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EC.3M 4.BS

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## **TEST APPROVAL DOCUMENT**

**REPORT ON A DOOR CYCLE TEST AND TWIST TEST**

**CONDUCTED IN ACCORDANCE WITH THE REQUIREMENTS OF  
TEST STANDARD ANSI A250.4-2001**

**Sample: Hollow Metal Door, Standard Steel Door, Insulated Steel Door**

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### **TEST SPONSOR**

**Hollow Metal Manufacturers Association  
A Division of NAAMM  
8 South Michigan Avenue, Suite 1000  
Chicago, IL 60803  
United States of America**

### **REPORT FOR**

**Sam Hoon Company Limited  
577-1 Songrea 2-Dong  
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Buchone-City  
Kyunggi-Do  
South Korea**

### **REPORT BY**

**Lloyds Register EMEA  
London Design Support Services  
71 Fenchurch Street  
London  
United Kingdom  
EC.3M 4.BS**

## **INTRODUCTION**

Between October 08 2008 and March 27 2009, the Cranfield Institute Engineering Department conducted a Cycle Test to evaluate the physical endurance of a vertically reinforced Hollow Metal Steel Door, Standard Steel Door and Insulated Steel Door. The test was conducted for the Hollow Metal Manufacturers Association (HMMA), a division of National Association of Architectural Metal Manufacturers (NAAMM) for use by authorised members. The test was conducted in accordance with the Standard Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcing, ANSI A250.4-2001, except that the test was conducted for one million cycles. The physical endurance tests were witnessed by a Senior Metallurgical Surveyor from Lloyds Register and the readings at every hold/inspection point duly recorded for use in the preparation of this Test Approval Document.

## **TEST MATERIALS**

### **DOOR LEAF**

Nominal 1000mm wide x 2200mm high x 44.5mm thick single leaf, and 2700mm\*2500mm double leaves ,vertically stiffened, hollow metal with 1.6mm Galvanized Steel faces. Standard HMMA/NAAMM Type 861-door construction.

### **DOOR FRAME**

Hollow Metal 2.0mm thick Galvanized Steel, double rabbet with 150mm jamb depth. Standard HMMA/NAAMM construction.

### **HARDWARE**

Panic Device – Lawrence Rim Exit Device – 5500 Series  
Hinges – Lawrence Part Number LH604PB 4.1/2” x 4.1/2”  
Door Closer – LCN 4040

## **TEST ASSEMBLY**

See figs. 1 and 2 as a part of this report

The test apparatus used in the test, except for the pneumatic force applicator, is in compliance with the drawings in the Test Standard ANSI A250.4-1994.

The clearance between the adjacent edges of the door and the frame jambs/header were maintained at 3mm, with a 1.5mm tolerance. The clearance between the bottom of the

Door and the concrete floor beneath it was maintained at 9.5mm, with a 1.5mm tolerance.

Installation of the door was supervised by a technician from Stiles Custom Metal (a member of HMMA/NAAMM). The hardware installation was supervised by a technician from Lawrence and Company Inc

### TWIST TEST

The Twist Test was conducted immediately before the Cycle Test, and then repeated every 23,000 cycles until 100,000 cycles had been completed. Thereafter, the Twist Test was conducted at every 50,000 cycles, until the test was completed at 1 million cycles. During the test, the hinge pins and silencers (mutes) were removed from the test assembly, and the door was secured to the frame as shown in Fig2. Compressive force loads were applied in 44 N/m increments to zero and the deflections noted. At each load the test assembly was held for approximately 5 minutes, in order to obtain a steady and consistent deflection reading.

### CYCLE TEST

After each Twist Test the hinges were re-assembled by inserting the hinge pins, and the clearances described in the "Test Assembly" were maintained. The Cycle Test was then conducted for 25,000 cycles until the first 100,000 cycles were completed. Throughout the test, the assembly was set up so that the door was closed at an approximate rate of 15 cycles per minute. After the Twist Test, at this stage, the Cycle Test was conducted for 50,000 cycles before the Twist Test. A minimum swing angle of 60 degrees was assured for each cycle. The hinges and the exit device were lubricated every 100,000 cycles. In accordance with the client's instructions, the test was stopped at 1,000,000 cycles.

### OBSERVATIONS

The door was operable after 1,000,000 cycles.

