White Paper Series

Security Features In Revolving Doors

MOVING BEYOND EGRESS AND ENERGY EFFICIENCY

Horton AUTOMATICS

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Benefits of Revolving Doors

Revolving doors not only provide a means of egress and entry, but can also increase the aesthetics, energy efficiency and security of a building. Revolving doors enable unique design options for the architect and building owner.

Because they act as “always open” to pedestrians and “always closed” to the elements, they greatly reduce air infiltration in and out of the building, which results in measurable energy savings in addition to eliminating drafts, creating a more comfortable environment, reducing dirt and debris, and providing security.

Security is of utmost concern to many types of facilities such as state and U.S. government buildings, R&D laboratories, pharmaceutical companies, hospitals, financial institutions, office buildings and educational facilities. Typical building security measures usually require a security detail and several time consuming steps. Imagine a time that you’ve entered a federal building and had to go through security. First you enter off the street and are directed with crowd control stanchions to a guard station where you may show identification, run personal belongings through an X-ray security scanner, and then walk through a metal detector or possibly even a full body scanner. This type of systemis slow, cumbersome, and allows for human error.

Controlled access security revolving doors are a more secure system that removes the security personnel component of the equation, provides several layers of security, as well as energy savings and effective high traffic management to boot.

Spacious compartments provide an elegant, energy-efficient entrance up to 16 feet in diameter to manage high volume traffic needs including shopping carts, bicycles, wheelchairs, walkers and even hospital stretchers.

History of Revolving Doors

For a brief history of the revolving door, let's look to Theophilus Van Kannel, a Philadelphian who was granted a U.S. patent on August 7, 1888 for what he called a "storm-door structure." The patent drawings show a three-partition revolving door that is described as having three radiating and equidistant wings and weather strips that ensure a snug fit.

As Kannel described them, the advantages of this type of door over a hinged door were the prevention of wind, snow, rain or dust. It was noiseless and couldn't be blown open by wind. There was no possibility of collision; people could pass in and out at the same time; and it eliminated noise from the street. In 2007 Theophilus Van Kannel was inducted into the National Inventors Hall of Fame for this invention. Kannel's innovative invention almost 130 years ago is now commonplace in buildings throughout the world, but has been continually improved with far greater sensor and security technology in place today.

Revolving Door Components and Configurations

Now let's discuss the different types of revolving door components and configurations. The components you must understand are the drum (the round enclosure), the throat openings (where people enter and exit), the wings (partitions between compartments), the center shaft (around which the wings rotate) and the motorized or mechanical speed control. The drum can either be round or segmented, with a round or segmented canopy, and either a throat- or center-connected configuration.

There are several types of revolving doors: manual, automatic, security and exit lane doors. Manual revolving doors can handle large volumes of traffic in both directions and are a low cost, energy efficient alternative to automatic revolving doors, which are also very energy efficient and offer easy, hands free operation. Automatic revolving doors have a series of active and passive sensors for door wing safety, to prevent entrapment and to detect obstructions. Security doors handle standard to high security applications, while exit lane doors are used in settings such as airports, stadiums and transportation facilities for security and to control one-way traffic.

Wing Design

For each type of revolving door there are different available configurations: two-, three- or four-wing. Two-wing revolving doors offer the largest compartment size, as there is no center shaft. The entire door, including the ceiling, rotates on a channel inside the canopy. Because of their large compartment size they are often used in healthcare facilities to accommodate wheelchairs, walkers, gurneys and carts.

Two-wing automatic doors easily accommodate large volumes of traffic in both directions and also offer the best airlock for energy efficient design. There is a superior airlock because in lieu of a single, center core there are two cores, one on each of the wings. These cores completely close the throat opening to outside elements and are desirable in cold climates to prevent ice and snow from entering the throat opening during non-operating hours.

A two-wing, round drum, automatic revolving door can handle heavy pedestrian traffic up to 80 people per minute. It is ideal for healthcare, corporate headquarters, airports and retail applications.

