

## SELECTION OF COMMUNICATION CABLE IN BUILDINGS

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CM—COMMUNICATION CABLE FOR GENERAL PURPOSE (NOT FOR RISERS OR PLENUMS WITHOUT METALLIC CONDUIT) . . . . .	10	G. D Station Wire Conductor Identification . . . . .	11
A. D Inside Wire (DIW) . . . . .	10	1. GENERAL	
B. Tinned Inside Wire (TIW) . . . . .	10	1.01 This practice describes the selection of communication (voice or voice combined with data, signaling, or lightguide transmission) cable in buildings.	
C. H Station Wire . . . . .	10	1.02 This practice is reissued to:	
D. Shielded Inside Wire . . . . .	10	• Add Precautions	
E. Connector Cables . . . . .	10	• Bring practice into compliance with the 1987 NEC (National Electrical Code)	
CMX—RESTRICTED USE COMMUNICATION CABLE, PRIMARILY FOR RESIDENCES . . . . .	11	• Add new UL (Underwriters Laboratories) Listed cables.	
5. REFERENCE . . . . .	11	Since this is a general revision, arrows ordinarily used to indicate changes have been omitted.	
6. ISSUING ORGANIZATION . . . . .	11	* Registered trademark of E.I. du Pont de Nemours & Co., Inc.	

**1.03** The fire safety recommendations of this practice meet or exceed the requirements of the NFPA (National Fire Protection Association) Standards 90A-1987, "Standard for the Installation of Air Conditioning and Ventilating Systems," and 70-1987 NEC.

**1.04** Local electrical and building codes may be more or less restrictive than the recommendations of this practice. *Follow the most restrictive code or recommendation.* Know the requirements of local electrical and building codes. These codes and the national and regional codes are revised periodically. Comply with the latest issue of the most restrictive applicable codes.

**1.05** According to the 1987 NEC, only UL Listed cables are permitted to be used in buildings except for outside plant cable which will be limited to 50 feet beyond the point of entry or exiting from heavy metal conduit.

**1.06** The 1987 NEC requires that communication cables and wires meet one of four levels of fire resistance shown in Table A.

**2. PRECAUTIONS**

**2.01** Use of unapproved building cable can create a fire hazard. Refer to "Fire Safety Considerations of Cables in Buildings," Practice 620-100-001.

**2.02** All communication cables shall be listed as being suitable for the purpose as specified in NEC, Article 800-3(b).

**2.03** Cables that combine voice and data transmission must be listed as communication cables.

**3. SELECTION**

**3.01** In selecting wire or cable, the following should be considered:

- (a) Type and gauge of wire or cable to meet the specific job requirements
- (b) Number of conductors necessary for service and providing an economical allowance for future requirements
- (c) Location of terminal, protector, connecting block, telephone set, conduit facilities provided, etc
- (d) Customer satisfaction with appearance and routing of wire and cable
- (e) Conformance with the applicable codes such as the 1987 NEC.

<b>TABLE A FIRE-RESISTANCE LEVELS</b>		
NEC TYPE (NOTE 1)	MEETS FIRE TESTS	APPLICATIONS
CMP	UL-910 Plenum Cable Test	General purpose, riser and plenum
CMR	UL-1666 Riser Test	General purpose and building riser cables
CM	UL Vertical Tray Test	General purpose
CMX	UL Vertical Wire (VW-1) Test	Primarily for residential use (unless in conduit)
Note: 1. UL Listed cables and packaging shall be marked with the appropriate designation type.		

**3.02** The fire-resistance hierarchy of cables and permitted interchanges of cables are shown in Fig. 1 and 2. Figure 2 illustrates UL Listed type CMP, CMR, CM, and CMX cables that can also be used for power limited signaling cable and fire alarm signaling cables. Examples of selection of cables, sizes, colors, and uses are shown in Table B. (Use the Electronic Wire and Cable Catalog or contact your AT&T Representative for additional information.)

