



PDHonline Course E451 (2 PDH)

Designing to NFPA 720-2015, Carbon Monoxide Alarms

Instructor: Thomas Mason, PE

2020

PDH Online | PDH Center

5272 Meadow Estates Drive
Fairfax, VA 22030-6658
Phone: 703-988-0088
www.PDHonline.com

An Approved Continuing Education Provider

NFPA 720 2015 Summary

Standard for the Installation of Carbon Monoxide (CO) Detection and Warning Equipment

TM, 7Oct14

CODE: Title, Standard, not Code
DISCUSSION: Consistent with recent trend at NFPA, this document emphasized that the enforcement comes through adoption by State or local government and the Authority Having Jurisdiction (AHJ).
ACTION ITEM: When writing a specification for a fire alarm which includes CO detectors, include the statement, "Carbon Monoxide detectors, equipment and notification devices shall strictly follow NFPA 720-2015."

CODE: Preface, Large parts extracted from NFPA 72-2013, Fire Alarm and Emergency Signaling Code
DISCUSSION: NFPA 72 explicitly excludes carbon monoxide detectors and references NFPA-72.
ACTION ITEM: When the text of NFPA-720 is not clear, it may be explained by the corresponding section in the NFPA-72, especially the NFPA-72 Handbook.

CODE: 1.2.1, Purpose of this Standard is to warn occupants of the presence of carbon monoxide in time to escape.
DISCUSSION: The first common use of CO detectors was to turn on fans where auto exhaust fumes are intermittently present. Arguably, that function closely matches the alarm function and Life-Safety considerations (dual power sources, supervised wiring) are appropriate for fan control also.
ACTION ITEM: Use professional judgment in the application of Life Safety systems.

CODE: 1.4, Equivalency - no Standard limitation on using equivalent or superior devices.
DISCUSSION: This is CYA talk. NFPA has been sued by smoke-and-mirrors salesmen and wants to avoid future problems.
ACTION ITEM: Be very careful in accepting new technology which appears too good to be true.

CODE: 1.4.1, Equivalency - Submit documentation to AHJ for acceptance.
DISCUSSION: In all cases, not just equivalency, the AHJ makes the final decision.
ACTION ITEM: At the end of the day, the measure of project success is getting a Building Permit, then an Occupancy Permit. Coordination with the AHJ is recommended.

CODE: 3.2.1, Approved means accepted by the AHJ.
DISCUSSION:
ACTION ITEM:

CODE: 3.2.3, 4, Labeled and Listed mean documentation satisfactory to the AHJ.
DISCUSSION: For many years, designers assumed that "listed" meant UL listed. The lawsuits, mentioned previously, caused NFPA to become very circumspect in this section.

ACTION ITEM: Require UL-listing in your specification if you think that provides higher quality and reliability.

CODE: 3.3.1, Definition of *Acoustically Distinguishable Space (ADS)*

DISCUSSION: NFPA is moving towards field testing of intelligibility on voice notification systems. This is a “camel’s nose in the tent.”

ACTION ITEM: Watch this area closely. It is expected that there will be future requirement, but it is near-impossible today, even though intelligibility meters are being marketed.

CODE: 3.3.6, Definition of *Carbon Monoxide Detector*

DISCUSSION: Be careful here. NFPA defines *control unit, control function interface device and warning equipment* separately.

ACTION ITEM: Use the term *Carbon Monoxide Detector System* in your specification to include all the necessary pieces-and-parts.

CODE: 3.3.23, Signal - Alarm, Supervisory, Trouble

DISCUSSION: These are the same concepts as used in fire alarm smoke and heat detectors. For fire alarms, we count on contractors and suppliers with decades of experience and continuing relationships with the AHJ. It is possible to get former garage door salesmen selling CO systems.

ACTION ITEM: Keep the boilerplate in the specification regarding Alarm, Supervisory and Trouble Signals. Look for these features in the submittals.

CODE: 4.3.2, Manufacturer’s instructions

DISCUSSION: This standard requires that manufacturer’s application and installation instructions be followed.

ACTION ITEM: Get a copy of the manufacturer’s application and installation instructions as part of the submittal.

CODE: 4.4.2, Installer qualifications.

DISCUSSION: This standard requires that the installer (or his supervisor) be experienced and certified or factory-trained.

ACTION ITEM: Require submission of installer name and qualifications in the submittal.

CODE: 4.5.3.2, Two independent and reliable power supplies

DISCUSSION: I haven’t taken apart my Home Depot residential CO monitor, but I am guessing it does NOT contain a backup battery. This section applies to both commercial and residential units.

ACTION ITEM: List this in your specification; check for it in the submittal.

CODE: 4.5.5.2, Branch circuit requirements

DISCUSSION:

ACTION ITEM: Dedicated circuit; marked as CO supply; accessible only to qualified personnel; (not required to be painted red, but still a good idea)

CODE: 4.5.6.1.1, Backup power starts in 10-sec and lasts 4-hr

DISCUSSION: Fire alarm backup power is much more stringent

ACTION ITEM: Find out if occupants are expected to evacuate in the event of a power failure. If NOT, then make sure that PRIMARY power is on the generator and SECONDARY power is available if the generator fails.

