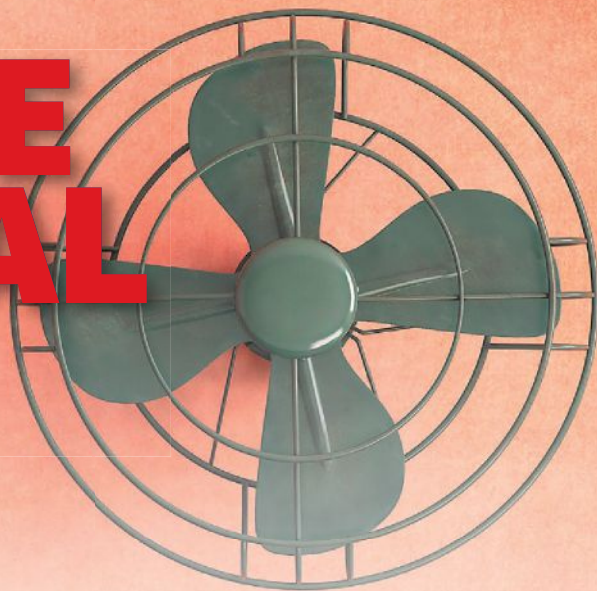


APPLIANCE ELECTRICAL SAFETY

Using OSHA's NRTL Program

By Veronica Stanley



WHAT DOES YOUR COMPANY DO when employees bring appliances (e.g., heaters, fans, hot plates) into the workplace? Failure to comply with workplace regulations for appliances can lead to injuries and fires. Appliances are often identified or suspected as a root cause of workplace fires (Hall Jr., 2013; U.S. Fire Administration, 2019).

Many safety professionals are responsible for appliance workplace safety or may be expected to know the basics at some point in their careers. Individuals who have attended formal accredited safety education programs during the past 20 years may remember appliances briefly discussed as product safety became a standard element in such programs (IOM, 2000). However, safety professionals may not feel prepared for the real-world needs of developing appliance electrical safety program elements.

OSH professionals may become involved in determining the acceptability of electrical appliances, such as fans or heaters, when employees bring them into the workplace for personal use, when

performing reviews before purchases are made by the employer, when developing policies or recommendations for workplace appliance use, or when performing periodic reviews for compliance with OSHA regulations or other standards incorporated by the organization.

OSHA regulations reviewed in this article are for a typical office setting that has no unique hazards, for example, a fan or heater used in an office by an employee for personal comfort. Additional considerations not discussed here are needed for environments with unique hazards or with

the potential for unique hazards (e.g., classified by OSHA regulation as a Class II, Division 1 location). This article also does not address the scenario in which an organization chooses to make in-house repairs to appliances; however, note that organizations choosing to make in-house repairs to appliances must ensure that repairs comply with the acceptability of the appliances for electrical safety under OSHA regulations (OSHA, 2010).

Key Fundamentals of OSHA Regulations Addressing Appliances

OSHA's (2015) electrical regulations for general industry are found in 29 CFR 1910, Subpart S. OSHA definitions pertaining to appliances are in section 1910.399 (key terms are presented in Table 1). Appliances, specifically, are addressed in section 1910.305(j)(3), Wiring Methods, Components and Equipment for General Use.

OSHA stipulates that only acceptable (i.e., approved) electrical appliances, as defined in Subpart S, may be used in the workplace (Miles, 2009; OSHA, 1999). Acceptable includes those items that are "accepted, or certified, or listed, or labeled or otherwise determined to be safe by a nationally recognized testing laboratory" (i.e., pursuant to OSHA's NRTL program).

Appliances Are a Category of Equipment

Based on the OSHA definitions (Table 1, p. 30), appliances are a type of equipment. The term *equipment* is defined to be general; therefore, care must be taken when substituting the word *equipment* for the word *appliance*. While both equipment and appliances are defined within general definitions in OSHA 1910, Subpart S, Electrical, the title of Subpart P, Hand and Portable Powered Tools and Other Handheld Equipment, can cause an individual to confuse the section of OSHA regulation being referred to. *Equipment* is not defined in Subpart P within general terms.

In many cases, repeating key terminology may help maintain clarity of nuanced regulatory language and guide the reader to relevant sections of the OSHA regulations. Safety professionals

KEY TAKEAWAYS

- This article discusses OSHA regulations applicable to appliances, and details the agency's nationally recognized testing laboratory (NRTL) program as applicable to appliances.