No metal fatigue, cracking, breakage or deterioration of the edge seam, welds or

De lamination of the metal stiffeners was evident on the outside appearance of the door leaf at the end of the test.

After the test, the door was cut into four equal parts and examined. No metal fatigue, or breakage of the welds was evident.

The top and bottom channels and hardware reinforcements were securely in place, they did not show any evidence of fatigue. None of the tapped holes were stripped.

The maximum deflection of the door during the Twist Test was 9.24mm at 438 N/m applied load, after 1 million cycles. Maximum deflection was 5.33mm at 1,000,000 cycles. This complies with the requirements of 31.75mm at 1,000,000 cycles as specified in the Test Standard for Level A Hollow Metal Doors. Level A is the highest level of maximum performance described in the Test Standard

The maximum residual deflection after the completion of 1 million cycles was 0.28mm at 1,000,000 cycles. The requirement specified in the Test Standard is a maximum of 3.17mm at the completion of 1,000,000 cycles for Level A Hollow Metal Steel Door, Standard Steel Door and Insulated Steel Door.

**CONCLUSION**

**THE DOOR PASSED THE CYCLE TEST AFTER BEING SUBJECTED TO 1 MILLION CYCLES.**



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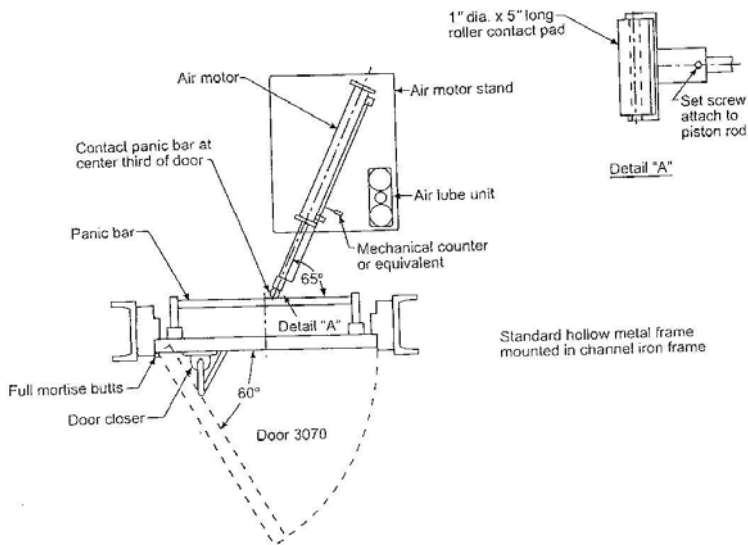


Figure 1 - Swing test detail

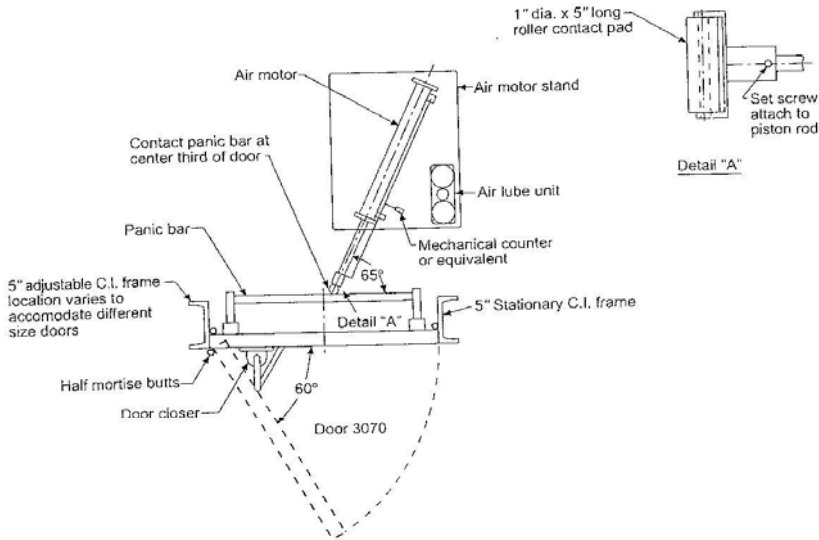


Figure 1A - Swing test detail

Door can be tested in channel iron frame with half mortise hinges (no pressed steel frame).

