

11. STANDARDS AND SPECIFICATIONS

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11. STANDARDS AND SPECIFICATIONS (CONT.)

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11. STANDARDS AND SPECIFICATIONS

11.1 Standards Organizations

11.1.1 AAR Association of American Railroads

50 F., N.W.
Washington, DC 20001
(202) 639-2100

DOCUMENT NO.	TITLE
168	Copper-Covered Steel Wire with or without Weather-Resistant Covering
168	Copper Alloy Wire with or without Weather-Resistant Covering
168	Hard-Drawn Copper Wire with or without Weather-Resistant Covering
168	Copper-Bearing Steel Wire with or without Weather-Resistant Covering
575.2	Specification for Single Conductor No. 18 AWG to 400,000 CM, Clean Stripping, Rubber Insulated, 0–3,000 Volt Braided Cable for Train Lighting and Air Conditioning Service
581.3	Specification for Single Conductor, Clean Stripping Rubber Insulated, 0–600 Volt, Neoprene Jacketed Cable for Locomotive and Car Equipment
582.2	Specification for Train Line Control Cable for Multiple Unit Cars and Electric Locomotives, 0–600 Volt, Clean Stripping, Rubber Insulated, Braided
589	Specification for Single Conductor, Chlorosulfonated Polyethylene Integral Insulated-Jacketed, 0–300 Volt, 0–600 Volt Cable for Locomotive and Car Equipment
590	Specification for Single Conductor, Silicone Rubber Insulation, 0–300 Volt, 0–600 Volt, Glass Polyester Braided, 125°C Cable for High Temperature Use on Locomotive and Car Equipment
591	Specification for Single Conductor, Clean Stripping Ethylene Rubber Insulated, 0–600 Volt, Chlorosulfonated Polyethylene Jacketed Cable for Locomotive and Car Equipment

11. STANDARDS AND SPECIFICATIONS

11.1.2 AEIC Association of Edison Illuminating Companies

600 N. 18th St., PO Box 2641
Birmingham, AL 35291-0992
(205) 250-2530

DOCUMENT NO.	TITLE
CS1	Impregnated-Paper-Insulated, Lead-Covered Cable, Solid Type
CS2	Impregnated-Paper-Insulated Cable, High-Pressure Pipe Type
CS3	Impregnated-Paper-Insulated, Lead-Covered
CS4	Impregnated-Paper-Insulated Low and Medium-Pressure, Self-Contained, Liquid-Filled Cable
CS5	Thermoplastic and Cross-Linked Polyethylene Insulated Shielded Power Cables Rated 5 through 46 kV
CS6	Ethylene Propylene Rubber, Insulated Shielded Power Cables, Rated 5 through 69 kV
CS7	Cross-Linked Polyethylene Insulated Shielded Power Cables, 46 through 138 kV
CS31	Electrically Insulating Low Viscosity Pipe Filling Liquids for High-Pressure Pipe-Type Cables
G1	Guide for Application of AEIC Maximum Insulation Temperatures at the Conductor for Impregnated-Paper-Insulated Cables
G2	Electrical Tests of Cables, Joints 138 kV and above
G3	Installation of Pipe Type Cable Systems
G4	Installation of Extruded Dielectric Insulated Power Cable Systems Rated 69 kV through 138 kV
G5	Underground Extruded Cable Pulling Guide
G7	Guide for Replacement and Life Extension of Extruded Dielectric 5–35 kV Underground Distribution Cables



11. STANDARDS AND SPECIFICATIONS

11.1.3 ANSI American National Standards Institute

11 West 42nd Street
New York, NY 10036
(212) 642-4900

DOCUMENT NO.	TITLE
0337-D	Local Distributed Data Interface (LDDI) Network Layer Protocol
0338-D	Data-Link Layer Protocol for Local Distributed Data Interfaces
0382-D	Fiber Distributed Data Interface (FDDI) Network Layer Protocol
0503-D	Fiber Distributed Data Interface (FDDI) Station Management Standard
0684-D	FDDI—Media Access Control
719	Nonmetallic-Sheathed Cables
C8.16	Rubber-Insulated Tree Wire
C8.18	Weather-Resistant (Weatherproof) Wire and Cable-URD Type
C8.19	Weather-Resistant Saturants and Finishes
C8.34	Weather-Resistant Wire and Cable, Neoprene Type
C8.35	Weather-Resistant Wire and Cable, Polyethylene Type
C8.9	Slow-Burning Wire and Cable
S-87-640	Fiber Optic Outside Plant Communications Cable
X3.129	Intelligent Peripheral Interface (IPI) Enhanced Physical Interface
X3.148	Fiber Distributed Data Interface (FDDI) Physical Layer
X3.184	Fiber Distributed Data Interface (FDDI) Physical Layer Medium Dependent
X3T9.5	Fiber Distributed Data Interface

11. STANDARDS AND SPECIFICATIONS

11.1.4 ASTM American Society for Testing and Material 100 Barr Harbor Drive West Conshohocken, PA 19428-2959 (610) 832-9585

DOCUMENT NO.	TITLE
B1	Hard-Drawn Copper Wire
B2	Medium-Hard-Drawn Copper Wire
B3	Soft or Annealed Copper Wire
B5	Electrolytic Tough-Pitch Copper Refinery Shapes
B8	Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
B29	Pig Lead
B33	Tinned Soft or Annealed Copper Wire
B47	Copper Trolley Wire
B49	Hot-Rolled Copper Rods
B105	Hard-Drawn Copper Alloy Wires for Electrical Conductors
B172	Rope-Lay-Stranded Copper Conductors (Bunch Stranded Members)
B173	Rope-Lay-Stranded Copper Conductors (Concentric Stranded Members)
B174	Bunch-Stranded Copper Conductors
B189	Lead-Alloy-Coated Soft Copper Wire
B193	Resistivity of Electrical Conductor Materials
B227	Hard-Drawn Copper Clad Steel Wire
B228	Concentric-Lay-Stranded Copper-Clad Steel Conductors
B229	Concentric-Lay-Stranded Copper and Copper-Clad Steel Composite Conductors
B230	Aluminum 1350-H19 Wire, for Electrical Purposes
B231	Concentric-Lay-Stranded Aluminum Conductors
B232	Concentric-Lay-Stranded Aluminum Conductors, Coated, Steel-Reinforced (ACSR)
B233	Aluminum 1350 Drawing Stock for Electrical Purposes
B246	Tinned Hard-Drawn and Medium-Hard-Drawn Copper Wire
B258	Standard Nominal Diameters and Cross-Sectional Areas of AWG Sizes of Solid Round Wire Used as Electrical Conductors
B263	Determination of Cross-Sectional Area of Stranded Conductors
B298	Silver-Coated Soft or Annealed Copper Wire

Continued



11. STANDARDS AND SPECIFICATIONS

11.1.4 ASTM American Society for Testing and Material 100 Barr Harbor Drive West Conshohocken, PA 19428-2959 (610) 832-9585

Continued

DOCUMENT NO.	TITLE
B314	Aluminum 1350 Wire for Communication Cable
B324	Aluminum Rectangular and Square Wire
B397	Concentric-Lay-Stranded Aluminum Alloy 5005-H19 Conductors
B399	Concentric-Lay-Stranded Aluminum Alloy 6201-T81 Conductors
B401	Compact-Round Concentric-Lay-Stranded Aluminum Conductors, Steel Reinforced (ASCR/COMP)
B410	Bonded Copper Conductors for Use in Hookup Wire for Electronic Equipment
B452	Copper-Clad Steel Wire for Electronic Application
B496	Compact Round Concentric-Lay-Stranded Copper Conductors
B500	Galvanized and Aluminized Stranded Steel Core for Aluminum Conductors, Steel Reinforced (ACSR)
B549	Concentric-Lay-Stranded Aluminum Conductors, Aluminum Clad Steel Reinforced (ACASR/AW)
B566	Copper-Clad Aluminum Wire
B609	Aluminum 1350 Round Wire, Annealed and Intermediate Tempers
B624	High Strength, High Ductility, Copper Alloy Wire
B694	Copper, Copper Alloy, Copper-Clad Stainless Steel and Strip for Electrical Cable Shielding
B736	Aluminum; Aluminum Alloy, Aluminum Clad Steel Cable Shielding Stock
D353	Natural Rubber Performance Insulation for Wire and Cable, 60°C
D373	Varnished Cloth for Electrical Insulation
D469	Natural Rubber Heat Resisting Insulation for Wire and Cable, 75°C
D470	Test Methods for Testing Cross-Linked Insulations and Jackets for Wire and Cable
D532	Natural Rubber Sheath for Wire and Cable
D574	Ozone-Resisting Insulation for Wire and Cable
D752	Heavy-Duty Black Neoprene Sheath for Wire and Cable
D753	General-Purpose Neoprene Sheath for Wire and Cable

