STD.NEMA VE 1-ENGL 1996 6470247 0513143 877

NEMA STANDARDS PUBLICATION

NEMA VE 1

METAL CABLE TRAY SYSTEMS

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS

Not for Resale

STD.NEMA VE 1-ENGL 1996 ■ 6470247 0513144 703 ■

NEMA Standards Publication No. VE 1-1996

METAL CABLE TRAY SYSTEMS

Published by:

National Electrical Manufacturers Association
1300 North 17th Street, Suite 1847
Rosslyn, Virginia 22209

© Copyright 1997 by the National Electrical Manufacturers Association. All rights including translation into other languages, reserved under the Universal Copyright Convention, the Berne Convention for the Protection of Literary and Artistic Works, and the International and Pan American Copyright Conventions.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

TABLE OF CONTENTS

FOREWORD ii

SECTION 1 GENERAL
Scope 1
Referenced Standards 1
Definitions 2

SECTION 2 MANUFACTURING STANDARDS
Materials 5
Finishes 5
Dimensions 6
Protection of Cable Insulation 7
Fittings 8
Marking of Trays 8

SECTION 3 PERFORMANCE STANDARDS AND LOAD/SPAN CLASS DESIGNATIONS
Working (Allowable) Load Capacity 9
Load/Span Class Designations 9

SECTION 4 TEST STANDARDS
Destruction Load Test 11
Deflection Test 12
Electrical Continuity of Connections 12

SECTION 5 SPECIFICATIONS AND DRAWINGS
Data to Appear in Specifications 13
Data to Appear on Drawings 13

SECTION 6 APPLICATION INFORMATION
Deflection 15
Concentrated Static Load 15
Warning! Walkways 15
Fittings 15
Supports 15
Support Locations 15
Protection of Cable Insulation 17
Thermal Contraction and Expansion 17
Cable Installation 18

FIGURES

Figures 6-1 through 6-8 Support Locations for Fittings 19

Figure 6-9 Gap Setting of Expansion Splice Plate 20

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

Foreword

This Standards Publication provides technical requirements concerning the construction, test, and performance of metal cable tray systems. The development of this publication is the result of many years of research, investigation, and experience by the members of the Metal Cable Tray Section of NEMA. Throughout the development of this publication, test methods and performance values have been related as closely as possible to end-use applications. It has been developed through consultation among manufacturers, with users and engineering societies, to result in improved serviceability and safety of metal cable tray systems.

This publication reflects the study of applicable building codes and the *National Electrical Code*, and adheres to applicable national material and manufacturing standards, such as those of the American Society for Testing and Materials, the American Iron and Steel Institute, the Aluminum Association, and Underwriters Laboratories, Inc. This publication is periodically reviewed by the Metal Cable Tray Section of NEMA for any revisions necessary to keep it up to date with advancing technology.

Comments or recommended revisions are welcomed and should be submitted to:

Vice President, Engineering
National Electrical Manufacturers Association
1300 North 17th Street, Suite 1847
Rosslyn, Virginia 22209

The primary purpose of this Standards Publication is to encourage the manufacture and utilization of standardized metallic cable tray systems and to eliminate misunderstandings between manufacturers and users.

The cable tray system manufacturer has limited or no control over the following factors which are vital to a safe installation:

1. Environmental conditions
2. System design
3. Product selection and application
4. Installation practices
5. Maintenance of the system.

This Standards Publication has been promulgated with a view towards promoting safety to persons and property by the proper selection and use of metal cable tray systems.

This Standards Publication was developed by the Metal Cable Tray Section. Section approval of the standard does not necessarily imply that all section members voted for its approval or participated in its development. At the time it was approved, the Section was composed of the following members:

B-Line Systems, Incorporated—Highland, IL
Chalfant Manufacturing Company—Cleveland, OH
T.J. Cope, Incorporated—Collegeville, PA
GS Metals Corporation—Pickneyville, IL
MP Husky Corporation—Greenville, SC
P-W Industries, Incorporated—Atlanta, GA
Square D Company—Oxford, OH
Thomas & Betts—Memphis, TN

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

Section 1
GENERAL

1.1 SCOPE

This standard covers continuous, complete, metallic systems of ladder, trough, solid-bottom or channel cable tray intended for, but not limited to, the support of power, control, and signal cables.

1.2 REFERENCED STANDARDS

In this publication, reference is made to the standards listed below. Copies are available from the indicated source.

American National Standards Institute
11 West 42nd Street
New York, NY 10036

National Fire Protection Association
Batterymarch Park
Quincy, MA 02269

ANSI/NFPA 70-90 *National Electrical Code*

American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 19103

A123-89 *Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products, Specifications for*

A525-87 *General Requirements, Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Specifications for*

B633-85 *Electrodeposited Coatings of Zinc on Iron and Steel, Specifications for*