#### 4. UL LISTED CABLES

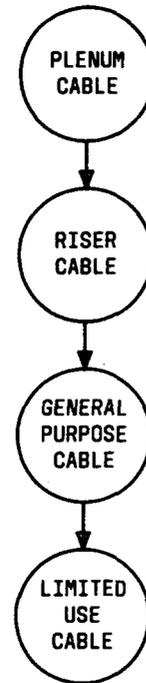
##### **CMP—COMMUNICATION CABLE FOR PLENUMS, (ALSO USABLE FOR RISERS OR GENERAL PURPOSE)**

**4.01** UL Listed type CMP cables are fire-resistant, low smoke producing cables per the UL fire tests. Several options in materials and design exist to satisfy mechanical and electrical requirements. Examples of the Listed type CMP cables are as follows:

- C Plenum
- ECTFE/ECTFE (an example is HALAR\*)
- ECTFE/PVDF-CP
- "TEFLON"/ECTFE

**4.02** C plenum cable consists of PVC insulated 24 AWG conductors jacketed with PVDF-CP material. The 25-pair size uses a fire-resistant core wrap around the pairs. This cable does not have a shield.

**4.03** The ECTFE/ECTFE cable (insulated and jacketed) offers the option of a cable produced with a fluorocarbon compound of Ethylene and monoChloroTriFluoroEthylene. The ECTFE/ECTFE



**Fig. 1—Fire-Resistance Hierarchy for Limited Energy Cables**

cable is available in 22 and 24 gauges and in shielded and unshielded versions.

**4.04** The ECTFE/PVDF-CP plenum cable (insulated and jacketed) has the same applications as previous plenum designs except the outer jacket is a polyvinylidene fluoride copolymer jacketing material. The ECTFE/PVDF-CP construction is available in 22 and 24 gauges and in shielded and unshielded versions.

\* Registered trademark of Ausimont.

