### **Overview: Installation instructions**

These installation instructions are only guidelines. Errors and Omissions statement from <u>TECH DATA</u> p.6 applies to this document. Applicable building codes, standards and accepted practices apply. Follow installation and ICC500 requirements. Align with the architect, project engineer and other contractors. The Authority Having Jurisdiction is the final authority in issues related to the installation and use of any building products. This doc is supported by typical installations found in our collaboration with the Steel Door Institute (SDI). Reference "Prep and Installation Videos" of <u>SDI</u> <u>Videos</u> (referenced videos are not tornado specific).

### A. ORDERING PALADIN FRAMES AND DOORS

- For ordering the correct undercut and installing correctly, reference latching hardware installation instructions. The door gap is a max 1/8" from bottom of door to top of lip on a WS-T-304L cup strike (see section F.12) (FIG. 1) or 1/8"-1/4" to the top of an LM9300 strike plate (FIG. 2). Manufacture strike must always be used and must be anchored (LM9300) or grouted (WS-T-98/9927/57) into slab as directed by hardware instructions.
- Installations must follow hardware & accessory manufacturer guidance in data sheets, installation instructions and templates. See helpful links to the right, Steelcraft Paladin webpage right margin, or search the Allegion **Document Library for Allegion hardware or** accessory catalogs, tech data, and installation instructions. For installation into concrete foundations and shelter walls, follow ICC500 industry code which includes references to other industry codes such as ACI 318 for structural concrete and ACI 530 for masonry structures. Verify any requirements with your local AHJ (Authority Having Jurisdiction), the final authority in issues related to the installation and use of any building products.
- 3. As with all Tornado Doors and Frames, order frames and doors based on opening size, which is the horizontal dimension from rabbet to

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- B. FP FRAME INSTALLATION
- C. <u>FP FRAME ANCHORING</u>
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- E. SEALS; THRESHOLDS; WS-T BOTTOM LATCHING; SIGNAGE
- F. INSTALLATION and MAINTENANCE CHECKLISTS
- G. ICC 500 TORNADO DOCUMENTS and RESOURCE LINKS

### HELPFUL LINKS (webpages and downloads)

- <u>STEELCRAFT.COM Paladin Website links (site right margin)</u>
   <u>Customer Bulletin</u> Explains ICC 500-2020 offering
  - <u>TECH DATA (link)</u> see TORNADO SECTION
     Approved doors/hardware pp212-215
- ALWAYS FOLLOW HARDWARE INSTALLATION
- - See last page for Tornado document links
- CERTIFIED PUBLIC LISTINGS
  - O 2020 UL LISTING FOR WS-T EXIT PAIRS (ZHLA.79)
  - O 2020 ITS LISTING (ITS 64895)
  - 0 2014 ITS LISTING (ITS 39897)
- ICC 500
  - <u>ICC 500-2020</u>
  - O <u>FEMA 361</u>
    - FEMA 361 Highlights
- SUPPORT
  - <u>email support@allegion.com</u> (subject: Steelcraft) Call (877) 671-7011 #1
  - email STEELCRAFT TECHNICAL PRODUCT SUPPORT Call (877) 671-7011 #2, #5

FIG. 1 – WS-T-98/9927/57: BOTTOM GAP about 1/4" to finished floor when strike lip sits on slab (max 0.285" when using max .125 required distance from bottom of latch housing to top of 0.16" thick strike lip).

See Section F.11 – Grouting procedure. Threshold configurations shown affecting door undercut.



FIG. 2 - LM9300: BOTTOM GAP 1/8"-1/4" from bottom of door to top of strike. See Section F.11 – grouting procedure shown must be used when using thresholds to ensure connection of strike to slab (no cavity/grout used when attaching strike directly to slab).



## PALADIN Tornado FP Frame and PW Door Installation Instructions PAGE 2 OF 14

rabbet, and vertical dimension from bottom of frame to head rabbet. Typical door gaps are 3/32" to jambs, and 1/8" to the head. ICC500 limits door undercuts to 3/4".