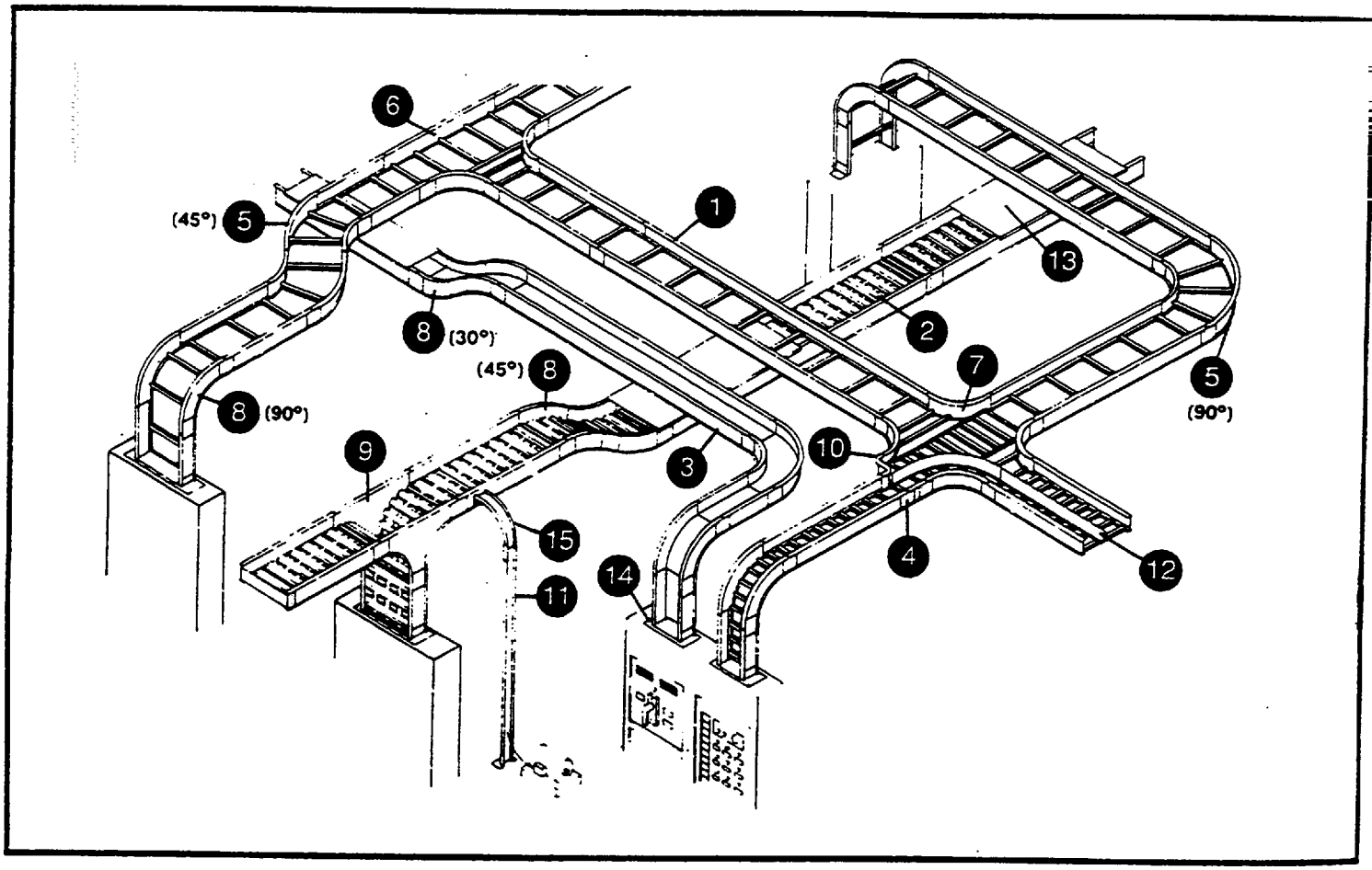
B766-86 *Electrodeposited Coatings of Cadmium, Specification for*

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS

Not for Resale

1.3 DEFINITIONS

Metallic cable tray system. An assembly of cable tray straight sections, fittings, and accessories that forms a rigid structural system to support cables.



Legend

1. Ladder Cable Tray
2. Trough Cable Tray
3. Solid Bottom Cable Tray
4. Cable Tray Connector
5. Horizontal Elbow
6. Horizontal Tee
7. Horizontal Cross
8. Vertical Elbow
9. Vertical Tee
10. Reducer
11. Channel Cable Tray
12. Divider
13. Cover
14. Tray-to-box Connector
15. Channel Vertical Elbow

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

Ladder cable tray. A prefabricated metal structure consisting of two longitudinal side rails connected by individual transverse members.

Trough cable tray. A prefabricated metal structure greater than 4 inches [102] in width consisting of a ventilated bottom* within integral or separate longitudinal side rails.

* A cable tray bottom having openings sufficient for the passage of air and utilizing 60 percent or less of the plan area of the surface to support cables.

Solid bottom cable tray. A prefabricated metal structure consisting of a bottom with no openings within integral or separate longitudinal side rails.

Straight section. A length of cable tray which has no change in direction or size.

Cable tray fitting. A device which is used to change the direction or size of a cable tray system.

Cable tray connector (Splice Plate). A device which joins cable tray straight sections and fittings, or both.

The basic types of connectors (splice plates) are:

1. Rigid
2. Expansion
3. Adjustable
4. Reducer

Horizontal elbow (Horizontal bend). A cable tray fitting which changes the direction in the same plane.

Horizontal tee. A cable tray fitting which is suitable for jointing cable trays in three directions at 90-degree intervals in the same plane.

Horizontal cross. A cable tray fitting which is suitable for joining cable trays in four directions at 90-degree intervals in the same plane.

