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Selection and Installation Guidelines
for Fittings for Use with Non-Flexible Metallic Conduit or Tubing
(Rigid Metal Conduit, Intermediate Metal Conduit,
and Electrical Metallic Tubing)

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Foreword

The selection and installation guidelines provided herein offer practical information on correct product selection and industry-recommend practices for the installation of fittings for non-flexible conduit or cable in accordance with the *National Electrical Code*® (NEC).

These guidelines have been developed and approved by the NEMA Conduit Fittings Section, which periodically reviews them for any revisions necessary to address changing conditions, product listing and installation requirements, and technical progress. Section approval of this Standard does not necessarily imply that all Section Members voted for its approval or participated in its development.

Comments for proposed revisions are welcome and should be submitted to:

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NEMA FB 2.10-2021 revises and supersedes NEMA FB 2.10-2013.

At the time this Standard was approved, the Conduit Fittings Section was composed of the following Members:

ABB Inc.	Memphis, TN
Arlington Industries, Inc.	Scranton, PA
Atkore International	Harvey, IL
Bridgeport Fittings, LLC	Stratford, CT
Eaton's Crouse-Hinds Business	Syracuse, NY
Emerson Automation Solutions	Rosemont, IL
Hubbell Incorporated	Shelton, CT
IPEX USA, LLC	Oakville, ON, Canada
Legrand, North America	Syracuse, NY
nVent CADDY	Solon, OH
Producto Electric Corporation	Orangeburg, NY
Progressive Machine Die, Inc.	Macedonia, OH
Sigma Electric Manufacturing Corporation	Garner, NC
Southwire Company	Carrollton, GA
Steel Electric Products Co., Inc.	Brooklyn, NY

Introduction

It is a common perception that in any continuous system, the joints (splices, taps, couplings, connections) are the weakest link. In fact, specifically by design, this is not usually the case. In order to achieve this design performance, variables such as *selection, preparation,* and *assembly technique* must be considered. We know it is not practical to have a system without joints, so we strive to build in safety where these occur.

The expectations and demands on our electrical raceway systems have continued to evolve. Many metallic conduit raceway systems (conduit, fittings, and enclosures) are relied upon both to provide mechanical protection for circuit conductors and to carry potentially dangerous fault currents. Non-flexible metallic and nonmetallic conduit and metallic and composite cable systems have been introduced to meet ever-changing market needs. Emerging manufacturing technology and economic pressures have resulted in noticeable changes to some system components.

Because of this evolution, sole reliance on the historical mechanical evaluation criteria of the system's components is of increasing concern to those charged with approving an installation. These concerns are very often evidenced through product Standards development and installation code processes.

Along with evolving manufacturing technology, improved and new materials and processes are used in the manufacture of conduit fittings. Considering the variety of materials—steel, iron, aluminum, zinc, and engineered plastics—the industry has come a long way in providing numerous options to suit an infinite number of applications. Through the years, NEMA Member companies that manufacture conduit fittings have met the needs of the market with new and innovative product designs that continue to live up to higher Standards demanded by the market.

These guidelines are written by the NEMA Conduit Fittings Section (BI-FB) to provide installers and inspectors with an industry perspective of best practices in selecting and installing the products we manufacture. Focus is placed on important fundamentals and recent changes to codes, product Standards, and latest technologies. The Member companies of the NEMA Conduit Fittings Section promote the selection and installation of Listed conduit and cable fittings, Listed conduit and cable, and associated supports. Listing of electrical system components qualifies them to minimum performance requirements and provides for ongoing conformity surveillance. Listed conduit fittings can be recognized by the trademark of the qualified electrical testing laboratory on the part or its smallest unit container.

It is our objective to maintain a closer liaison with the installers of our products and the professional electrical inspector. Through this liaison, we intend to provide uniform education and understanding as to the intended use and application of our products and develop an alliance, founded in trust, that will enable us together to address and resolve the concerns and challenges we each face. Thousands of downloads of earlier editions of this document and its regular use as a reference in codes and Standards forums give us confidence that we are meeting this objective.

Note 1: All references to the *National Electrical Code* are to the 2020 Edition.
Note 2: NFPA 70®, *National Electrical Code*, and *NEC* are registered trademarks of the National Fire Protection Association, Quincy, MA.

Product Standards and Installation Codes

Conduit and cable fittings for use in “ordinary” (unclassified) locations in the U.S. are typically designed and manufactured to meet the requirements of NEMA Standards Publication ANSI/NEMA FB 1 *Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable*. “Listed” fittings are typically evaluated to Underwriters Laboratories (UL) Standard ANSI/UL 514B *Conduit, Tubing, and Cable Fittings.* Specific use information related to Listed fittings is available in the UL General Information for Electrical Equipment Directory, or online at www.ul.com.

