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Security Hardware and Security System Planning for Museums

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Security Hardware and Security System Planning for Museums

by Wayne Kelly

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Abstract

Theft and vandalism of our cultural collections is escalating every year. This publication is intended to help managers of cultural institutions to better their preparations against the ever-increasing threat of theft and vandalism. Numerous, inexpensive methods of improving security protection and various types of currently available sensors and computerized alarm systems are illustrated and described. Various types of sensors and their placement within a standardized level of protection proposed for each area in a cultural facility are also recommended.

Author

Wayne Kelly began his career with the National Museums of Canada Corporation (NMC) in 1977, after working for eight years in law enforcement in the Ottawa area. In his position as Chief, Technical Support Division, he was responsible for the design, purchase, and ongoing maintenance of all electronic intrusion alarm equipment installed in the National Museums' buildings. During this time, Wayne successfully completed numerous courses on security protection offered by the RCMP, the Canadian Armed Forces, and the Smithsonian Institution. In the mid 1980s, Wayne joined the Museum Assistance Program of the Department of Canadian Heritage as a technical advisor on physical security and intrusion alarm systems, and in the 1990s he worked with the Preventive Conservation Services of the Canadian Conservation Institute, conducting on-site security evaluations for museums, galleries, and heritage sites across Canada, as well as documentation and application reviews for the Movable Cultural Property Program.

Illustrations

Wayne Kelly in collaboration with Bill Conly.

Cover

Musée du Québec, Pavillon Gérard-Morisset.
Photo: Luc Chartier.

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1. Introduction

Physical security of museums and heritage sites concerns all of us. Although the responsibility for the safety and security of the visiting public, the staff, and the valuable collections is mandated to the director or manager of the institution, in reality this responsibility should be shared by everyone. For example, if an item from the collection is damaged, lost, or stolen, the public is the ultimate loser.

In the past, security was thought of as the sole responsibility of security guards and their immediate supervisors. In some institutions, security was the secondary function of the maintenance staff, or a junior member of the museum or gallery staff. Senior management did not appreciate the need for security, and often did not have the time to devote to a job that seemed mundane, inconvenient, and unimportant when compared with other daily operations.

In recent years, financial constraints have led to a shortage of security resources in many institutions. In some cases, the lack of knowledge about security requirements has also been a factor, resulting in not engaging properly trained staff or security experts when required. Also, many museums have relied on the local alarm equipment salesperson or representative to provide the necessary expertise during the planning stages of a new or renovated building. Salespersons, however, are in the business of selling their company's products, and often are not qualified to advise properly and cost-effectively on security requirements. Similarly, for some of the larger more expensive projects, the electrical consultant ends up designing the intrusion alarm system.

Security awareness has dramatically increased in the last few years. Governments, boards, societies, and senior managers have all learned to appreciate the costs associated with fire, theft, vandalism, and natural disasters. Most Canadian museums, galleries, and heritage sites are aware of the need for security — especially when they plan to loan part of their collections to other institutions.

Recognizing the need for better security, the Museum Assistance Program established a program of knowledgeable and experienced technical advisors who offered advice on physical security and systems, fire and safety, and collection preservation. As part of the program, these advisors assessed the institution's security needs and made the necessary recommendations for improvement. Today, this team of advisors is part of the Preventive Conservation Services (PCS) of the Canadian Conservation Institute and is available to assist any public museum, gallery, or heritage site.

To date, security surveys, reviews, and evaluations conducted at various institutions across Canada have been well received. It seems that most museums, galleries, and heritage sites are experiencing the same types of problems, and most want to improve their security as soon as possible. In many instances, the solutions are quite similar.

2. Security Recommendations

In general, there are three levels of security. Table I illustrates these levels and the areas, within an institution (excluding display areas), commonly assigned to each level.

Table I. Security levels

Level One *Highest security*	**Level Two** *High security*	**Level Three** *Basic security*
permanent storage vault	collection packing and unpacking areas	general office area
temporary storage vault	conservation laboratories	general storage and supplies
other collection storage areas	photographic studios	hydro rooms
	preparation areas	telephone rooms
	shipping and receiving areas	cleaning rooms
	money and records storage	maintenance rooms
	audio-video equipment storage	furnace/environmental rooms
	other attractive item storage	boardroom/cafeteria/shops
	overnight collection storage	areas that never contain collection or attractive items
	managerial offices that display collection items	

Each level of security requires different types of equipment, such as electronic sensing devices, closed-circuit television (CCTV), intercoms, door hardware, and special construction materials. Each level also requires different operational procedures, e.g., the security procedures used for a collection storage vault differ from those used for a front foyer.

Table II lists the recommended equipment for each level of security. Once the areas within a building have been assigned an appropriate security level, the institution can determine its equipment needs.

Table II. Equipment requirements

Level One *Highest security*	**Level Two** *High security*	**Level Three** *Basic security*
infrared motion detectors	infrared motion detectors	
magnetic door contacts	magnetic door contacts	good quality doors and locks
mortised, six-pin deadbolt locks	mortised, six-pin deadbolt locks	key-in-knob locks
registered keyways, not keyed to floor master	locks keyed to floor master	keyed alike level-3 doors
key kept at security desk or director's office		
daytime card access	daytime card access	
approved access only	division-head-approved access	occupant-approved access
no windows	minimal windows, sealed and shut, with optional steel mesh or bars	functional and lockable windows
inward-opening doors	non-removable hinge pins	
heavy-duty door closures	heavy-duty door closures	
no glass in doors	minimal glass in doors	
no doors to the exterior	emergency exits with magnetic locks	emergency exits with magnetic locks
1.2-mm (3⁄64") cold-rolled steel doors	metal/solid-core wood doors	
1.6-mm (1⁄16") steel door frames	1.6-mm (1⁄16") steel door frames	
11.3-mm x 11.3-mm (7⁄16" x 7⁄16") butt hinges	11.3-mm x 11.3-mm (7⁄16" x 7⁄16") butt hinges	
CCTV camera	optional CCTV camera	
intercom/telephone to security desk	intercom/telephone to security desk	
45-cm (18") corridor along the four walls		
collection storage vault not on outside wall		
concrete walls, slab under floors		
no workstations	numerous workstations	numerous workstations

Galleries and display areas, both permanent and temporary, do not accurately fit into the three levels of security. These areas are meant for full public access, i.e., they do not have doors to lock, they have little or no security access controls, and they are not sealed off after hours. This makes them more vulnerable to theft and vandalism. The most effective method of protecting galleries and display areas during public hours is to employ security staff experienced in first aid and emergency evacuation. This, however, is not always feasible, so the available security staff and other staff must share the responsibility of monitoring these areas.

CCTV video cameras can also provide security monitoring by extending the visual capability of one person into numerous display areas at one time. The main monitoring desk must be staffed at all times during public hours. In an emergency, there should be an efficient way of summoning help without leaving the main desk, unless personal safety is threatened.

CCTV system design is extremely important. There are all types and sizes of cameras, lenses, video switchers, 4-, 8-, and 16-camera video splitters, video cassette recorders (VCRs), and video monitors. All can operate in black-and-white or colour

format. Too often, museums and galleries depend on local equipment suppliers to design their systems. Not only can this lead to a system that is overdesigned, but also, quite often CCTV is not the best method to use.

The intrusion alarm system and CCTV system can be properly designed only when the architectural or electrical drawings, or both, are available. Each building must be reviewed and evaluated on an individual basis. It is recommended that the intrusion alarm system be controlled by a microprocessor or by a computer (PC) as much as possible. Smaller institutions can incorporate much less expensive microprocessor technology, but medium to large institutions should use PC-controlled technology.

Many major suppliers offer inexpensive computer-controlled intrusion alarm software, which includes full-colour graphics of predesigned building floor maps. These interactive floor maps include various designs and colours of icons that indicate different security sensors. These icons flash on and off when they are in the alarm mode. Details about these requirements and the types and locations of sensors can all be provided during the planning process.