When the wings completely close the throat opening, this is the only revolving door that is not "always open and always closed" during part of its rotation. Due to increased mechanical components necessary for this configuration, including the rotating ceiling, the two-wing door is typically more expensive than comparable three-wing automatic alternatives.

The three-wing automatic revolving door is commonly used to provide fast and efficient traffic flow, and because the compartments are large, they provide more room for walking and can easily fit luggage and more than one passenger (i.e. parent and child) in the compartment. This type of revolving door is often used in hotels, stores and restaurants.

Four-wing manual designs move people through the door quickly, because four compartments accommodate up to four people. This is appropriate for applications such as conference centers, universities and libraries where many people are moving quickly through the building.

Drum Configurations

Configurations for the drum enclosure can be segmented or round. The advantages of segmented drums are that they allow for flat or insulated glass or solid panels. Because there is no curved glass they have easier installation and lower costs than round drums and allow for immediate glass replacement when needed; if the glass is broken, one segment is less expensive to replace. More glazing options are also available with custom finishes, as they allow for mixing panel types such as insulated glass at the exterior and flat glass at the interior.

Round systems are more expensive because curved glass costs more, but there are more architectural options. There are fewer extrusions and this type of system is the industry norm so meets most specifications. A segmented drum with a round canopy offers the best of both options; the system is less expensive with a more appealing canopy.

A revolving door is a free-standing vestibule, so the unit can be conveniently located inside the building, outside the building, or centered between the interior and exterior. The drum enclosure can be center connected to the adjacent construction or throat connected at the entry's vertical rails. Adjacent construction should not bear down on the revolving door.

When designing and specifying it is important to consider whether you want a portion of the revolving door on the sidewalk and a portion inside (as with center connected) or the entirety of the revolving door inside the building or outside the building (throat connected). Locating the revolving door inside reduces interference with pedestrian traffic on the sidewalk but takes up lobby space inside, while locating it on the exterior takes up sidewalk space but provides more lobby space, which may be important for retail and restaurant applications.

Other important design considerations are the diameter, position and finish of the revolving door. Typical diameters for revolving doors range from 6 feet to 16 feet. On four wing revolvers, two standard parking positions are available, plus "+" or "X." The "+" position has a smaller throat opening at one eighth of the circle and is more difficult to enter and exit, while the "X" position has a larger throat opening but takes up a quarter of the circle. Material finishes can be specified to match adjacent construction, while the wing and drum can be designed to match important sight lines. Customizations for these systems include special anodized and paint finishes, metal cladding, glass ceilings, lighting, signage and extended canopies.

A three-wing, segmented drum, automatic revolving door system provides spacious compartments for an elegant, energy efficient entrance. With diameters up to 16 feet, this system is ideal for managing high traffic volumes including wheelchairs, walkers and stretchers.

A four-wing, round drum, easy flow manual revolving door system is an excellent choice for energy efficiency and architectural appeal. Mechanical speed control and book-fold hardware for emergency egress are standard.

Because there is no curved glass, segmented drums have easier installation and lower costs than round drums and allow for immediate glass replacement when needed.

Security and Safety Features

Now that you have a solid understanding of the revolving door components and available configurations, let's move on to talk about security revolving door systems, as well as safety features that maximize the health, safety and welfare of building occupants.

On November 28, 1942 the Cocoanut Grove, a popular nightclub in Boston, Massachusetts, went up in flames killing 492 people, the deadliest nightclub fire in history. One of the main reasons cited for the large number of casualties was the single revolving door located at the entrance, which was rendered useless. As the mob of panicking patrons attempted to use the door as an escape it soon became jammed, trapping countless people between the door and the crowd pushing towards it. As a result, many people died from smoke inhalation, not being able to escape the burning nightclub.