Vertical elbow (Vertical Bend).
A cable tray fitting which changes direction to a different plane. An inside vertical elbow changes direction upward from the horizontal plane. An outside vertical elbow changes direction downward from the horizontal plane.

Reducer (Straight, Right Hand, Left Hand).
A cable tray fitting which is suitable for joining cable trays of different widths in the same plane. A straight reducer has two symmetrical offset sides. A right-hand reducer, when viewed from the large end, has a straight side on the right. A left-hand reducer, when viewed from the large end, has a straight side on the left.

Channel cable tray. A prefabricated metal structure consisting of a one-piece ventilated bottom or solid-bottom channel section, or both, not exceeding 6 inches [152] in width.

Accessories. Devices which are used to supplement the function of straight sections and fittings, and include such items as dropouts, covers, conduit adapters, hold-down devices and dividers.

Cable tray support. A device which provides adequate means for supporting cable tray sections and fittings.

NOTE: Numbers in brackets [ ] are in millimeters unless otherwise noted.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

The basic types of cable tray supports are:

1. Cantilever bracket
2. Trapeze
3. Individual rod suspension.

Cable Tray Support Span. The distance between the center line of supports.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS

Not for Resale

Section 2
MANUFACTURING STANDARDS

2.1 MATERIALS

Cable tray systems shall be made of either corrosion-resistant metal or metal with a corrosion-resistant finish.

Aluminum and stainless steel alloys are inherently corrosion-resistant and no finish coating is required in most environments.

2.2 FINISHES

2.2.1 Carbon steel used for cable trays shall be protected against corrosion by one of the following processes:

A. Hot-dip mill galvanized in accordance with ASTM Publication No. A525 G90 Coating.*

Coating designation G90 of ASTM 525 has an average zinc coating weight of 1.25 oz. per square foot [0.381 kg/m2] of steel, total coating on both surfaces (1.06 mils [0.027] average thickness per side.)

Hot-dip mill galvanized coatings are produced by continuously rolling steel sheets or strips in coils through a bath of molten zinc. The process involves pretreating the steel to make the surface react readily with molten zinc as the strip moves through the bath at high speeds. During fabrication where slitting, forming, cutting, or welding is performed, the cut edges and heat-affected zone of welding are subject to superficial oxidation. These areas are then protected through electrolytic action of the adjacent zinc surfaces. The coating is smooth, ductile, and adherent.

B. Hot-dip galvanized after fabrication in accordance with ASTM Publication No. A123. Class B2.*

Class B2 of ASTM A123 has an average zinc coating weight of 1.50 oz. per square foot [0.46 kg/m2] (2.55 mils [0.064] average thickness per side.)

Fabricated products which are hot-dip galvanized are thoroughly cleaned, fluxed, and immersed into a bath of molten zinc where immersed into a bath of molten zinc where they react to form a metallurgically bonded zinc coating. Normal oxidation of the galvanized surfaces will, in a short period of time, appear as a dull gray or white coating. Some degree of roughness and variations of thickness can be expected due to the hot dipping process. Because the galvanizing process takes place at the low end of the stress-relieving temperature range, some stress relief occurs and some distortion or warping may result.

C. Other equivalent commercially available coatings.

2.2.2 Steel nuts and bolts shall be protected against corrosion by one of the following processes:

A. ASTM Publication No. B633
B. ASTM Publication No. B766
C. Other equivalent commercially available coatings.

* It is important to specify ASTM A525 or ASTM A123 to insure the specific coating is furnished.

NOTE: Numbers in brackets [ ] are in millimeters unless otherwise noted.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS

Not for Resale

2.2.3 Where metallic cable tray is intended for installation in highly corrosive environments, including most alkaline and acidic conditions, further protection against corrosion shall be provided by one of the following processes:

A. PVC (Polyvinylchloride)
A PVC coating shall be applied in a fluidized bed or by electrostatic spray.

The coating thickness shall be 15 mils [0.381]+5 mils [0.127].

Items to be protected shall be thoroughly cleaned, primed, and then coated with a fine grain UV (ultraviolet) stabilized vinyl plastic powder.

All field cuts and damaged areas of coated tray shall be repaired with a compatible PVC compound to ensure a coating integrity.

A PVC coating is generally applied to bare steel cable tray but can be applied in aluminum cable tray.

PVC is not recommended as a coating on galvanized steel cable trays because of rough surfaces and gas emissions which cause voids and adhesion problems.

B. Other equivalent commercially available coatings.

2.3 DIMENSIONS

2.3.1 General

Plus or minus values stated reflect the range of nominal dimensions in cable tray designs and are not intended to represent manufacturing tolerances.

2.3.2 Ladder Trays

1. *Lengths of Straight Sections*—12 feet [3660] plus or minus 3/16 inch [4.76] and 24 feet [7320] plus or minus 5/16 inch [7.94], not including connectors if attached.

2. *Widths*—6, 12, 18, 24, 30 and 36 inches [152, 305, 457, 610, 762 and 914], plus or minus 1/4 inch [6.35] inside dimension.

   Overall widths shall not exceed inside widths by more than 4 inches [102].

3. *Depths*—Inside depths shall be 3, 4, 5, and 6 inches [76.2, 102, 127.0, and 152], plus or minus 3/8 inch [9.53].

   Outside depths shall not exceed inside depths by more than 1-1/4 inches [31.7].