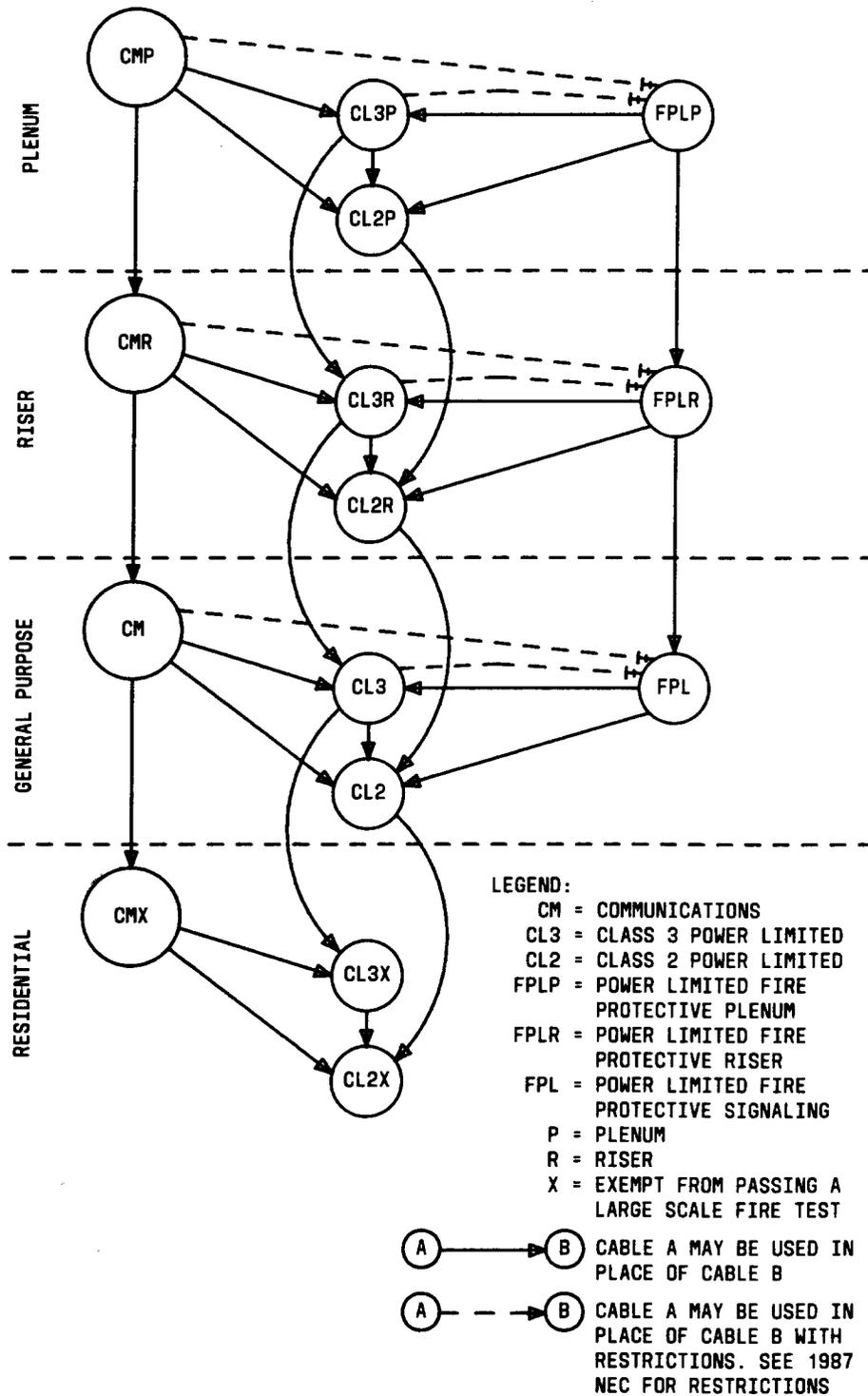


Fig. 2—Permitted Interchanges of Listed Cables

**TABLE B  
SELECTION OF WIRE AND CABLE**

TYPE OF CABLE (NOTE 1)	PAIR SIZE	GAUGE	JACKET COLOR			CONDUCTOR IDENTIFICATION TABLES	GROUND		CLASS OF SERVICE		USE	
			GRAY	NATURAL	BEIGE		SIGNAL	PROTECTOR	INDIV			
									BUSINESS	RESIDENCE		
Plenum Cable (CMP)	C Plenum Cable	2,3,4,6 and 25	24		•		C			•	•	Communication cable for plenum, risers, or general purpose. Not recommended for general purpose for economic reasons.
	ECTFE/ECTFE*	2-100	22 24		•		D			•	•	
	ECTFE/PVDF-CP†	2-100	22 24		•		D			•	•	
	"TEFLON‡"/ECTFE	4,25,50,75,100	24		•		D			•	•	
Riser Cable (CMR)	DIW	4,6,12,16,21 25,50,75 100,125,150 200,300 400,600§	22 24	•		•	C			•	•	Communication cable for risers or general purposes. It is not approved for plenums.¶
	AR Series Cable	200,300 400,600 900	22	•			E			•	•	
		100,150 200,300 400,600 900,1200 1500,1800	24	•			E			•	•	
		300,400 600,900 1200,1800 2400,2700 3000,3600	26	•			E			•	•	
	TIW	4,5,6 8,10,12,16 20,25,40 50,75,100 125,150	24	•			C			•	•	
Connector Cable	25	24	•						•	•		

See note and footnotes at end of table.

**TABLE B (Contd)**  
**SELECTION OF WIRE AND CABLE**

TYPE OF CABLE (NOTE 1)	PAIR SIZE	GAUGE	JACKET COLOR			CONDUCTOR IDENTIFICATION TABLES	GROUND		CLASS OF SERVICE		USE	
			GRAY	IVORY	BEIGE		SIGNAL	PROTECTOR	INDIV			
									BUSINESS	RESIDENCE		
General Purpose Cable (CM)	DIW	2,3,4,6 12,25	22	•		•			•	•	Communication cable for general purpose. Not approved for plenum or risers.¶	
		2,3	24	•		•			•	•		
	TIW	2,3	24	•		•			•	•		
		2,3,4,6 12,25,50 75,100, 125,150	26	•		•			•	•		
	HSW	3	24		•				•	•	Used primarily for prewiring.	
	Shielded DIW	2,3,4, 12,25	22	•						•	•	Used in electronically sensitive locations to control outside interference as in laboratory recording instruments.
		2,3,4,8 12,18,25	24	•						•	•	
Shielded TIW	2,3,4,8 12,18,25	24	•						•	•		
Connector Cable	25	24							•	•	For compatibility with plugs and receptacles of existing telecommunications, horizontal building distribution, and electronic switching equipment.	
Station (CMX)	DSW	2,3,4	22 24			•			•	•	Used primarily for residential station wiring. May be used in commercial buildings but must be installed in metallic tubing with only 10 feet exposed per the 1987 NEC. May be exposed out of doors. D station wire (2 pair 24 gauge) should not be used for prewiring purposes. Not for plenum or risers.¶	
Ground	Single	12				•	•				Size No.      Protectors Fused      Fuseless**	
	Single	10				•	**	•				
	Single	6				•	**	•				
									12	1 to 6	1 or 2	
									10	7 or more	3 to 6	
									6	Any number	Any number	

