Maintenance Control Program Changes

Learn about the MCP and updates made to it since 2010.

by John W. Koshak

In the world of elevators, manufacturers design newer components to require less maintenance. Replacing an older elevator controller, full of heat-generating relays, with a solid-state elevator controller with electronic components, devices, software and functions should reduce the maintenance time but not eliminate maintenance altogether. In general, anything with fewer moving parts, lower power consumption, lower heat generation and less friction requires less maintenance. Less maintenance does not mean no maintenance. There is no such thing as a zero-maintenance elevator system.

Learning Objectives

After reading this article, you should have learned:

- Maintenance on applicable components is required by code.
- Documenting maintenance, replacement, adjustment, testing and callbacks is required by code.
- Training on some procedures is necessary.
- Maintenance procedures are required to be available to elevator personnel.
- Access to some maintenance records must be provided onsite, while others are allowed to be offsite.

Advancements in technology in one subsystem of the elevator does not eliminate maintenance requirements of the other subsystems. Other components still need oil, grease, replacement, testing, inspection, adjustment and repair — maintenance. There are failures of some components that create safety hazards and can cause injuries and fatalities.

Elevators and escalators are not without hazard; they are large masses moving relatively quickly in a vertical hoistway or angular incline, creating fall hazards to anyone on the top of their cars. These hazards are obvious to those of us who work in the elevator industry, because we work on them daily. Users should not have to use anything but intuition and their experience to ride our conveyances, but the very young do not have the experience. Parents must accompany their children when around our equipment. To keep these hazards in check, the ASME A17.1/CSA B44 code has a maintenance section.

This article will provide information needed to educate elevator personnel to understand the recent changes to Section 8.6: Maintenance in the 2013 edition of A17.1/B44. Since maintenance is the frontline for hazard reduction and incident avoidance after design, manufacture and installation, education is critical, and every employer should ensure that its elevator personnel fully understands the requirements of this important section.

History

Maintenance on New Equipment Designs, published by Elevator World, Inc. in 2010 and available at www.elevatorbooks.com, explores how new equipment, primarily machine-room-less (MRL) elevators, incorporate the maintenance control program (MCP) given the new locations of the elevators' applicable components. It was written on the premise that MCPs were developed and are being utilized. Even in 2015, this is not always the case, as MCPs are still not being provided consistently. It is common for jurisdictional adoption to be delayed by many years, so not having one could be because of not having adopted the code

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requiring them. However, today, all jurisdictions have adopted at least the 2000 edition of the code; therefore, unless the jurisdiction has made an exception in its enabling law or regulation, the maintenance section is enforceable, and MCPs are required and should always be provided.

In 1997, the Canadian Standards Association (CSA) wrote its first extensive maintenance section in the *CSA B44 S1-97 Safety Code for Elevators and Escalators*. This extensive maintenance section was added to the 2000 edition of ASME A17.1 with some modifications during harmonization with the American elevator code. This changed the way maintenance was required and verified by inspectors.

What changed was how the code approaches maintenance considering one premise: that "Applicable Components" defined in this section must never be out of compliance due to lack of maintenance. If they are found out of compliance during a maintenance visit, they must be repaired, or the conveyance must be taken out of service until repairs are made. This conflicts with a tendency to reduce maintenance time and increase the interval between visits. This is the balance between too little maintenance that can create hazards and too much maintenance that costs more. To combat the extension of time between maintenance intervals (site visits), the code also requires an analysis of each unit using common metrics identified in Section 8.6. This analysis determines the maintenance interval, and the code directs the analysts to consider the age, condition, wear, quality, usage, environment, technology and use of Safety Integrity Level (SIL) devices to establish the interval or frequency of the tasks of maintenance.

The code requires that the tasks (maintenance procedures) be made available to elevator personnel so the correct procedure is performed. The procedures are per component. For example, a "brand x" governor has a maintenance procedure recommended by "manufacturer x". The necessary record keeping is set up to ensure the maintenance personnel maintain every applicable component using appropriate procedures established by the analysis in a timely manner. Then, the documentation of the maintenance tasks performed must be recorded to ensure they were done or reveal they were not done, with the records being available for viewing by elevator personnel and the owner.

