

EVALUATION REPORT

Title: Evaluation of Wind Load Rolling Steel Doors

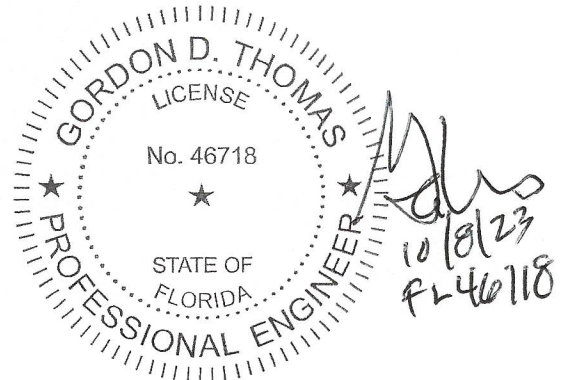
Report #: WD-2007-001R4

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- Revised January 14, 2009
- Revised October 8, 2023



I. Introduction/ Scope

Based on wind load test results from the 10, 16 & 22 ft wide rolling steel doors, the following evaluation was conducted to estimate the wind load performance for similar designed doors with increased width and lower design pressures. The report will also review the wind bar attachment method for alternate door sizes and the size change allowed for a stronger insulated slat material. The following report applies to the Series 800 (non-insulated slat) and Series 800C (polyurethane foam insulated slat) type doors.

The current configurations are listed under FL 8405 and this revision to evaluation report will review the requirements for compliance with the 8th Edition (2023) Florida Building Code. All testing was conducted in a manner that complied with ANSA/DASMA 108-2017.

II. Reference Material

The following items were used to prepare the evaluation report:

- A. ATI Test Reports. Tested in accordance to TAS 201-94, TAS 202-94 & TAS 203-94.
 - 1. 01-46387.01 (Model 822, 16 ft wide, +/- 47 psf), Dated 11/14/03
 - 2. 67981.01-109-18 (Model 822, 22 ft wide, +/- 47 psf), Dated 12/20/06
 - 3. 01-46388.01 (Model 822, 10 ft wide, +/- 47 psf), Dated 11/14/03
- B. Installation Instructions – Rolling Steel Doors Models 900 & 800 Series
WD PN 273621 (1995)
- C. Wayne Dalton Engineering Drawings
 - 1. Dwg# 035-0002, 10' x 8', #14 slat, +/-47 psf, Dated 10/03, 1 sheet
 - 2. Dwg# 035-0005, 16' x 8', #14 slat, +/-47 psf, Dated 10/03, 1 sheet
 - 3. Dwg# 035-0033, 22' x 8', #14 slat, +/-47 psf, Dated 11/06, 1 sheet

III. Evaluation

A. Design Calculations

1. Curtain material: ASTM A-446 Grade A; Min yield strength 40 ksi.
2. Calculations – Curtain slat
 - a. Total wind load on one slat at time of wind lock engagement

$$W_o = \frac{384 \times (E) \times (I_x) \times (D)}{5 \times (L^3)}$$

Where E = modulus of elasticity of steel (29.5 x 10⁶ lb/in²)
 I_x = Moment of Inertia
 L = door opening width + (offset, both sides)
 D = horizontal deflection

(lb/in²)
 (in⁴)
 (inches)
 (inches)

$$D = \text{sq rt} \{(6 s L)/8\}$$

where s = total slip, both sides

Slip = distance between inside of windlock and windlock bar

- b. Actual wind pressure on curtain

$$W_{pt} = \text{slat height} \times \text{slat length} \times \text{design pressure} = \text{load per slat (lbs)}$$

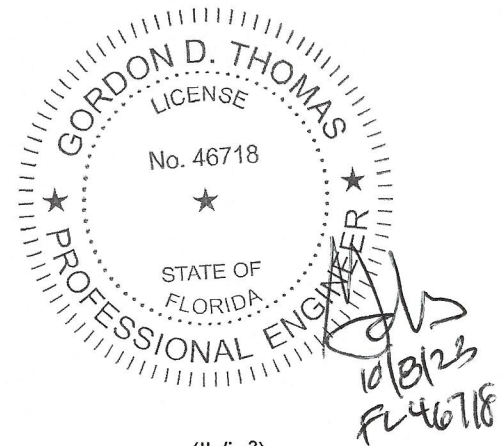
The actual wind pressure is compared to wind pressure required to engage wind locks to determine load transmitted through guide assembly after wind lock engagement. This amount will limit wind pressure and door size comparisons.

