Test Report

Fire Resistance Test
On
Fire Rated Steel Single Doors

Test Sponsor:

Karachi Steel Services

Test Report

On

Fire Resistance of Steel Fire Rated Single Doors

Testing Laboratory	:	Material Lab
Lab Reference No.	:	STQ-170128/112 SN 1/1
Lab Project No.	:	P-3725
Test Reference No.	:	170128437
Test Standard	:	BS 476: Part 22: 1987: Amd 2014.
Sample Description	:	1. Fire rated steel single door with 45mm thick steel leaf with Rockwool core without vision panel, Ironmongery from DORMA & ISEO 2. Fire rated steel single door with 45mm thick steel leaf with Rockwool core, Vision Panel & Ironmongery from DORMA & ISEO
Test Sponsor	:	Karachi Steel Services
Manufacturer	:	Karachi Steel Services
Test Sponsor Address	:	187, Nishter Road, Near Nishter Road Post Office, Garden West, Karachi, Pakistan
Telephone No.	:	+92 213 225 0950
Fax No.	:	+92 213 222 9891
Date Samples Received	:	24/01/2017
Date of test	:	28/01/2017
Date Report Issued	:	08/02/2017
Required Duration of test	:	120 minutes
No. of Pages	:	34

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MATERIAL LAB is **ACCREDITED** by the **DUBAI ACCREDITATION CENTER (DAC)**, accreditation certificate no: LB-008-TEST, to conduct Fire Resistance Tests in accordance with the following standards:

BS EN 1364 – 1	:	1999	Fire resistance tests for non-loadbearing elements – Part 1: Walls
BS EN 1364 – 3	:	2014	Fire resistance tests for non-loadbearing elements – Part 3: Curtain walling – Full configuration (complete assembly)
BS EN 1364 – 4	:	2014	Fire resistance tests for non-loadbearing elements – Part 4: Curtain walling – Part configuration
BS EN 1634 – 1	:	2014	Fire resistance and smoke control tests for doors and shutter assemblies, openable windows and elements of building hardware – Part 1: Fire resistance test for door and shutter assemblies and openable windows
BS 476 part 20	:	1987	Fire tests on building materials and structures- Part 20: Methods for determination of the fire resistance of elements of construction (general principles)
BS 476 part 22	:	1987	Fire tests on building materials and structures- Part 22: Methods for determination of the fire resistance of non-loadbearing elements of construction
ISO 834 – 1	:	2012	Fire-resistance tests – Elements of building construction – Part 1: General requirements
ISO 834 – 8	:	2002	Fire-resistance tests – Elements of building construction – Part 8: Specific requirements for non-loadbearing vertical separating elements
ISO 3008	:	2007	Fire-resistance tests – Doors and shutter assemblies
ISO 3009	:	2003	Fire resistance tests – Elements of building construction – Glazed elements

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CIVIL DEFENCE APPROVED

INTERNATIONAL TESTING AND CERTIFICATION BODIES

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ACCREDITATION CERTIFICATE

LB-008-TEST

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has accredited

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Al Quoz Industrial Area 4

Dubai- United Arab Emirates

In accordance with the requirements of ISO/ IEC 17025: 2005 to undertake the tests in the fields of:

Construction Materials Testing

Geotechnical Investigation

Environmental Testing

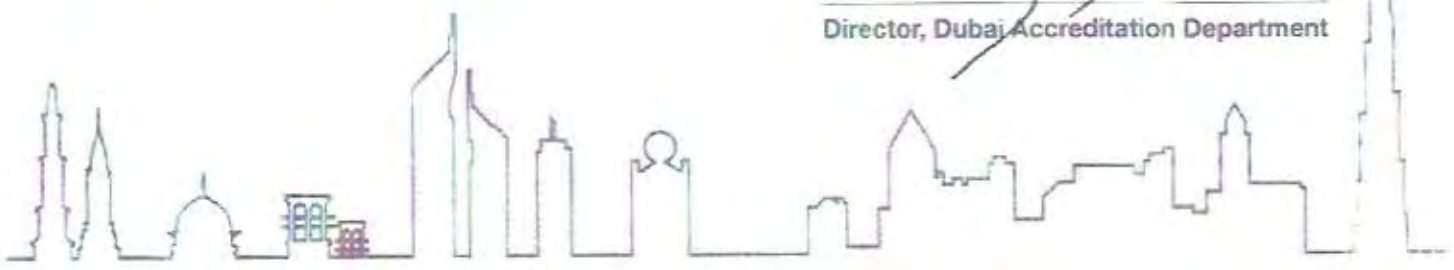
Listed in the attached Scope of Accreditation

This Accreditation is invalid without the attached scope of accreditation and shall remain in force within the validity period printed below, subject to continuing compliance with the requirements of the accreditation program.

Validity of Certificate: from 07- 03- 2016 to 06- 03- 2019

Initial Accreditation Date: 05- 02- 2004

Director, Dubai Accreditation Department



SCOPE OF ACCREDITATION

Construction Materials Testing

Material Lab

Al Quoz Industrial Area 4

Dubai- United Arab Emirates

Scope Issue No: 10 **Accreditation Certificate No: LB-008-TEST**

Scope Validity Period: 07-03-2016 to 06-03-2019 **Issued by (Head of Section):**

Type of Task	Materials/Products	Task Name	Standard method
Fire Resistance	Non load bearing Concrete blocks, Wall	Fire resistance tests for non-load bearing elements. Part 1. Walls Performance criteria Integrity ,Insulation and Radiation	BS EN 1364-1
	Non load bearing elements-Curtain wall-full configuration (complete assembly	Fire resistance tests for non-load bearing elements. Curtain walling. Full configuration (complete assembly) Performance criteria Integrity ,Insulation and Radiation	BS EN 1364-3
	Non load bearing elements-Curtain wall-(Part configuration)	Fire resistance tests for non-load bearing elements. Curtain walling. Part configuration Performance criteria Integrity ,Insulation and Radiation	BS EN 1364-4

Note: For history details of accredited conformity assessment activities, please refer to Dubai Accreditation Department, Dubai Municipality.

SCOPE OF ACCREDITATION

Construction Materials Testing

Material Lab

Al Quoz Industrial Area 4

Dubai- United Arab Emirates

Scope Issue No: 10 **Accreditation Certificate No: LB-008-TEST**

Scope Validity Period: 07-03-2016 to 06-03-2019 **Issued by (Head of Section):**

Type of Task	Materials/Products	Task Name	Standard method
Fire Resistance	Doors, Shutters and open able windows	Fire resistance and smoke control tests for door and shutter assemblies, open able windows and elements of building hardware. Fire resistance test for door and shutter assemblies and open able windows Performance criteria Integrity ,Insulation and Radiation	BS EN 1634-1
	Building materials and structures	Fire tests on building materials and structures-method for determination of the fire resistance of elements of construction (general principles) (non load bearing only) Performance criteria Integrity ,Insulation and Radiation	BS 476.20

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Scope Validity Period: 07-03-2016 to 06-03-2019 **Issued by (Head of Section):**

Type of Task	Materials/Products	Task Name	Standard method
Fire Resistance	Building materials and structures	Fire tests on building materials and structures- method for determination of the fire resistance of non-load bearing elements of construction Performance criteria Integrity ,Insulation and Radiation	BS 476.22
		Fire-resistance tests - Elements of building construction - Part 1: General requirements (non load bearing only) Performance criteria Integrity ,Insulation and Radiation	ISO 834-1
		Fire-resistance tests — Elements of building construction -- Part 8: Specific requirements for non-load bearing vertical separating elements Performance criteria Integrity ,Insulation and Radiation	ISO 834-8

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Scope Issue No: 10 **Accreditation Certificate No: LB-008-TEST**

Scope Validity Period: 07-03-2016 to 06-03-2019 **Issued by (Head of Section):**

Type of Task	Materials/Products	Task Name	Standard method
Fire Resistance	Doors and shutters	Fire resistance tests- Door and shutter assemblies. Performance criteria Integrity ,Insulation and Radiation	ISO 3008
	Building construction – glazed elements	Fire-resistance tests - Elements of building construction - Glazed elements Performance criteria Integrity ,Insulation and Radiation	ISO 3009
Mechanical/ Physical	Water proofing membrane	Standard Test Method for Water Absorption of Plastics	ASTM D570
		Special Directive for the Assessment of Reinforced Water proof Covering of Atactic Polypropylene (APP) polymer Bitumen and Styrene Butadiene-styrene(SBS) Elastomeric Bitumen- Heat Resistance	European Union of Agreement, UEA tc M.O.AT 30 & 31 Para E
		Flexible sheets for waterproofing. Determination of tensile properties. Bitumen sheets for roof waterproofing	EN 12311-1

Note: For history details of accredited conformity assessment activities, please refer to Dubai Accreditation Department, Dubai Municipality

1: Introduction

Material Lab is accredited to perform fire resistance tests in accordance with British, European and International Standards by the Dubai Accreditation Centre (DAC), accreditation certificate no: LB-008-TEST. Material Lab is approved from the United Arab Emirates Ministry of Interior Civil Defence GHQ.

The Fire Testing Division of Material Lab, located in Al Quoz industrial area of Dubai, was commissioned by Karachi Steel Services to perform a fire resistance test on two single leaf, latched fire rated steel door assemblies, both tested simultaneously in the same test frame. The test was witnessed by Mr. Wali Ahmed, representative of the test sponsor and representatives from C.C.S. (Conformity Certification Services)

The aim of this test report is to provide a comprehensive description of the procedure exercised to obtain the fire resistance of two single-action, latched, single leaf fire rated steel door assemblies (Specimen -1 with vision panel & Specimen-2 without vision panel), both mounted in the same testing frame. The door sets, provided by the client, were tested in accordance with British Standard 476 part 22:1987/Amd: 2014 on 28th of January 2017 at Material Lab's main facility.

2: Instrumentation

A fully computerized and automated 3.03m by 3.03m vertical fire resistance testing furnace employing the latest technology in PLC system by Siemens was used for this test. The furnace relies on its 10 powerful burners, which utilize a fixed proportion of liquefied petroleum gas and air, to raise temperature inside the furnace to around 1200 °C. All instruments vital for obtaining conclusive fire resistance data during the test have been identified in table 1.