Definition

For clarity, the MCP consists of several components. Each is identified, and only when discussing all of them together is it correct to call a document an MCP. One component is an analysis that considers the eight elements (metrics) that form the basis of how much maintenance is required, or determines the interval of maintenance. Another component is the records, these being divided into the location where they are stored and how the data is retrieved. Included are the test, callback, repair and replacement records. It is not uncommon for people to simply refer to the records as "the MCP"; this is inaccurate and leads to confusion.

Today, all jurisdictions have adopted at least the 2000 edition of the code; therefore, unless the jurisdiction has made an exception in its enabling law or regulation, the maintenance section is enforceable, and MCPs are required and should always be provided.

"Who should provide the MCP?" is a question commonly asked. The owner is responsible for doing this or having it done. As owners typically contract this service to elevator maintenance companies, it is not unusual for the maintenance companies to provide the MCP. Several companies independent from the maintenance provider are now available to owners for MCP purchase.

"Who owns the MCP?" is another common question. This is where it is important to understand that the "MCP" has several components (some being "owned" by the owner) with analysis components that may be proprietary to a company that owns the process. If a company develops an MCP (using its experience and resources), it owns the analytical output. When that company loses the account, it does not have to relinquish the entire MCP but must, however, provide the five years of maintenance records as they are generated. The records are not the entire MCP; they are just a component of the program.

Traditional Maintenance

For decades, maintenance and supervision did essentially the same things as the MCP now requires. Companies were aware of the "at-risk" elevator components; they created check charts to provide reminders for their maintenance personnel, and provided training and manuals on the equipment. The decrease in service time and visits the industry seems to be undergoing and subsequent increase in incidents motivated code writers to write maintenance requirements.

The maintenance of elevators, as practiced in the 1980s, started upon sales evaluation. When a salesperson said to a field technician, "We are bidding a building. Come with me so I know how to bid it," the technician performed an evaluation of the equipment and its condition, and the maintenance company verified its personnel had the capability, training, time and equipment manuals to provide maintenance. Most devices back then were made up of relays and rotating equipment; the similarities among manufacturers were far greater. For example, if a technician could troubleshoot one relay controller, he or she could generally troubleshoot any relay controller. This changed significantly with the sophistication of computer controllers.

Traditional pre-maintenance visits included verifying the condition of the job and identifying if it was necessary to bring the equipment up to code or company standard before taking on a problem. Older equipment with motor-generators and rotating speed control systems required much more maintenance than a solid-state motor controller does. Solid-state equipment has fewer moving parts, no carbon dust to clean up, etc. Together, the

sales and field team would establish a minimum time based on the conditions, set the interval (an analysis), then send the bid to the customer. Competitors did the same thing; the lowest bid would typically prevail.

Once the maintenance job was given, the maintenance company created a check chart and callback, repair, alteration and testing records. The information was tucked away in the job folder in the office. All important events in a conveyance's history during its maintenance were in a folder, including when alterations were done, when proposed items were replaced or repaired, vandalism billing, etc. The history of the unit with regards to general data was in the folder. Callbacks were also maintained by address and conveyance number.

Callbacks

Ideally, preventative and predictive maintenance of the equipment would reduce or prevent any failure of components and provide the owner with 100% availability of the conveyance. But, things sometimes wear quicker than expected, some components are too frail for unexpectedly high usage, general wear and tear may be left unattended, and/or misuse and abuse by users will cause callbacks.

Callbacks are the single largest indicator of the quality of maintenance. They are the canary in the mine indicating lack of oxygen, showing where the conveyance is failing and enabling identification of root causes to determine how the maintenance company's resources should be used. Clemense Ehoff, assistant professor of Accounting at Kean University in Union, New Jersey, confirms the use of callbacks as a company's internal method of determining maintenance effectiveness in his case study.[1]

This list of root cause possibilities is long, and it is the job of the supervisor and mechanic to determine the reason for a high number of callbacks, make the appropriate adjustment and watch for improved results. The callback could be the result of a training issue; a mechanic unfamiliar with the system; a particular design misapplication issue; the use of a switch rated at too low a current that, thus, burns up; an environmental issue; or a machinery space exposed to weather or contaminants.

