T HANGER DOORS
QUEENSBURY, NY
WIND LOAD CALCULATIONS
September 21, 2020

## DOOR WIND LOAD CALCULATIONS

This structure has been designed in accordance with the requirements of the American Society of Civil Engineers MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES ASCE 7. The following wind load requirements were employed in the design of the structure:

- Wind Load Requirements employed in the Design of the Structure
  - Ultimate Wind Speed: $V_{ULT}$ = 90 MPH
  - Wind Borne Debris: NO
  - Basic Wind Speed: $V_{ASD}$ = 70 MPH
  - Building Category II, Enclosed
  - Wind Exposure C

Door wind load calculations based on individual structural panels secured at top and bottom with rollers and pins with the door in the closed position whenever high winds are expected. Door wind load calculations meet ASCE 7 “Minimum Design Loads for Buildings and Other Structures” for building mean roof height under 20 ft.

Calculations are limited to FOLDTITE SYSTEMS, INC., FOLD-TITE STACKER System Door Series CSA-2.5 Plus designed for:

Plank Construction Services: 41 ft 6 in X 11 ft 9 in
Fold-Tite Stacker Door Drawing # Plan_FT4112Q T081220Rev

To be installed:
Floyd Bennet Memorial Airport (GFL)
Queensbury, N.Y.


William F. Stuhrke, PhD, P.E.
State of Florida PE # 22150


This item has been electronically signed and sealed by William F. Stuhrke on the Date/Time stamp shown using a digital signature. Printed copies of the document are not considered signed and sealed and the signature must be verified on any electronic copies.

Digitally signed by William Stuhrke
Date: 2020.09.21 17:23:30 -04'00'

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## WIND LOAD PRESSURE

Ultimate Wind Speed $V_{ULT}$ = 90 MPH

Velocity pressure exposure coefficient exposure C (ASCE 7 Table 6-5)

$K_Z$ = 0.85

Topographic Factor (ASCE 7 Eq. 6-1, Figure 6-2, no hill or escarpment)

$K_{ZT}$ = 1.0

Directionality Factor (ASCE Eq. 6-1, Table 6.6)

$K_D$ = 0.85

Importance Factor II = 1.00

Velocity pressure (ASCE 7 Eq. 6-13)

$Q_Z = 0.00256 \bullet K_Z \bullet K_{ZT} \bullet K_D \bullet V^2 \bullet I$

$Q_Z$ = 15.0 lb•ft/ft$^2$

External pressure coefficient (ASCE 7 Figure 6-5A)

Positive: 0.7, Negative: -0.8 $G_{CP}$ = -0.8

Internal pressure coefficient enclosed (ASCE 7 Table 6-7)

Positive: 0.18, Negative: -0.18 $GC_{PI}$ = 0.18

## DESIGN WIND PRESSURE (MAX.)

Components and cladding, mean building height under 60 ft

$P = -Q_Z \bullet (GC_P - GC_{PI})$

P = 14.7 lb•ft/ft$^2$

## ASD WIND LOAD FACTOR

$P_{ASD} = 0.6 \bullet P$

$P_{ASD} = 8.8\ lb \bullet ft/ft^2$

**CRITICAL STRUCTURAL CONDITION**

The critical structural condition for the door is the bending of the vertical members on the sides of the individual door panels. The critical panels are the center panels.

Panel Clear Span Height

$H = 11\ ft\ 7\ in$

$H = 139\ in$

Panel Width

$W = 3\ ft\ 4.25\ in$

$W = 40.25\ in$

Load on Vertical Edge Members

$L = P_{ASD} \bullet W/2$

$L = 14.76\ lb \bullet ft/ft$

$L = 1.23\ lb \bullet ft/in$

Moment on Vertical Edge Member

$M_{MAX} = L \bullet H \bullet H/8$

$M_{MAX} = 2{,}971\ lb \bullet in$

Edge Member Properties

The edge member is an aluminum extrusion from KEYMARK CORPORATION, die number T-S55472, Aluminum Alloy 6063 T-5 for FOLDTITE SYSTEMS

#CSA-2.5 VERTICAL. The member has the following properties according to the KEYMARK CORPORATION.

$I_X = 0.478\ in^4$

$I_Y = 0.208\ in^4$

$S_X = 0.359\ in^3$

$S_Y = 0.159\ in^3$

Aluminum Properties Alloy 6063 T-5

$F_{YALLOWABLE} = 14{,}000\ lb / in^2$

Moment Allowable

$M_{ALLOWABLE} = S_X \bullet F_Y$

$M_{ALLOWABLE} = 5{,}026\ lb \bullet in$

**THEREFORE, THE MEMBER IS ADEQUATE**

**HANGER BOLTS AND LOCK PINS**

Loading on Hangers

Door Width (DW)

DW = 41 ft 6 in

Door Height (DH)

DH = 11 ft 9 in

Hanger Spacing (HS)

HS = 4 ft 0 in

Lock Pin Spacing (LPS)

LPS = 5 ft 11.2 in

Drop Pin Spacing (DPS)

DPS = 4 ft 7.3 in

Number of Pins = 8

Door Weight (DW)

DW = 1.99 lb/in

Wind Loading (P)

$P = 8.8\ lb \bullet ft/ft^2$

Dead Load / Hanger (DLH)

$DLH = 171.7\ lb \bullet ft$

Wind Load at Verticals (WLV)

$WLV = 711\ lb \bullet ft$

HANGER BOLTS, LOCK PINS LOADING & SIZE

Load capacity of threaded hanger rods/bolts, based on an allowable bolt stress (ABS) of 60,000 $lb \bullet ft/in^2$ Grade 5

Bolt Length = 7.00 in, Bolt Diameter = 5/8 in

Bolt Area = 0.20 $in^2$, Max Allowable Load = 12,200 $lb \bullet ft$

Bolt Stresses for Applied Loads

Axial Tension Stress (ATS) = DLH/BA

$ATS = 858.5\ lb/in^2$

Shear Stress (SS) = WLV/BA

$SS = 3{,}555\ lb/in^2$

Combined Stress

CS = ATS/ABS + SS/ABS ≤1.0

CS = .361

**THEREFORE, THE HANGER BOLTS ARE ADEQUATE**

LOCK PINS

Load capacity of drop lock pins, based on an allowable pin stress (APS) of 60,000 lb • ft/in$^2$

Pin Diameter = ½ in

Pin = 0.196 in$^2$

Pin Stress for Applied Load

SS = 2,722 lb/in$^2$

**THEREFORE, THE DROP PINS ARE ADEQUATE**

**THEREFORE, THE DOOR DESIGN IS ADEQUATE**