Equipment ID	Equipment Description
FTF-1	Vertical Large Fire testing furnace, complete with LPG supply system
PLCS-1	PLC system for data acquisition by Siemens
WINCC-1	Visual and calculating software by Siemens
PS-1 to 2	Calibrated Pressure Transducers
IFTC-1 to 9	Calibrated Furnace Internal Thermocouple (K Type)
FSF-2	Steel Frame for sample assembly.
FTIR-1 to 5	Calibrated IR sensors for deflection measurements.
FGG6-1	Gap Gauge ϕ 6 mm
FGG25-1	Gap Gauge ϕ 25 mm
FCP-1	Cotton pad
FCPF-1	Cotton pad supporting frame
EFTC-1 to 10	Calibrated Unexposed Surface Thermocouple (K Type)
FVRT-1	Calibrated Roving Thermometer
FATS-2	Calibrated Ambient temperature sensor
RPF-1	Ambient temperature sensor assembly

Table 1: Detail of equipment used to perform the test

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3: Door Conditioning

The specimens were delivered to the lab on 22/01/2017 by representatives of the client. The doors were stored in ambient conditions of 20°C - 26°C and the moisture content of the supporting construction constituents were determined.

4: Specimen Description:

The specimens under observation were a single - action, latched, single-leaf steel door assembly with 45mm thick leaf having Rockwool core and a vision panel (Specimen – 1) and a single - action, latched, single-leaf steel door assembly with 45mm thick leaf having Rockwool core and without a vision panel (Specimen – 2). All components used for the assembly of the fire rated steel door sets, including all hardware, are provided in table 2.1.

Name	Manufacturer/Supplier	Physical Properties	Additional Details (provided by test sponsor)
Fire Rated Steel Door Leaf (Specimen – 1 & Specimen – 2)	KSS (Manufacturer)	Overall Thickness: 45mm	2mm thick hot dipped galvanized steel sheet bent to form hollow steel leaf profile and filled in with Rockwool
Fire Rated Steel Door Frame (Specimen – 1 & Specimen – 2)	KSS (Manufacturer)	Jamb Width: 200mm	2mm thick galvanized Iron sheet bent to form hollow steel frame profile and filled in with standard grout
SS Pivots (Specimen – 1 & Specimen – 2)	KSS (Manufacturer)	Overall Length: 175mm	3 Nos. of Stainless steel pivots for each door
TG Pull Handles (Specimen – 1)	DORMA (Supplier)	Overall Dimension: (210 x 85) mm	Model No.: TG 9355, Stainless Steel Pull Handle
Mortise Dead Lock (Specimen – 1)	DORMA (Supplier)	-	Model No.: 388A, Mortise Dead Lock with EPC cylinder
Panic Push Bar (Specimen – 1)	DORMA (Supplier)	Overall Dimension: (840 x 145 x 63) mm	Model No.: PHB-3105, Single point locking modular panic bar
Overhead Door Closer (Specimen – 1)	DORMA (Supplier)	Overall Dimension: (245 x 98.5 x 47.5) mm	Model No.: TS-83, Silver colour Over Head Door Closer
Perimeter Seal (Specimen – 1)	NGP (Supplier)	-	-
Automatic Door Bottom Seal (Specimen – 2)	NGP (Supplier)	-	-
Trim with Handle and European Profile Cylinder (Specimen – 2)	ISEO (Brand) JB SAEED(Supplier)	Overall Dimension: (136 x 119 x 69) mm	Model No.: 94011005T, Black Painted Trim with Handle and 5 PIN European Profile Cylinder
Panic Push Bar with Lock (Specimen – 2)	ISEO (Brand) JB SAEED(Supplier)	Overall Dimension: (842 x 165 x 63) mm	Model No.: 944408458T, Panic Push Bar with Self Locking Steel Latch
Overhead Door Closer (Specimen – 2)	NEW STAR (Brand) JB SAEED(Supplier)	Overall Dimension: (250 x 100 x 77) mm	Model No.: 184, Silver colour Over Head Door Closer
Perimeter Seal (Specimen – 2)	PEMKO (Supplier)	-	Model No.: IR 80
Automatic Door Bottom Seal (Specimen – 12)	KILARGO (Supplier)	-	Model No.: IS8100si, Automatic Door Bottom Seal
Rockwool (Specimen – 1 & Specimen – 2)	INCOM ROCKWOOL (PVT) LIMITED	-	Wired Mat Type Rockwool having stated density of 60 – 140 kg/m³ used as leaf infill
Glass for Vision Panel (Specimen – 1)	SCHOTT (Manufacturer)	Nominal Thickness: 6mm	Trade Name: PYRAN S, 6mm Fire Rated Glass
Tape for Vision Panel Glass (Specimen – 1)	-	Nominal Thickness: 3mm	Trade Name: KERAFIX 2000

Table 2.1: Items used for design of fire rated steel doors

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Comprehensive detail regarding the fire rated steel door frame is provided in table 2.2.

Comprehensive detail regarding the fire rated steel door leaf is provided in table 2.3.

Details on all essential hardware (ironmongery) applied to the fire rated door sets are provided in tables 2.4 to 2.13.

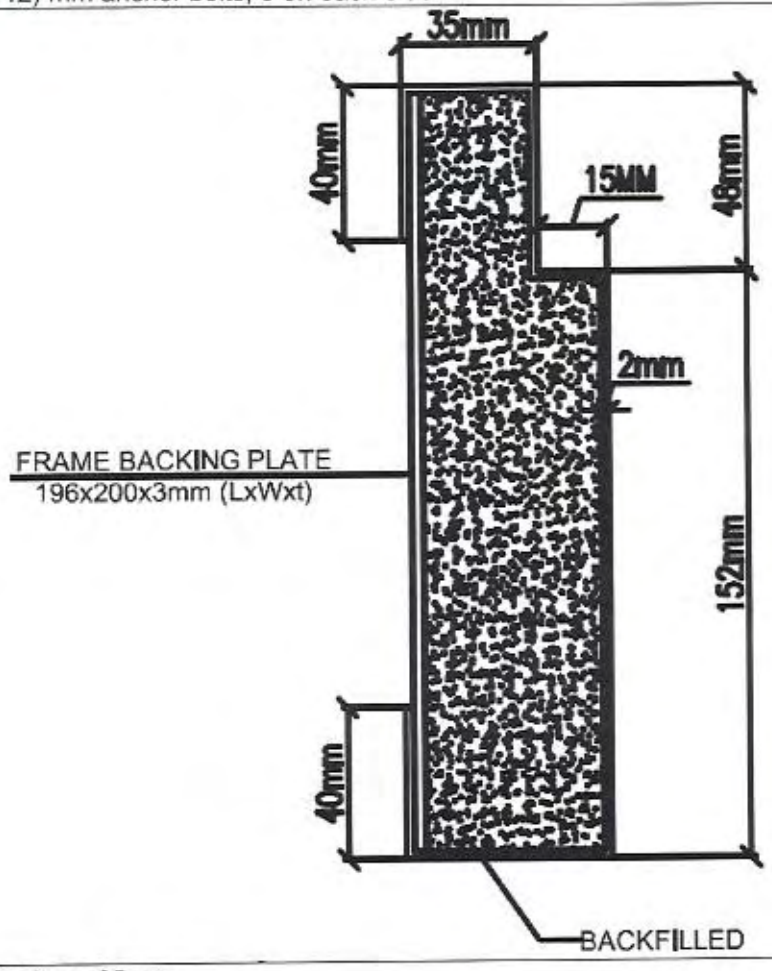
Fire Rated Steel Door Frames (Specimen – 1 & Specimen – 2)	
Overall Dimension of Frame	Height x Width: (2200 x 1000) mm
Overall Width of Jamb	200 mm
Type of Frame	Steel Hollow Frame with Grout as infill
Frame Constituents	2mm thick Galvanized Iron Sheet bent to form frame outer profile
	(196 x 200) mm frame backing plate 3mm thick
	(100 x 12) mm anchor bolts, 3 on each side
Frame Dimensions	
	Rebate Face: 35 mm
	Frame Stop: 15 mm
	Rebate: 48 mm
	Soffit: 152 mm

Table 2.2: Steel Door Frame Details

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Fire Rated Steel Door Leafs (Specimen – 1 & Specimen – 2)	
Overall Dimension of Leaf	Height x Width: (2154 x 926) mm
Overall Thickness of Leaf	45 mm
Core Type	Rockwool Infill
Leaf Constituents	2mm thick galvanized Iron sheet bent to form hollow steel leaf profile
	38mm x 50mm x 1.5mm Fabricated G.I. Box for all Peripheral Frame and Midrails
	38mm x 38mm x 14 Gauge Fabricated G.I. Box
	Wired Mat Type Rockwool having stated density of 100 kg/m³ used as infill
	Automatic Door Bottom Seal

Table 2.3: Steel Door Leaf Details

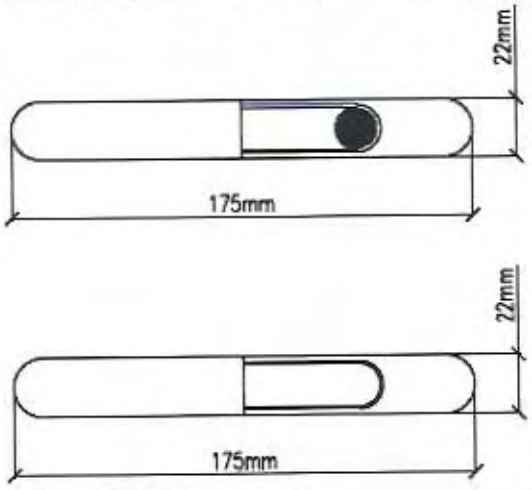
SS Pivot for 60 minutes Fire Rated Steel Doors (Specimen – 1 & Specimen – 2)	
Manufacturer	Karachi Steel Services
Overall Dimension	Length x Thickness: (175 x 22) mm
Material	Stainless Steel
No. of Hinges used in both Doors	3
Pivot Location for both Doors	1) 150mm from top leaf edge to top of 1st hinge
	2) 664mm from bottom of 1st hinge and top of 2nd hinge
	3) 665mm from bottom of 2nd hinge and top of 3rd hinge
	4) 150mm from bottom leaf edge to bottom of 3rd hinge
Pivot Dimension Details	

Table 2.4: Door Hinge Details

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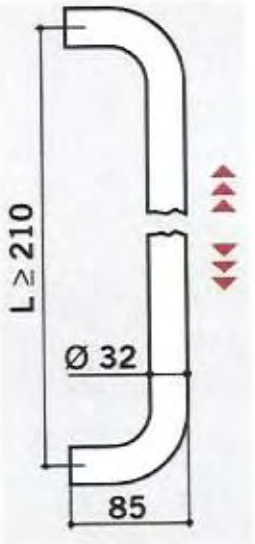
TG Pull Handles for Fire Rated Steel Door (Specimen – 1 Only)	
Manufacturer (Model No.)	DORMA (TG9355)
Material	Stainless Steel
Overall Dimension	Length x Width: (210 x 85) mm
Diameter	32mm
Pull Handle Figure	
Pull Handle Dimension	

Table 2.5: Pull Handle Details

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Email: mld@eim.ae Website: www.mlab.ae