- Examples demonstrate how to read equipment markings, and readers will gain insight useful for determining the acceptability of electrical appliances.

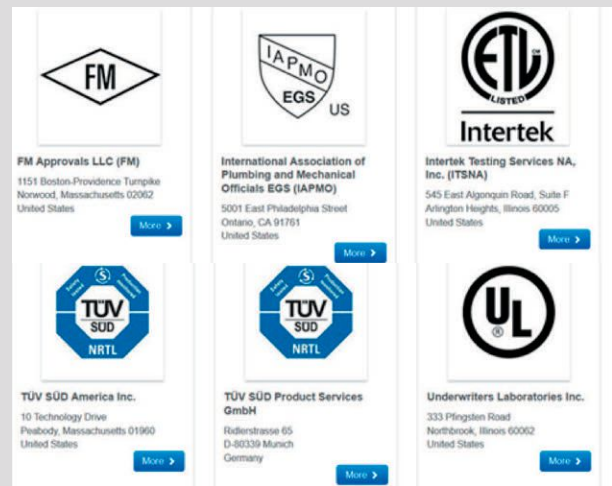
- The article also discusses program elements recommended for strengthening an existing appliance electrical safety program and resources for developing a new program.

TABLE 1
KEY DEFINITIONS FROM 1910.399

Term	Definition
Acceptable	An installation or equipment is acceptable to the assistant secretary of labor, and approved within the meaning of this Subpart S: (1) if it is accepted, or certified, or listed, or labeled, or otherwise determined to be safe by [an NRTL] recognized pursuant to OSHA 1910.7; (2) with respect to an installation or equipment of a kind that no [NRTL] 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; (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.
Accepted	An installation is "accepted" if it has been inspected and found by [an NRTL] to conform to specified plans or to procedures of applicable codes.
Appliances	Utilization equipment, generally other than industrial, normally built in standardized sizes or types, that is installed or connected as a unit to perform one or more functions.
Certified	Equipment is "certified" if it bears a label, tag or other record of certification that the equipment: (1) has been tested and found by [an NRTL] to meet nationally recognized standards or to be safe for use in a specified manner; (2) is of a kind whose production is periodically inspected by [an NRTL] and is accepted by the laboratory as safe for its intended use.
Equipment	A general term including material, fittings, devices, appliances, fixtures, apparatus, and the like, used as a part of, or in connection with, an electrical installation.
Identified (as applied to equipment)	Approved as suitable for the specific purpose, function, use, environment, or application, where described in a particular requirement. Note to the definition of <i>identified</i> : Some examples of ways to determine suitability of equipment for a specific purpose, environment, or application include investigations by [an NRTL] (through listing and labeling), inspection agency, or other organization recognized under the definition of <i>acceptable</i> .
Labeled	Equipment is "labeled" if there is attached to it a label, symbol or other identifying mark of [an NRTL]: (1) that makes periodic inspections of the production of such equipment; (2) whose labeling indicates compliance with nationally recognized standards or tests to determine safe use in a specified manner.
Listed	Equipment is "listed" if it is of a kind mentioned in a list that: (1) is published by [an NRTL] that makes periodic inspection of the production of such equipment; (2) states that such equipment meets nationally recognized standards or has been tested and found safe for use in a specified manner.

FIGURE 1
CURRENT LIST OF NRTLs

The Current List of NRTLs web page lists organizations in OSHA's NRTL program. An excerpt is depicted here.



should strive to educate employees on key terminology used in safety regulations so they understand the appropriate use of the terms for each situation. Exercise caution when selecting synonyms for words that have regulatory definitions. If synonyms are used, they should be specified as such and efforts should be made to address possible confusion for readers. OSHA stipulates the broader category of electrical equipment that must be acceptable and approved within the meaning of Subpart S (Fairfax, 2003a).

Appliances Are Not Tools

The term *tool* cannot be substituted for *appliance* because the terms are not equivalent. Subpart S does not have a definition for *tool*; it is defined in 29 CFR 1910, Subpart P, as explosive-actuated, unless otherwise indicated (OSHA, 2007).

OSHA's NRTL Program

OSHA created the nationally recognized testing laboratory (NRTL) program to ensure that certain types of equipment are tested and certified for safe workplace use. OSHA uses this program to approve more than appliances and maintains a page entitled Types of Products Requiring NRTL Approval (OSHA, 2009). Thus, an appliance is a type of product.