Ron Schloss has suggested that an achievable number of callbacks for reliably maintained equipment is two callbacks per year for escalators, three per year for hydraulic elevators and four callbacks per year for traction elevators.[2] Further supporting this number, in *Elevator and Escalator Accident Reconstruction and Litigation*, the authors cite the same callback rate per annum.[3] I concur with this, using my experience of documenting more than 20 routes in the San Francisco Bay Area as a superintendent for a major company in the 1980s. From the callback rate I measured, I could identify the needed maintenance resource and apply it to the specific problem. I could measure the quality of the mechanic, equipment and customer. Fairly determining this balance requires having been in the trenches to know what is real and what is exaggerated. All supervisors/superintendents must have had a minimum of four years of actual field experience in maintenance to understand the various elements and supervise with experience and intelligence.

Lastly, when payroll was due, the route sheets, service tickets, purchase receipts and billable service tickets were added up by the maintenance department, verified, collated, stapled and sent to headquarters, where payroll was made. As a supervisor, I read every callback report, and when it was unclear, I called the mechanics and clarified what was unclear. I believe this is an important review for a supervisor to have the customer and company's interest and mechanics'/helpers' interests as their focus, constantly asking how to make the operation more efficient, fulfilling and rewarding for all parties.

Modern Maintenance

As time passed, the age of electronic tools such as personal data assistants, dedicated data input tools and, later, tablets and smartphones eliminated the pen-and-paper model of recording maintenance. These devices can dispatch personnel, instruct them on the maintenance tasks to be done and when to do them, create the records of maintenance being performed, display the procedures and output to payroll. It makes sense to have one person or device (instead of two or three people) performing data input.

However, recent history has shown that some critical data has been lost in the transition to digital recording. Most systems do not allow the level of detail pen-and-paper documentation methods provided. Many use codes or abbreviated descriptions to record callbacks, leaving important details to the imagination. The 2013 code changes to the maintenance section were focused on the allowance of the use of electronic systems and where the data must be made available. The texture of the information is different, however; the level of detail is now in the form of lookup tables and limited fields of a few characters to describe a corrective action. Time will tell if the details will improve, but current systems are not adequate as intended by the code, nor equivalent to the recordation of the 1990s.

Salespeople still go out and bid jobs with supervisors, time estimates of maintenance are still determined, information is still entered into databases, and maintenance routes are still structured by management, algorithms and mechanic feedback. Details such as mechanic training, capability and serviceability are, hopefully, considered when assigning equipment. The industry trend is to take any manufacturer's equipment into a maintenance portfolio. With hundreds of component manufacturers, this level of complexity means companies have to train mechanics on many different control systems. Any required special procedures and the way in which they are communicated to the maintenance mechanic are important.

Common to both the old and new methods is the mechanic. There are approximately 25,000 maintenance technicians in the U.S. and Canada. Understanding the code that affects their daily life is a must for several reasons: safety, professionalism and protecting your livelihood (if you are required to be licensed, as more than 35 jurisdictions now do). Controllers are becoming more and more complicated. There are still tasks to be done on all the applicable components,

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but further knowledge is required for all high-tech components. Many companies employ the strategy that calls for adjusters (employees with more extensive education) to supplement route mechanics.

MCP Problems

Many maintenance companies provide a version of an MCP; there are some notable issues with some of them. My findings as a consultant since 2008 show that improvements can be made with the following with most MCPs I have seen.

No Interval Analysis

Maintenance records with preprinted intervals for every piece of equipment likely fail to pass the analysis test and, therefore, do not conform to code. For example, consider a highly used 1980s Westinghouse CDM system with relay logic, 3-mps (600-fpm) traction controller with a motor-generator. Compare that high-maintenance-demand job to a 1-mps (200-fpm) thyssenkrupp TAC 32 traction solid-state controller (2014 technology) with a solid-state drive in a low-use building. One company's maintenance record preprints that you look at the controller semiannually and uses the same preprinted manual for all jobs.

Clearly, the intervals in this case need to be different but are not. An analysis on the one metric "technology" may say that less frequency is needed for the newer technology, but if the new job were in a sugar factory, where dust is so thick it clogs the controller cooling vents and fans, the temperature may exceed manufacturer recommendations and cause the solid-state boards to fail. This would indicate more frequent maintenance is required due to the "environment" conditions. The analysis is not that difficult; it just must be done.

No Callback Detail

Maintenance records with callbacks recorded as codes for corrective actions without a description of a corrective action taken fails the documentation test and, therefore, does not conform to code. The code is clear that a complete description is required. The code is deliberate that a description be provided to ensure the corrective actions are known to the next mechanic taking a call.