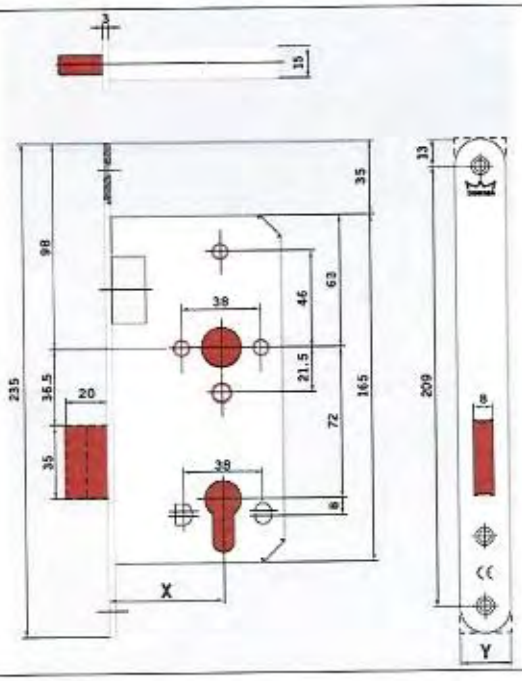
Mortise Dead Lock for Fire Rated Steel Door (Specimen – 1 Only)	
Supplier (Model No.)	DORMA (388A)
Additional Detail	20mm double throw dead bolt, centers 72mm, dead bolt operable by cylinder EPC
Mortise Dead Lock Dimensions	
Mortise Dead Lock Figure	

Table 2.6: Mortise Dead Lock Details

المكتب الرئيسي : صندوق بريد : ١١٤٧١٧ ، دبي – الامارات العربية المتحدة ، هاتف : ٣٤٠٦٥٧٨ ٤ ٩٧١+، فاكس : ٣٤٠٥٦٧٧ ٤ ٩٧١+
أبوظبي : صندوق بريد : ٦١٨٣١ ، هاتف: ٥٥٠٣٠٤٠ ٢ ٩٧١+، فاكس : ٥٥٠٣٠٤١ ٢ ٩٧١+
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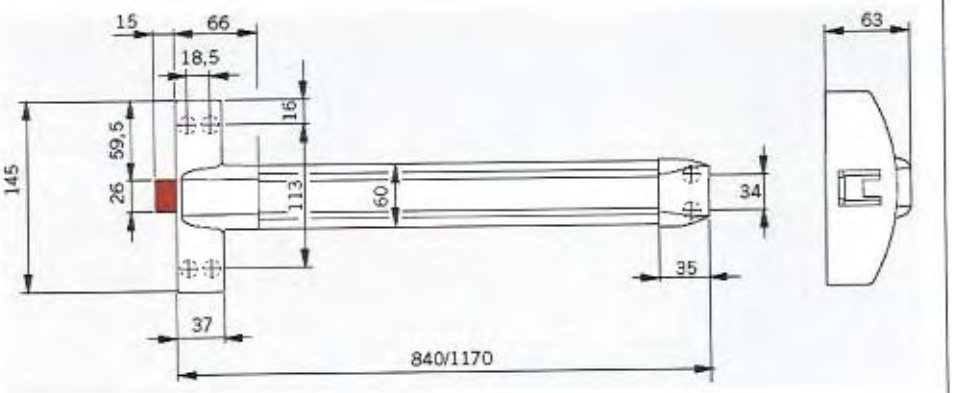
Panic Push Bar for Fire Rated Steel Door (Specimen – 1 Only)	
Supplier (Model No.)	DORMA (PHB 3105)
Overall Dimension	Length x Height: (840 x 145) mm
Overall Thickness	63mm
Additional Details	Single point locking, modular with security anti thrust latch and dogging device
Material	Steel latch, steel latch keeper with spacer plates
Finish	Silver colour
Push Bar Dimensions	

Table 2.7: Panic Push Bar Details

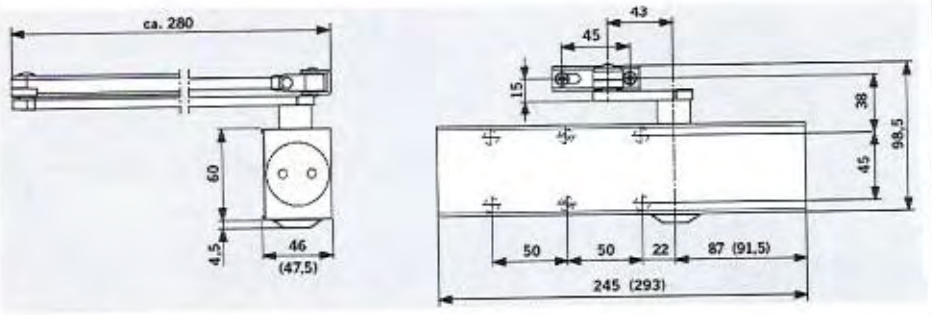
Over Head Door Closer for Fire Rated Steel Door (Specimen – 1 Only)	
Manufacturer (Model No.)	DORMA (TS 83)
Overall Dimension	Length x Height: (245 x 98.5) mm
Overall Thickness	47.5 mm
Finish	Silver Colour
Door Closer Figure	
Door Closer Dimensions	

Table 2.8: Door Closer Details

Material Lab
P.O.BOX: 114717, Dubai, United Arab Emirates

LB-008-TEST

المكتب الرئيسي : صندوق بريد : ١١٤٧١٧ ، دبي – الامارات العربية المتحدة ، هاتف : ٣٤٠٦٥٧٨ ٤ ٩٧١+ ، فاكس : ٣٤٠٥٦٧٧ ٤ ٩٧١+
أبوظبي : صندوق بريد : ٦١٨٣١ ، هاتف: ٥٥٠٣٠٤٠ ٢ ٩٧١+ ، فاكس : ٥٥٠٣٠٤١ ٢ ٩٧١+
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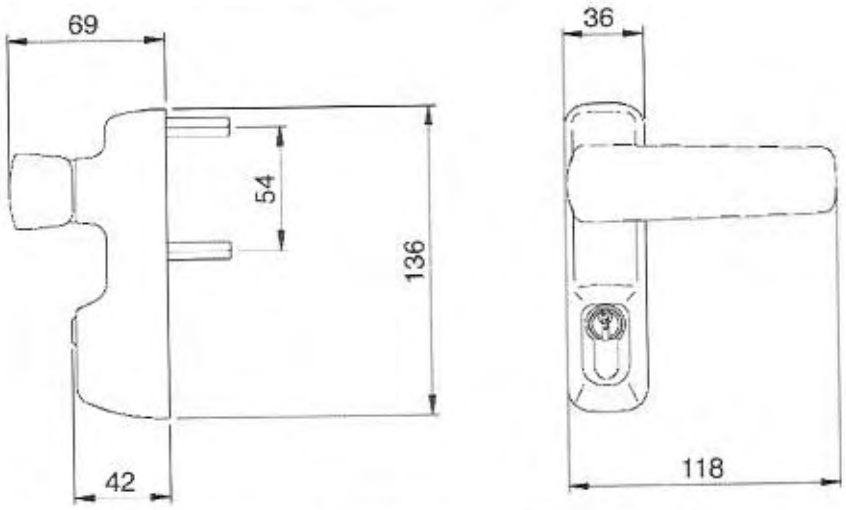
Trim with Handle & European Profile Cylinder for Fire Rated Steel Door (Specimen – 2 Only)	
Brand/Supplier (Model No.)	ISEO/JB Saeed (94011005T)
Overall Dimension	Length x Height: (118 x 136) mm
Overall Thickness	69mm
Additional Details	Painted Black and with 5 PIN European Profile Cylinder
Push Bar Figure	
Push Bar Dimensions	

Table 2.9: Trim with Handle and European Profile Cylinder Details

LB-008-TEST

المكتب الرئيسي : صندوق بريد : ١١٤٧١٧ ، دبي – الامارات العربية المتحدة ، هاتف : ٣٤٠٦٥٧٨ ٤ ٩٧١+، فاكس : ٣٤٠٥٦٧٧ ٤ ٩٧١+
أبوظبي : صندوق بريد : ٦١٨٣١ ، هاتف: ٥٥٠٣٠٤٠ ٢ ٩٧١+، فاكس : ٥٥٠٣٠٤١ ٢ ٩٧١+
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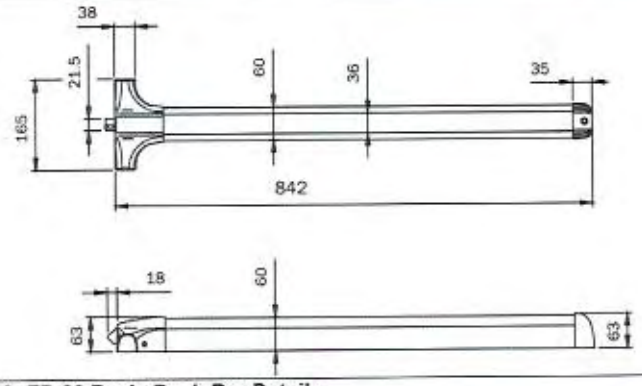
Panic Push Bar for Fire Rated Steel Door (Specimen – 2 Only)	
Brand/Supplier (Model No.)	ISEO/JB Saeed (944408458T)
Overall Dimension	Length x Height: (842 x 165) mm
Overall Thickness	63mm
Additional Details	Self Locking Steel Latch
Push Bar Figure	
Push Bar Dimensions	

Table 2.10: FD 60 Panic Push Bar Details

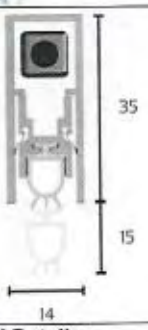
Automatic Door Bottom Seal for Fire Rated Steel Door (Specimen – 1 Only)	
Supplier (Model No.)	KILARGO (IS8010 si)
Overall Dimensions	Height x Thickness: (50 x 14) mm
Door Bottom Seal Figure	
Door Bottom Seal Dimension	