**EXAMINED**

This plan has been examined and given the status shown below

**APPROVED**

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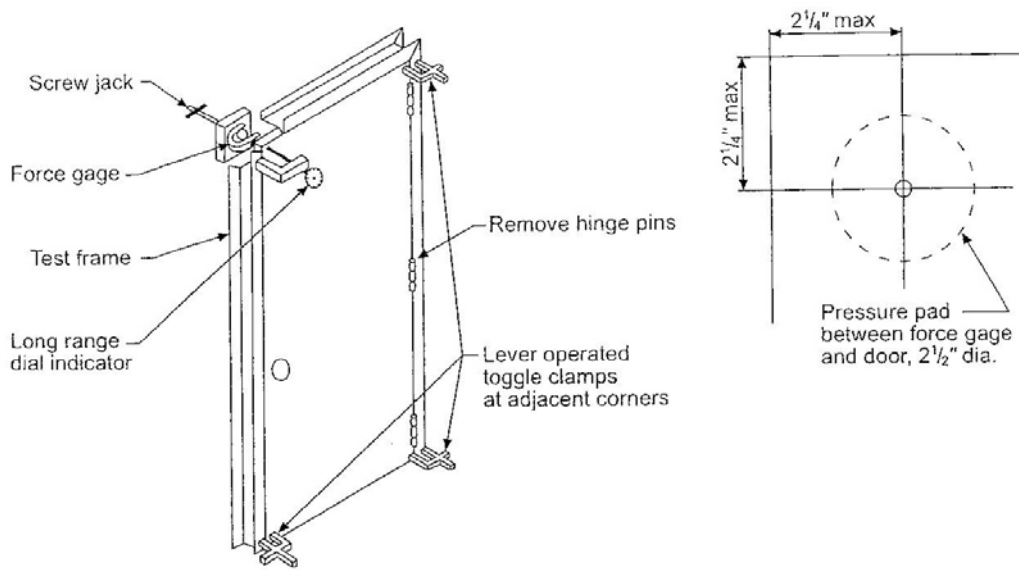


Figure 2 – Twist test

EXAMINED

This plan has been examined and given the status shown below

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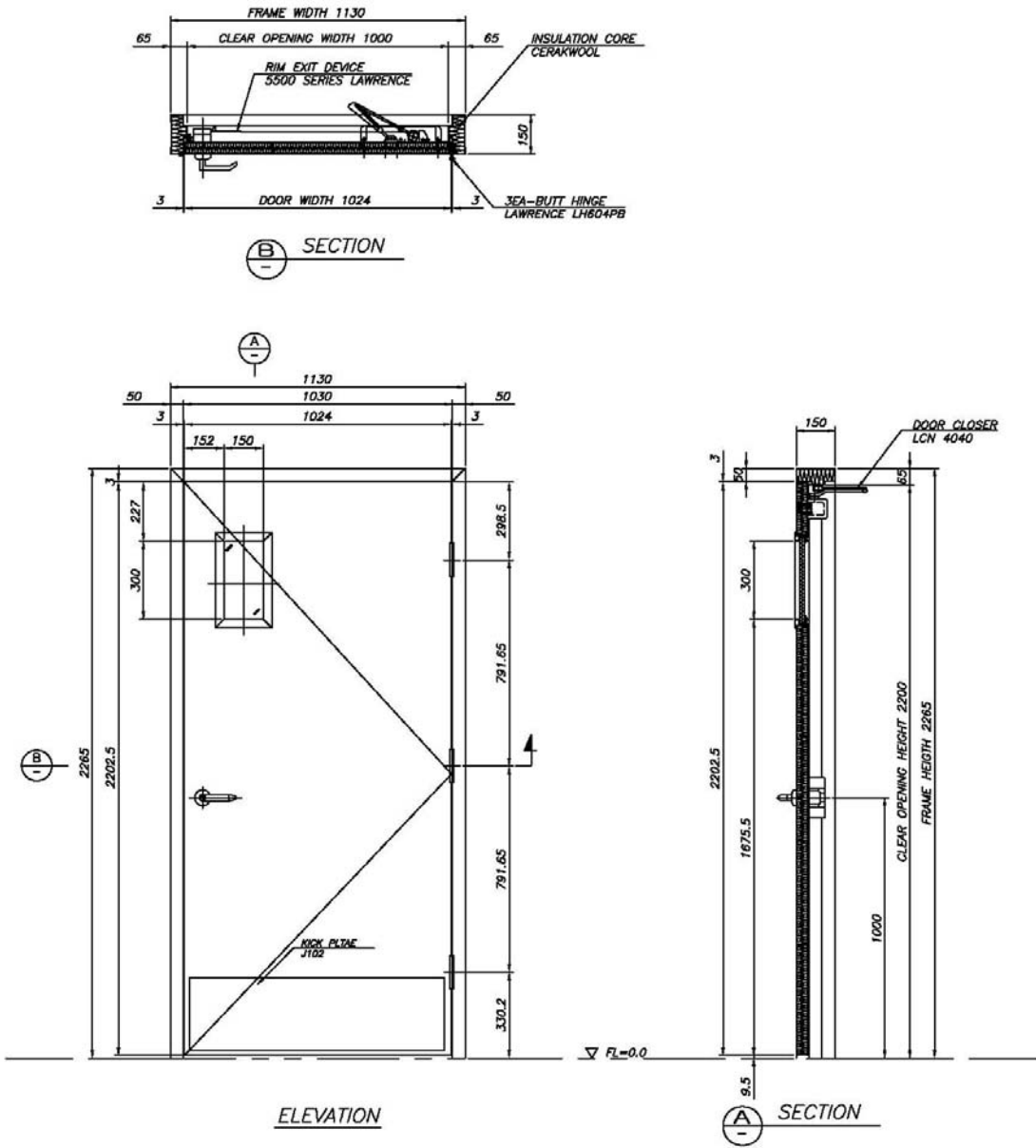
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Date 20/07/2009 Initials [Signature]

