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# The Essential 18-Point Checklist

## for Code-Compliant Elevator Installations

Electrical contractors must manage the ups and downs of codes and standards — a task that is made more complicated by frequent changes and by standards that refer to each other.

White Paper

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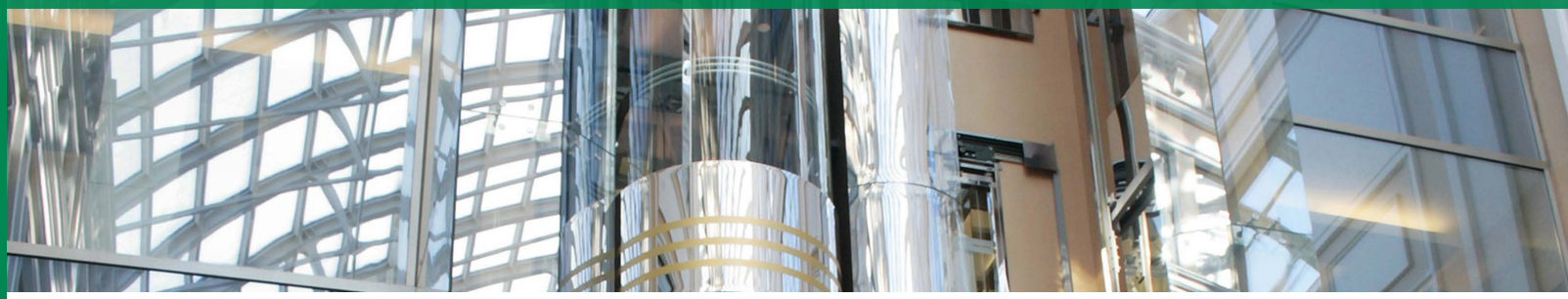