All security system components, both in the field and in the security monitoring room, should be connected to the building emergency power system. The intrusion alarm system should also have its own battery backup with enough reserve power for 30 minutes or more. This allows enough time for the backup generator to come on line. Because most intrusion sensors are connected to some type of multiplexer or data-gathering panel, it is important to have at least three or four hours of reserve battery power in these panels.

Many large institutions have security control rooms containing numerous pieces of equipment for security, internal and external communications, elevators and environmental controls, and fire alarm systems. All of this equipment generates heat and dry, stale air. Incorporating plans for adequate fresh air and cooling systems into the construction of security rooms is recommended for the benefit of security staff who must work in these rooms for long periods.

Room furniture should be comfortable and pleasing to the eye. Chairs must provide proper back and neck support. Writing surfaces, such as the security console or the report desk, should be comfortable to use and large enough for two persons to share.

Room lighting is also important. Too much light may reduce the picture quality of the CCTV video monitors and weaken the text quality on the alarm monitor screen. Security staff, however, need enough light to read directives, operating procedures, and daily orders, as well as write incident reports and keep daily radio logs. Depending on the size of the room, incandescent, rheostat-controlled track lighting is recommended.

3. Key Control Systems and Procedures

3.1 Master Keying Systems

Access to and throughout a building can be controlled by using a master keying system. Figure 1 illustrates the controls that can be obtained in a small museum or gallery using a one-level master keying system.

Notice that the front entrance doors are keyed to change key A-1 and the rear door is keyed to change key A-4. These two lock cylinders are not keyed to the floor master key. The collection storage lock is keyed separately and should be a registered keyway, as it cannot be copied. Each office or workspace is keyed to a change key and to the floor master key. These offices can be keyed separately (KS), keyed alike (KA), or in groups, depending on operational requirements.

In the above scenario, a master key issued nightly to the cleaners, for example, allows them access to the offices and display areas to conduct their cleaning, but not to the storage vault. Copying this master key does not give them future access to the building.

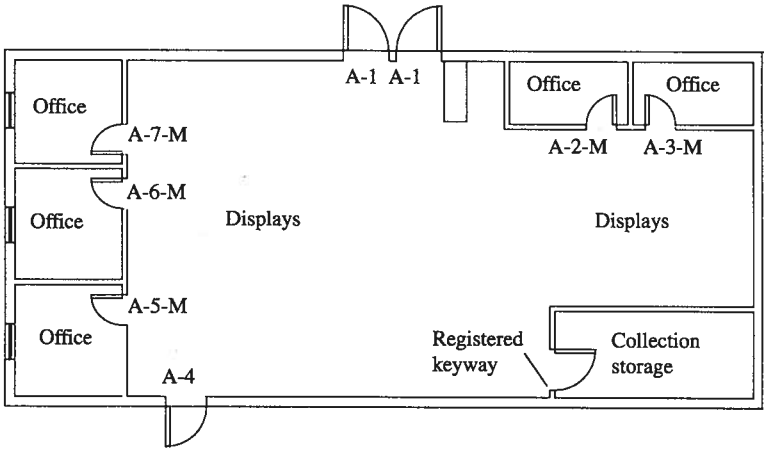


Figure 1. A = change key (occupant key), B for 2nd floor, etc.; # = lock number; M = master key

Figure 2. Multi-level master keying system
(Small and medium-sized museums and galleries)

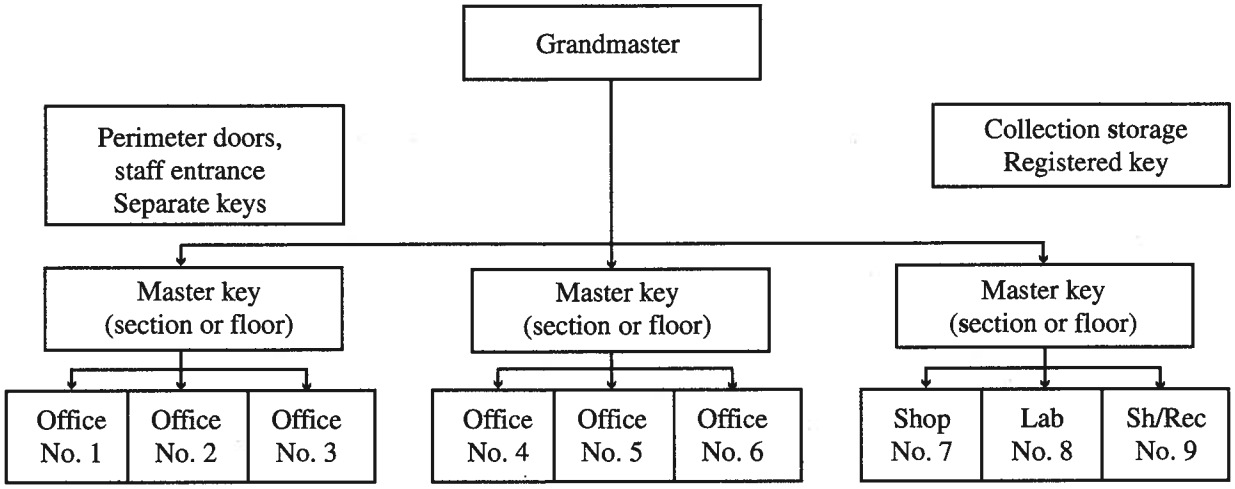
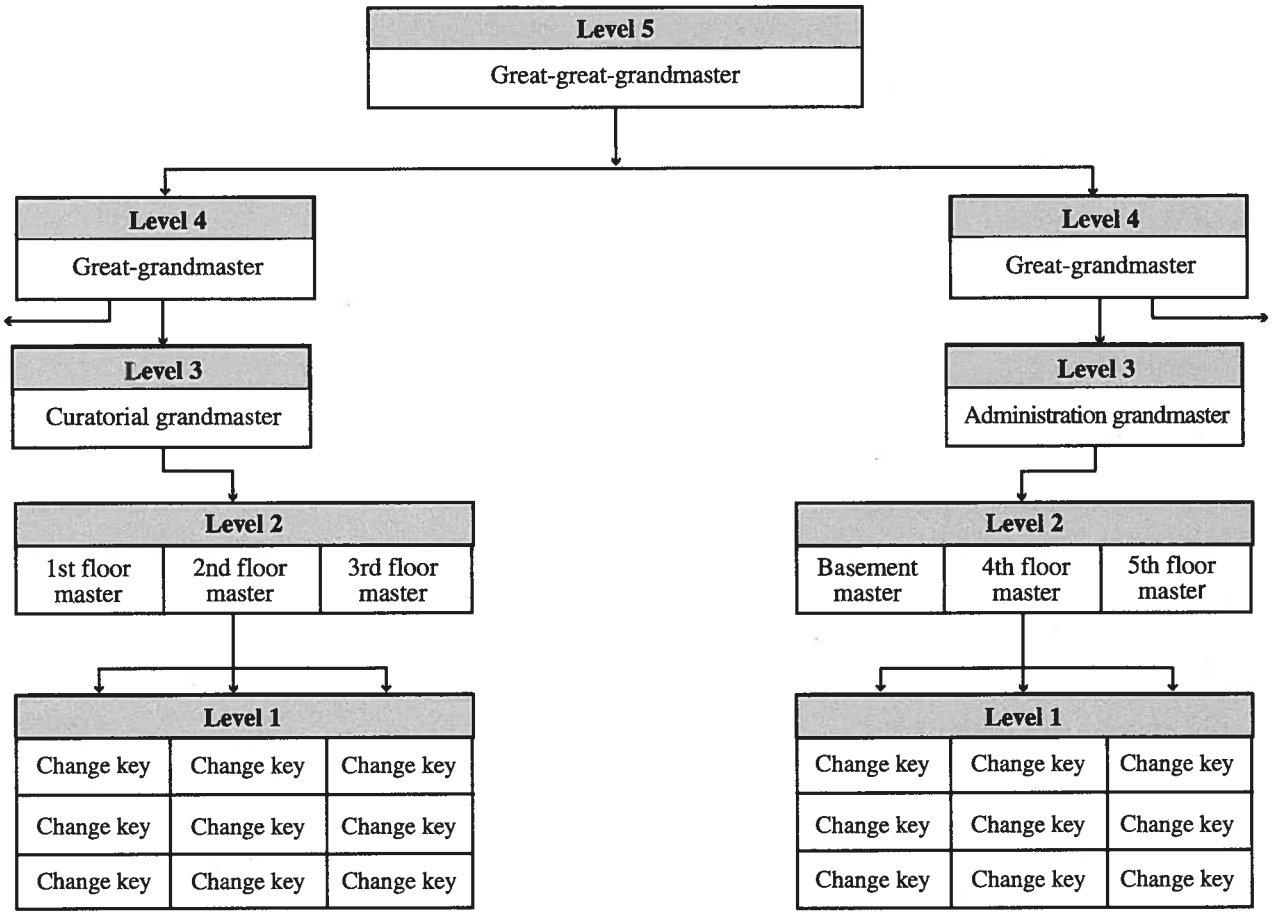