This event led to a reform of safety standards and codes across the country; it is now illegal to have only one revolving door as a main entrance. The revolving door should be flanked by outward opening doors with panic bar openers and equivalent exiting capacity, and the revolving door wings should bookfold against themselves in emergency situations, so they become a double partition collapsing at 180 degrees, allowing people to pass on either side.

General Safety Features for Automatic Revolvers

General safety features that are needed to meet building codes and standards include sensors such as a canopy mounted motion detector, a sensor to detect a person in the rotating path, entry point sensors, toe guard sensors, contact safety edges and emergency buttons.

Other general safety features that are needed to meet building codes and standards include sensors such as a canopy mounted motion detector, a sensor to detect a person in the rotating path, entry point sensors, toe guard sensors, contact safety edges and emergency buttons. Scanning sensors auto-rotate the door but slow or stop it when objects are within 8 to 12 inches of the door wings.

Another safety feature is a magnetic lock that prevents the door from breaking out unless initiated by human intervention. Electromagnets hold the wings in their locked position under normal conditions with 1000 pounds minimum force. Door wings will collapse into bookfold position for emergency egress after power is released from the magnetic lock. This is important for high wind and stack pressure conditions such as in sky scrapers.

A torque limiting control constantly monitors the motor current to detect any resistance and limit torque. If the door wings come in contact with an object during rotation, the control shuts down and stops. After an adjustable time delay, the door attempts to restart in slow speed. Once clear, it resumes normal operation. Torque limiting should be checked once the door is running at operating speed and the sensitivity adjusted so that the force exerted by the door is 15 to 25 pounds (66 to 110 newtons).

Note: Some doors contain logic that activates the "idle" mode when the safety edge or torque limiting feature is activated. Also, if the setting is too light (sensitive) it may cause nuisance tripping (momentary stops and restarts) on door start-ups or in cold weather conditions. Check with the installer to confirm how your door is intended to function.

Revolving doors have wall safety edges that stop the operator when pressure is applied. Unintentional bumping with luggage, etc. less than one quarter of a second will not stop the door. Dip switches located in the controls allow the choice between automatic or manual restart (push) in the event of a torque limiting or safety edge stop.

Power operated swing doors adjacent to the revolving door are recommended for safety reasons in situations where a pedestrian is significantly physically impaired and no assistance is readily available, or when a pedestrian is wary of a revolving door.

ANSI/BHMA A156.27 Code Compliance

The American national standard for Power and Manual Operated Revolving Pedestrian Doors is ANSI/BHMA A156.27. This standard establishes requirements for power operated

revolving type doors, which rotate automatically when approached by pedestrians and/or small vehicular traffic, and manual revolving type doors for pedestrians. Included are definitions, general information, performance standards and provisions to reduce the chance of user injury and entrapment. This standard does not cover revolving doors for industrial or trained traffic nor does it attempt to assess any factors that exist with respect to custom installations. The following are partial descriptions of requirements. Please see the complete standard for detailed requirements, method and exceptions.

Egress Component Force Requirements

Each revolving door wing shall be capable of breakout when a force 130 pounds (570 newtons) is applied at a point 3 inches (75millimeters) from the outer edge of the outer wing stile and 40 inches (1020 millimeters) above the floor. Exception: Two-wing doors with automatic center panels per 7.3 are excluded.

Automatic Door Signs

Automatic revolving doors shall be marked with a visible sign. The sign shall include the words “Automatic Door” and minimum 1 inch (25 millimeters) tall black letters placed at 50 inches +/- 12 inches (1270 millimeters +/- 305 millimeters) from the floor to the centerline of the sign. Consult the standard for additional signage requirements.

Starting Force

In the initial 1.5 seconds, the force required to prevent a stopped revolving door from rotating shall not exceed 50 pound-force (222 newtons) applied 1 inch (25 millimeters) from the outer edge of the outer wing stile. The force to prevent the door from revolving after the 1.5 second initial startup shall not exceed 40 pound-force (178 newtons).

