

Analyzing NFPA 790 and 791

*Adoption of criteria helps standardize the work of field evaluation bodies
and helps electrical inspectors determine competency*

Executive Summary

The electrical industry has evolved tremendously since the days of Thomas Edison and Nikola Tesla battling for widespread use of direct and alternating current. Today, concealed knob and tube wiring is rarely installed. Incandescent light bulbs have almost been rendered extinct. The “Pushmatic” type of circuit breaker is disappearing. In their place, technology has ushered in energy efficient lighting, photovoltaics, fuel cells, and wind electric systems.

In order to keep workers and the public safe from the hazards of electricity, it falls to the electrical inspection industry to approve new electrical equipment, materials, installations, and procedures. In the United States specifically, the electrical safety system—comprised of the Occupational Safety and Health Administration (OSHA), Nationally Recognized Testing Laboratories (NRTLs), Field Evaluation Bodies (FEBs), Authorities Having Jurisdiction (AHJs), and others—ensures products meet safety standards and are capable of being installed in accordance with applicable codes including the National Electrical Code (NEC).

However, with electrical products being developed and brought to market at a dizzying pace, electrical inspectors are under much pressure to keep pace. To do so, they must be able to rely on third-party testing organizations like an FEB, which is why the National Fire Protection Association (NFPA) recently published requirements for FEB competency and standards for determining FEB acceptability.

This paper takes a closer look at these two standards that make a significant impact on the way the electrical inspection industry approves equipment and installations:

- NFPA 790: Standard for Competency of Third-Party Field Evaluation Bodies
- NFPA 791: Recommended Practice and Procedures for Unlabeled Electrical Equipment Evaluation

History of Field Evaluations

The process of listing and labeling electrical products is an important practice that helps ensure compliance with requirements and standards published by OSHA, NFPA, and American National Standards Institute (ANSI), plus other organizations that produce safety standards. It serves to protect the public from possibly fatal electrical hazards. However, over the past 40 years, the electrical inspection industry has seen a significant increase in one-of-a-kind, limited production, used, or modified electrical products that are not listed or field labeled under a certification program.

The roots of this problem can be traced to California, where the number of manufacturing establishments doubled between 1947 and the mid 1970s. At the time, numerous factories were being renovated for the production of electrical components, computing equipment, printing, and scientific instruments. In addition, various other factories were being retrofitted for the automated manufacturing process. This activity led to an abundance of electrical equipment installations with no listing or certification marks to verify that United States codes and safety standards had been met. In some instances, marks had been applied; but they were unrecognizable or questionable to AHJs.

Put in the uncomfortable position of determining if such equipment should be approved, AHJs began to consider the necessity for such electrical equipment to be evaluated in the field. It also fell to the AHJs to determine which bodies would perform such evaluations.

To address these issues, AHJs turned to independent electrical testing firms. At the request of the AHJ, the testing firms evaluated and reported on the safety of the equipment and its compliance with relevant requirements and standards.

NFPA Definitions

Field Evaluations:

The process used to determine conformance with requirements for one-of-a-kind, limited production, used, or modified products that are not listed or field labeled under a certification program.

Authority Having Jurisdiction:

An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

Field Evaluation Body:

An organization, or part of an organization, that performs field evaluations of electrical or other equipment.

Approved:

Acceptable to the authority having jurisdiction.

Third-Party Testing Organizations

FEBs and NRTLs are the two types of testing organizations that support the AHJ, and their basic function is the same. They both perform product safety testing—evaluating and certifying the safety of electrical equipment. But how these organizations are certified and details of how they perform their evaluations can be quite different.

NRTLs must comply with Occupational Safety and Health Administration (OSHA) provisions and are certified by the U.S. Department of Labor. NRTLs perform the service stipulated in Code of Federal Regulations (CFR) 1910.399 (1) which states that an installation of equipment is acceptable to the Assistant Secretary of Labor if it is accepted, or certified, or listed, or labeled, or otherwise determined to be safe by a nationally recognized testing laboratory pursuant to §1910.7. NRTLs provide product safety testing and certification primarily at the point of manufacture. Their listing process involves rigorous (and often destructive) testing of representative samples of a product and periodic factory follow-up verification and inspection (usually 2-4 times per year) to ensure new production exactly mirrors the tested samples.

FEBs must comply with NFPA 790 and 791 standards and have the capability to provide product safety testing and labeling primarily in the field. The field evaluation process involves the non-destructive testing and assessment of each device or piece of equipment. Although some NRTLs offer FEB services, OSHA does not certify FEBs and does not accredit NRTLs to provide FEB services.

