



ANSI E1.58 – 2017
Electrical Safety Standard for Portable Stage and
Studio Equipment Used Outdoors

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Key to interest categories:

CP custom-market producer
DE designer
DR dealer or rental company
MP mass-market producer
G general interest
U user

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Foreword

The entertainment industry often uses standard electrical equipment to create performance spaces in outdoor locations that are subject to weather and damp conditions. As a general requirement, the National Electrical Code specifies that all electrical equipment must be approved as suitable for the installation and use. [NEC 110.2] Suitability of equipment may be evidenced by listing or labeling. [NEC 110.3(A)] It is also required that the equipment shall be installed and used in accordance with any instructions included with the listing or labeling. [NEC 110.3 (B)]. While this would preclude the use of indoor listed equipment in an outdoor setting, the NEC provides an exception for temporary theatrical and motion picture installations provided the installation is supervised by qualified personnel. (See Annex A for citations from NEC Article 110.)

1 General

1.1 Scope

The scope of this Standard is the planning and execution of temporary outdoor portable electrical installations in compliance with the intent of NFPA 70, National Electrical Code, Sections 520.10 and 530.6 which state that “Portable stage and studio lighting equipment and portable power distribution equipment not identified for outdoor use shall be permitted for temporary use outdoors, provided the equipment is supervised by qualified personnel while energized and barriered from the general public.” (This quote is from 520.10; 530.6 is similar.) Safety is the primary concern. Conditions that degrade the operational performance or life of the electrical equipment are secondary.

FPN: While this scope focuses on outdoor installations, it can be noted that the same principles would apply to an indoor facility that is also identified as a damp or wet location.

1.2 Purpose

The purpose of this document is to provide guidance for qualified persons tasked with supervising portable stage and studio lighting equipment and portable power distribution equipment not identified for outdoor use when used outdoors where weather such as damp or wet conditions and temperature extremes exist; recognizing the hazards involved and identifying ways to mitigate the hazards to reduce the risk of either injury to persons or damage to property.

2 Identify Outdoor Conditions

The qualified person responsible for the outdoor electrical installation shall check the forecast weather conditions to determine what can be expected during the installation, use, and removal of all electrical equipment. This includes the forecast for precipitation, flood potential, the range of ambient temperatures, and wind conditions.

FPN: Professional weather services may be the best source for accurate forecasts.

2.1 The National Electrical Code (NFPA 70, Article 100 Definitions) includes definitions for damp and wet locations. It also provides descriptions of various weather and rain

conditions. These definitions shall be used in evaluating the electrical equipment as related to outdoor conditions. (See Annex B for list of defined terms.)

2.2 Other sources of water exposure shall be evaluated as well. These may include irrigation systems (sprinklers); streams, pools, fountains or other bodies of water; fogs (including oceanic salt bearing); and wind borne spray or mist.

2.3 Arid locations that have the potential for blowing sand or dust should be evaluated as well since these elements can also compromise the safe performance of electrical equipment.

FPN: Organic dusts are flammable and potentially explosive. If these are present, the rules for hazardous locations apply. (Reference NFPA 70, Article 506)

2.4 The potential for lightning strikes shall also be evaluated.

3 Identify Electrical Hazards

3.1 Electrical Shock

The qualified person shall evaluate all electrical equipment to identify where damp or wet conditions may increase the potential for electrical currents to flow in unintended paths that can expose persons to an electrical shock hazard. Equipment not listed for outdoor use may have multiple paths where moisture or dust can enter and create a hazard.

3.2 Overheating

The qualified person shall evaluate all electrical equipment to identify where electrical components can be compromised by overheating due to increased circuit resistance and/or reduced ventilation.

FPN: Moisture and dust contaminants can result in corrosion and/or pitting of electrical contacts which increase resistance and component heating.

FPN: Electrical equipment is manufactured with a specified operating temperature range. If the equipment is being utilized in an extremely hot or cold environment that exceeds the range, precautions will be necessary to avoid damage and hazardous results.