Acceptable Door RPM

The charts below show the maximum allowable revolutions per minute (RPM) of Manual and Automatic Revolving doors, which is dependent on the inside diameter of the drum extended canopies. In addition to ANSI/BHMA A156.27, revolving doors must also meet ADA standards for barrier-free entrances, should be tested to meet National Fire Protection Association (NFPA) regulations, must meet national and local building codes related to emergency exits, and may require a swing door adjacent. In addition, meeting other regional requirements such as CSA, IBC (International Building Code), BOCA (Building Officials and Code Administrators) and Miami-Dade standards may be necessary.

Acceptable Door RPM – Manual Revolving Door

Inside Diameter (Maximum)	6 ft 1828 mm	7 ft 2133 mm	8 ft 2438 mm	9 ft 2743 mm	10 ft 3048 mm
RPM	12	11	10	9	8

Acceptable Door RPM – Automatic Revolving Door with Center Shaft

Nominal Door Diameter	8 ft 2438 mm	9 ft 2743 mm	10 ft 3048 mm	11 ft 3352 mm	12 ft 3657 mm	12 ft 6 in 3819 mm
RPM Standard Speed	7.2	6.4	5.7	5.2	4.8	4.6

ANSI/BHMA A156.27 establishes requirements for power operated revolving type doors, which rotate automatically when approached by pedestrians and/or small vehicular traffic, and manual revolving type doors for pedestrians.

A security revolving door turns one compartment at a time, allowing only one authorized person to enter from the unsecure area.

The Visdom Elite sensor interacts with Horton Automatics ControlFlow security revolving door control to keep would-be violators out of the restricted area, yet provide ease of access to valid users.

The Visdom Elite can be tailored to meet the level of security you require with several modes of operation such as card in-card out, card in-free exit and can communicate with card reader systems utilizing an anti-pass back feature.

Security in Buildings

Security measures are a necessity in many buildings today. The 9/11 attacks in Manhattan and Washington, D.C. led many building owners and managers to upgrade their security protocols and systems. Surveillance cameras, lobby turnstiles and other high-tech security measures became commonplace features within many large properties and most employees have come to accept that more layers of security are now a necessary burden.

Yet, while experts generally agree that U.S. buildings are safer than they were before 9/11, they also warn that many building owners and managers have grown complacent on security issues since the attacks. The Building Owners and Managers Association (BOMA) holds the position that, "Building owners and managers must develop or update a comprehensive emergency preparedness plan for each building based on reasonable threat analyses to prepare for future emergencies and to provide a safe working environment for their tenants.

Industry guidelines and any federal, state or local regulations must recognize that emergency preparedness plans for individual buildings will differ and that a 'one-size-fits-all' approach is unworkable and ill-advised." Since 9/11, the office building industry has more tha doubled its expenditures in providing a safe and prepared office environment, according to BOMA's Experience Exchange Report (EER).

Another helpful tool for architects, engineers, building owners and managers is the newly released AEI Manual of Practice—Building Security Rating System, a publication of the American Society of Civil Engineers (ASCE). This Manual of Practice presents a building security rating system (BSRS) that can be used to improve the security of buildings and occupants subjected to violent attack. The BSRS offers a comprehensive method to account for threats and hazards, consequences and impacts, and vulnerability and mitigation as related to building security.

Airport Exiting – Secure to Non-Secure

After the attacks, perhaps the most immediate and obvious changes took place in U.S. airports. Two months after the attacks, Congress federalized airport security by passing the Aviation and Transportation Security Act, which created the Transportation Security Administration. Prior to 9/11, security had been handled by each airport, which outsourced to private security companies.

The new TSA implemented procedures that included stricter guidelines on passenger and luggage screening. Only ticketed passengers could go through security, and an ever-changing array of machinery and procedures were introduced to scan for weapons and destructive items. As new threats were discovered after 9/11, new procedures were introduced, including removing shoes and banning liquids.