Table 2.11: Automatic Door Bottom Seal Details

المكتب الرئيسي : صندوق بريد : ١١٤٧١٧ ، دبي – الامارات العربية المتحدة ، هاتف : ٩٧١٤ ٣٤٠٦٥٧٨+، فاكس : ٩٧١٤ ٣٤٠٥٦٧٧+
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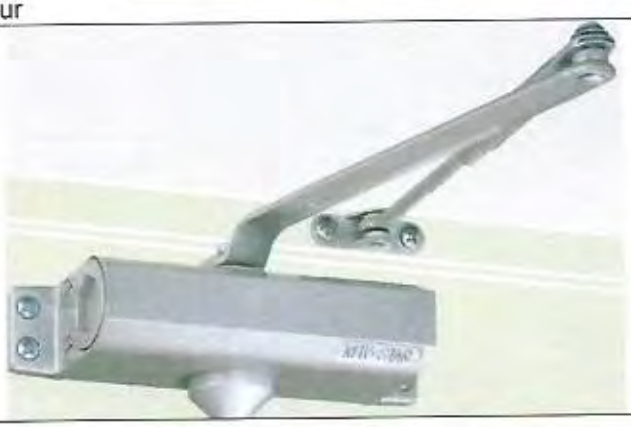
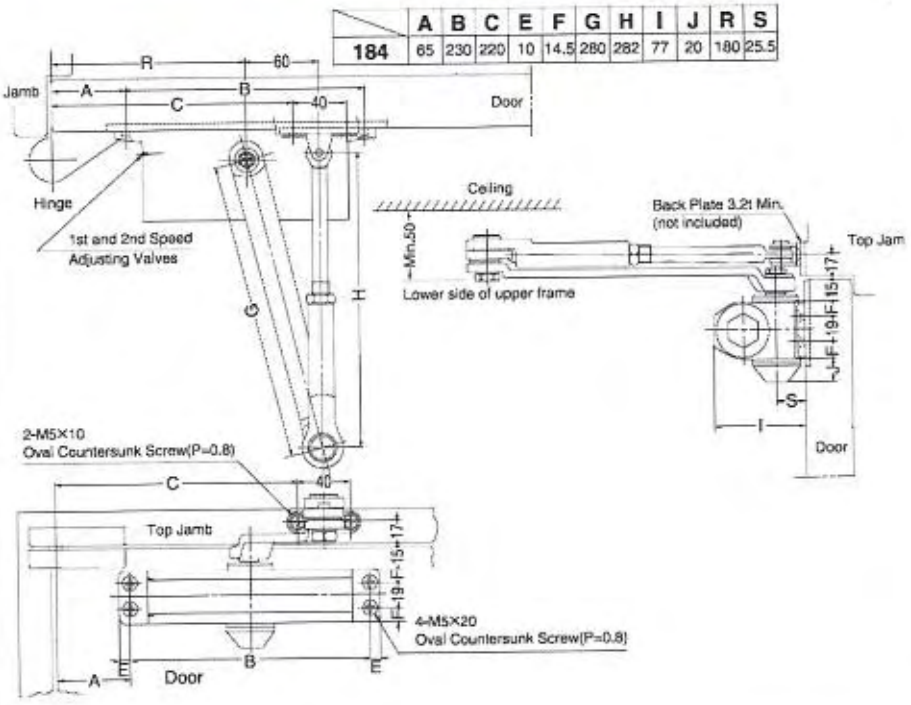
Over Head Door Closer for Fire Rated Steel Door (Specimen – 2 Only)	
Brand/Supplier (Model No.)	NEW STAR/JB Saeed (184)
Overall Dimension	Length x Height: (250 x 100) mm
Overall Thickness	77mm
Finish	Silver Colour
Door Closer Figure	
Door Closer Dimensions	

Table 2.12: Overhead Door Closer Details

المكتب الرئيسي : صندوق بريد : ١١٤٧١٧ ، دبي – الامارات العربية المتحدة ، هاتف : ٣٤٠٦٥٧٨ ٤ ٩٧١+، فاكس : ٣٤٠٥٦٧٧ ٤ ٩٧١+
أبوظبي : صندوق بريد : ٦١٨٣١ ، هاتف: ٥٥٠٣٠٤٠ ٢ ٩٧١+، فاكس : ٥٥٠٣٠٤١ ٢ ٩٧١+
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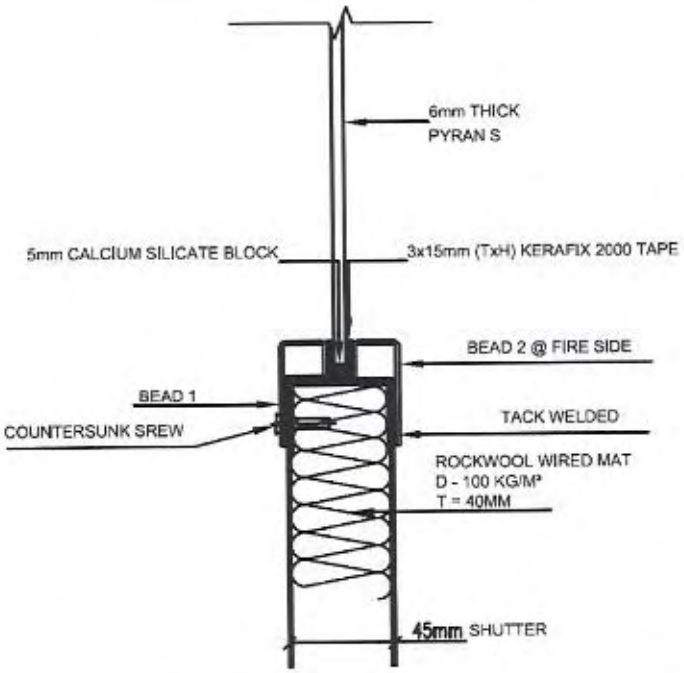
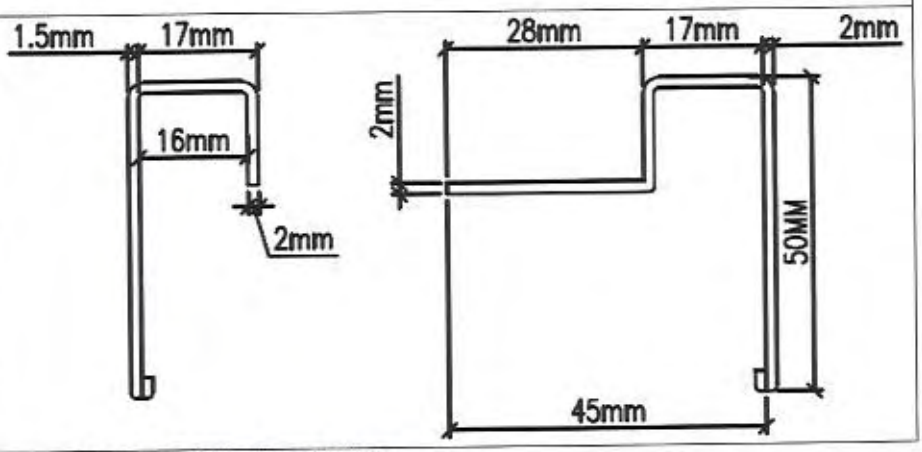
Vision Panel Details for Fire Rated Steel Door (Specimen – 1 Only)	
Manufacturer (Trade Name)	SCHOTT (PYRAN S)
Vision Panel Overall Dimensions	(375 x 375) mm
Glass Nominal Thickness	6 mm
Aperture Dimension	(300 x 300) mm
Glass Overall Dimension	(310 x 310) mm
Visible Glass Dimension	(275 x 275) mm
Glass Seal Details	3mm thick KERAFIX 2000 Tape applied on glass perimeter overlapping 15mm and 5mm thick Calcium Silicate spacers on bottom only
Vision Panel Frame Detail	(50 x 45) mm & (50 x 17) mm, 2mm thick Steel Beading Profiles
Vision Panel Frame Fixing Detail	Steel Beading tack welded to leaf on exposed side and screwed on unexposed side
Vision Panel Details	
Glazing Bead Details	

Table 2.13: Vision Panel Details

المكتب الرئيسي : صندوق بريد : ١١٤٧١٧ ، دبي – الامارات العربية المتحدة ، هاتف : ٣٤٠٦٥٧٨ ٤ ٩٧١+ ، فاكس : ٣٤٠٥٦٧٧ ٤ ٩٧١+
أبوظبي : صندوق بريد : ٦١٨٣١ ، هاتف: ٢٥٥٠٣٠٤٠ ٢ ٩٧١+ ، فاكس : ٢٥٥٠٣٠٤١ ٢ ٩٧١+
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Installation of FD 60 Doors (Specimen – 1):

Gap at sill level between the FD60 door panels and the floor was approximately 5mm. Gap between the FD 60 door panels and frames on fire exposed side, both vertical and horizontal sides, was less than 2mm. Gap between the FD 60 door panels and frames on front side, both vertical and horizontal sides, was less than 5mm. Figure 1.1 to 1.5 illustrates front, side and fixing details of the completed FD 60 door panels and frame assembly.

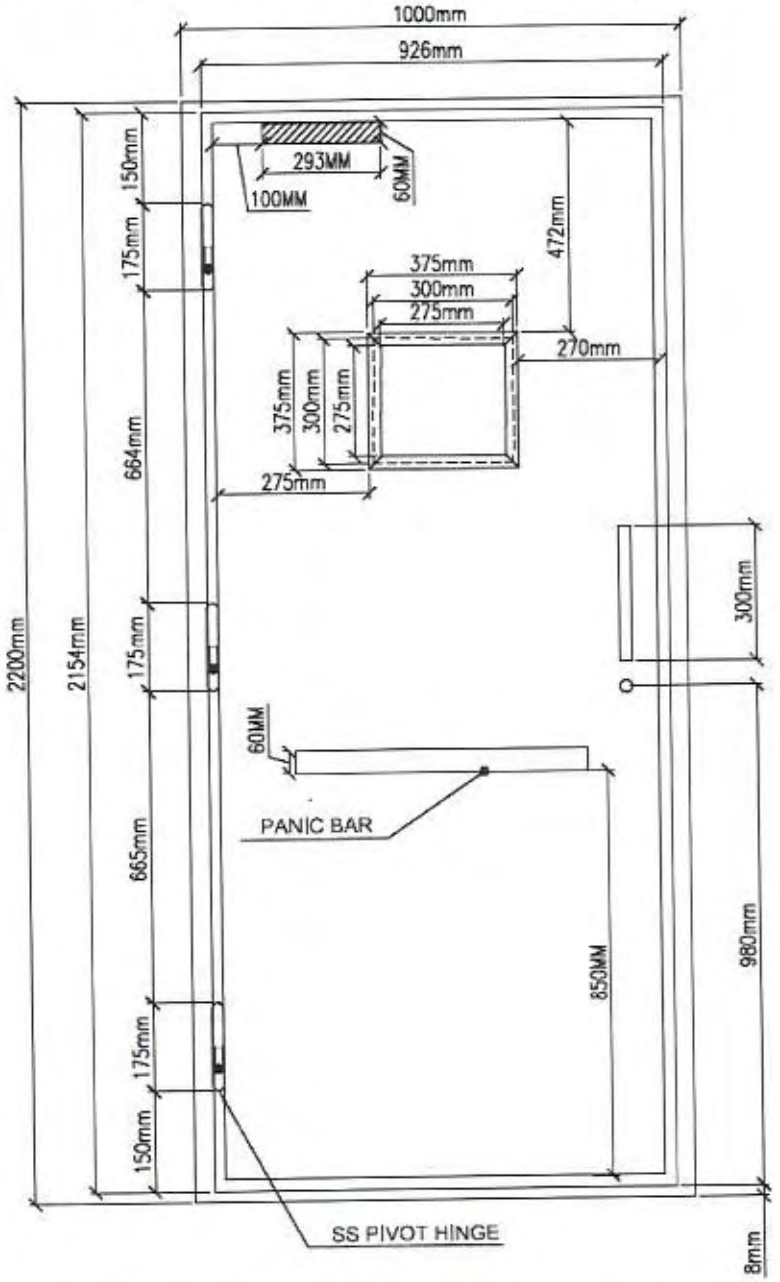

Figure 1.1: Fire side view of the assembled door set (Specimen – 1)