- <u>Handing</u> Correctly understanding handing in ordering and installing tornado products is critical to life safety. See "Handing procedures diagrams" (FIG. 3) also in tech data p11 as well as tornado-specific handing details on p208.
- <u>Glass kit</u> with frame will be installed from the factory. Care instructions are provided on the glass sticker and in <u>TECH DATA</u> p164 and p207. Stickers should be removed after installation and paint. See FIG. 4 handing chart. (FIG. 4). Call support or email <u>support@allegion.com</u>, subject Steelcraft, for glass replacement options.
  - The Exterior, or Outside, is always the Storm side (the side of the door that faces a storm). Typically, this is the Key Side, but not always (e.g. not typical, but if the shelter is the hallway and a connected classroom is outside of the shelter, the outside of your door would face the classroom since that is the side facing the outside, or storm side, of the shelter).
  - The Interior, or Inside, is always the Safe side (the side on the inside of your shelter or safe room). Typically, this is the non-Key Side, but not always (e.g. not typical, but if the shelter is the hallway and a connected classroom is outside of the shelter, the inside of your door would face the hall since that is the side facing the inside, or safe side, of the shelter).
  - Note that PW doors may be inswing or outswing when using lever trim. But PW doors with panic exit hardware will always be outswing with the panic bar on the safe side and the door opening out towards the Outside, or Storm side.
- <u>Shutter frames</u> Handing. Shutters protecting from glass windows would be ordered straight handed/inswing (FIG. 4). Straight handed without







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# PALADIN Tornado FP Frame and PW Door Installation Instructions PAGE 3 OF 14



#### Notes (shutter handing diagram)

- 1. Inside = Safe side; Outside = storm side
- 2. Lock options for Sectional indicator (locked) and VandIgard (e.g. LMV9371) must be specified when ordering locks
- 7. Order Acknowledgement Sent to the email on file. It is important to review to avoid delays and costly changes within 24 hours. Contact support@allegion.com, subject "Steelcraft -Incorrect Order!" with order number.

### B. FP FRAME INSTALLATION

- 1. Follow installation as a guide, noting differences with Paladin Frames in the instructions below. See SDI/Allegion collaborative video under SDI Videos > Steel Door and Frame Installation > How to Install Frames in Masonry Construction (note videos here are not tornado specific)
- 2. As with any frame installation, take the time to make certain that frames are continually checked for "plumb, level and square" throughout installation.
- 3. Match frame and opening location by opening number or mark number (FIG. 7). Verify ICC500 / FEMA 361 label, as well as fire label if applicable. Confirm handing of frame to drawings/door schedule/hardware schedule.



FIG. 8 – PROPERLY GRIND OFF SHIPPING BAR



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listing or AHJ

#### FIG. 7 – MATCH OPENING LOCATION AND FRAME MARK NUMBER

# PALADIN Tornado FP Frame and PW Door Installation Instructions PAGE 4 OF 14

- Verify correct reinforcement, hinge size, strike type, closer and other reinforcements for mounting hardware.
- Determine floor finish (concrete, wood, tile, etc.). Verify correct frame size and undercut. The latch must always engage the strike which must be securely embedded (WS-T-304L, FIG. 26) or anchored (LM strike plate, FIG. 2) into the concrete slab, regardless of threshold or finished floor. See FIG. 29 for a typical Saddle less common rabbeted (bumper) thresholds for WS-T-98/9927/57 latching, with ADA install.
- You may need to fix uneven floors prior to frame installation to avoid problems in closure, latching and maintaining an even gap/undercut.
- 7. Frames may be ordered KD or SUA (Welded). Refer to Tech data. An SUA frame will arrive with a shipping bar welded to the base of the frame to prevent collapsing and twisting in transit. Do not use this bar to set the frame. Grind it off; do not hammer it off to avoid damage to the frame, prior to setting the frame (FIG. 8, previous page).
- 8. KD frames are assembled using the corner tab/slots (see Tech data).
- <u>New masonry wall construction install</u> (e.g. grout filled CMU block walls), set your frame first and then build 3000 psi grout filled CMU block walls up evenly on both jambs.
  - Lay out your frame on the floor per drawings prior to setting the frame.
  - Verify handing, hardware reinforcements, hinge size, strike type and closer mounting
  - Precisely cut square spreader to maintain proper frame spacing setting frame (FIG. 9).
  - Verify the jambs are plumb, head level, and frame is square. Install base anchors into concrete (FIG. 10), adjust with screws to keep head level and to achieve proper floor clearance. Frame may be shimmed with a flat metal washer or fender washer.
  - Set frame using back braces and spreader bars (FIG. 11).

