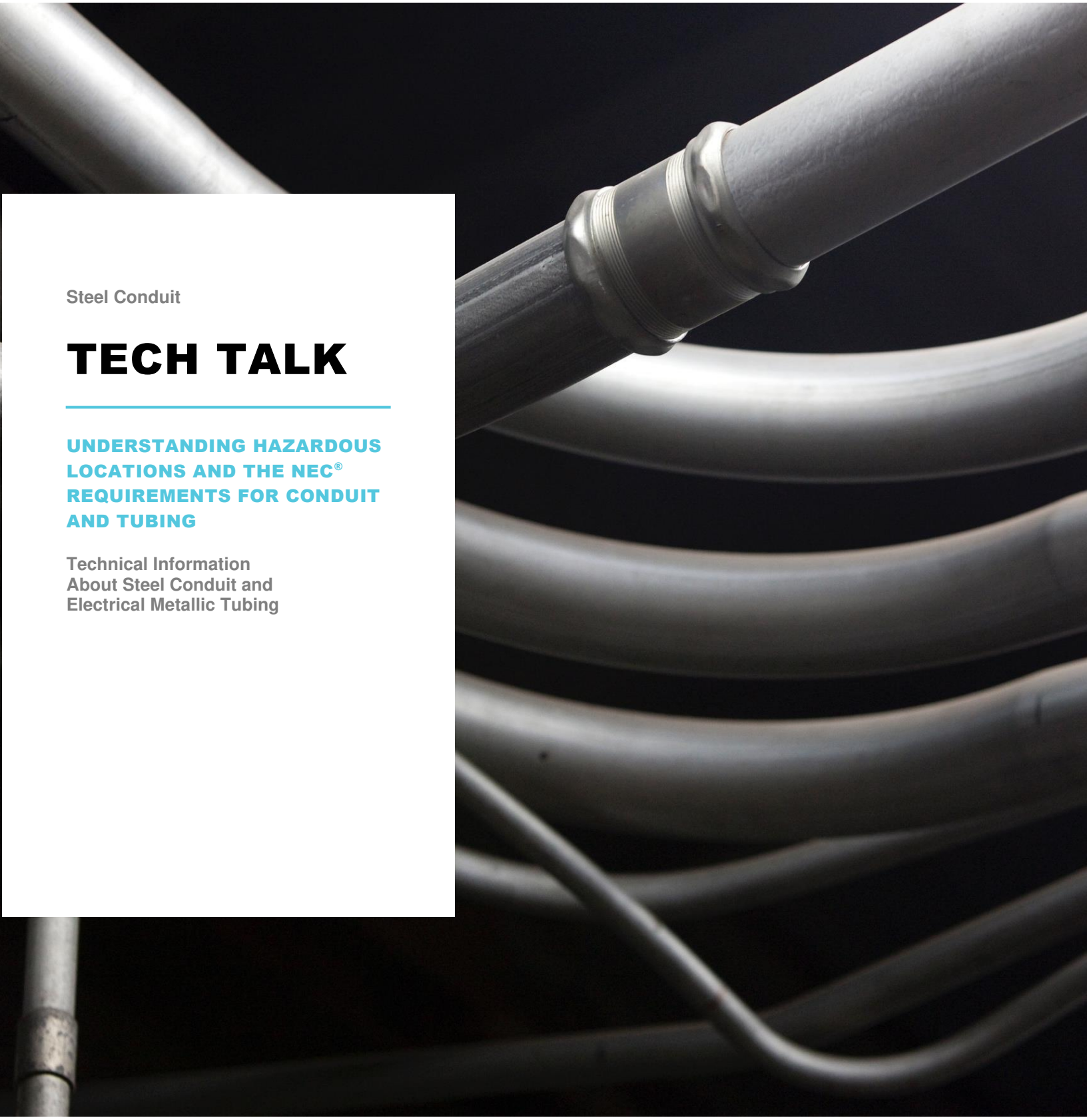
STEEL TUBE INSTITUTE



Steel Conduit

TECH TALK

UNDERSTANDING HAZARDOUS LOCATIONS AND THE NEC® REQUIREMENTS FOR CONDUIT AND TUBING

Technical Information
About Steel Conduit and
Electrical Metallic Tubing

KNOW YOUR LOCATION, KNOW YOUR WIRING METHOD

Do you know if you are installing wiring in a hazardous (classified) location? The technical information included in this paper can be used as a guide to help determine the correct classification and further understand the conduit and tubing requirements governed by the National Electrical Code® (NEC) when installing electrical wiring in hazardous locations.