المكتب الرئيسي : صندوق بريد : ١١٤٧١٧ ، دبي – الامارات العربية المتحدة ، هاتف : ٣٤٠٦٥٧٨ ٤ ٩٧١+، فاكس : ٣٤٠٥٦٧٧ ٤ ٩٧١+
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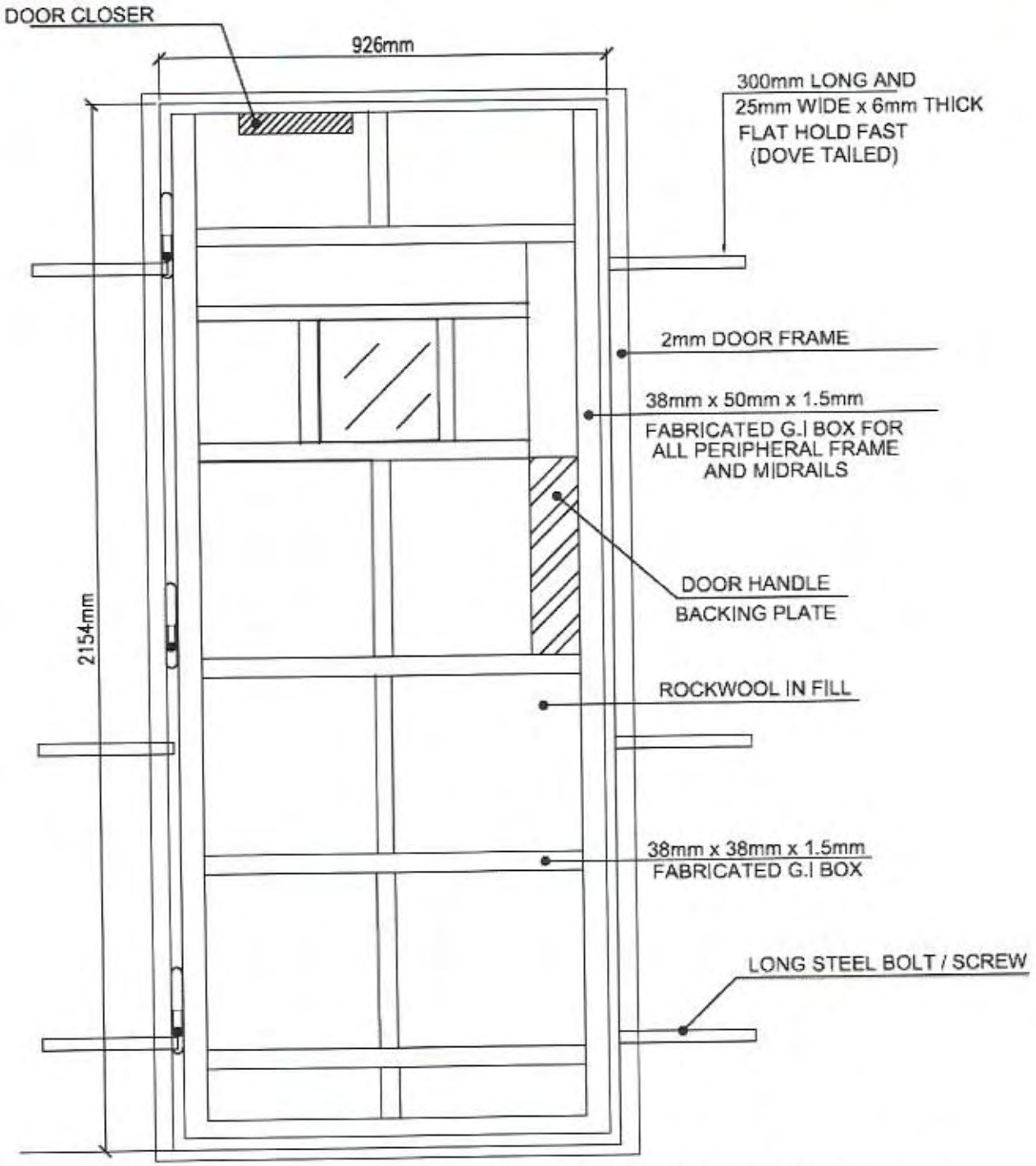

Figure 1.2: Internal view showing stiffener layout of the assembled door set (Specimen – 1)

المكتب الرئيسي : صندوق بريد : ١١٤٧١٧ ، دبي – الامارات العربية المتحدة ، هاتف : ٣٤٠٥٦٧٨ ٤ ٩٧١+ ، فاكس : ٣٤٠٥٦٧٧ ٤ ٩٧١+
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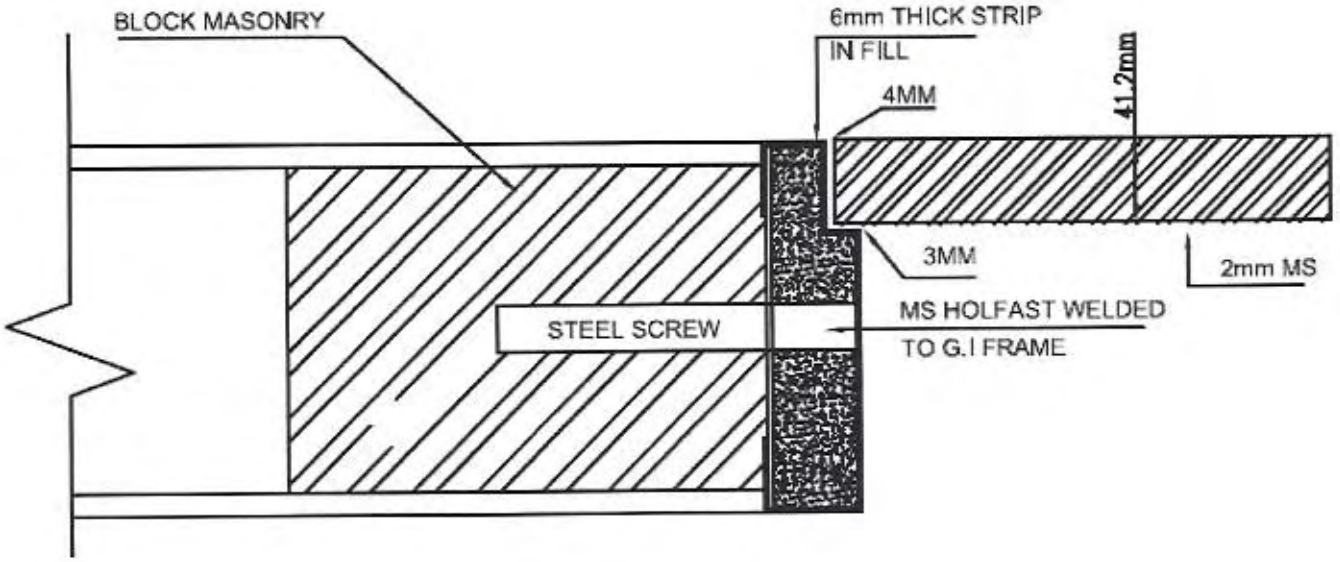

Figure 1.3: Top view of right section showing fixing details of frame and leaf of door set (Specimen – 1)

Sr. No.	Component	Height
1	Door Leaf	2154
2	Frame Rebate Face	35
3	Vertical Door Gap between Frame and Leaf	3
4	Door Gap between Door Leaf and Floor	8
Total Height		**2200**

Table 2.14: Dimensional verification of height of Specimen – 1 dimensions

Sr. No.	Component	Width
1	Door Leaf	926
2	Frame Rebate Face	35 * 2
3	Door Gap between Frame and Leaf	2 * 2
Total Width		**1000**

Table 2.15: Dimensional verification of width of Specimen – 1 dimensions

المكتب الرئيسي : صندوق بريد : ١١٤٧١٧ ، دبي – الامارات العربية المتحدة ، هاتف : ٣٤٠٦٥٧٨ ٤ ٩٧١+، فاكس : ٣٤٠٥٦٧٧ ٤ ٩٧١+
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Installation of FD 60 Door (Specimen – 2):

Gap at sill level between the FD60 door panels and the floor was approximately 5mm. Gap between the FD 60 door panels and frames on fire exposed side, both vertical and horizontal sides, was less than 2mm. Gap between the FD 60 door panels and frames on front side, both vertical and horizontal sides, was less than 5mm. Figure 1.6 to 1.10 illustrates front, side and fixing details of the completed FD 60 door panels and frame assembly.

