



1900 NE MIAMI CT. SUITE 2-15, MIAMI, FL 33132

September 18, 2025

To: Whom it may concern,

From: Hermes F. Norero, P.E.
Texas Registered Professional Engineer #118471

On behalf of: Allegion – Schlage Lock Company, LLC.
11819 N. Pennsylvania Street
Carmel, IN 46032

Subject: Grout Filled Shim Space for Tornado Doors

Report: PER 10146

Scope:

The purpose of this report is to evaluate the adequacy of grout filling the frame and gap space from the frame to the substrate on the Steelcraft/Republic Tornado Steel Door & Frame Assembly and the Commercial Steel Door by Allegion – Schlage Lock Company, LLC. (Drawing PWF002 & PWG002). The proposed optional installation fully grouts the frame to maintain compliance when the gap/shim space is greater than the accepted 1/4". The evaluation has been conducted in accordance with the applicable provisions of the 2021 International Building Code, ICC 500-2020 and FEMA 320/361.

Analysis and Findings:

A. Design Ratings

Based on Drawing PWF002 & PWG002, the Tornado Steel Door & Frame assembly is approved for a maximum overall frame dimension of 52" x 100" at a design pressure of +/- 252 psf for Single units and a maximum overall frame dimension of 100" x 100" at a design pressure of +/- 252 psf for double units. The anchoring is to be evaluated based on the worst-case scenario in the product approval and serves to qualify all other sizes under PWF002 & PWG002. Since the largest unit in PWF002 & PWG002 is qualified to use the alternate installation method, units approved under any active ICC 500-2020 listings with UL and Intertek-ATI under Schlage Lock Company, LLC (Allegion) are also adequate to use this installation method. Units approved under drawing PWF002 & PWG002 are to be installed using the anchor patterns stated in their respective approvals.

This alternate installation method provides a maximum allowable gap/shim (prior to grouting full) of 1-1/8" for 2" face jambs and heads anchored with 5" bolts, and 1-3/8" for 4" face heads anchored with 7-1/4" bolt assemblies. This is based on 1-1/4" required bolt embedment into the original substrate prior to grouting.



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B. Installation Analysis

The analysis was conducted on the Tornado Steel Door & Frame Assembly which is to be installed into poured concrete or grout filled CMU blocks using EMA Tube and Strap anchors where additional grout is poured into the frame and the gap space between the frame and the substrate. The addition of grout into the frame and gap space is done to remove the cantilever distance between the frame and the substrate, allowing for a higher anchor capacity of 725 lbs per anchor. The grout used must have a minimum compressive strength of 3000 psi with a 4" maximum slump and must be poured and vibrated such that mixture has no air bubbles and is fully cured. Grout will be poured into the frame through 1" maximum diameter holes and the 1" diameter piece of steel removed from the frame will be replaced with the same or similar piece of steel. Replacement piece of steel will be tack welded back and forth (groove weld) across the circumference to avoid the frame getting too hot until filled with weld material.

Anchoring used for installation will be a 3/8" HILTI HLC-FPH sleeve anchor with a minimum embedment of 1.25" and a minimum edge distance of 3.125". Anchors shall be spaced 4.5" typ (6" max) from top, 2.5" typ (6" max) from bottom, 6" typ (8" max) from rabbet in head and equally spaced thereafter. Placement may be adjusted +/- 3" as required to avoid interference with hardware or reinforcement. Additional information on anchor quantities, locations, and reinforcements are provided in drawing PWF002 & PWG002. Please see appendix for anchoring analysis with grout filled space.

Limits of Use:

1. Units shall be installed and operated as outlined within the [manufacturer's instructions](#).
2. Should conditions vary from those described within this report, further evaluation shall be conducted by a registered engineer or architect.
3. The manufacturer is responsible for the fabrication and design of the products to be installed.
4. The existing substrate shall be adequate to withstand imposed loads from specified systems and anchorage as verified by the Engineer of Record.

Referenced Data:

1. 2021 International Building Code
2. ICC 500-2020
3. FEMA 320/361
4. PWF002
5. PWG002
6. PER 5947 EMA Report
7. ASTM C476-20 – Standard Specification for Grout for Masonry

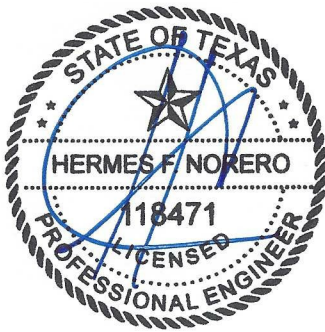


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Conclusion:

In my professional opinion, the alternate installation method described in this report is qualified to be used with the Steelcraft/Republic Tornado Steel Door & Frame Assembly by Allegion - Schlage Lock Company, LLC in accordance with the limitations of this report and the referenced data.