FIG. 9 – CUT ACCURATE SPREADER BAR TO NOMINAL WIDTH FIG. 10 – ADJUSTABLE BASE ANCHOR INSTALL WITH DRIVE PIN ANCHOR





FIG. 11 – TEMPORARILY BRACE FRAME



FIG. 12 – INSTALL TIE WIRE FOR INWARD TENSION

FIG. 13 – ADD MID-HEIGHT SPREADER





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FIG. 14 – MASON SHOULD CHECK PLUMB, LEVEL, SQUARE BEFORE BEGINNING



FIG 15. LAY BLOCK, CHECKING FOR PLUMB, LEVEL AND SQUARE EVERY TIME YOU MAKE AN ADJUSTMENT



## PALADIN Tornado FP Frame and PW Door Installation Instructions PAGE 5 OF 14

- For openings with electrical components, now install conduit or flex cable.
- Install a piece of tie wire at about 48" from the floor and twist tight to hold inward tension on the spreader bar (FIG. 12).
- Add a mid-frame temporary spreader to keep frame straight and aligned (FIG. 13).
- Mason should check plumb, level and square before beginning (FIG. 14).
- Lay block and fill with grout evenly on both sides, lightly tapping the frame to settle the grout fill. Mason should check plumb, level and square before starting and throughout the process (FIG. 15).
- For Paladin frames anchoring, see <u>ICC500</u> <u>Tornado/FBC EHPA Hurricane install</u> <u>instruction drawings</u>, pp.8-14.
  - For jambs in new masonry with CMU block, the order will include approved Masonry T anchors to be placed between top 2 blocks, bottom 2 blocks, and every other block as evenly as possible for nominal 8"x8"x16" CMU blocks (FIG. 16). Masonry T's are provided in your order and keep jambs in place by holding tight against stops.
  - For heads, use EMA's or Lintel wedge anchor assembly (FIG. 17).
  - 4-sided shutters come with EMA bolts for heads and sills, but for heads, you may specify the same Lintel wedge specified in 3-sided masonry frames.
- After laying 8-9 courses, the masonry should be allowed to set, typically overnight. Leave spreaders and temporary back bracing in place overnight. Clean out any grout from hinge pockets and strike reinforcements, as well as on the floor.
   Continue checking "plumb, level and square" and be sure the frame does not move from your layout lines on the floor (FIG. 18).
- On day two, carefully remove the back braces and continue laying brick. The head



#### FIG. 17 – LINTEL WEDGE ANCHOR ASSEMBLY IN HEADS FOR NEW MASONRY APPLICATIONS



FIG. 18 – MASON CHECKS PLUMB, LEVEL, SQUARE BEFORE LAYING BLOCK AND THROUGH BUILD PROCESS



FIG. 19 – TYP A HIGH PSI PREFAB CONCRETE LINTEL IS USED, ALTHOUH PROPER STEEL LINTELS MAY ALSO BE SPECIFIED. REF NON-TORNADO SDI/ALLEGION MASONRY INSTALL VIDEO min 7:50-8:30. ENSURE NO SAGGING.



# PALADIN Tornado FP Frame and PW Door Installation Instructions PAGE 6 OF 14

will need grout fill as well, followed by the lintel above the head (FIG. 19). Check again for plumb, level, and square, and be sure no sagging has occurred in the head. Remember that any time you fill a head > 42" length with grout, you need to use a vertical brace from head to floor to prevent sagging in the head (FIG. 20). This completes installation in new construction.

FIG. 20 – SUPPORT HEAD WITH VERTICAL BRACE ON ANY HEAD OVER 42" LONG. SHIM AS NEEDED TO KEEP HEAD LEVEL.





- 10. **Existing masonry wall construction install** (typically tilt up, pre-fab concrete, or CMU walls installed prior to frame installation), the same rules of plumb, level and square apply.
  - Wall condition must be provided on the order for proper anchor quantities and locations. These specific anchors and locations will be provided automatically from the factory at the time of the order and will appear on the order acknowledgement and invoice.
  - If any anchor interference is possible [with hardware or other], please reference our <u>Anchor Lookup</u> <u>Tool</u> or reference anchor drawing details, see <u>ICC500 Tornado/FBC EHPA Hurricane install instruction</u> <u>drawings</u>, pp.8-14. Anchors locations may be adjusted +/- 3" to avoid interference.
  - For quantity of EMA anchors, see our <u>Anchor Lookup Tool</u> on our <u>Paladin site, right margin downloads</u>.
  - Min edge distance and other requirements are listed in anchor drawing details, <u>ICC500 Tornado/FBC</u> <u>EHPA Hurricane install instruction drawings</u>, pp.8-14 for all approved anchoring specifications.
  - You will install the KD or SUA frames using Existing Masonry Anchors. The bottom EMA serves as the base anchor (typ located approximately 2.5" above the bottom of the frame).
  - All EMA's will use welded-in tube and strap anchors in dimpled frames provided from the factory (FIG. 21), along with approved Hilti anchor bolts (FIG. 21-22). 2" face bolts will use our 5" bolt and do not require grout filled frames.
  - 4" face heads use our 6" bolt with extender requiring minor assembly (FIG. 21).
  - Unlike 2" face, 4" face heads require full grout if using standard practice methods (1" hole max in head, later plug welded & finished smooth).