No Procedures Available

An MCP with no procedures to reference the task to be performed by elevator personnel potentially leaves the task undone, unfinished or inadequate, and fails to conform to the code. If the tasks were provided and clearly defined, it should be available when needed. As with any profession, knowledge, training and recommended procedures are needed to ensure the tasks are performed completely. There is a tendency by companies to assume mechanics are trained by others and that the recommended procedures are not needed. Some procedures that are very vague (sometimes to the point of attempting to have one small paragraph for all brands of all vintages) are being drafted. This may be acceptable for very simple devices like a final limit switch, but it is inadequate when talking about complex equipment, such as the controller.

Incomplete Tasks

A glaring failure of most MCPs incorporating electronic reporting is the inability to split time for a task. An example is hoistway-door maintenance. If the job is a two-stop hydraulic elevator, the task of door maintenance will certainly take less than a day. If the job is a service car with 80 front and 80 rear opening doors, it will certainly take more than a day. Task reminders provided with electronic tools must allow adequate time to do the work and to record where one day's work ends and where to pick up the work later. Sometimes this work has weeks between the tasks. Means to ensure the correct amount of time is reserved and verification by the mechanic of completing the task must be provided.

Changes in the 2013 Code

The changes in the ASME A17.1-2013/CSA B44-13 Code were not directed at the deficiencies above. They are more to define where specific records must be provided and how they may be viewed. The following changes to the code and their ramifications are below. Underlined text represents the changes in the 2013 edition:

1) New definitions were added to define particular words:

"maintenance: a process of routine examination, lubrication, cleaning, and adjustment of parts, components, and/or subsystems for the purpose of ensuring performance in accordance with the applicable Code requirements. (See also repair and replacement.)

"maintenance control program (MCP): a documented set of maintenance tasks, maintenance procedures, examinations, and tests to ensure that equipment is maintained in compliance with the requirements of 8.6.

"maintenance interval: the specified period between the occurrences of a specific maintenance task.

"maintenance procedure: an instruction or sequence of instructions for performing a specific task(s).

"maintenance task: a maintenance activity (work) that needs to be accomplished."

2) The preamble to Section 8.6 added clarity on the purpose of the section. Note that the requirement indicates these components should not be found out of compliance by an inspector, but that the maintenance company, engaged by the owner, must maintain them in compliance:

"SECTION 8.6

"MAINTENANCE, REPAIR, REPLACEMENT, AND TESTING

"Requirement 8.6 applies to maintenance, repairs, replacements, and testing. Maintenance, repair and replacement shall be performed to provide compliance with the code applicable at the time of installation or alteration."

3) To clarify what an MCP must provide, the language was added in 8.6.1.2.1:

"8.6.1.2 General Maintenance Requirements

"**8.6.1.2.1** *A written Maintenance Control Program shall be in place to maintain the equipment in compliance with the requirements of 8.6. The MCP shall specify examinations, tests, cleaning, lubrication, and adjustments to applicable components at regular intervals (see definition for maintenance) and shall comply with the following."*

4) Several changes were made for organizational and clarification purposes. To clarify that every unit

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must have an MCP and that it must be viewable onsite at all times, the following language was added in 8.6.1.2.1(a):

"(a) A Maintenance Control Program for each unit. (see 8.6.1.1.1) shall be provided by the person(s) and/or firm maintaining the equipment and shall be viewable on site by elevator personnel at all times from time of acceptance inspection and test or from the time of equipment installation or alteration (see 8.10.1.5)."

5) Clarified what the MCP must include and which documentation must remain onsite:

"(b) The MCP shall include, but not be limited to, the code required maintenance tasks, maintenance procedures and examination and tests listed with the associated requirement (see 8.6.4 thru 8.6.11). Where maintenance tasks, maintenance procedures, or examinations or tests have been revised in 8.6 the MCP shall be updated.

"(c) The MCP shall reference On-Site Equipment Documentation (see 8.6.1.2.2) needed to fulfill 8.6.1.2.1(b) and On-Site Maintenance Records (see 8.6.1.4.1) that record the completion of all associated maintenance tasks specified in 8.6.1.4.1(a)."