Figure 3. Multi-level master keying system
(Large museum/gallery building)

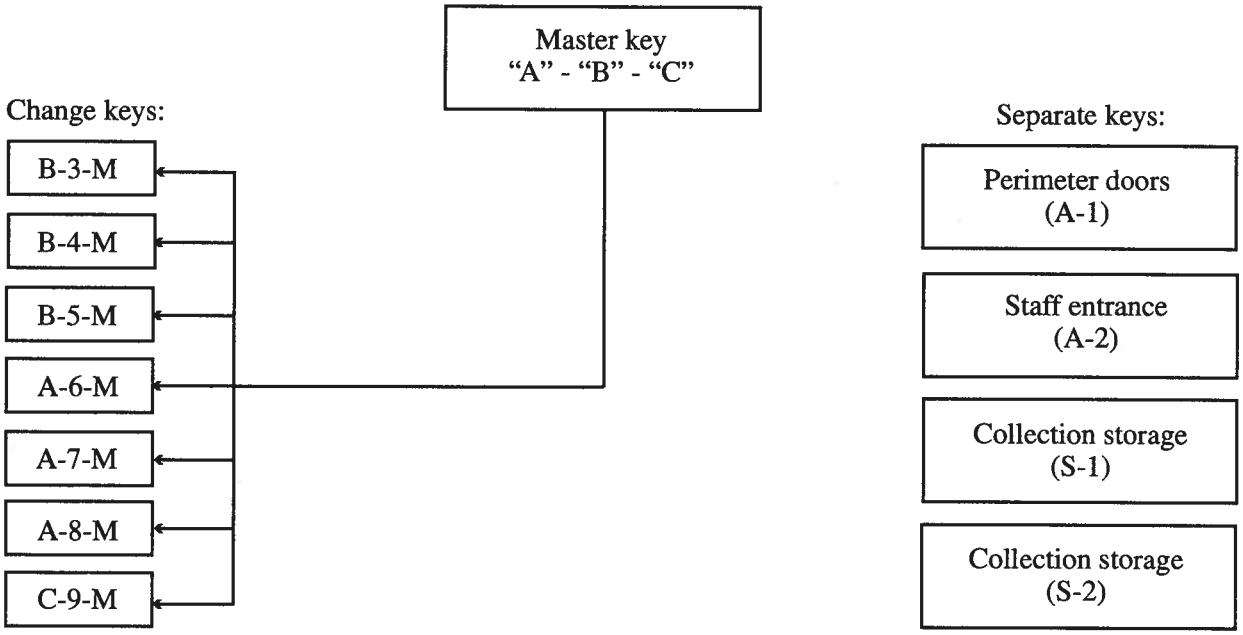


Note: Change keys (occupant keys) can be keyed alike (KA) in groups, or they can be keyed differently (KD).

A multi-level master keying system is used in medium-sized and large museums and galleries (Figures 2 and 3). The following principles apply.

- Building utility rooms should be keyed separately from the museum key system. They can be keyed alike (KA) (e.g., all cleaning rooms), or they can be keyed differently (KD) (e.g., telephone, hydro, washrooms, etc.).
- Collection storage vaults should never be placed on the master key system. These vault doors should have registered keyways to prevent key copying.
- Perimeter doors (excluding the staff entrance door) can be keyed alike (KA), but should never be placed on the master key system. The staff entrance door should be keyed differently (KD). This allows the approved staff to be issued **one key only.**
- Offices can be keyed alike (KA) in groups, or they can be keyed separately. They can be placed on the **floor** or **section** master key.
- The grandmaster key should always be kept in the security room, the director's office vault, or a secure, lockable key press located in a secure alarm zone. The master key is issued to a staff member only if absolutely necessary. The master key should **never** be removed from the building.
- Small museums and galleries should have a one-level master key system.

Figure 4. One-level master keying chart



Key A - B - C	the master key, designated as "M" in the key code, provides access to all areas: A (main floor), B (basement), and C (second floor).
Key A-1	provides access to all perimeter doors. Restrict its possession to persons having a specific need for a specified time period. Never remove it from the building.
Key A-2	provides access through the staff entrance door. Restrict its possession to a single staff member, or to all approved permanent staff.
Keys B-3-M to C-9-M	provide access to each respective workspace in B, A, and C.
Keys S-1 and S-2	are special restricted keys (registered) for the collection storage vaults, which cannot be copied.

It is important to remember that when using a master key system, if the master key is lost, all workspaces with the designation "M" are compromised and must be re-keyed. **However, the loss of the master key does not allow access to the building**. If an office change key is lost, only that office lock must be re-keyed.

3.2 Basic Rules of a Key Control System

The security value of any master keying system is totally dependent on the key controls of that particular system. Without discipline and specific key controls, any master keying system will eventually break down and all knowledge about a building's keys will be lost. The following recommendations will help institutions begin or regain the controls required to protect their buildings, their staff, and their collections.

- Identify keys and locks with an alpha or numeric code, or both.
- Stamp "Do Not Copy" on keys as a deterrent to copying.
- Distinguish markings on keys from cylinder pin codings or key cuts.
- Code change keys (occupant keys) indirectly to the master key system and issue them only to those people who have a definite requirement for them.
- Maintain a record (key log book) of all keys issued.
- Never issue or loan master keys to the cleaning staff or to any other outside contractor or agency conducting work in the building.
- Control master keys strictly and ensure that only security staff use them after hours during security sweeps and shutdown tours.
- Retain master keys or restricted keys for emergency use in numbered, sealed envelopes in a secure storage cabinet such as a locked, steel key press in the security room or in an alarmed room.
- Do not retain **duplicate** master keys for emergency access. Store all spare keys permanently in a locked, steel key press.
- Never remove master keys from the building. If the building has 24-hour security coverage have staff leave **all keys** with security at the end of the day. Have staff sign out their working keys each morning.

Figures 1 through 4 will help to determine the type of master keying system that is most suitable for an institution. Regardless of the type of keying system chosen, the basic rules for key control hold.

Management must take a lead role by advising all staff that key controls are in place and that the basic rules are to be followed by everyone, including all levels of management. A quality, well-disciplined key control system may be an inconvenience to museum staff, but it is the price that must be paid to protect public treasures and heritage. Key control is one of the more important safeguards that should be maintained by every museum, regardless of its size or location.

