testing required will be at the splice of nonterminated MUP cable to the AD-type pulp cable. This additional effort is compensated by the segregation into 25-pair groupings in the subsequent MUP splices. If this testing is not done, there will be no splicing or testing benefits in any subsequently made facility splices.

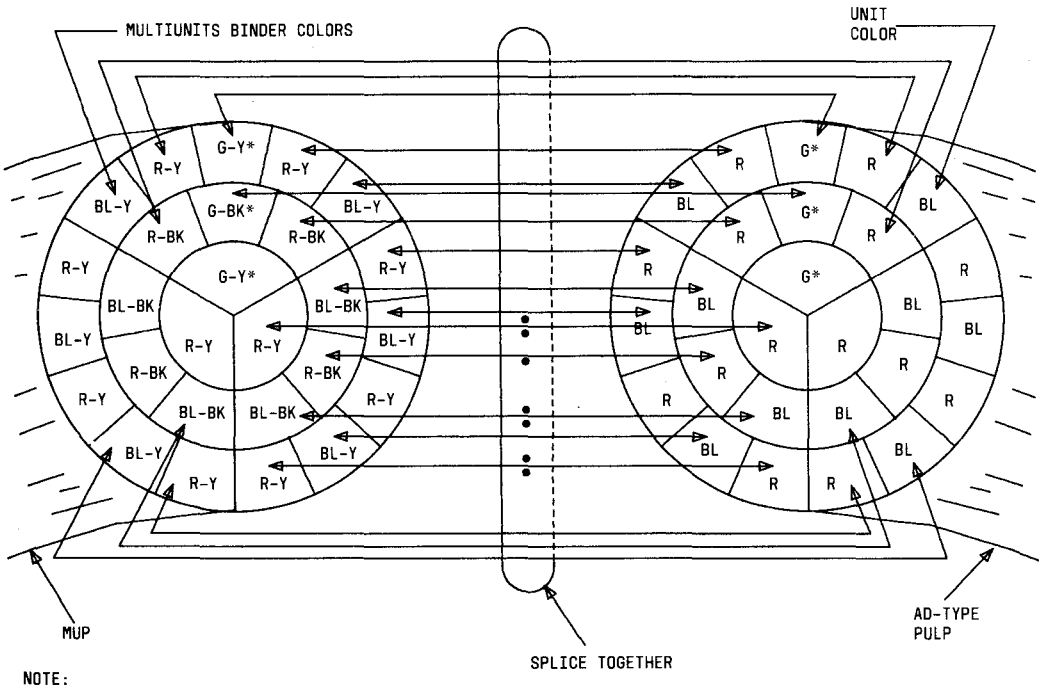


Fig. 12—MUP Interfacing With AD-Type Pulp Cable

10.03 Several examples of interfacing MUP with AD-type pulp cables are discussed in A., B.,and C.

A. Section Replacement

10.04 A MUP cable (Fig. 13) is placed between sections of AD-type pulp cable, eg, in the replacing of a wet section of cable. The MUP cable is treated just as AD-type pulp cable, ignoring the primary unit identification.

B. Cable Relief Job

10.05 MUP cable (Fig. 14) is used to relieve a working standard pulp cable back to the central office. Binder group integrity for the 25-pair primary units (12- and 13- for 50-pair multiunits) is easily established at the central office tip-cable splice.