NRTLs are private-sector organizations that OSHA has recognized as meeting the legal requirements in 29 CFR 1910.7 to perform testing and certification of products using consensus-based test standards. Each NRTL has its own mark that is registered with a patent and with OSHA. A full list of marks can be found on OSHA's Current List of NRTLs web page (OSHA, 2019b). OSHA regulation requires that the NRTL program information remain current and laboratories must renew with OSHA. Test standard information is updated and announced in the *Federal Register*.

OSHA authorizes using "NRTL's mark for the product standards for which the NRTL has been recognized" (OSHA, 1999). OSHA does not require that the test standard number be added to the appliance by the manufacturer, but markings must be useful to identify a current and valid listing, and to identify what standards or category was used for evaluation (K. Robinson, personal communication, Sept. 26, 2018).

The current list of NRTLs includes 19 laboratories. Figure 1 shows examples from the current list of NRTLs. On the site, clicking the "more" button for each directs to its NRTL page, showing the scope of OSHA's recognition. Contact information is provided for each recognized testing site as well as the currently recognized test standards for that NRTL. The recognized



UL 1261	Electric Water Heaters for Pools and Tubs
UL 1277	Electrical Power and Control Tray Cables With Optional Optical-Fiber Members
UL 1278	Movable and Wall - or Ceiling-Hung Electric Room Heaters
UL 1283	Electromagnetic-Interference Filter
UL 1285	Pipe and Couplings, Polyvinyl Chloride (PVC) for Underground Fire Service
UL 1286	Office Furnishings

Photo 1 (left): An approved UL mark that should match the OSHA website. Photo 2: An example of how OSHA's website offers verification that a company is certified to a certain standard.

test standards are useful for verifying the mark on a product. The limited information on OSHA's website is a good starting point. NRTLs can be contacted for additional information, which is often necessary when researching older appliances. Keeping all manufacturer information that came with the appliance is advised. Additional information on NRTLs can be found in these publications:

- NRTL Program Policies, Procedures and Guidelines (OSHA, 1999);
- Certification of Workplace Products by Nationally Recognized Testing Laboratories (OSHA, 2010).

Test Standards

NRTLs follow test standards established by standards developing organizations (SDOs) such as Underwriters Laboratories Inc. (UL), Institute of Electrical and Electronics Engineers and ANSI. OSHA maintains a complete list of test standards on its Appropriate Test Standards page (OSHA, 2019a). There, OSHA states that many of the standards are also approved by ANSI as American National Standards. An NRTL recognized for an ANSI-approved test standard may use either the latest proprietary SDO version or the latest ANSI version of that standard, regardless of which version appears on OSHA's list. OSHA recommends contacting ANSI to find out whether a test standard is currently ANSI-approved.

Multiple Marks Possible

The UL mark was included in Figure 1 to show that UL is one of the 19 currently recognized NRTLs. The example mark for an NRTL displayed on OSHA's Current List of NRTLs page is one of many that may be registered for that specific NRTL. Each NRTL's page includes a link to the certification mark website to research other marks. Manufacturers provide a variety of useful materials; for example, some manufacturers provide the test standard.

NRTL Mark Explained by Example

An NRTL certification mark is often found on a label affixed to each unit of a product or is stamped on the product. Small products may have the mark on product packaging, which is a good reason to keep all manufacturer information. Photos 1 and 2 provide examples of how to find information using a label from an appliance that has the test standard number on it. This allows users to directly search OSHA's website for current information. The manufacturer is not required to provide the test standard number. In some cases, it may be necessary to contact the NRTL or even the manufacturer. In the latter case, having the product literature can be critical for obtaining that information.

Photo 1 shows an approved mark on a product that looks the same as on the OSHA website. The "more" link for that NRTL gives an option to check the recognized testing standards the NRTL can perform. The OSHA website verifies that the NRTL is certified to test to the UL 1278 standard for movable and wall-

or ceiling-hung electric room heaters, which is the UL standard that was used to test this product (Photo 2).

The Importance of Identifying NRTL Marks Registered With OSHA

As discussed, the employer must comply with OSHA regulation for workplaces in the U.S. Appliances may bear non-NRTL certification marks intended for other countries, which should not be construed as equivalent to OSHA requirements for the U.S.

An example of a non-NRTL certification mark is the CE mark, which is used by the EU to indicate that a product meets its requirements for product safety. However, this mark does not indicate that the product went through the necessary testing standards required by OSHA for workplaces that NRTLs are approved to perform.

