

Community Tornado Safe Room Doors: Installation and Maintenance

Safe room door assemblies are one of the most important components of a safe room because they must provide the same level of protection as the walls and roof, yet also remain functional for quick access. To provide reliable life-safety protection against extreme wind events, safe room door assemblies need to be certified as compliant with ICC® 500, *Standard for the Design and Construction of Storm Shelters*,¹ installed as specified by the manufacturer, and regularly maintained by the safe room owner or operator.

Certification

ICC 500 requires manufacturers of storm shelter impact-protective systems, including door and shutter assemblies,² to have their products rigorously tested and certified to ensure they will not fail in the event of a tornado or hurricane. The entire storm shelter door assembly must pass the required testing in the same configuration in which it will be installed in the storm shelter or safe room. Figure 1 shows the components of the door assembly. Any change to any of these components would necessitate re-evaluation by the certifying agency and retesting in the new configuration pending re-evaluation results.

Successful certification is demonstrated by labels permanently attached to the assembly as approved by third-party certification agencies³. Certification includes verification of testing, listing of approved components of the assembly, and follow-up inspection of the manufacturer's product and processes. Important information regarding performance of these assemblies is shown on the label and

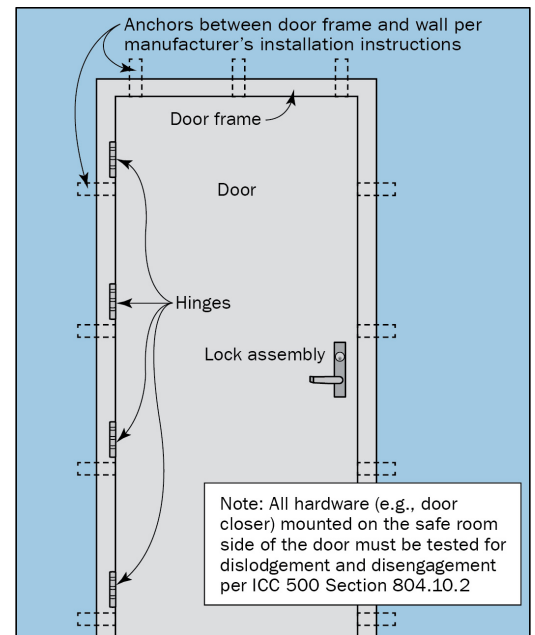


Figure 1: Components of a safe room door assembly

¹ ICC 500 is published by the International Code Council.

² This fact sheet covers safe room door assemblies, but the guidance can be applied to interior-operated shutters. Consult a registered design professional regarding maintenance for fixed impact-protective systems.

³ ICC 500 Section 112 provides minimum requirements for listing and labeling.



includes the design pressure (which is less than the tested pressure) and the tested missile weight and impact speeds.

Safe Room versus Storm Shelter

Though similar, there are important differences between safe rooms and storm shelters. While both must meet all ICC 500 requirements, safe rooms also meet Federal Emergency Management Agency (FEMA) Funding Criteria.

The latest FEMA Funding Criteria are provided in FEMA P-361, *Safe Rooms for Tornadoes and Hurricanes: Guidance for Community and Residential Safe Rooms* (2021), at the beginning of each Part B chapter and summarized in Appendix D. If a new safe room will be constructed with FEMA grant funds, the FEMA Funding Criteria become requirements, in addition to the requirements for storm shelters in ICC 500-2020.

Since FEMA P-361 does not include FEMA Funding Criteria specific to safe room opening protection, the ICC 500 requirements addressed in this fact sheet govern both storm shelters and safe rooms. Therefore, safe rooms are included by reference whenever this fact sheet uses the term “storm shelter.”

Although ICC 500 requires impact-protective systems for openings to be labeled indicating compliance with the standard, there is no universal format for such labels. A representative example is shown in Figure 2. Note the label shown in this figure references the previous editions of ICC 500 and FEMA P-361, which were published in 2014 and 2015, respectively. Label marking requirements in the current edition of ICC 500 include the same basic information, except that new products installed in FEMA-funded safe rooms or storm shelters in locations where ICC 500-2020 is adopted should reference the 2020 edition of ICC 500. Although most labels also reference FEMA P-361, this is not required.