Continued

11. STANDARDS AND SPECIFICATIONS

11.1.4 ASTM American Society for Testing and Material
100 Barr Harbor Drive
West Conshohocken, PA 19428-2959
(610) 832-9585

Continued

DOCUMENT NO.	TITLE
D754	Synthetic Rubber Insulation for Wire and Cable, 75°C Operation
D755	Synthetic Rubber Insulation for Wire and Cable, 60°C Operation
D866	Styrene-Butadiene (SBR) Synthetic Rubber Jacket for Wire and Cable
D1047	Polyvinyl Chloride Jacket for Wire and Cable
D1351	Polyethylene-Insulated Wire and Cable
D1352	Ozone-Resisting Butyl Rubber Insulation for Wire and Cable
D1523	Synthetic Rubber Insulation for Wire and Cable, 90°C Operation
D1679	Synthetic Rubber Insulation for Wire and Cable, 75°C Operation
D1929	Setchkin Furnace Fire Test
D2219	Polyvinyl Chloride Insulation for Wire and Cable, 60°C Operation
D2220	Polyvinyl Chloride Insulation for Wire and Cable, 75°C Operation
D2308	Polyethylene Jacket for Electrical Insulated Wire and Cable
D2655	Cross-linked Polyethylene Insulation for Wire and Cable Rated 0 to 2,000 Volts
D2656	Cross-linked Polyethylene Insulation for Wire and Cable Rated 2,001 Volts to 35 kV
D2708	Extra-Heavy-Duty Acrylonitrile-Butadiene/Polyvinyl Chloride (NBR/PVC) Jacket for Wire and Cable
D2768	General-Purpose Ethylene-Propylene Rubber Jacket for Wire and Cable
D2770	Ozone-Resisting Ethylene Propylene Rubber Integral Insulation and Jacket for Wire
D2802	Ozone Resistant Ethylene Propylene Rubber Insulation for Wire and Cable
D2819	Extra-Heavy Duty Black Polychloroprene Jacket for Wire and Cable
D2863	Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)
D3554	Track-Resistant Black Thermoplastic High Density Polyethylene Insulation for Wire and Cable

Continued



11. STANDARDS AND SPECIFICATIONS

11.1.4 ASTM American Society for Testing and Material 100 Barr Harbor Drive West Conshohocken, PA 19428-2959 (610) 832-9585

Continued

DOCUMENT NO.	TITLE
D3555	Track-Resistant Black Cross-linked Thermosetting Polyethylene Insulation for Wire and Cable
D4244	General Purpose, Heavy-Duty and Extra-Heavy-Duty NBR/PVC Jackets for Wire and Cable
D4245	Ozone-Resistant Thermoplastic Elastomer Insulation for Wire and Cable, 90°C Dry–75°C Wet Operation
D4246	Ozone-Resistant Thermoplastic Elastomer Insulation for Wire and Cable, 90°C Operation
D4247	Specification for General-Purpose Black Heavy-Duty and Black Extra-Heavy-Duty Polychloroprene Jackets for Wire and Cable
D4314	Specification for General Purpose Heavy-Duty and Extra-Heavy-Duty Cross-linked Chlorosulfonated Polyethylene Jackets for Wire and Cable
D4565	Test Methods for Physical and Environmental Performance Properties of Insulations and Jackets for Telecommunications Wire and Cable
D4566	Testing Electrical Performance Properties of Insulations and Jackets for Telecommunications Wire and Cable
D5537	Heat Release, Flame Spread and Mass Loss Testing of Insulating Materials Contained in Electrical or Optical Fiber Cables When Burning in a Vertical Cable Tray Configuration
E574	Duplex, Base Metal Thermocouple Wire with Glass Fiber or Silica Fiber Insulation
E662	Specific Optical Density of Smoke Generated by Solid Materials
E1223	Type N Thermocouple Wire
E1354	Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter

11. STANDARDS AND SPECIFICATIONS

11.1.5 Bell Communications Research Corporation (Bellcore) Customer Service Piscataway, NJ 08854-4196 (800) 521-2673

DOCUMENT NO.	TITLE
TA-NWT-000063	Revisions to Network Equipment-Building System. Generic Equipment Requirements
TA-NWT-000078	Generic Physical Design Requirements for Telecommunication Products and Equipment
TA-NWT-000347	Generic Requirements for Central Office Power Cables
TA-NWT-001398	Generic Requirements for Broadband Coaxial Drop Cable
TA-NWT-001399	Generic Requirements for Broadband Coaxial Distribution Cable
TA-TSY-000120	Customer Premises or Network Ground Wire
TA-TSY-000121	One Pair Aerial Service Wire
TA-TSY-000122	Multiple Pair Aerial Service Wire
TA-TSY-000123	Single Pair Buried Wire
TA-TSY-000124	Multiple Pair Buried Wire
TA-TSY-000125	Rural Aerial Distribution Wire
TA-TSY-000126	Network Cross-Connecting Wire
TA-TSY-000127	Network Aerial Block Wire
TA-TSY-000128	Bridle Wire
TA-TSY-000129	Tree Wire
TA-TSY-000130	Customer Premises Cross-Connecting Wire
TA-TSY-000131	Customer Premises Plenum Cable/Wire
TA-TSY-000132	Customer Premises Shielded Station Wire
TA-TSY-000133	Inside Wiring Cable (3 to 125 Pair Sizes)
TA-TSY-000134	Two Pair Station Wire
TA-TSY-000135	Miniature Ribbon Connector and Cable Assembly
TA-TSY-000136	Distributing Frame Wire
TA-TSY-000137	Standard PVC Switchboard Cable
TA-TSY-000138	Cross-linked PVC Switchboard Cable
TA-TSY-000139	Central Office Coaxial Cable
TA-TSY-000140	Standard Shielded Polyethylene Insulated Twisted Pair Cable
TA-TSY-000141	Terminating Cable

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11. STANDARDS AND SPECIFICATIONS

11.1.5 Bell Communications Research Corporation (Bellcore) Customer Service Piscataway, NJ 08854-4196 (800) 521-2673

Continued

DOCUMENT NO.	TITLE
TA-TSY-000142	Central Office Hookup Wire
TR-NWT-000020	Generic Requirements for Optical Fiber and Optical Fiber Cable
TR-NWT-000492	Generic Requirements for Metallic Telecommunication Wire
TR-TSY-000100	PIC Filled ASP Cable
TR-TSY-000101	Aircore PIC ALPETH Cable
TR-TSY-000102	PIC Self Support Cable
TR-TSY-000103	Pulp Bonded STALPETH Cable
TR-TSY-000104	Pulp Bonded PASP Cable
TR-TSY-000105	Pulp Bonded Steam Resistance Cable
TR-TSY-000106	Underground Foam-Skin PIC Bonded STALPETH Cable
TR-TSY-000107	PIC Bonded PASP Cable
TR-TSY-000108	PIC Reinforced Self-Support Cable
TR-TSY-000109	PIC Filled Screened ASP Cable
TR-TSY-000110	PIC Bonded Steam Resistant Cable
TR-TSY-000111	PIC Riser Cable
TR-TSY-000112	PIC Bonded Screened PASP Cable
TR-TSY-000113	PIC PAP Cable
TR-TSY-000114	PIC Screened PAP Cable
TR-TSY-000115	Inner-City PIC Filled Screened ASP Cable
TR-TSY-000116	Inner-City PIC Bonded Screened STALPETH Cable
TR-TSY-000117	Inner-City PIC Bonded Screened PASP Cable
TR-TSY-000119	PIC Filled Bonded ASP Cable
TR-TSY-000326	Generic Requirements for Optical Fiber Cables
TR-TSY-000356	Generic Requirements for Optical Cable Innerduct
TR-TSY-000409	Generic Requirements for Intrabuilding Optical Fiber Cables
TR-TSY-000442	Generic Requirements for Fiber Optic Couplers
L-780000	Filled Core, Duct and Direct Burial (Deactivated)

Continued

11. STANDARDS AND SPECIFICATIONS

11.1.5 Bell Communications Research Corporation (Bellcore) Customer Service Piscataway, NJ 08854-4196 (800) 521-2673

Continued

DOCUMENT NO.	TITLE
L-780001	Air Core, Aerial and Duct (Deactivated)
L-780002	Air Core, Self-Support Aerial Cable (Deactivated)
L-780007	Air Core, Direct Burial (Deactivated)
L-780008	Air Core, Reinforced Self-Support Aerial Cable (Deactivated)
L-780011	Riser Cable (Replaced by TR-TSY-000111)
PUB-48007	Inside Wiring Cable (Replaced by TA-TSY-000133)
PUB-48008	Two Pair Station Wire (Replaced by TA-TSY-000134)
PUB-48012	Miniature Ribbon Connector Cable (Deactivated)