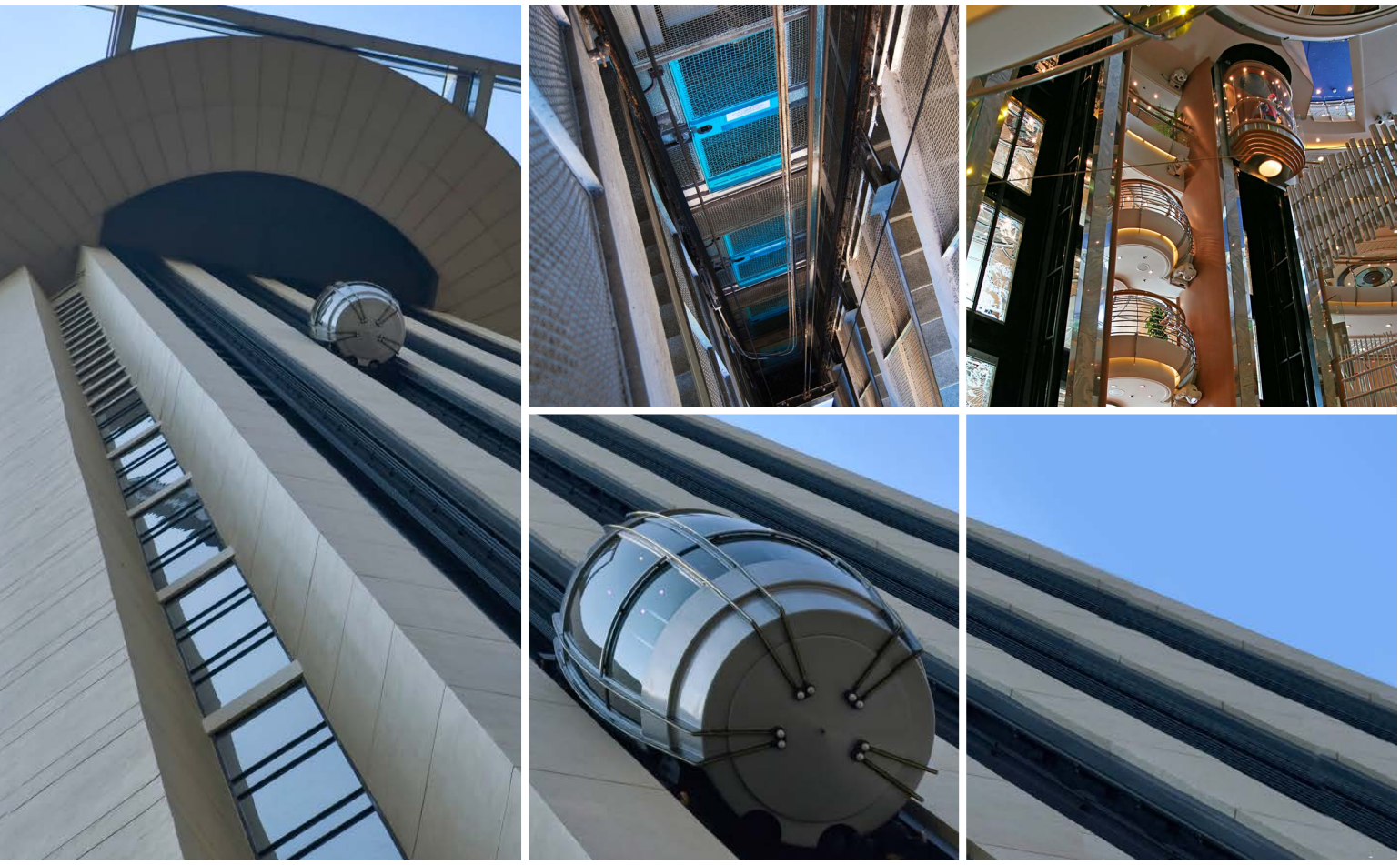

## Introduction

*The planning and installation of an elevator is a complicated task — but not necessarily because of any inherent technical difficulty with the elevator system itself. Much of the complexity comes from the often-bewildering array of codes and regulations that must be followed in every part of the job. It's not enough to learn and comply with a few national codes and standards: each state has its own set of standards and inspection requirements, and many cities have their own, too. How is a contractor to cope?*

*Fortunately, many of these codes and standards contain quite similar provisions, and it's possible to boil down the major ones into a fairly short list. This article will look at the major codes and standards that elevator electrical installations must meet. It also explores a way for contractors to outsource much of the code compliance work to vendors.*

***Standard-setting bodies***

*The main standards-setting organizations we are concerned with are the National Fire Protection Association® (NFPA®), the American National Standards Institute and American Society of Mechanical Engineers (ANSI/ASME), and UL (formerly Underwriters Laboratories). We will look at each in turn.*

***NFPA***

*NFPA publishes NFPA 72, the National Fire Alarm and Signaling Code. This, in its own words, "covers the application, installation, location, performance, inspection, testing, and maintenance of fire alarm systems, supervising station alarm systems, public emergency alarm reporting systems, fire warning equipment and emergency communications systems (ECS), and their components. Provisions are expressed in prescriptive requirements with performance-based design methods and risk analysis requirements provided and essential for the proper design and integration of mass notification systems."*

**1** **NFPA 72 6.15.4.4** requires monitoring for the presence of operating voltage to the control circuit that shut down the elevator power. The standard also states that any loss of voltage to this control circuit should cause a supervisory signal and require remote annunciation.

To comply with this standard, the contractor who builds and installs the elevator panel must include a voltage monitoring relay.

**NEC**

NFPA also publishes NFPA 70, the National Electrical Code®, usually referred to as the NEC® or simply "The Code," which has several articles that apply to elevators.

It is important to note that the version of the NEC required by law varies by location. As shown in Figure 1 a number of states have adopted the 2017 NEC, more than half of the country is using the 2014 NEC, and the balance mixed between the 2011 and 2008 NEC editions or no statewide adoption at all. Similar differences may also exist among different counties or local municipalities within a given state.

The main NEC article addressing elevators and dumbwaiters is 620.

**2** **NEC Articles 620.22A and 620.53** require the use of separate branch circuit and circuit protection device to power lighting device(s), receptacle(s) and ventilation for the elevator car. They also state that these branch circuits must be separate from the main power disconnecting device.

**3** **NEC Article 620.51** requires the use of separate single disconnecting means and overcurrent protection device to disconnect the main power to the elevator from both emergency and normal power system. It also states that this disconnecting means must not disconnect the power supplied to the branch circuits.

The disconnecting means (which must be a listed device) must be an enclosed externally operable fused motor circuit switch or circuit breaker capable of being locked in the open position. This lock must be a permanent part of the panel, and cannot be replaced by a portable locking device. It must not be possible to open or close the disconnect means remotely, although the disconnecting

