The Litigator's Handbook for Automatic Door Sensors

Industry Standards, Daily Inspections, and Breach of Duty

By Michael Panish, Door Expert Witness

Mike Panish provides answers to the most frequently asked questions about door sensors and daily safety checks for all automatic door systems.

Q: Who is responsible for testing an automatic pedestrian door system and how often should it be tested?

A: All automatic door systems must be tested on a daily basis and anytime there is an interruption to the power of the door operator. This daily non delegable duty is imparted to the **owner/end user** by the manufacturer, as described in the owner's or operators' manuals, and applicable automatic door industry guidelines and standards.

Q: How do I learn about performing automatic door safety checks?

A: Information is typically provided with the equipment installation or operation manual, online, by calling the manufacturer, from a competent service provider, or other trained automatic door entity, and usually from applied labels affixed adjacent to the door activation controls.

Q: What are the types of sensors on automatic door systems?

A: Most automatic door systems utilize both presence detection and motion detection sensors.

Q: How do you properly inspect and test their functions?

A: The only proven method for verifying safe operation of any automatic door system is to perform a thorough **walk-test of the door** every day or when there is interruption to the power supplied to the door system.

Q: What is the importance of making thorough inspections of all sensors on an automatic pedestrian door system?

A: Door sensors must be fully recognized by the door control. If the door "brain" does not understand the signals being sent by a properly operating and adjusted sensor, the door will not react if pedestrians or other obstacles are present. All automatic door systems that rely upon sensors need to be tested prior to letting pedestrians use the door.

Q: What do door sensors on automatic doors do?

A: Most automatic doors have a motion activation approach sensor to initiate the door opening and presence detection sensor(s) to maintain the door in an open position when the door path of travel is occupied.

Q: What is the difference between a motion and presence detecting sensor?

A:

- A Presence Detection Sensor is an electronic device that can detect the presence of an obstruction such as a pedestrian in a zone of coverage and provide a signal to a control device which will affect the movement of a motor of a power operated door system.

- A Motion Detection Sensor, also known as an approach activation sensor, is an electronic device that is designed to detect movement adjacent to a doorway which will send a signal to the door control to activate the operator motor of the automatic door to initiate door opening.

Q: What is a daily safety check?

A: The requirement imparted to all end users or owners (the entity having the direct care and control) of automatic pedestrian door systems to thoroughly inspect the functionality of the comprehensive door system prior to allowing any pedestrians to transition the doorway each and every day.

Q: What happens if a motion detecting sensor does not function?

A: In most cases, the door will either not open when approached by a pedestrian, or errant signals sent from a defective sensor will keep the door in a held open position indefinitely.

Q: Is a non-working motion /approach sensor a danger to pedestrian users?

A: In most cases, a door that will not automatically open is an inconvenience but does not lead to a door impact with a pedestrian. If a door is continually held open and does not close without warning or active presence detection, it should not affect a pedestrian, however, may lead to security or environmental issues. **The answer is** that it is typically not a problem for pedestrian users or safety. The average person will enter an open door, or if the door is closed seek another entry point or think that the business location is closed.

Q: What happens if a presence sensor does not function?

A: It is probable than an obstruction in the path of the door travel will not be detected. This is the most critical sensor to protect a pedestrian user. A non-working sensor may create a door impact with a user resulting in an injury to the pedestrian.

Q: Is it possible for a sensor to be partially working or misaligned?

A: Yes. Depending upon the age and type of presence detection sensor, it is possible that areas that are required to have presence detection coverage may be missing sensor coverage. In many types of sensors (particularly older generations that are still in use), there are multiple emitters that have discreet areas of coverage. For example, if an overhead presence detection sensor has 5 beams pointing downward toward the threshold, if one or two are non-functional or pointed to another location, there is a strong possibility that there will be a ”hole” in the desired field of required coverage that will not be protected. This is typically due to burned out, misaligned, or damaged emitters.

Q: Is presence detection always active? How does the presence sensor turn on?

A: No, presence detection is started as the motion detection sensor is activated in most cases. Depending upon the type of door system, a properly functioning presence detection sensor may have to turn off to allow complete door cycling operations. In the case of sliding door systems, the most recent standards require presence detection protection until a sliding door is within 6 inches of fully closed.