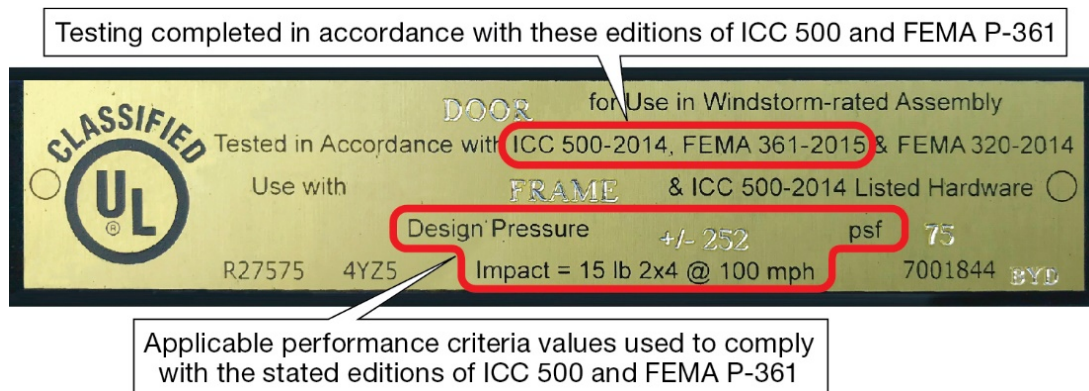


Figure 2: Example UL tornado safe room door label for a product that has been tested to earlier safe room criteria

Installation

ICC 500-2020 includes the following installation requirements for door and shutter assemblies:

- Section 110.1.2.1 specifies that all post-installed anchors (including those used to install impact-protective systems) require a special inspection to verify compliance with the required design information listed in Section 106.2.1 (reference item 21).
- Sections 107.1 and 107.3 require that construction documents for community storm shelters include a quality assurance plan (QAP) prepared by a registered design professional. Section 107.2 lists the installation of door and shutter assemblies as items that must include detailed requirements in the QAP.
- Section 107.4 requires contractors who install the assembly to acknowledge their responsibility by submitting a written statement to the authority having jurisdiction (AHJ).

What should the QAP include? The QAP should include detailed quality control measures to verify that the assembly installation is in accordance with the manufacturer's installation instructions. Recommended measures include requiring direct coordination with the manufacturer where any differences between installation instructions and field conditions are encountered and installation oversight by the architect (or their agent) who specified the assembly.

Who installs door assemblies? Even when installation oversight is provided for quality control purposes, the contractor who installs the assembly must take responsibility for following the manufacturer's installation instructions exactly as they are provided. Although contractors should not be held responsible for the fabrication of components manufactured and certified by others to meet ICC 500 requirements, they should be held responsible for purchasing and installing components and assemblies that are consistent with the construction documents and the manufacturer's installation instructions so that the assembly is capable of providing reliable life-safety protection during extreme wind events.

Maintenance

Safe room door assemblies should be regularly maintained to protect their functionality and maximize their lifespan.

Why do it? Door assembly maintenance is especially important because specialized safe room door hardware can easily fall out of adjustment or rust and stick because of lack of lubrication, which could in turn result in failure of the hardware to engage quickly during an event.

In recognition of the critical role maintenance plays in the storm shelter's ability to provide reliable life-safety protection, ICC 500-2020 includes requirements for community storm shelters in Section 113, Evaluation and Maintenance. Section 113.2 (Evaluation) of the standard specifies that impact-protective systems must be evaluated for compliance with the manufacturer's operational and maintenance requirements. Section 113 also provides the minimum frequency of evaluations, how to address repairs and replacement of assemblies, and recordkeeping.

Who should do it? ICC 500 Section 113.2 specifies the owner or the owner's authorized agent is required to perform the evaluation. Candidates for the 'owner's authorized agent' may include facilities and maintenance staff with

assistance as needed from the door manufacturer or distributor, or a subject matter expert recommended by the AHJ.

What should be checked? The following are examples of items that should be verified during a routine maintenance check:

- Clean latch points (e.g., there should be no debris at the floor strike point that would prevent a full connection; clean out debris if needed)
- No rust
- Functioning hardware
- Proper hardware lubrication
- Proper functionality of any electrical door assembly component and its redundant manual function
- Nothing affixed (e.g., bulletin boards) to the safe room side of the door (affixed objects may become flying debris when the exterior face of the door is impacted)

It is recommended that storm shelter and safe room owners contact the door assembly manufacturer, as the manufacturer may have additional checks that should be performed for its specific door assembly. The manufacturer may also be able to provide maintenance and inspection training, as well as guidance on when to contact them with an issue. Figure 3 illustrates example maintenance check points for a sample community safe room door.

