New Fire Alarm Low Frequency Notification Requirements for Hotel and Apartment Occupancies

Independent Alliance of the Electrical Industry,
Benjamin Franklin Chapter

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Today's Objectives

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Upon completion, participants will be better able to:

- Understand the origin of low frequency requirements
- Identify challenges facing fire alarm industry and technology advancements
- Learn low frequency signaling codes for sleeping areas.
- Apply the low frequency notification methods to designs

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			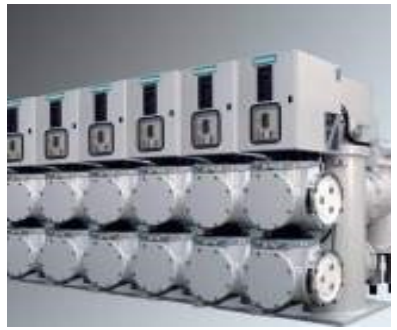		

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				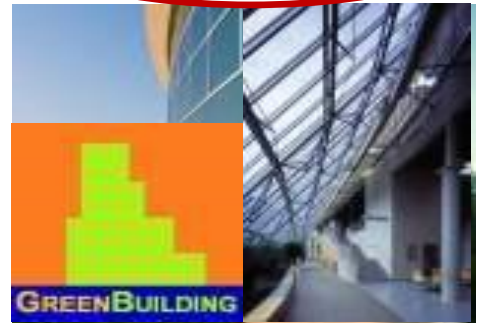

Fire Statistics

The young and older populations are have a higher fire risk.

High Risk Groups:

- **School aged children:** 13% of fire fatalities in residential buildings were under the age of 10.[4]
- **Alcohol or drug-impaired:** It's suspected that over 27% of civilian fatalities in residential building fires are linked to alcohol, drug, or chemical influence.[4]
- **People with hearing loss:** More than 34.5 million people in the US are hard of hearing.[5]

Sources:

4. USFA, Civilian Fire Fatalities in Residential Buildings Report
5. Waking Effectiveness of alarms for adults who are hard of hearing, NFPA Dorothy Bruck, Ian Thomas June 2007

Waking Effectiveness Study

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The Fire Protection Research Foundation conducted studies to determine the best methods to wake high risk groups using these signals:

1. 400 Hz square wave signal
2. 520 Hz square wave signal
3. 3 KHz pure tone (standard)
4. Bed shaker (under mattress)
5. Pillow shaker
6. 110cd strobe light

The low frequency signal is 6 to 10 times more effective at waking children than the standard 3 KHz audible fire alarm signal*

*Awakening of Sleeping People – a Decade of Research, Ian Thomas and Dorothy Bruck July 2008

Who benifits from Low Frequency Fire Alarm Signals?

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Children - Fewer than one in three children aged 6-10 years woke up reliably to a standard smoke alarm signal – even when the smoke alarm was directly over their bed.

Hearing Impaired - About a million people in the US are deaf. 70 million have moderate to severe hearing loss.

Heavy Sleepers - A high-pitched smoke alarm is not always effective to awaken you up from a sound sleep.

Older Adults - For those over 75 years old, the risk of fire death skyrockets to 3.5x the national average. As we age, we loose our ability to hear higher frequency tones.

UL Low Frequency Labeling

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UL created new 520 Hz test protocols and standards:

ANSI/UL 464*:Standard for Safety Audible Signal Appliances*

- A low frequency notification appliance complying with section 24.1, shall be marked “Low Frequency Alarm”

ANSI/UL 217: *Single and Multiple Station Smoke Alarms*

- A low frequency alarm complying with Section 65, Audibility Test, shall be marked “Low Frequency Alarm”

Manufacturers Product Response

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24VDC POWER DRAW	
38 mA	128 mA

Standard Piezo 3KHz

Low Frequency Horn 520 Hz

4”

Voice Speaker 400 to 4KHz

New Products Introduced

NFPA 72

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2010 edition of NFPA 72 introduced the *new* T3 low frequency code changes for sleeping areas.

18.4.5.3* Effective January 1, 2014, where audible appliances are provided to produce signals for sleeping areas, they shall produce a low frequency alarm signal that complies with the following:

1. The alarm signal shall be a square wave or provide equivalent awakening wave or provide equivalent awakening ability.
2. The wave shall have a fundamental frequency of 520 Hz ± 10%.