11.1.6 CANENA Council for the Harmonization of Electrical Standards in North America c/o NEMA 1300 N. 17th Street Suite 1847 Rosslyn, VA 22209 (703) 841-3258



11. STANDARDS AND SPECIFICATIONS

11.1.7 EIA Electronic Industries Association

2500 Wilson Blvd.
Arlington, VA 22201-3834
(703) 907-7500

EIA documents are available from Global Engineering Documents, Inc. (800) 854-7179

DOCUMENT NO.	TITLE
199A	Solid and Semisolid Dielectric Transmission Lines
215	Method for Calculation of Current Ratings on Hookup Wire
225	Rigid Coaxial Transmission Lines
230	Color Marking of Thermoplastic Covered Wire
232-D	Interface Between Data Terminal Equipment and Data Communication Equipment Employing Serial Binary Data Interchange
259	Rigid Coaxial Transmission Lines and Connectors, 75 Ohms
280-B	Solderless Wrapped Electrical Connections
297-A	Cable Connectors for Audio Facilities for Radio Broadcasting
359-A	Munsell Color Chips for Color Coding of Wire and Cable
364-A	Electrical Connector Test Procedure
403	Precision Coaxial Connectors for CATV 75 Ohms
422-A	Electrical Characteristics of Balanced Voltage Digital Interface Circuits
423-A	Electrical Characteristics of Unbalanced Voltage Digital Interface Circuits
440-A	Fiber Optic Terminology
449-1	General Purpose 37-Position and 9-Position Interface for Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange
455	Standard Test Procedures for Fiber Optic Fibers, Cables, Transducers, Connecting and Termination
492AAAA	Detail Specification for 62.5 μm Core Diameter/125 μm Cladding Diameter Class 1a Multimode, Graded-Index Optical Waveguide Fibers
568	Commercial Building Telecommunications Wiring Standard
569	Commercial Building Standard for Telecommunications Pathways and Spaces
570	Residential and Light Commercial Telecommunications Wiring Standard
606	Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
471000A	Sectional Specification for Fiber Optic Communication Cables for Outside Aerial Use

Continued

11. STANDARDS AND SPECIFICATIONS

11.1.7 EIA Electronic Industries Association
2500 Wilson Blvd.
Arlington, VA 22201-3834
(703) 907-7500

EIA documents are available from Global Engineering Documents, Inc. (800) 854-7179

Continued

DOCUMENT NO.	TITLE
471000B	Sectional Specification for Fiber Optic Communications Cables for Underground and Buried Use
472000	Generic Specification for Fiber Optic Cables
472000C	Sectional Specification for Fiber Optic Communications Cables for Indoor Use
472000D	Sectional Specification for Fiber Optic Communications Cables for Outside Telephone Plant Use
475000B	Generic Specification for Fiber Optic Connectors
492000A	Generic Specification for Optical Wave Guide Fibers
515000	Generic Specification for Optical Fiber and Cable Splices
546000	Inspection Device
IS-43	Omnibus Specification—Local Area Network Twisted Pair Data Communication Cable
IS-43AA	Cable for LAN Twisted Pair Data Communications—Detail Specification for Type 1 Outdoor Cable
IS-43AB	Cable for LAN Twisted Pair Data Communications—Detail Specification for Type 1 Non-Plenum Cable
IS-43AC	Cable for LAN Twisted Pair Data Communications—Detail Specification for Type 1 Riser Cable
IS-43AD	Cable for LAN Twisted Pair Data Communications—Detail Specification for Type 1 Plenum Cable
IS-43AE	Cable for LAN Twisted Pair Data Communications—Detail Specification for Type 2 Non-Plenum Cable
IS-43AF	Cable for LAN Twisted Pair Data Communications—Detail Specification for Type 2 Plenum Cable
IS-43AG	Cable for LAN Twisted Pair Data Communications—Detail Specification for Type 6 Office Cable
IS-43AH	Cable for LAN Twisted Pair Data Communications—Detail Specification for Type 8 Undercarpet Cable

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11. STANDARDS AND SPECIFICATIONS

**11.1.7 EIA Electronic Industries Association
2500 Wilson Blvd.
Arlington, VA 22201-3834
(703) 907-7500**

EIA documents are available from Global Engineering Documents, Inc. (800) 854-7179

Continued

DOCUMENT NO.	TITLE
IS-43AI	Cable for LAN Twisted Pair Data Communications—Detail Specification for Patch Cable
IS-43AJ	Cable for LAN Twisted Pair Data Communications—Detail Specification for Type 9 Plenum Cable

**11.1.8 FAA Federal Aviation Agency
800 Independence Ave S.W.
Washington, DC 20591
(202) 267-3826**

DOCUMENT NO.	TITLE
FAA-701	Rubber-Insulated Cable (0–8,000 Volts)
L-824-A, B, C	Underground Electrical Cables for Airport Lighting Circuits

11. STANDARDS AND SPECIFICATIONS

11.1.9 ICEA Insulated Cable Engineers Association

PO Box 440
South Yarmouth, MA 02664
(508) 394-4424

DOCUMENT NO.	TITLE
P-32-382	Short Circuit Characteristics of Insulated Cable
P-43-457	Conductor Resistances and Ampacities at High Frequencies
P-45-482	Short Circuit Performance of Metallic Shields and Sheaths of Insulated Cable
P-46-426	Ampacity Tables (Replaced by IEEE 835)
P-53-426	Ampacities, Including Effect of Shield Losses for Single-Conductor Solid-Dielectric Power Cable 15 kV Through 69 kV (NEMA WC 50)
P-54-440	Ampacities of Cables in Open-top Cable Trays (NEMA WC 51)
P-56-520	Cable Tray Flame Test
P-81-570	600 V Direct Burial Cable Single Electrical Conductors and Assemblies with Ruggedized Extruded Insulation
S-56-434	Polyolefin Insulated Communication Cables for Outdoor Use
S-61-402	Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (NEMA WC 5)
S-65-375	Varnished-Cloth-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (NEMA WC 4)
S-66-524	Cross-Linked-Thermosetting Polyethylene Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy for Wire and Cable (NEMA WC 7)
S-68-516	Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (NEMA WC 8)
S-69-530	Coaxial Communication Cable (CATV) (NEMA WC 41)
S-70-547	Weather-Resistant Polyolefin Covered Wire and Cable
S-73-532	Standard for Control Cables (NEMA WC 57)
S-75-381	Portable and Power Feeder Cables for Use in Mines and Similar Applications (NEMA WC 58)
S-80-576	Communications Wire and Cable for Wiring Premises
S-82-552	Instrumentation Cables and Thermocouple Wire (NEMA WC 55)
S-87-640	Fiber Optic Outside Plant Communications Cable
T-25-425	Guide for Establishing Stability of Volume Resistivity for Conducting Polymeric Components of Power Cables
T-26-465	Guide for Frequency of Sampling Extruded Dielectric Power, Control, Instrumentation and Portable Cables for Test (NEMA WC 54)

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11. STANDARDS AND SPECIFICATIONS

11.1.9 ICEA Insulated Cable Engineers Association

PO Box 440
South Yarmouth, MA 02664
(508) 394-4424

Continued

DOCUMENT NO.	TITLE
T-27-581	Standard Test Methods for Extruded Dielectric Power, Control, Instrumentation and Portable Cables (NEMA WC 53)
T-29-520	Guide for Conducting Vertical Cable Tray Flame Tests (210,000 BTU/Hour)
T-30-520	Guide for Conducting Vertical Cable Tray Flame Tests (70,000 BTU/Hour)
T-31-610	Water Penetration Resistance Test, Sealed Conductor
T-33-655	Low-Smoke, Halogen-Free (LSHF) Polymeric Cable Jackets

11.1.10 IEC International Electrotechnical Commission

3 Rue de Varembe
P.O. Box 131
1211 Geneva 20, Switzerland
Tel: 41-22-734-01-50
Fax: 41-22-733-38-43



DOCUMENT NO.	TITLE
50	International electrotechnical vocabulary. Chapter 451. Electric cables.
55	Paper-insulated metal-sheathed cables for rated voltages up to 18/30 kV (with copper or aluminum conductors and excluding gas pressure and oil-filled cables)
78	Characteristic impedances and dimensions of radio-frequency coaxial cables
92	Electrical installations in ships
96	Radio-frequency cables
141	Tests on oil-filled and gas-pressure cables and their accessories
169	Radio-frequency connectors
173	Colors of the cores of flexible cables and cords
183	Guide to selection of high-voltage cables
189	Low-frequency cables and wires with PVC insulation and PVC sheath
204	Electrical equipment of industrial machines
208	Aluminum alloy stranded conductors

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11. STANDARDS AND SPECIFICATIONS