4. Door Hardware

It is important to understand that door hardware, like anything else, varies in cost and quality. All too often, institutions choose to use inexpensive and ineffective doors, door frames, and door locking hardware, especially on the more sensitive ground floor perimeter doors. Listed below are door hardware items, each of which plays an important role in the overall security of a door. The discussions that follow focus on the types of door hardware recommended in museums, galleries, and heritage sites.

- Door
- Door frame
- Throwbolt, deadbolt, or lock bolt
- Strike plate
- Lock cylinder
- Key
- Door closure
- Door hinges

4.1 Deadlatch or Deadlocking Latch Bolt

A key is not required to **engage** this type of latch (Figure 5). When the door is closed the latch becomes "dead." The latch bolt has a side pin that, if properly installed, is held in a retracted position by the strike plate (see Strike Plate) when the door is closed. This prevents the bolt from being pried open by a knife or screwdriver.

There is a modest level of protection because of the deadlatch feature, however proper installation is critical. The side pin (or plunger) must be held in a retracted position when the door is closed. If the pin is not kept retracted, the bolt can be pushed back into the lock with ease. Normally some play or looseness is present because partial spring action is necessary. During inspections it is quite common to find these types of deadlatches improperly installed.

This type of lock should be used only for basic security environments such as general offices, cleaning rooms, staff lounges, and so on. The deadlatch is engaged by an inside thumb-turn or push-and-turn interior knob. It is often referred to as a key-in-knob (KIK) because a key is used to disengage the deadlatch from the exterior.

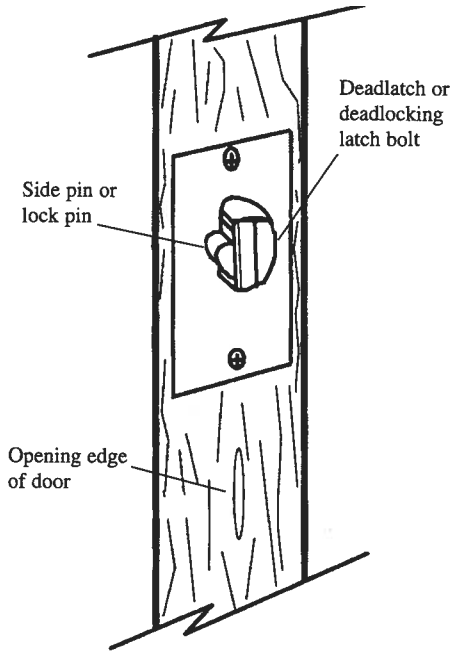


Figure 5. Deadlatch or deadlocking latch bolt

4.2 Deadbolt Lockset (Mortised)

The deadbolt lockset (Figure 6) does **not** have a spring function. An exterior key-function and an interior thumb-turn or key-function are required to engage or disengage the deadbolt or throwbolt. The bolt must be a minimum of 2.5 cm (1") in length, and should have hardened steel inserts to prevent sawing (Figure 7). This type of deadbolt **cannot** be opened with a plastic card or knife. A properly installed deadbolt will withstand most prying attacks. It offers superior strength when used as a mortised +, meaning the cylinder and bolt mechanism are installed inside the solid-core wood or metal-clad door. **The cylinder should have six-pin tumblers** (see Cylinders and Keys) to prevent picking by either hand-held picks or the more effective mechanical pick-gun.

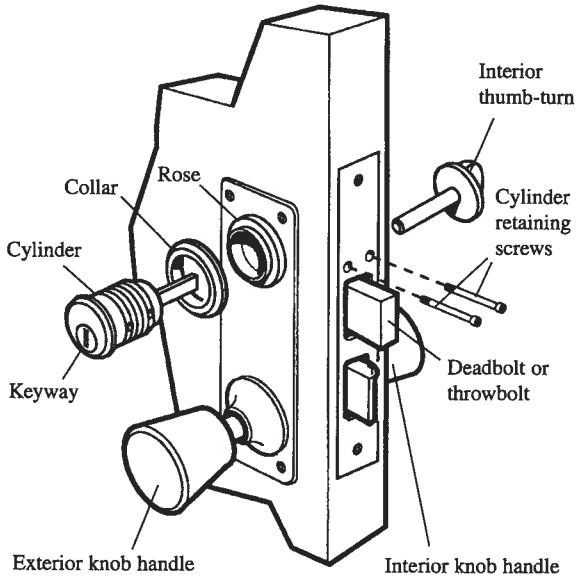


Figure 6. Deadbolt lockset

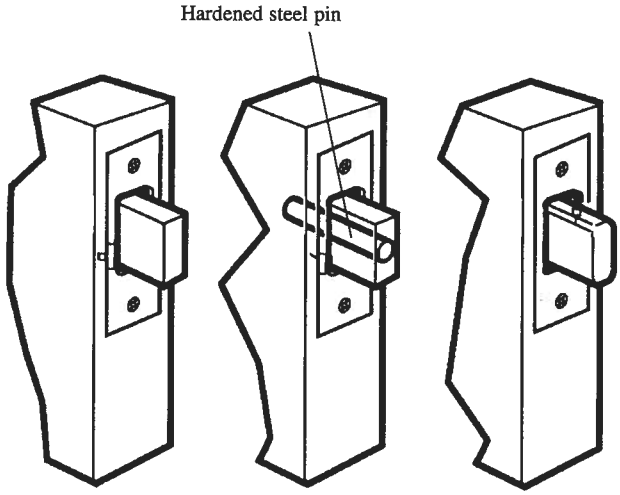


Figure 7. Deadbolts

The deadbolt can be configured without an exterior key-function, but with an interior thumb-turn or key-function (Figure 6). **An interior key-function** is required if there is glazing (glass) in or around the door. Deadbolt locksets, although a little more expensive, require low maintenance, and will provide proper security for a building.

4.3 Strike Plate

Strike plates (sometimes known as door strikes) protect the throwbolt or lock bolt. They also add strength to the complete locking system. Many types are designed to operate with the various lock bolts, such as the spring latch strike, which will accept both a spring latch and a deadbolt, and the strike with steel box, which is preferred for use with the normal deadbolt strike plate. The two types are illustrated in Figure 8 along with the normal deadbolt strike plate. Ensure that the correct strike plates are supplied with the locksets when purchased.

4.4 Cylinders and Keys

The cylinder is the main core of the lock assembly, and is constructed to certain design principles that determine the shape and size of the key. The most common type of cylinder used today is the pin tumbler cylinder (Figure 9).

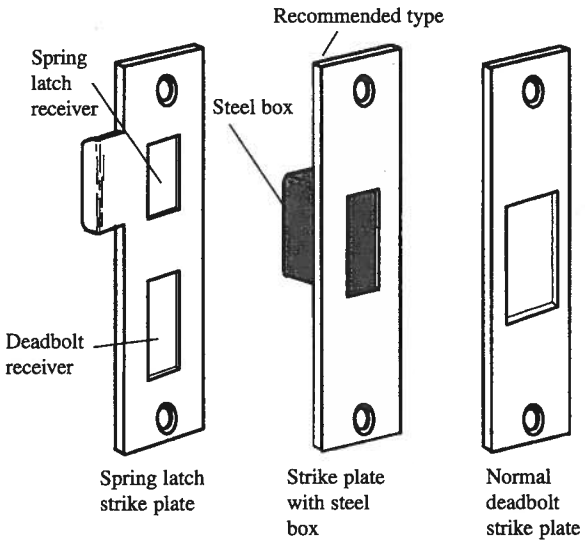


Figure 8. Strike plates

The pin tumbler cylinder contains a plug that is held up by spring-driven top pins. These top pins and springs are housed in the cylinder body. The plug itself contains the active or bottom pins. These bottom pins are made in various lengths so that when the key is inserted in the plug, the pins are the correct length to reach the bottom on each cut of the key. When this function is completed, the pins form a common shear line that allows the plug to rotate within the cylinder. The plug has a cam attached at the rear. Once rotated, the cam activates a mechanism within the lock that causes the lock to open or close.