CODE: 4.5.10.6, 12-hour generator fuel supply on hand

DISCUSSION:

ACTION ITEM: When I specify a generator, I call for fuel for 60%load for 3-days. The 12-hour requirement would not affect me. Since old diesel fuel goes toxic and requires handling as a hazardous material, the 12-hour requirement may be meaningful in a well-thought-out design.

CODE: 4.6, Distinctive Signals for Alarm, Supervisory and Trouble, common to fire alarm OK

DISCUSSION: Be careful. Common audible is OK. Separate visual, with big tags, are required.

ACTION ITEM: Check the boiler plate in your specifications for compliance.

CODE: 4.7.3.6, deactivated alarm shall maintain audible trouble notification

DISCUSSION: This is also in the current fire alarm code.

ACTION ITEM: Check the boiler plate in your specifications for compliance.

CODE: 4.8.5, deactivated supervisory notification shall automatically restart after 24-hours

DISCUSSION: This is also in the current fire alarm code.

ACTION ITEM: Check the boiler plate in your specifications for compliance.

CODE: 4.11, Detector performance and limitations

DISCUSSION: 85 – 110% supply voltage; 32 – 120F temp, manufacturer’s published limits

ACTION ITEM: That 32F minimum is a problem for unheated parking garages. System Sensor sells a combined fire / CO detector rated 32 – 100F, 15 – 90% RH. Gamewell, same. Notifier, same.

<http://www.cpsc.gov//Global/Research-and-Statistics/Technical-Reports/Home/Carbon-Monoxide/COAlarmConformanceReportFY%202013ClearedTechReport.pdf> 1 of 6 models tested passed all tests. Temp and humidity were the problems. Temp standard was 32 – 120F. Siemens FDOTC241 is rated down to 0F.

CODE: 4.12.5, Zoning Required

DISCUSSION: It is important to group the annunciation of detectors so that alarms correspond to evacuation zones. In a voice notification system, it is possible to be selective in sending people in one

location to one exit and others to a different exit.

ACTION ITEM: Standard fire alarm boilerplate requires zoning. Check your specification.

CODE: 4.14, Monitoring Integrity.

DISCUSSION: Carbon monoxide alarms must have supervised wiring and devices.

ACTION ITEM: Check standard spec boilerplate; do not accept residential units.

CODE: 4.14.2, Completion Documents

DISCUSSION: An 8-page forms is required. Normally, I don't check this because the wording is that the forms must be submitted to the AHJ and they are very careful with fire alarms. As carbon monoxide alarms are relatively new, the same standard of care may not be present.

ACTION ITEM: Include this in spec but also ask for an installation sticker on the outside of the cabinet. A later section says that all CO detectors must be replaced after 10-years. You need to know when to start counting.

CODE: 5.2.3, Separate Systems

DISCUSSION: CO alarm need not be integrated into fire alarm, but conflicting alarms are forbidden.

ACTION ITEM: Think very carefully before designing stand-alone systems.

CODE: 5.3.3.1, Nonrequired carbon monoxide detection systems shall meet the requirements of this standard.

DISCUSSION:

ACTION ITEM: There is no such thing as "almost an NFPA CO alarm". Some Owners insist on adding a CO detector to a plant SCADA system or BAS system. They are not life-safety rated.

CODE: 5.8.2.5.1, Signal transport equipment

DISCUSSION: Routers and servers used in the carbon monoxide alarm system shall be listed for carbon monoxide alarm service

ACTION ITEM: Again, there is liability in attempting to "roll your own" carbon monoxide alarm system.

CODE: 5.8.2.9, permitted silencing of alarm sounder

DISCUSSION: if panel continues to indicate alarm

ACTION ITEM: Indication of false alarms is permitted so long as a reminder remains

CODE: 5.8.3, Interconnection with Household Carbon Monoxide Alarms

DISCUSSION: Building alarm can trip household alarm; Household alarm or trouble can be logged to building system. Household cannot trip building evacuation alarm.

ACTION ITEM:

CODE: 5.8.4.5, Mass notification speakers or emergency communications systems
DISCUSSION: can be connected to the carbon monoxide alarm system, in accordance with NFPA 72
ACTION ITEM: NFPA 72 permits non-supervised public address for alarms. I disagree strongly.

CODE: 5.8.5.3.7, application limitations, 32 – 100F, 10 – 95% RH
DISCUSSION: except for specifically designed units, and these do exist
ACTION ITEM: see 4.11 comment

CODE: 5.8.5.3.9, Protection During Construction
DISCUSSION: protection from dust required.
ACTION ITEM: Most detectors come with caps for protection during construction. Include in specification.

