

Informational Note: See 300.4(G) for the protection of conductors size 4 AWG or larger.

354.48 Joints. All joints between conduit, fittings, and boxes shall be made by an approved method.

354.50 Conductor Terminations. All terminations between the conductors or cables and equipment shall be made by an approved method for that type of conductor or cable.

354.56 Splices and Taps. Splices and taps shall be made in junction boxes or other enclosures.

Δ **354.60 Grounding.** Where equipment grounding is required, an assembly containing a separate grounding conductor shall be used.

Exception No. 1: The equipment grounding conductor shall be permitted to be run separately from the conduit where used for grounding dc circuits as permitted in 250.134, Exception No. 2.

Exception No. 2: The equipment grounding conductor shall not be required where the grounded conductor is used to ground equipment as permitted in 250.142.

Part III. Construction Specifications

354.100 Construction.

(A) **General.** NUCC is an assembly that is provided in continuous lengths shipped in a coil, reel, or carton.

(B) **Nonmetallic Underground Conduit.** The nonmetallic underground conduit shall be listed and composed of a material that is resistant to moisture and corrosive agents. It shall also be capable of being supplied on reels without damage or distortion and shall be of sufficient strength to withstand abuse, such as impact or crushing, in handling and during installation without damage to conduit or conductors.

(C) **Conductors and Cables.** Conductors and cables used in NUCC shall be listed and shall comply with 310.10(C). Conductors of different systems shall be installed in accordance with 300.3(C).

(D) **Conductor Fill.** The maximum number of conductors or cables in NUCC shall not exceed that permitted by the percentage fill in Table 1, Chapter 9.

354.120 Marking. NUCC shall be clearly and durably marked at least every 3.05 m (10 ft) as required by 110.21. The type of conduit material shall also be included in the marking.

Identification of conductors or cables used in the assembly shall be provided on a tag attached to each end of the assembly or to the side of a reel. Enclosed conductors or cables shall be marked in accordance with 310.8.

ARTICLE 355

Reinforced Thermosetting Resin Conduit (RTRC)

Part I. General

Δ **355.1 Scope.** This article covers the use, installation, and construction specification for reinforced thermosetting resin conduit (RTRC) and associated fittings.

• **355.6 Listing Requirements.** RTRC, factory elbows, and associated fittings shall be listed.

Part II. Installation

355.10 Uses Permitted. The use of RTRC shall be permitted in accordance with 355.10(A) through (I).

(A) **Concealed.** RTRC shall be permitted in walls, floors, and ceilings.

(B) **Corrosive Influences.** RTRC shall be permitted in locations subject to severe corrosive influences as covered in 300.6 and where subject to chemicals for which the materials are specifically approved.

(C) **Cinders.** RTRC shall be permitted in cinder fill.

(D) **Wet Locations.** RTRC shall be permitted in portions of dairies, laundries, canneries, or other wet locations, and in locations where walls are frequently washed, the entire conduit system, including boxes and fittings used therewith, shall be installed and equipped so as to prevent water from entering the conduit. All supports, bolts, straps, screws, and so forth, shall be of corrosion-resistant materials or be protected against corrosion by approved corrosion-resistant materials.

(E) **Dry and Damp Locations.** RTRC shall be permitted for use in dry and damp locations not prohibited by 355.12.

(F) **Exposed.** RTRC shall be permitted for exposed work if identified for such use.

Informational Note: RTRC, Type XW, is identified for areas of physical damage.

(G) **Underground Installations.** For underground installations, see 300.5 and 305.15.

(H) **Support of Conduit Bodies.** RTRC shall be permitted to support nonmetallic conduit bodies not larger than the largest trade size of an entering raceway. These conduit bodies shall not support luminaires or other equipment and shall not contain devices other than splicing devices as permitted by 110.14(B) and 314.16(C)(2).

