

| Requirements for Type TC cables in accordance with the <i>NEC</i> and the <i>CEC</i> | | | | | |
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| <i>NEC</i> | | | <i>CEC</i> | | |
| General Requirements | | | | | |
| Description | Reference | Requirement | Description | Reference | Requirement |
| Cable Tray System | 318-2. Definition. A unit or assembly of units or sections and associated fittings forming a structural system used to securely fasten or support cables and raceways. | | Cable Tray | Section 0, Object, Scope And Definitions Cable tray means a raceway consisting of troughing, and fittings therefore, so formed and constructed that insulated conductors and cables may be readily installed or removed after the cable tray has been completely installed, without injury either to conductors or their coverings. | |
| Recognized Wiring Methods for Cable Tray Systems | 318-3 (a) and (b) Multi-conductor Type TC cables are recognized in 318-3(a) as one of many permitted wiring methods for Cable Tray Systems. For industrial establishments, 318-3(b) permits single conductor cables No. 1/0 or larger (and, No. 4 or larger for grounding) that are marked "For CT Use". | | Conductors in Cable Trays | 12-2204 (2) Type TC tray cables shall be permitted (as an alternate to requirement in 12-2204 (1)) in cable trays in areas of industrial establishments that are inaccessible to the public. Single conductor Type TC tray cables shall not be smaller than 1/0 AWG. | |
| Type TC | Article 340 Power and Control Tray Cable: Type TC | | Type TC | Table 19, Section 12 and other specific rules. No specific article for Type TC. | |
| Definition | 340-1. Definition. Type TC power and control tray cable is a factory assembly of two or more insulated conductors, with or without associated bare or covered grounding conductors under a nonmetallic sheath, for installation in cable trays, in raceways, or where supported by a messenger wire. | | Definition | No specific definition. Per CEC and CSA Standard C22.2 No. 230 – Tray Cables, it can be a single conductor (1/0 AWG and larger) or a factory assembly of two or more insulated conductors, with or without associated bare or covered grounding conductors under a non-metallic sheath, for installation in cable trays. | |
| Listing | In accordance with UL Standard 1277, Electrical Power and Control Tray Cables with Optional Optical-Fiber Members. Single conductor cables, which are recognized in Table 310-13, are evaluated in accordance with their respective product standards for their use in cable trays and marked "For CT Use". | | Listing | In accordance with CSA Standard C22.2 No. 230 – Tray Cables. | |

Table 1.

Summary

Examination of code and standards requirement in North America suggests that the interactive system of *Code-Product Standards-Verification* provide a set of choices for wiring methods in demanding environments in the industrial establishments. Power and Control Tray Cable – Type TC products can be used successfully in many applications in these environments. It is also clear that there is no single construction of Type TC that is suitable for all possible applications. Selection of a specific design depends upon the installation conditions and the required product performance characteristics for a particular application. Also, versatility, availability, and costs of alternate wiring methods, such armored cables and conductors in raceways, are compared against the similar features of Type TC cables and associated cable tray installation.



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¹ The installation code (NOM-001-SEMP-1994) recognizes Type TC products in Article 340. However, it is being revised and at present time there is no known product standard in place for Type TC products in Mexico, limited information from Mexico is presented here. Since the installation code in Mexico is likely to remain similar to the *NEC*, it also likely that the product standard, when developed, for Type TC products will be similar to UL 1277.

² In Canada, Appendix A in CEC Part II is an integral part of the *Code*.

Applications and Installation Requirements

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| <p>Uses Permitted</p> | <p>340-4</p> <ol style="list-style-type: none"> 1. For power, lighting, control, and signal circuits. 2. In cable trays, or in raceways, or where supported in outdoor locations by a messenger wire. 3. In cable trays in hazardous (classified) locations as permitted in Articles 318, 501, 502, 504, and 505 in industrial establishments where the conditions of maintenance and supervision ensure that only qualified persons will service the installation. 4. For Class 1 circuits as permitted in Article 725. 5. For nonpower-limited fire alarm circuits if conductors comply with the requirements of Section 760-27. 6. In industrial establishments where the conditions of maintenance and supervision ensure that only qualified persons will service the installation, and where the cable is not subject to physical damage, Type TC tray cable that complies with the crush and impact requirements of Type MC cable and is identified for such use shall be permitted as open wiring in lengths not to exceed a total of 50 ft (15.24 m) between a cable tray and the utilization equipment or device. The cable shall be supported and secured at intervals not exceeding 6 ft (1.83 m). Equipment grounding for the utilization equipment shall be provided by an equipment grounding conductor within the cable. | <p>Uses Permitted</p> | <p>Table 19</p> <p>Tray cables are recognized for use in raceways including ventilated, non-ventilated, and ladder type cable trays in wet locations and where exposed to weather.</p> <p>12-2204</p> <p>(2) Type TC tray cables shall be permitted in cable trays in areas of industrial establishments that are inaccessible to the public provided the cable is:</p> <ol style="list-style-type: none"> (a) Installed in conduit, other suitable raceway, or direct buried, where not in cable tray; and (b) Provided with mechanical protection where subject to damage either during or after installation; and (c) No smaller than 1/0 AWG if a single conductor is used; and (d) Installed only where qualified persons service the installation. <p>Table 19 and (18-068, 18-156, and 18-252)</p> <p>For use in cable trays in Class I Division 2 and Class II Division 2 hazardous locations.</p> <p>Table 19</p> <p>Type TC cable directly buried in the earth shall be marked as suitable for the purpose.</p> |
| <p>Uses Not Permitted</p> | <p>340-5</p> <ol style="list-style-type: none"> 1. Installed where it will be exposed to physical damage 2. Installed as open cable on brackets or cleats 3. Used where exposed to direct rays of the sun, unless identified as sunlight resistant 4. Direct buried, unless identified for such use. | | <p>Uses permitted rules include (or preclude) conditions for uses not permitted.</p> |
| <p>Bends</p> | <p>340-8</p> <p>Bends in Type TC cable shall be made so as not to damage the cable.</p> | | <p>No specific reference for Type TC.</p> |
| <p>Bending Radius</p> | <p>None specified.</p> | | <p>None specified.</p> |
| <p>Ampacity</p> | <p>340-7</p> <p>The ampacities of the conductors of Type TC tray cable shall be determined from Section 402-5 for conductors smaller than No. 14 and from Section 318-11.</p> | | <p>12-2212</p> <p>Similar to the requirements in 318-11, the ampacities of the conductors of Type TC tray cable is determined in accordance with various provisions for installation of Type TC cable in cable trays.</p> |