FIG. 21 – WELD-IN TUBE AND STRAP (TSTRAP) ANCHORS IN DIMPLED FRAME TO ACCEPT TAPERED FLAT HEAD SLEEVE ANCHORS, INCLUDING ASSEMBLY FOR 4" FACE HEAD APPLICATIONS



- Rust preventative frame back coating is recommended but not required.
- For EMA anchor bolt details, see our price book and <u>ICC500 Tornado/FBC EHPA Hurricane install</u> <u>instruction drawings</u>, pp.8-14. Contact support for bolt manufacturer tech data.
- Bolt installation (FIG. 22). Drill a 3/8" hole approx. 3-4" deep, or the manufacturer recommended 1" min deeper than the bolt embedment depth. Bolt manufacturer required embedment is 1-1/4" into Concrete or CMU block, although your typical embedment, using approved bolts and 1/4" shims, will be approx 2-1/8" with 2" face frames, and approx 2-3/8" using 4" face frames. Review wall construction to avoid any steel reinforcement within 1/2" of this wall depth or as recommended by engineer. See ANSI B212.15 for drill bit tolerances. Blow the hole clean. Do not expand the anchor

## PALADIN Tornado FP Frame and PW Door Installation Instructions PAGE 7 OF 14

prior to installation. Drive the anchor through the frame and tube and strap anchor until anchor is firmly seated and to the required embedment depth. Tighten the anchor by turning the head 3 to 5 turns past finger tight, to manufacturers recommendation of 10 ft-lbs. max torque (FIG. 22).

- Notes on Lintels and concrete shelter walls. Lintels are typically a high PSI concrete (FIG. 19), bond beams, or a 3/16"-1/4" Steel plate lintel (all are allowed to be used with our product). Structural planning should keep internal concrete wall steel reinforcements away from anchor bolt locations to avoid interference. If wall reinforcements are hit when predrilling EMA bolts, you must drill through these reinforcements to install your anchor. Check with the shelter contractor, architect, structural engineer, or licensed professional engineer, but this typically is allowed (does not affect the integrity of the walls).
- Frame installation and shimming. ICC 500 defers to the manufacturer's listing and installation instructions. Follow this guide and standard industry protocol. Useful resources and links:

Oseful resources and links:

<u>ANSI A250.11</u> -- Frame installation instructions including shimming the frame into the opening, with reference to <u>SDI 122</u> -- Reviews shimming after door is hung including adjustments at hinges to fix gaps

How-to Shim Door Hinges – Reference to SDI 122 with videos

- Galvanized steel shim material is recommended to ensure shims will sustain loads designated by testing protocols and to resist corrosion.
- Max allowable shimming (also rough opening), 1/4" at head and each jamb; 3/8" max across both jambs. This measurement also used to find rough opening.
- For gaps along the door between shims or other, ICC Section 306.5 exception 3 says joints, resulting gaps or voids should not allow a direct path for smaller debris particles into the shelter. Non-structural gaps should be filled on both sides of the frame so that debris would need to impact at least 2 surfaces prior to arriving into the protected occupant area.
  - Gaps up to 1/4" may be caulked. Larger/deeper gaps fill with backer rod, wood filler strips or similar as recommended by engineer or architect for aesthetics to resist airflow in windstorms.
  - Material used should be non-combustible as needed so as not to negate fire ratings.

#### FIG. 22 – EMA BOLT INSTALLATION (2" AND 4" FACE HEADS OPTION) WITH BOLT MANUFACTURER'S MIN REQUIREMENTS

Windstorm sleeve anchor masonry bolts Steelcraft Q326 (2" face) and Q327/Q325 (4" face) (Hilti HLC-FPH Sleeve Anchors)





1) Drill 3/8" hole 1"min deeper than bolt embedment 2) Clean debris from hole

3) Tap bolt through hole back of frame into concrete 4) Screw in to expand sleeve anchor -- 10 ft lb max



original graphic and general install instructions/images provided by Hilti

LINK -- <u>ICC500 Tornado/FBC EHPA (FL41734.1)</u>
 Hurricane install instruction drawings