(I) **Insulation Temperature Limitations.** Conductors or cables rated at a temperature higher than the listed temperature

rating of RTRC conduit shall be permitted to be installed in RTRC conduit, if the conductors or cables are not operated at a temperature higher than the listed temperature rating of the RTRC conduit.

355.12 Uses Not Permitted. RTRC shall not be used under the following conditions.

(A) Hazardous (Classified) Locations.

- (1) In any hazardous (classified) location, except as permitted by other articles in this *Code*
- (2) In Class I, Division 2 locations, except as permitted in 501.10(B)(1)(6)

(B) Support of Luminaires. For the support of luminaires or other equipment not described in 355.10(H).

(C) Physical Damage. Where subject to physical damage unless identified for such use.

Type RTRC installed in a location where the raceway is subject to physical damage must be marked "XW." If the location is above ground and exposed to physical damage, the conduit must be marked "AG XW RTRC."

See also

305.15(A), 334.15(B), 501.10(B)(1)(6), and 551.80(B) for examples of requirements specifying the use of RTRC-XW

(D) Ambient Temperatures. Where subject to ambient temperatures in excess of 50°C (122°F) unless listed otherwise.

(E) Theaters and Similar Locations. In theaters and similar locations, except as provided in 518.4 and 520.5.

In addition to the conditions in 355.12(A) through (E), nonmetallic conduits are not permitted to be installed in ducts, plenums, and other air-handling spaces.

See also

300.22, which limits the use of materials in ducts, plenums, and other air-handling spaces, which could contribute smoke and products of combustion during a fire

355.20 Size.

(A) Minimum. RTRC smaller than metric designator 16 (trade size ½) shall not be used.

Δ **(B) Maximum.** RTRC larger than metric designator 155 (trade size 6) shall not be used.

Informational Note: See 300.1(C) for the trade sizes and metric designators that are for identification purposes only and do not relate to actual dimensions.

355.22 Number of Conductors. The number of conductors shall not exceed that permitted by the percentage fill specified in Table 1, Chapter 9. Cables shall be permitted to be installed where such use is not prohibited by the respective cable articles.

The number of cables shall not exceed the allowable percentage fill specified in Table 1, Chapter 9.

Table 1 of Chapter 9 specifies the maximum percent fill of conduit or tubing. No internal dimensions for Type RTRC are given in the *NEC*® for calculating the allowable number of conductors. Conductor fill calculation can be in accordance with provided dimensions marked on the conduit. For the exact dimensions for fill calculations of RTRC, refer to the product standard or to the manufacturers' product information.

Δ **355.24 Bends.**

(A) How Made. Bends shall be so made that the conduit will not be damaged and the internal diameter of the conduit will not be effectively reduced. Field bends shall be made only with identified bending equipment. The radius of the curve to the centerline of such bends shall not be less than shown in Table 2, Chapter 9.

(B) Number in One Run. The total degrees of bends in a conduit run shall not exceed 360 degrees between pull points.

• **355.28 Trimming.** All cut ends shall be trimmed inside and outside to remove rough edges.

355.30 Securing and Supporting. RTRC shall be installed as a complete system in accordance with 300.18 and shall be securely fastened in place and supported in accordance with 355.30(A) and (B).

(A) Securely Fastened. RTRC shall be securely fastened within 900 mm (3 ft) of each outlet box, junction box, device box, conduit body, or other conduit termination. Conduit listed for securing at other than 900 mm (3 ft) shall be permitted to be installed in accordance with the listing.