4. *Rung Spacing on Straight Sections*—6, 9, 12, or 18 inches [152, 229, 305, or 457] on centers.

5. *Radii*—12, 24, and 36 inches [305, 610, and 914].

6. *Degree of Arc for Elbows*—30, 45, 60, and 90 degrees.

2.3.3 Trough Trays

1. *Lengths of Straight Sections*—12 feet [3660] plus or minus 3/16 inch [4.76] and 24 feet [7320] plus or minus 5/16 inch [7.94], not including connectors if attached.

NOTE: Numbers in brackets [ ] are in millimeters unless otherwise noted.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

2. *Widths*—6, 12, 18, 24, 30, and 36 inches [152, 305, 457, 610, 762 and 914], plus or minus 1/4 inch [6.35], inside dimension.

   Overall widths shall not exceed inside widths by more than 4 inches [102].

3. *Depths*—Inside depths shall be 3, 4, 5, and 6 inches [76.2, 102, 127.0, and 152], plus or minus 3/8 inch [9.53].

   Outside depths shall not exceed inside depths by more than 1-1/4 inches [31.7].

4. *Radii*—12, 24, and 36 inches [305, 610, and 914].

5. *Degrees of Arc for Elbows*—30, 45, 60, and 90 degrees.

6. *Transverse Elements*—The maximum open spacing between transverse elements shall be 4 inches [102] measured in a direction parallel to the tray side rails.

2.3.4 Solid-Bottom Trays

1. *Lengths of Straight Sections*—12 feet [3660] plus or minus 3/16 inch [4.76] and 24 feet [7320] plus or minus 5/16 inch [7.94], not including connectors if attached.

2. *Widths*—6, 12, 18, 24, 30, and 36 inches [152, 305, 457, 610, 762 and 914], plus or minus 1/4 inch [6.35], inside dimension.

   Overall widths shall not exceed inside widths by more than 4 inches [102].

3. *Depths*—Inside depths shall be 3, 4, 5, and 6 inches [76.2, 102, 127, and 152], plus or minus 3/8 inch [9.53].

   Outside depths shall not exceed inside depths by more than 1-1/4 inches [31.7].

4. *Radii*—12, 24, and 36 inches [305, 610, and 914].

5. *Degree of Arc for Elbows*—30, 45, 60, and 90 degrees.

6. *Bottom*—Bottom is solid.

2.3.5 Channel Trays

1. *Lengths of Straight Sections*—12 feet [3660] plus or minus 3/16 inch [4.76] and 24 feet [7320] plus or minus 5/16 inch [7.94], not including connectors if attached.

2. *Widths*—3, 4, and 6 inches [76.2, 102, and 152], plus or minus 1/4 inch [6.35], inside dimension.

3. *Depths*—1-1/4 to 1-3/4 inches [31.7 to 44.4] outside dimensions.

4. *Radii*—12, 24, and 36 inches [305, 610, and 914].

5. *Degree of Arc for Elbows*—30, 45, 60, and 90 degrees.

2.4 PROTECTION OF CABLE INSULATION

The inside of cable tray systems shall present no sharp edges, burrs, or projections which can damage cable insulation.

NOTE: Numbers in brackets [ ] are in millimeters unless otherwise noted.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

2.5 FITTINGS

The design and construction of fittings shall be based on the assumption that they will be supported in accordance with the recommendations given in 6.6 for support locations.

2.6 MARKING OF TRAYS

2.6.1 Warning! Walkways

Inasmuch as cable tray is designed as a support for power or control cables, or both, and is not intended or designed to be a walkway for personnel, the user is urged to display appropriate warnings cautioning against the use of this support as a walkway. The following language is suggested:

Warning! Do not use as a walkway, ladder or support for personnel. Use only as a mechanical support for cables, tubing and raceways.

2.6.2 Statement of Compliance

To identify the NEMA load/span class(es), the following label will be used:

- Manufactured to NEMA VE 1 standard.
- Load/span class (appropriate class designation from VE 1, Paragraph 3.2).

2.6.3 Marking of Trays when used as Equipment Grounding Conductors

When steel or aluminum cable tray systems are used as equipment grounding conductors, cable tray sections and fittings shall be marked to show the minimum cross-sectional area in accordance with Article 318 of the *National Electrical Code*.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

Section 3
PERFORMANCE STANDARDS AND LOAD/SPAN CLASS DESIGNATIONS

3.1 WORKING (ALLOWABLE) LOAD CAPACITY

The working (allowable) load capacity represents the ability of a cable tray to support the static weight of cables. It is equivalent to the destruction load capacity, as determined by testing in accordance with 4.1 divided by a safety factor of 1.5.

3.2 LOAD/SPAN CLASS DESIGNATIONS

There shall be three working load categories of cable tray:*

1. lbs/linear ft. [74.4 kg/m] (Symbol A)
2. lbs/linear ft. [111.6 kg/m] (Symbol B)
3. lbs/linear ft. [148.8 kg/m] (Symbol C)

and, four support span categories of:

1. feet [2.44 m]
2. feet [3.66 m]
3. feet [4.87 m]
4. feet [6.09 m]

Utilizing these, the load/span class designations of Table 3-1 shall apply.