**Figure 1.**
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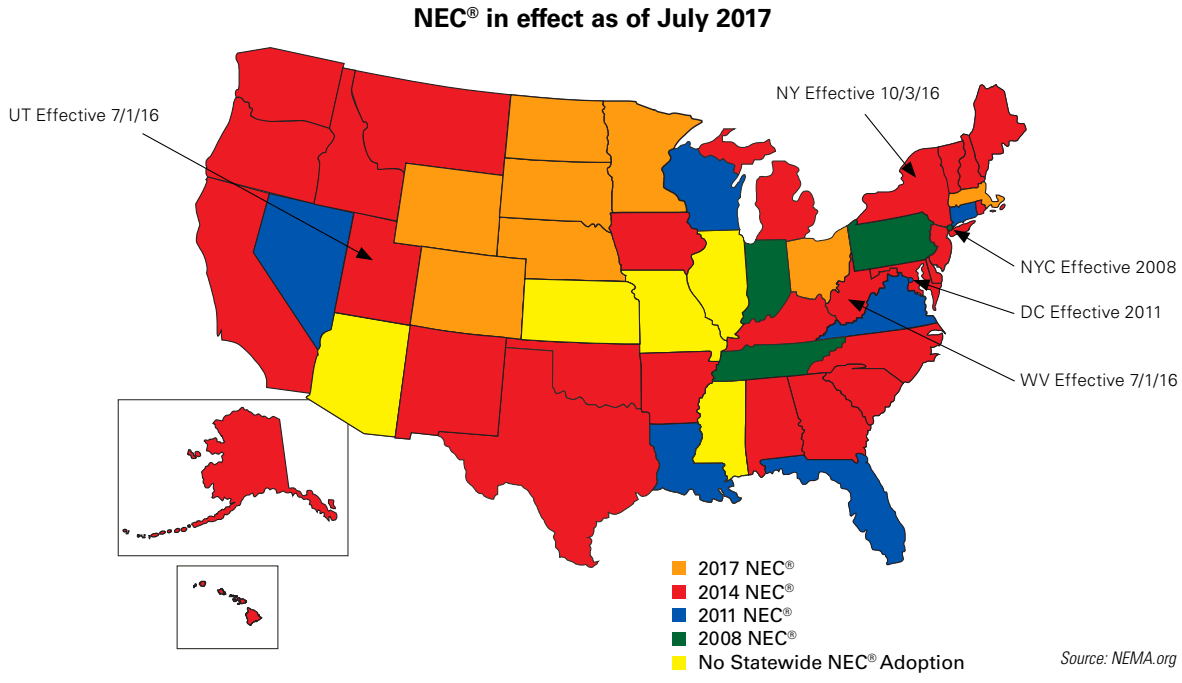

means may automatically open the power supply to affected elevators before any sprinklers in the hoistways, machine rooms, control rooms, machinery spaces, or control spaces apply water.

To comply with this article of the code, the electrical contractor must install elevator disconnect switches, and these switches must have provisions for shunt trip.

In addition, this article requires that "where an additional power source is connected to the load side of the disconnecting means, which allows automatic movement of the car to permit evacuation of passengers, the disconnecting means required in 620.51 shall be provided with an auxiliary contact that is positively opened mechanically, and the opening shall not be solely dependent on springs. This contact shall cause the additional power source to be disconnected from its load when the disconnecting means is in the open position."

There are exceptions to this involving platform lifts and stairway chairlifts.

NEC Article 620.51 also includes requirements on where the disconnect may be located.

To meet this requirement of the electrical code, the elevator panel must include mechanical interlock auxiliary contacts. The next sections of the code are concerned with a means for disconnecting power. Disconnect switches, as previously mentioned, must be provided in the elevator panel.

**4** **NEC Article 620.52** covers elevators that receive power from more than one source. It requires that there be a disconnect for each source of electrical; power, and that this disconnect must be within sight of the equipment served. A warning sign must be posted warning that turning off one switch does not de-energize all parts of the controller. A similar sign is required on a disconnecting switch that does not kill all power in cases where controllers are interconnected.

**5** **NEC Article 620.53** covers the disconnecting means for car lights, receptacle(s), and ventilation. It requires a single means for disconnecting these located in the machine room or control room for that elevator car. It must be an enclosed externally operable fused motor circuit switch or circuit breaker capable of being locked in the open position. Locking provisions are essentially the same as those in 620.51. A sign must be posted by the switch to identify the location of the supply side overcurrent protective device.

There is an exception with respect to branch circuits for car lighting, receptacle(s) and ventilation, if the ventilation motor does not exceed 2 hp. In this case the disconnect may comply with NEC 430.109(C), which allows the use of either a general-use switch, an AC-only snap switch, or a listed manual motor controller, but the provisions for listed devices and locking remain in force.

**6** **NEC Article 620.54** requires a single disconnect for all ungrounded heating and air conditioning power to the elevator car. The requirements for this disconnect are the same as those in Article 620.51 as far as being an enclosed externally operable fused motor circuit switch or circuit breaker capable of being locked in the open position, although there are some exceptions.