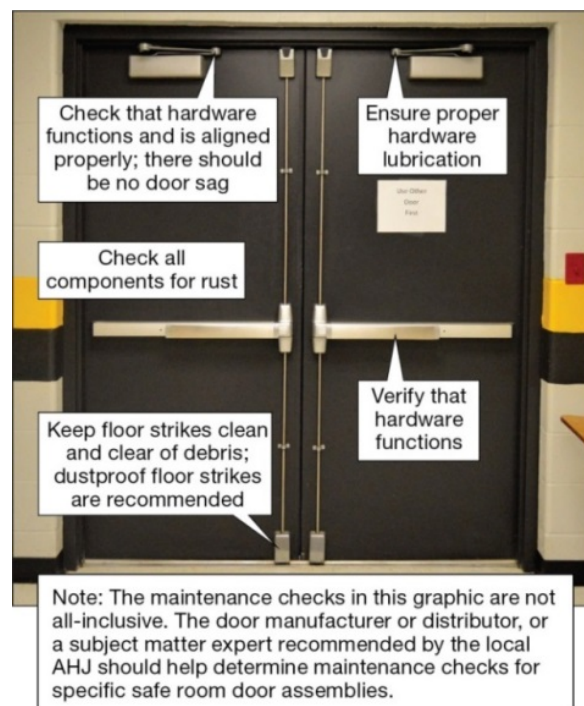


Figure 3: Example maintenance check points for a sample community safe room door

How often should it be checked? ICC 500 Section 113.2 requires evaluation of the storm shelter envelope and impact-protective systems at least annually and when requested by the AHJ (e.g., after an extreme wind event). Best practices for monitoring and maintenance frequency depend on the amount of use per day. A confidential report (unpublished, 2017) found that approximately 75 percent of 289 community tornado shelter doors aged between 10 and 17 years old had issues that could have caused failure during a tornado event. Based on this report, the frequency of a safe room door assembly's maintenance needs to increase as a function of its age and use. Recommended frequency of door monitoring and maintenance is shown in Table 1.

Table 1: Recommended monitoring and maintenance frequency for door assemblies

Estimated Use (Cycles per Day)	Recommended Check Frequency
Rarely (less than 100)	During drills or three times a year
100–499	Monthly
500–1,000	Weekly

Source: Personal communication by authors of confidential 2017 report.

Solutions

Install a secondary set of doors. One way to decrease the frequency of safe room door usage in high-traffic areas is to install a secondary set of doors for everyday use and pin back the safe room doors into an open position for use only during high-wind events or drills. If considering implementation of this approach, the safe room owner or operator should consult with the door assembly manufacturer first to ensure that the new configuration will not impede timely engagement and operation of the safe room door.

What About Residential Safe Room Doors?

Refer to FEMA's *Residential Tornado Safe Room Doors* Fact Sheet (2021) for guidance on selecting, verifying, and installing tested and labeled residential safe room door assemblies. When careful selection and installation of the safe room door assembly are overlooked, the safe room door may fail during a tornado and put occupants at great risk of injury or death.

Some information in this fact sheet is pertinent to owners of residential safe rooms, specifically the bulleted issues listed in the Maintenance section. However, in most cases, safe room door assemblies inside individual dwellings are opened and closed much less frequently than those in multi-use community safe rooms (e.g., safe rooms also serving as school gyms). As a result, it is generally sufficient to perform only one or two maintenance checks a year for in-home safe room door assemblies. Any resulting questions can be directed to the door manufacturer, distributor, or a subject matter expert recommended by the AHJ.

Replace door hardware. If the maintenance check and follow-up inspection indicate that the door hardware needs to be replaced, it is important to ensure the replacement meets the appropriate performance criteria. In accordance with ICC 500 Section 113.3.1, replacement components must be specified within the tested or listed door assembly.

Because safe room door components can take weeks to acquire from the manufacturer, replacements for parts likely to wear out faster should be ordered when the door is installed to quickly address future maintenance issues. Such parts include hinges, latches, and locks.

Replace safe room door assembly. Safe room door assemblies may eventually need to be replaced. While the door assembly's useful life depends on the frequency of use, maintenance, and general conditions, proper maintenance and regular cleaning will extend its useful life. ICC 500 Section 113.3.2 provides that replacement storm shelter impact-protective systems must meet the applicable requirements of the standard and be tested and installed in accordance with the requirements for new installation or construction.

Resources

FEMA P-361. 2021. *Safe Rooms for Tornadoes and Hurricanes: Guidance for Community and Residential Safe Rooms*. Fourth Edition. Download a free copy from <https://www.fema.gov/emergency-managers/risk-management/safe-rooms/resources>.

ICC 500. 2020. *ICC/NSSA Standard for the Design and Construction of Storm Shelters*.
<https://codes.iccsafe.org/content/ICC5002020P1>.

UL Online Certification Directory:

<https://iq.ulprospector.com/info/>. After registering for a free account, log into "UL Product iQ" directory and enter "ICC 500" under "Start your search" to find products that have passed ICC 500 testing.

Intertek Online Certification Directory:

https://bpdirectory.intertek.com/Pages/DLP_Search.aspx. Under "Standard," select "ICC-500" from the pull-down menu and click on "Search" for a list of products that have passed testing for the appropriate edition of ICC 500.

National Accreditation & Management Institute (NAMI) Online Certification Directory:

https://www.namicertification.com/index.php?option=com_namicert&view=structural&Itemid=115. Under 'SPECIFICATION', select ICC 500 for compliant products.

If you have additional questions pertaining to FEMA safe room guidance publications, please contact the Safe Room Helpline at Saferoom@fema.dhs.gov.