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Entry Door Protection

There are **four** things you need to consider when you think about exterior entry doors and how to make them less likely to be damaged or to leak during a hurricane. They are:

- The strength of the door including its ability to resist windborne debris impacts
- The anchorage of the door to the door frame in its closed and locked position including its ability to remain closed
- The anchorage of the door frame to the wall structure
- Reducing the potential for water intrusion



Shuttered entry door

(click image for larger version)

Hinged doors are usually large compared to a piece of glass in a window. So if a door gets broken open by wind, unless it is shuttered with a non-porous system, it will almost always result in pressurization of the interior of the home.

Strength of the Door:

If the door and framing are metal and there is no glass in the door, the door will likely resist wind pressures and hurricane debris. Some kinds of solid wood doors will also provide good protection from wind pressure and debris impacts. In some cases, we have found stickers on the edge of the door where the hinges are mounted that indicate the design pressure and impact rating for the door. Beware of doors that have raised flat wood panels installed in a framework of solid wood around the edges. These panels and support members are typically not well attached to each other and the doors frequently burst apart when impacted by debris.



**Wood panel door before
impact test**

(click image for larger version)



**Wood panel door after
impact test**

(click image for larger version)

Doors may not be as strong as they seem. Even doors with metal surfaces frequently have a wood framework around the edges and possibly a foam core. While the metal may help keep windborne debris from penetrating the face of the door, it is not uncommon to have the edge of the door split at the latch and the metal buckle around the latch, under either wind pressure or the impact of debris. While a shutter system will typically protect the door from the impact of windborne debris, most allow enough air leakage around the edges of the shutter or through corrugations, even if they are capped, so that the door becomes fully loaded with the wind pressure from the storm. In Hurricane Charley, a number of homeowners had their exterior entry doors burst open even though they were shuttered.



Doors with metal skins tend to do better. This door was impact rated and the door itself performed well. However, the latching and framing are critical to total system performance.

(click image for larger version)

Your best bet for keeping your exterior entry door closed during a storm is

to have a pressure rated door that is well anchored to the frame with adequate locks to handle the wind pressure. Having a door that is also impact rated will mean that you do not need to shutter the door to protect it from windborne debris.

How many men equal the wind pressure on your door?

In a 130 mph wind, category 3 hurricane, a typical 3' wide door has about 580 pounds of pressure applied to it. That is more than two heavy men standing, if not jumping, on your door. In a 150 mph wind the 580 pounds becomes 780. That is three 260 pound men standing on your door. Bear in mind hurricane winds are not nice smooth steady winds. Instead, they are pounding winds that shake and tear things apart. Perhaps you can visualize the effects of wind pressures on your exterior door by considering them mounted flat above the floor with the frame on blocks or supported by chairs and men standing or jumping on it. Do you feel safe?

You can shutter doors with a code approved pressure and impact rated shutter system, but you must keep at least one door operable from inside the living space (not through the garage) to provide egress to the outside. This can be done by using an accordion shutter system that can be operated from both inside and outside the house. Also consider replacing at least one door with one that is code approved for wind pressures appropriate for your area and debris impact tested and approved. You can check with your building department to determine the local requirements. There are also ways to install corrugated and other panel systems so that they provide a means of escape.

Anchorage to the Door Frame:

Exterior entry doors, and particularly those that open inward, can be forced open by wind pressure or the impact of flying debris. Doors are held to the frame around them by not much - just hinges and the door lock. Remember that doors can get pulled out as well as get pushed in. Adding slide latches can add strength to the lock side of the door, but only if the latches are rather substantial, are sizeable, and have long enough screws to hold the latches in place. If a door only has two hinges it probably can't withstand a hurricane wind - Period. Dead bolts must extend far enough into the strike plate (flat metal on the door jamb that receives the deadbolt and holds the door in the closed position). Importantly the strike plate has to be secured into the jamb



really well. Many times that is not the case. Frequently one can see that the wood of the door jamb has been split by the screws holding the strike plate or by abuse. Almost always there is not much wood on the jamb to hold the screws for the strike plate in place. To

compound the problem you may well notice that the edge of the door around the deadbolt is split and in any case there is not a lot of wood holding the deadbolt in place. All of these observations point to the need to assure oneself that the lock side of the door can withstand pressures created by winds that are a lot stronger than the forces a door experiences in everyday use. One can purchase deadbolts that are heftier than others. However if the door or door jamb is split or weakened a stronger lock may not offer much additional protection.

