

Steel Conduit

# TECH TALKS

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## FITTINGS

Technical information about steel  
conduit and electrical metallic tubing



When planning a new construction project, renovation or addition to an existing structure, you need to choose which wiring method is the most effective, taking into consideration physical protection, location, required corrosion resistance and whether it must serve as an equipment grounding conductor. Steel raceways, such as Rigid Metal Conduit (RMC), Intermediate Metal Conduit (IMC), and Electrical Metallic Tubing (EMT), will meet all these various installation needs. However, you will need to select the proper fittings for the installation to help ensure the raceway's performance.

*Note: Elbows, couplings and nipples are not considered fittings because they are evaluated in accordance with the applicable raceway product standard.*

## PRODUCT/PACKAGING MARKINGS

The decision can be made simpler if you know what product or package markings to look for and the proper installation steps for such fittings:

- One of the major benefits of steel raceways is that they can be used as an equipment grounding conductor per National Electrical Code® (NEC®) Sections 342.60, 344.60, 358.60 and 250.118. Since steel conduit and tubing can be used as an equipment grounding conductor, all fittings and connectors associated with them must pass a resistance and continuity test to confirm that they can provide an effective ground fault current path to receive a product listing under safety standard UL® 514B. All metal fittings for use with non-flexible metal raceways must pass both of the following tests:
  - Resistance test — For this test, the fitting / connector is assembled either joining two pieces of steel raceway or attaching a piece of steel raceway to a box. The resistance is measured between two points on the assembly as a specified amperage is passed through the assembly. The resistance measured cannot exceed a specific amount or the fitting / connector will not pass.
  - Current test — For this test, a high current is passed through the assembly for a specific period. The fitting must withstand the current for the specified amount of time without showing any signs of damage. After the fitting is subjected to the current, a continuity test is performed. The fitting must continue to provide continuity after the current test to pass this portion of the listing.
- Any fitting that is Listed to UL 514B for use with steel raceways is tested to be used as an equipment grounding conductor raceway system. **To verify that the fitting has been tested for carrying current, make sure the label states, “Listed to UL 514B and/or CSA C22.2 no. 18.3-12 for use with Rigid Metal Conduit (RMC), Intermediate Metal Conduit (IMC), or Electrical Metallic Tubing (EMT)”.**
- Encasement of steel raceways in concrete requires that the fittings being used are listed to UL 514B and/or CSA C22.2 no. 18.3-12 as concrete-tight. **Look for the listing mark and “Concrete-tight” on the package or label.**
  - Compression-type fittings are concrete-tight if they are listed to the UL or CSA standards listed above.
  - Set screw fittings may be required to be taped to be concrete-tight. If this is the case, the markings on the package will state **“Concrete-tight when taped”** or similar wording.
- When installing steel raceways below grade, in concrete slabs, in direct contact with earth, in locations subject to saturation with water or other liquids, or in unprotected locations exposed to weather, it is considered a “Wet Location” by the National Electrical Code. **To ensure use of the proper fittings in these environments, look for the package or label to state “Wet Locations” and listed to UL 514B and/or CSA C22.2 no. 18.3-12.**
  - Sometimes the package may say **“Raintight”** instead of “Wet Locations” but should still state it is listed to the UL or CSA standard.
- Steel Conduit and Tubing can be used in many hazardous locations according to NEC Article 500. Below are some general guidelines for choosing the correct fitting for the installation:
  - Standard threaded couplings provided with steel conduit are permitted for use in all Class, Division and Zone locations.
  - Division 1 locations require that the fitting be listed for the specific purpose. **When using steel conduit in a Division 1 location, you need to make sure the fitting is listed to UL 1203 and marked for the specific location, such as Class I Division 1.**
  - Division 2 locations are considered to be ordinary locations per the applicable product standard; therefore, you do not need nor can you receive a listing for a Division 2 location on a fitting.
  - If the location requires a type rating such as “Dust-tight” for Class II, Division 2 or Class III, Division 2, fittings need this special listing requirement in order to comply with installation requirements per the NEC or CE Code Part 1.



## FITTING INSTALLATION

Once you have confirmed the use of the appropriate fitting for the location, the next step is proper installation of the fitting. The bullet points below will cover proper installation procedures for set screw and compression-type fittings for use with steel raceways. Also outlined are some of the requirements the fitting must pass to receive certification by a Qualified Testing Laboratory and ensure that when properly installed and maintained, the fitting will not separate.

- Set Screw-Type Fittings
  - When installing set screw type fittings, the industry-recommended practice is to tighten the screw / bolt to the torque that can be applied by the screwdriver itself. Do not over-tighten by using a wrench or any other tool to help apply more torque to the screw. *Performance of the fitting may be reduced by over-tightening as much as it can be by under-tightening.*
  - When set screw fittings are tested to UL 514B or CSA C22.2, the following torque values are used unless a manufacturer specifies a torque value:
    - The torque value used for a No. 8 screw is 20 lbf-in.
    - The torque value used for a No. 6 screw is 12 lbf-in.
    - The torque value used for all other size screws is 35 lbf-in.
    - After the fitting is tightened to the proper torque, a pull test is performed using 300–1000 lbf, depending on trade size, to ensure the fitting does not separate.
    - If a manufacturer provides torque values in their installation procedures for the fitting, these values should be used when tightening the fitting.
- Compression-Type Fittings
  - The industry-recommended practice for installing compression-type fittings is to tighten the nut the maximum amount allowed by hand and then wrench-tighten.
  - When compression fittings are tested, the following torque values are used unless a manufacturer specifies a torque value:
    - ½ trade size fitting is tightened to 300 lbf-in
    - ¾ trade size fitting is tightened to 500 lbf-in.
    - 1 trade size fitting is tightened to 700 lbf-in.
    - 1 ¼ trade size fitting is tightened to 1000 lbf-in.
    - 1 ½ trade size fitting is tightened to 1200 lbf-in.
    - 2–4 trade size fittings are tightened to 1600 lbf-in.
    - After the fitting is tightened to the proper torque, a pull test is performed using 300–1000 lbf, depending on trade size, to ensure the fitting does not separate.
    - If a manufacturer provides torque values in their installation procedures for the fitting, these values should be used when tightening the fitting.

## CONDUIT / TUBING INSTALLATION

Proper installation of the fittings also requires proper installation of the conduit / tubing, which means securing the conduit properly and knowing which conduit to use.

- The securing and supporting of steel conduit and tubing is covered by the NEC in Section .30 of Articles 342, 344 and 358. These sections require that conduit and tubing be supported every 10 feet and securely fastened within 3 feet from every outlet box, junction box, device box, cabinet, conduit body or other termination. Improper securement of the conduit can put extra strain on the fitting, possibly leading to a premature failure of the fitting.
- Choosing the right steel raceway for the installation can also have an impact on the performance of the system. RMC and IMC are permitted be used under all atmospheric conditions and in areas subject to severe physical damage. EMT is permitted to be installed in areas subject to physical damage but not in areas subject to severe physical damage. If installing a raceway in an area known to be subject to physical damage with the possibility of extensive physical damage or repeated damage, RMC or IMC should be used instead of EMT.

When the correct fittings are chosen and they are installed properly, steel raceway systems are an economical, flexible, effective and long-lasting method for electrical systems.