11.1.10 IEC International Electrotechnical Commission

3 Rue de Varembe
P.O. Box 131
1211 Geneva 20, Switzerland
Tel: 41-22-734-01-50
Fax: 41-22-733-38-43



Continued

DOCUMENT NO.	TITLE
212	Measurement of smoke density of electric cables burning under defined conditions
227	PVC insulated cables of rated voltages up to and including 450/750 V
228	Conductors of insulated cables
229	Tests on cable oversheaths which have a special protective function and are applied by extrusion
230	Impulse tests on cables and their accessories
245	Rubber insulated cables of rated voltages up to and including 450/750 V
287	Calculations of the continuous current rating of cables (100% load factor)
304	Standard colors for insulation for low-frequency cables and wires
331	Fire-resisting characteristics of electric cables
332	Tests on electric cables under fire conditions
339	General purpose rigid coaxial transmission lines and their associated flange connectors
344	Guide to the calculation of resistance of plain and coated copper conductors of low-frequency cables and wires
446	Identification of conductors by colors and numerals
457	Rigid precision coaxial lines and their associated precision connectors
465	Specification for unused insulating mineral oils for cables with oil ducts
488	Dimensions of copper conductors in local cables
502	Extruded solid dielectric insulated power cables for rated voltages from 1 kV to 30 kV
538/B	Electric cables, wires and cords: Method 5 of test for polyethylene insulation and sheath
540	Test methods for insulations and sheaths of electric cables and cords (elastomeric and thermoplastic compounds)

Continued

11.1.10 IEC International Electrotechnical Commission

3 Rue de Varembe
P.O. Box 131
1211 Geneva 20, Switzerland
Tel: 41-22-734-01-50
Fax: 41-22-733-38-43



Continued

DOCUMENT NO.	TITLE
541	Comparative information on IEC and North American flexible cord types
649	Calculation of maximum external diameter of cables for indoor installations
693	Dimensions of optical fibres
695	Fire hazard tests
702	Mineral insulated cables with a rated voltage not exceeding 750 V
708	Low-frequency cables with polyolefin insulation and moisture barrier polyolefin sheath
719	Calculations of the lower and upper limits for the average outer dimensions of cables with circular copper conductors and of rated voltages up to and including 450/750 V
724	Guide to the short-circuit temperature limits of electric cables with a rated voltage not exceeding 0.6/1.0 kV
728	Cabled distribution systems Part I: Systems primarily intended for sound and television signals operating between 30 MHz and 1 GHz
754	Tests on gases evolved during combustion of electric cables
800	Heating cables with a rated voltage of 300/500 V for comfort heating and prevention of ice formation
811	Common tests methods for insulating and sheathing materials of electric wires
834	Performance and testing of teleprotection equipment of power systems
840	Tests for power cables with extruded insulation for rated voltages above 30 kV up to 150 kV
859	Cable connections for gas insulated metal enclosed switchgear for rated voltages of 72.5 kV and above
885	Electrical test methods for electric cables
966	Generic specification for radio-frequency and coaxial cable assemblies
1034	3 meter cube smoke apparatus

11. STANDARDS AND SPECIFICATIONS

11.1.11 IEEE Institute of Electrical and Electronic Engineers, Inc.
445 Hoes Lane
Piscataway, NJ 08854
(800) 678-4333

DOCUMENT NO.	TITLE
45	Recommended Practice for Electrical Installations on Shipboard
48	Test Procedures and Requirements for High-Voltage AC Cable Terminations
82	Test Procedure for Impulse Voltage Tests on Insulated Conductors
83	Test Procedures for Radial Power Factor Tests on Insulating Tapes in Paper-Insulated Power Cable
101	Guide for the Statistical Analysis of Thermal Life Test Data
120	Master Test Code for Electrical Measurements in Power Circuits
127	Aerospace Equipment Voltage and Frequency Ratings
146	Definitions of Fundamental Waveguide Terms
323	Qualifying Class 1E Equipment for Nuclear Power
383	Standard for Type Test of Class 1E Electric Cables, Field Splices and Connections for Nuclear Power Generating Stations
400	Guide for Making High-Direct-Voltage Tests on Power Cable Systems in the Field
402	Guide for Measuring Resistivity of the Cable Insulation Materials at High Direct Voltages
404	Standard for Cable Joints for Use with Extruded Dielectric Cable Rated 5 through 138 kV
422	Guide for Design and Installation of Cable Systems in Power Generating Stations
510	Recommended Practices for Safety in High Voltage and High Power Testing
524	Installation of Overhead Transmission Line Conductors
525	Guide for the Design and Installation of Cable Systems in Substations
532	Guide for Selecting and Testing Jackets for Cables
539	Definitions and Terms Relating to Overhead-Power-Line Corona and Radio Noise
575	Guide for the Application of Sheath-Bonding Methods for Single Conductor Cables and the Calculation of Induced Voltages and Currents in Cable Sheaths

Continued



11. STANDARDS AND SPECIFICATIONS

11.1.11 IEEE Institute of Electrical and Electronic Engineers, Inc.
445 Hoes Lane
Piscataway, NJ 08854
(800) 678-4333

Continued

DOCUMENT NO.	TITLE
576	Recommended Practice for Installation, Termination, and Testing of Insulated Power Cable as Used in the Petroleum and Chemical Industry
610	Computer Dictionary
634	Standard Cable Penetration Fire Stop Test
635	Guide for Selection and Design of Aluminum Sheaths for Cables
690	Standard for the Design and Installation of Cable Systems for Class 1E Circuits in Nuclear Power Generating Stations
789	Standard Performance Requirements for Communications and Control Cables for Application in High Voltage Environments
802	Local and Metropolitan Area Networks: Overview and Architecture
812	Definitions of Terms Relating to Fiber Optics
816	Guide for Determining the Smoke Generation of Solid Materials Used for Insulations and Coverings of Electrical Wire and Cable
835	Power Cable Ampacity Tables
930	Analysis of Voltage Endurance Data for Electrical Insulation
972	Trial-Use Standard for Connections of Insulated Aluminum Conductors
1017	Field Testing Electric Submersible Pump Cable
1018	Specifying Electric Submersible Cable-Ethylene-Propylene Rubber Insulation
1019	Specifying Electric Submersible Pump Cable-Polypropylene Insulation
1202	Flame Testing of Cables for Use in Cable Trays in Industrial and Commercial Occupancies
C62.41	Surge Voltage in Low-Voltage AC Power Circuits
C62.92	Neutral Grounding in Electrical Utility Systems

11. STANDARDS AND SPECIFICATIONS

11.1.12 ISA Instrument Society of America
67 Alexander Drive
PO Box 12277
Research Triangle Park, NC 27709
(919) 549-8411

DOCUMENT NO.	TITLE
RP 12.6	Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations
S50.02	Fieldbus Standard for Use in Industrial Control Systems

11.1.13 ISO International Standards Organization
1 Rue de Varembe
1211 Geneva 20
Switzerland
Tel: 41-22-749-0111
Fax: 41-22-733-3430
(Publications also available from ANSI)

DOCUMENT NO.	TITLE
4589	Oxygen Index Test
5657	Radiant Cone Flame Test
DP9306	Flammability Test
TR9122	Toxicity Test

11.1.14 ITU International Telecommunication Union
General Secretariat-Sales Section
Place des Nations
CH-1211 Geneva 20
Switzerland
Tel: 42-22-730-5111
Fax: 41-22-730-5194

DOCUMENT NO.	TITLE
CCITT Blue Book, Vol. 3	Transmission Media Characteristics



11. STANDARDS AND SPECIFICATIONS

11.1.15 MSHA Mine Safety and Health Administration

U.S. Department of Labor
Industrial Park Boulevard
R.R. 1, Box 201B
Triadelphia, WV 26059
(304) 547-0400

11.1.16 NEMA National Electrical Manufacturers Association

1300 N. 17th Street
Suite 1847
Rosslyn, VA 22209
(703) 841-3200

DOCUMENT NO.	TITLE
HP 3	Electrical and Electronic PTFE Insulated High Temperature Hookup Wire; Types E (600 Volt), EE (1,000 Volt) and ET (250 Volt)
HP 4	Electrical and Electronic FEP Insulated High Temperature Hookup Wire, Types K, KK, and KT
HP 100	High Temperature Instrumentation and Control Cable
HP 100.1	High Temperature Instrumentation and Control Cables Insulated and Jacketed with FEP Fluorocarbons
HP 100.2	High Temperature Instrumentation and Control Cables Insulated and Jacketed with ETFE Fluoropolymers
HP 100.3	High Temperature Instrumentation and Control Cables Insulated and Jacketed with Cross-linked (Thermoset) Polyolefin (XLPO)
HP 100.4	High Temperature Instrumentation and Control Cables Insulated and Jacketed with ECTFE Fluoropolymers
WC 1	Asbestos, Asbestos-Varnished Cloth and Asbestos-Thermoplastic Insulated Wire and Cable (ICEA S-28-357)
WC 2	Steel Armor and Associated Coverings for Impregnated-paper-insulated Cables (ICEA S-67-401)
WC 3	Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (ICEA S-19-81)
WC 4	Varnished-Cloth-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (ICEA S-65-375)
WC 5	Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (ICEA S-61-402)
WC 7	Cross-Linked-Thermosetting Polyethylene Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy for Wire and Cable (ICEA S-66-524)