Counterfeit appliances also pose a safety concern. The document, "Identifying Counterfeit Items Quick Tips," produced by an OSHA cooperative program, can help OSH professionals recognize these devices (ACIL, 2007). OSHA (2010) states that the hazards of using nonapproved products include "electric shock, arc flash, blast events, electrocution, equipment shorts, explosions, burns, fires, toxic atmospheres generated by burning and decomposing insulation and other materials associated with electrical fires, and wiring and component failures." Additionally, Electrical Safety Foundation International (ESFI, 2015), a nonprofit organization that promotes electrical safety, provides educational materials related to counterfeit electrical products.

Two standards, ANSI/NEMA Z535.4-2011, Product Safety Signs and Labels, and ANSI/NEMA Z535.6-2011, Product Safety Information in Product Manuals, Instructions and Other Collateral Materials, may help professionals to understand product literature. National Electrical Manufacturers Association (NEMA, 2009) provides two documents related to product safety covered by ANSI Z535. These documents discuss mistakes in manuals, instructions and other collateral material.

Critical OSHA Regulations for Determining Acceptability of Electrical Appliances

Certain details in OSHA regulations are applicable to electrical safety program elements addressing appliances. A safety professional is not required by law to make an overarching, binary determination about appliance electrical safety. The related OSHA regulations overseen by a safety professional pertaining to appliances are limited, requiring only an external evaluation of the appliance itself. However, certain requirements pertain to considering use within the workplace context.

As noted, appliances are a category of equipment. In 1910.303, OSHA requires that listed or labeled equipment shall be installed and used in accordance with any instructions included in the listing or labeling. To ensure that appliance use will be in accordance with specifications listed by the manufacturer for that particular appliance (e.g., in accordance with the listing or labeling), the safety professional must first review the manufacturer's information that came with the appliance. Next, to



(Clockwise from top) Photo 3: A visual assessment of the cord depicting the plug and affixed manufacturer labeling and warnings, which should remain legible on the appliance. Photo 4: The result of a bathroom appliance installed without an electrical assessment; the switch is installed under a soap dispenser and the power plug is installed close to a sink, both of which create potential risk. Photo 5: An outlet tester can be used to test the outlet where an appliance will be placed, these tests should be documented to help formulate decisions.

determine suitability the safety professional must compare the manufacturer's information with the environment where the appliance will be used and the conditions of use. A process should be in place for meeting any ongoing requirements (e.g., maintenance), if any. As noted in Table 1 (p. 30), listing or labeling by an NRTL is a way to determine the suitability of equipment for specific purposes, environments or applications.

Safety professionals should not assume that they can take the same steps with every appliance of a certain category. Safety testing, labeling and information included by the manufacturer may vary with the intended use, country of sale or user group (i.e., household vs. commercial) for the appliance. Thus, the appliance can be packaged with different information. For example, a personal fan purchased at a big-box retail establishment could be marked for household use only, necessitating different steps for the safety professional than a fan that went through OSHA's NRTL program requirements and is therefore OSHA compliant. Information that the manufacturer provides with the appliance must be reviewed to obtain critical information, such as the NRTL mark.

"Household Use" or "For Household Use Only"

Employees may desire to bring items into the workplace that are designed for household use only. OSHA requires that "all electrical equipment used by employees meets or exceeds OSHA standards" regardless of whether the appliance was

originally sold for household use only (Fairfax, 2003b). Having a process for OSHA regulatory compliance is the employer's responsibility. In Subpart S, OSHA does not define the terms *household use* or *for household use only* (Fairfax). Note that NRTLs may distinguish between household and commercial use for items that are certified by the NRTL. Do not assume that information on NRTL websites is tailored to OSHA regulatory compliance; these groups are separate organizations from OSHA. NRTLs may be involved in standards development, testing, inspection or certification related to various other areas of regulation or consensus standards. Also, NRTLs may support operations in multiple countries. For example, CSA Group is an OSHA-recognized NRTL registered in Ontario, Canada.

OSHA provides instructions for determining compliance. The agency suggests performing an evaluation of relevant factors to determine whether to allow workplace use of a specific appliance labeled for household use only, including determining whether workplace use is comparable to household use (Fairfax, 2003b). Factors in making this determination include 1) the level of anticipated daily use; 2) the knowledge of the users; and 3) the care and cleaning of the machine (Fairfax).