**Note:**

- 1. All wire and cable listed should not be used near heat sources exceeding 140°F.
- \* Unshielded has white jacket.
- † Shielded has gray jacket.
- ‡ Registered trademark of E.I. du Pont de Nemours & Co., Inc.
- § Pair sizes from 125 through 600 in 24 gauge only.
- ¶ Shall not be used in plenums except inside approved conduit.
- \*\* Any ground wire that can be used as a protector ground can also be used as a signal ground. Because of expense, it is not recommended that No. 10 or 6-gauge wire be placed for use as signal ground only.

4.05 The insulated conductor color codes for C plenum cables are shown in Table C. The insulated conductor color codes for ECTFE/ECTFE and ECTFE/PVDF-CP cables are shown in Table D.

4.06 The "TEFLON"/ECTFE cable is available in 24 gauge, unshielded designs with pair sizes of 4, 25, 50, 75, and 100. The color code is shown in Table D.

TABLE C		
DIW, TIW, AND C PLENUM CONDUCTOR IDENTIFICATION		
PAIR	TIP WIRE	RING WIRE
1	W-BL	BL-W
2	W-O	O-W
3	W-G	G-W
4	W-BR	BR-W
5	W-S	S-W
6	R-BL	BL-R
7	R-O	O-R
8	R-G	G-R
9	R-BR	BR-R
10	R-S	S-R
11	BK-BL	BL-BK
12	BK-O	O-BK
13	BK-G	G-BK
14	BK-BR	BR-BK
15	BK-S	S-BK
16	Y-BL	BL-Y
17	Y-O	O-Y
18	Y-G	G-Y
19	Y-BR	BR-Y
20	Y-S	S-Y
21	V-BL	BL-V
22	V-O	O-V
23	V-G	G-V
24	V-BR	BR-V
25	V-S	S-V

TABLE D	
ECTFE/ECTFE, "TEFLON"/ECTFE, AND ECTFE/PVDF-CP (1-25 PAIRS) CONDUCTOR IDENTIFICATION	
PAIR NO.	COLORS (TIP/RING)
1	White-Blue/Blue
2	White-Orange/Orange
3	White-Green/Green
4	White-Brown/Brown
5	White-Slate/Slate
6	Red-Blue/Blue
7	Red-Orange/Orange
8	Red-Green/Green
9	Red-Brown/Brown
10	Red-Slate/Slate
11	Black-Blue/Blue
12	Black-Orange/Orange
13	Black-Green/Green
14	Black-Brown/Brown
15	Black-Slate/Slate
16	Yellow-Blue/Blue
17	Yellow-Orange/Orange
18	Yellow-Green/Green
19	Yellow-Brown/Brown
20	Yellow-Slate/Slate
21	Violet-Blue/Blue
22	Violet-Orange/Orange
23	Violet-Green/Green
24	Violet-Brown/Brown
25	Violet-Slate/Slate

**CMR—COMMUNICATION CABLE FOR RISERS (ALSO USABLE FOR GENERAL PURPOSE)**

**4.07** UL Listed riser communication cables (CMR) are as follows:

- D Inside Wire (DIW) (24 gauge, 4 pair and above, only)
- AR Series Cable
- Tinned Inside Wire (TIW) (24 gauge, 4 pair and above, only)
- Connector Cables (see AT&T Electronic Wire and Cable Catalog for codes rated CMR).

Additional cable designs have CMR listing, e.g., switchboard cables. For a complete list, refer to the Electronic Wire and Cable Catalog or contact your AT&T Representative.

**A. D Inside Wire (DIW)**

**4.08** The D inside wiring cable is for riser or general use in customer telephone systems wiring. The plastic jacket has improved frictional properties, permitting placement without the aid of lubricants. Lubricants could eventually corrode and clog conduit, making it more difficult to place additional wire.

**4.09** The cable is made of PVC insulated copper conductors formed into pairs and jacketed with PVC. In pair sizes greater than 25, the units are stranded together to form the core. Each unit has a different color binder for unit identification. *None of the 22- and 24-gauge shielded DIW cables are CMR listed.*

**4.10** The colored insulation in combination with single dashes of colored ink provide individual conductor identification (Table C).