Continued

11. STANDARDS AND SPECIFICATIONS

11.1.16 NEMA National Electrical Manufacturers Association

**1300 N. 17th Street
Suite 1847
Rosslyn, VA 22209
(703) 841-3200**

Continued

DOCUMENT NO.	TITLE
WC 8	Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (ICEA S-68-516)
WC 26	Wire and Cable Packaging
WC 41	Coaxial Communication Cable (CATV) (ICEA S-69-530)
WC 50	Ampacities, Including Effect of Shield Losses for Single-Conductor Solid-Dielectric Power Cable 15 kV through 69 kV (ICEA P-53-426)
WC 51	Ampacities of Cables in Open-top Cable Trays (ICEA P-54-440)
WC 52	High Temperature and Electronic Insulated Wire-Impulse Dielectric Testing
WC 53	Standard Test Methods for Extruded Dielectric Power, Control, Instrumentation and Portable Cables (ICEA T-27-581)
WC 54	Guide for Frequency of Sampling Extruded Dielectric Power, Control, Instrumentation and Portable Cables for Test (ICEA T-26-465)
WC 55	Instrumentation Cables and Thermocouple Wire (ICEA S-82-552)
WC 56	3.0 kHz Insulation Continuity Proof Testing of Hookup Wire
WC 57	Standard for Control Cables (ICEA S-73-532)
WC 58	Portable and Power Feeder Cables for Use in Mines and Similar Applications (ICEA S-75-381)
WC 61	Transfer Impedance Testing
CC1	Electrical Power Connectors for Substations
CC3	Connectors for Use Between Aluminum or Aluminum Copper Overhead Conductors



11. STANDARDS AND SPECIFICATIONS

11.1.17 NFPA National Fire Protection Association
1 Batterymarch Park
PO Box 9101
Quincy, MA 02269-9101
(617) 770-3000

DOCUMENT NO.	TITLE
70	National Electrical Code
75	Protection of Electronic Computer/Data Processing Equipment
99	Health Care Facilities Handbook

11.1.18 NIST National Institute of Standards and Technology
Gaithersburg, MD 20899
(301) 975-2000

11. STANDARDS AND SPECIFICATIONS

11.1.19 REA Rural Electrification Administration U.S. Department of Agriculture Washington, DC 20250 (202) 382-8674

DOCUMENT NO.	TITLE
PE-7	Aerial Drop Wire
PE-17	Rural Distribution Wire (deactivated)
PE-19	Polyethylene Insulated Bridle Wire (deactivated)
PE-20	Inside-Outside Station Wire (deactivated)
PE-21	Plastic Insulated Line Wire (deactivated)
PE-22	Aerial and Duct Telephone Cable
PE-23	Direct Burial Telephone Cable (deactivated)
PE-27	Figure 8 One Pair Distribution Wire (deactivated)
PE-28	Figure 8 Multipair Distribution Wire (deactivated)
PE-38	Figure 8 Telephone Cable
PE-39	Filled Telephone Cable
PE-44	Low-Loss Buried Distribution Wire (deactivated)
PE-50	Buried Distribution Wire (deactivated)
PE-54	Filled Buried Distribution Wire (deactivated)
PE-71	Inside Wiring Cable (deactivated)
PE-72	Switchboard Cable (deactivated)
PE-86	Filled Buried Service Wire
PE-89	Filled Telephone Cable With Expanded Insulation

11.1.20 SAE Society of Automotive Engineers 400 Commonwealth Dr. Warrendale, PA 15096 (412) 776-4970

DOCUMENT NO.	TITLE
J156	Fusible Links
J1127	Battery Cable
J1128	Low Tension Primary Cable
J1292	Automobile Truck, Truck-Tractor, Trailer, and Motor Coach Wiring
J1939	Serial Control and Communication for Vehicle Networks



11. STANDARDS AND SPECIFICATIONS

11.1.21 UL Underwriters Laboratories, Inc.
333 Pfingsten Rd.
Northbrook, IL 60062
(708) 272-8800

DOCUMENT NO.	TITLE
4	Armored Cable (Type AC)
13	Power Limited Circuit Cable (Types CL3P, CL2P, CL3R, CL2R, CL3, CL3X, PLTC)
44	Rubber-Insulated Wires & Cables (Types XHHW, XHHW-2, RHH, RHW, RHW-2, RH, SA, SIS)
62	Flexible Cord & Fixture Wire (Types SO, SOW, SOW-A, SJ, SJO, SPT-1, etc.)
83	Thermoplastic Insulated Wires (Types TW, THW, THW-2, THWN, THWN-2, THHN, THHW, TA, TBS, TFE, FEP, FEPB)
133	Varnished-Cloth Wires & Cables (Type V)
183	Manufactured Wiring Systems
444	Communication Cables (Types CMX, CM, CMR, CMP)
486A	Wire Connectors and Soldering Lugs
486B	Wire Connectors for Use with Aluminum Conductors
486C	Splicing Wire Connectors
486D	Insulated Wire Connectors for Use with Underground Conductors
486E	Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
493	Thermoplastic Insulated Underground Feeder & Branch Circuit Cables (Types UF, UF-B)
497	Protectors for Communication Circuits
719	Nonmetallic-Sheath Cables (Types NM-B, NMC-B)
723	Tests for Surface Burning Characteristics of Building Materials
758	Appliance Wiring Material (Type AWM)
817	Cord Sets and Power-Supply Cords
854	Service Entrance Cables (Types USE, SE, SE-U, SE-R, USE-2)
910	Test for Flame-Propagation and Smoke-Density Values for Electrical and Optical-Fiber Cables Used in Spaces Transporting Environmental Air
1063	Machines Tool Wires & Cables (Type MTW)

Continued

11. STANDARDS AND SPECIFICATIONS

**11.1.21 UL Underwriters Laboratories, Inc.
333 Pfingsten Rd.
Northbrook, IL 60062
(708) 272-8800**

Continued

DOCUMENT NO.	TITLE
1072	Medium Voltage Power Cable (Type MV)
1277	Type TC Power & Control Tray Cables (Type TC)
1309	Marine Shipboard Cable
1424	Cables for Power-Limited Fire-Protective-Signaling Circuits
1426	Electric Cables for Boats
1459	Telephone Equipment
1565	Wire Positioning Devices
1569	Metal Clad Cables (Type MC)
1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords
1604	Electrical Equipment for Use in Class I and II, Division 2, and Class III Hazardous (Classified) Locations
1666	Standard Test for Flame Propagation Height of Electrical and Optical Fiber Cables Installed Vertically in Shafts
1685	Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables
1690	Data-Processing Cable
1740	Industrial Robots
1863	Communication Circuit Accessories

**11.1.22 U.S. Government Specifications
Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402
(202) 783-3238**

DOCUMENT NO.	TITLE
J-C-30	Wire & Cable Electrical Power
J-C-94	Nonmetallic Cable
J-C-103	Rubber-Insulated Wire & Cable
J-C-121	Rubber-Insulated Wire & Cable (0–8,000 Volts)
J-C-129	Thermoplastic-Insulated Wire & Cable



11. STANDARDS AND SPECIFICATIONS

Continued

**11.1.22 U.S. Government Specifications
Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402
(202) 783-3238**

Continued

DOCUMENT NO.	TITLE
J-C-138	Varnished-Cloth-Insulated Wire & Cable (0–5,000 Volts)
J-C-145b	Weather-Resistant Electric Wire & Cable
J-C-580A	Flexible Cord and Fixture Wire
QQ-W-343	Electrical Copper Wire, Uninsulated

**11.1.23 U.S. Military Specifications
Commanding Officer
Naval Publications and Forms Center
5801 Tabor Ave.
Philadelphia, PA 19120
(215) 697-2667**

DOCUMENT NO.	TITLE
DOD-C-84054C	General Specification for Cables, Fiber Optics (Metric)
MIL-C-17F	General Specifications for Cables, Radio Frequency, Flexible and Semirigid
MIL-C-915	General Specification for Cable and Cord, Electrical, for Shipboard Use
MIL-C-3432E	Cable (Power & Special Purpose) and Wire, Electrical (300–600 Volts)
MIL-C-4921	Airport Lighting Butyl and Neoprene
MIL-C-5756B	Cable and Wire, Power, Electric, Portable
MIL-C-5854C	Wire, Electrical, Iron and Constantan Thermocouple
MIL-C-8777C	Wire, Electrical, Silicone-Insulated, Copper, 600 V, 200°C
MIL-C-13777G	General Specifications for Cable, Special Purpose, Electrical
MIL-C-18959	Portable Power Cable
MIL-C-23806A	General Specification for Cable, Radio Frequency, Coaxial, Semirigid, Foam Dielectric
MIL-C-24640	General Specification for Cable, Electrical, Lightweight for Shipboard Use