Revolving security doors can now be used to Revolving security doors can now be used togreat effect in airports. All airports have a secure and a non-secure side, sometimes called airside and landside. The airport application is intended to keep the secure and non-secure sides separated while allowing easy movement from secure to non-secure sides for appropriate individuals great effect in airports. All airports have a secure and a non-secure side, sometimes called airside and landside. The airport application is intended to keep the secure and non-secure sides separated while allowing easy movement from secure to non-secure sides for appropriate individuals.

A one-way security revolving door has supplied the solution that allows travelers to easily exit secure areas. Typically offered in a 3-wing design, this door allows travelers to leave the airport through a secure one-way only exit, eliminating the need for a manned station and allowing the guard to be deployed to make roving patrols.

In the past five to seven years airports have requested an additional level of security to prevent objects from being thrown or placed into the revolving door and "rotated" through to the secured side. Object detection systems prevent an object from being swept into the secure restricted area.

A three-wing, round drum, one-way, automatic exit airport security door is designed specifically for airport applications to protect against security breaches in one-way traffic patterns. It can be equipped with object detection technology to detect undesirable and dangerous objects.

Security Doors

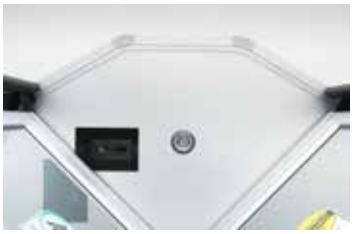
Beyond airports, there are many other applications for security revolving door systems, including laboratories, financial institutions and government buildings. A traditional hinged or sliding security door is usually equipped with a card reader and a magnetic lock or electric strike. But, once this type of door is open there is nothing to prevent multiple people from entering with an authorized person, resulting in a security breach. With a two-way security revolving door, it turns one compartment at a time, allowing only one authorized person to enter into the secure area. Consider how many times a security entrance is breached by a simple request to hold the door open as a possible unauthorized individual enters the secure area. With a security revolving door, the employee does not have this option.

Security revolving door systems include one- and two-way controlled access, high orlow traffic handling, plus many access contro options such as biometric or card readers, anti-piggybacking and anti-tailgating, bullet resistant glass and object detection.

Operation of One-Way Revolving Door

The one-way system is also ideal for transporting pedestrians from secure to nonsecure areas in applications other than airports, while the two-way is often used for controlled access such as at pharmaceutical labs. Both systems free up security resources, eliminating the need for manned stations.

A one-way security revolver provides free access out and no access, or restricted access, in. If security is breached the door locks and alarmsgo off. Different diameters of the drum are available, such as 8 foot, 9 foot, 10 foot or 12 foot.



Object detection reduces the threat of unidentified objects entering a secure environment by preventing the unauthorized passing of dangerous packages through one-way security revolving door systems.

Operation of Two-Way Revolving Door

With a two-way revolving door, traffic can be controlled from both directions. An access control system device such as a biometric reader or card scanner is required at the entrance to each side to obtain passage authorization. The user presents identification, enters the door and then proceeds through to the other side.

With matted systems authorization activates a door in the "X" position. A door in the "+" position is activated after the active mat is stepped on. The door rotates at a rate of 3 to 4 RPM for a half turn if in "X" position and a quarter turn if in "+" position. Once the passenger exits, the door then stops and locks. Unauthorized passage will cause the door to stop, lock and announce a security violation. The door rotates back to clear the secure area then resumes normal rotation.

Doors can be set up for card out or free out depending upon customer security requirements. The capacity is 12 people per minute with simultaneous in and out traffic, based on one person per compartment, 4 compartments per revolution and 3 revolutions per minute. 4-wing design is ideal to provide 2-way security and has been used in dormitory and office building applications as a standard revolving door during the day and a security door at night.

The system you specify should provide full operation for at least 2 hours in the event of power failure. Also consider that some systems use overhead sensors rather than entry mats to activate the door, have a customizable voice annunciator that is field programmable with voice messages, or wireless remote setup with numerous modes of operation and other programming options. Matless two-way anti-tailgating security systems are also available.

