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 and storm shelter door assemblies should be certified as compliant with the latest edition of ICC® 500,[1] installed as specified by the manufacturer, and regularly maintained by the safe room owner or operator.

Not all doors are the same

ICC 500 (Section 306) requires manufacturers of storm shelter impact protective systems, including door, window, and shutter assemblies, to have their products rigorously tested and certified to ensure they will not fail in the event of a tornado or hurricane.[2,3] 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 attached to the doors as approved by third-party certification agencies, an example of which is shown in Figure 2. Certification includes verification of testing, listing of approved components of the assembly, and follow-up inspection of the manufacturer's product and processes.
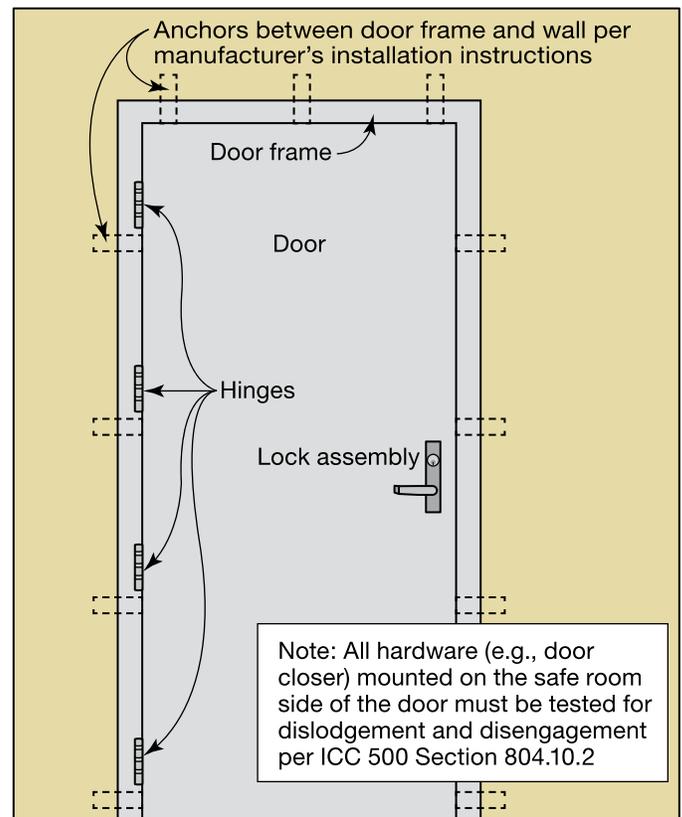
Safe Room versus Storm Shelter

Though similar, there are important differences between safe rooms and storm shelters. While both must meet all ICC 500 requirements, safe rooms also meet the Recommended Criteria for safe rooms described in FEMA P-361, *Safe Rooms for Tornadoes and Hurricanes: Guidance for Community and Residential Safe Rooms* (2015); these criteria are more conservative than those presented in ICC 500 for storm shelters.

The differences are explained at the beginning of each chapter of FEMA P-361 Part B and summarized in Table D-1 of Appendix D. If a safe room will be constructed with FEMA grant funds, the Recommended Criteria become requirements, in addition to the requirements for storm shelters in ICC 500. Although not required, a best practice is to apply FEMA safe room guidance to storm shelters.

Since FEMA P-361 (2015) does not include Recommended Criteria specific to safe room opening protection, the ICC 500 requirements addressed in this fact sheet fully govern both storm shelters and safe rooms. Therefore, safe rooms are included by reference whenever this fact sheet uses the term "storm shelter."

---

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 108 provides the requirements for design information signage and labeling.

Anchors between door frame and wall per manufacturer's installation instructions

Door frame

Door

Hinges

Lock assembly

Note: All hardware (e.g., door closer) mounted on the safe room side of the door must be tested for dislodgement and disengagement per ICC 500 Section 804.10.2

Figure 1: Components of a safe room door assembly

Figure 2: Example UL tornado safe room door label

Important information regarding performance of these assemblies is the tested design pressure and the tested missile impact speeds.

Certification labels are required according to the second edition of ICC 500 (Section 108.2). ICC 500 has also been updated to require manufacturers to test minimum-sized listed door assemblies in addition to the maximum sizes (Section 803.1).

Installation

ICC 500 requires that construction documents for community storm shelters include a quality assurance plan (QAP) prepared by a registered design professional and specify that proper installation is the contractor's responsibility.

What must the QAP include? Section 107.3 of ICC 500 lists the installation of missile-resistant shelter envelope assemblies as one of the items that must include relevant detailed requirements in the QAP. Storm shelter door assembly installations should be included under the special inspections required and details should be provided in the QAP.