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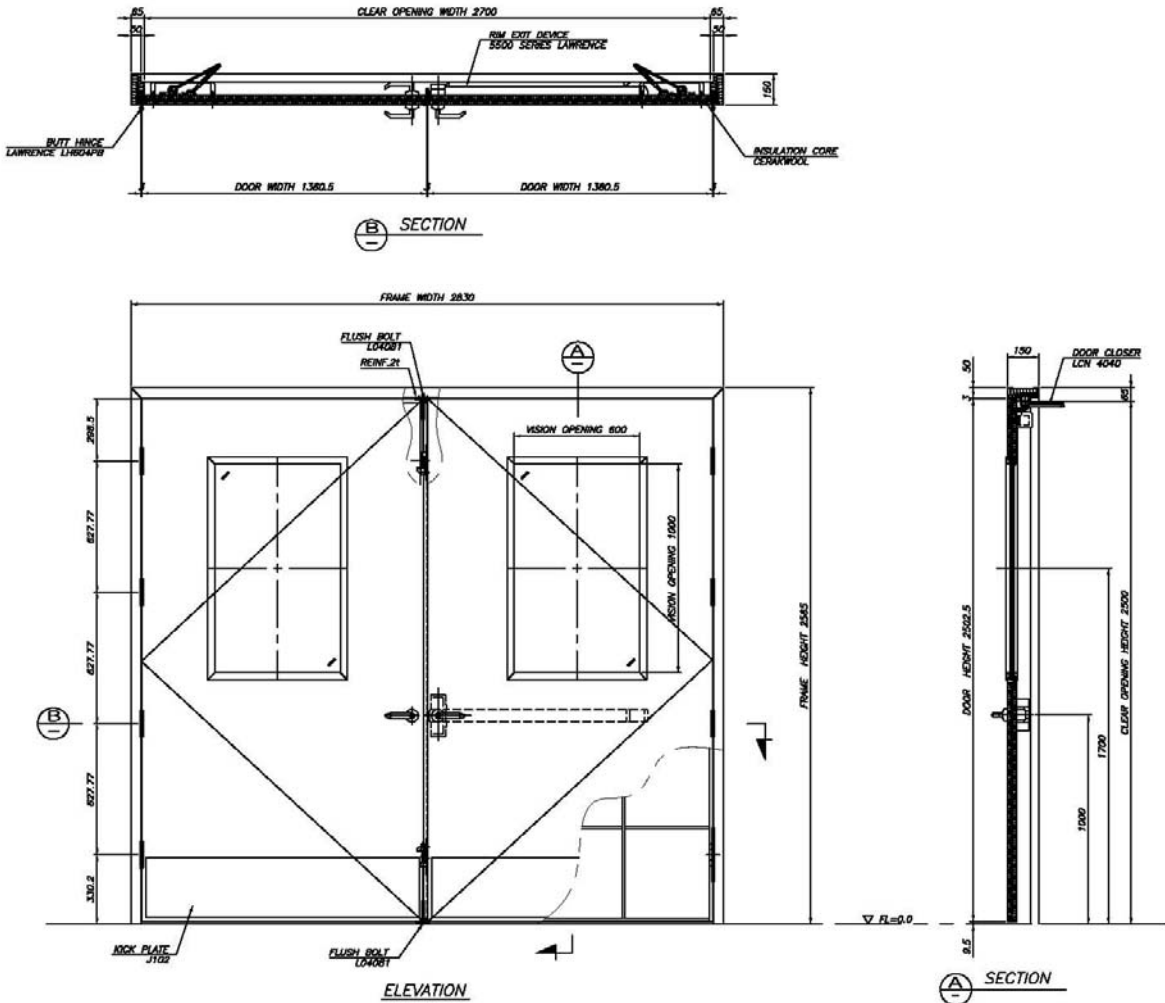
**Drawing of Test Sample**