OSHA regulations also allow other organizations like FEBs to provide equipment labeling. CFR 1910.399 states: An installation or equipment is acceptable to the Assistant Secretary of Labor, and approved within the meaning of this Subpart S:

(2) With respect to an installation or equipment of a kind that no nationally recognized testing laboratory accepts, certifies, lists, labels, or determines to be safe, if it is inspected or tested by another Federal agency, or by a State, municipal, or other local authority responsible for enforcing occupational safety provisions of the National Electrical Code, and found in compliance with the provisions of the National Electrical Code as applied in this subpart; or

(3) With respect to custom-made equipment or related installations that are designed, fabricated for, and intended for use by a particular customer, if it is determined to be safe for its intended use by

its manufacturer on the basis of test data which the employer keeps and makes available for inspection to the Assistant Secretary and his authorized representatives.

Evolution of the Standards

The processes developed during the early days of field evaluations evolved into the procedures being used today. In fact, the American Council for Electrical Safety (ACES) was formed in 1998 and began a several-year process of drafting a document to address the practice of field evaluation of electrical equipment. In 2003, ACES introduced Recommended Practice and Procedures for Unlabeled Electrical Equipment Evaluation (which would later become NFPA 791).

ACES then focused its efforts on organizations that perform field evaluations. In 2005, ACES published Recommended Competency Guidelines for Third-Party Field Evaluation Bodies (which would later become NFPA 790). ACES then approached NFPA to consider adopting these two documents as new standards.

Meanwhile, International Accreditation Service (IAS), a subsidiary of the International Code Council (ICC), issued Criteria for Field Evaluation of Unlisted Electrical Equipment (AC354) in 2006. This document referenced both ACES documents as part of accreditation requirements.

In 2013, after a thorough vetting process including involvement with ANSI, NFPA adopted the two ACES documents as standards 790 and 791. IAS has since revised its Criteria for Field Evaluation of Unlisted Electrical Equipment to specifically reference these two standards.

Approving Unlabeled Electrical Equipment

In today's electrical industry, it is not uncommon for AHJs to encounter installed electrical equipment that is unlabeled for one reason or another. For example, equipment may lack a label because it:

- Is one of a kind
- Was manufactured in limited quantities
- Was previously used at another location
- Was modified in the field

When an AHJ encounters these types of products, a decision must be made as to whether or not the equipment will be approved. The AHJ has two options: to apply the provisions in NEC Article 110.3 Examination, Identification, Installation and Use of Equipment, or to request a field evaluation. Both options present significant challenges for the AHJ.

Applying the provisions in NEC Article 110.3 is not a simple or quick task. The AHJ must consider factors such as suitability and use of the equipment, mechanical strength and durability, wire bending and connection space, insulation, heating and arcing effects, classification, and safeguarding of persons working on or near the equipment.

Does the AHJ have the time, specific knowledge, tools, testing equipment, and access to relevant standards to adequately consider such factors and make a sound judgment? With the hectic schedule faced by most AHJs, it is unreasonable and unfair to rest this burden solely on their shoulders.

As an alternative to applying NEC Article 110.3, the AHJ can request a field evaluation of the electrical equipment in question. Should this option be selected, the AHJ must do the following:

- Determine the competency of the third-party FEB selected by the owner, contractor, engineer, or stakeholder of the electrical equipment to be evaluated
- Verify the validity of the field evaluation report provided by the FEB

NFPA 790 and 791 were created to help AHJs address these very requirements.

Determining Competency with 790

The provisions of NFPA 790 address requirements for the qualification and competency of a body performing

field evaluations on electrical products and assemblies with electrical components. The purpose of the standard is to help AHJs determine FEB acceptability.

The standard provides the detailed practices and procedures an FEB shall document and submit in writing to the AHJ in order to apply for recognition. This includes information concerning the FEB's:

- Organization and management structure
- Personnel qualifications and training
- Testing and measuring equipment
- Field evaluation preparation
- The evaluation report
- The statement of conformity

Some important considerations that fall into the above categories include ensuring that an FEB is an independent, yet legally identifiable business entity that can provide impartial evaluations while working within a documented structure.

It's also important that an FEB have the appropriate technical background for the areas in which it operates, while being well versed in applicable codes and standards. The FEB needs to be able to specify the standards or requirements that formed the basis for its field evaluation.

Proper documentation and record keeping are also significant considerations. Not only should an FEB have updated documentation regarding its rules and procedures for granting and withdrawing statements of conformity, but it should also have personnel qualification records that specify training, experience, education and more. This information should be part of a defined record retention policy.