Continued

11. STANDARDS AND SPECIFICATIONS

11.1.23 U.S. Military Specifications
Commanding Officer
Naval Publications and Forms Center
5801 Tabor Ave.
Philadelphia, PA 19120
(215) 697-2667

Continued

DOCUMENT NO.	TITLE
MIL-C-24643	General Specification for Cable and Cord, Electrical, Low Smoke, for Shipboard Use
MIL-C-27072A	Special Purpose, Electrical, Multiconductor Cable
MIL-C-27500	Tefzel Aerospace Cable
MIL-C-28830B	General Specification for Cable, Radio Frequency, Coaxial, Semirigid, Corrugated Outer Conductor
MIL-C-31012C	General Specification for Connectors, Coaxial, Radio Frequency
MIL-C-38359A	Cable, Power, Electrical, Airport Lighting, Cross-Linked, Polyethylene XLP
MIL-C-49055B	General Specifications for Cables, Power, Electrical (Flexible, Flat, Unshielded). Round Conductor
MIL-C-49059A	General Specifications for Cable, Electrical (Flexible, Flat, Unshielded), Flat Conductor
MIL-C-55021A	General Specificaiton for Cables: Twisted Pairs and Triples, Internal Hookup
MIL-C-60220	Cables, Special Purpose, Electrical (Data Transmission Use)
MIL-C-83522A	General Specification for Connectors, Fiber Optic, Plug-Receptacle-Adapter Style, Fixed Single Terminus
MIL-C-83526	General Specifications for Connectors, Fiber Optic, Circular Environmental Resistant, Hermaphroditic
MIL-C-550213A	Cables: Twisted Pair Internal Hookup, Shielded and Jacketed, High Temperature
MIL-HDBK-299	Cable Comparison Handbook Data Pertaining to Electric Shipboard Cable
MIL-S-81824	Splices, Electric, Crimp Style, Copper, Insulated, Environment Resistant
MIL-W-76B	Wire and Cable, Hookup, Electrical, Insulated
MIL-W-5086	Wire, Electric, Polyvinyl Chloride Insulated, Copper or Copper Alloy
MIL-W-5846C	Wire, Electrical, Copper and Constantan Thermocouple
MIL-W-16878	General Specifications for Wire, Electrical, Insulated
MIL-W-22759D	Wire, Electric, Fluoropolymer-Insulated, Copper or Copper Alloy

Continued



11. STANDARDS AND SPECIFICATIONS

11.1.23 U.S. Military Specifications
Commanding Officer
Naval Publications and Forms Center
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Philadelphia, PA 19120
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Continued

DOCUMENT NO.	TITLE
MIL-W-25038E	General Specification for Wire, Electrical, High Temperature and Fire Resistant
MIL-W-81044	Wire, Electric, Cross-linked Polyalkene, Cross-linked Alkane-Imide Polymer, or Polyarylene Insulated, Copper or Copper Alloy
MIL-W-81381	Wire-Electric, Polyimide-Insulated Copper or Copper Alloy

11.2 Fire Safety Tests

11.2.1 Fire Safety Test Methods

Some of the most common fire safety test methods used in the wire and cable industry are listed below:

Table 11.1–Fire safety test methods

Fire Hazard	North America	Europe
Ignitability	Oxygen Index (ASTM D2863)	IEC 332-3 Appendix A
Propagation	Vertical Tray UL 1581	IEC 332-3
Smoke	NBS Chamber (ASTM E662)	3 Meter Cube (IEC 20(CO) 178)
Toxicity	New York State (Univ. of Pittsburg)	ISO Guide TR 9122
Corrosivity	ASTM Copper Mirror Test	IEC 754-1

11. STANDARDS AND SPECIFICATIONS

11.2.2 NEC Fire Test Summary

Table 11.2–NEC fire test summary

NATIONAL ELECTRICAL CODE ARTICLE	PLENUM (UL-910)	RISER (UL-1666)	GENERAL USE (UL-1581 VERTICAL TRAY)	RESTRICTED (UL-1581 VERTICAL WIRE)
645	–	–	DP	–
725, Class 2	CL2P	CL2R	CL2	CL2X
725, Class 3	CL3P	CL3R	CL3	CL3X
725 Power Limited Tray Cable	No Listing	No Listing	PLTC	No Listing
727 Instrumentation Tray Cable	No Listing	No Listing	ITC	No Listing
760 Fire Protective Power Limited	FPLP	FPLR	FPL	No Listing
760 Fire Protective Nonpower Limited	NPLFP	NPLFR	NPLF	No Listing
770 Optical Fiber Nonconductive	OFNP	OFNR	OFN or OFNG	No Listing
770 Optical Fiber Conductive	OFCP	OFCR	OFC or OFCG	No Listing
800 Communication	CMP	CMR	CM or CMG	CMX
800 Undercarpet Communication	No Listing	No Listing	No Listing	CMUC
820, Cable TV	CATVP	CATVR	CATV	CATVX

CABLE APPLICATION	COMMON NAMES	FLAME ENERGY
Plenum Space	UL 910, Steiner Tunnel (CSA FT-6)	300,000 BTU/Hr
Riser Shaft	UL 1666, Riser Test (No CSA Equivalent)	527,000 BTU/Hr
General Use	UL 1581 Vertical Tray, IEEE 383 (CSA FT-4)	70,000 BTU/Hr
Restricted Use	UL 1581 Vertical Wire, VW-1 (CSA FT-1)	3,000 BTU/Hr



11. STANDARDS AND SPECIFICATIONS

11.2.3 Comparison of Vertical Cable Tray Tests

Table 11.3–Comparison of vertical cable tray tests

	IEEE 383 UL 1581	ICEA T-29-520	CSA FT-4	IEEE 1202	UL 1685 /UL ^a	UL 1685 /IEEE ^b	IEC 332-3
Burner power (kW)	21	62	20	20	21	21	20
Time of flame (min)	20	20	20	20	20	20	20, 40 ^g
Alternate source	Yes, oily rag ^d	no	no	no	no	no	no
Burner placement ^c	600 mm ^e 75 mm in back	300 mm 200 mm in back	300 mm 75 mm in front	300 mm 75 mm in front	457 mm 75 mm in back	457 mm 75 mm in front	600 mm 75 mm in front
Angle of burner	horiz.	horiz.	20° up	20° up	horiz.	20° up	horiz.
Tray length (m)	2.4	2.4	3.0	2.4	2.4	2.4	3.5
Tray width (m)	0.3	0.3	0.3	0.3	0.3	0.3	0.5
Sample length (m)	2.4	2.4	2.3	2.3	2.4	2.4	3.5
Width of tray used for cables (m)	0.15 front only	0.15	0.25 front only	full front only	0.15 front only	full front only	0.30 front or front + back ^l
Thin-size cables to be bundled	no	no	if D < 13 mm	if D < 13 mm	no	if D < 13 mm	mounted flush, with no spaces
Test enclosure specified	no	no	yes	yes	yes	yes	yes
Required air flow rate	N.A.	N.A.	> 0.17 m ³ /s	0.65 m ³ /s	5 m ³ /s	5m ³ /s	^h
Test runs needed	3	2	2	2 × 2 ^f	1	1	1
Max. char length (m, from bottom)	2.4	2.4	1.786	1.786	2.4	1.786	3.1
Peak smoke release rate (m ² s ⁻¹)	N.A.	N.A.	N.A.	N.A.	0.25	0.40	N.A.
Total smoke released (m ²)	N.A.	N.A.	N.A.	N.A.	95	150	N.A.