NFPA 72 required low frequency for fire alarm system notification appliances and smoke detectors, but exempted 120VAC smoke alarms.

NFPA 72

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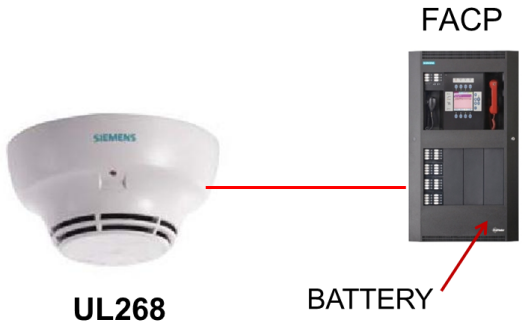
SMOKE DETECTOR



UL268

RESIDENTIAL & COMMERCIAL

System smoke detectors with audible bases and building audible signals in sleeping areas are required to provide a low-frequency tone per NFPA 72 Section 29.3.8.

SMOKE ALARM

UL217

RESIDENTIAL

NFPA 72 Chapter 29 *Single and Multiple-Station Alarms and Household Fire Alarm Systems* section 29.3.6 exempted the 120VAC smoke alarms from the new 520 Hz low frequency requirements.
No manufacture could cost-effectively produce them.

NFPA 720

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2009 edition of NFPA 720, states that audible appliances in sleeping areas are required to produce a low frequency alarm signal (T4) for CO detection. In the 2012 edition, the code was expanded to include sleeping areas in commercial spaces. Effective date: January 1, 2015.

IBC & IFC 2021 editions

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In section 907.5.2.1.3.2, sleeping rooms of Group R-1 and R-2 occupancies that are required to have a fire alarm system, the audible alarm signal activated by single or multiple-station smoke alarms in the dwelling unit or sleeping units shall be a 520-Hz signal complying with NFPA 72.

There are <u>no</u> UL217 120 VAC single or multiple station smoke alarms on the market with an integral 520 Hz sounder.

Per IBC [2021] 907.2.11.7 when system smoke detectors (UL 268) are installed in residential applications, they must be programmed as a supervisory signal so activation of a detector in a dwelling unit only initiates the notification inside the dwelling unit. It must not activate notification appliances outside of the dwelling unit or dispatch the fire department.

Solutions

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Now both a general building alarm and a local in-unit smoke activation must produce a low frequency tone. This new code requirement will necessitate utilizing the building's fire alarm system with one of the following methods:

1. System smoke detectors with low-frequency sounder bases.
2. System smoke detectors with addressable notification.
3. System smoke detectors with a dedicated & controllable NACs for each residential unit.
4. System smoke detectors with a NAC addressable module for each residential unit.

The residential unit system smoke detectors must be programmed as supervisory signals which are non-latching/ self-restoring. This will allow them to automatically deactivate when the smoke condition clears. Voice systems may use one of the above options with the addition of speaker appliances that have a frequency range which includes 520Hz. Select a low-frequency pre-announce tone to be broadcasted before the voice message.

Benifits of smoke detectors vs. smoke alarms

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An addressable smoke detector with a sounder base can be programmed to function the same as a typically hard-wired smoke alarm and offer several advantages:

- Multi-criteria detection options for more rapid and reliable fire detection.
- Supervised circuits and equipment to assure operation.
- Operating power from a centralized source.
- Detector activity is date/ time stamped in the FACP's history log.
- NFPA 72 recommends replacing 120 VAC smoke alarms every 10 years. System smoke detectors (with constant sensitivity monitoring) need to be only replaced when the FACP determines the smoke detector is defective (typical life cycle 30 years).
- Alarm verification feature, option to reduce unwanted alarms using NFPA 72 approved sequence of operation to valid alarm-initiation signal.

Local Low Frequency Code Requirements

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The 2021 IBC has expanded the 520 Hz low frequency signaling requirements in multi-occupant residential occupancies.

120VAC smoke alarms are no longer a viable design option. This code is currently enforced in NJ & DE, July 2025 in PA.

Most engineers will specify low frequency notification regardless of the jurisdiction to ensure compliance and reduce their design liability.

Poor Planning

Thank You!