Q: What causes a presence sensor to fail to provide proper coverage?

A: As with all electronic components, it is possible to have degenerative failures. Sensors can be damaged by electrical surges, loose wiring connections, force impacts, and other component issues.

Q: How do sensors work?

A: Sensors have evolved over time and have used a variety of products to detect pedestrians. In early sensors, primitive forms used bicycle type reflectors, microwave, infrared and other Doppler type emitters to broadcast their signals onto obstructions. Their field of protection was often limited and affected by color saturations. Most early sensors interpreted crudely from these broadcasts to recognize that there was an object within their field of overview. Modern sensors are refined and highly tunable to create complete protection and detect small variations in their fields of coverage.

Q: How does an automatic door function in an easy to understand way?

A: Automatic pedestrian door systems use sensors to awaken and activate the door operator. A motion detecting sensor encounters something within its field of view, and sends a signal to a processor, or door control module. The module interprets the signal from the motion detector and sends an activation signal to the door motor. The motor turns on, and through a transmission or direct coupling drives belts or chains to move the doors it is attached to. At the same time of activation, signals are sent via the control module to activate and wake up the presence detection sensor (s). Sometimes there are multiple sensors associated with presence detection. As a pedestrian transitions the doorway, the various sensors on the door report zones of occupation to the door control module. Once a pedestrian has passed through the doorway, and no obstruction is present, a timer which is inherent in the control module counts down and allows the door motor to close the opened doors. The door system then waits dormant for a new activation signal to start the sequence over again.

Q: Can you compare the parts of an automatic door in terms of human anatomy?

A: The sensors of all automatic pedestrian doors are like the eyes of a human. They are connected to the control module which is like our brain. There is a harness or cable that connects power to the sensor as well as transmits signals to the control module. That is equivalent to an optic nerve which connects our eyes to our brain. The control module, or brain then sends signals to the motor, which is equivalent to our muscles. The motor moving the doors are attached to the motor by chains, belts or directly driven by what would be considered the connection of our nervous system impulses coupled to tendons that move our muscles whether through the voluntary or involuntary nervous system.

Q: How do these components function to make the door operate, and what affects their performance in human terms?

A: As the sensors of all automatic door systems are similar to the functions of human eyes, they are connected with cabling (optic nerve) that communicates with the control module (Brain) of the door system. It is possible that a perfectly functioning sensor (the eye) is not properly communicating through the harness with the brain. Therefore, due to poor conductivity, blocked signals or inability of the brain to interpret the signal, the sensor cannot transmit its image. So, in effect, the sensor may be fully functional and works but the control module is blind to its output. Sensors can also send perfect signals through their cabling to the control module. And, due to confusion of the programming of the control module, may not be able to interpret their signal information.

Q: How would a door owner know of these functional issues?

A: Perform a daily safety check to observe the function of the sensors and see how the door operates.

Q: How can defective door functions be fixed?

A: Sometimes the defective door system can be corrected by simply turning the device off and then on. That may reboot the control module, and the missing programs that interpret the sensor output will reconfigure to allow the door to operate safely. If that does not work, it is essential that a competent service provider be consulted to test and repair the door. Any defect that cannot be fixed through a reboot should result in the door system being shut off and remain off until competent repairs are performed.

Q: Are door sensors reliable and safe?

A: Not all older door sensors are reliable. Newer products that are in current production have been tested over extended periods of time and have proven to be more reliable. A properly functioning and aligned door sensor is part of an entire system that when fully functional should be safe for all pedestrian users. No properly functioning automatic door system should come into contact with a pedestrian if appropriately used.

Q: What kind of sensors are required to be on a door system?

A: That depends upon the kind of automatic door system.