CODE: 5.8.6.2, Notify building or zone only
DISCUSSION: There is an exception for notifying only the zone. Read carefully.
ACTION ITEM:

CODE: 5.8.6.3, Notification zones
DISCUSSION:
ACTION ITEM: layout detection zones per evacuation plan

CODE: 5.8.6.5.1, Carbon monoxide audible alarm - 100mS on, 100mS off, 100 mS on, 100mS off, 100 mS on, 100mS off, continue...
DISCUSSION: Fire alarm audible – 500mS on, 500mS off, 500mS on, 500mS off, 500mS on, 500mS off, 1500mS off, continue... (NFPA 72 18.4.2.1)
ACTION ITEM:

CODE: 5.10, Off-Premises Signals
DISCUSSION: Remote monitoring must include alarm, trouble and supervisory
ACTION ITEM: Include in specification

CODE: 5.12, Low-Power Radio (Wireless) Systems
DISCUSSION: Not covered here. I have had extremely bad experience with wireless systems - unexpected dead zones and unreliable operation. Apply at your own risk.
ACTION ITEM:

CODE: 6.3.3.2, Visual notification devices must not be labeled, FIRE.
DISCUSSION: Separate notification device and label for CARBON MONOXIDE.
ACTION ITEM: Covers, guards and substantial mounting recommended.

CODE: 6.4.8, Intelligibility, required but not verification.
DISCUSSION:
ACTION ITEM:

CODE: 6.4.5.5, Alarm sound level 10dB above ambient.
DISCUSSION: NFPA 72 18.4.3.1, fire alarm sound level 15dB above ambient
ACTION ITEM:

CODE: Table 6.5.5.4.1() Room Spacing for Wall-Mounted Visible Appliances
DISCUSSION: Complex table. Seems to reduce to 40-ft c-c for typical 75cd strobe
ACTION ITEM: Same table in 72HB-2013

CODE: 6.5.5.5.5, Not more than 15-ft from end of corridor and not more than 100-ft c-c in corridor
DISCUSSION:
ACTION ITEM: Same requirements in 72HB-2013

CODE: X.X.x.x.x.x,, Commercial / Industrial spacing for CO Detectors, 70-ft x 70-ft
DISCUSSION: NFPA 720-2015 does not address commercial / industrial spacing of CO detectors. The reference in 4.11 says to follow manufacturer's published limit. Commercial CO detector published data says "5,000 sa-ft coverage per detector".
ACTION ITEM: Check manufacturer's application data for the design basis detector for your project. Prepare plan drawings which use this data.

CODE: 6.5.5.4.2, Strobes shall be synchronized
DISCUSSION: Unsynchronized strobes can initiate epileptic seizures. Come installers aren't careful. It is just a jumper lead between strobe driver (main panel) units.
ACTION ITEM: Same requirements in 72HB-2013. Please sync between fire alarm and CO alarm.

CODE: 6.9.2.1, Private mode
DISCUSSION: This is a special provision for occupancies where evacuation is difficult or impossible, as prisons and hospitals. It is legal to notify only the guards or nurses, but there are requirements in this section.
ACTION ITEM:

CODE: 7.1, off-premises monitoring
DISCUSSION: Off-premises monitoring is not required, but, if implemented, rules apply.
ACTION ITEM:

CODE: 8.7.2, Replace alarms when end-of-life signal activates or 10-years from date of manufacture.

DISCUSSION: The standard does not limit this requirement to residential units. Note, “date of manufacture”, not “date of installation.”

ACTION ITEM:

CODE: 8.8.1.1, Testing by qualified technician every 3 years

DISCUSSION: This is limited to household carbon monoxide detection systems, but places a burden on residents, landlords and public housing administrators.

ACTION ITEM:

CODE: 9.3.3, number of household CO detectors not stated

DISCUSSION: The adopting or enforcing body makes this determination

ACTION ITEM:

CODE: 9.4.1.1, CO alarms required outside each sleeping unit, on every occupiable level

DISCUSSION: This does not relieve installers from complying with local or State requirements for more. Interconnecting so one detector trips all alarms is recommended. Required in 9.6.4.

ACTION ITEM:

CODE: 9.4.2.2.1.1, Mild to Severe Hearing Loss, 520 Hz at 75dB

DISCUSSION: There will be a discussion of which locations require this. More is safer.

ACTION ITEM:

CODE: 9.4.2.2.1.2, Moderately Severe to Profound Hearing Loss

DISCUSSION: This topic is recognized but not covered here.

ACTION ITEM:

CODE: 9.6.2.1, 85 dB minimum

DISCUSSION: Chapter 9 is HOUSEHOLD, but household is not defined within NFPA 720. NFPA 72 Handbook defines household as one- and two-family dwellings and certain occupancies such as sleeping rooms or guest suites or hotels, and the dwelling units of apartment and condominium buildings.

ACTION ITEM:

CODE: 9.5.3.1, Battery only

DISCUSSION: Must be tested monthly and provide warning at end-of-life.

ACTION ITEM:

CODE: 9.6.4, CO detectors must be interconnected to sound all alarms.

DISCUSSION:
ACTION ITEM:

(end NFPA 720-2015 Summary)