State-Specific Requirements

Safety professionals should educate themselves on any applicable state-specific regulations. In its "Guide to U.S. Electrical and Electronic Equipment Compliance Requirements," National Institute of Standards and Technology (NIST, 2017) provides a useful summary of national regulatory authorities and state-specific information. Examples of useful information found in the document include a discussion of California's air cleaner regulation that limits the amount of ozone from indoor air cleaning devices and its appliance labeling regulation that requires a permanent, unique serial number on any appliance sold in the state.

Requirements Within OSHA Regulations

For appliances, OSHA regulations require visual inspection, electrical assessment and appliance markings.

Visual Inspection

In 1910.334, OSHA requires cord- and plug-connected equipment to be visually inspected before initial use "for external defects (such as loose parts, deformed and missing pins, or damage to outer jacket or insulation) and for evidence of possible internal damage (such as pinched or crushed outer jacket)." Photo 3 shows a cord with plug and affixed manufacturer labeling and warnings, which should remain legible on the appliance. If an issue is found during inspection, the defective or damaged item must be removed from service until repaired and verified to be safe for use (Miles, 2009). If the equipment remains connected once put in place and not exposed to damage, reinspection is not required until relocation.

In 1910.305, OSHA stipulates that "appliances may have no live parts normally exposed to contact other than parts functioning as open-resistance heating elements"; "shall have a means to disconnect it from all ungrounded conductors"; and if "supplied by more than one source, the disconnecting means shall be grouped and identified."

Cords should remain accessible to inspection but managed to prevent them from being a hazard. Cords must not be fastened with staples or other means that may cause damage. OSHA states that tape wrapping on the cord impedes visual inspection (Miles, 2009). Repair or replacement of the cord is necessary when the outer jacket is penetrated or when the conductors or insulation

inside are damaged (Miles). Section 1910.303(b)(1) states that “electric equipment shall be free from recognized hazards that are likely to cause death or serious physical harm,” specifically requiring assessment for heating effects under conditions of use, suitability for installation and use, and of the electrical insulation.

Electrical Assessment

Appliances must be supplied with the energy requirements specified by the manufacturer for operating safely in the location of operation. Thus, when safety professionals approve appliances for use in the workplace, they must also consider the electrical supply needed for operation.

The electrical assessment should verify that a suitable outlet exists at the intended location for placing the appliance in such a way that does not introduce a safety hazard. Photo 4 shows the result of a bathroom appliance installed without an electrical assessment. The switch was installed under the soap dispenser, resulting in corrosion and intrusion of moisture into the switch box from foreseeable dripping. A power plug was also installed to the lower left of the sink, which can create a risk of water splash.

OSHA clearly states that replacing an existing appliance electrical cord with a longer one in order to reach a receptacle violates the appliance’s NRTL certification, as flexible cords and cables cannot be used as a substitute for the fixed wiring of a structure (Miles, 2009). The appliance certification applies to the whole unit as approved for manufacture, including its original electrical cord. OSHA (2002) allows only acceptable appliances in the workplace. Alteration of an appliance is not permitted in any way that modifies the conditions under which the NRTL defined it as acceptable and approved as an electrical appliance. Thus, changing specifications of the electrical cord would be considered a violation because that would alter the appliance. OSHA stipulates that appliances that require being wired with a flexible cable directly into a junction box may not be used in workplaces (Miles).

Appliance Markings

Section 1910.305, Wiring Methods, Components and Equipment for General Use, requires that the manufacturer visibly mark on the appliance or make easily accessible after installation critical appliance electrical information that includes a rating in either volts and amperes, or volts and watts. As necessary, any externally required motor overload protection or specific operating frequency must be specified.

In general provisions of section 1910.303, OSHA requires identification of the manufacturer and ratings (e.g., voltage, current, wattage) on equipment in order for it to be used in the workplace. This includes “manufacturer’s name, trademark or other descriptive marking by which the organization responsible for the product may be identified.” Other requirements discussed in this section include disconnecting means and circuits pertaining to appliances, and durability requirements of markings.

OSHA requires that when double insulation or its equivalent is used as a form of protection for appliances, it must be marked distinctively to indicate that the appliance uses an approved double insulation system (OSHA, 2002).

Other Recommended Program Elements Responsible Person

All appliances should be officially assigned to a responsible person whose duties for safe use are officially explained and documented. An updated list of appliances should be kept for easy reference during safety inspections. Inspections should

verify that assigned responsibilities are being executed by those tasked to implement instructions provided by the manufacturer, such as for installation, use and maintenance.