Pin tumbler cylinders may contain from five to seven pins. Many manufacturers offer cylinders with pick-resistant pins. The number of pins is very important. People with a basic knowledge of locks will most likely be able to open a five-pin lock in a matter of minutes, especially if they possess a mechanical pick-gun. However, the same does not hold true for a six-pin lock. These locks are extremely difficult to pick, even with a mechanical pick-gun.

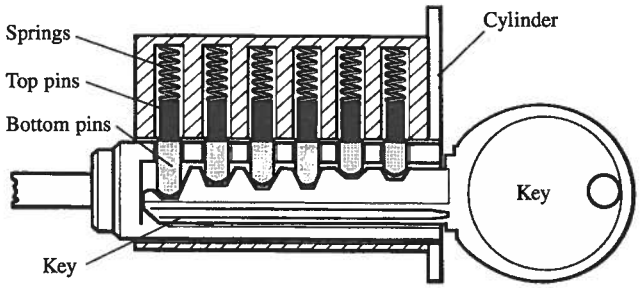


Figure 9. Pin tumbler cylinder and key

The biaxial cut, six-pin tumbler locks, which are manufactured by Medeco Locks Inc., are a good example. These three-dimensional locks require a specific type of key, and the special key blanks are available only from Medeco and their approved distributors. Medeco provides up to seven levels of security on their key blanks, and the most secure level key blanks must be purchased directly from them. This ensures that the key system is never in the hands of a local locksmith. This maximum level has some drawbacks because it causes more inconvenience to the user each time keys are required. Extra keys can be ordered initially and stored in a safe. For lower levels of security, a Medeco master distributor can, with an approved signature, cut keys. The cutting is done from numbered blank stock, which is strictly controlled by Medeco. Other major lock manufacturers have security locks as well. Companies such as Schlage, Abloy, Sargent, Corbin, Almet, and Dom are well respected for some of their security hardware products.

4.5 Doors and Frames

Two types of pedestrian doors should be used in secure areas of a building. The first type is solid-core wood, meaning it is constructed of solid wood rather than the hollow-core or double-sided wood veneer normally used in doors of private homes. The second type is the hollow-core, metal-clad door, which is described below in more detail.

The hollow-core, metal-clad door should be 4.4 cm (1 ¾") thick. The exterior metal cladding should be 16-gauge steel, zinc coated, and have top and bottom channels of 14-gauge steel with the same zinc coating. The interior of the door should have 14-gauge steel stiffeners, running the full length of the door at 15-cm (6") centres vertically. The interior top face should have a 3.2-mm (⅛") steel reinforcing plate to hold the heavy-duty door closure, and 4.7-mm (3⁄16") reinforcing steel in the opening edge of the door to hold the three or four door hinges.

The door should be completely degreased and primed with a coat of zinc chromate. Hinges with non-removable hinge pins must be used on all exterior and interior security doors. Door frames should be constructed with 14-gauge, cold-rolled steel, pressed to a standard profile. These doors and frames are readily available and commonly used in major construction projects throughout Canada and the United States.

Exterior doors, and all other doors leading into secure areas such as collection storage rooms, conservation labs, and photo studios, should be equipped with heavy-duty door closures.

4.6 Overhead Doors

Most museum and gallery buildings are equipped with overhead doors (Figure 10). These types of doors are used for the shipping and receiving of supplies and collection items. Heritage sites often have their overhead doors located in on-site shops or garages. Some advice on the security requirements at these particular locations is necessary.

Historically, the shipping and receiving area of a museum or gallery has been extremely vulnerable. During site evaluation studies conducted across Canada, some overhead doors were secured by jamming them with pieces of 2.5-cm x 7.5-cm (1" x 3") wood strapping, or by jamming them to the steel frames with small 6-mm (¼") carriage bolts. One particular museum went as far as tying the door closed with hemp cord.

There are many disadvantages to using awning or sectional-type wood doors. It is recommended not to use them, because access through these types of wood doors is very easy.

A sectional steel overhead door is recommended, with interior and exterior metal cladding. The exterior facing should be 16-gauge, cold-rolled galvanized steel, to protect against the environment, but the interior facing can be thinner (and less expensive) 18-gauge galvanized steel. The overhead door should be 4.4 cm (1 ¾") thick and be equipped with interior, vertical steel stiffeners at 30-cm (12") centres. The exterior face of the door should not have any fasteners as all bolts should fasten on the inside. The interior face should be riveted to the stile and stiffeners. The door opening requires steel doorjambs and a header section to support the weight and operation of the heavy-duty overhead door.

The overhead door should be equipped with appropriate metal brackets to allow for a sliding, flat steel bar to penetrate the steel side frame on each side and be secured with padlocks, which can be keyed alike (KA) (Figure 10). The commonly used, surface-mount spring latch lock is not recommended.

The sides of the overhead door should overlap the door opening by at least 10 cm (4") to prevent any penetration at the edges of the door. All hinge rollers should be heavy-duty and should be installed with round head bolts with nut fasteners on the inside. The weather stripping at the bottom of the door should be solid, heavy-duty neoprene with an extruded aluminum housing.

Glazing (glass) should **never be used in these doors**. Glass inserts provide quick and easy access, even for an amateur. Some building planners have recommended using Georgian Glass inserts in various security doors. This is erroneous. Glazing with fine steel wire embedded in the glass at 1.3-cm to 2.5-cm (½" to 1") centres both horizontally and vertically is not appreciably more secure than normal glazing. The wire mesh only prevents the glass from shattering when broken.

If a viewing panel is an absolute necessity in a collection storage or overhead door, installing a 7.5-cm x 7.5-cm (3" x 3") section of heavy-duty polycarbonate (i.e., Lexan) is recommended. The section itself must have heavy-duty steel framing either welded on both sides of the door, or the exterior steel frame should be fastened through the door and the interior frame by round head bolts that are exposed on the exterior. Make the interior nut fasteners inoperable by grinding the end of the bolt or by spot-welding to prevent the nut from being removed.