B. Door Configurations

The following doors were tested and approved.

	10 ft wide	16 ft wide	22 ft wide
Curtain Material	22 ga steel	22 ga steel	22 ga steel
Design Pressure	+/-47 psf	+/-47 psf	+/- 47 psf
Windlocks	Alt	Cont	Cont
Mounting	E & Z	E & Z	E & Z
Wall Bolts – E guides (steel)	5/8" x 1", 18 OC	5/8" x 1", 18 OC	5/8" x 1", 18 OC
Wall Anchors – Z guide (masonry)	5/8" x 6-1/2, 18 OC	5/8 x 6-1/2, 18 OC	5/8" x 7", 18 OC
Wall Angle	3 x 2 x 3/16	3 x 2-1/2 x 3/8	4 x 3 x 3/8
Guide Angle –Middle	2-1/2 x 1-1/2 x 3/16	2-1/2 x 2 x 1/4	3-1/2 x 3-1/2 x 1/4
Guide Angle – Outer	3 x 3 x 3/16	4 x 3 x 1/4	3 x 2 x 1/4
Wind bar	1/4 thk	3/8 thk	3/8 thk, 5/8" Plug 10 OC
Guide Bolts	3/8, 18" OC	5/8, 18" OC	5/8, 18" OC

Table 1 – Tested Door Construction Overview



C. Wind Load Design – Increased Width/ Design Pressure (10 & 22 ft wide)

The following table displays the results of the comparative analysis for the 10 ft and 22 ft wide service doors against doors of the same design with larger widths / lower design pressures and lower widths / higher design pressure.

The standard curtain gauge material for non-insulated doors based on width is as follows:

0'-0" – 22'-0" ft wide	-	22 ga
22'-1/8" – 25'	-	20 ga
25'-1/8" – 40'	-	18 ga
Over 40'		16 ga

If the width increases upon 22 or 25 ft wide, the appropriate material will be substituted and re-calculated.

	Width (ft)	DP (psf)	Slat type	Slat ga	Windlks	Pitch (in)	slip	E (lbs/in^2)	Ix (in^4)	Deflect (in)	Wo (lbs)	Wps (lbs)	Wps-Wo (lbs)
Test Config	10	47	Service	22 (0.030)	Alt	2.46	0.125	2.95E+07	0.0106	3.41	43	96	53
Eval #1	12	37	Service	22 (0.030)	Alt	2.46	0.25	2.95E+07	0.0106	5.27	39	91	52
Eval #2	13.25	31	Service	22 (0.030)	Alt	2.46	0.25	2.95E+07	0.0106	5.53	31	84	54
Test Config	22	47	Service	22 (0.030)	Cont	2.46	0.5	2.95E+07	0.0106	10.02	13	212	199
Eval #3	19	56	Service	22 (0.030)	Cont	2.46	0.5	2.95E+07	0.0106	9.33	18	218	200
Eval #4	19.75	53	Service	22 (0.030)	Cont	2.46	0.5	2.95E+07	0.0106	9.51	16	215	198
Eval #5	20.75	50	Service	22 (0.030)	Cont	2.46	0.5	2.95E+07	0.0106	9.74	14	213	198
Eval #6	28	37	Service	18 (0.048)	Cont	2.46	0.75	2.95E+07	0.0174	13.83	14	212	199
Eval #7	32.75	31	Service	18 (0.048)	Cont	2.46	0.75	2.95E+07	0.0174	14.94	9	208	199

Table 2 – Non- Insulated Slat, Design Pressure/ Width Comparative Analysis

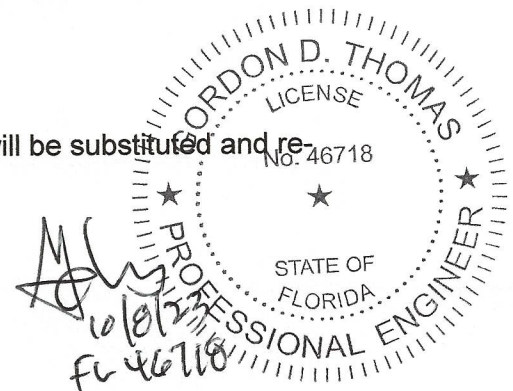
D. Wind Load Design – Insulated Door (10, 16 & 22 ft wide)