Verification of compliance is vital. According to OSHA, determining compliance includes checking that use of the appliance is in accordance with listing or labeling. For example, a fan sold for household use may be acceptable for personal cooling in the workplace, but not attached as part of workplace machinery or process (Fairfax, 2005).

Decision Logic

Safety departments should develop a decision logic for the fate of appliances suspected of having sustained damage that affects critical operations or safety functions. Determine whether an appliance should be allowed in the workplace if it cannot be assessed in-house after an incident, for example, after suspected problems with the electrical connection where the appliance had been plugged in, such as evidenced by thermal effects at the outlet. Evidence for formulating decisions should be documented, such as the results of testing the outlet where an appliance was plugged in (Photo 5).

Reviewing Other Relevant Standards

Considerations for National Fire Protection Association (NFPA) and other standards should be made. Workplace programs that go beyond OSHA and incorporate additional standards, such as NFPA, are more effective. The following examples show evidence for the need to review NFPA standards.

- NFPA 1, Fire Code, addresses electrical fire safety for extension cords, commonly used to provide power for appliances (NFPA, 2018a). The standard also provides specifics for radiant space heaters, another common workplace appliance. An example of useful information found in this standard applies to the clearance distance around radiant space heaters, which is listed at 3 ft in Chapter 34.

- NFPA 101, Life Safety Code, uses the term *portable cooking appliances* (e.g., toasters) to differentiate from those that are fixed (NFPA, 2018b). NFPA used data from nuisance alarm studies to determine appropriate distances from smoke alarms for cooking appliances. Heeding NFPA distances for cooking appliances will minimize instances of nuisance alarm activation through normal use.

- NFPA 70E, Standard for Electrical Safety in the Workplace, discusses maintenance of electrical equipment or parts, such as repair or replacement of individual portions (NFPA, 2018c). Maintenance must be performed “in accordance with manufacturer’s instructions or industry consensus standards. The equipment owner or the owner’s designated representative shall be responsible for maintenance of the electrical equipment and documentation.” The standard also prohibits cords and cables that are worn, frayed or damaged because they may pose an electrical hazard. In addition, the standard includes requirements for maintaining warnings and other identification, of circuits such as voltage markings affixed and in legible condition.

Product Safety Databases

Safety professionals can make use of freely accessible national data by reviewing information from product safety databases. One example of such a database is SaferProducts.gov from U.S. Consumer Product Safety Commission (CPSC, 2011). Data can also come from healthcare professionals, government officials and public safety entities. CPSC (2013) also hosts a searchable recall list, which is particularly useful for those reviewing

the safety of products brought into the workplace by employees. Keep a record of searches for appliances performed in these databases to document performing due diligence.

Follow-Up

Appliances tend to be addressed in a disjointed fashion. Some considerations for appliances may be addressed in the electrical program and some may be addressed as part of area inspections. Consider whether this disjointed approach efficiently covers all the regulatory requirements. If not, appliances may deserve a stand-alone program.

An Appliance Specific Program

In its resource library, Minnesota Counties Intergovernmental Trust, home of Minnesota OSHA Workplace Consultation Program, provides specific information recommended for policy addressing appliances in the workplace (MCIT, 2018).

Equipment Surveys

Those beginning a program from scratch will need to develop documentation of the appliances at that facility. Consider using methods that work for others as inspiration. For example, Lawrence Berkeley National Laboratory's (2019) online electrical equipment safety program manual discusses a process for conditional acceptance criteria for equipment, a process for inspecting and approving electrical equipment, and a process for addressing repair, salvage and out-of-service equipment.

Electrical Safety Self-Assessment

ESFI (2012) provides an online electrical safety self-assessment tool that covers general electrical. Many questions in the self-assessment link to the regulation on which the question is based.

Conclusion

Implementing OSHA regulations for electrical safety helps minimize risk from injury and fires. It is imperative for safety professionals who are responsible for appliance electrical safety program elements to clearly understand the appliance-specific OSHA regulations and the requirements of its NRTL program. The ability to read NRTL markings helps OSH professionals identify appliances that underwent the safety testing required by OSHA as well as counterfeit appliances that can pose a safety concern.

Safety professionals need a clear understanding of the applicable OSHA regulations to develop an effective appliance electrical safety program for a location's needs. In that sense, safety professionals perform a quality-control function through external visual checks of appliances, when ensuring the suitability of use for the environment, and when ensuring that manufacturer-recommended practices are being implemented so that appliances are used in accordance with the listing or labeling requirements. By implementing OSHA regulations, safety professionals reduce the risk to the organization. **PSJ**

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