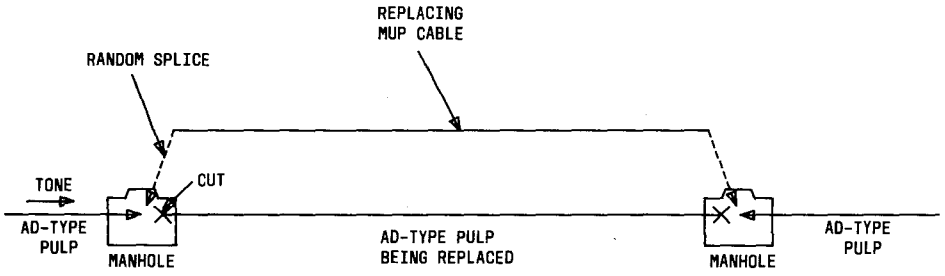


Fig. 13—Replacing AD-Type Pulp Cable With MUP Cable

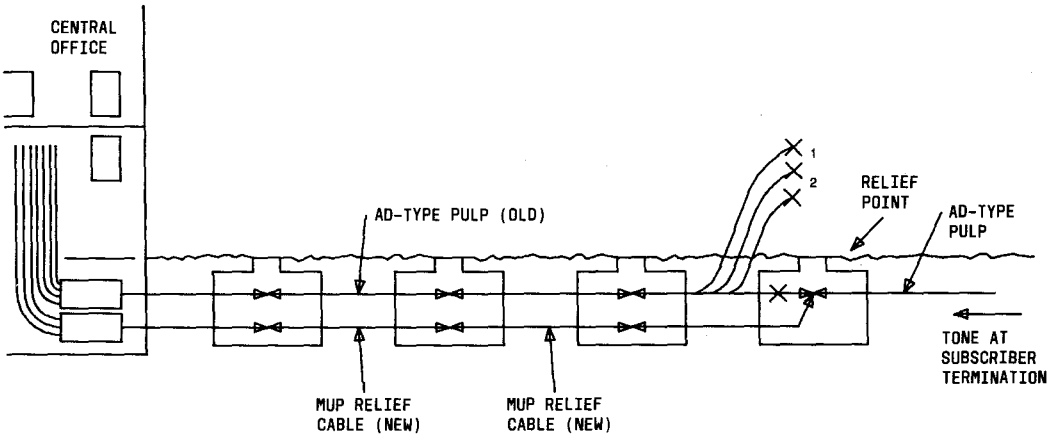


Fig. 14—Working Cable Replaced with MUP Cable

10.06 As long as AD-type cable is spliced to the field side of MUP cable, no tagging of pairs will be required. Tagging may take place at Pulp-PIC junctions, as with AD-type cable, or at AD-MUP junctions where the MUP cable is spliced to the field side of AD cable.

C. Cable Extensions

10.07 Figure 15 shows MUP cable being used to extend AD-type cable.

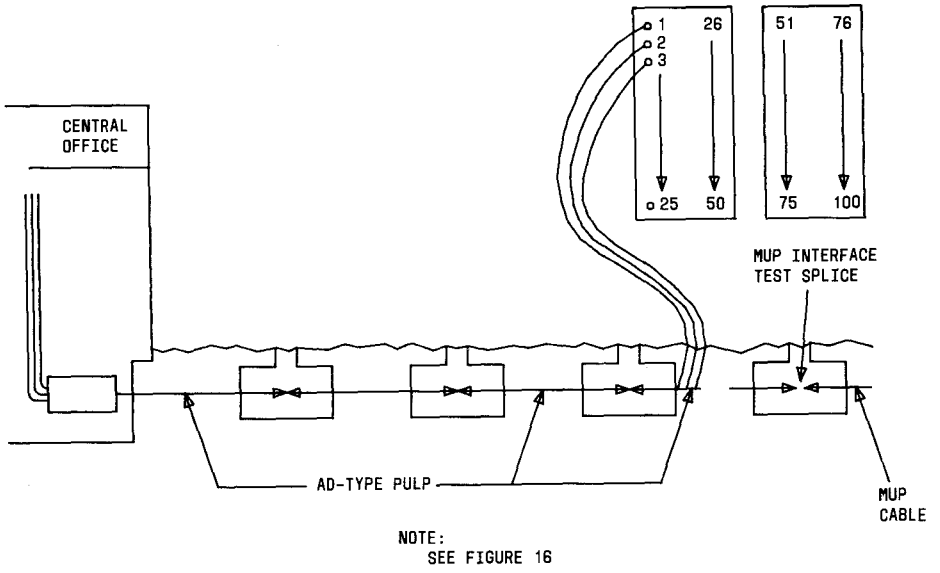


Fig. 15—AD-Type Pulp Cable With MUP Cable

10.08 If the MUP cable pairs are not terminated, it will be necessary to do an additional test on the AD-type pulp cable at the interface of the two types of cable. It is necessary to identify pairs in the standard cable only to the extent to establish the 25-pair groups.

10.09 If for some reason the MUP cable pairs have been terminated, complete identification of pairs (Fig. 16) is needed just as if the MUP were an AD-type pulp cable.

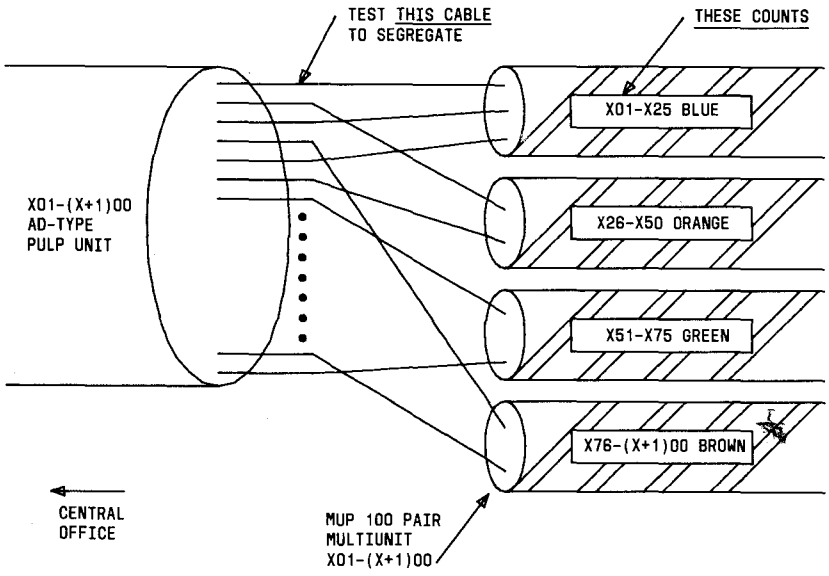


Fig. 16—Testing AD-Type Pulp Interfaces