- Swinging doors typically have an approach or motion detection sensor and a proximity or presence detection sensor on both sides of the door to protect the user and guard against an injury to a non-user standing within the swing path of travel on the opposite side of the doorway.
- Sliding doors typically have a motion detecting sensor on both sides of the doorway, and a presence detecting sensor to protect the threshold when occupied. Depending upon the time that the door was fabricated, it may also have cross threshold holding beams as an additional form of threshold protection as earlier versions of overhead presence detector sensors were not always capable of providing adequate protection alone.
- Revolving doors are the most complex form of automatic door systems and have numerous redundant sensors. These include motion/approach sensors to start the door moving, entry/exit point overhead sensors to protect a pedestrian in a location where an eminent crush could occur between the rotating door and the fixed exterior drum. Wing sensors that mount on the active door wing of each compartment, and a variety of crush sensors. One is known as a heel sensor that is located on the bottom of each door wing, vertical sensors that are located on the fixed drum edge and edge of the moving door wings, and potential additional sensors that monitor the

rotational speed and movement of the pedestrians keeping the door paced behind the slowest moving pedestrian.

Q: Which door system has the most complex sensors?

A: Without a doubt, **revolving door systems have the most complex and redundant sensor systems of all automatic door systems.** This is because a revolving automatic door possesses the most mass and can impart the greatest impact force upon pedestrians if improperly operating leading to severe injuries to pedestrian users.

Q: Are any automatic doors self-monitoring for sensor safety?

A: Post 2017, the industry guidelines mandated that any new doors be self-monitoring. Doors manufactured prior to June of 2017 that did not self-monitor were not required to be retrofitted for this design aspect. In most cases, self-monitoring only shows the control module that the sensor is connected to the device. It does not give information as to what it is looking at, or if the sensor is properly aligned to adequately protect a pedestrian. Daily safety checks are still needed to provide safety for all users even if the door has self-monitoring capabilities. A walk-test is the only comprehensive way to positively know the condition of any automatic door system.

Q: Do all door systems require daily inspections, annual inspections, or more frequent inspections?

A: All manufacturers impart a daily responsibility to the owner or end user of all automatic door systems to inspect their doors. All automatic door systems must be thoroughly inspected on a daily basis and properly walk-tested to verify that all of the door sensors and safety systems are fully functioning and properly aligned. Manufacturers also provide information in their owner's manuals that annual inspections be performed by qualified and competent service providers to ensure that all of the door systems are working as designed. It is good practice to increase service intervals on highly used automatic door systems. Proactive quarterly inspections make for safer door systems for all users, whether employees or the general public.

Q: How can a sliding doorway be open for numerous users without any impact, and then suddenly close upon a pedestrian?

A: Most sliding doorways have at least 3 different sensors. One approach/motion detecting sensor on each side of the opening and at least one presence sensor covering the threshold. The activation of either of the two motion detection sensors causes the door to open and or can cause the door to remain in an open condition by proximity of cars or pedestrians adjacent to the doorway. Door controls have a programmed timer built into their circuits. Per the door manufacturer standards, after there is a loss of signal from either of the two motion sensors (activation of the door to

open by sensing of motion adjacent to the doorway), the door control is typically programmed to allow the door to close after at least 1 ½ seconds. When a properly functioning door system is activated by the motion of an adjacent pedestrian or vehicle, the control module is supposed to open the doors. It is also supposed to activate the presence detection sensor that guards the threshold for pedestrian protection which is supposed to remain fully active until the doors are within 6 inches of the fully closed position. When a nonfunctional or partially functional threshold protection sensor does not signal an obstruction to the control module, the control module will react as if there is no obstruction across the door path of travel and allow the doors to close. The doors are not being held open due to threshold occupation, rather due to motion approach detection on either side of the doorway. When the motion detection goes away, the doors will close. This is why many people are injured in sliding door impacts where door owners have claimed that there is nothing wrong with their sliding door systems. The reality is that there indeed is faulty threshold sensor protection that would have been revealed if appropriate daily walk-testing had occurred. No properly functioning automatic door should ever close upon a pedestrian user!

Q: What is a proper way to test an automatic pedestrian door system?

A: The three main types of automatic door systems (swinging, sliding and revolving) require specialized test procedures for their specific functions. The measurements described below are minimums, and they may be augmented to fit the needs of the individual environment.