6) Clarified the MCP can be maintained remotely under the stated conditions, provided instructions are provided for onsite viewing:

"(d) Where the MCP is maintained remotely from the machine room, machinery space, control room, or control space (see 8.11.1.8) instructions for on-site locating or viewing the MCP either in hard copy or in electronic format shall be posted on the controller or at the means necessary for test (see 2.7.6.4). The instructions shall be permanently legible with characters a minimum of 3 mm (0.125 in) in height. (e) The specified scheduled maintenance intervals (see 1.3) shall, as applicable, be based on:

(1) equipment age, condition, and accumulated wear

(2) design and inherent quality of the equipment

(3) usage

(4) environmental conditions

(5) improved technology

(6) the manufacturer's recommendations and original equipment certification for any SIL rated devices or circuits (see 8.6.3.12 and 8.7.1.9)

(7) the manufacturer's recommendations based on any A17.7/B44.7 approved components or functions"

7) Specifies specific procedures that must be included in the MCP:

"(f) Procedures for tests; periodic inspections; maintenance; replacements; adjustments; and repairs for traction-loss detection means, broken-suspension-member detection means, residual-strength detection means, and related circuits shall be incorporated into and made part of the Maintenance Control Program. [See 2.20.8.1, 2.20.8.2, 2.20.8.3, 8.6.11.10, 8.10.2.2.2(cc)(3)(c)(2), 8.10.2.2.2(ss), and 8.6.4.19.12.]."

8) 8.6.1.2.2 clarifies which MCP components are required to be on site in hard copy (not viewable from an electronic display device):

"8.6.1.2.2 On-Site Documentation

The following documents specified in 8.6.1.2.2 (a), (b), and (c) shall be written and permanently kept on-site in the machine room, machinery space, control room, control space, or in the means necessary for test (2.7.6.4) in hard copy for each unit for elevator personnel.

"The documentation specified in 8.6.1.2.2(d) shall be on-site and available to the specified personnel.

"(a) Up-to-date wiring diagrams detailing circuits of all electrical protective devices (see 2.26.2) and critical operating circuits (see 2.26.3)."

9) 8.6.1.2.2(b) clarifies that procedures for inspection and testing not in the *ASME A17.2 Guide for Inspection of Elevators, Escalators, and Moving Walks* must be provided onsite for certain components. This means mechanics must have access to and understand the testing procedures of A17.2:

"(b) Procedures for inspections and tests not described in A17.2 and procedures or methods required for elevator personnel to perform maintenance, repairs, replacements, and adjustments, as follows:

(1) All procedures specifically identified in the code as required to be written (e.g. 8.6.4.20.8 check out procedure for leveling, 8.6.5.16.5 check out procedure for over speed valve, and 8.6.8.15.7 check out procedure for reversal stop switch, etc.),

(2) unique maintenance procedures or methods required for inspection, tests, and replacement of SIL rated E/E/PES electrical protective devices and circuits. See 2.26.4.3.2, 2.26.9.3.2(b), 2.26.9.5.1(b), and 2.26.9.6.1(b),

(3) unique maintenance procedures or methods required for inspection, tests, and replacement of equipment applied under alternative arrangements (see 1.2.2.1) shall be provided by the manufacturer or installer,

(4) Unique maintenance procedures or unique methods required for inspection and test of equipment specified in an A17.7/B44.7 Code Compliance Document (CCD)."

10) 8.6.1.2.2(c) and (d) specifies the checkout procedures that must be provided:

"(c) Written checkout procedures:

(1) to demonstrate E/E/PES function as intended (see 8.6.4.19.10)

(2) for elevator leveling speed with open doors (see 8.6.4.20.8)

(3) for hydraulic elevator over speed valve (see 8.6.5.16.5)

(4) for escalator reversal stopping device (see 8.6.8.15.7)

(5) for escalator handrail retarding force (see 8.6.8.15.13)

(d) Written procedures for the following:

(1) Evacuation procedures for elevators by authorized persons and emergency personnel shall be available on site. (see 8.6.11.5.2 and A17.4)

(2) The procedure for cleaning of a car and hoistway transparent enclosures by authorized persons. (see 8.6.11.4.2)"

11) 8.6.1.4 clarifies where records must be available and retained for five years:

"8.6.1.4 Maintenance Records

Maintenance records shall document compliance with 8.6. Instructions for locating the maintenance records of each unit, for viewing on site, shall be posted on the controller or at the means necessary for test (see 2.7.6.4). The

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provided instructions shall be permanently legible with characters a minimum of 3 mm (0.125 in.) in height. These records shall be retained for the most recent 5 years or from the date of installation or adoption of this code edition, whichever is less or as specified by the authority having jurisdiction. Existing maintenance records up to 5 years shall be retained."