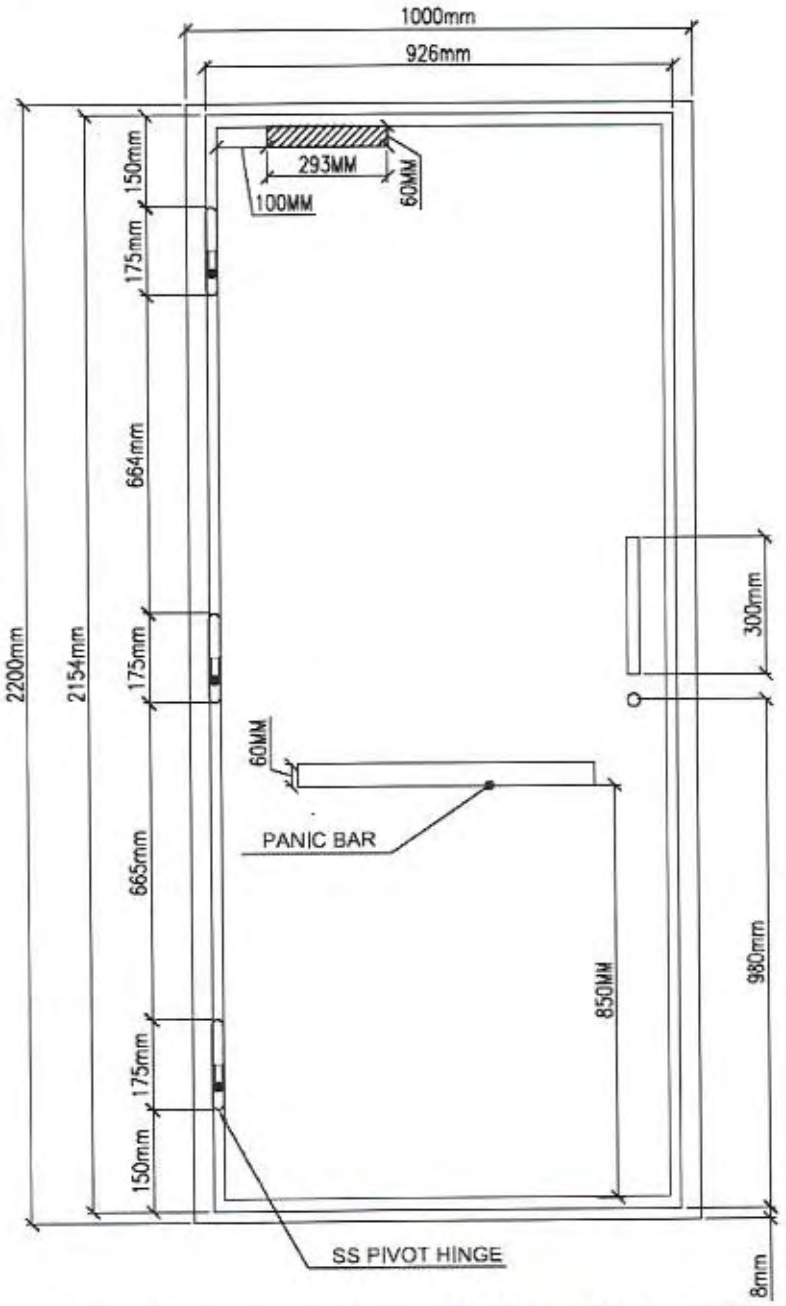

Figure 1.4: Fire side view of the assembled door set (Specimen – 2)

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أبوظبي : صندوق بريد : ٦١٨٣١ ، هاتف: ٥٥٠٣٠٤٠ ٢ ٩٧١+ ، فاكس : ٥٥٠٣٠٤١ ٢ ٩٧١+
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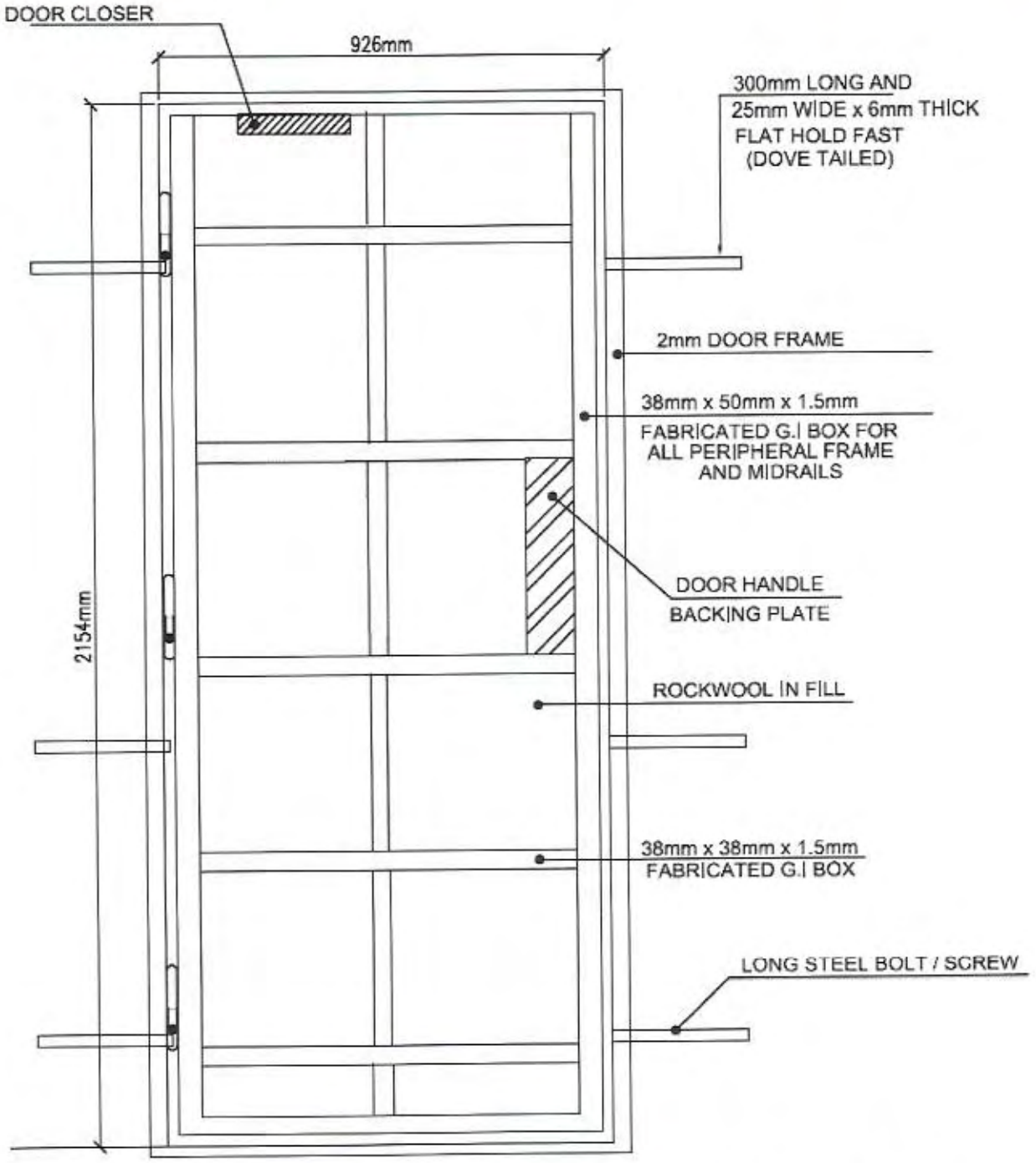

Figure 1.5: Internal view showing stiffener layout of the assembled door set (Specimen – 2)

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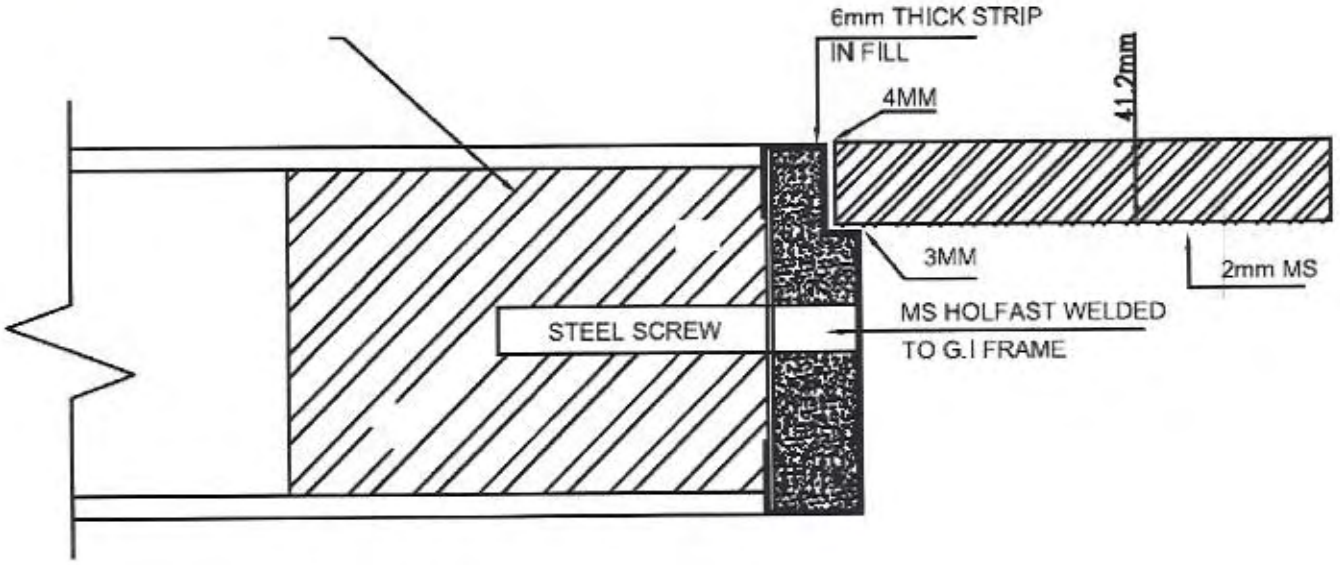

Figure 1.6: Top view of right section showing fixing details of frame and leaf of door set (Specimen – 1)

Sr. No.	Component	Height
1	Door Leaf	2154
2	Frame Rebate Face	35
3	Vertical Door Gap between Frame and Leaf	3
4	Door Gap between Door Leaf and Floor	8
Total Height		**2200**

Table 2.16: Dimensional verification of height of Specimen – 2 dimensions

Sr. No.	Component	Width
1	Door Leaf	926
2	Frame Rebate Face	35 * 2
3	Door Gap between Frame and Leaf	3 * 2
Total Width		**1000**

Table 2.17: Dimensional verification of width of Specimen – 2 dimensions

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5: Specimen Preparation

A rigid steel frame with fire resistive concrete blocks fixed on its internal perimeter having an opening of 3.03 x 3.03 meter was used to prepare the specimen for testing. Masonry blocks were used as rigid supporting construction, in accordance with clause 7.3.1 of BS 476-22, as these blocks had a fire resistance greater than the specimen. The blocks were assembled in the testing frame by the laboratory's skilled workers. An opening of 2205mm x 1010mm was left in the right of this supporting construction for the fire rated steel door with vision panel (Specimen – 1) and after a separation distance of 350mm another opening of the same dimension was left on the left side of the supporting construction for assembly of the fire rated steel door (Specimen – 2).

The Steel door assemblies were then fixed in to the supporting construction opening by the sponsor's skilled workers. The door frames were fixed to the supporting construction and gaps in between the frame and blocks were sealed using mortar. It was ensured that the opening of the door was outside away from the furnace. In accordance with BS EN 1634-1 clause 13.4.2, testing a steel door with opening outside away from the furnace covers integrity criteria for both sides of the door.

After fixation, the specimen was verified to be in accordance with technical drawings provided by the sponsor. Gap measurements were taken. The doors were left in its closed position. No locks were engaged and only the lock latch held the doors in their closed position in accordance with clause 7.3.2 of BS 476-22.

