



1.0 MANUFACTURER'S IDENTIFICATION

- 1.1 **NAME OF APPLICANT:** Safe Sheds, Inc.
1003 S Maple
Salem, IL 62881
- 1.2 **CONTACT PERSON:** Michelle Barbee & Don Guymon
- 1.3 **TEST LAB CERTIFICATION:** Accredited by the American Association of Laboratory of Accreditation (A2LA) in accordance with the recognized International Standard ISO/IEC 17025.



2.0 TEST UNIT IDENTIFICATION

- 2.1 **PRODUCT TYPE:** **Series 1** — FEMA 320 and ICC-500 Vent
Series 2 — FEMA 320 and ICC-500 Escape Hatch
Series 3 — FEMA 320 and ICC-500 Door
- 2.2 **MODEL NUMBER:** N/A.
- 2.3 **CONFIGURATION:** See Article 3.0 Test Unit Description.
- 2.4 **SAMPLE SIZE:** See Article 3.0 Test Unit Description.
- 2.5 **ASSEMBLY:** See Article 3.0 Test Unit Description.
See construction photos, pages 7-8, 11-12, 15-17.
- 2.6 **DRAWINGS:** See Appendix B Drawings.



3.0 TEST UNIT DESCRIPTION

3.1 TEST FRAME UNIT CONSTRUCTION:

3.2 ASSEMBLY CONSTRUCTION:

Series 1— The shelter vent consisted of a C 6x8.2 channel 8-in. long with openings at each end of the channel. The channel covered a 5-in. diameter hole in the concrete shelter wall and was held in place with a 3/8-in. carriage bolt that connected to a grappling spider constructed of 1/4-in. x 1-in. steel strapping.

Series 2— The escape hatch cover was 2-ft. 2-in. x 1-ft. 8-in. x 3/16-in. and was stiffened horizontally with 3/8-in. x 22-in. x 1 1/2-in. strapping and stiffened vertically with 3/8-in. x 14-in. x 1 1/2-in. strapping. A 3/4-in. x 16 1/2-in. bar handle was welded to the hatch. The escape hatch frame was 2-ft. x 1-ft. 6-in. and was constructed of a welded C 4x5.4 channel. When installed in the concrete shell the frame would be welded to the #4 rebar concrete wall reinforcing. 3/4-in. Grade 5 machine bolt nuts were welded to the inside channel frame corners for connection of the hatch cover. The hatch was attached to the frame with 3/4-in. x 1 1/2-in. Grade 5 bolts.

Series 3— The 3/16-in. plate steel door measured 3-ft. x 6-ft. 1-in. and was mounted as an out-swinging door. The door was hung on (3) 4 1/2-in. 5-knuckle weld-on butt hinges. The door frame was a C 4x5.4 welded channel frame. The door is stiffened horizontally with (8) 7-ga. x 1-in. x 1 5/8-in. x 33 5/8-in. long angles. The door is locked with a three point, single action swing latch that engaged (3) x 7-in. x 2-in. x 3/8-in. plates behind the 1-in. x 1-in. x 1/8-in. angle stop welded to the channel frame. A 1-in. x 1-in. x 1/8-in. angle safety bar is provided assist the latching handle.

Refer to the engineering drawings in Appendix B for further details on **Series 1**, **Series 2**, and **Series 3**.

4.0 TEST RESULTS

4.1 SCOPE: Conduct impact tests related to a 250-mph ground speed tornado (100-mph horizontally at vertical or near vertical surfaces and/or 67-mph vertically at horizontal surfaces inclined less than 30 degrees).



4.2 SUMMARY OF RESULTS:

Test Method	Test Conditions	Test Conclusion
<p><u>Impact Test</u> FEMA 320 & ICC-500 – Tornado Protocol 4, See Appendix A</p>	<p><u>Impacts</u> Series 1— FEMA 320 and ICC-500 Above-ground Shelter/Door/Panel.</p> <p>Series 2— FEMA 320 and ICC-500 Shelter/Door/Panel.</p> <p>Series 3— FEMA 320 and ICC-500 Shelter/Door/Panel.</p> <p>Test projectile 15-lb. wooden 2-in. x 4-in. propelled at 100-mph.</p>	<p>Series 1– Passed the required impacts for an EF-5 tornado. Awarded <u>Model #20180824A.1</u></p> <p>Series 2– Passed the required impacts for an EF-5 tornado. Awarded <u>Model #20180824A.2</u></p> <p>Series 3– Passed the required impacts for an EF-5 tornado. Awarded <u>Model #20180824A.3</u></p> <p>See Conclusions Article 5.0.</p>

4.3 INDOOR WEATHER CONDITIONS:

Series 3

Temperature	85.5 degrees
Relative Humidity	39 %
Barometric Pressure	29.98 in-Hg



4.4 IMPACTS

Impact Speed: 100-mph x 15-lb. wood 2-in. x 4-in.