4.7 Securing an Overhead Door

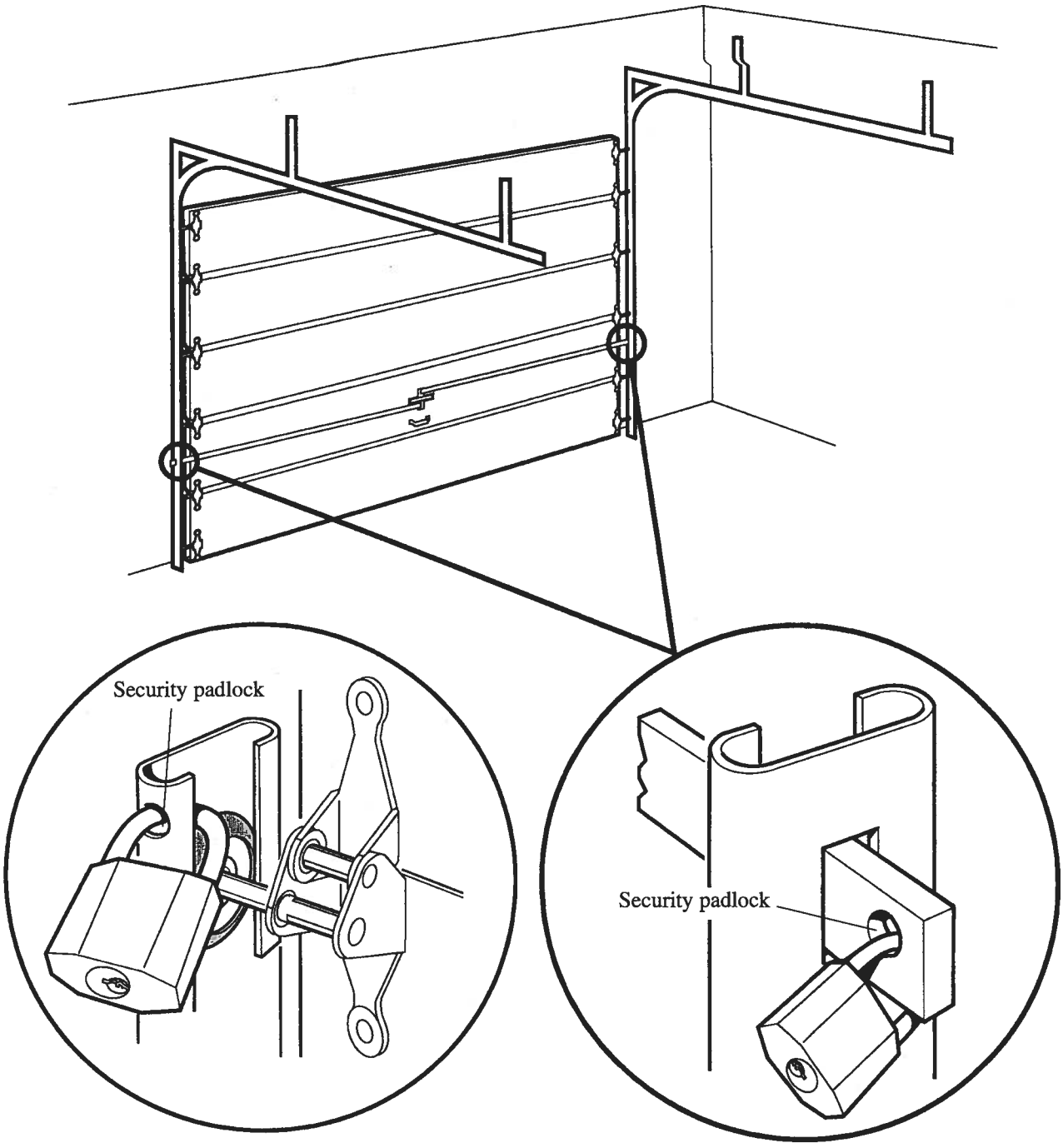


Figure 10. An overhead door, with close-ups of two types of locks

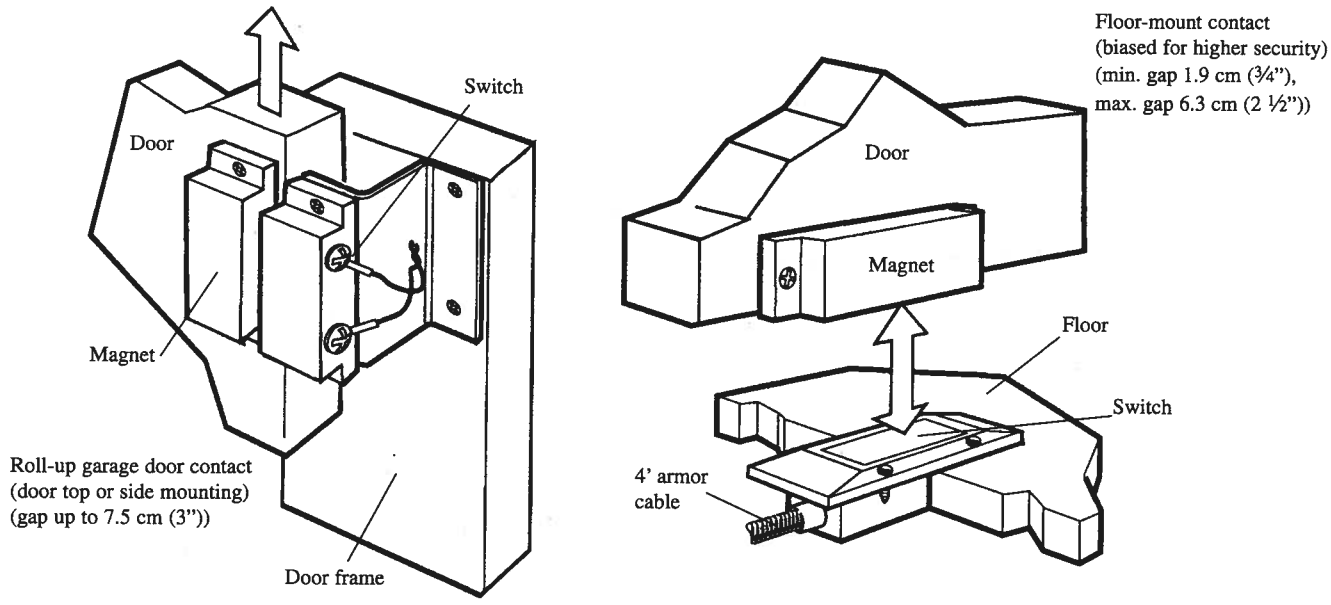


Figure 11. Contact alarm switches

Specially designed contact alarms should be used to alarm overhead doors. One type has the upper half of the switch attached to the door and the lower section embedded in the concrete floor. Another type is installed on the top or side of the door and frame. These are acceptable in most cases. The floor type should have a minimum of 1.2 m (4') of armor (steel) cable, which will protect the wiring from damage by forklifts, hand trucks, vehicles, and heavy crates. The two contact alarm switches are illustrated in Figure 11.

4.8 Prevention of Hinge Pin Removal

All doors opening to the exterior have door hinges mounted so that the hinge pins are exposed. This exposure allows the removal of the hinge pins. When purchasing new door hinges, specify that the hinges must have non-removable pins. Use one of the two methods illustrated in Figure 12 for preventing the removal of pins in existing hinges.

One method (No. 1) is to remove the two existing middle wood screws and install a 1.9-cm (¾") longer screw nail, with its head filed off, in one of the screw holes. This will leave about 1.9 cm (¾") of exposed screw nail. When the door is closed, the screw nail will penetrate the empty hole on the opposite side. If a perpetrator removes the hinge pin, the door cannot be removed from the jamb because both sections of the hinge are attached.

The second method (No. 2) is to drill a small hole directly through the hinge pin collar and the hinge pin. Then insert an expandable pin with pliers, or tap the drilled hole and screw in an appropriate hex pin. Ensure both types are flush.

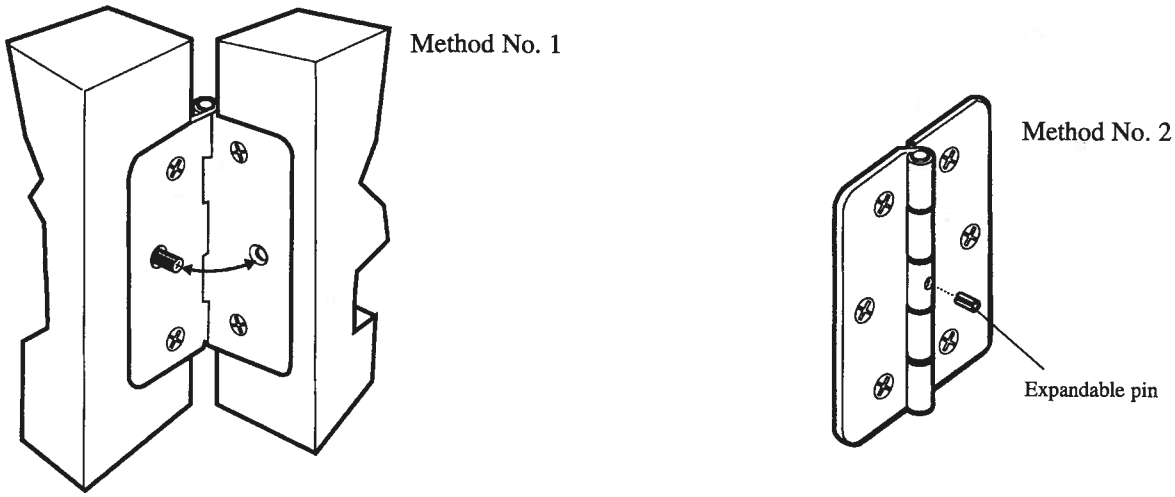


Figure 12. Preventing removal of hinge pins

4.9 Steel Door Astragals

A door astragal is a flat steel moulding of varying length that is applied to the meeting edges of a pair of doors, or to a single door and door frame. It is intended to protect against foul weather conditions, but more importantly it protects against attack on the lock bolt. A full-length steel astragal also protects against prying or jimmying the door. Figure 13 illustrates the different lengths, types, and methods of installation.