Table 3-1
LOAD/SPAN CLASS DESIGNATIONS

Working Load		Support Span		Class Designation
Lbs/ft.	[kg/m]	Feet	[m]	Per 3.1
50	[74.4.]	8	[2.44]	8A
75	[111.6]	8	[2.44]	8B
100	[148.8]	8	[2.44]	8C
50	[74.4]	12	[3.66]	12A
75	[111.6]	12	[3.66]	12B
100	[148.8]	12	[3.66]	12C
50	[74.4]	16	[4.87]	16A
75	[111.6]	16	[4.87]	16B
100	[148.8]	16	[4.87]	16C
50	[74.4]	20	[6.09]	20A
75	[111.6]	20	[6.09]	20B
100	[148.8]	20	[6.09]	20C

NOTE 1—The above working loads are for cable only; when considering applications requiring concentrated static load, see 6.2.
NOTE 2 —These designations do not apply to channel tray, and the manufacturer should be consulted.

*For deflection see 6.1.

NOTE: Numbers in brackets [ ] are in millimeters unless otherwise noted.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS

Not for Resale

Section 4
TEST STANDARDS

4.1 DESTRUCTION LOAD TEST

4.1.1 Test Specimen

For each design of cable tray, two separate tests shall be made. An unspliced straight section of the widest width shall be used in each test.

For ladder type cable trays rung spacing shall be 12 inches on center.

Differences in gauge, height of side rails, rung or bottom to side rail connection, or the configuration of any part constitute a different design.

4.1.2 Type and Length of Span

Test spans shall be simple beam spans with free unrestrained ends. Trays shall not have side restraints. Span lengths shall be as specified plus or minus 1-1/2 inches [38.1].

4.1.3 Orientation of Specimens

Specimens shall be tested in a horizontal position. The total length of the test specimen shall be not more than the specified span length plus 20 percent. Any overhang shall be equal.

4.1.4 Supports

Each end of the specimen shall be supported by an 1 1/8 inch [28.6] wide by 3/4 inch [19.0] high steel bar(s) with a 120-degree "Vee" notch cut in its bottom to a depth of 3/16 inch [4.76]. The "Vee" notch shall rest on a 1 inch [25.4] solid round steel bar which is welded at a maximum of 12 inches [305] on center to a firm steel base, or the specimen shall be supported directly on a 2-1/2 inch [63.5] maximum diameter round steel bar or heavy wall steel tube welded to a firm steel base.

4.1.5 Loading Material

Loading material shall be steel strips, lead ingots, or other loading material.

Steel strips shall have rounded or deburred edges, a maximum thickness of 1/8 inch [3.18], a width of 1-1/8 [28.6] to 2 inches [50.8], a maximum length of 4 feet [1220].

Five lead ingots, each weighing approximately 5 pounds [2.26 kg], shall be interconnected across corners into a string of 5 ingots approximately 22 inches [559] long. Individual ingots are normally hexagonal, approximately 3 inches [76.2] in diameter, and 1-1/2 inches [38.1] deep.

Other loading material shall have a maximum weight of 10 pounds [4.53 kg], a maximum width of 5 inches [127], and a maximum length of 12 inches [305].

4.1.6 Loading

All specimens shall be loaded to destruction. The load shall be applied in at least 10 increments which are approximately equal.

NOTE: Numbers in brackets [ ] are in millimeters unless otherwise noted.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

Loading shall be uniformly distributed for the length and breadth of the specimen except that the loading material shall be not closer than 1/2 inch [12.7] nor further than 1 inch [25.4] from the innermost elements of the side rails. It shall be arranged across the tray with a minimum of 3/8 inch [9.53] between stacks so that the loading material does not bridge transversely. All loading material shall be placed between the supports without overhanging.

For loading weight in a ladder-type tray, it shall be permissible to cover the bottom of the tray between supports with a flat sheet of No. 9 gauge [3.8] flattened expanded material not more than 3 feet [910] long and with a wire hole size of 3/4 inch [19.0], or a flat sheet of No. 16 gauge [1.5] sheet steel not more than 3 feet [910] long. The expanded metal or sheet steel shall not be fastened to the tray and shall be no closer than 1/2 inch [12.7] to the side rails. The 3-foot [910] lengths shall not overlap. The weight of the expanded metal or sheet steel shall be added to the total weight of the loading material.

4.1.7 Destruction Load Capacity

The total weight of the loading material on the cable tray at the time it is destroyed shall be considered to be the destruction load capacity of the cable tray.

4.1.8 Interpolation and Extrapolation of Test Data

When allowable load and deflection data are determined by load tests, values for span lengths not tested shall be determined by interpolation from a curve based on values for a minimum of three tested span lengths. Extrapolation toward shorter span lengths is permissible but shall not be used for span lengths longer than a longest span length tested.

4.2 DEFLECTION TEST

The vertical deflection of the tray shall be measured at two points along the line midway between the supports and at right angles to the longitudinal axis of the tray. The two points of measurement shall be at the midpoint of the span of each side rail.

The average of these two readings shall be considered to be the vertical direction of the tray.

4.3 ELECTRICAL CONTINUITY OF CONNECTIONS

4.3.1 Test Specimen

Each specimen shall consist of two 24-inch [610] lengths of side rail plus mechanical connecting means.

4.3.2 Resistance Test Procedure

Each specimen should be joined together, using the mechanical connector and following the instructions provided by the manufacturer.

A current of 30 amperes shall be passed through the specimen and the resistance measured between two points 6 inches [152] on each side of the joint. The net resistance of the joint shall be not more than 0.00033 ohm as computed from the measured voltage drop and the current passing through the specimen.