### C. FP FRAME ANCHORING

- 1. <u>Anchor drawing details</u>. Link to <u>ICC500 Tornado/FBC EHPA Hurricane install instruction drawings</u>, pp.8-14.
- <u>Anchor installation quality</u>. Locations and quality of installation should be checked and verified prior to and during installation to ensure quality of anchoring/installation. Reference this Guide and Steelcraft.com Paladin section, including downloads in the Steelcraft.com right margin.
- <u>Anchor locations and quantity</u>. Order will provide the correct locations and quantity of anchors based on wall construction and frame size. Reference the following links for approximate anchor locations: <u>Standard Anchor Locations</u> and <u>Anchor Lookup Tool (Excel)</u>.
- <u>Anchor bolts</u>. Quantity and type figured for openings are based on wall construction and frame size. The correct type and quantity of bolts are added to the frame order and ship with ordered product. Replacement bolts can be found in the price book parts section to order as needed if misplaced.
- 5. <u>Collaborate with other Tornado Shelter Contractors</u>. Plan well in advance of manufacturing and construction to avoid interference that might hinder proper installation and anchoring, causing expensive fixes or replacements later, is imperative. For example, placement of concrete or CMU block reinforcement (rebar) should be clear of the frame's anchor locations and embedment including tolerance per the contractor. If rebar interferes it must be drilled through to achieve bolt engagement.
- 6. <u>Replacement frames</u>. New frames should avoid old anchor locations and will be located appropriately 2-3" from old locations by Steelcraft upon request. Align with Tornado shelter contractor for wall repairs. Repairs and old anchor locations (<u>ref 1:20 if bolts removed</u>) fill with min 3000lb concrete/wall psi or <u>CTS</u> <u>RapidSet Cement All non-shrink grout</u> as a good option for repairs up to 4" (must follow manufacturer's instructions; CTS tech support 800-929-3030). If not possible to avoid old locations, alternate anchoring methods may be used, such as bolting 1/8" steel plates at anchor locations and welding the frame to the plates, p.13 of <u>ICC500 Tornado/FBC EHPA Hurricane install instruction drawings</u>.
- Min 3000 PSI recommended for any concrete, concrete filled CMU, lintel, slab, as well as filling bottom strike cavities and thresholds as needed. Verify specific requirements found on <u>Anchor Assy Drawings</u>, pp.8-14, and direction from concrete manufacturer, architect and licensed PE.
- 8. <u>Max gap</u> at wall opening and frame is 1/4" at head and each jamb; 3/8" max across both jambs.
- 9. In drilling holes for EMA expansion anchors, drill min 1" deeper than the anchor sleeve final actual embedment, blow out dust, and install expansion anchor bolts tightened to 10 ft lb max.
- 10. <u>Grouted frame throats</u>. Frames do not require grouting except in 4" face heads and in new masonry jambs, heads or sills, which must be grouted full.
- 11. Anchors per location -2 per location for JD's greater than or equal to 9-1/8".
- 12. Edge distance is measured from center of bolt to opposite side of CMU block.
- ICF Walls. For anchoring into ICF walls (insulated concrete forms) bolt embedment cannot exceed 2/3 the thickness ("X") of the solid concrete, and must have 4" min solid concrete behind embedded bolt. All anchor spacing and edge distance requirement must be maintained. SEE IMAGE RIGHT.
- Additional information available at <u>Steelcraft.com</u>. Email <u>Steelcraft Product Technical Support</u> / call (877) 671-7011. General video installation reference (*not tornado specific*), see <u>SDI Videos</u>.



# PALADIN Tornado FP Frame and PW Door Installation Instructions PAGE 9 OF 14

### D. PW DOOR INSTALLATION

These installation instructions are only guidelines. Applicable building codes, standards and accepted practices apply. Follow typical door installation and ICC500 requirements. The Authority Having Jurisdiction (AHJ) is the final authority in issues related to the installation and use of any building products. Typical installation details are supported by a video collaboration with the Steel Door Institute (SDI). See "Steel Doors and Frame Installation" of <u>SDI Videos</u> – Videos are not tornado-specific.

- In the SDI video link above, see (not tornado video) installation <u>"How to Install a Steel Door,"</u> and review callouts of this guide. Take care, noting that Tornado doors weigh considerably more than typical doors.
- Locate the correct door using the mark number on the doors and verify on the drawing and hardware schedule. Verify ICC500 / FEMA 361 label, as well as fire label if applicable.
- Prior to beginning, check the frame for plumb, level and square (FIG. 23). A good door installation can rarely make up for a poor frame installation, see SDI/Allegion collaborative videos (not tornado specific) to reference in this situation. See <u>SDI Videos</u>, Prep and Installation Videos, Troubleshooting Videos.
- 4. Verify correct hinges and locations on drawings and the hardware schedule. Dimension taken from top of the door to top of the hinge cutout will be 1/8" less than the dimension from the rabbet to top of frame hinge cutout (FIG. 24).
- 5. Check screw holes and reinforcements to be sure they are clear. Use the correct tap and machine screw provided by Ives, the approved hinge manufacturer (FIG. 25).
- Check hardware schedule or submittal to verify standard or heavyweight hinges. For heavyweight hinges, remove (pull out) existing wire spacers, adjust set screw or break off existing hinge fillers (FIG. 26).
- 7. Attach Ives hinges to door. Install hinge pins with open end toward the bottom of the door.
- To begin installing the door, set it up on end and onto a wood wedge or similar spacer to line up door and frame hinges. Align and install top hinge on door to top frame hinge reinf (FIG. 27).
- 9. Install middle and bottom hinges to the frame.
- Remove the wedge spacer under the door and test for proper door closure and proper gaps. Reference SDI-122 for Bind or Alignment issues, and <u>SDI/Allegion Troubleshooting Videos</u>.
- 11. Install the lockset, closer or any other auxiliary hardware. After installing locksets, open and close the door to ensure the latch is engaging properly.