**7** **NEC Article 620.55** requires that each branch circuit for other utilization equipment have a single means for disconnecting all ungrounded conductors located in the machine room or control room/machine space or control space, and capable of being locked in the open position.

The provision for locking or adding a lock to the disconnecting means must be installed on or at the switch or circuit breaker used as the disconnecting means and must remain in place with or without the lock installed. Portable means for adding a lock to the switch or circuit breaker are not permitted as the means required to be installed at and remain with the equipment.

Where there is more than one branch circuit for other utilization equipment, the disconnecting means must be numbered to correspond to the identifying number of the equipment served. A sign must be posted near the disconnecting means to identify the location of the supply side overcurrent protective device.

**8** **NEC Article 620.61** covers overcurrent protection for elevator systems.

**9** **NEC Article 620.62** requires selective coordination: "Where more than one driving machine disconnecting means is supplied by a single feeder, the overcurrent protective devices in each disconnecting means shall be selectively coordinated with any other supply side overcurrent protective devices." Selective coordination is also covered in NEC 240.12.

To meet provide selective coordination, switches in the elevator panel should include sufficiently fast-acting overcurrent protection. For example, a panel outfitted

with UL Listed Class J fuses and fuse blocks would allow for easy coordination with other system overcurrent devices, while also providing sufficient interruption rating.

**10** **NEC Article 620.71** regulates the location of the disconnecting means, motor-generator sets and motor controllers for elevators, dumbwaiters and moving walk driving machines.

**11** **NEC Article 620.82** requires that, for electric elevators, the frames of all motors, elevator machines, controllers, and the metal enclosures for all electrical equipment in or on the car or in the hoistway shall be bonded in accordance with NEC 250, Parts V and VII.

**12** **NEC Article 620.91,** *Emergency and Standby Power Systems,* allows elevators to be powered by either an emergency or standby power system. The article also calls out latest version is ASME A17.1-2013/ CSA B44-13, *Safety Code for Elevators and Escalators,* 2.27.2, for additional information.

This article also requires that for elevator systems that regenerate power back into a power source that is unable to absorb that regenerative power under overhauling elevator load conditions, other means must be provided to absorb this power. This may include other building loads, such as power and lighting, provided that these are automatically connected to the emergency or standby power system operating the elevators and are large enough to absorb the elevator regenerative power.

Article 620.91 also requires that the disconnecting means required by Article 620.51 disconnect the elevator from both the emergency or standby power system and the normal power system.

**13** **NEC Article 700.32** involving emergency systems was added in 2005, originally as Article 700.28. Based on interpretations by the local authority having jurisdiction, emergency systems would likely include emergency lighting, ventilation, fire detection and alarm systems, elevators, fire pumps, and any sort of industrial process where interruption of the electrical system would be hazardous to the workers or any other persons involved or nearby. This article requires that "emergency system(s) overcurrent devices shall be selectively coordinated with all supply side overcurrent protective devices," with the exception that selective coordination not be between two overcurrent devices located in series if no loads are connected in parallel with the downstream device.

**ANSI/ASME**

This standard has multiple articles dealing with elevators, all under Article A17. In most areas, ASME/ANSI A17.1, A17.2, A17.3, A17.5, A18.1 take precedence over other codes, although they may be added to in specific localities.

**14** **ANSI/ASME A17.1** – *Safety Code for Elevators and Escalators,* requires the use of shunt trip disconnecting switches in elevators and machine rooms to disconnect the main power before the activation of a sprinkler system.

Removing the main power eliminates the potential risk of a shock hazard condition that could occur in the event of a fire. Note the similarity of this provision to NEC Article 620.51.

To comply with this standard, the contractor or panel builder must include a fire safety interface relay that will allow power to the circuit to be turned off at the Fire Command Center of a building.

The adoption of ASME Standard varies by state, as do the features required on the switch, so a contractor should choose a switch based on the local ASME Standard to which the elevator is installed.

**15** **ANSI/ASME A17.3** – *Safety Code for Existing Elevators and Escalators (Includes Requirements for Electric and Hydraulic Elevators and Escalators),* in ASME's words, "ASME A17.3-2015 is intended to serve as the basis for state and local jurisdictional authorities in adopting retroactive requirements for existing elevators and escalators to enhance the safety of the general public. It is also intended as a standard reference of safety requirements for the guidance of architects, engineers, insurance companies, manufacturers, and contractors, and as a standard of safety practices for building owners and managers of structures where existing elevator equipment covered in the scope of the Code is used."