NOTE: Numbers in brackets [ ] are in millimeters unless otherwise noted.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

Section 5
SPECIFICATIONS AND DRAWINGS

5.1 DATA TO APPEAR IN SPECIFICATIONS

The following statement and minimum data, when applicable, should appear in all cable tray specifications:

1. Cable tray shall be manufactured and installed in accordance with NEMA Standard VE 1-1996
2. Load/span class designation (see Section 3)
3. Type (see Section 1.2)
4. Material (see Section 2.1)
5. Finish (see Section 2.2)
6. Rung Spacing (see Section 2.3)
7. Inside depth (see Section 2.3)
8. Width (see Section 2.3)
9. Fitting radius (see Section 2.3)
10. Accessories (see Section 1.2).

5.2 DATA TO APPEAR ON DRAWINGS

The following minimum data should appear on all cable tray drawings:

1. Type (ladder, trough, etc.)
2. Width
3. Straight section, fitting, or accessory
4. Fitting radii
5. Elevation (bottom of tray)
6. Vertical and horizontal changes in direction
7. Clearances—vertical and horizontal
8. Number of trays
9. Supports
10. Show graphic scale.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS

Not for Resale

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS

Not for Resale

Section 6
APPLICATION INFORMATION

6.1 DEFLECTION

Under normal applications deflection limitations should not be included in design criteria for cable trays. However, if unusual or special conditions exist, the manufacturer should be consulted. Limitations of deflection for aesthetic purpose only can result in an over-designed tray system.

6.2 CONCENTRATED STATIC LOAD (If Required by User)

A concentrated static load is not included in Table 3-1, Load/Span Designations. Some user applications may require that a given concentrated static load be imposed over and above the working load. When so specified, the concentrated static load may be converted to an equivalent, uniform load (W_e) in pounds per linear foot [kilograms per meter] using the formula and added to the static weight of cables in the tray. This combined load may be used to select a suitable load/span designation (See Table 3-1.) If the combined load exceeds the working load shown in Table 3-1, the manufacturer should be consulted.

$$W_e = \frac{2 \times (\text{Concentrated Static Load})}{\text{span length, ft. [m]}}$$

6.3 WARNING! WALKWAYS

See clause 2.6.1.

6.4 FITTINGS

Changes in direction should be mechanically continuous and accomplished by use of fittings having dimensions in accordance with 2.3.

6.5 SUPPORTS

Supports for cable trays should provide a strength and working load capacity sufficient to meet the load requirement of the cable tray systems.

1. Horizontal and vertical tray supports should provide an adequate bearing surface for the tray and should have provisions for holddown clamps or fasteners.
2. In addition, vertical tray supports should provide secure means of fastening cable trays to supports.

6.6 SUPPORT LOCATIONS

6.6.1 Horizontal Cable Tray Straight Sections

Horizontal cable tray straight sections should be supported at intervals not to exceed the support span for the appropriate NEMA Class Designation shown in Table 3-1. Unspliced straight sections should be used on all simple spans and on end spans of continuous span runs. A support should be located within 2 feet [610] of each side of an expansion connector. Straight section lengths should be equal to or greater than the span length to ensure not more than one splice between supports.

NOTE: Numbers in brackets [ ] are in millimeters unless otherwise noted.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

6.6.2 Horizontal Cable Tray Fittings

1. *Horizontal Elbow Supports* (See Figure 6-1)
   Supports for horizontal tray fittings should be placed within 2 feet [610] of each fitting extremity, and as follows:

   (A) 90-degree supports at the 45-degree point of arc
   (B) 60-degree supports at the 30-degree point of arc
   (C) 45-degree supports at the 22-1/2—degree point of arc (except for the 12-inch [305] radii)
   (D) 30-degree supports at the 15-degree point of arc (except for the 12-inch [305] radii).

2. *Horizontal Tee Supports* (See Figure 6-2)
   Within 2 feet [610] of each of the three openings connected to other cable tray items for the 12-inch [305] radius. On all other radii, at least one support should be placed under each side rail at the horizontal tee preferably as shown in Figure 6-2.

3. *Horizontal Cross Supports* (See Figure 6-3)
   Within 2-feet [610] of each of the four openings connected to other cable tray items for the 12-inch [305] radius. On all other radii, at least one support should be placed under each side rail of the horizontal cross, preferably as shown in Figure 6-3.

4. *Horizontal Wye Supports* (See Figure 6-4)
   Within 2-feet [610] of each of the three openings connected to other cable tray items, and at 22-1/2 degree point of the arc adjacent to the branch

5. *Reducer Supports* (See Figures 6-5 and 6-6)
   Within 2-feet [610] of each fitting extremity.

6.6.3 Vertical Cable Tray Elbows (See Figure 6-7)

Vertical cable tray elbows at the top of runs should be supported at each end. Vertical cable tray elbows at the bottom of runs should be supported at the top of the elbow, and within 2-feet [610] of the lower extremity of the elbow.

6.6.4 Vertical Cable Tray Tees (See Figure 6-8)

Vertical cable tray tees should be supported within 2-feet [610] of each fitting extremity.

6.6.5 Vertical Straight Sections

Vertical straight sections should be supported indoors at appropriate intervals permitted by the building structure; outdoor support intervals should be determined by wind loading. The maximum distance between vertical supports should not exceed 24-feet [7320] on centers.