FIG. 23 – CHECK PLUMB, LEVEL AND SQUARE PRIOR TO DOOR INSTALLATION



FIG. 24 – VERIFY HINGE LOCATIONS



FIG. 25 – CLEAR FOREIGN MATTER

FIG. 26 - REMOVE FILLER PLATE FOR HEAVY WEIGHT HINGES





FIG 27 – INSTALL IVES HINGE FIRST IN TOP



# PALADIN Tornado FP Frame and PW Door Installation Instructions PAGE 10 OF 14

### E. SEALS/GASKETING; THRESHOLDS; BOTTOM LATCHING; SIGNAGE

See Approved models <u>Steelcraft Tech data</u>, p214-215.

- 1. Avoid special gasketing. Maintain proper latching and avoid potential binding or interference.
- When using a threshold, refer to hardware installation of strikes (page 1 help links) and items 11-12 below. With or without threshold, the bottom strike must always be anchored into the slab with bolts (LM) or concrete (WS-T) to ensure a direct structural connection of door and frame to slab.
- 3. Avoid surface auto door bottoms since they can interfere with the bottom latch.
- 4. Only approved Zero products can be added to the inside; others can be added to outside/storm side.
- 5. Surface mounted seals work well but may need to be cut short to fit around the closer mounting and sometimes the WS-T RIM strike mounting.
- 6. Approved continuous hinges may be used to seal the jamb edge.
- 7. Do not use a top jamb and strike jamb seal to avoid cutting around latches in the field.
- 8. Approved gaskets, seals, or thresholds must not impede or affect the function of the opening or latching hardware.
- 9. Zero recommends thresholds extend 3/8" past the door thickness if possible.
- 10. Zero V3 Full body strength option available for thresholds (for heavy duty commercial traffic, schools, etc.)
- 11. Use 6" wide or greater saddle thresholds when using surface vertical rods; consider Zero 546, 656.
- 12. Rabbeted / Bumper thresholds consider 566 when ADA is required, or 568 when ADA is not required. Consider Rain Drips for water infiltration.
- 13. For screw applied meeting edge gasketing, consider Zero 328.
- 14. For sweeps and door bottoms, consider Zero 139.
- 15. Thresholds and WS-T-98/9927/57 bottom strike install notes:
  - First set threshold in place to mark strike location per hardware install instructions.
  - Cut hole and mark slab under threshold. Remove and mark slab to cut 3"x3" min cavity with undercut as shown below, centered around strike 1" min below strike.
  - Clean, fill with min 3000 psi grout (consider CTS RapidSet CementAll), & re-attach threshold so min 3" area around strike is grouted full up to threshold.
  - Prior to grouting, mask/add foam block to cavity in the sidewall of cup strike.
  - After grouting, insert strike and use 1"x1" square wood post to push grout down about 3/4"-7/8" so that engaged latch will rest within 1/4" of grout but not hit grout.
  - Clean area and remove/clean masking/foam block in sidewall of cup strike so the stepped latch bolt will engage strike on impact. Let set.
  - See undercut section 13 below.

## PALADIN Tornado FP Frame and PW Door Installation Instructions PAGE 11 OF 14

FIG. 29 – WS-T-98/9927 Pair and WS-T-98/9957 Single -- BOTTOM STRIKE INSTALLATION WITH THRESHOLD EXAMPLES

For required Installation Gaps posted in hardware installation instructions, see bottom page 1, FIG 1 for WS-T and FIG 2 for LM9300. Threshold placements may vary to best suit opening. Reference ADA link <u>2010 ADA Standards for Accessible Design</u>.