"8.6.1.4.1 On-Site Maintenance Records

"(a) Maintenance Control Program Records

". . .

"(b) Repair and Replacement Records

". . .

"(c) Other Records

". . ."

12) 8.6.1.4.2 clarifies how callbacks must be documented and made available. It also adds a requirement to provide contact information to report trouble on the unit:

***"8.6.1.4.2** Call Backs (Trouble Calls): A record of call backs shall be maintained and shall include the description of reported trouble, dates, time and corrective action(s) taken that are reported by any means to elevator personnel. These records shall be made available to elevator personnel when performing corrective action. For elevator personnel other than personnel performing the corrective action, records will be available upon request. Instructions on how to report any need for corrective action (trouble calls) to the responsible party shall be posted on the controller or at the means necessary for test (see 2.7.6.4). The instructions shall be permanently legible with characters a minimum of 3mm (0.125 in.) in height."*

13) 8.6.1.7.2 clarifies that any testing using the alternative testing methods allowed in 8.6.4.20 must be added to the test tag. This alternative testing is described in detail in "Safety and Buffer Testing without Weights" (ELEVATOR WORLD, September 2010):

"8.6.1.7.2 Periodic Test Tags. *A metal tag with the applicable code requirement(s) and date(s) performed, and the name of the person or firm performing the test, shall be installed to be readily visible and securely attached to the controller of each unit for all periodic tests. If any of the alternative test methods contained in 8.6.4.20 were performed then the test tag must indicate alternative testing was utilized for the applicable requirement."*

14) 8.6.2.6 clarifies repairs of SIL devices. To briefly explain this, electrical/electronic/programmable electronic safety-related (E/E/PES) devices rely on four Safety Integrity Layers of failure protection (defined in IEC 61508 and similar Programmable Electronic Systems in Safety-Related Applications for Lifts and Programmable Electronic Systems in Safety-Related Applications for Escalators standards. After more than a decade of review, SIL devices were allowed in A17.1 in 2007. These devices are designed to replace mechanical and electromechanical components on the promise of improved reliability. Because they are very different from traditional components, the language in the 2013 edition was clarified:

"8.6.2.6 Repairs involving SIL Rated Device(s) SIL Rated Device(s) used to satisfy 2.26.4.3.2, 2.26.8.2, 2.26.9.4(b), 2.26.9.5.1(b), and 2.26.9.6.1(b) shall:

(a) not be repaired in the field

(b) be permitted to be repaired in accordance with the provisions for repair where included in the listing/certification,

(c) not be affected by other repair(s) such that the listing/certification is invalidated.

"8.6.3.13 Replacements involving SIL Rated Device(s) (See 1.3)

". . ."

15) 8.6.4.19.15 adds a requirement to test the emergency communication system (phone in the elevator):

"8.6.4.19.15 Emergency Communications. Emergency communications shall be tested to determine conformance with the applicable requirements (Item 1.6)."

16) 8.6.11.6 adds the requirement to barricade an escalator that is not working:

"8.6.11.6 Escalators and Moving Walks Startup and Procedures

"8.6.11.6.1

"(a) Escalators and moving walks shall be started only by authorized personnel (see 1.3) trained in compliance with the procedures specified in 8.6.11.6.2 through 8.6.11.6.5.

"(b) Stopped escalators shall not be used as a means of access or egress by non-authorized personnel and shall be properly barricaded if accessible to the general public to prevent such use.

"NOTE: Proper barricades are described in the Elevator Industry Field Employee Safety Handbook-Escalator/Moving Walk Barricades."

Conclusion

As the code evolves, changes to the maintenance section should provide further clarification of the obligations of the owner and maintenance companies contracted by them, and what is expected of mechanics and maintainers. This section should be made mandatory minimum education for maintenance mechanics or technicians by all states requiring mechanic licensing.

Clearly, there are benefits to this section of code. Where these components are maintained in compliance, the risk of injury is very low. Components can always fail, but these applicable components do not typically fail catastrophically. My experience is that a persistent lack of maintenance is causal in many incidents. The lack of education of mechanics is the foremost issue leading to incidents, followed by a lack of adequate time to even observe the components, let alone properly maintain them.