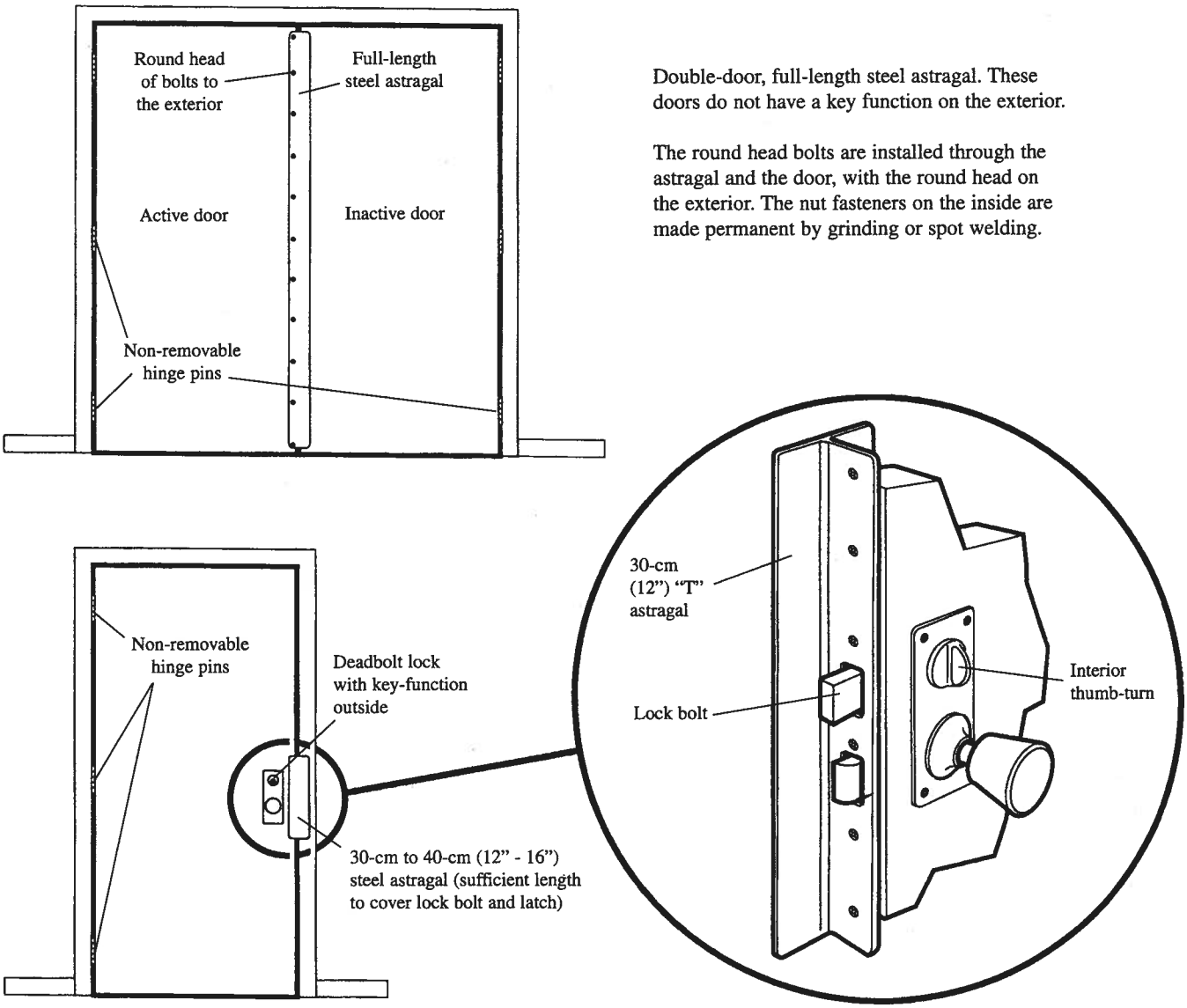


Figure 13. Steel door astragals

5. Microprocessor-based Intrusion Alarm System

The purpose of an intrusion alarm system is to protect an institution's collections, its employees, and the visiting public. Normally the detection equipment is installed in areas that contain or may contain collection items, as well as in common travel routes, exterior doors and windows, roof hatches, and air ducts and vents. General office space is not considered a high risk area unless it contains collection items. Quite often senior managers like to display samples of a collection in their offices or boardrooms. This practice should be discouraged, but if it is to continue, these offices must be treated as collection holding areas and level two security must apply.

Figure 14 illustrates a single floor museum that is equipped with a microprocessor-based intrusion alarm system. A description of the layout of the system and why the design is configured this way is also given.