**4.11** The length of runs is determined by any signaling equipment used or by dial- and night-light loading. See Practice 501-136-100 for lamp loading information.

**4.12** To prevent cracking of the jacket or insulation, D inside wiring cable should not be installed in locations where the temperature is below +15 degrees F.

**B. AR Series Cable**

**4.13** The AR series riser cables are generally intended for use in commercial, high rise residential, and telephone company buildings because the pair sizes are large (100-3600).

**4.14** Only CMR listed cables such as the AR series can be used without conduit in vertically stacked closets or utility rooms which are *not* fireproof (fire-resistance rated). AR series riser cables are UL Listed communication cables meeting the fire-resistance requirements for riser cable per Section 800-3(b)(2) of the NEC.

**4.15 Conductors:** The conductors of the AR series cables are untinned annealed copper. The cable codes and wire gauges of AR series cables are:

- ARAM—22 gauge
- ARMM—24 gauge
- ARTM—26 gauge.

**4.16 The Insulation:** The untinned copper conductors have a dual insulation of PVC over expanded (foamed) polyethylene. This insulation improves the fire resistance of the cable while very closely matching the electrical properties of the outside plant cables.

**4.17 Wire color codes** are as follows.

(a) The AR series cables with *900 pairs or less* have the standard PIC (plastic-insulated conductor) color code. This PIC color code is covered in detail in Practice 626-101-005.

(b) The AR series cables with *1200 pairs or more* follow the "mirror-image PIC" color code with spare pairs. (See Practice 626-107-006.) AR riser conductor identification is shown in Table E. Each 25-pair group has a color-coded unit binder to facilitate complete identification of all pairs in the cable.

**4.18** The cable sheath is a corrugated aluminum shield bonded to a gray PVC jacket.

**4.19** Riser communication cables, sizes, colors, and use are shown in Table B.

**TABLE E**  
**AR RISER**  
**CONDUCTOR IDENTIFICATION**

PAIR NO.	COLOR	
	TIP	RING
1	White	Blue
2	White	Orange
3	White	Green
4	White	Brown
5	White	Slate
6	Red	Blue
7	Red	Orange
8	Red	Green
9	Red	Brown
10	Red	Slate
11	Black	Blue
12	Black	Orange
13	Black	Green
14	Black	Brown
15	Black	Slate
16	Yellow	Blue
17	Yellow	Orange
18	Yellow	Green
19	Yellow	Brown
20	Yellow	Slate
21	Violet	Blue
22	Violet	Orange
23	Violet	Green
24	Violet	Brown
25	Violet	Slate

### C. Tinned Inside Wire (TIW)

**4.20** The tinned inside wire can be used for wire wrapping to exposed terminals in commercial buildings and central offices, but standard switchboard cables are usually recommended for most central office applications. The TIW can also be used for riser or general use in customer telephone systems wiring. See Practice 800-612-162 for switchboard cable selection.

**4.21** The tinned, copper wires are insulated with PVC and twisted into pairs. The pairs are jacketed with PVC. The units are stranded together to form the core. In pair sizes larger than 25, each unit has a different color binder for unit identification. The 24-gauge size is available in unshielded and shielded versions, and the 26-gauge size is available in an unshielded version only.

**4.22** The colored insulation in combination with single dashes of colored ink provide individual conductor identification (Table C).

### D. Connector Cables

**4.23** These cables come in many different configurations of ribbon connectors and cut ends for compatibility with the various plugs and receptacles of existing systems. The connector cable retains the UL Listing of the cable when the connectors have been added.

**4.24** Applications include telecommunications, horizontal building distribution, and terminating at electronic switching equipment.

**4.25** All round connector cables feature 25 twisted pairs, available in 24 AWG with ribbon-type connectors. The connector cable line includes PVC jacketed, plenum (listed type CMP), and shielded (listed type CM) cables.

**4.26** The C25 series of connector cables features the 126 connecting block in combination with ribbon-type connectors, or on bare ended cables. The 126 connecting block allows quick field termination of up to 24 pairs of wires in an insulation displacement connector block.

