

**EVALUATION REPORT**  
Anchor Calculations  
SZ Series Single Commercial  
Steel Flush Entry Door with  
F16 Series Frame by IR

Client: Ingersoll-Rand Company  
Report: IR2010-001R2  
Date: 4/20/11  
Prepared By: Gordon Thomas, P.E.  
FL # 46718



## I. OVERVIEW / SCOPE

The following evaluation report provides supporting anchor calculations for Dade County submittal along with the tests conducted on the SZ 3070 Single Commercial Steel Flush Entry Door. There are six different anchors (lag bolts, masonry anchors, wire ties, T straps, jamb anchor-wood & jamb anchor-steel). The calculations are based on a design pressure of +/- 80 psf along with results contained in test report CTLA-2037W.

The calculations do not check the design of the lock, door hinges or door panel. Calculations assumes door to be a rigid member and failure to be a result of shearing of the anchor connection. All anchor connections are located at the left & right jambs only and the loads are transmitted to the jamb attachment.

The results are summarized at the end of the report.

## II. REFERENCE MATERIAL

The following reference materials were provided in support of the product evaluation

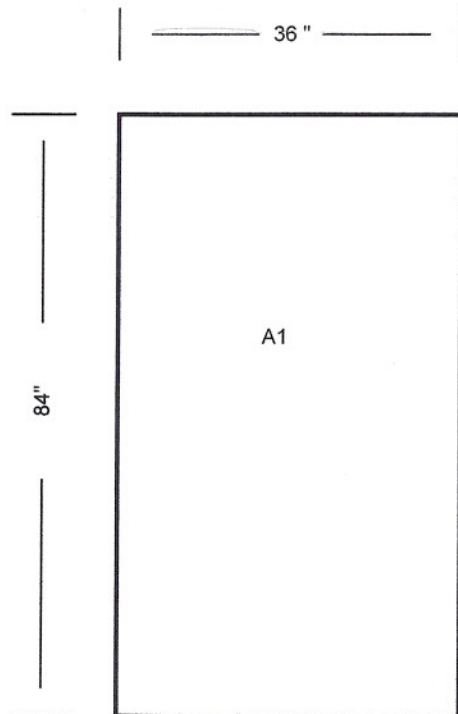
1. IR Drawing 2037W (3 shs) – SZ Series Single Flush Doors, Rev A.
2. Certified Testing Laboratories Report # CTLA – 2037W, Dated 6/29/10.



### III. EVALUATION

#### A. Load distribution

##### 1. Area



Area:

$$A_1 = 84" \times 36" = 3024 \text{ in}^2 = 21 \text{ ft}^2$$

##### 2. Pressure/ Loads

$$P_1 = 21 \text{ ft}^2 \times 80 \text{ psf} = 1680 \text{ lbs}$$

All of the loads of the door go back to the locking hardware and hinges. For the worse case, this would be for a single door, outswing, negative wind load with single point latching. This would cause 1/2 the door load to go to the jamb. With a factor of safety, the frame loads at the jamb would be:

$$W_{\text{jamb}} = 1680 \text{ lbs}/2 * 1.25 = 1050 \text{ lbs}$$



## B. Masonry Anchors

Type: 3/8" Rawl-Bolt, or approved equivalent  
Wall Type: Min 2000 psi concrete  
Embed Depth: Min 2"

### Design Criteria

- Allowable shear:  $4015 \text{ lbs}/4 = 1004 \text{ lbs/ bolt}$
- Allowable tension:  $6525 \text{ lbs}/4 = 1631 \text{ lbs/ bolt}$
- Spacing between anchors: Min 2-1/2"
- Edge distance – shear: Min 3"
- Edge distance – tension: Min 3"

Anchor Qty (jambs) =  $1050/1004 = 1.05$   
Use 4 anchors, minimum

## C. Lag Bolts

Type: Min 3/8" dia Lag bolt, 6" long  
Material: Assume specific gravity, G, of ovendry wood to be 0.42-0.50.  
Allowable lateral resistance  
for parallel-to-grain loading (1-1/2" side member): 280 lbs/ lag bolt

Lag bolt Qty (jambs) =  $1050/280 = 3.75$   
Use 4 bolts, minimum

## D. Wire Ties

Type: 0.188" wire masonry wire anchor  
Wire Shear Area:  $3.14 (0.188^2)/4 = 0.0277 \text{ in}^2$

Allowable load per wire:  $0.4 \times (36\text{ksi}) \times 0.0277 \text{ in}^2 = 398.9 \text{ lbs}$   
Allowable load per wire tie:  $2 \times 398.9 = 798 \text{ lbs}$

Wire tie Qty (jambs) =  $1050/798 = 1.32$   
Use 4 wire ties, minimum



## E. Jamb Anchor – Wood Stud

Type: IR Part Number 3An0100P016 – Universal Adjustable Jamb Anchor  
Shear Failure – Assume strap failure  
Shear Area =  $0.63" \times 0.048" = 0.03 \text{ in}^2$  each side