(B) Supports. RTRC shall be supported as required in Table 355.30(B). Conduit listed for support at spacing other than as shown in Table 355.30(B) shall be permitted to be installed in accordance with the listing. Horizontal runs of RTRC supported by openings through framing members at intervals not exceeding

TABLE 355.30(B) Support of Reinforced Thermosetting Resin Conduit (RTRC)

Conduit Size		Maximum Spacing Between Supports	
Metric Designator	Trade Size	mm or m	ft
16–27	½–1	900 mm	3
35–53	1¼–2	1.5 m	5
63–78	2½–3	1.8 m	6
91–129	3½–5	2.1 m	7
155	6	2.5 m	8

TABLE 355.44 Expansion Characteristics of Reinforced Thermosetting Resin Conduit (RTRC) Coefficient of Thermal Expansion = 2.7×10^{-5} mm/mm/°C (1.5×10^{-5} in./in./°F)

Temperature Change (°C)	Length Change of RTRC Conduit (mm/m)	Temperature Change (°F)	Length Change of RTRC Conduit (in./100 ft)	Temperature Change (°F)	Length Change of RTRC Conduit (in./100 ft)
5	0.14	5	0.09	105	1.89
10	0.27	10	0.18	110	1.98
15	0.41	15	0.27	115	2.07
20	0.54	20	0.36	120	2.16
25	0.68	25	0.45	125	2.25
30	0.81	30	0.54	130	2.34
35	0.95	35	0.63	135	2.43
40	1.08	40	0.72	140	2.52
45	1.22	45	0.81	145	2.61
50	1.35	50	0.90	150	2.70
55	1.49	55	0.99	155	2.79
60	1.62	60	1.08	160	2.88
65	1.76	65	1.17	165	2.97
70	1.89	70	1.26	170	3.06
75	2.03	75	1.35	175	3.15
80	2.16	80	1.44	180	3.24
85	2.30	85	1.53	185	3.33
90	2.43	90	1.62	190	3.42
95	2.57	95	1.71	195	3.51
100	2.70	100	1.80	200	3.60

those in Table 355.30(B) and securely fastened within 900 mm (3 ft) of termination points shall be permitted.

355.44 Expansion Fittings. Expansion fittings for RTRC shall be provided to compensate for thermal expansion and contraction where the length change, in accordance with Table 355.44, is expected to be 6 mm (¼ in.) or greater in a straight run between securely mounted items such as boxes, cabinets, elbows, or other conduit terminations.

Because RTRC exhibits a considerable change in length per degree change in temperature, expansion fittings are required for specific variations in temperature. In some areas, outdoor temperature variations of over 100°F are common. According to Table 355.44, a 100-foot run of RTRC will change 1.80 inches in length if the temperature change is 100°F. Information concerning installation and application of this type of coupling can be obtained from manufacturers' instructions. Expansion fittings are seldom used underground, where temperatures are relatively constant.

See also

300.7(B) and its commentary regarding the expansion of RTRC

355.46 Bushings. Where a conduit enters a box, fitting, or other enclosure, a bushing or adapter shall be provided to protect the wire from abrasion unless the box, fitting, or enclosure design provides equivalent protection.

Informational Note: See 300.4(G) for the protection of conductors 4 AWG and larger at bushings.

355.48 Joints. All joints between lengths of conduit, and between conduit and couplings, fitting, and boxes, shall be made by an approved method.

355.56 Splices and Taps. Splices and taps shall be made in accordance with 300.15.

Δ 355.60 Grounding. Where equipment grounding is required, a separate grounding conductor shall be installed in the conduit.

Exception No. 1: The equipment grounding conductor shall be permitted to be run separately from the circuit conductors as permitted in 250.134, Exception No. 2, for dc circuits and 250.134, Exception No. 1, for separately run equipment grounding conductors.

Exception No. 2: An equipment grounding conductor shall not be required where the grounded conductor is used to ground equipment as in 250.142(A).

Part III. Construction Specifications

355.100 Construction. RTRC and fittings shall be composed of suitable nonmetallic material that is resistant to moisture and chemical atmospheres. For use aboveground, it shall also be flame retardant, resistant to impact and crushing, resistant to distortion from heat under conditions likely to be encountered in service, and resistant to low temperature and sunlight effects. For use underground, the material shall be acceptably resistant to moisture and corrosive agents and shall be of sufficient strength