Accreditation

Earning accreditation from an organization such as IAS is another way for an FEB to demonstrate its competency. Accreditation from IAS provides objective evidence that an organization operates at the highest level of ethical, legal and technical standards. In fact,

in the accreditation criteria for field evaluation of unlisted electrical equipment, IAS specifically states that organizations “must meet all requirements of this criteria, NFPA 790, and NFPA 791.”

Standardization of Evaluations with 791

The purpose of 791 is to inform AHJs about the recommended evaluation procedures for unlabeled electrical equipment and to aid them in determining acceptability of evaluation results reported by FEBs. Secondly, the document standardizes procedures so that FEBs can perform evaluations in a consistent and reliable manner, thereby facilitating acceptance.

By definition, a field evaluation performed by an FEB addresses one-of-a-kind, limited production, used, or modified equipment. NFPA 791 contains the requirements for pre-site and construction inspections, electrical testing, reporting and documentation, and the FEB statement of conformity or label.

Evaluation Process

The evaluation process to be performed by the FEB and outlined in NFPA 791 is similar to the process an AHJ follows when performing an inspection and includes the following:

- Review of relevant codes and standards
- Visual inspection of the electrical equipment
- Electrical testing
- Written report of discrepancies that references applicable codes and standards
- Final re-inspection to verify compliance
- Labeling

It’s important to note that while NFPA 791 standardizes the field evaluation process, working with the right FEB can ensure that evaluations are completed in a timely fashion. For example, pre-site preparation calls for evaluators to review service history and construction changes, and to consider common noncompliance issues.

Working with an experienced FEB would help to expedite this process, especially when the FEB is intimately aware of relevant electrical testing procedures and standards. Preparation of the written evaluation report and other documentation is also streamlined with an established, qualified FEB. It’s this report, structured per NFPA 791 requirements, that provides guidance to the AHJ when reviewing a field evaluation and determining its acceptability.

Evaluation Site

Field evaluation of equipment is most often performed at the final installation site. However, as stipulated in NFPA 790, preliminary evaluation can be performed at the point of manufacturing, at interim distribution points, and in the FEB’s facilities. When performed, these inspections are to assess the overall construction and safety of the equipment.

Regardless of the site of the evaluation, the testing of products must be performed per the applicable standard, or multiple standards, that apply. However, due to the non-laboratory setting of the testing sites, and the need for the equipment to still function properly after testing, it may not be possible to perform all tests described by applicable standards. For example, destructive type testing and testing components beyond their respective limitations and ratings, which are requirements in some standards, may be impractical. NFPA 791 recognizes this and allows limited testing when necessary.

Field Evaluation Label

After noncompliant items have been resolved, electrical testing has been performed, and the equipment has been evaluated to comply with the applicable standards, a field evaluation label will be placed on the piece of equipment.



Figure 1. One of the most common forms of evidence considered acceptable by AHJs is the labeling by a third party.

By looking for an FEB label, an inspector will have information about the standards to which the product has been labeled. In addition, the inspector can call on the FEB for help with safety or acceptance questions regarding equipment suitability when something does not look correct.

When AHJs rely on labeled products, it can make the job easier since the inspector does not need to evaluate all the parts as required by NEC 110.3(A). This is how FEBs help electrical inspectors complete work more efficiently.

LABELING	VS.	LISTING
<ul style="list-style-type: none"> Associated with products evaluated by FEBs 		<ul style="list-style-type: none"> Associated with products evaluated by NRTLs
<ul style="list-style-type: none"> Safety testing occurs primarily in the field 		<ul style="list-style-type: none"> Safety testing and certification occurs primarily at the point of manufacture
<ul style="list-style-type: none"> Involves non-destructive testing of each device or piece of equipment 		<ul style="list-style-type: none"> Involves rigorous testing of representative samples and factory follow-up inspection
<ul style="list-style-type: none"> Must comply with 790 and 791 provisions 		<ul style="list-style-type: none"> Must comply with OSHA provisions

Conclusion

Regularly updated consensus codes and standards from organizations such as OSHA, ANSI, NFPA, and others play a critical role in protecting the public from possible deadly hazards posed by an ever-changing electrical environment.

The recently adopted standards, NFPA 790 and NFPA 791, provide AHJs with clear requirements for effectively addressing and approving electrical equipment and installations that are either unique; have been manufactured in limited quantities; or are used or have been modified in the field.

By understanding these codes and how they relate to the selection of qualified field evaluation bodies (FEBs), the performance of field evaluations, and the labeling of electrical products; AHJs can better fulfill their role in protecting the public from electrical-related property loss, injuries, and fatalities.

For more information on the standards outlined in this white paper, call **800-Go to eti** or email your request to **info@eticonformity.com**.



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