Who installs door assemblies? Proper installation is the contractor's responsibility per ICC 500 (Section 107.3.3). Storm shelter door assemblies must be installed in accordance with the manufacturer's installation instructions so that the on-site assembly is configured exactly the same as the model assembly that passed testing and was certified. Although contractors should not be held responsible for whether components manufactured by others meet ICC 500 requirements, they should be held responsible for purchasing and installing components that are consistent with the contract documents and instructions provided by the manufacturer so that the door assembly provides the level of protection it was designed to provide.

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. To ensure effectiveness, every safe room should have an Operations and Maintenance Plan, and maintenance costs should be considered during budget planning.

Who should do it? The safe room's Operations and Maintenance Plan should identify who performs the monitoring and maintenance of the door assembly. Candidates may include facilities and maintenance staff with assistance as needed from the door manufacturer or distributor, or a subject matter expert recommended by the local Authority Having Jurisdiction (AHJ).

What about Residential Safe Room Doors?

Refer to FEMA's *Residential Tornado Safe Room Doors* Fact Sheet (2018) for guidance on selecting, certifying, and installing tested 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 questions can be directed to the door manufacturer, distributor, or a subject matter expert recommended by the local Authority Having Jurisdiction (AHJ).

What should be checked? The following are examples of items that should be verified during a 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 safe room owners contact the safe room door 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.
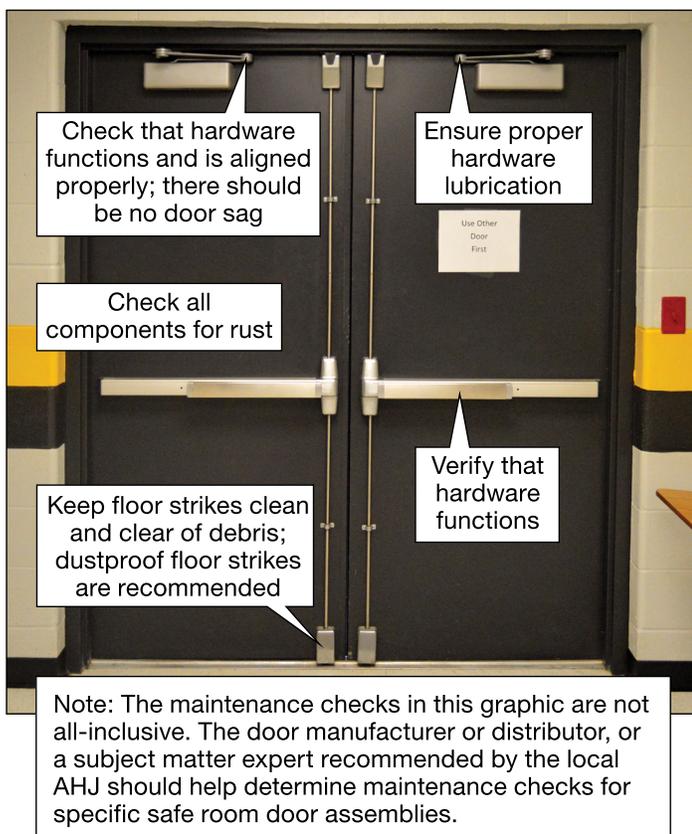

Check that hardware functions and is aligned properly; there should be no door sag

Ensure proper hardware lubrication

Check all components for rust

Keep floor strikes clean and clear of debris; dustproof floor strikes are recommended

Verify that hardware functions

Note: The maintenance checks in this graphic are not all-inclusive. The door manufacturer or distributor, or a subject matter expert recommended by the local AHJ should help determine maintenance checks for specific safe room door assemblies.

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

How often should it be checked? 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 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.

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. Replacement parts should meet the provisions of the code adopted when the door assembly was installed. 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. 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.

See our current releases and stay updated by visiting our website at https://www.fema.gov/safe-rooms.

Resources

FEMA P-361. 2015. *Safe Rooms for Tornadoes and Hurricanes: Guidance for Community and Residential Safe Rooms*. Third Edition. Download a free copy from https://www.fema.gov/fema-p-361-safe-rooms-tornadoes-and-hurricanes-guidance-community-and-residential-safe-rooms.

ICC 500. 2014. *ICC/NSSA Standard for the Design and Construction of Storm Shelters*. Purchase and download ICC 500-2014 from http://shop.iccsafe.org/standards/icc-standards/icc-500-2014-icc-nssa-standard-for-the-design-and-construction-of-storm-shelters.html.

UL Online Certification Directory. Available at https://iq.ulprospector.com/info/.

After registering for a free account, log into 'UL Product iQ' directory and enter 'zhla' under 'Start your search' to find products that have passed ICC 500-14 testing. Note: If prompted, select 'Windstorm-Rated Assemblies' (not 'keyword') when entering 'zhla.'

Intertek Online Certification Directory. Available at https://bpdirectory.intertek.com/Pages/DLP_Search.aspx.

Under "Standard,' select 'ICC-500 (2014)' from the pull-down menu and click on 'Search' for a list of products that have passed ICC 500-14 testing.

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