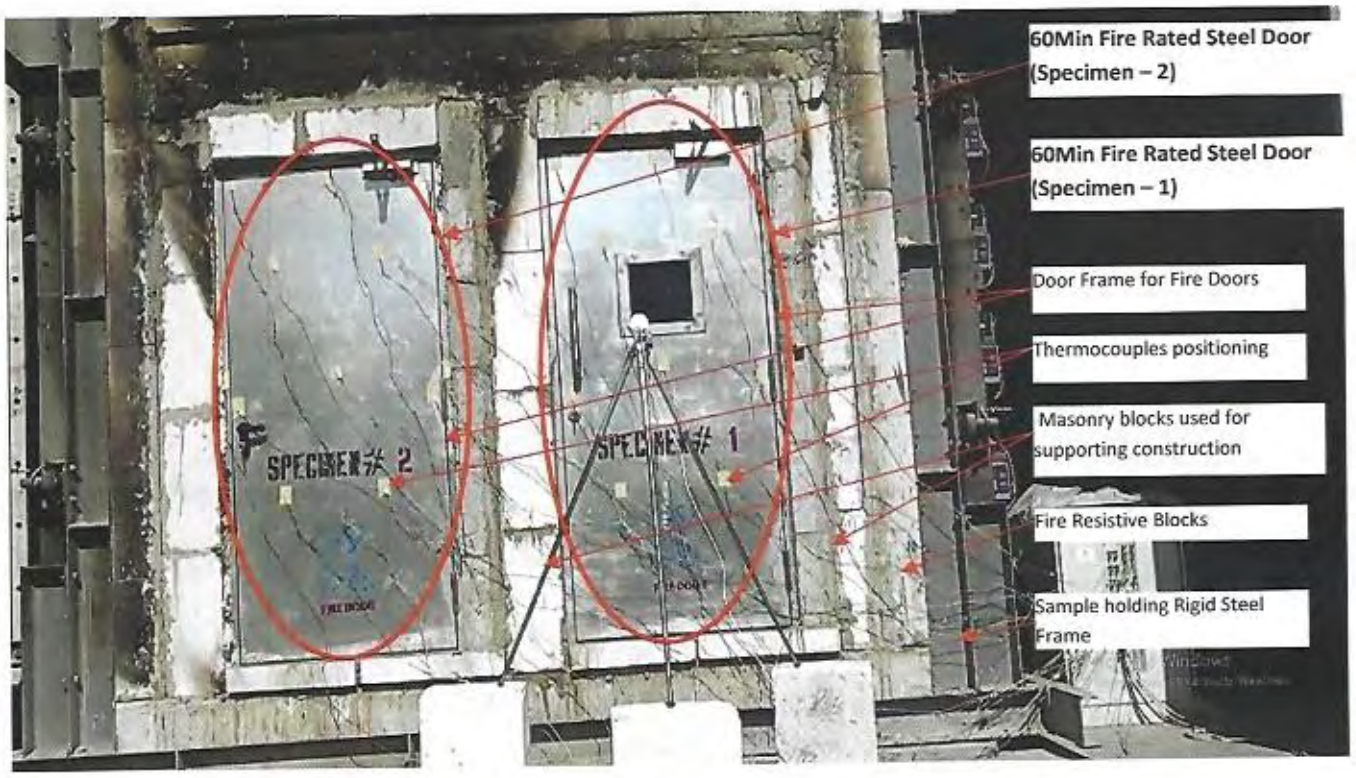

Figure 2: Test specimens mounted in frame for testing

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6: Application of Instruments

Nine internal unshielded K type thermocouples were positioned in accordance with clause 7.4.3 of BS 476-22 for measurement of internal temperature of the furnace. A positioning diagram, figure 8, for the internal thermocouples has been provided in appendix 3.

In order to ensure the insulation properties of both door assemblies, 13 K type thermocouples were installed on unexposed surface of each specimen as per the requirements of BS 476: Part 22. 1987: Amd 2014.

As per clause 7.4.5(a) of BS 476-22, for measuring average temperature rise, five thermocouples (TC-1 to TC-5) were located on each door leaf. The thermocouples were placed at the center of each leaf and at the center of each quarter section of each door leaf. A positioning diagram, figure 10, for thermocouples placed on the door has been provided in appendix 3.

For the determination of maximum temperature rise on the unexposed side of each door leaf and door frame, 8 additional thermocouples (TC-6 to TC-13) were positioned as shown in figure 9 of appendix 3. None of these thermocouples were located closer than 50mm of any hardware or door leaf edges.

Graph used for determining the average temperature of the unexposed side of the fire rated steel door (Specimen – 1), for evaluation of insulation criteria, can be seen in appendix 2, figure 4. Graph used for determining the maximum temperature rise on the unexposed side of the fire rated steel door (Specimen – 1), for evaluation against insulation criteria, can be examined in appendix 2, figure 5.

Graph used for determining the average temperature of the unexposed side of the fire rated steel door (Specimen – 2), for evaluation of insulation criteria, can be seen in appendix 2, figure 6. Graph used for determining the maximum temperature rise on the unexposed side of the fire rated steel door (Specimen – 2), for evaluation against insulation criteria, can be examined in appendix 2, figure 7.

Four infrared sensors were set up for measuring the deflection at mid height of each door and its frame. D1 was set at mid height of the fire rated steel door frame (Specimen – 1) and D2 was set to measure deflection at approximately the center of the fire rated steel door leaf (Specimen – 1). D3 was set at mid height of the fire rated steel door frame (Specimen – 2) and D4 was set to measure deflection at approximately the center of the fire rated steel door leaf (Specimen – 2). Results have been provided in table 5.3 & 5.4.

Two pressure sensing heads, located at 1 m and approximately 2.5 m above the furnace floor, were installed to monitor furnace pressure as per the requirements of clause 3 of BS 476: Part 22. 1987: Amd 2014.

LB-008-TEST

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7: Test Procedure

The preparation and fixation of the thermocouples were followed by mounting of the test frame in front of the furnace. Prior to test commencement, proper functionality of all sensors and thermocouples were ensured for accurate display and data acquisition.

The specimen and its associated supporting construction were thoroughly inspected for cracks or damage. Any gaps between the door frame and the supporting construction was filled in with mortar.

Ambient air temperature surrounding the laboratory was noted. Values characterizing ambient environment directly before and after the test are given in table 3.

Ambient temperature @2:25 p.m. before start of test (°C)	Ambient temperature @4:17 p.m. at end of test (°C)	Difference between ambient at start and end of test (°C)
32.9	33.6	0.7

Table 3: Ambient air temperature surrounding the laboratory

The furnace was then initiated to commence the actual test and a trained fire testing engineer was instructed to take specimen observations throughout the test duration. These observations have been tabulated in Test Results section.

Both the doors were observed simultaneously for the duration of testing.

A video camera was set up to record the full duration of the test. A DVD containing a PDF copy of the test report, pictures from the test and complete video recording of the test has been provided along with this report.

Furnace conditions during the test, such as temperature and pressure, were kept in accordance with clause 3 of BS 476: Part 22: 1987: Amd 2014. During the test a neutral pressure plane was set up 1m above the furnace floor and the pressure at the top of the furnace was not allowed to exceed 20 Pa.

The temperature inside the furnace did not deviate and remained within the tolerance limits set in BS 476: Part 22. The graph representing regulation of internal temperature of the furnace in accordance with BS 476-22 has been provided in figure 3 of appendix 2.

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8: Test Results

OBSERVATIONS:

Observations shown in table 4 form an integral part of this report:

Time [min]	Observation on unexposed side of Fire Rated Steel Doors
0	Commencement of Test.
6	Light smoke observed escaping from lock cylinder of **Specimen – 1**.
8	Light smoke observed escaping from top left corner of **Specimen – 1**.
9	Light smoke observed escaping from top left corner of **Specimen – 2**.
20	Light smoke observed escaping from top horizontal edge of **Specimen – 1 & Specimen – 2**.
24	**Specimen – 1** door closer arm has detached and smoke observed escaping from door closer.
39	**Specimen – 1** vision panel steel beading turning light brown.
40	Smoke observed escaping from bottom sill of **Specimen – 2**.
40	Discoloration of leaf skin at top horizontal edge and vertical sides from top up till mid height of **Specimen – 1**.
43	Discoloration of left vertical edge of **Specimen – 2**.
44	Smoke observed escaping from door closer of **Specimen – 1.**
62	Door closer of **Specimen – 2** has turned golden brown.
65	Discoloration of **Specimen – 1 & Specimen – 2** leaf skin revealing outline and location of stiffeners and internal frame work.
68	Formation of greenish grey patches on various location of leaf skin on **Specimen – 1**.
112	Door closer of **Specimen – 2** has caught fire. Sustained flaming from **Specimen – 2** door closer for more than 10 seconds. **SPECIEMEN – 2 HAS FAILED INTEGRITY CRITERIA AFTER 112 MINUTES OF TESTING.**
112	**Specimen – 1** still stable. No failure observed in **Specimen – 1** after 112 minutes of testing.
112	Termination of Test upon request of the client.

Table 4: Observations of fire rated steel doors (Specimen – 1 = with vision panel & Specimen – 2 = without vision panel)

After being exposed for a total duration of 112 minutes, the fire rated single-leaf steel door assembly with vision panel (Specimen – 1) was evaluated against the integrity and insulation criteria set in clause 7.6 of BS 476: Part 22: 1987: Amd 2014. The door system was found to achieve the following fire resistance properties illustrated in table 5.1.

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Fire Resistance of Single Leaf Steel Door with Vision Panel (Specimen – 1) after 112 minutes of testing:

Fire Rated Steel Single Door Assembly with Rockwool Infill and Vision Panel		
Test Parameters	**Results**	**Remarks**
Insulation: 23 Minutes		
1. Average Temperature	**23 minutes**	Specimen has failed insulation due failure in maximum temperature rise on unexposed surface.
2. Maximum Temperature	**23 minutes**	Maximum temperature recorded after 23minutes of testing was 220 °C @ TC-6 which exceeded standard limits.
Integrity: 112 Minutes		
1. Sustained Flaming	**112 minutes**	No Sustained flaming observed for more than 10 seconds up till 112 minutes of testing
2. 6mm Gap Gauge	**112 minutes**	No propagation or penetration of 6mm gap gauge throughout 112 minutes of testing
3. 25mm Gap Gauge	**112 minutes**	No propagation or penetration of 25mm gap gauge throughout 112 minutes of testing

Table 5.1: Integrity & Insulation Evaluation of Fire Rated Steel Door According to BS 476: Part 22: 1987: Amd 2014

After being exposed for a total duration of 112 minutes, the fire rated single-leaf steel door assembly (Specimen - 2) was evaluated against the integrity and insulation criteria set in clause 6.6 of BS 476: Part 22: 1987: Amd 2014. The door system was found to achieve the following fire resistance properties illustrated in table 5.2.

