NOTIFICATION APPLIANCES
So far, we have covered the basic operation of control panels and the initiating devices that place the panels in an alarm condition. We are now going to review the notification appliances that are energized or “turned on” by the control panel.

The term “notification appliance circuits” has undergone somewhat of an evolution in the past few years. These were designated for many years as “signal circuits”, “alarm circuits”, and also “indicating circuits”. Revisions to NFPA Standards a few years ago adopted the term “notification appliances and notification appliance circuits (NACs)” to avoid confusion and misunderstanding and also to differentiate them from the communication circuits used by addressable fire alarm systems.

Notification appliances are divided into two very basic categories, audible and visual. Obviously, the audible appliances make loud noises and the visual appliances flash bright lights. Recently, tactile devices have been developed for the hearing impaired, but are used at the present only in very specialized applications and only as a secondary or ancillary unsupervised device. One example of this would be a “bed shaker” which is used to awaken the hearing impaired.

AUDIBLE APPLIANCES
Installed audible notification appliances should differ from other audible devices in use in the area. For example, if a school uses bells to signal the start of classes, bells should not be used as notification appliances in that building.

The most widely used audible appliance is the horn. Horns presently on the market employ both electromechanical and electronic designs.

Electromechanical horns have been used for many years and are constructed using a set of breaker points and diaphragm. These horns are capable of providing a surprisingly loud sound output, but have the disadvantage of the mechanical breaker points oxidizing, corroding, or going out of adjustment. In addition, the loud output requires a substantial amount of current to do the job. Other disadvantages are that only one tone is available, the breaker points create “spikes” which can be transmitted back to the control panel, and electromagnetic interference (EMI) can be radiated from the area where the horn is sounding. Manufacturers have designed their horns to minimize these problems, but EMI in the past has been known to cause unwanted alarms from smoke detectors located immediately in front of the horn.

One of the newest developments in this area is the “electron-mechanical” horn which uses the old familiar diaphragm, but has an electronic circuit in place of the breaker points, much in the same manner as electronic ignition replaced the old automobile breaker points. This type of horn has the advantage of generating substantial sound output without the inherent disadvantages of breaker points.

The latest fire alarm requirements require a “temporal pattern” which requires the notification appliances to sound three rounds of three blows each, with specified intervals between blows and rounds of code. Temporal patterns are usually programmed at the factory by the panel manufacturer and the installer need not be concerned with the proper time duration of the blows and rounds. The most the installing technician need be concerned with is selecting the proper jumper position inside the enclosure. The disadvantages of electronic horns presently on the market are their loudness and the fact that many electronic horns are not suitable for weatherproof use. The loudness of these horns is measured at a higher frequency than the electromechanical horns. While the decibel measurements are comparable, in actual applications the electronic horns sometime are not as audible to the average human ear, or especially to people with deteriorating hearing. Recent research indicates that a lower frequency tone, in the vicinity of 520 Hz is heard much more readily by people with deteriorating hearing. Sound output, of course, is dependent upon building construction, layout, furnishings, etc.

The ABC’s of Fire Alarm Systems - Part VI
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today, although their use is rapidly decreasing due to the Temporal Pattern requirements. Bells presently in use usually range from 6 to 10 inches in diameter.

Most bells encountered today are made in vibrating, motor-driven or single stroke variations with vibrating or motor driven bells in the majority. The single stroke bell is suited only for march time or coded applications (including temporal pattern) as it emits a louder, cleaner sound than a vibrating bell. The disadvantage is that it draws considerably more current than the vibrating or motor-driven bells and cannot operate on uninterrupted or “non-coded” current, as the bell would give one blow and then “hang up”. Vibrating bells draw moderate amounts of current, while motor bells usually draw less current. A disadvantage of the motor driven bell in the past was the tendency of the motor to stick or bind because it sat idle for long periods. To be sure, present manufacturers again have overcome many of the shortcomings, but these problems are inherent in the principle of operation. Vibrating bells do not lend themselves readily to Temporal Pattern signaling.

Chimes operate in the same manner as bells, and are usually constructed similarly to bells, using the same mechanism, only with a chime kit mounted in place of the gong shell. Chimes do not have adequate sound output for use as general evacuation appliances, but are mostly used in hospitals, etc. as prealarm or presignal devices to alert available personnel that an emergency exists and a general evacuation may be imminent.