- **Swing doors:**

Approach the doorway, it should begin to open when the user is approximately 4 feet in front of the door, or when the door control mat (if present) is occupied. If the door is in-swinging compared to out-swinging the door should open in front of the user without making contact with the user. If the door opens outward, it is important to test for outswing sensor protection to avoid hitting a person that may be within the swing path of the door. Older doors may have mat sensors, while more current sensors may be added or part of the door sensor package, so all aspects need to be evaluated for function. There may also be active proximity sensors that keep the door open while within the path of door swing, so standing within the swing area, check to see if the door will move when occupied. Test the doorway from both sides to determine that all sensors are fully operational, it may require that two people test some of the door safety devices for proper coverage areas. Leave the areas of sensor coverage and watch to see how long the door remains open and that it closes smoothly. See if reactivation is possible from the exit side of the doorway.

- **Sliding doors:**

Approach the door and see that it activates to open when you are approximately 4 feet in front of the doorway. I recommend that the door be tested left, right and center for the full width of the active opening to determine that there are appropriate zones of activation regardless of the angle of approach to the doorway. Once the door is open, stand motionless upon the threshold (left, right and center) for a minimum of 10 seconds, longer if desired. The door should not move to close while the threshold is occupied. If there are optical holding beam sensors installed as part of the threshold protection, verify that all sensors are active. Proceed through the opening and turn around as the door begins to close, verifying that reactivation occurs and the doors will reopen. Make the same tests from the opposite side to verify functions. Remember that all one way doors are really two way doors and that all sensors on both sides of the door should remain active until the doors are within 6 inches of closed.

- **Revolving doors:**

Approach the door and verify that the motion detection sensors start rotating the door. Look to see if the door is moving at an appropriate pace. Can you easily enter the doorway without fear of impact? Once inside the first compartment, you are testing the speed of the door, and whether the overhead wing sensor is detecting your presence. Slow down until the door wing is about 2 feet behind you, and wait for an audible alert (if part of the door system) indicating that you should keep moving, or move forward, etc. If there is no audible alert, wait until the door reacts to your presence by slowing down or stopping. Do this across the wing compartment. Start toward the center of the drum and move outward. Verify that overhead presence detection exists all along the compartment. Overhead wing sensors should have two points of protection. One at about 20 inches in front of the wing, and the second at about 10 inches in front of the wing panel. If these two points are properly functioning, the door should pace with your gate, and if you slow down even further, the door should reduce speed or stop completely prior to making contact with you. There should be a crush sensor on the bottom of each wing panel that when impacted by your heel should stop the door revolving immediately. In addition, there are sensors that are in position vertically upon wings and at the door entry/exit location that should be tested by squeezing the foam rubber jacket within which they are enclosed. Squeezing them at any location up to about 5 feet above the floor should stop the door rotation immediately. On new or upgraded revolving doors, there should be an entry/exit point overhead sensor that is located within the last 20-24 inches of the fixed part of the drum of the door on both entry and exit locations. Standing within this zone should brake the door to a full stop as the door sweeps and reaches this point. You have to enter each segment of the door and perform the same tests to verify that all sensors are working the same in all wing compartments. Once you have tested the sensors, step outside of the rotating door, and

push the emergency stop button. There should be an emergency stop on each entry/exit point. There should also be another button for slowing down the door to half rotational speed. Test the function at all entry/exit points.

Q: Does walking past an automatic door system to see that it is opening, or asking someone about how it is working, or walking through the doorway to see that it opens in front of me and closes behind me count as a daily safety check?

A: NO, the only proper way to verify if the door is working properly, regardless of its style or type is to perform a thorough walk-test that includes testing the presence detection sensor functions properly. Every day, someone has to walk-test the door, stand anywhere where there could be potential for impact, and verify that the door will not make contact with the person testing it.

Q: How often does this testing need to be performed?

A: Each and every day prior to allowing pedestrian usage. If the location is open 24 hours, the testing should be conducted at the same time every day, regardless of whether the doors are turned off or remain on.

Q: After I have had a professional service provider work on my door, what is the next time I need to test the doorway?

A: Immediately after the servicing of the door is completed and whenever a loss of power to the door occurs, or the very next day prior to allowing pedestrians through it. In the event that the service provider did not perform proper repairs, your testing will confirm or verify that the doors are working safely for all users.