While A17.3 has many provisions, only a few are applicable to builders of elevator control panels. These include the requirement for a standby system to provide general illumination in the elevator car that will come on when normal lighting fails, and must be able to operate for at least four hours.

The article also requires a stop switch in the elevator pit, and a stop switch on top of each elevator car.

## 16 CSA B44.1-14/ASME-A17.5-2014:

– *Elevator and Escalator Electrical Equipment.* In ANSI's words: "The purpose of this Standard is to reduce the risk of injury to persons and damage to property from fire and electrical shock. To this end, it is a safety Standard for the design and construction of equipment to be used in conformity with the rules of the applicable elevator and electrical codes (i.e., ASME A17.1/CSA B44 and CSA C22.1, Canadian Electrical Code, Part I, or ANSI/NFPA 70)."

**BOCA**

The National Building Code developed by Building Officials Code Administrators International (BOCA) is a model building code that has been adopted throughout most of United States. It requires the use of a separate disconnecting switch with shunt trip features to power the elevators used in multi-storage buildings. It has since been subsumed by the International Building Code (IBC). Parts of the IBC refer to a number of NFPA standards including the NEC.

## 17

In agreement with **ANSI/ASME A17.1,** in the event of a fire, the shutdown of main power to an elevator circuit before activation of sprinklers is required. As previously mentioned, compliance may be achieved by installing a fire safety interface relay on the elevator panel.

## 18 UL50 & UL98

Any shunt trip disconnecting switch that meets the required NEC, ANSI/ASME, NFPA and BOCA Codes and Standards is generally made available as an enclosed dead-front switch. UL Standards UL50 and UL98 cover the requirements of these enclosed electrical switches. UL Listed elevator shunt trip switches are generally required in the field to meet elevator inspection requirements.

**UL50** – *Enclosures for Electrical Equipment, Non-Environmental Considerations*

**UL98** – *Fusible Disconnect Switches*

**UL891** – *Dead Front Switches*

It is the responsibility of the electrical contractor to ensure that all components used in an elevator panel are UL Listed. Pre-engineered elevator panels that are purchased pre-assembled typically carry a single UL rating on the entire panel.

**Farming it out**

Codes and standards change frequently, and just keeping up with all of them is time-consuming and expensive, and contributes nothing to the bottom line. What is the best way to handle it?

One is to dedicate one or more employees to code compliance, and have those employees review the design and fabrication of every electrical panel in every elevator contract, making engineering changes to the drawings as necessary to keep everything in compliance.

The other alternative is to hire someone to do it. There's an old saying in the engineering business: "Don't build what you can buy." Making a one-off panel is the same as making a one-off anything, with up-front engineering, parts procurement, assembly, and any needed certification. If you're installing an elevator, is that the way you want to spend your money?

A much better choice is to buy a pre-engineered panel from a company that specializes in doing that, and can usually customize an existing design to meet local codes. This eliminates all the engineering and fabrication time and expense, and it saves installation time for the contractor, because it comes with pre-wired circuits. It makes life easier for the electrical inspector because relevant agency approvals are inherent in the panels' designs. *In the end, it saves time and money.*

**Elevator Disconnect Switches with Shunt Trip**

An often-cited example of elevator electric requirements centers around shunt tripping. Elevator power supplies circuits and feeders for data processing rooms require shunt tripping and/or selective coordination by code, while building emergency systems also frequently require selective coordination. In the case of the elevator panel, the operating sequence goes like this:

1. Fire detection devices detect a fire and send a signal to the fire command center.
2. The fire command center sends signals out to trigger the fire alarm, contact the Fire Department, return the elevator to the ground floor, and tell the elevator disconnect switch to wait for the elevator to descend to the ground or otherwise designated floor.
3. Once the elevator reaches the ground floor and opens the door to release any passengers, a switch on the panel turns off the power to the elevator.
4. The fire command center then sends a signal to turn on the sprinklers to extinguish the fire.

Shunt trip switches that meet all legal requirements are available pre-engineered, pre-assembled and pre-wired, with code compliance assured. Figure 2 shows an example.

**Figure 2.**
The Littelfuse LPS Series Shunt Trip Disconnect Switch provides a simple and economical solution for applications that require selective coordination and shunt trip capabilities.


As evidenced by the information discussed in the article above, there is a wealth of information that needs to be taken into consideration when installing elevator systems - especially when it comes to achieving compliance with all the related codes and standards involved. For the benefit of both you and your customers, it is essential to be aware of, and become familiar with, both national and local codes and standards involved with elevator systems. Be sure to contact Littelfuse to take advantage of their expertise and knowledge with this topic.

**For more information, visit**
**Littelfuse.com/LPS**

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