Existing Fire Alarm Systems

ISSUE:

The purpose of this bulletin is to identify conditions where a building fire alarm system may be subject to modifications in order to provide or maintain an expected level of protection for occupants. This bulletin applies to fire alarm systems installed in buildings constructed prior to Alberta Building Code (ABC) 1997. Fire alarm systems in buildings constructed under ABC 1997 or subsequent Codes are to meet the Codes in effect.

There are 4 factors that influence the degree of changes that may be necessary to a building fire alarm system in order for it to provide the expected level of protection. The factors take into consideration the need for changing systems that were installed to "good engineering practice" prior to established Codes and standards. The factors also reflect how fire alarm systems installed under established Codes should be regarded when changes are contemplated and to what degree the requirements of the most current Code and standards apply in renovations and changes to the systems.

1. MAINTENANCE

Minimum Level of Servicing for a Fire Alarm System

- Applies to all fire alarm systems
- Keeps the system functioning to the original design and installation standards and provides for the most part, fault-free operation
- All parts and devices are tested annually and defective parts are replaced with listed compatible components. This generally applies to field devices such as heat detectors, smoke detectors, audible devices, manual pull stations and end-of-line devices, etc.
- Defective control panels may be replaced as part of a maintenance procedure ONLY IF THE EXACT REPLACEMENT PANEL IS AVAILABLE TO ENSURE THE ULC LISTING IS NOT COMPROMISED

Note: Professional engineering involvement for the replacement of control panels and field devices is not required for normal maintenance of the alarm system.

Note: Control Panel Replacement for other reasons such as:

- ♦ old models are no longer available from the manufacturer
- ♦ new panels are needed to accommodate newer field device technology
- ♦ different manufacturer's panel is selected for the system

This is no longer considered normal fire alarm system maintenance and now is considered to be a "repair" of the system.

2. REPAIR

Level of Work Needed to have a Functioning System

- Applies to fire alarm systems in buildings constructed prior to ABC 1997
- Significant repair involving the replacement of the control panel is necessary in order to have the alarm system operate and function as intended
- It is intended that ABC 1997 or the most current Code requirements not be applied when repairing an existing system, but rather, a "piece-for-piece" replacement of existing defective devices is necessary to obtain a functioning alarm system, for example:
    - ♦ Heat detectors are replaced with new heat detectors
    - ♦ Bells are replaced with new audible devices
    - ♦ Smoke detectors are replaced with new smoke detectors
    - ♦ Control panel is replaced with a newer control panel, etc.
- New panels and new field devices may incorporate newer technological features such as being addressable and must be compatible for maintaining the ULC listing for example:
- ♦ A 110 volt, 3-wire non-supervised control panel and system is repaired with equipment that operates on 24 volts and is supervised

- The principle of a repair is to have the system meet and function to the original requirements of the Code and standards applicable at the date of construction. The exception to this rule applies to building constructed prior to ABC 1978, which references the first fire alarm system standard being, CSA-B222.0, "Installation Code for Local Fire Alarm Systems." Fire alarm systems installed in building prior to ABC 1978, were designed under "good engineering practice" and may not be subject to any standard installation methods. Therefore, fire alarm systems installed prior to ABC 1978, should be repaired to meet the minimum requirements prescribed by ABC 1981 which references ULC-S524-M1980, "Standard for the Installation of Fire Alarm Systems," or if necessary for apartments, be upgraded to conform to the apartment upgrading guideline.

Note: Professional engineering involvement is necessary when repairing existing fire alarm systems where the size and occupancy of the building under ABC 1981 determines professional involvement. Professional engineering involvement may include as little as preparing a scope of work for the building alarm system and a final verification after installation.

3. UPGRADING

First Degree of Modification to the Original Fire Alarm System Design

- Applies to fire alarm systems in buildings constructed prior to ABC 1997.
- Involves changes to the design of the original system.
- Upgrading may be initiated voluntarily by the owner as a proactive measure in keeping older buildings safe for occupants, or by upgrading provisions established under the Alberta Fire Code (AFC).

- Involves the addition of new devices, components, panels, zones, etc., and is intended to incorporate some of the specific barrier free requirements of ABC 1990 such as visual appliances.
- May be applied to building floors and spaces being renovated for new tenants or occupancies.
- Upgrading usually involves the integration of new improved devices for better operation and easy trouble shooting of the system.
- **When necessary, fire alarm systems being upgraded should meet the minimum requirements prescribed by ABC 1990, which references ULC-S524-M1986, "Standard for the Installation of Fire Alarm Systems."**

Note: Specific fire alarm system upgrading requirements must be reviewed and accepted by the authority having jurisdiction (AHJ).