Q: What styles of automatic doors are the most prevalent within the United States?

A: Currently, the most popular by product placement quantity are sliding door systems. They have replaced swinging doors as the primary power open door system, and in fact have become a proprietary component of a revolving door manufacturer that has created a hybrid door that works as a revolver during lower traffic times and converts to a sliding door system during elevated traffic times. The overall door placement favors sliding doors in terms of price points, ease of maintenance and popularity of design over swinging or revolving doors in the current marketplace. They also tend to be the most cost effective and are retrofittable into most prior revolving door or swing door locations.

Q: Do service providers understand the different requirements of swinging, sliding or revolving door systems regarding sensor integration and door operational functions?

A: As with all service industries, not everyone is equal. Some technicians are fully competent to work on all automatic door systems, possessing extensive and comprehensive knowledge while others are deficient in their training and field experience. Unfortunately, automatic door service technicians are often trained in the "watch one, do one, teach one" method. This, like a game of "telephone" is dependent upon the prior persons interpretation of the message. Even with trade organizations training and certification, I have observed technicians that are "certified" and yet lack proficiency in various forms. Swinging and sliding doors are more common than revolving doors in terms of installation quantities. There are many service providers that have little or no expertise with revolving door systems as they have had limited involvement working on those types of automatic door systems.

Most service providers encounter either older style swinging door systems or sliding door systems due to their vast product placement. Revolving door systems make up the smallest percentage in terms of placement in the automatic door world. Many service providers have no knowledge or limited experience with revolving door systems. These service providers are frequently unfamiliar with the distinct mechanical requirements of revolving doors. Consequently, they often attempt repairs based on inapplicable sliding-door experience, resulting in service that is both technically deficient and non-compliant with applicable safety standards. Until quite recently, trade organizations that many service providers subscribe to did not even have training or informational programs about revolving door systems. It is essential that an end user seeks the services of an experienced and competent revolving door service provider and not rely upon a relatively inexperienced service provider faking their way through a revolving door repair.

Q: As the owner of a door system, am I responsible for a defective repair made by a routine service provider, and do I have any recourse if an injury occurs after service?

A: Yes. The facility's duty to ensure a safe environment is non-delegable. While the technician may have performed a deficient repair, the facility is responsible for identifying the error through its mandated daily safety inspections. Because these inspections must occur after any service call is completed, the failure to catch a "botched" repair constitutes a separate breach of the standard of care. As the door owner, you should have walk-tested the door along with the service technician who performed the work and confirmed that the repair or service work left you with a fully functional and safe doorway. As with all contractors working on your facility, you should

have a copy of the contractor's insurance policy and a letter of indemnification from his coverage in your possession prior to allowing work on your property. You may have recourse, however, if you personally verify that the work performed was correct at the time of the service call, the service provider has met the standard of care and fulfilled his responsibility. The very next day, it is your responsibility to make appropriate safety inspections and continually inspect the safety of all of the door systems.

Michael Panish is the nation's preeminent expert in automatic door systems, bringing over 45 years of hands-on experience as a door, hardware, and security equipment contractor. His practice provides balanced, technical analysis for both plaintiff and defense counsel. He continuously provides expert services for plaintiff claims, and represents manufacturers, service providers, and component suppliers in complex injury claims. For a comprehensive evaluation of your next case, contact Mr. Panish directly at (888) 902-4272 (Ask for Sharon).

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- **The Ins and Outs of Automatic Door Operation**
  A basic primer in how they work, what to look for, and how to analyze defects vs. deferred maintenance. Expert witness for automatic doors, Michael Panish, takes you through the basics for your case.
- **Automatic Doors - The Importance of Checking your Doors Daily**
  Daily safety checks for automatic doors.
- **Automatic Doors & Daily Safety Inspections**
  An explanation of automatic door sensors and how they work, why it is important to check them daily, and how they protect pedestrians.
- **Automatic Door Sensors - The Evolution of Automatic Door Sensors**
- ***How door sensor technology has advanced and how automatic doors have become safer.***