This un-reinforced door frame gave way at the strike plate when the door was subjected to wind pressures. The plastic sheeting was used to help apply the pressure.

(click image for larger version)

All doors should have at least three hinges and a security lock with a dead bolt that is 3/4" to 1" long. The screws in the hinges need to be long enough to go through the door frame and into the wall structure. Installing heavy duty sliding latches at the top and bottom corners of the door above and below the latch and deadbolt can provide excellent extra protection when a hurricane strikes. Also, beware of doors that are mounted in a wood frame and particularly if they open inward. Windborne debris can easily burst these doors open unless the anchorage of the door has been reinforced.

Double entry or "French doors" have been particularly susceptible to failure from wind pressure and should have the highest priority for strengthening or shuttering. If you have glass panels in the doors or wood doors with raised panels, your least expensive option will likely be to shutter the door. If they are solid doors, at a minimum you should improve the anchorage of the fixed door by adding heavy duty barrel bolt sliding latches at the top and bottom and make sure the barrels extend into the header and floor (not just the threshold unless it is well anchored to the floor).

The door framing and installation details are key elements of a pressure and impact rated door system. To retain that rating, the doors have to be installed according to the manufacturer's installation instructions using the tested hardware.

Anchorage of the Frame to the Wall:

Like windows, the framing around door openings is usually larger than the door frame that is going to be installed. This allows the frame to be



French doors frequently burst open during strong hurricanes.

(click image for larger version)

shimmed so that the door is vertical, even if the framing is not quite perfect. Consequently, fasteners used to hold the door frame in place have to go through the door frame, through the gap and into the wall framing. Fasteners can be added to improve the anchorage of the door frame to the wall. The length of the fastener will need to be at least 3 inches. Wood screws should be #12. Nails should be 10 or 12 penny. Tapcons can be 3/16" diameter. Finish nails will be the least visually apparent. Counter sinking nails just a little below the surface and then filling the shallow hole with caulk will make them nearly invisible. If you are sure you are getting a good bite into the structure of the house, then space the first fastener within 6" of the end of the frame member (one fastener at the top and one at the bottom of each side) and then no farther apart than 16". When you install fasteners you can probably feel how well they are biting into the building. If they are absolutely loose, you may have to use a longer fastener. If they are just somewhat infirm the wood of the house may be rotted because of water damage or termites. Or the fastener may be missing the structure. This is sometimes the case when the window on a frame house is located near the outside face of the wall. If you are using screws, make sure not to tighten them so much that you warp the door frame.

Water Intrusion:

Out-swinging doors are likely to work better at keeping water out than in-swinging doors because they will tend to push harder against the weather stripping as the wind blows harder. However, no door, except submarine doors, can keep all water out. The sidebar makes it pretty clear that you can't keep water from coming in around doors. However, you may well be able to keep some water out by replacing weather stripping and by making sure the crack between the door and the threshold is small. A 3' wide door with a threshold crack only 1/16" tall is the same as a square hole 1 and 1/8" on a side or a round hole nearly 1 and 1/4" in diameter. Imagine standing outside with a garden hose and squirting water through your door. How much water would come into the house? In the time that hurricanes drive rain in, it could be gallons and gallons - much more than you can sop up with towels. And remember hurricanes don't squirt water gently.

Inspecting Your Hinged Door: Is It Strong Enough?

Inspect your door to determine its condition including whether it has the basic necessary strength, is in need repair, needs a new lock, or needs to be replaced. If you are relying only on the deadbolt and door latch to keep a door closed on the door knob side, bear in mind that they have to be able to withstand half the pressure applied to the door, that is $580/2=290$ pounds for a 130 mph wind.