Note: Professional engineering involvement is necessary for the upgrading of existing fire alarm systems where the size and occupancy of the building under ABC 1990 determines professional involvement. Professional engineering involvement may include as little as preparing a scope of work for the building alarm system and a final verification after installation.

4. REPLACEMENT

Second Degree of Modernization to the Original Building Fire Alarm System Design

- Applies to buildings that undergo complete or extensive modernization involving the "gutting out" of basic building services and equipment. It is intended to make an old building into a new building.
- May be initiated by the owner usually as a result of changing the occupancy or use of the building.

Note: Where a fire alarm system is completely replaced due to modernization of the building, the new fire alarm system must be a complete new design and is required to meet the intent and application of the most current Building Code in force.

OPINION OF RETROACTIVE REGULATIONS

Alberta introduced two retroactive regulations for upgrading fire alarm systems:

(1) Smoke Detector Regulations A.R. 129/77
(2) Controlled Buildings & Residential Occupancy Buildings Regulation A.R. 317/79

The following is an opinion on the application of Alberta's retroactive regulations:

Alberta Regulations 129/77 and 317/79, even though they have been repealed, remain in force and are deemed to have been made under the new enactment (the Fire Code) provided the requirements are not inconsistent with the new Fire Code. Interpreted from Section 32(1)(e) of the Interpretation Act.

Although the new Code is more stringent, it should not be interpreted as being inconsistent with the previous regulations. The current Fire Code provides for acceptance of an existing building or fire protection measure which brings A.R. 129/77 and A.R. 317/79 within the parameters of Sentences 1.1.2.3.(1) or (2) of the AFC 1997. This means, that where a building was upgraded or accepted as complying with A.R. 129/77 and/or A.R. 137/79, the provisions of the ABC 1997 is deemed to have been complied with.

If anything does not fall within the scope of Sentence 1.1.2.3.(1) of the Fire Code, then Sentence 1.1.2.3.(2) provides that existing building or fire protection measures constructed may be permitted so long as there is “a degree of life safety acceptable to the authority having jurisdiction” or “measures are taken to provide a degree of fire safety that is acceptable to the authority having jurisdiction.”

Sentence 1.1.2.3.(1) can be interpreted as restricting the retroactive application of the AFC as this would be prejudicial to owners of residential occupancies to upgrade fire alarm systems to meet the requirements of each new Building Code.

APPLICATION OF NEW CODE REQUIREMENTS TO FIRE ALARM SYSTEMS THAT ARE BEING UPGRADED OR REPLACED

Owners, designers and the authority having jurisdiction (AHJ) should determine the original design parameters and standards for an existing fire alarm system as outlined in Appendix “A” of this bulletin. When dealing with existing conditions, the AHJ may determine if other measures are needed to provide an acceptable degree of fire alarm system audibility and reliability. In cases where fire alarm systems are being replaced due to the modernization of a building, all provisions of ABC 1997 would apply.

ANALYSIS PROCEDURE:

Several factors need to be considered when determining the existing safety level of an alarm system and the degree of any proposed changes.

1. Is the alarm system in safe and operable working condition?
2. What year was the building constructed?
3. What Regulations or Code originally applied to the building?
4. Are upgrading guidelines being applied to the building?
5. Have changes to the building affected the design or safety of the original system?
6. Determining the extent of new Code requirements applicable in providing an acceptable degree of safety.

APPLICATION OF AUDIBILITY REQUIREMENTS TO FIRE ALARM SYSTEMS THAT ARE BEING RENOVATED OR UPGRADED

Designers and the authority having jurisdiction (AHJ) should determine the original design parameters and standards for an existing fire alarm system. **Appendix “A”** of this bulletin details the Code requirements in place for a specific time period. When dealing with existing conditions, the AHJ may determine if the degree of audibility and life safety is acceptable or that other measures are needed to provide an acceptable degree of fire alarm system audibility.

AUDIBILITY LEVELS

The ABC 1997 introduced a requirement affecting the audibility levels of fire alarm systems in residential occupancies. The new Code prescribes 75 dBA as the specific sound pressure level to be achieved in the sleeping room of a residential occupancy. The National Research Council (NRC) Appendix note explains that an additional audible device in a suite would be necessary when the sound pressure level of corridor devices exceed 110 dBA in order to be heard within the suite. The standard established by the new Code is necessary as a result of increased sound barrier levels now required between residential suites and public corridors.

Many owners, designers, building and fire safety authorities are questioning the 75 dBA audibility level as it is applied to existing apartment buildings and especially for those that are upgrading a fire alarm system.

