

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

Document Number SST 1-122888
Issue Number 0
Page 1 of 8
Date 03 June. 2010

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, Maximum Duty Door

This report is for the exclusive use of the client named herein
and Lloyds Register authorises the client named herein to reproduce this Report
This report must be reproduced in its entirety

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
Sosa-Gu
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 January 26 2010 and May 29 2010, the Cranfield Institute Engineering Department conducted a Cycle Test to evaluate the physical endurance of a vertically reinforced Hollow Metal Door or Maximum Duty 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 x 2500mm x 44.5mm Double leaves, vertically stiffened, hollow metal with 2.0mm Galvanized Steel faces. Standard HMMA/NAAMM Type 861-door construction.

DOOR FRAME

Hollow metal 2.0mm thick Galvanized Steel faces, Double rabbet with 150mm jamb depth. Standard HMMA/NAAMM construction.

HARDWARE

Lock Sets – SARGENT M-9024

Hinges – BUTT HINGE McKinney TA2314

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 were 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

Delamination 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.

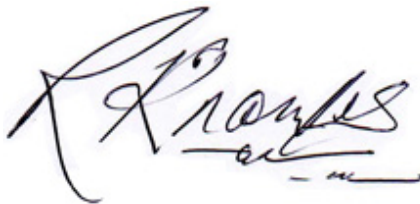
The top and bottom channels and hardware reinforcements were securely in place, they did not show any evidence of fatigue. None of the tapped holes were stripped.

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 Doors or Maximum Duty Doors

CONCLUSION

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



F. Jones
Lead Signatory
Lloyds Register EMEA
London Design Support Services
71 Fenchurch Street
London
United Kingdom
EC.3A 4.BS