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- [] Is the edge of the door split where the deadbolt is located?
- [] Is the door jamb split at or near the strike plate for the deadbolt?
- [] Is the strike plate well anchored to the jamb or are the screws short, loose, or wood split?
- [] Is the deadbolt loose or does the deadbolt seem flimsy?
- [] Does the door have only two hinges?
- [] When you can push on the edge lock edge of the door and push it towards the hinges do the hinges move the frame (jamb) in a way that does not instill confidence?
- [] Does the door jamb seem well secured to the framing of the house? If it obviously is not well secured, you have a problem. But even it seems well secured then it may take a professional to determine that more definitively. See side bar.
- [] Does the threshold seem well attached to the floor? Many times they are not well secured or the anchors/screws work their way loose. It is important that thresholds that have stops (the door bumps into a ledge) be well secured because they will help hold a door in place in one wind direction.
- [] If you have double doors with pins at the bottom or top then examine them carefully to determine how effective they are. Are the plates that hold the frames of the pins well secured to the edge of the door? Is the wood around them split? Are the screws secure, long enough, and effective? Do the holes into which the pins are inserted in the threshold and above the door look effective at keeping the doors closed? Do the pins insert at least ½" into the holes?
- [] Does the door have a sidelight?
- [] Does the wall around the door seem strong? If a door has 'handmade' sidelights, then one needs to be especially concerned about how much strength there is to hold the door and sidelight in place. The forces can easily be excess of 800 pounds.
- [] Does the door have raised panels such that when you look at them carefully they are less than ½" thick in places?
- [] Is the door a wind rated door? Is it rated by its manufacturer to be able to withstand pressures in excess of 40 to 50 pounds per square foot? Unless it was manufactured after 1994 it likely is not rated for pressure. If the door is wind rated it will have a label on a side edge or the top edge.
- [] Is the door rated to be debris resistant? Unless it was manufactured after 1994 it likely is not rated for impact.

How to Make Your Door Stronger:

If your answers to any one of the questions above is "yes" then you need to address the issue or just assume the door will fail. There are three approaches to protecting the door opening. One is to repair the door, another is to install non-porous shutters in front of the door so that the door itself is not such a big issue, and the best solution in many situations is to replace the door with one designed to withstand wind pressures and to resist windborne debris impacts.

Hinges: Replacing the screws that secure hinges to the door jamb can add a lot of strength to the fastening. In newer doors typically two screws of each hinge are longer than the other two. In older doors this may well not be the case. Even when longer screws are used, they may not be long enough to penetrate the wood jamb of the door, the shim space, and get a good bite into the structure of the house. Unfortunately screws typically used for hinges are a little odd in size, being either #7 or #9 depending on the size of the hinge. The screws should penetrate the structure of the house at least 1¼" inch.

Repair: There may be ways to repair or strengthen a door installation. Here are some ideas.

- Replace the hinge screws that go into the door or probably more importantly into the door jamb with longer ones. Unfortunately in some doors these screws are an odd size so finding a longer screw with the diameter you need may be a problem.
- Replacing a flimsy deadbolt might solve part of the problem on the latch side of the door connection.
- If the door or jamb is split, it may be possible to repair the splits using security hardware available at hardware stores (designed for making door more secure against burglars). A skilled carpenter may be able to salvage a door by the use of suitable glue and some screws. In some situations a metal security plate might solve your door's problems.
- Adding security slide latches can help, but do not be deceived by the effectiveness of ones that use little screws less than ¾" long. When using latches be sure the wood they are being fastened to has the capacity to resist vigorous and repeated tugging.

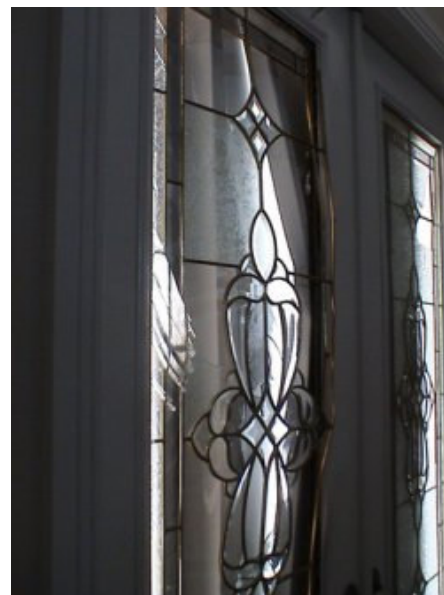
If your door has one or more sidelights you need to evaluate whether the wall is strong enough to hold the door in place when the door and the sidelight is subjected to wind forces. It may take a professional to make this evaluation.

Shutters: Shutters are designed to provide protection against debris, a very important value. However, they may not provide protection against the door being blown open by wind pressure. Also, they may not provide much protection against water intrusion if the panels are not fastened to the house in a water tight manner. If shutters are installed a few feet in front of a door, then they will offer water intrusion protection as well. If they are close to the door, a sizeable impact may damage the door.



This shutter took a direct impact of a large tile missile. The door behind the shutter was damaged as a result.

(click image for larger version)



The door behind the shutter shown to the left.