Impact Tests

Series/Impact	Velocity (mph)	Location	Results
1/1	100.15	Center	9/32-in. deformation. See photos, pages 9-10.
2/1	100.35	Center	21/32-in. deformation and 22/32-in. separation. See photos, pages 13-14.
3/1	100.94	Near Upper Right Lock	5/8-in. deformation. See photos, pages 18-19.
3/2	99.90	Near Center Lock	17/32-in. deformation, lost safety bar but door remained locked. See photos, pages 20-21.
3/3	100.85	Near Center Hinge	17/32-in. deformation, no damage to hinge. See photos, pages 22-23.



5.0 CONCLUSIONS

Within the bounds of reasonable engineering and technical certainty, and subject to change if additional information becomes available, the following is my professional opinion:

Impact tests were conducted by TTU NWI Debris Impact Facility on August 24, 2018 for Safe Sheds, Inc. The 4-in. thick reinforced concrete to documented in FEMA 320 and FEMA 361 to be tornado impact resistant and meets NWI DIF Protocol 4, Tornado.

Tested products included the following:

Series 1— The shelter vent consisted of a C 6x8.2 channel 8-in. long with openings at each end of the channel. The channel covered a 5-in. diameter hole in the concrete shelter wall and was held in place with a 3/8-in. carriage bolt that connected to a grappling spider constructed of 1/4-in. x 1-in. steel strapping.

Series 2— The escape hatch cover was 2-ft. 2-in. x 1-ft. 8-in. x 3/16-in. and was stiffened horizontally with 3/8-in. x 22-in. x 1 1/2-in. strapping and stiffened vertically with 3/8-in. x 14-in. x 1 1/2-in. strapping. A 3/4-in. x 16 1/2-in. bar handle was welded to the hatch. The escape hatch frame was 2-ft. x 1-ft. 6-in. and was constructed of a welded C 4x5.4 channel. When installed in the concrete shell the frame would be welded to the #4 rebar concrete wall reinforcing. 3/4-in. Grade 5 machine bolt nuts were welded to the inside channel frame corners for connection of the hatch cover. The hatch was attached to the frame with 3/4-in. x 1 1/2-in. Grade 5 bolts.

Series 3— The 3/16-in. plate steel door measured 3-ft. x 6-ft. 1-in. and was mounted as an out-swinging door. The door was hung on (3) 4 1/2-in. 5-knuckle weld-on butt hinges. The door frame was a C 4x5.4 welded channel frame. The door is stiffened horizontally with (8) 7-ga. x 1-in. x 1 5/8-in. x 33 5/8-in. long angles. The door is locked with a three point, single action swing latch that engaged (3) x 7-in. x 2-in. x 3/8-in. plates behind the 1-in. x 1-in. x 1/8-in. angle stop welded to the channel frame. A 1-in. x 1-in. x 1/8-in. angle safety bar is provided assist the latching handle.

Refer to the engineering drawings in Appendix B for further details on **Series 1**, **Series 2**, and **Series 3**.

These tests were consistent with the guidelines of FEMA 320 (2014) and ICC-500 (2014). The [above-ground shelter/door/panel] was tested with debris impacts per the Test Protocol 4, Tornado. These impacts relate to a 250-mph ground speed Tornado. (100-mph horizontally at vertical or near vertical surfaces and/or 67-mph vertically at horizontal surfaces inclined less than 30 degrees.)



Series 1 Passed – FEMA 320 and ICC-500 (Awarded **Model #20180824A.1**).

Series 2 Passed – FEMA 320 and ICC-500 (Awarded **Model #20180824A.2**).

Series 3 Passed – FEMA 320 and ICC-500 (Awarded **Model #20180824A.3**).

*The hook on the safety bar should be sufficiently long to fully engage the locking handle and the safety bar should be tethered to the door per ICC-500 (214), Section 503.1, Latching Mechanisms. **These issues have been satisfied and are included in Appendix C.***

Note: All tested products expire five years from the Model Number Date and must be retested. Failure to retest expired models will result in removal from the NWI DIF Tested Products Database.

The manufacturer is advised to install warning signs inside the shelter that warns the occupants to not come in contact with the surfaces of the shelter and to wear hearing protection during a storm event. Any alterations made to the shelter design or construction must be approved or retested by TTU NWI Debris Impact Facility.

All testing was in strict accordance to FEMA 320 (2014) and ICC-500 (2014).



Engineer of Record
Larry J. Tanner, P.E., R.A.