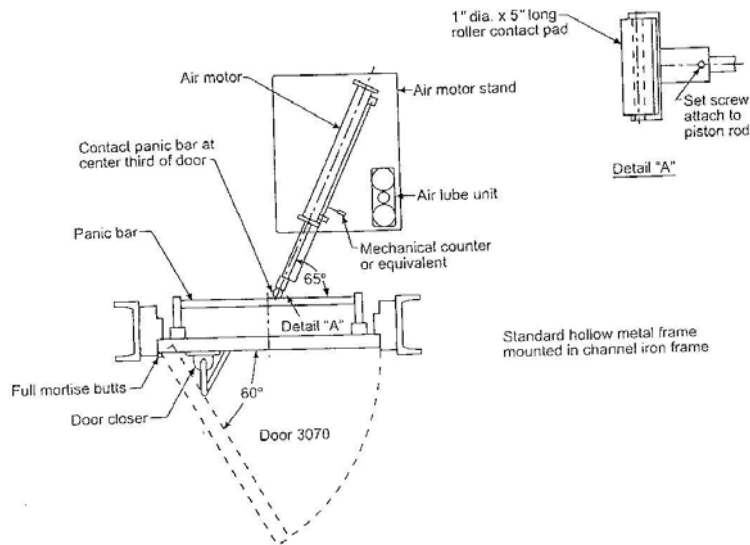


Figure 1 - Swing test detail

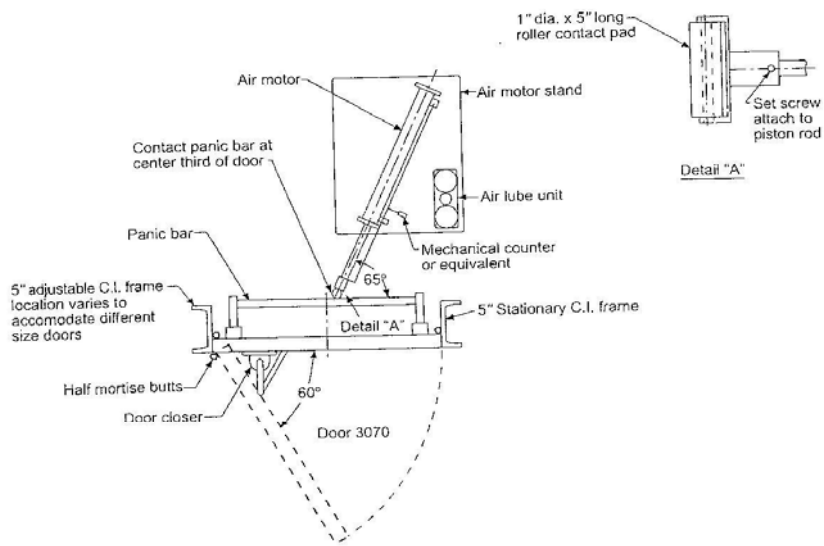


Figure 1A - Swing test detail

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

Document Number SST 1-122888

Date 03/06/2010 Initials RK

London Plan Approval
 Lloyds Register EMEA

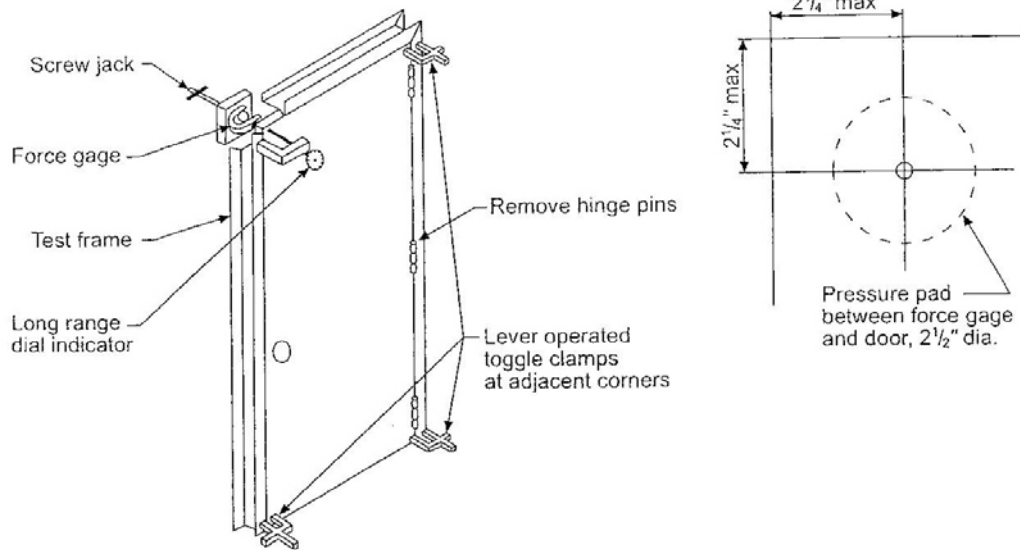
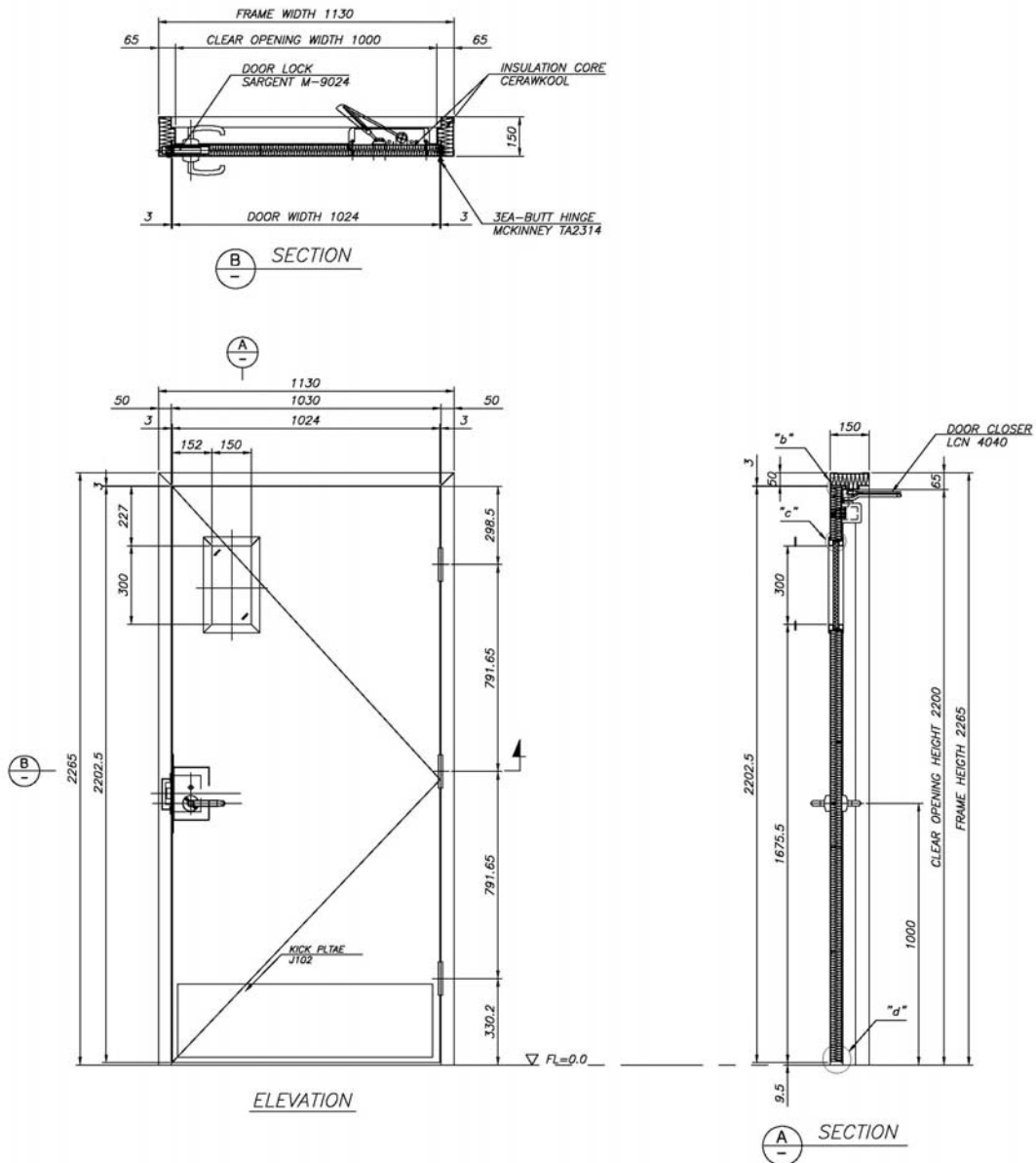