(click image for larger version)

Replacement: Your best bet may well be to replace the door with one specifically designed and rated for high wind and debris applications. Such a properly installed door should give you confidence. Getting a new door and getting it installed is not inexpensive, but may be the most cost effective solution. Some doors are simply too hard to effectively repair. Another advantage of a new door is that the weather stripping will likely be better than in an older door. For convenience it is hard to beat a new door because it will always be in place ready to do its storm protection job for you without your having to lift a finger. So with a new door you get better wind storm protection and better energy efficiency 24 hours a day. When selecting a door there the two important criteria are the wind pressure rating of the door and whether the door is debris resistant. The design pressure is given as a DP rating for the door. For impact standards, see [Local and National Debris Impact Standards](#). Minimum design pressures in the building code are based on the design wind speed for your location. You can get an estimate of the design wind speed by checking the map in [Assessing your Risks](#). The following table provides values from the building code for doors located near corners of the house. The values will be slightly lower for doors located away from corners (more than about 4-feet away).

DP Ratings for Doors - Code Minimum Values Based on Design Wind Speed

Design Wind Speed (mph)	Door Near Corner (pounds per square foot)	Door Away From Corner (pounds per square foot)
110	30	25
120	35	30

130	40	35
140	45	40
150	50	45

Inspecting Your Hinged Door. Will it Keep Water Out?

When inspecting, don't hesitate to get on your hands and knees to look carefully under the door to look for cracks and to see how easily you think water can slip through.

- Is the edge of the door split where the deadbolt is located?
- Is the weather stripping on the sides and top of the door in good shape? Can you see air? Is it a snug fit? Does it extend all the way at the top from side to side or at the sides from top to bottom? Has it shrunk or cracked?
- Has the weather stripping lost its pliability?
- Is the gap between the bottom of the door and the threshold more than 1/16"?
- Is the threshold well secured to the floor?
- Is the threshold water tight under it? Can water flow under the threshold?
- Is the rubber on top of the threshold ripped or not in a nice bubble shape or worse missing?

If your steel or fiberglass door came as a factory made assembly with jamb and threshold it will likely have a sweep of some sort under the bottom edge of the door. The sweep may be several flaps of rubber that act as sweeps. They are easily torn if the space between the bottom of the door and the threshold is too small.

- Is the sweep torn or ragged? Even if the flaps are in good shape you can imagine how easy it would be for a strong wind to push them aside to let water flow into the house.
- Is the door warped so that in places weather stripping can perform as it should, but at other places there is an air gap? This is a common problem with wood doors. A crack 1/16" wide by 2' long is equal to a square hole greater than 1" on a side. That will let a tremendous amount of wind driven rain into your house.
- Can you see big gaps or sunlight at the top corners or bottom corners of the door? You may have to look from different angles or from both the inside and outside to answer this for sure.

[] Do some of the door's raised panels have cracks in them or do some panels fit loosely?

Leaks Around Doors

The gap between the frame of a door and the door can be made to be pretty air tight under normal conditions. Hurricanes are not normal conditions.

For example a regular 3 foot wide front door that is the usual 6'-8" tall has a perimeter of 3' times two (top and bottom) plus 6'-8" times two (the two sides) for a total perimeter of 19'-4". If the crack around the door is as small as 1/32" (a few sheets of paper) the total area of the cracks is the same as a square hole 2 and 5/8" on a side or a circle 3" in diameter. This means that if someone is standing outside with a garden hose with a nozzle on it (not unlike a hurricane) you can imagine how much water can come thru. So you should not be surprised that in a hurricane a door will allow a lot of water to enter. This will be more water than you can possibly mop up with bath towels. Besides if you are prudent you are not in that upwind room during a hurricane.

When you look at your door you may well not see daylight on all sides, but you can be assured that when the door is subjected to strong wind driven rain (think hose with strong nozzle) the wind will make cracks even larger and water will flow through the cracks, even if they are not visible under ordinary conditions. The wind will also likely just push the weather stripping aside to allow water to flow in.

If you have a pair of doors 8' tall, the leak size becomes the same as a hole 4" in diameter.

How to Reduce Leaks:

Weather strips at the tops and sides of doors: The first thing is to determine whether the door is salvageable and the condition of the weather stripping. If the door is salvageable but the weather stripping is damaged or has lost its flexibility, then consider replacing weather stripping. Usually that is pretty easy to do. In some situations especially for door jambs not made in a factory you can easily replace the weather stripping that is built into a wood strip on the door jamb that is called a door stop. A door stop is usually about 3/8" thick by about 1 3/4" wide that has a hollow vinyl strip, a flapper shaped piece of rubber, or a plastic coated spongy weather strip attached to the 3/8" edge facing the door. Sometimes you can replace the weather strip without having to replace the entire door stop. If you choose not to replace the door stop, you may have to shop around to find the right size and shape of weather stripping. Some weather stripping can simply be pulled out of a groove in the door jamb. In other situations you will

find staples or little nails that were also used to hold the weather stripping in place. Simply tear the stripping out of the slots and then remove the nails or staples before attempting to install new stripping. Small wire cutters are handy tools for cutting the nails or staples in the groove. Before you do any of this it might be prudent to cut off a little piece of weather stripping near the floor so you can take it as a sample when you go shopping. An alternative is to simply replace the door stop. They are readily available at home supply stores. The disadvantage of replacing the door stop is that it will need to be painted.