High Security Applications

For high security applications such as entrances in airports, R&D labs and other facilities where unauthorized objects or entry violations are a concern, sophisticated sensor technology can be used for object detection and anti-piggybacking / anti-tailgate security.

Object Detection

Object detection reduces the threat of unidentified objects entering a secure environment by preventing the unauthorize passing of dangerous packages through one-way security revolving door systems such as those commonly installed in airports and other high security environments. The system utilizes an array of sensors to detect unauthorized attempts to pass dangerous objects from an outside source to the secure side of an entrance, then stops and captures the violating object. An audible alarm notifies personnel of object detection and once the violation is rectified the system automatically resets. For maximum security, bullet-resistant glass is often available.

Anti-Tailgating/Piggybacking Technology

Advanced anti-piggybacking/anti-tailgating prevention sensors are often used in financial institutions, government and other high security installations to detect unauthorized entry violations. Tailgating is the unauthorized entry attempt via separate compartment while an authorized person is entering or exiting.

Piggybacking is unauthorized entry into the same compartment (forcible or collusion) while an authorized person is entering. A system should minimize False Acceptance Rates (FARs), which allow a piggypacker access, and False Rejection Rates (FRR), which reject a single authorized user. Most FRRs occur due to sensitive anti-piggybacking systems.

An advanced sensor system goes beyond existing vision-based, weight-based, infrared and ultrasonic systems. It can actually discern the difference between true violations and everyday authorized personnel, such as a person with a parcel or heavy clothing, which other systems often detect inaccurately. New sensor technology can “tell” if another person is in the compartment and will lock the system. In addition, it can maintain simultaneous continuous flow from both directions and can be configured in an “X” or “+.” This technology is immune to shadows, reflections and environmental changes, minimizing false alarms. The system you specify should have the capability of marking individual events.

Piggybacking is unauthorized entry into the same compartment (forcible or collusion) while an authorized person is entering.

Revolving security door systems can be tailored to meet the level of security required with several modes of operation to control flow such as card in-card out or card in-free exit, and can communicate with card reader systems utilizing an anti-pass back feature, meaning the user can't pass their card back to another person to gain access. This keeps potential violators out of the restricted area, yet provides ease of access to valid users.

How revolving Security Doors Work – An Example

To activate the revolving door, the user presents their access card to the card reader located on one or both sides of the door (or provides their biometric marker if such a system is in place). A LED located on the card reader mounting bracket will change from red to green indicating valid presentation, with an audible beep sounding simultaneously. If the card reader response is greater than two seconds, traffic through the revolving door will be slowed; the card reader's manufacturer can provide instructions to decrease response time.

A revolving door with wings in standard "plus" (+) position will begin to rotate when the valid user steps on the active mat and will allow the valid user eight seconds or three attempts to enter door. When the revolving door wings are in the "X" position, the door begins rotating after a valid card presentation is received and the valid user will be given three quadrant rotations to successfully enter the door. After successfully walking through the revolving door, the LED color will change back to red. Security doors have a reverse safety mode. In the event of a security violation the door will stop rotating and a voice annunciation then warns, "Security violation, door will reverse."

Activation by Optional Push Button Switches and Motion Detectors

Optional push button switches and motion detectors are activating switches that may be used on the EXIT side of security revolving doors. Simply press the push button to activate door rotation. For doors equipped with motion detectors, the door should start revolving smoothly when a user is about 4 to 5 feet (1219 to 1524mm) from the door. The sensor pattern should cover the entire throat area. When the user steps out of the sensor zone and after a brief time delay (two seconds minimum) the door should slow and stop at the quarter point. The detection pattern should be at least as wide as the entry.

Summary

We hope you now understand the important role that security revolving door systems can play in keeping buildings and their occupants safe from unauthorized intruders who may wish them harm. They can be used in a wide variety of applications, from airports to laboratories, office buildings and financial institutions.

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