Figure 2 – Twist test

EXAMINED
This plan has been examined and given the status shown below
APPROVED
Document Number SST 1-122888
Date 03/06/2010 Initials RK
London Plan Approval
Lloyds Register EMEA

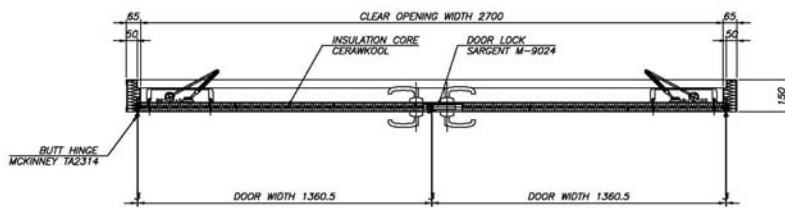
Drawing of Test Sample

**Maximum Duty Door
 -Single Door (1000x2200)**

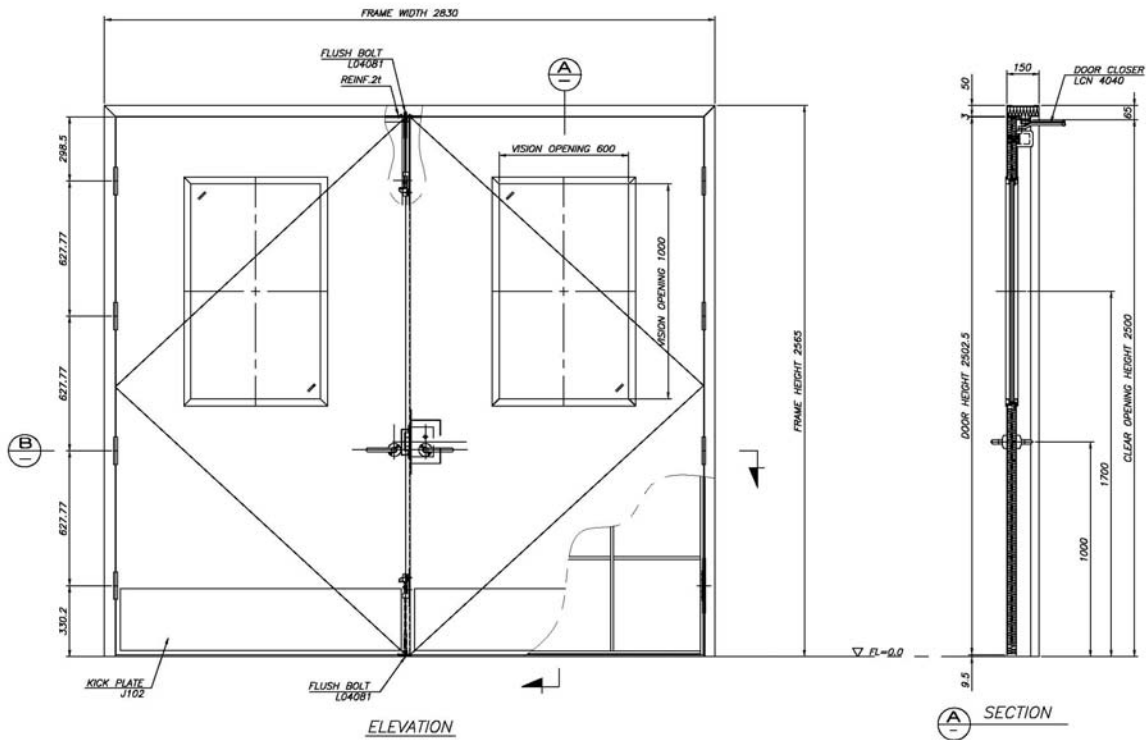


Drawing of Test Sample

**Maximum Duty Door
 -Double Door (1000x2200)**



B SECTION



A SECTION