I trust that this will satisfy your needs, however feel free to contact if you have any questions.



Hermes F. Norero, P.E.

Texas Registered Professional Engineer #118471

Certification of Independence:

Please note that I do not have nor will I acquire a financial interest in any company manufacturing or distributing the product(s) for which this report is being issued. Also, I do not have nor will I acquire a financial interest in any other entity involved in the approval process of the listed product(s).



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APPENDIX

Anchor Capacity Analysis



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Product Evaluation Report

Shear Design Value

Concrete Anchor Calculations

Fastener type: **3/8" Hilti HLC-FPH**

Reference: Manufacture Published Data

Substrate: 2000 PSI Concrete or Greater

Minimum embedment: 1.25 in

Minimum Spacing: 4.00 in

Minimum edge distance: 3.13 in

Allowable Design Value: $Z' = 725$ lbs / anchor

Masonry Anchor Calculations

Fastener type: **3/8" Hilti HLC-FPH**

Reference: Manufacture Published Data

Medium Weight Hollow Block

Substrate: CMU (Per ASTM C-90)

Minimum embedment: 1.25 in

Minimum Spacing: 4.00 in

Minimum edge distance: 3.13 in

Allowable Design Value: $Z' = 800$ lbs / anchor

Fastener type: **3/8" Hilti HLC-FPH**

Nominal Diameter: $D = 0.375$ in

Cantilever distance: 0.00 in

Moment arm: 0.00 in

Allowable bending stress: $F_b = 23.44$ ksi

Actual bending stress: $f_b = 0.00$ ksi

Combined bending plus shear: $(f_b/F_b) + (f_v/F_v) = 1.0 \leq 1.0$

Maximum design value in cantilever: 1553 lbs / anchor

Minimum anchor capacity: 725 lbs / anchor

Factor of Safety: $\Omega = 4.00$

Bending Yield strength: $F_y = 92.00$ ksi

Ultimate strength: $F_u = 125.00$ ksi

Allowable shear stress: $F_v = 14.06$ ksi

Actual shear stress: $f_v = 14.07$ ksi

Elastic Modulus: $S = 0.0052$ in³

Area: $A = 0.11044662$ in²

Product Evaluation Report

Manufacturer Published Data

Table 4 — Carbon steel sleeve anchor allowable loads in grout-filled block^{1,2,3,4,5,6,7}

Nominal anchor diameter	Nominal embedment in. (mm)	Edge distance in. (mm)	Tension lb (kN)	Shear lb (kN)
1/4	1 (25)	4 (101)	290 (1.3)	305 (1.4)
		≥ 12 (305)		
5/16	1 (25)	4 (101)	385 (1.7)	500 (2.2)
		≥ 12 (305)		
3/8	1-1/4 (32)	4 (101)	435 (1.9)	725 (3.2)
		≥ 12 (305)		
1/2	1-1/2 (38)	4 (101)	605 (2.7)	865 (3.8)
		≥ 12 (305)		1,145 (5.1)
5/8	2 (51)	4 (101)	710 (3.2)	1,050 (4.7)
		≥ 12 (305)		1,815 (8.1)
3/4	2 (51)	4 (101)	840 (3.7)	1,050 (4.7)
		≥ 12 (305)		1,970 (8.8)

- 1 Values are for lightweight, medium-weight or normal-weight concrete masonry units conforming to ASTM C90 with 2,000 psi grout conforming to ASTM C474.
- 2 Embedment depth is measured from the outside face of the concrete masonry unit.
- 3 Values are for anchors located in the grouted cell, bed joint, cross web or any combination of the above.
- 4 For anchors installed in the T joint or head joint reduce tension values by 20%.
- 5 Values for edge distances between 4 inches and 12 inches may be calculated by linear interpolation.
- 6 Anchors are limited to one per unit cell.
- 7 Based on using a safety factor of 4.

Table 5 — Carbon steel sleeve anchor allowable loads in hollow concrete block^{1,2,3,4}

Nominal Anchor Diameter	Nominal embedment in. (mm)	Tension lb (kN)	Shear lb (kN)
1/4	1 (25)	350 (1.5)	305 (1.4)
5/16	1 (25)	375 (1.7)	560 (2.5)
3/8	1-1/4 (32)	435 (1.9)	800 (3.5)
1/2	1-1/2 (38)	565 (2.5)	1,125 (5.0)

- 1 Based on using a safety factor of 4.
- 2 ASTM Specification C90, Type II.
- 3 Installation in the mortar joints is outside the scope of the published data.
- 4 Anchors are limited to one per unit cell with a minimum edge distance of 12 inches.