**1. Standard Steel Door  
- Single Door (1000x2200)**



Drawing of Test Sample

1. Standard Steel Door  
- Double Door (2700x2500)

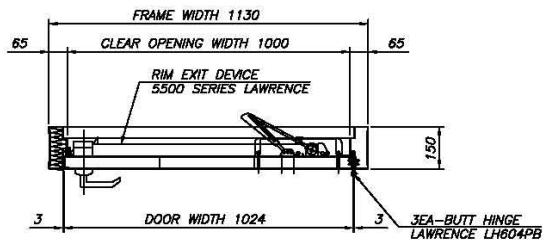




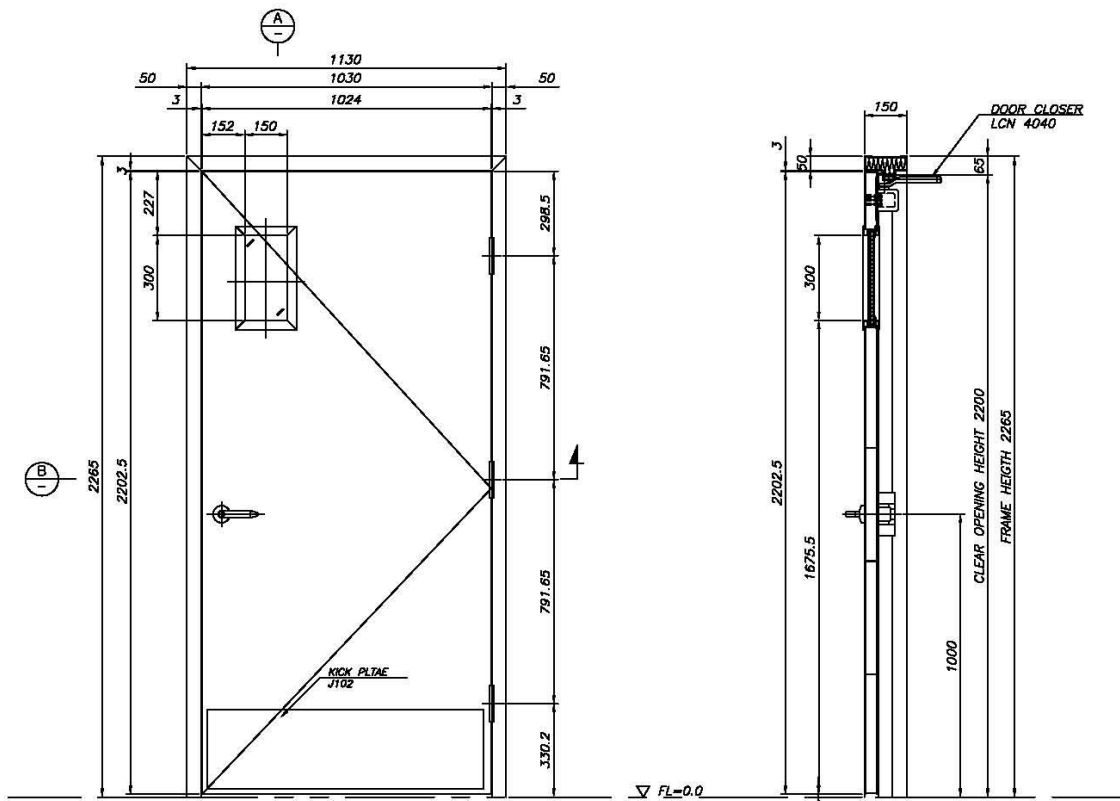
Drawing of Test Sample

2. Hollow Metal Door

- Single Door (1000x2200)