CLASSIFICATION OF LOCATION

First, the classification of the location must be determined. Chapter 5 of the NEC contains information for Special Occupancies, including hazardous (classified) locations. Article 500, Section 500.5 (A) through (D) provides information describing the classes and divisions.

Often, the hazardous area classification and extent is determined by a team that can include chemical, electrical, insurance, mechanical, process, safety and other representatives. The authority having jurisdiction (AHJ) is responsible for approving electrical equipment in the hazardous location but does not typically classify the area. Some occupancies have specific area classifications provided in NEC Articles 511 through 517.

To classify hazardous locations, we use two guidelines:

- NFPA 497, Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas
- NFPA 499, Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas

Additional information is available from the International Society of Automation (ISA) and the American Petroleum Institute (API).

This technical paper addresses Class I, II and III hazardous locations only. Additional information on the zone classification system can be referenced in Articles 505 and 506.

Class I Locations:

- Locations where flammable gases, flammable liquid-produced vapors or combustible liquid-produced vapors are or may be present in the air, in quantities sufficient to produce explosive or ignitable mixtures.

Class II Locations:

- Locations that are hazardous because of the presence of combustible dust.

Class III Locations:

- Locations that are hazardous because of the presence of easily ignitable fibers or where materials producing combustible flyings are handled, manufactured or used, but such fibers / flyings are not likely to be in suspension in the air in quantities sufficient to produce ignitable mixtures.

For each hazardous location class there is a division, which can be either a 1 or a 2. The major difference between a Division 1 and Division 2 area is determined by the presence of the hazardous material:

Division 1:

- Vapors, liquids, dusts and other hazardous materials are present under normal operating conditions or can exist frequently because of maintenance or equipment failure.

Division 2:

- Hazardous materials exist through handling, storage or abnormal and infrequent malfunctioning. The NEC contains more specific information for the identification of the specific class or division of a location.

Underwriters Laboratories and the U.S. Occupational Safety and Health Administration (OSHA) also publish information for identifying and determining the class and division for hazardous locations. Their information and descriptions are similar to what is published in the NEC. For that specific information, refer to UL's guide information AAIZ, Equipment for Use in and Relating to Class I, II and III Hazardous Locations, and OSHA Standards CFR 1910. 307 and CFR 1926.407; specifically, 1910.399 and 1926.449 for definitions.

WIRING METHODS

After the hazardous location classification and division is determined, you can choose the appropriate wiring method. This technical paper will focus on rigid metal conduit (RMC), intermediate metal conduit (IMC) and electrical metallic tubing (EMT) installed in Class I, II and III, Division 1 and 2 locations. The requirements for these raceways and wiring methods in normal locations and occupancies can be found in the following articles: 342 for IMC, 344 for RMC and 358 for EMT. For hazardous locations, you must refer to Articles 501 for Class I, 502 for Class II and 503 for Class III.