The following table displays the results of the comparative analysis for the 10 ft, 16 ft and 22 ft wide service doors against doors with insulated slats, larger widths and lower design pressures. The insulated slat is comprised of an outer and inner slat with urethane foam in the middle. As show below, the section properties for insulated slats are higher than singe slat service doors and would allow for larger widths with equal design pressures.

The standard curtain gauge material for insulated doors based on width is as follows:

0'-0" – 27'-0" ft wide	-	22 ga
27'-1/8" – 30'	-	20 ga
25'-1/8" – 42'	-	18 ga

If the width increases upon 27 or 30 ft wide, the appropriate material will be substituted and re-calculated.



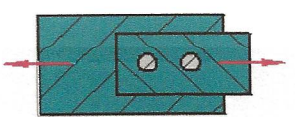
	Width (ft)	DP (psf)	Slat type	Slat ga	Windlks	Pitch (in)	slip	E (lbs/in ²)	Ix (in ⁴)	Deflect (in)	Wo (lbs)	Wps (lbs)	Wps-Wo (lbs)
Test Config	10	47	Service	22 (0.030)	Alt	2.46	0.125	2.95E+07	0.0106	3.41	43	96	53
Eval #1	14.75	37	Insulated	22 (0.030)	Alt.	2.46	0.375	2.95E+07	0.0217	7.13	59	112	53
Eval #2	16	31	Insulated	22 (0.030)	Alt.	2.46	0.375	2.95E+07	0.0217	7.42	48	102	53
Test Config	16	47	Service	22 (0.030)	Cont	2.46	0.375	2.95E+07	0.0106	7.42	24	154	130
Eval #3	17.5	47	Insulated	22 (0.030)	Cont	2.46	0.375	2.95E+07	0.0217	7.76	39	169	130
Eval #4	20.5	37	Insulated	22 (0.030)	Cont	2.46	0.375	2.95E+07	0.0217	8.39	26	155	129
Eval #5	23.5	31	Insulated	22 (0.030)	Cont	2.46	0.375	2.95E+07	0.0217	8.97	19	149	130
Test Config	22	47	Service	22 (0.030)	Cont	2.46	0.5	2.95E+07	0.0106	10.02	13	212	199
Eval #6	23	47	Insulated	22 (0.030)	Cont	2.46	0.5	2.95E+07	0.0217	10.25	23	222	199
Eval #7	28.75	37	Insulated	20 (0.036)	Cont	2.46	0.75	2.95E+07	0.0253	14.01	19	218	199
Eval #8	33.75	31	Insulated	18 (0.048)	Cont	2.46	0.75	2.95E+07	0.0295	15.17	15	214	200

Table 3 – Insulated Slat, Design Pressure/ Width Comparative Analysis

E. Wind Lock Bar Attachment

The 16 ft and 22 ft wide doors were tested with a 3/8" x 1" wind bar welded to the middle angle. The bar was plug welded to the angle using a 5/8" round plug weld spaced 10" on center. The wind bar is used to retain the wind locks at the end of the slat to keep the curtain in the guide. The following table displays the results of the comparative analysis to show an increase in weld spacing for doors that have a lower width or design pressure. The maximum spacing is also based on maximum allowable stress in the wind bar when supported on each end by a plug weld.

Weld Joint Calculation - Engineers ...