Continued

11. STANDARDS AND SPECIFICATIONS

Table 11.3—Comparison of vertical cable tray tests

Continued

- ^a Version with UL 1581 exposure.
- ^b Version with CSA FT-4/IEEE 1202 exposure.
- ^c Height above bottom, distance from specimen surface.
- ^d Not applicable in the UL 1581 version.
- ^e This dimension is 457 mm in the UL 1581 version.
- ^f Two each on two different sizes of specimens.
- ^g Time is 20 minutes for Category C, 40 minutes for Categories A and B.
- ^h Not yet specified.
- ⁱ Depends on amount of cable loading

Source: NIST Technical Note 1291

11.2.4 UL 910 Steiner Tunnel Test for Plenum Rated Cable

The UL Standard 910 “**Steiner Tunnel**” **Flame Test** measures flame spread and smoke generation in a simulated air handling plenum. A 25 ft long Steiner Tunnel is used for the test, with intake and exhaust ducts and a means of regulating flow velocity of air through the tunnel. Windows at 1 ft intervals allow for flame spread measurements, and an optical device in the exhaust of the chamber measures smoke density. The cable samples are mounted in a cable tray in one layer in the tunnel and the tunnel is sealed. Two circular burners are mounted vertically at the intake end of the tunnel just in front of the cable tray. Methane is burned, along with a 240 ft/min forced draft through the tunnel for twenty minutes, and the flame is extinguished. Flame spread and smoke density are monitored throughout the test. A cable is listed for plenum use if flame spread is less than 5 ft from the end of the ignition flame, and optical density is less than 0.5 Maximum peak, and 0.15 Maximum average. The output of the burner is 300,000 BTU/hr and the energy consumed for the test is 100,000 BTUs. The Canadian version of this test is known as the **CSA FT-6 fire test**.

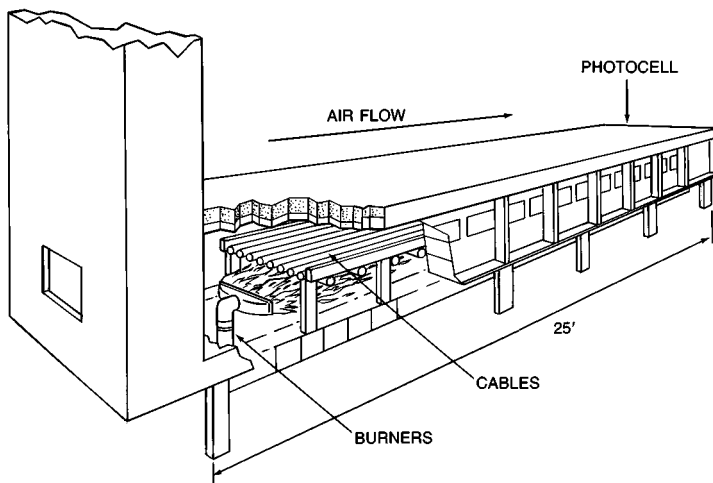


Figure 11.1—UL 910 Steiner tunnel test

11.2.5 UL 1666 Riser Flame Test

The **Riser Flame Test**, as described in Underwriters Laboratories Standard 1666, was developed to test cable flammability in riser applications. This test simulates a fire in a nonflame stopped riser within a high-rise building. The chamber for the test is a 3 story block construction design. Steel fire doors provide access to the 2nd and 3rd levels for installing cables, and 1 ft × 2 ft rectangular holes in both the second and third level floors allow cable to be installed in racks extending between the first and third levels. A burner is made up of a ¼ in. gas pipe with 90° elbow mounted below a 1 ft square drilled steel plate. The burner is mounted on the edge of the riser hole on the floor of the second level. A mixture of air and propane is burned for thirty minutes and then shut off, extinguishing the burner flame. A cable may be listed as riser cable if the flame does not propagate up to the floor of the third level. The energy output of the burner is 527,500 BTU/hr, or a consumed test energy of 263,750 BTUs.

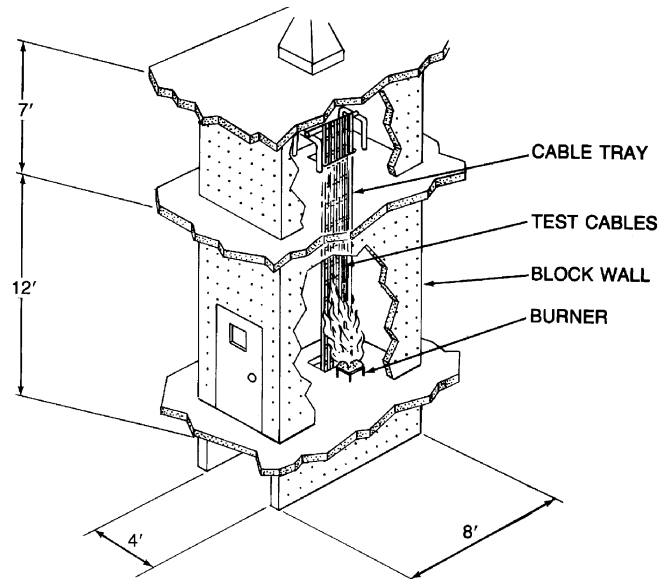


Figure 11.2–UL 1666 Riser flame test

11.2.6 UL 1581 Vertical Tray Flame Test (IEEE 383)

The **Vertical Tray Flame Test** is used as a good approximation of flame spread in cables run in groups. A steel ladder type tray 12 in. wide × 3 in. deep and 8 ft long with 1 in. × ½ in. rungs spaced 9 in. apart is mounted vertically on the floor of the test chamber. The center 6 in. of the tray is filled with cable samples in one layer spaced ½ cable diameter apart. A 6 to 1 mixture of air to propane is burned using a 10 in. wide ribbon burner. The burner is placed horizontally 3 in. from the back of the tray, 2 ft from the floor, and midway between 2 rungs. The flame is applied for twenty minutes and then removed. A cable passes the vertical tray test if it does not propagate flame to the top of the tray (6 ft). A cable may continue to burn after the burner is shut off; however, the test is not complete until the cable stops burning. The energy output of the burner is 70,000 BTU/hr and the cable is subjected to 23,333 BTUs for the test.

11. STANDARDS AND SPECIFICATIONS

11.2.7 ICEA T-29-520

A variation on the UL 1581 Vertical Tray Test (IEEE 383) is the 210,000 BTU flame test specified in ICEA Standard T-29-520. In the 210,000 BTU test, the setup is essentially the same as with the 70,000 BTU test except the gas flow is increased to generate 210,000 BTU/hr instead of 70,000 BTU/hr of flame energy and the burner-to-cable spacing is increased to 200 mm. See Section 11.2.3 for more details.

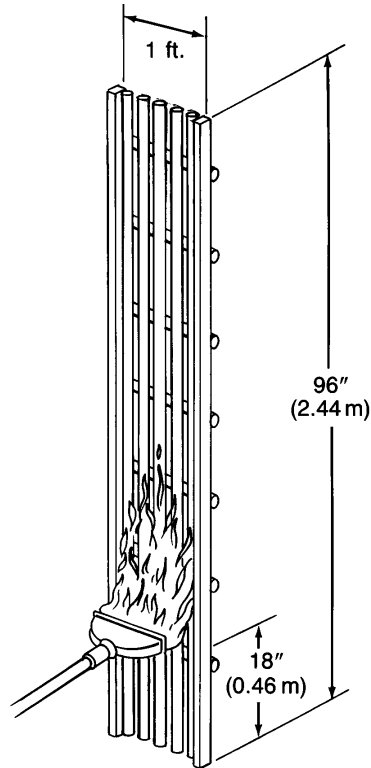


Figure 11.3–UL 1581 Vertical tray flame test

11.2.8 CSA FT-4

Another flame test variation similar to the IEEE 383 test is CSA's FT-4 test. This test is a later generation of the IEEE 383 test and is generally considered more stringent than the IEEE 383 test.

11.2.9 IEEE 1202

The IEEE 1202 flame test is the latest version of the original IEEE 383 Flame Test developed in the 1970s. The 1202 test is virtually identical in test severity to the Canadian FT-4 test which was the most recent version of the IEEE 383 test until publication of IEEE 1202 in 1991.

11.2.10 UL 1685

UL Standard 1685 is essentially the UL 1581 (IEEE 383) fire test with a smoke emission requirement added. A cable passing this test can be given an "LS" (Limited Smoke) listing.

11.2.11 UL 1581 VW-1 Flame Test

The VW-1 Flame Test was the first flame test developed for studying flame spread on wire and cable. The test measures relative flame propagation of a single wire or cable. The test procedure is detailed in Underwriters Laboratories Standard 1581, but a general overview of the test is as follows. The fixture used is a bench-mountable 12 in. wide, 14 in. deep, and 24 in. high steel box open at the front and top. Clamps hold a single specimen vertically in the center of the box. A Tirrill burner (similar to a Bunsen burner) is mounted on a 20° angle block and has a flame 4 to 5 inches high with a ½ in. inner blue cone. The burner is placed so the inner cone meets the test sample surface. Ten inches above this point a kraft paper “flag” is placed on the sample facing away from the burner, and cotton batting covers the floor of the chamber to a height 9 in. below the point. The flame is applied to the sample for 15 seconds 5 times (total 75 seconds) with a minimum 15 seconds between flame applications or until burning ceases, whichever is longer. A sample “Passes VW-1” if less than 25% of the flag is burned away, the cable doesn’t burn longer than 60 seconds after any flame application, and the cotton batting is not ignited by dripping particles. The energy output of the burner is less than 3,000 BTU/Hr and the test energy is less than 65 BTUs. The Canadian version of this test is the FT-1.