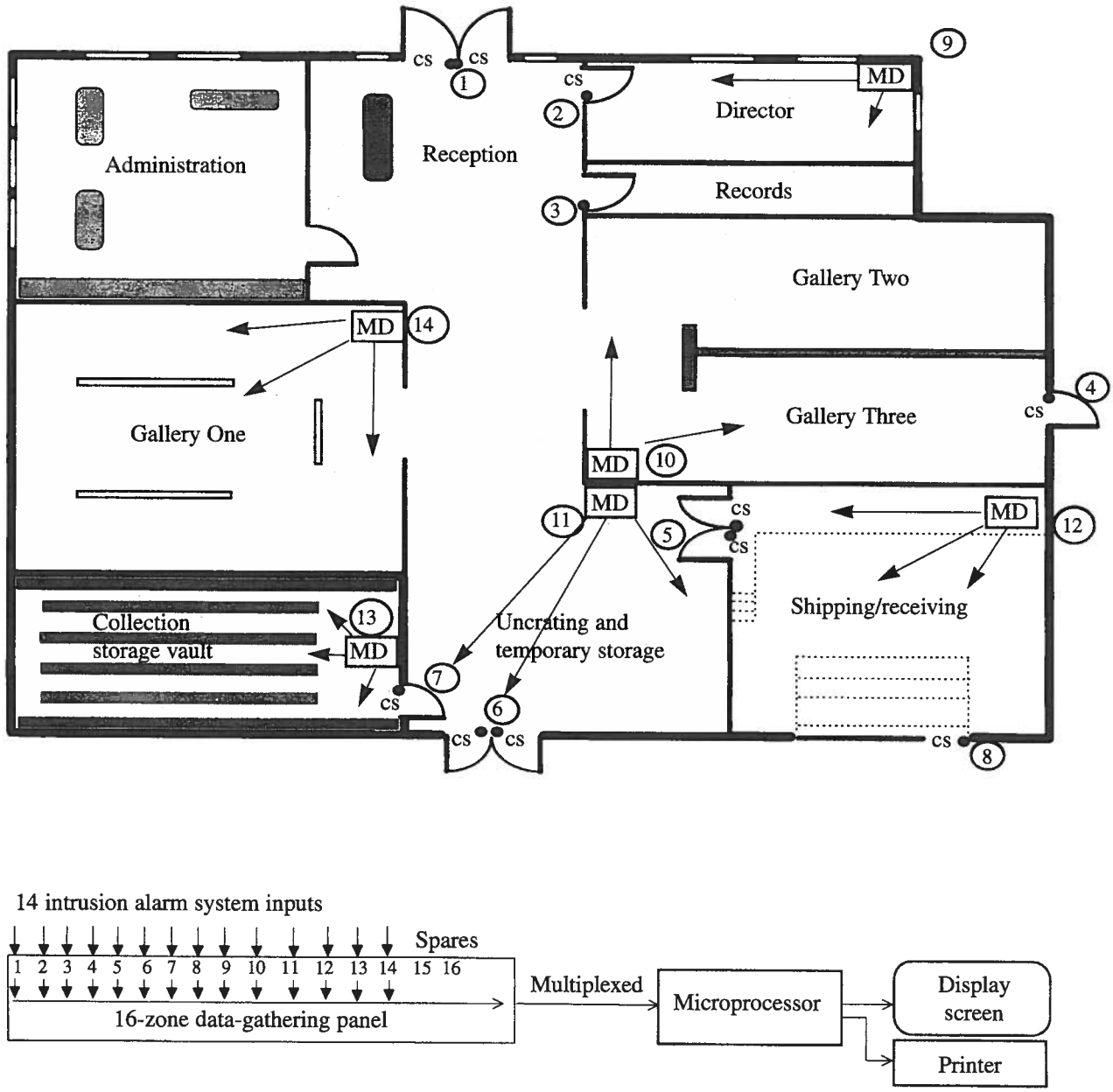


Figure 14. Alarm system

5.1 Alarm System Description

The small circled numbers represent the zones (1 to 14) in which the security devices transmit information to the data-gathering panel (DGP) or autonomous control unit (ACU).

Zone 1: The two front-door contact alarm switches.

Zone 2: The contact alarm switch installed on the entrance door to the director's office (personnel files, money, and collection items).

Zone 3: The contact alarm switch on the door to the records room.

Zone 4: The contact alarm switch on the exterior door leading to the exterior from Gallery Three.

Zone 5: The contact alarm switches on the double doors leading from the shipping/receiving area into the uncrating and temporary storage area.

Zone 6: The contact alarm switches on the double doors on the south wall leading from the uncrating and temporary storage area to the exterior of the building.

Zone 7: The contact alarm switch on the entrance door leading into the collection storage vault.

Zone 8: The contact alarm switch installed on the overhead door in the shipping/receiving area.

Zone 9: The verified passive infrared/microwave (PIR) motion detector located in the northeast corner of the director's office.

Zone 10: The PIR motion detector located in the southwest corner of Gallery Three.

Zone 11: The PIR motion detector located on the north wall of the uncrating and temporary storage area.

Zone 12: The PIR motion detector located in the northeast corner of the shipping/receiving area.

Zone 13: The PIR motion detector located on the east wall of the collection storage vault.

Zone 14: The PIR motion detector located in the northeast corner of Gallery One.

All of the above security devices transmit by zone number to a corresponding input on the DGP or ACU. The DGP's memory is programmed with information about each individual point. This method is commonly called "distributed intelligence." Each point or zone is also programmed to the corresponding colour graphics floor plan, which is automatically displayed upon receipt of an alarm signal from one of the sensors.

The alarm system computer processes and memorizes all alarm signals, then displays them on the system monitor screen, with the corresponding colour graphics floor plan. The computer is also the data entry tool for programming all points at the DGP.

The DGP unit is normally installed in the most central position of the 64 points that it can monitor. Each additional DGP should also be centrally installed within the points it is monitoring. All DGPs are locked and alarmed against tampering.

The computer (PC), keyboard, printer, and monitors should all be installed in the security control room if possible, because this room offers a 24-hour security presence. If the building is not large enough to house a security control room, ensure that this important equipment is installed within a protected area.

Conclusion

Cultural artifact damage and loss resulting from lax security measures can be prevented by effective planning. This planning, which should be done with the advice of an experienced technical security advisor, should include a thorough review of the different levels of security required. From this review, key control systems can be designed. Informed choices can also be made for door hardware and for intrusion alarm systems. The most important element is for all concerned to take security seriously, and to implement the measures needed.

Glossary of Security Terminology

Active door
A door in a set of double doors that normally opens first and allows the second door to open. It houses the deadbolt lockset.

Astragal
A steel plate attached to the opening edge of either an active door or a single door. It is used to protect against an attack on the throwbolt or the insertion of a jimmy bar between the doors or between the single door and the doorjamb.

Butt hinge
A type of hinge designed for surface mounting or mortising into the door edge and rabbet of a door frame.

CCD video camera
A charged coupled device video camera that incorporates the use of a solid-state imaging sensor instead of the older technology of Vidicon, Newvicon, and Ultracon pickup tubes. It has longer life, better light sensitivity, and good resolution, and it is the most common type used today.

Change key
The key used to lock and unlock the cylinder of a particular area or space. Its "cut pattern" can be included on the Area master, Floor master, Grandmaster, and Great-grandmaster, etc., system.

Deadbolt lock
A lockset that does not use springs or bevel to engage or disengage the throwbolt. It is engaged or disengaged by means of a key or thumb-turn.

Door closure
A mechanical device (hydraulic or pneumatic) attached to the top of a door to drive the door to the closed position once it is released by the user.

Double cylinder
A lockset that has a key-function on both sides (interior and exterior) or that has no exterior key-function. It is recommended when there is glazing in or around the door.

Electric strike
An electrically controlled locking system whereby the strike pin that engages the fixed latch bolt in a door edge can be released by remote control (push-button).

Flush bolt
A door-locking bolt so designed that when installed (mortised) it is flush with the face or opening edge of the door. When activated, it drives up into the door headcasing and the second unit drives down into the floor or sill plate.

Hinge pin
A small, case-hardened, vertical steel pin that connects the side of the hinge fastened to a door frame and the other side of the hinge fastened to a door edge.

Inactive door
A door in a set of double doors that is not normally used, and that cannot be opened first. The astragal on the active door keeps this door closed. This door is often secured with top and bottom flush pins or slide bolts, and normally contains the strike to receive the throwbolt from the lock in the active door.

Keyway
The vertical opening in the lock cylinder that receives the key.

Lockset
A complete lock with cylinder, trim, bolt, knobs, handles and paddles, etc.

Mortise lock
A lock designed for installation in a door body and not on the surface of a door.

Panic bar
A door-locking device designed to permit an immediate exit by pressing firmly on a bar or paddle to release the lock bolt or latch bolt.

Pin tumblers
The most important part of the pin tumbler cylinder. Pins are usually made of brass, are varied in length, and have angled end cuts. The pins are also called bottom pins and have one end tapered to fit the V cut of a key. It is these pin tumblers, used in varying lengths and angle cuts, that determine the combination of the cylinder. Keys are cut to fit the height and angle of the pins precisely, thereby releasing the cylinder keyway to rotate and engage or disengage the lock bolt.

PIR detectors
Verified passive infrared motion detectors (PIR) are electronic devices that can sense motion in a protected area. Verified means that the sensor is incorporating two different technologies within the same physical unit. The PIR section senses heat and the movement of the heat source. For example, if the room temperature is 20°C and an intruder enters at a temperature of 34 or 35°C, the sensor recognizes the variance, and if movement occurs at a rate of 0.006 m (0.02') per second, the sensor goes into the alarm mode. The second technology commonly used is microwave. This sensor transmits an energy field at a designated frequency and then receives the bounce or reverberation of the same signal in the receive section of the unit. This is commonly known as the Doppler effect. If the bounce back of the signal is not identical to the signal transmitted (and it would be different with an intruder in the area), the unit will go into alarm mode. When both technologies are in the alarm mode at the same time, a verified alarm signal is sent to the control panel indicating a possible intrusion.

Single cylinder
A lockset that has a key-function on the exterior and a thumb-turn on the interior.