FPN: Overheating can lead to the failure of insulation leading to an electrical shock hazard. Also, the exposure of hot components (such as glass lenses) to sudden cooling, can result in physical failures that can result in injuries from falling debris.

3.3 Inspection

3.3.1 The qualified person shall visually inspect all electrical equipment prior to use for water intrusion potential including: housings, electrical connectors, electrical insulation, and operating components. (See Annex C for sample inspection recommendations.)

3.3.2 All equipment showing evidence of damage due to prior exposure to weather events shall be removed from service in order to prevent electrical shock and overheating hazards.

3.3.3 All electrical equipment shall be dry and in good repair before being utilized.

3.3.4 After an exposure to weather events, electrical equipment shall be re-inspected and all compromised equipment shall be removed from service.

FPN: ANSI E1.32 - 2002, Guide for Luminaire Inspection and NFPA 70B Recommended Practice for Electrical Equipment Maintenance provide some guidelines for inspecting electrical equipment.

4 Identify Protection Options

4.1 Physical barriers between the electrical equipment and the general public shall be installed and maintained to keep unauthorized persons from contact with the equipment.

4.2 Appropriate electrical grounding and bonding shall be installed.

4.3 Class A ground-fault circuit interrupter devices shall be utilized under the guidance of ANSI E1.19 – 2015 *Recommended Practice for the Use of Class A Ground-Fault Circuit Interrupters (GFCIs) Intended for Personnel Protection in the Entertainment Industry*. The qualified person shall ensure any life critical circuits are protected by means other than a GFCI.

4.4 The qualified person may specify shielding or enclosures to protect indoor listed electrical equipment to at least the level of damp location requirements. (See Annex B for a list of defined terms.)

4.4.1 Protective shielding or enclosures shall be constructed of materials that will not be degraded by heat or weather conditions. Where the protected equipment generates heat, the materials used shall be of a type that cannot be ignited by those temperature levels. (See Annex D for sample recommendations.)

4.4.2 Protective shielding or enclosures shall provide for proper ventilation of the protected equipment to prevent overheating.

5 Operations

5.1 A written Action Plan shall be distributed to all involved personnel prior to the energization of the electrical distribution system(s). The Action Plan shall identify persons responsible for implementing the action plan, include trigger events/thresholds, and operating procedures for safely de-energizing the system(s). The Action Plan shall also include procedures for inspections and safety clearance prior to re-energizing the system(s) following a shutdown.

*FPN: The Contract Services Administration Trust Fund has published **SAFETY BULLETIN #38, GUIDELINES FOR INCLEMENT OR SEVERE WEATHER** written by the Industry-Wide Labor-Management Safety Committee for the Motion Picture and Television Industry that identifies the safety considerations that should be addressed when working outdoors in areas where there is a potential for thunderstorms, lightning, flash flooding, extreme winds, large hail, tornados and hurricanes. It can be accessed from the web at www.csatf.org*

5.2 The qualified person shall monitor weather / environmental conditions during the installation, use, and removal of the electrical equipment.

5.2 At the onset of weather conditions, all unprotected electrical equipment shall be de-energized immediately as outlined in the Action Plan.

5.3 Where possible, protective coverings should be applied to the de-energized equipment for the duration of the weather conditions to facilitate a return to service.

5.4 When the weather conditions cease, the qualified person shall inspect all electrical equipment to ensure that it is dry and in good condition before re-energizing as outlined in the Action Plan. All compromised equipment shall be removed from service.

Annex A, NFPA 70, National Electrical Code, 2017 edition, Article 110— Requirements for Electrical Installations

This Annex is a synopsis of some of the requirements for electrical installations found in NFPA 70, Article 110. Consult the National Electrical Code for the exact requirements. The NEC can be read on-line at <http://www.nfpa.org/codes-and-standards>.

110.2 Approval.

This clause requires conductors and equipment required or permitted per the NEC to be “approved,” which means that a third-party has tested it for safety and labeled the equipment if it is acceptable.