The last audible appliance is the loudspeaker. Obviously, these are intended for voice evacuation systems, and must be listed by a Nationally Recognized Testing Laboratory (NRTL) for fire alarm use. Speakers are installed in supervised circuits and the great majority are used in high-rise buildings where selective evacuation is necessary due to the difficulty of evacuating a building completely in an emergency. The results of the 9-11 disaster indicate that this practice is far from being resolved and much effort is now being dedicated to mass notification measures. Emergency voice evacuation and mass notification systems will be discussed in a future article.
VISUAL APPLIANCES

Visual appliances employed in the past included flashing incandescent lights and various types of strobe lights. With the advent of the Americans With Disabilities Act, (ADA), only high intensity strobes are capable of producing the light intensities required. The ADA guidelines (ADAAG) have been updated in the recent past, are quite complex, and have been the subject of many lectures and much discussion. There was great confusion in the early days of the ADA, since the ADA is a federal law, enforceable basically in court, and local code enforcement officials had no authority to either approve or interpret the ADA. In fact, these requirements have been the subject of entire publications and are beyond the scope of this article. Many state codes have been harmonized in accordance with ADAAG guidelines, so now meeting these codes also satisfies the ADA, but not all codes have been updated in this fashion. Anyone planning to become involved with the layout of fire alarm systems is well advised to consult one or more of these publications.

And now to return to strobe lights. These have a high intensity output, with some providing a light intensity as high as 110 candela. Light intensity levels are defined as CANDELA (effective candlepower) which is the measuring criteria per ANSI/UL Standards 1638 and 1971, and is defined as the average light output generated during one flash cycle. This should not be confused with peak candlepower which is immensely greater. Before strobes were standardized, some manufacturers used peak candlepower figures in their literature which led to some confusion.

Other strobes in common use are rated as “15/75” candela, as they emit a 15 candela flash when viewed from the side, but exhibit 75 candela when viewed directly.

Both the fire alarm designer and installer should be aware of one problem with strobes. A strobe flash rate greater than 1 Hertz per second could induce epileptic seizures in persons afflicted with this disorder. Therefore, the ADA mandates a flash rate between 1 and 3 Hertz/second. If two or more strobes are observable from a single location, synchronization of the strobes is necessary to meet this requirement. Microprocessor based panels currently on the market are designed to meet this.

The other important thing to remember when using strobes is that the high intensity light output is directly related to current consumption. In many cases, the quantity of strobes required for an installation may exceed the capacity of a smaller control panel which might have a limited number of notification appliance circuits. Many of these circuits are commonly rated at 1.75 amperes maximum per circuit with a total panel limitation being somewhat less, such as a maximum of 3 amperes for both circuits combined. It doesn’t take many strobes at 245 amperes each to exceed the capacity of such a circuit. In these instances, a larger panel or NAC extender panel will be required. These supply additional notification appliance circuits and correspondingly larger power supplies. Strobe lights depend on the charging and discharging of a capacitor to flash their xenon flash tube. If the current to the strobe is interrupted or pulsed, it could interfere with the proper operation of the strobe. Microprocessor-based controls and extender panels are designed with provision for synchronization of strobes and temporal patterns for the horns.

Strobes are most often mounted on horn and speaker covers so both the audible and strobe comprise a single unit. This makes for simpler wiring and combines both into a compact package. Strobes are also available in “stand alone” configurations and ceiling mount, although ceiling mount units do not at present completely meet ADA requirements, as the light intensity requirements are based on the strobes being observed directly, something difficult to do with an overhead device. Strobes are also available on plates which accommodate bells or chimes, so they can also be installed in one package.

Some jurisdictions require (erroneously) that only the audible appliances can be silenced after an alarm with the strobes continuing to flash until the panel is reset. This practice has been criticized recently, as flashing strobes indicate an evacuation signal to the hearing impaired.

COMPATIBILITY

Until fairly recently, compatibility was not an issue as far as notification appliances were concerned. The devices merely had to have the same nominal operating voltage as the notification appliance circuit. The advent of microprocessor panels has resulted in some control panels operating at somewhat higher voltage levels, resulting in instances, depending on the supply voltage to the panel, where the operating voltage was outside the range of some notification appliance. This, in addition to flash synchronization requirements makes it necessary for strobes and horns to be tested for compatibility with individual control panels. If there is any question about device compatibility, the panel installation manual or manufacturer’s compatibility document will list the compatible devices.

The only exception to this compatibility requirement is for loudspeakers. There are no existing requirements at present. The main thing to remember, however, in the case of strobe/speaker combinations, the strobe is still subject to compatibility requirements.