Max Shear Load:  $2 \times 0.03 \times 36,000 \times .6 = 1296 \text{ lbs}$

Wood stud Qty (jambs) =  $1050/1296 = 0.81$   
Use 4 wood studs, minimum

## F. Jamb Anchor – Steel Stud

Type: IR Part Number 3An0100P016 – Universal Adjustable Jamb Anchor  
Shear Failure – Assume screw diameter  
Shear Area =  $3.14 \times (0.164)^2/4 = 0.0211 \text{ in}^2$  each screw

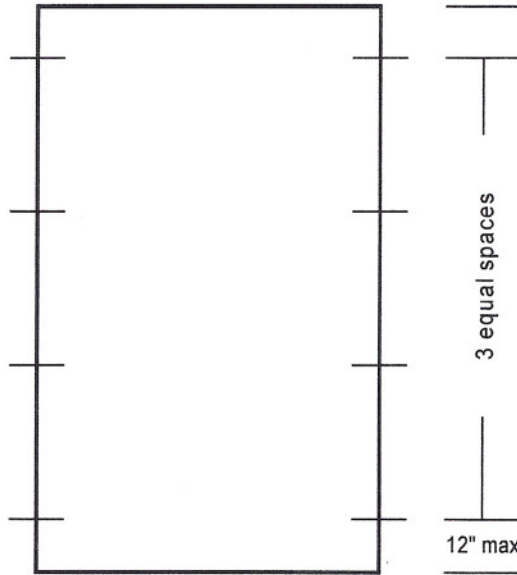
Max Shear Load:  $2 \times 0.0211 \times 36,000 \times 2/3 = 1013 \text{ lbs}$

Steel stud Qty (jambs) =  $1050/1013 = 1.036$   
Use 4 steel studs, minimum

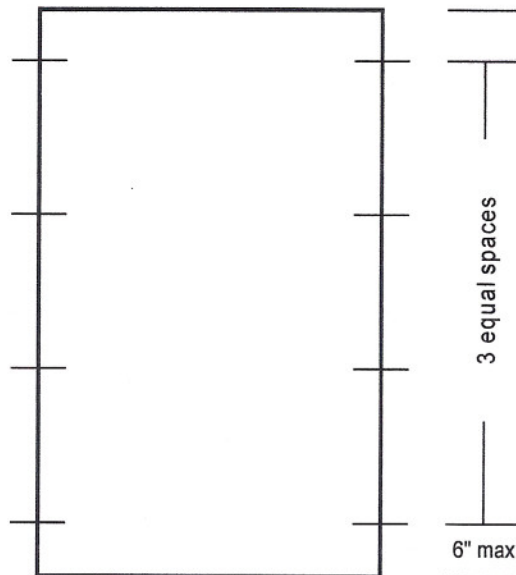
C. Summarized Results

1. Single Doors

a. Masonry Anchors

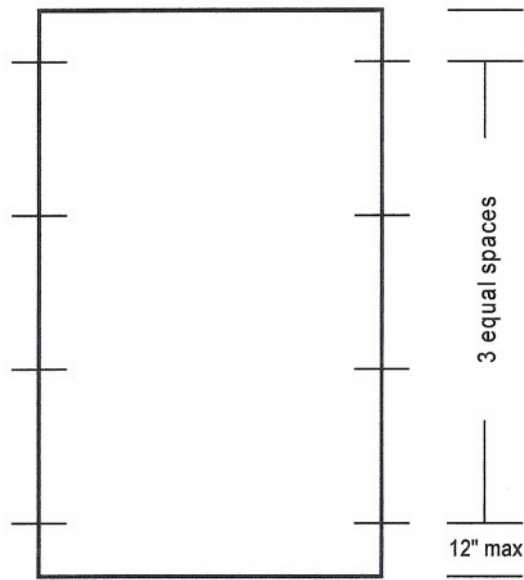


b. Lag Bolts

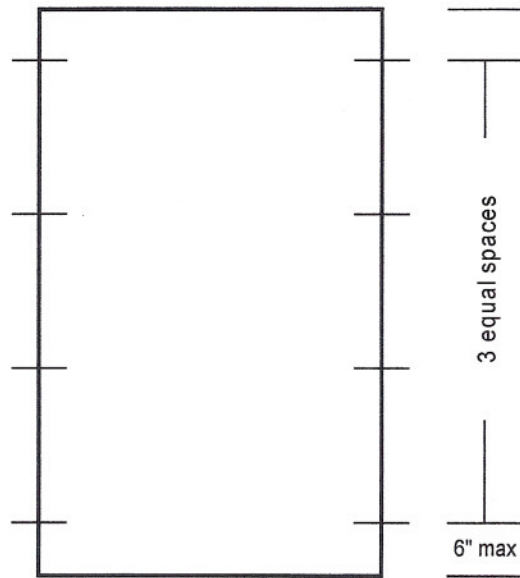




c. Wire Ties



d. Jamb anchor – wood stud



e. Jamb anchor – steel stud