110.3 Examination, Identification, Installation, and Use of Equipment.

(A) Examination. This clause and its subclauses list factors that should be considered for evaluation, including the suitability of the equipment for the installation, its mechanical strength and durability, wire bending and connection space, insulation, heat effects, arcing effects, and other factors.

(B) Installation and Use. This clause requires equipment to be installed and used in accordance with whatever instructions were included in the equipment’s safety evaluation for approval.

110.11 Deteriorating Agents.

This clause says that equipment shall not be operated in environments that will damage it. The clause flags using equipment not rated for outdoors in outdoor environments as being particularly a problem, unless the equipment is protected. Other deteriorating agents include certain gases and liquids, and elevated temperatures.

110.12 (B) Integrity of Electrical Equipment and Connections.

This clause requires internal parts of electrical equipment to not be damaged or contaminated by foreign matter such as paint, plaster, or cleaners. Furthermore the parts shall not be damaged in a way that affects safety or mechanical strength, such as by being bent, broken, or corroded.

110.26 (E) (2) Outdoor.

Outdoor installations are required to comply with 110.26(E)(2)(a) through (c). These clauses require outdoor electrical equipment to be installed in identified enclosures and protected from accidental contact by unauthorized personnel, by vehicular traffic, or by accidental spillage or leakage from piping systems. If the equipment is likely to require adjustment or maintenance while energized, clause (c) requires working space around the equipment. The amount of space required depends on a number of factors that are given in other cited clauses.

110.28 Enclosure Types

110.28 says that Table 110.28 shall be used for selecting equipment enclosures for use in specific locations other than hazardous (classified) locations. That table lists twenty Enclosure Types—ten indoor and ten outdoor—and describes what kind of protection can be expected from each type. It also offers informational notes about what Enclosure Types normally are associated with common terms, such as “raintight,” “rainproof,” “watertight,” and “dusttight.” It also notes that Ingress protection (IP) ratings may be found in ANSI/NEMA 60529, but that IP ratings are not a substitute for Enclosure Type ratings. The NEC specifies enclosures by Enclosure Type ratings, not IP ratings.

Annex B, NFPA 70, National Electrical Code, 2017 edition, Article 100—Definitions

This Annex lists some of the words that have special definitions in the National Electrical Code. Consult the National Electrical Code for the exact definitions. The NEC can be read on-line at <http://www.nfpa.org/codes-and-standards>.

Approved	Listed
Authority Having Jurisdiction (AHJ)	Location, Damp
Bonded (Bonding)	Location, Dry
Dusttight	Location, Wet
Effective Ground-Fault Current Path	Rainproof
Grounded (Grounding)	Raintight
Guarded	Watertight
Identified (as applied to equipment)	Weatherproof
Labeled	

Annex C, Recommendations for inspecting equipment that has been used or stored outdoors before it is energized.

1. Check the equipment enclosure for weakness that prevents its ability to protect the contents due to rusting, or in the case of a polymeric enclosure, due to UV exposure.
2. Check the mounting method for weakness that prevents its ability to keep the equipment or any of its accessories from falling due to rusting, or in the case of a polymeric mounting method, due to UV exposure.
3. Check to make sure there is no water in the equipment, including connectors and terminals.
4. Check all insulating materials to make sure they have not absorbed water.
5. Check all glass components such as lenses and lamps for cracks or broken elements.

Annex D, Recommendations for providing shielding during periods of precipitation while equipment is energized

1. Equipment should be provided with an overhead shelter or canopy that prevents precipitation from impinging on the equipment either vertically or at 45 degrees from vertical. The overhead shelter or canopy should be of fire retardant material and heat resistant if close to hot equipment. The overhead shielding should be so arranged to not trap heat.
2. Power supply cords or any extension cables that have wires in a sleeving or does not have a “W” in its type designation should also be sheltered.

3. Connectors that are not of the weatherproof-type should also be sheltered.
4. If enclosures are used they must be of the type suitable for the environment. The type information in the NEC should be referenced. Furthermore, they should provide sufficient ventilation so as to not trap heat from heat-producing equipment. (See NFPA 70 Table 110.28 - Enclosure Selection, For Outdoor Use)