Duct tape may be no joke!

Water Intrusion Preventative Measures At Doors And Windows

Although it is unproven, it seems that suitable tape applied to the outside of your windows to cover the cracks between the frame and the sash or parts of the sash where windows overlap might reduce the amount of water getting driven into your house. The tape must be sticky enough to stay on and must be water resistant enough to maintain its effectiveness. Two types of tape might offer such features. One would be a good quality cloth duct tape. Unfortunately there are a lot of inferior quality duct tapes. Aluminum foil type tape used by AC duct installers is more reliable. The aluminum tape about 2½" wide has paper applied to the sticky side that one removes when applying the tape. Some brands of this tape have printed instructions for installation. The most important installation hint is to use a semi-rigid squeegee to rub over the tape to press the adhesive to the substrate. When using any tape, the surface must be dust and grease free. Unfortunately nearly all tapes have to be applied to dry surfaces. So plan ahead.

Air gaps at thresholds: Your door threshold is likely to be an adjustable one if it has two holes in the top of it below which are bolts that are used to move the threshold up or down. If the rubber on a nonadjustable threshold is deteriorated you can buy a new threshold from which you can salvage the rubber. This way you won't have to go to the effort of changing the threshold itself. Another way to deal with gaps under doors is to replace the threshold with a higher one. They are readily available in a variety of heights. Another approach is to add a spacer to the bottom of the door. Unfortunately this means removing the door. If the gap under a door varies much it may be that the door has pulled away from the jamb at the top hinge. This is fixable by installing larger or longer screws or by replacing the hinge and installing larger or longer screws. Weather stripping applied to the face of a door may well not be effective at keeping water out. If you have a steel or fiberglass door with deteriorated weather stripping under the door, it can usually be replaced fairly easily by removing the door. When you shop for the replacement it would be helpful to know the brand of the door. Unfortunately, that may be difficult to determine. To get that replacement stripping you will likely have to get it from a lumber/contractor supply store.

Air gaps at corners: The weather stripping of doors is often such that a little adhesively applied pad is required to be placed at the lower corners of

the jambs. These pads tend to come off with use and sometimes they never even get installed. The pads are wedge shaped plastic coated foam that are about 2" by 2" and about 1/8" thick to 1/4" thick in a wedge shape. They are not readily purchased except from door manufacturing facilities that may be a part of the lumber companies where builders buy their supplies.

Warped door: If the door is warped you probably should consider replacing the door as it will probably leak badly during a hurricane. You might notice that a warped door changes shape with season and in the case where a door is exposed to direct sunlight the door may even change shape between morning and night.

Storm panels: Storm panels may only offer marginal protection against water intrusion. If your entrance way for a door has in effect an exterior hallway consider locating storm panels at the entrance of the "hallway" so that water that gets blown behind storm panels will have to travel some distance to the door. If you can reduce the buildup of water on the door, less will be driven through cracks by the wind pressure difference across the door.

Replacement with a pressure and impact rated door: This is the ideal solution but may not solve all of the water intrusion issues.

Building a dam: While water beating against the door can be driven through any cracks and crevices whether they are at the bottom or top of the door, most of the water will tend to be blown in under the door. The best technique that door manufacturers have found for keeping water from flowing into the house under the door is to build a deep reservoir that the water has to fill before it overflows into the room. The height of the reservoir is the most critical element. From the table of design pressures presented above, a 130 mph wind can create a pressure of 35 pounds per square foot (psf) on a door in the middle of a wall. Each inch of water height exerts a pressure of 5.2 pounds per square foot at its base. Consequently, the 35 psf wind pressure equals the pressure applied by water 6.7 inches deep. Consequently, building a dam about 7 to 8 inches deep that can be sealed to the door frame on the inside of the door, in such a way that water doesn't leak under it, would greatly reduce the chances that much water would be blown in when winds approach 130 mph.

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