Below is a breakdown of the conduit and tubing permitted by the Hazardous Location Articles:

501 — Class I Locations

Class I, Division 1:

- Threaded rigid metal conduit (Type RMC) or threaded steel intermediate metal conduit (Type IMC)

Class I, Division 2:

- Threaded rigid metal conduit (Type RMC) or threaded steel intermediate metal conduit (Type IMC)
- Rigid metal conduit (Type RMC) and intermediate metal conduit (Type IMC) with listed threaded or threadless fittings

502 — Class II Locations

Class II, Division 1:

- Threaded rigid metal conduit (Type RMC) or threaded steel intermediate metal conduit (Type IMC)

Class II, Division 2:

- Threaded rigid metal conduit (Type RMC) or threaded steel intermediate metal conduit (Type IMC)
- Rigid metal conduit (Type RMC), intermediate metal conduit (Type IMC), with listed threaded or threadless fittings
- Electrical metallic tubing (Type EMT)

503 — Class III Locations

Class III, Division 1:

- Rigid metal conduit (Type RMC), intermediate metal conduit (Type IMC) or electrical metallic tubing (Type EMT)

Class III, Division 2:

- Rigid metal conduit (Type RMC), intermediate metal conduit (Type IMC) or electrical metallic tubing (Type EMT)

As shown above, all conduit and tubing wiring methods identified for each Division 1 location are also allowed for Division 2.

Rigid metal conduit and intermediate metal conduit suitable for use in Division 1 locations include the elbows, nipples and associated standard threaded rigid metal conduit couplings. These couplings are listed as part of the conduit standard, either UL® 6 for RMC or UL 1242 for IMC. Standard threaded rigid metal conduit couplings are stamped "EC" as part of the UL listing standard. The threaded and threadless couplings referenced under Division 2 locations would apply to fittings. All threaded and threadless fittings must be listed for use in hazardous locations. In addition, all fittings used for connecting EMT must also be listed.

EXPLOSION PROOF

STI members often receive questions about whether conduit and conduit couplings are "explosion proof." The NPT tapered conduit thread and straight tapped conduit coupling are designed so that five full threads are engaged when the connection is wrench tight. This thread engagement was designed to contain internal explosions. The threaded connections allow the burning gas to cool as it escapes, so that any explosion would be confined to the inside of the conduit. This connection is not designed to prevent an explosion — full prevention is not possible — but the possibility of an explosion is mitigated.

NEC Section 501.15, Sealing and Drainage, includes the requirements for using conduit seals. "Sealoff" or "sealing" fittings can be used to further mitigate the possibility of an explosion. These fittings minimize the passage of gases and vapors from traveling freely through the conduit. These devices are designed to stop or localize explosive gases from traveling through the conduit. They also prevent flames from passing throughout the electrical installation. Depending on the location, underground conduits entering buildings may also require sealing fittings.

In addition to 501.15, 501.15(A)(1)(1) permits only threaded couplings or explosion-proof fittings between the sealing fitting and the explosion-proof enclosure.

GROUNDING AND BONDING

Article 250 Section 250.118 permits RMC, IMC and EMT to be used as an equipment grounding conductor. When installing conduit and tubing in any location, especially hazardous locations, it is important to ensure the electrical continuity of the metal raceways. Class I, II and III locations are required to be grounded and bonded as specified in Article 250, including 250.100; however, the .30(A) section for each class requires bonding by using a bonding jumper or other approved means of bonding. Locknut-bushing or double-locknut types of connection do not meet the requirements for bonding.

IN SUMMARY

Several organizations and standards offer information for identifying a hazardous or classified location, such as NFPA, UL and OSHA. As stated in the 2014 NEC Handbook, locations are "classified as hazardous due to the materials handled, processed, or stored in those locations. Hazardous (classified) locations, if properly treated, are not necessarily any more dangerous to work in than other areas or locations." In these locations, it is important to install only approved wiring methods and raceways. One easy requirement to remember is this: You cannot go wrong with rigid metal conduit and intermediate metal conduit. They are permitted in all hazardous (classified) locations.

As with all electrical installation, any local codes or amendments must be reviewed, along with approval by the AHJ. For further information, please see the Steel Tube Institute website at steeltubeinstitute.org/steel-conduit

Referenced Standards:

- NFPA 70, National Electrical Code (2020)
- NFPA 70, National Electrical Code Handbook (2020)
- UL AAIZ Guide Information, Equipment for Use in and Relating to Class I, II and III, Division 1 and 2 Hazardous Locations (2019)