6.6.6 Sloping Trays

Sloping trays should be supported at intervals not exceeding those for horizontal trays of the same design for the same installation.

NOTE: Numbers in brackets [ ] are in millimeters unless otherwise noted.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

6.6.7 Fittings as End of Run

A fitting which is used as an end of the run dropout should have a support attached to it, firmly reinforcing the fitting.

6.7 PROTECTION OF CABLE INSULATION

The inside of cable tray systems should present no sharp edges, burrs, or projections which could damage cable insulation.

6.8 THERMAL CONTRACTION AND EXPANSION

It is important that thermal contraction and expansion be considered when installing cable tray systems. If it is determined that expansion connectors are required, reference should be made to Table 6-1 for maximum spacing.

The cable tray should be securely fixed at the support nearest to its midpoint between the expansion connectors and secured by expansion guides at all other support locations. The cable tray should be permitted longitudinal movement in both directions from that fixed point towards the expansion connectors.

Accurate gap setting at the time of installation is necessary for the proper operation of the expansion connectors. The following procedure should assist the installer in determining the correct gap:

Step 1—Plot the highest expected cable tray metal temperature on the maximum temperature vertical axis. Example's Value = 100°F. (See Figure 6-9)

Step 2.—Plot the lowest expected cable tray metal temperature on the minimum temperature vertical axis. Example's Value = -28°F.

Step 3—Draw a line between these maximum and minimum temperature points on the two vertical axis.

Step 4—To determine the required expansion joint gap setting: Plot the cable tray metal temperature at the time of the cable tray installation on the Maximum temperature vertical axis. (Example's Value: 50°F). Project over from the 50°F point on the maximum temperature vertical axis to an intersection with the line between the maximum and minimum cable tray metal temperatures. From this intersection point, project down to the gap setting horizontal axis to find the correct gap setting value (Example's Value: 3/8 inch gap setting). This is the length of the gap to be set between the cable tray sections at the expansion joint splice plate location.

Table 6-1
MAXIMUM SPACING BETWEEN EXPANSION JOINTS THAT PROVIDE FOR ONE INCH [25.4] MOVEMENT

Temperature Differential		Steel		Aluminum	
F	{C}	Feet	[m]	Feet	[m]
25	[-4]	512	[156]	260	[79.2]
50	[10]	256	[78.0]	130	[39.6]
75	[24]	171	[52.1]	87	[26.5]
100	[38]	128	[39.0]	65	[19.8]
125	[51]	102	[31.1]	52	[15.8]
150	[65]	85	[25.9]	43	[13.1]
175	[79]	73	[22.2]	37	[11.3]

NOTE: Numbers in brackets are in millimeters unless otherwise noted.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

6.9 CABLE INSTALLATION

When installing cable in cable tray, it is important that care and planning be exercised so that the cable or the cable tray is not damaged or destroyed. The cable manufacturer should be contacted for maximum pulling tensions and minimum bending radii, and advice on prevention of "egging" or deformation of cable jacketing or shielding.