## PALADIN Tornado FP Frame and PW Door Installation Instructions PAGE 12 OF 14

- 16. **Undercuts.** The door undercut is the distance from the bottom of the door to the bottom of the frame (slab). The Frame should sit on the structural foundation with finished floor cut around the frame, not placed under the frame. The threshold may sit on thinner finished floors but the strike must be grouted into the foundation as shown. Thicker floors should carefully consider the slab and grouted threshold to maintain maximum structural connection between slab and grouted in threshold as shown below as a possible example. A licensed architect or structural engineer must be used to ensure this connection and the total tornado shelter is designed and built in compliance with ICC 500 and applicable building codes.
  - 3/4" maximum allowable undercut per ICC 500 is provided as the default in orders to allow for a typical 1/2" ADA saddle threshold if the strike plate (LM) or lip (WS-T) sits on the threshold. Note some AHJ's may require the plate/lip to be embedded into the threshold flush so that the top of the strike is at 1/2" ADA requirement. For any other threshold to fit your opening, you must calculate and specify your undercut when ordering. See the examples above for some common thresholds and dimensions. See approved thresholds in <u>Steelcraft Tech data</u>, Approvals p214-215.
  - ICC 500-2020, 306.4.1.5 Door undercut. Door assemblies in the storm shelter envelope shall be limited to a 3/4" max undercut. ICC defines undercut as the bottom of the door to the floor/slab (not the floor covering)
  - NFPA 80, 4.8.4.2 **Clearance** under the bottom of the door shall be measured vertically from the bottom of the door to the top of the finished floor or threshold.



17. **Signage.** The General Contractor is responsible for posting clear signage on the safe side, supported by lock indicators where available to communicate to occupants when and how to lock during a storm event. If no lock indicator is used, additional information may be required for clear understanding by the occupants. The following is provided as possible examples:



### F. INSTALLATION and MAINTANANCE CHECKLISTS

Qualification Checklist prior to installation

- 1. Each installer is an experienced tradesman, skilled in the application of tornado hollow metal doors and frames with a record of successful in-service performance for installing hollow metal doors and frames similar in quantity, type, and quality to that indicated for this project.
- 2. 🗆 ICC 500-2020 and fire labels located on door edge and frame rabbet; or door top/head for continuous hinges.
- 3. Hardware provided for installation is approved reference <u>Steelcraft Tech data</u>, Approvals p214-215, and Certified Labeling Body Public Listings found on <u>G. ICC 500 TORNADO DOCUMENTS and RESOURCE MATRIX LINKS</u>
- 4. All hollow metal and hardware is in accordance with reviewed shop drawings and manufacturer's printed installation and anchoring instructions per ICC 500-2020. Installation Instructions are provided and understood.

### **Functional Checklist**

- 5. After installation of frames, a designated person from the hardware installation company checked the project to confirm proper installation of frames to support the proper installation and operation of doors and hardware.
- 6. All hollow metal and hardware is securely installed in place without twists, warps, bulges or other unsatisfactory or defacing workmanship. All hollow metal components are straight, plumb, level, and square allowing the doors to open and close latch without binding.
- 7. Any Glass is installed with Philips head bolts on safe side, without visible damage to outer layers of glass or film.
- 8. Uverified acceptable gaps around beveled edge doors (reference ICC500 306.3.6 and NFPA (80)
  - Jambs and meeting edges of pairs of beveled edge doors target 3/32, max 3/16" meeting edge.
  - Head to top of door 1/8".
  - Undercut from finished floor/sill without threshold to bottom of door 3/4" max.
  - Proper gaps between door edges and strikes per hardware manufacturer's installation instructions (1/8" max for WS-T and 1/4" max for LM9300)
- 9. Hardware latching is fully functional and operational. All latches fully engage upon closing, strikes free of debris.
  - If not apparent, test each latch point separately by taping over the others to keep them from latching.
- 10. 
  Trim functions operate as expected and in accordance with ICC 500 and NFPA 80 as required.
- 11. 
  Non-egress/storm side operating hardware is locked, disabled, or inactive and not susceptible to unintentional unlatching by debris impact. When no storm is present, if such hardware is active, the egress/safe side provides lockdown functions accompanied by signage clearly communicating how and when to lock down (in a storm event).
- 12. D Bottom strike is grouted securely into the slab. If threshold is used, threshold and strike are grouted fully to slab.
- 13. 
  Final adjustments to the door and hardware have been made prior to the final inspection and acceptance by the Architect and Owner. Defective items including doors or frames that are damaged or unacceptable to the Architect or Owner have been replaced and accepted.
  - Adjust doors for proper operation, free from binding or other defects.
  - All surfaces are clean and restored. Scraps and debris are removed and site is in clean condition.
  - Prime coat / Touch up has been done immediately after erection, sanded smooth rusted or damaged areas of prime coat, and touch-up with compatible, approved air-drying primer.
- 14. 
  Proper protection of doors and frames is provided and GC advised until Owner accepts completed project.
  Damaged or disfigured doors and frames to be replaced by the responsible party. Some repairs may not be allowed
  in the field in order to maintain the labeled tornado approval. Consult with manufacturer or AHJ.
- 15. Upon completion, the installer has delivered one complete set of all installation and maintenance instructions.