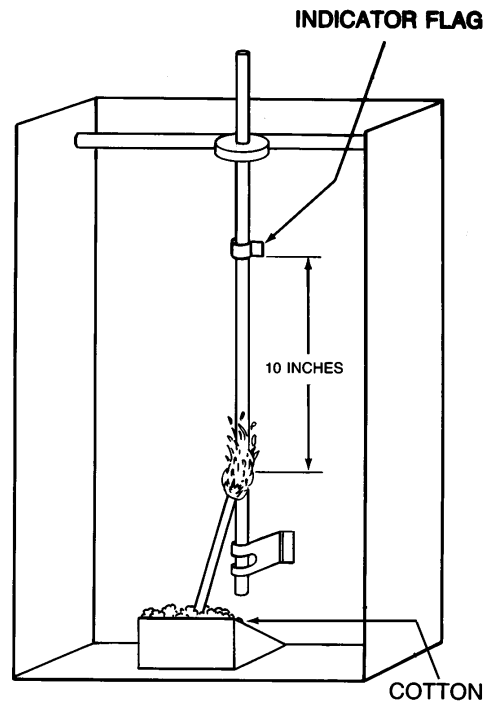


Figure 11.4–UL 1581 VW-1 flame test

11. STANDARDS AND SPECIFICATIONS

11.3 Regulatory and Approval Agencies

11.3.1 Underwriters Laboratories

UL Standard	UL Listing(s) Covered in the Standard
4 Armored Cable	AC
13 Power Limited Circuit Cable	CL3P, CL2P, CL3R, CL2R, CL3, CL3X, PLTC
44 Rubber Insulated Wires & Cables	XHHW, RHH, RHW, RH, SIS, RHW-2, XHHW-2
62 Flexible Cord & Fixture Wire	XT, CXT, TFN, TFFN, TPT, TST, TS, S, SA, SE, SO, SEO, SOO, ST, STO, STOO
83 Thermoplastic Insulated Wires	T, TW, THW, THHN, THNN, FEP, FEPB, TFE, THW-2, THWN-2
133 Varnished Cloth Wires & Cables	V, VD, M, VL, VDL, VML
444 Communication Cables	MPP, CMP, MPR, CMR, MP, CM, CMX
493 Thermoplastic Insulated Underground Feeder & Branch Circuit Cables	UF
719 Nonmetallic-Sheath Cables	NM, NMC
854 Service Entrance Cables	USE, SE, USE-2
1063 Machine Tool Wires & Cables	MTW
1072 Medium Voltage Power Cable	MV
1277 Electrical Power & Control Tray Cables with Optional Optical Fiber Members	TC
1426 Standard for Electric Cables for Boats	—
1569 Metal Clad Cables	MC
1581 Reference Standard for Electrical Wires, Cables, and Flexible Cords	—
— No published UL Standard. UL Listing is by contract with each manufacturer.	W, G

Typical examples of UL's mark appear below:



Figure 11.5—Typical UL marks



11. STANDARDS AND SPECIFICATIONS

11.3.2 National Electrical Code (NEC)

History and Articles

The first NEC document was written in 1897 at the insistence of various insurance, electrical, architectural, and other interested parties. Up to and including 1996, there have been a total of 47 editions. It is revised on a regular three year schedule. The National Electrical Code is divided into approximately 120 articles.

The Code is published by the **National Fire Protection Association (NFPA)** as a “recommended standard” and does not become law until officially adopted by state or local governments. Enforcement and interpretation of the Code is ultimately the responsibility of “the authority having jurisdiction,” i.e., the local inspector.

The intent of the Code is to insure the electrical and fire safety of electrical equipment. It does not attempt to insure the reliability, performance, proper operation or long life of equipment—these considerations are beyond its scope.

National Electrical Code Articles especially pertinent to the wire and cable industry include:

- Article 100 Definitions
- Article 110 Requirements for Electrical Installations
- Article 200 Use and Identification of Grounded Conductors

- Article 210 Branch Circuits
- Article 215 Feeders
- Article 220 Branch-Circuit and Feeder Calculations

- Article 225 Outside Branch Circuit and Feeders
- Article 230 Services
- Article 250 Grounding

- Article 300 Wiring Methods
- Article 305 Temporary Wiring
- Article 310 Conductors for General Wiring

- Article 318 Cable Trays
- Article 321 Messenger Supported Wiring
- Article 326 Medium Voltage Cable Type MV

- Article 328 Flat Conductor Cable Type FCC
- Article 330 Mineral-Insulated, Metal-Sheathed Cable
- Article 333 Armored Cable Type AC

- Article 334 Metal-Clad Cable
- Article 336 Nonmetallic Sheathed Cable Types NM and NMC
- Article 337 Shielded Nonmetallic-Sheathed Cable Type SNM

- Article 338 Service-Entrance Cable Types SE and USE
- Article 339 Underground Feeder and Branch-Circuit Cable Type UF
- Article 340 Power and Control Tray Cable Type TC

Continued

11. STANDARDS AND SPECIFICATIONS

- Article 346 Rigid Metal Conduit
- Article 348 Electrical Metallic Tubing
- Article 351 Liquid-Tight, Flexible Metal Conduit and Liquid-Tight, Flexible Nonmetallic Conduit

- Article 362 Wireways
- Article 363 Flat Cable Assemblies Type FC
- Article 400 Flexible Cords and Cables

- Article 402 Fixture Wires
- Article 500 Hazardous (Classified) Locations
- Article 501 Class I Locations

- Article 502 Class II Locations
- Article 503 Class III Locations
- Article 504 Intrinsically Safe Systems

- Article 604 Manufactured Wiring Systems
- Article 610 Cranes and Hoists
- Article 645 Electronic Computer/Data Processing

- Article 725 Class 1, Class 2, Class 3, Remote-Control, Signaling and Power-Limited Circuits
- Article 727 Instrumentation Tray Cable
- Article 760 Fire Protective Signaling Systems

- Article 770 Optical Fiber Cables
- Article 800 Communication Circuits
- Article 820 Community Antenna Television (CATV) and Radio Distribution Systems

Table 11.4 – NEC Article 725 — Summary of remote control, signaling and power-limited circuit types

	Circuit Voltage	Maximum Current
Class 1 Remote Control and Signaling (<i>Not</i> Power Limited)	0 thru 600	Unlimited
Class 1 Power Limited	0 thru 30	33 Amps
Class 2 Power Limited (Fire & Shock Safe)	0 thru 30 30 thru 150	8 Amps 0.005 Amps
Class 3 Power Limited (Fire Safe Only)	30 thru 150	10 Amps

Note: The above is an overview only. See Article 725 of the NEC for complete requirements. Class 2 and 3 cables must be rated at least 300 volts, but may *not* be so marked.

11.3.3 International

Table 11.5—Symbols of international organizations

Agency	Country (ies) Represented	Symbol
Canadian Standards Association (CSA)	Canada	
Comite Electrotechnique Belge Service de la Marque (CEBEC)	Belgium	
DEMKO	Denmark	
Electrical Inspectorate	Finland	
Electricity Trust of South Australia	Australia	
European Committee for Electrotechnical Standards (CENELEC)	See Note 1.	
International Electrotechnical Commission (IEC)	See Note 2.	
International Standards Organization (ISO)	More than 60 around the world	
Istituto Italiano del Marchio	Italy	
N. V. Kema	Netherlands	
NEMKO	Norway	
Österreichischer Verband für Elektrotechnik	Austria	

Continued

11. STANDARDS AND SPECIFICATIONS

Table 11.5—Symbols of international organizations

Continued

Agency	Country (ies) Represented	Symbol		
SEMKO	Sweden			
Technische Prüfanstalten des SEV's	Switzerland			
Underwriters Laboratories (UL)	USA	 		
Union Technique de L'Electricite	France			
VDE - Prüfstelle	Germany			
Note 1:	Austria	Greece	Norway	
	Belgium	Iceland	Portugal	
	Denmark	Ireland	Spain	
	Finland	Italy	Sweden	
	France	Luxemburg	Switzerland	
	Germany	Netherlands	United Kingdom	
Note 2:	Australia	France	Malaysia	Slovenia
	Austria	Germany	Mexico	South Africa
	Belarus	Greece	Netherlands	Spain
	Belgium	Hungary	New Zealand	Sweden
	Bulgaria	India	Norway	Switzerland
	Canada	Indonesia	Pakistan	Thailand
	China	Ireland	Poland	Turkey
	Croatia	Israel	Portugal	Ukraine
	Czech Republic	Italy	Romania	United Kingdom
	Denmark	Japan	Russian Federation	United States of America
	Egypt	Korea, Republic of	Singapore	Yugoslavia
	Finland	Luxemburg	Slovakia	