SUPPORT LOCATIONS FOR FITTINGS

Figure 6-1
HORIZONTAL ELBOWS

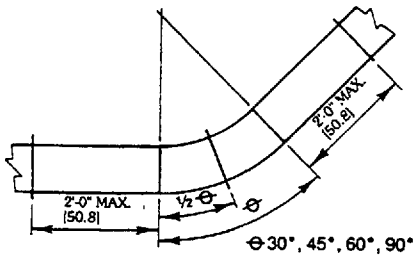


Figure 6-2
HORIZONTAL TEE

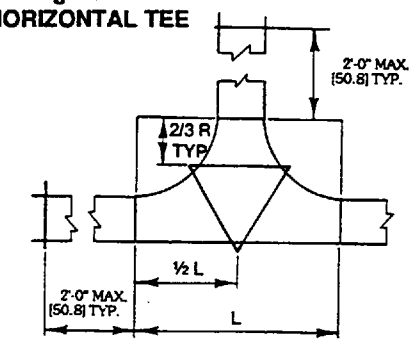


Figure 6-3
HORIZONTAL CROSS

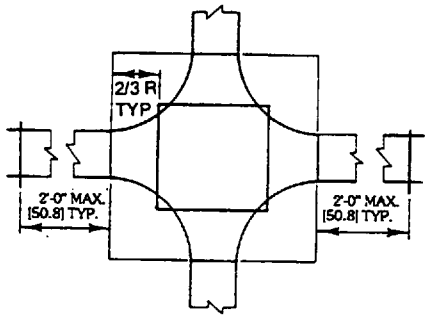


Figure 6-4
HORIZONTAL WYE

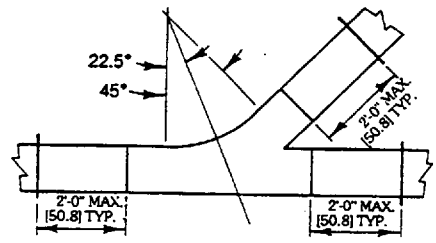


Figure 6-5
STRAIGHT REDUCER

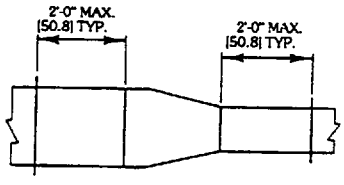


Figure 6-6
OFFSET REDUCER

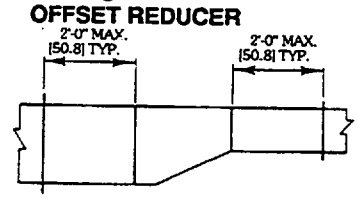


Figure 6-7
VERTICAL ELBOWS

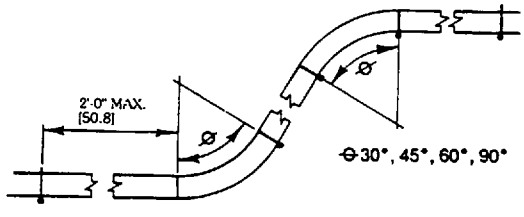
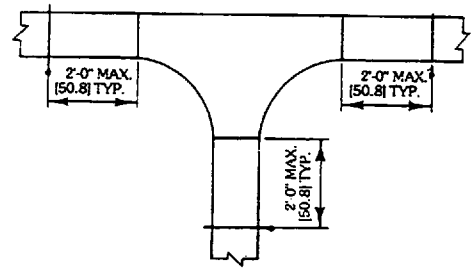
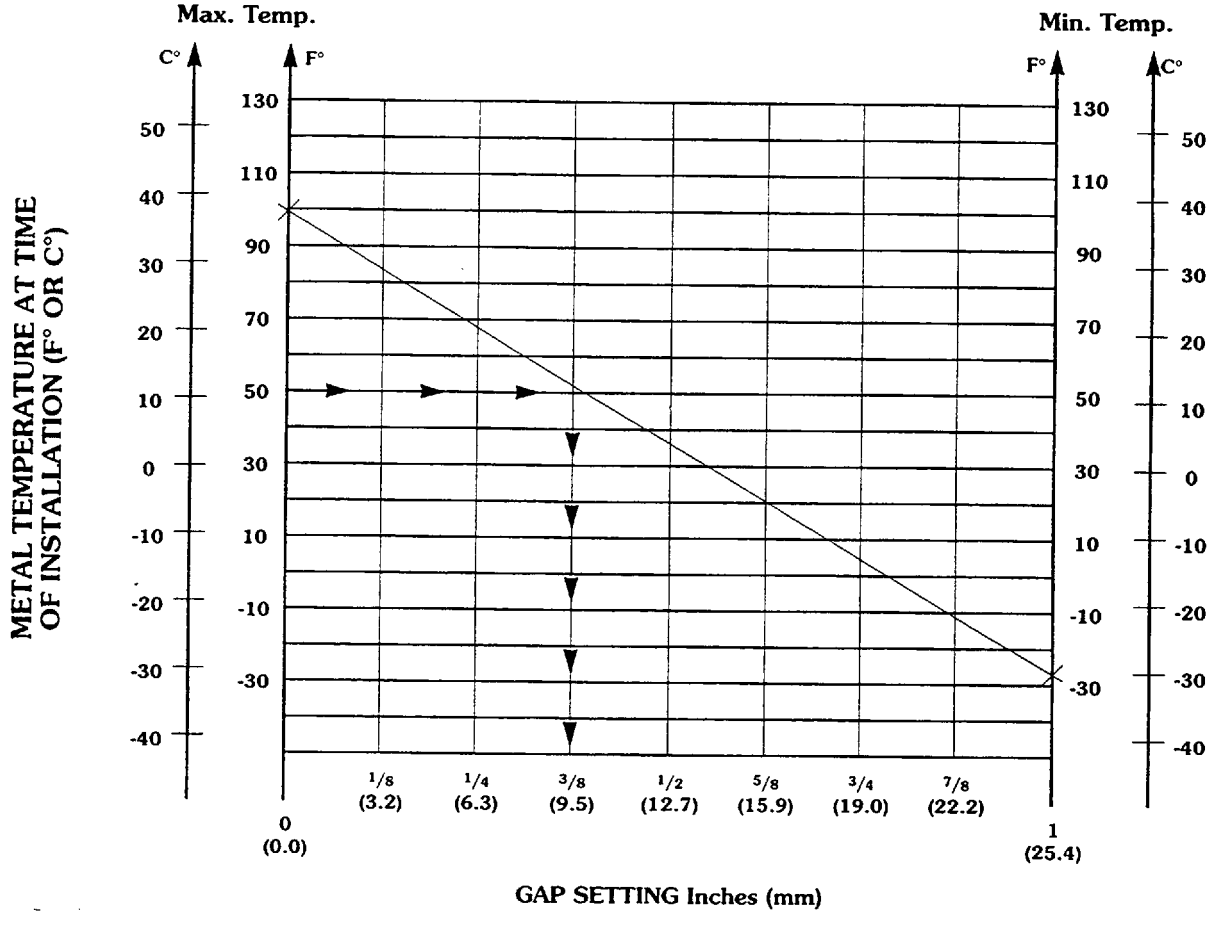


Figure 6-8
VERTICAL TEE



Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

Figure 6-9
GAP SETTING OF EXPANSION SPLICE PLATE
1" (25.4 mm) GAP MAXIMUM



Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS

Not for Resale

6470247 0513022 161

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION · 1300 NORTH 17TH STREET · SUITE 1847 · ROSSLYN, VA 22209

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS

Not for Resale