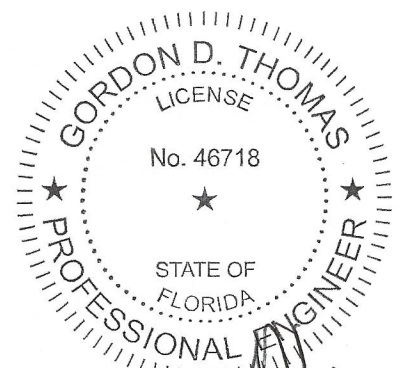


Shear Stress in Weld Base Arc

$$\tau_z = \frac{F}{0.5 \cdot d^2 \cdot i} \quad [\text{MPa, psi}]$$

Where:

τ_z = Shear stress in weld base area [MPa, psi]



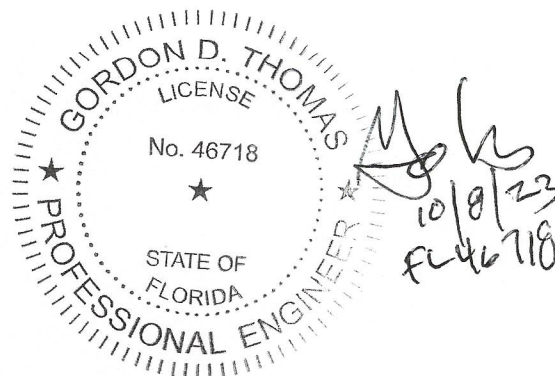
	Width (ft)	DP (psf)	Slat	Slat ga	Windiks	Pitch (in)	slip	N	E (lbs/in^2)	Ix (in^4)	Deflect (in)	Angle (rad)	Angle (deg)	Wps-Wo (lbs/ slat)	Force	Windbar	Spacing (in - OC)
Test Config	22	47	Service	22 (0.030)	Cont	2.46	0.5	4.88	2.95E+07	0.0106	10.02	0.15	8.64	199	197	3/8" x 1"	10
Eval # 1	22	37	Service	22 (0.030)	Cont	2.46	0.5	4.88	2.95E+07	0.0106	10.02	0.15	8.64	154	153	3/8" x 1"	13
Eval # 2	22	31	Service	22 (0.030)	Cont	2.46	0.5	4.88	2.95E+07	0.0106	10.02	0.15	8.64	127	126	3/8" x 1"	16
Eval # 3	16	47	Service	22 (0.030)	Cont	2.46	0.5	4.88	2.95E+07	0.0106	8.57	0.18	10.13	127	125	3/8" x 1"	16
Eval # 4	16	37	Service	22 (0.030)	Cont	2.46	0.5	4.88	2.95E+07	0.0106	8.57	0.18	10.13	94	93	3/8" x 1"	21
Eval # 5	16	31	Service	22 (0.030)	Cont	2.46	0.5	4.88	2.95E+07	0.0106	8.57	0.18	10.13	74	73	3/8" x 1"	24
Eval # 6	12	47	Service	22 (0.030)	Cont	2.46	0.5	4.88	2.95E+07	0.0106	7.45	0.20	11.69	60	59	3/8" x 1"	24
Eval # 7	12	37	Service	22 (0.030)	Cont	2.46	0.5	4.88	2.95E+07	0.0106	7.45	0.20	11.69	36	35	3/8" x 1"	24
Eval # 8	12	31	Service	22 (0.030)	Cont	2.46	0.5	4.88	2.95E+07	0.0106	7.45	0.20	11.69	21	21	3/8" x 1"	24

Table 4 – Wind Lock Bar Attachment Comparative Analysis

IV Limitations of Use

The primary limitations of use are outlined in the original test reports. The sole exceptions to those limitations as outline in this report are based on door width, slat type (insulated), slat curtain gauge, design pressure and plug weld spacing for the wind lock bar. All other items (wall and guide angle sizes, wall anchors, bottom bar, head plates, pipe assembly, hood design, wind lock spacing, etc) have not changed. The drawings for the 10, 16 and 22 ft designs are listed in Section II, Reference Material. Based on the ATI tests performed under TAS-201, 202 & 203, the above configurations for 22 ft wide doors and under are approved for HVHZ (high velocity hurricane zone) applications. Door configurations up to 22 ft wide are approved for HVHZ since these have been tested.

I have concluded that the construction listed above complies with the structural requirements for wall components & cladding as determined in accordance with Section 1609 of the 8th Edition (2023) Florida Building Code.



Certification of Independence of Evaluation Entity

I hereby certify that (1) I have no financial interest in Wayne Dalton Corporation; (2) I am an independent licensed Professional Engineer in the State of Florida and; (3) I comply with the criteria of independence as stated in 9B-72.110 (3), F.A.C. and 9B-72.110(4), F.A.C.