Construction and Performance Requirements

| UL 1277 | | CSA Standard C22.2 No. 230 – Tray Cables | |
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| Construction | Consists of two or more current carrying circuit conductors with or without either or both of the following, all under an overall jacket: a) One bare or one or more insulated grounding conductor(s), and b) One or more individually jacketed optical-fiber members. | Construction | Details of construction are not published in this Standard because the test and marking requirements of this Standard are in addition to the basic requirements for the cable construction that appear in other published CSA Standards. Except for single conductor products being marked Type TC, construction is similar to Type TC in the US. |
| Conductors | Copper (Sizes # 14 AWG and larger depending upon other specific requirements). Aluminum or copper clad aluminum (Sizes # 12 AWG and larger depending upon other specific requirements). Copper (Sizes # 16 - # 18) for control conductors. | Conductors | Copper (Sizes # 14 AWG and larger depending upon other specific requirements). Aluminum (Sizes # 12 AWG and larger depending upon other specific requirements). Copper (Sizes # 16 - # 18) for control conductors. |
| Equipment Grounding | Typically included. Same voltage rating as the circuit conductors. | Equipment Grounding | Typically included. Same voltage rating as the circuit conductors. |
| Insulation | Typically: Thermoplastic: Per UL 83 (600 V) wet and or dry ratings. (Ex: THW or THHN/THWN) Thermoset: Per UL 44 (600 V or 2000 V) wet and dry ratings. (Ex: XHHW (600 V) or RHH/RHW (2000 V)) Other: Control conductors per UL 62 Standard and or optical fiber member(s) in 600 V Tray Cables. | Insulation | Typically: Thermoplastic: Per CSA C 22.2 No. 75 (600 V) wet and or dry ratings. (Ex: TW or T90 (dry only)) Thermoset: Per CSA C 22.2 No. 38 (600 V or 1000 V) wet and dry ratings. (RW90 (600 V) or RW90 (1000 V)) Tray cable in Canada also includes medium voltage power cables. Other: Where permitted, control conductors and or other assemblies per other CSA Standards. |
| Temperature Rating | Temperature rating of conductor insulation. | Temperature Rating | Temperature rating of conductor insulation. |
| Sheath | Thermoplastic or thermoset. Properties of sheath and conductor insulation along with the assembly contribute towards the capability of the construction to meet the required flame test and other physical performance requirements. | Sheath | Thermoplastic or thermoset. Properties of sheath and conductor insulation along with the assembly contribute towards the capability of the construction to meet the required flame test and other physical performance requirements. |
| Vertical-Tray Flame Test | Per UL 1277 (UL 1581). Protocol is also known as IEEE 383. | FT 4 Vertical-Tray Flame Test | Per C22.2 No. 0.3. Protocol is also known as IEEE 1202 and considered more severe than IEEE 383. |
| Other required tests include | Cold Bend Test (-25° C), Deformation Test of Jacket, Heat Shock Test of Thermoplastic Jacket, etc. | Other required tests include | Cold Bend (-25° C), Impact Test, Crushing Test, Cold Impact Test, Weather Resistance Test, etc. |
| Marking | Type TC, conductor size, conductor material (where required), voltage rating, identification for ungrounded and grounded conductors, color of insulated grounding conductor, temperature rating (where required), etc. | Marking | Type TC, conductor size, conductor material (where required), voltage rating, identification for ungrounded and grounded conductors, color of insulated grounding conductor, temperature rating (where required), etc. |
| Optional Markings | FT 4 Vertical Tray Flame Test Cold Impact (-40° C) Open Wiring: Type TC shall meet crush and impact requirements for Type MC Sunlight-Resistance Direct Burial VW-1, oil-resistant, gasoline-resistant, reagent-resistant, or other individual conductor use may itself be identified on the tag, reel, or carton. | | Cold Impact (-40° C) (Typically preferred) Low Acid Gas (LAG) (Not a requirement in the CEC or Standards but, complied commercially in most cases.) |