Conduit and cable fittings designed and manufactured to ANSI/NEMA FB 1 have fundamental design elements in common. NEMA conduit and cable fittings manufacturers have agreed that these basic design and construction features are fundamental to safety, performance, interchangeability, and system compatibility. Besides outlining the essential functional characteristics of conduit and cable fittings, ANSI/NEMA FB 1, as a voluntary consensus design Standard, tends to be very specific in suggesting types of materials, acceptable wall thickness, corrosion protection, and other minimum criteria for metallic components and physical properties requirements for nonmetallic components.

An evaluation by a qualified electrical testing laboratory verifies that Listed fittings contain essential design characteristics such as conduit end stops, conduit centering stops (for couplings), smooth-rounded wire entries, minimum corrosion protective coatings, and essential dimensions (e.g., throat diameters) that are within specified tolerances. A Listed conduit fitting can be identified by the distinctive trademark of the testing laboratory on the fitting itself and/or on the smallest unit container. Performance tests include mechanical sequences (e.g., Assembly, Bend Tests, Pull Tests) and electrical tests (e.g., electrical resistance before and after the Bend Test in mechanical sequence, Fault Current Test, Electrical Continuity Test) designed to represent “real life” for these fittings both during installation and in service throughout the useful life of the system.

As one might imagine, these Standards are dynamic and change over time to facilitate the introduction of new technologies and to address the needs and expectations of the installer and the electrical inspector. They also meet with the intent of *NEC* Section 110.3(B) by providing the installer with necessary information.

Given that all “Listed” fittings have met the appropriate design and performance requirements, the selection of the right fitting for an application is the single most important factor leading to a safe, effective, and permanent installation. The way things used to be—“I’ve always used that fitting for this application”—may not be the right way today. We have to get back to the fundamentals.

Beyond **selection** of the right fitting for the application, almost every other variable comes down to good **workmanship**, something every craftsman takes pride in and that is fundamentally required by *NEC* Section 110.12, and **personal preference** in selecting optional features and benefits that distinguish alternative brands.

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Section 1
Fittings for Use with Electrical Metallic Tubing (EMT)

Steel, stainless steel, or aluminum electrical metallic tubing (EMT) is for use in virtually all types of electrical systems as a raceway for branch circuits, feeders, and service entrances. *NEC* Section 358.6 requires that "EMT, factory elbows, and associated fittings shall be listed." EMT is permitted in wet, damp, and dry locations and may be used exposed or concealed, buried directly in earth, or embedded in concrete. For a detailed description of the permitted uses of EMT, refer to NFPA 70 *National Electrical Code* (*NEC*)*,* Section 358.10.

NEC Section 250.118(4) permits electrical metallic tubing to serve as the equipment grounding conductor, to ground metal boxes, enclosures, etc., of the electrical system to a single grounding point.

The requirements for Listed electrical metallic tubing are found in:

a. UL 797 *Electrical Metallic Tubing – Steel*
b. UL 797A *Electrical Metallic Tubing – Aluminum and Stainless Steel*
c. ANSI C80.3 *Electrical Metallic Tubing—Steel (EMT-S)*

1.1 Fitting Selection

The *NEC*, in Section 300.15, requires that "fittings and connectors shall be used only with the specific wiring methods for which they were designed and listed."

EMT fittings are available in a variety of materials such as steel, malleable iron, aluminum, and zinc. Selection of the material type of a fitting is a matter of design considerations or personal preference, as all Listed fittings conform to the same minimum performance criteria. ANSI/UL 514B contains the requirements for Listed EMT fittings. Other industry Standards pertaining to EMT fittings are ANSI/NEMA FB 1 and Federal Specification A-A-50553A (superseding A-A-50553 and W-F-408E).

Two general categories describe how fittings attach to EMT to ensure a sound mechanical and electrical connection: set-screw type and compression (gland) type. See Figure 1-1 for typical designs. Specialized indenter-type fittings are also available for use with EMT. Indenter-type fittings rely on a specific indenting tool to indent both the fitting and the tubing. In addition to box connectors and couplings, other fittings designed for use with EMT include:

combination couplings: Are designed to make the transition in a raceway from EMT to another raceway type such as rigid metal conduit (RMC), intermediate metal conduit (IMC), flexible metal conduit (FMC), liquidtight flexible metal conduit (LFMC), or another trade size of EMT.

pull elbows: Change the direction of the raceway by 90° or less and have a removable cover to facilitate wire pulling.

conduit bodies: Provide access to conductors in the raceway, allow for a change in direction of the raceway, and when Listed for the purpose and marked with an internal volume, may accommodate splices or installation of certain wiring devices.

expansion-deflection fitting: A raceway accessory that compensates for the linear expansion, linear contraction, and offset or angular deflection of a raceway system.

expansion fitting: A raceway accessory that compensates for the linear expansion or contraction of a raceway system.