SECTION B



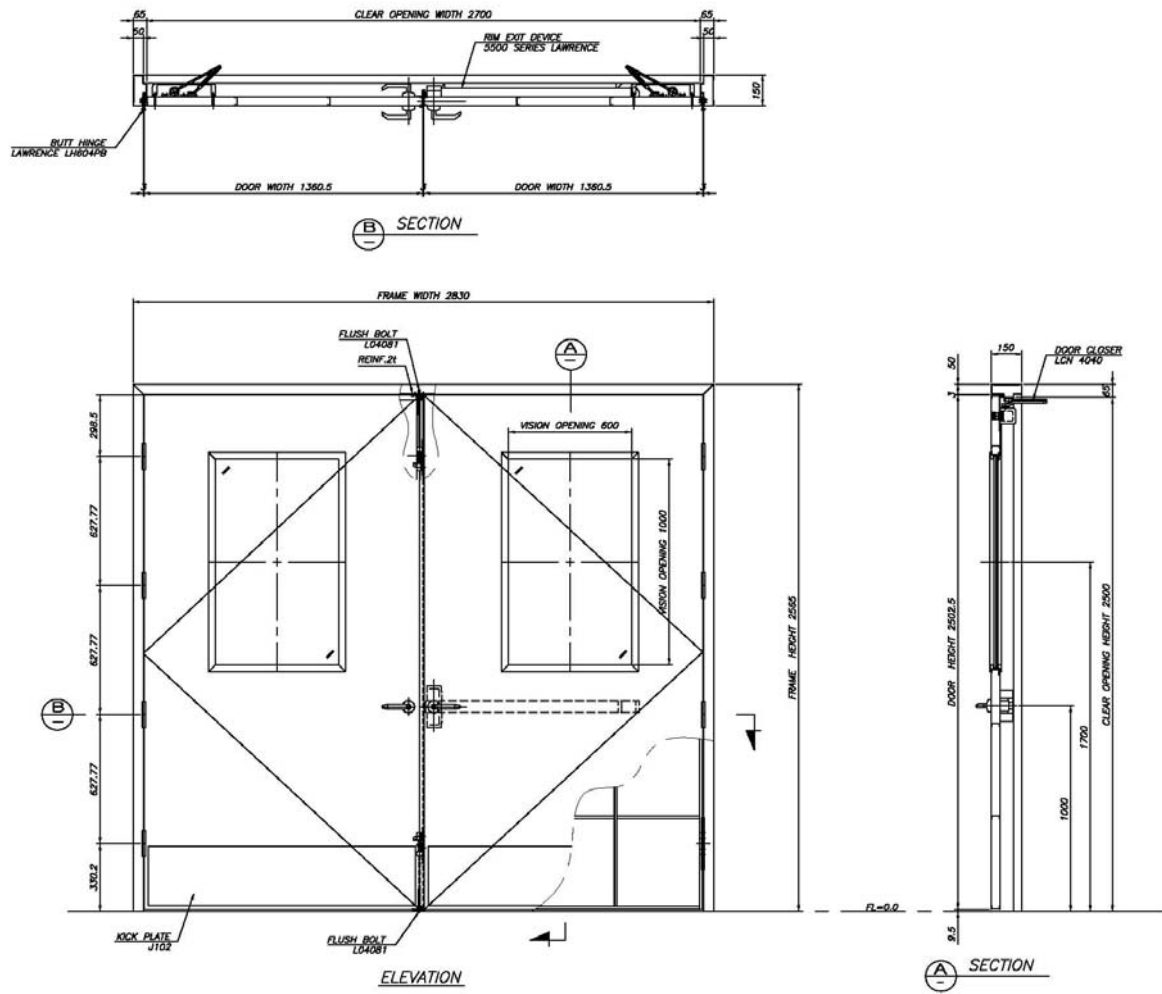
ELEVATION

SECTION A

Drawing of Test Sample

2. Hollow Metal Door

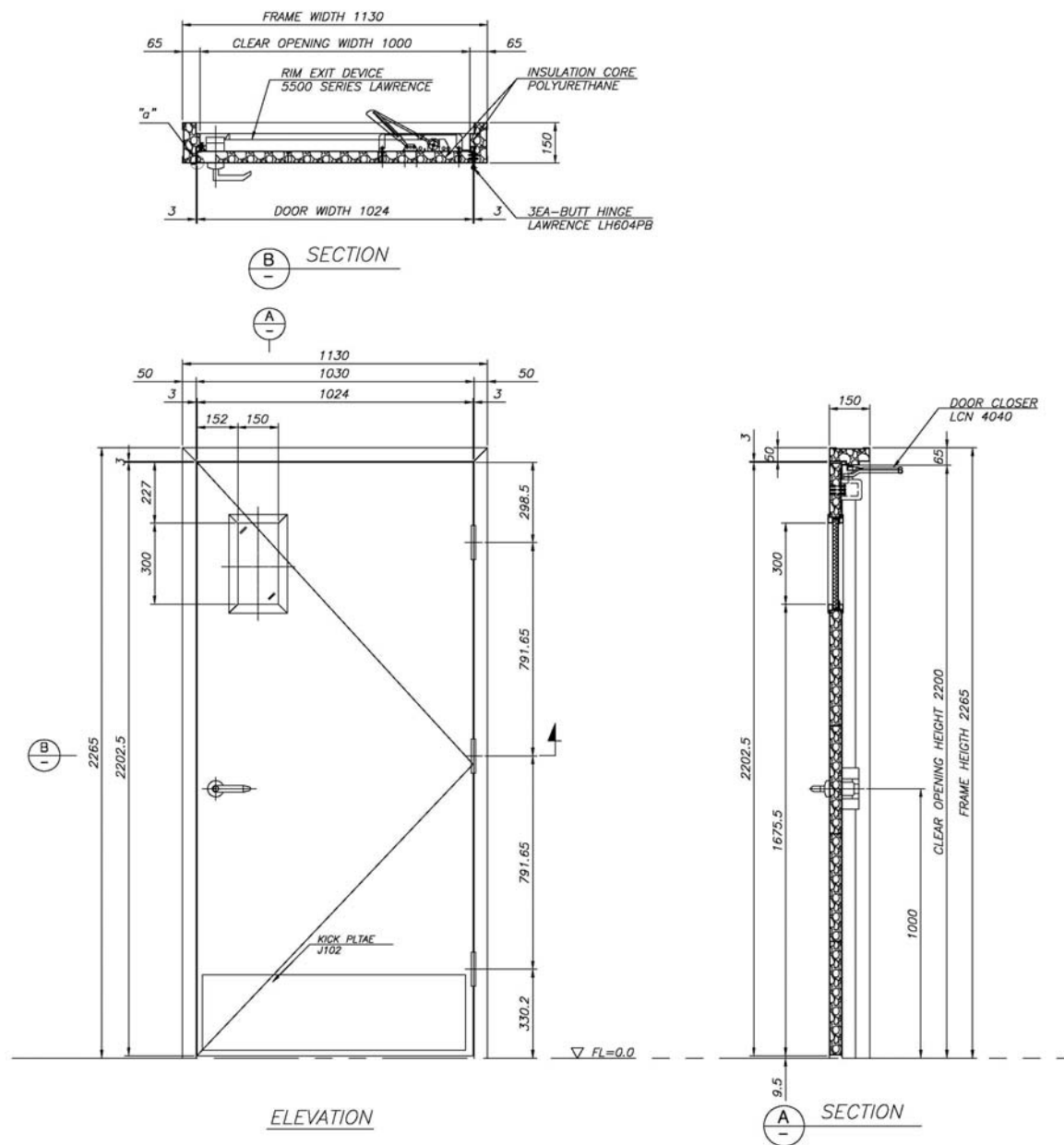
- Double Door (2700x2500)



Drawing of Test Sample

3. Insulated Steel Door

- Single Door (1000x2200)



Drawing of Test Sample

3. Insulated Steel Door

- Double Door (2700x2500)