**CM—COMMUNICATION CABLE FOR GENERAL PURPOSE (NOT FOR RISERS OR PLENUMS WITHOUT METALLIC CONDUIT)**

4.27 The following are some of the UL Listed general purpose communication cables (CM).

- D Inside Wire (DIW) (22 gauge, 2-25 pair; 24 gauge, 2 and 3 pair)
- Tinned Inside Wire (TIW) (24 gauge, 2 and 3 pair; 26 gauge, 2-150 pair)
- H Station Wire (HSW) (24 gauge, 3 pair)
- Shielded Inside Wire (22 gauge, 2 and 4 pair; 24 gauge, 2-25 pair)
- Connector Cables (see AT&T Electronic Wire and Cable Catalog for cables listed type CM).

**A. D Inside Wire (DIW)**

4.28 The D inside wiring cable is for general use in customer telephone systems wiring. The 22-gauge DIW and 2- and 3-pair 24-gauge DIW do not meet the UL requirements for listed riser cable. The plastic jacket has improved frictional properties, permitting placement without the aid of lubricants. Additional information on the cable design is in paragraphs 4.09 through 4.12.

**B. Tinned Inside Wire (TIW)**

4.29 The tinned inside wiring cable is used for wire wrapping to exposed terminals in commercial buildings or central offices. The wire can be used for general use in customer telephone systems wiring. See paragraphs 4.20 and 4.21 for additional information on the cable design.

**C. H Station Wire**

4.30 The H station wire is intended for prewiring of single or multifamily residences during construction and for general use in station wiring within commercial buildings. In most conduit or duct applications, the wire can be pulled without lubricants. It has three twisted pairs of PVC insulated 24 AWG copper conductors. Each conductor is distinctively colored (see Table F). The pairs have a different length of twist and are grouped together and jacketed with ivory-colored PVC underlaid by a nylon jacket-slitting cord.

TABLE F			
H STATION WIRE			
CONDUCTOR IDENTIFICATION			
SIZE	PAIR NO.	COLOR	
		TIP	RING
3 Pairs	1	W-BL	BL
	2	W-O	O
	3	W-G	G

4.31 The jacket and insulation of H station wire will withstand the stress of installation down to a temperature of -10 degrees F, and the jacket will resist deterioration of outdoor exposure to sunlight.

4.32 The length of runs of H station wire is determined by any signaling equipment used or by dial- and night-light loading. See Practice 501-136-100 for lamp loading information.

**D. Shielded Inside Wire**

4.33 Shielded inside wire is used in sensitive locations to minimize the effects of electromagnetic interference (EMI) keeping out unwanted external interference and by containing unwanted radiation. These locations can be computer centers, electronic laboratories, broadcast studios, or telephone centers, etc.

4.34 The shielded inside wire is available in 22- and 24-gauge bare copper conductors or tinned copper conductors. The conductor identification is shown in Table C.

**E. Connector Cables**

4.35 Connector cables are designed to provide a quick means for connecting inside cable to communication apparatus by mating receptacles to matching plugs.

4.36 A-type connector cables are furnished as single-ended (one end equipped, the other raw-ended) or double-ended (both ends equipped with the same type plug or receptacle). The double-ended A-type connector cables are normally cut to make two cables

for installation. B-type cables are furnished double-ended only with a plug at one end and a receptacle on the opposite end.

**4.37** General purpose cables, sizes, colors, and use are shown in Table B.

**CMX—RESTRICTED USE COMMUNICATION CABLE, PRIMARILY FOR RESIDENCES**

**4.38** UL Listed type CMX cable is listed below:

- D Station Wire (DSW).

**4.39** The D station wire can be used for indoor or limited lengths of outdoor runs and may be terminated on any terminals which will accommodate 22 or 24 AWG conductors. Do not use DSW to span; i.e., between buildings. The insulation of the individual conductors is distinctively colored to provide identification. Refer to Table G for color codes.

**4.40** Single-line installation length is determined by any signaling equipment used or by dial- and night-light loading. See Practice 501-136-100 for lamp loading information.

<b>TABLE G</b>	
<b>D STATION WIRE CONDUCTOR IDENTIFICATION</b>	
<b>PAIR NO.</b>	<b>COLOR</b>
1	Red/Green
2	Black/Yellow
3	Blue/White
4	Orange/Brown

**5. REFERENCE**

**5.01** Additional UL Listed cables are shown in the AT&T Electronic Wire and Cable Catalog.

**6. ISSUING ORGANIZATION**

Published by  
The AT&T Documentation Management Organization