### Maintenance Checklist

- 16. Regular field inspection and adjustment is to be conducted by knowledgeable maintenance personnel to ensure proper latching throughout the life of the product.
- 17. 🗆 Items 6-12 above should be checked daily and corrections made immediately, referencing door or hardware installation instructions as needed. Technical support should be contacted with any questions or concerns.

## PALADIN Tornado FP Frame and PW Door Installation Instructions PAGE 14 OF 14

### G. ICC 500 TORNADO DOCUMENTS and RESOURCE LINKS MATRIX

- Customer Bulletin Explains what's new in the Allegion ICC 500-2020 Offering
- <u>ICC 500-2020</u>
- FEMA 361 FEMA 361 Highlights
- Certified Public Listings
  - o 2020 UL LISTING FOR WS-T EXIT PAIRS (ZHLA.79)
  - o 2020 ITS LISTING (ITS 64895)
  - o 2014 ITS LISTING (ITS 39897)

	HOLLOW METAL	PANIC HARDWARE	LOCKS/LEVERS	HINGES	CLOSERS	HOLDERS/STOPS	SEALS/THRESHOLDS	LIGHTS
Brand Webpages	STEELCRAFT	VON DUPRIN	SCHLAGE	<u>IVES</u>	LCN	<u>GLYNN-</u> JOHNSON	ZERO	<u>TGP</u>
	n/a	Severe Weather Exits	<u>Schlage Severe</u> <u>Weather</u>		<u>Surface</u> Mounted <u>Closers</u>	n/a	n/a	
	Paladin Doors	VD Windstorm Solutions	<u>Multi-Point</u> <u>Lock</u>	n/a	<u>Fire &amp; Life</u> <u>Safety</u> <u>Devices</u>	n/a	n/a	
	FP Frames	<u>98/99 Series</u>	n/a	n/a	<u>9500 Auto</u> <u>Operator</u>	n/a	n/a	
Catalogs, Manuals	<u>Steelcraft</u> <u>Catalog</u>	<u>98/99 Series</u> <u>Catalog</u>	<u>L Series</u> <u>Catalog</u>	<u>lves</u> <u>Catalog</u>	Literature	<u>GJ Catalog</u>	Zero Catalog	
& Brochures	<u>Steelcraft</u> <u>Tech Data</u>	<u>VD Indicators</u> <u>Brochure</u>	<u>L Series Service</u> <u>Manual</u>	n/a		n/a	Zero E-Brochure	
Sell sheets	Paladin Sheet (2020 version in progress)	WS-T Data Sheet	LM9300 Cut Sheet (not tornado specific)	<u>Electrified</u> <u>Hinges</u>		n/a	n/a	
	n/a	<u>WS98/9957/9927</u> <u>Data</u> <u>Sheet (2014)</u>	<u>LM9300</u> <u>Tornado (2014)</u>	n/a		n/a	n/a	
	n/a	ESL Sheet	n/a	n/a		n/a	n/a	
360 Portal	Customer 360 Portal Login to Access: Price Books and Interactive Pricing tool (to verify approved hardware sets/nomenclature)							
Installation Instructions	Paladin Installation Instructions	<u>WS-T-98/9927</u> <u>Install</u>	<u>L Series Door</u> <u>Template Index</u>	n/a	Templates & Install Instructions	Templates & Install Instructions	Templates & Install Instructions	
Templates / Technical References	Standard Anchor Locations	WS-T-98/9957 Install - coming soon	LM9300 lock & rod interactive install	<u>SB360</u> <u>Surface</u> <u>Bolt</u> <u>Template</u>				
	<u>Approval</u> Lookup (2014)	<u>Grouting WS</u> <u>Strikes (2014)</u>	LM9300 Rod Install Instructions	<u>lves</u> <u>Template</u> <u>Index</u>				
	<u>Anchor</u> Lookup (Excel)	<u>ESL Kit Install</u>	LM9300 Lock Installation Instructions	lves Template Directory				
	<u>Standard</u> <u>Anchor</u> Locations	<u>377T-KC</u> Template	<u>Tornado</u> <u>Shutter</u> <u>Handing Guide</u>					
	ASSY / Anchor Drawings	<u>996L-BE</u> <u>Template</u>	n/a					
	<u>SDI</u> Installation Videos	<u>996L-DT</u> Template	n/a					

**END OF DOCUMENT**