Owners must understand the requirements and provide the minimum maintenance the code requires, engage qualified companies and understand that the low bid is not always the best bid. AHJs should mandate mechanic education that includes the MCP to ensure they are aware of what is expected of them and tested for understanding their obligation. Mechanics should know which procedures are to be performed and how to perform them; document their work completely to ensure complete maintenance; study the maintenance section of the code; understand that changes to the code occur and that they must be aware of these changes; and believe their work is lifesaving and significant. Elevator companies should contract at the price the work requires; train mechanics to understand the importance of

maintenance; collect the procedures into a company library for training and reference; provide proper tools and training to each mechanic; and ensure proper recording in its maintenance records.

References

[1] Clemense Ehoff. *Journal of Business Case Studies*, November/December 2010, Volume 6, Number 6.

[2] Ronald D. Schloss. "What Callbacks Cost," ELEVATOR WORLD, April 1997.

[3] James Filippone, P.E.; Joel D. Feldman, Esq.; Ronald D. Schloss; David A. Cooper; and Joseph L. Stabler. *Elevator and Escalator Accident Reconstruction and Litigation,* Elevator World, Inc., p. 101.

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Learning-Reinforcement Questions

Use the below learning-reinforcement questions to study for the Continuing Education Assessment Exam available online at www.elevatorbooks.com or on p. 129 of this issue.

- How should maintenance intervals be determined?
- In which document did the first MCP appear?
- Which aspects should be included in any MCP?
- How should the maintenance interval (time between maintenance visits) be modified when a conveyance is considered "high use"?
- For which items in 8.6.1.2.2(c) are checkout procedures mandatory?

ELEVATOR WORLD Continuing Education Assessment Examination Questions

Read the article **"Maintenance Control Program Changes"** (p. 59) and study the learning-reinforcement questions at the end of the article.

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1. Generally, the maintenance interval can be longer when a _____ controller is being used.
   a. relay-type
   b. solid-state
   c. solid-slate
   d. high-speed

2. The MCP is usually provided by the _____.
   a. owner
   b. mechanic
   c. company
   d. apprentice

3. The MCP requires maintenance be done to _____.
   a. applicable components
   b. applicable controllers
   c. acceptable components
   d. acceptable controllers

4. Procedures for maintenance of applicable components must be provided by the _____.
   a. manufacturer
   b. apprentice
   c. owner
   d. mechanic

5. The single biggest indicator of the quality of maintenance is _____.
   a. ride
   b. callbacks
   c. lamps
   d. incidents

6. As a measure of the quality of maintenance, the number of callbacks for a traction elevator should not exceed ____ callbacks per unit per year.
   a. two
   b. three
   c. four
   d. six

7. The interval of maintenance is determined by _____.
   a. the salesperson
   b. an analysis of the equipment
   c. the owner
   d. the superintendent

8. Callback records are required by code to _____.
   a. be in the mechanic's possession at all times
   b. include a description of the problem(s)
   c. include a description of the corrective action(s) taken
   d. include a description of the problem(s) and the corrective action(s) taken

9. Maintenance tasks are required by code to _____.
   a. be done by the building engineer
   b. be provided in the machine room
   c. be performed after hours
   d. have procedures available to the mechanic

10. The code specifically requires that applicable components be _____.
    a. kept in the parts cabinet
    b. kept in compliance with Section 8.6
    c. inspected to verify compliance
    d. viewed onsite

11. The list of applicable components is found in AMSE A17.1/CSA B44 Section_____.
    a. 8.6
    b. 8.5
    c. 8.4
    d. 8.1

12. To determine the maintenance interval, _____ must be analyzed.
    a. one conveyance
    b. the bank of conveyances
    c. each conveyance
    d. the building

13. Onsite documentation must include _____, _____ and _____.
    a. up-to-date wiring diagrams; procedures for inspections and tests; electronic checkout procedures
    b. up-to-date wiring diagrams; procedures for inspections and tests; written checkout procedures
    c. original wiring diagrams; procedures for inspections and tests; written checkout procedures
    d. up-to-date wiring diagrams; procedures for verification; written checkout procedures

14. Written procedures for evacuation of elevators by authorized and emergency persons and cleaning transparent enclosures by authorized personnel _____ be provided onsite.
    a. cannot
    b. must
    c. should not
    d. may

15. _____ for locating the maintenance records shall be posted on the controller or means necessary for testing.
    a. Maps
    b. Tests
    c. Instructions
    d. Procedures

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