NEMA Standards Publication

NEMA FB 2.20-2014

Selection and Installation Guidelines for Fittings for Use with Flexible Electrical Conduit and Cable

National Electrical Manufacturers Association

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Published by:

National Electrical Manufacturers Association
1300 North 17th Street, Suite 900
Rosslyn, Virginia 22209

www.nema.org

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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 flexible conduit or cable in accordance with the *National Electrical Code*®.

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 the 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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At the time this standard was approved, the Conduit Fittings Section was composed of the following members:

Adalet, a Division of Scott Fetzer	Cleveland, OH
AFC Cable Systems, Inc., a part of Atkore International	New Bedford, MA
Appleton Group	Rosemont, IL
Arlington Industries, Inc.	Scranton, PA
Bridgeport Fittings, Inc.	Bridgeport, CT
Calpipe Industries, Inc.	Downey, CA
Crouse-Hinds by Eaton	Syracuse, NY
Eaton's B-Line Business	Highland, IL
ERICO	Solon, OH
Hubbell Incorporated	Shelton, CT
IPEX USA LLC	Mississauga, ON, Canada
Legrand/Pass & Seymour	Syracuse, NY
Producto Electric Corporation	Orangeburg, NY
Progressive Machine Die, Inc.	Walton Hills, OH
Sigma Electric Manufacturing Corporation	Garner, NC
Steel Electric Products Company, Inc.	Brooklyn, NY
Thomas & Betts, A member of the ABB Group	Memphis, TN

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Introduction

It is a common perception that in any continuous system, the joints (splices, taps, couplings, and 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 to provide mechanical protection for circuit conductors and to carry potentially dangerous fault currents. 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 a 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 and cable fittings. Considering the variety of materials, such as steel, iron, aluminum, zinc, and engineered plastics, the industry has come a long way in providing numerous options to solve an infinite number of applications. Over the years, NEMA member companies that manufacturer conduit and cable 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 (5-FB). They 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 and cable 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 to 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, gives us confidence that we are meeting this objective. This and other valuable NEMA documents are available for download free of charge at www.nema.org.

NOTE—All references to the *National Electrical Code*® *(NEC)* are to the 2014 Edition.

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 and Cable Assemblies*. “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, inter-changeability, 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 or cable 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 bend test in mechanical sequence, fault current test, electrical continuity test) designed to represent “real life” for these fittings 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, **selection** of the right fitting for the 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 to **personal preference** in selecting optional features and benefits that distinguish alternative brands.