Fire alarm system audibility has been a requirement of the National Building Code (NBC) prior to the first edition of the ABC in 1974. Audibility requirements were originally prescriptive applying a specific size of device for a specific coverage of floor area. **Appendix "A"** describes in detail the specific audibility requirements for fire alarm system installed in pre-1974 buildings and for those buildings constructed under the ABC between the period of 1974 up to 1997.

APPENDIX "A"

Code Summary of Fire Alarm System Audibility Requirements

National Building Code 1970 established the following audibility standards. These standards applied to buildings constructed prior to and under the Alberta Building Code 1974.

- Fire alarm signals shall be distinctive in quality and pitch, and sufficiently loud to be heard above the normal noise level within the area served by the alarm

- Alarm gongs used as alarm sounding devices shall be located so as to provide at least
  a) one 4-in. diameter (102 mm) gong for each 1,000 sq ft (93 m^2) of floor area,
  b) one 6-in. diameter (152 mm) gong for each 5,500 sq ft (511.5 m^2) of floor area, or
  c) one 10-in. diameter (254 mm) gong for each 12,000 sq ft (1116 m^2) of floor area.

The standards established under Alberta Building Code 1978 are:

- Audible signal appliances shall be installed in each corridor and in such other locations as may be required and be sufficiently loud to be heard above the normal noise level within the area served by the appliance.

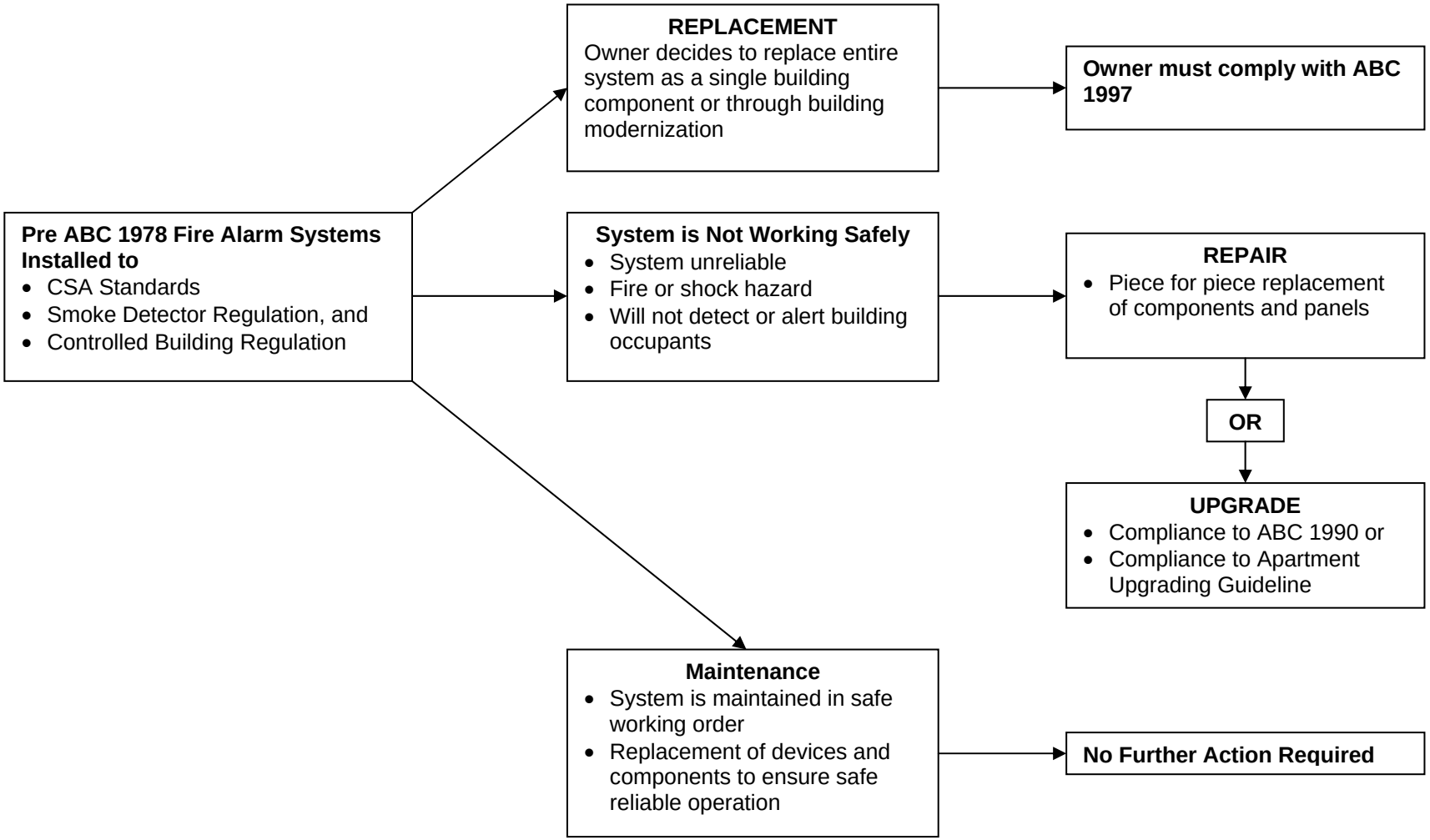
The standards established under Alberta Building Codes 1981, 1985 and 1990 are:

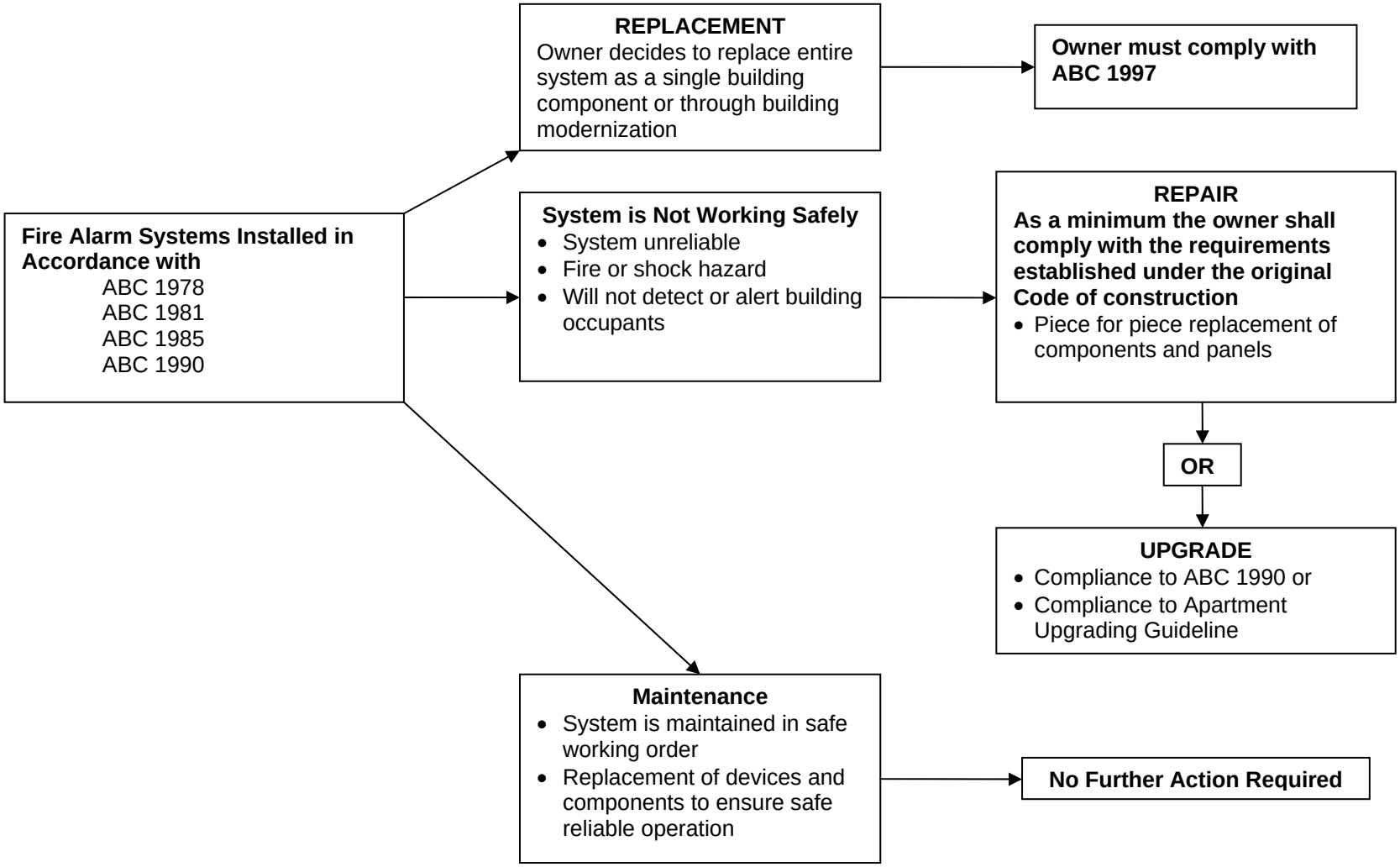
- Audible signal appliances forming part of a required fire alarm system shall be installed in a building so that alert signals, alarm signals and voice messages can be heard intelligibly throughout the floor area in which they are installed.
- Audible signal appliances shall be installed in each corridor and in such other locations as may be required and be sufficiently loud to be intelligibly heard by all occupants within the area served by the appliance.
- Each of the referenced ULC Standards S524 "Installation of Fire Alarm Systems" contained information on suggested sound pressure levels. The information was intended to provide design guidance and is as follows:

  a) For alarm or alert signals at least 15 dBA above the equivalent sound level or 5 dBA above the maximum sound level having a duration of at least 60 seconds whichever is greater, measured 1 500 mm above the floor, but not less than 90 dBA.
  b) For voice communication at least 9 dBA (ABC '81 and '85) or 15dBA (ABC '90) above the equivalent sound level or 3 dBA above the maximum sound level having a duration of at least 60 seconds, whichever is greater, measured 1 500 mm above the floor, but not less than 85 dBA.
  c) For the purpose of this clause, the equivalent sound level is the averaged, A-weighted sound pressure level measured over a 24 hour period under normal occupancy conditions.

Alberta Building Code 1997, Article 3.2.4.19., establishes a decibel measurement for the audibility of alarm systems.

- Audible signal devices forming part of a fire alarm system shall be installed in a building so that alert signals and alarm signals are clearly audible throughout the floor area in which they are installed.
- The temporal pattern of an alarm signal shall conform to the temporal pattern defined in Clause 4.2 of International Standard ISO 8201, "Acoustics - Audible emergency evacuation signal."
- The signals from smoke alarms and the patterns of alert signals shall be sufficiently different from the signals or patterns of alarm signals to ensure that there is no possibility of confusion.
- The fire alarm signal sound pressure level shall be not more than 110 dBA in any normally occupied area.
- The sound pressure level in a sleeping room from a fire alarm audible signal device shall be not less than 75 dBA in a building of residential occupancy when any intervening doors between the device and the sleeping room are closed.
- The sound pressure level from a fire alarm audible signal device in a floor area used for occupancies other than residential occupancies shall be not less than 10 dBA above the ambient noise level, but with a minimum value not less than 65 dBA.
- Fire alarm audible signal devices shall be supplemented by visual signal devices in any floor area in which
    a) the ambient noise level is more than 87 dBA, or
    b) the occupants of the floor area
        i) use ear protective devices,
        ii) are located within an audiometric booth, or
        iii) are located within sound insulating enclosures.
- The above shall also apply in an assembly occupancy in which music and other sounds associated with performances could exceed 100 dBA
- An audible signal device located within a dwelling unit shall incorporate a means that enables the device to be silenced for a period of not more than 10 min, after which the device shall restore to normal operation.
- An audible signal device located within a dwelling unit or a suite of residential occupancy shall be connected to the fire alarm system in a manner that disconnection of, or damage to, that device will not interfere with the ability of devices in other dwelling units, public corridors, or suites to sound an alarm.
- Audible signal devices referred to in the above sentence are not required to have individual electrical supervision.
- Audible signal devices shall be installed in a service space referred to in Sentence 3.2.1.1.(7) of the ABC 1997 and shall be connected to the fire alarm system.


Pre ABC 1978 Fire Alarm Systems Installed to
CSA Standards
Smoke Detector Regulation, and
Controlled Building Regulation
REPLACEMENT
Owner decides to replace entire system as a single building component or through building modernization
Owner must comply with ABC 1997
System is Not Working Safely
System unreliable
Fire or shock hazard
Will not detect or alert building occupants
REPAIR
Piece for piece replacement of components and panels
OR
UPGRADE
Compliance to ABC 1990 or
Compliance to Apartment Upgrading Guideline
Maintenance
System is maintained in safe working order
Replacement of devices and components to ensure safe reliable operation
No Further Action Required


Fire Alarm Systems Installed in Accordance with
ABC 1978
ABC 1981
ABC 1985
ABC 1990
REPLACEMENT
Owner decides to replace entire system as a single building component or through building modernization
Owner must comply with ABC 1997
System is Not Working Safely
System unreliable
Fire or shock hazard
Will not detect or alert building occupants
REPAIR
As a minimum the owner shall comply with the requirements established under the original Code of construction
Piece for piece replacement of components and panels
OR
UPGRADE
Compliance to ABC 1990 or
Compliance to Apartment Upgrading Guideline
Maintenance
System is maintained in safe working order
Replacement of devices and components to ensure safe reliable operation
No Further Action Required