Fire Resistance of Single Leaf Steel Door without Vision Panel (Specimen – 2) after 112 minutes of testing:

Fire Rated Steel Single Door Assembly with Rockwool Infill and without Vision Panel		
Test Parameters	**Results**	**Remarks**
Insulation: 29 Minutes		
1. Average Temperature	**29 minutes**	Specimen has failed insulation due failure in maximum temperature rise on unexposed surface.
2. Maximum Temperature	**29 minutes**	Maximum temperature recorded after 29minutes of testing was 220 °C @ TC-9 which exceeded standard limits.
Integrity: 112 Minutes		
1. Sustained Flaming	**112 minutes**	Sustained flaming observed from door closer for more than 10 seconds after 112 minutes of testing
2. 6mm Gap Gauge	**112 minutes**	No propagation or penetration of 6mm gap gauge throughout 112 minutes of testing
3. 25mm Gap Gauge	**112 minutes**	No propagation or penetration of 25mm gap gauge throughout 112 minutes of testing

Table 5.2: Integrity & Insulation Evaluation of Fire Rated Steel Door According to BS 476: Part 22: 1987: Amd 2014

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Total Deflection on Specimen – 1 after 112 minutes:

Infra-red Sensor Number	D1	D2
Deflection (mm)	6	25

Table 5.3: Deflection Results:

Total Deflection on Specimen – 2 after 112 minutes:

Infra-red Sensor Number	D3	D4
Deflection (mm)	8	29

Table 5.4: Deflection Results:

9: Limitations

This report details the method of construction, specimen and test preparations, test conditions and the results which were obtained strictly following only the procedures outlined in BS 476: Part 22: 1987: Amd. 2014 and BS 476: Part 20:1987 (General Requirements).

The results only relate to the behavior of the specimen of the elements of construction under the particular conditions of test; they are not intended to be the sole criteria for assessing the potential fire performance of the elements in use nor do they reflect the actual behavior in fires.

The test results refer only to the items tested and does not apply to assemblies with different dimensions or different components. Any interpretations or opinions expressed in this report are outside the scope of DAC accreditation. The test was carried out under standard conditions using testing equipment that is property of the Material Lab, Dubai. This report shall not be reproduced except in full, without the written approval of the laboratory.

Material Lab is an accredited independent laboratory. It is not associated / affiliated with any certification agency, manufacturer or producer in or out side of United Arab Emirates. Material Lab was not involved in any selection of the sampling procedure. The specimens were supplied by representatives of the client. Information regarding the source and model no. of intumescent and hardware were provided by the client.

In accordance with BS EN 1634-1 clause 13.4.2, testing a steel door with opening outside away from the furnace covers integrity criteria for both sides of the door.

Tested and Prepared By

Muhammad Zuhaib Saleem
Fire Testing Engineer

Verified By

Sohail Zafar
Laboratory Manager

سهيل ظفر
Sohail Zafar
Laboratory Manager

P.O.BOX: 114717, Dubai, United Arab Emirates

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Appendix 1:

Specimen drawings as provided by the sponsor (All dimensions are in 'mm')

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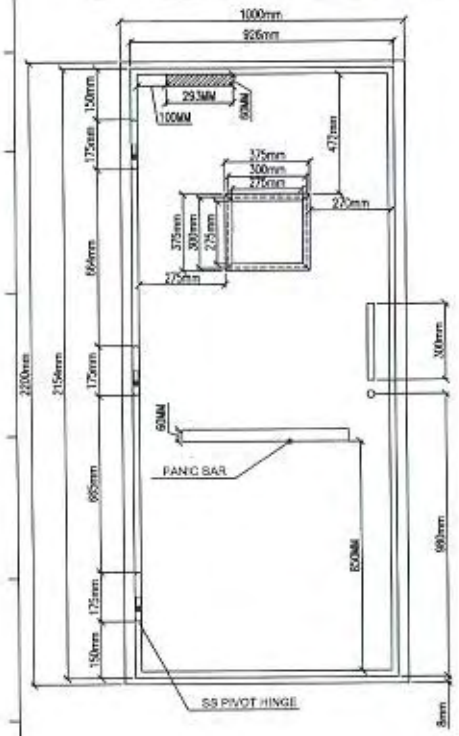
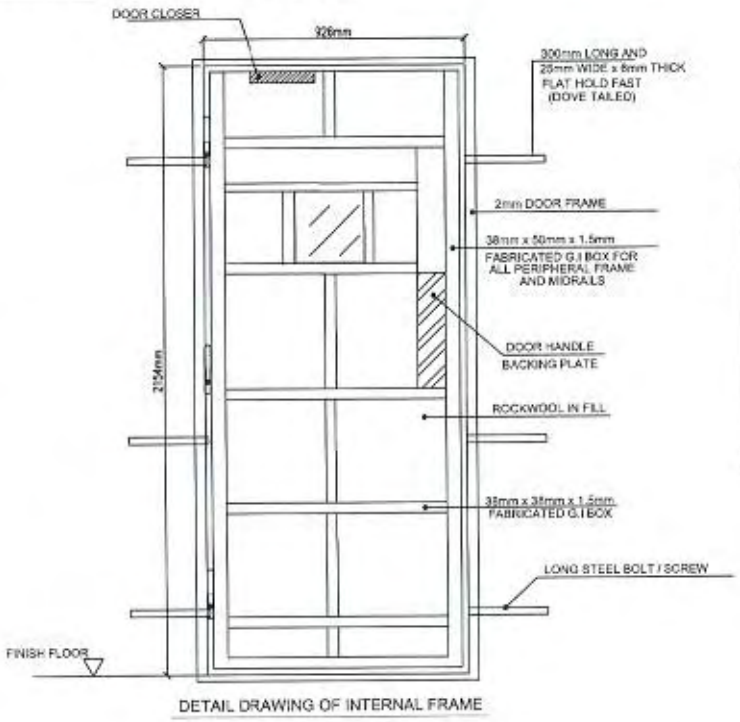
FD 60 MINS. ELEVATION & INTERNAL FRAMING (STIFFENERS, RAILS & STILES





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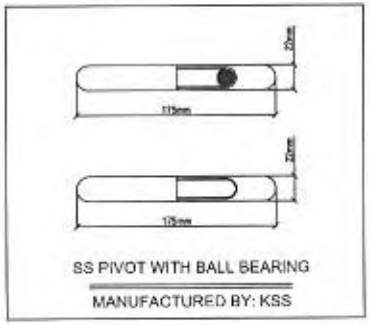
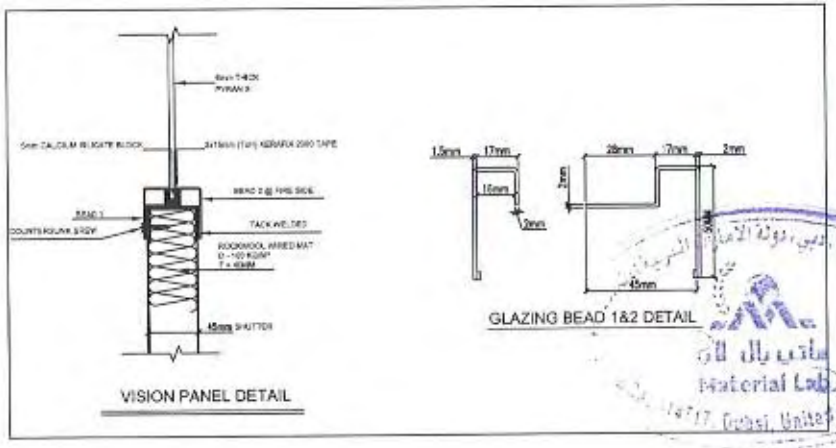
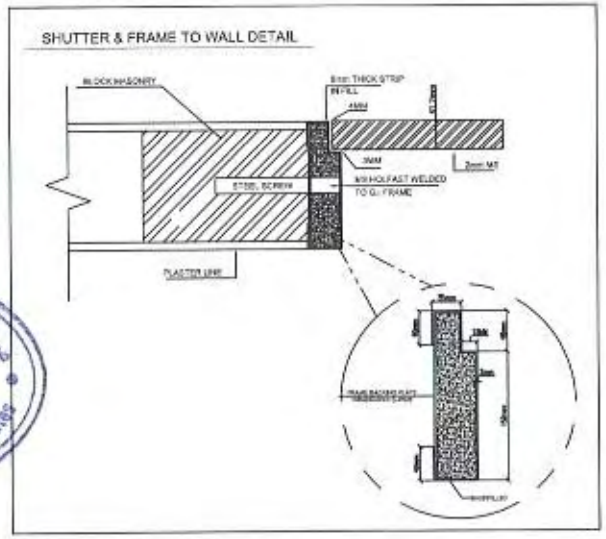






NOTES :

JOINTS – GTAW

FRAMES – BACKFILLED W/LEAN CONCRETE OR CONCRETE GROUTE

FRAME TO WALL GAPS = UP TO 20mm FULLY FILLED WITH WURTH (FU FOAM) OR NWITH GROUT

FRAMES TO SHUTTER GAPS(3 SIDES) = 4mm (max.)THRESHOLD = 8m

DOOR CLOSER – NEW STAR 184

DROP SEAL (AUTOMATIC DOOR)

KILARGO AUTOMATIC DOOR BOTTOM IS 8100–1070mm REF: IS8100si

SELF ADHESIVE PERIMETR SEAL – ASSA ABLOY

PANIC BAR WITH ANTIBACTERIAL ANTI-GEM COATING ISEO–101 REF: 944408458T

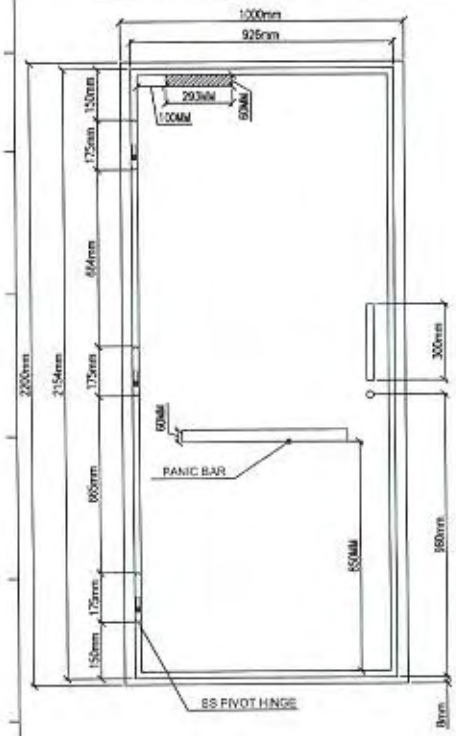
PANIC BAR LOCK ISEO–137

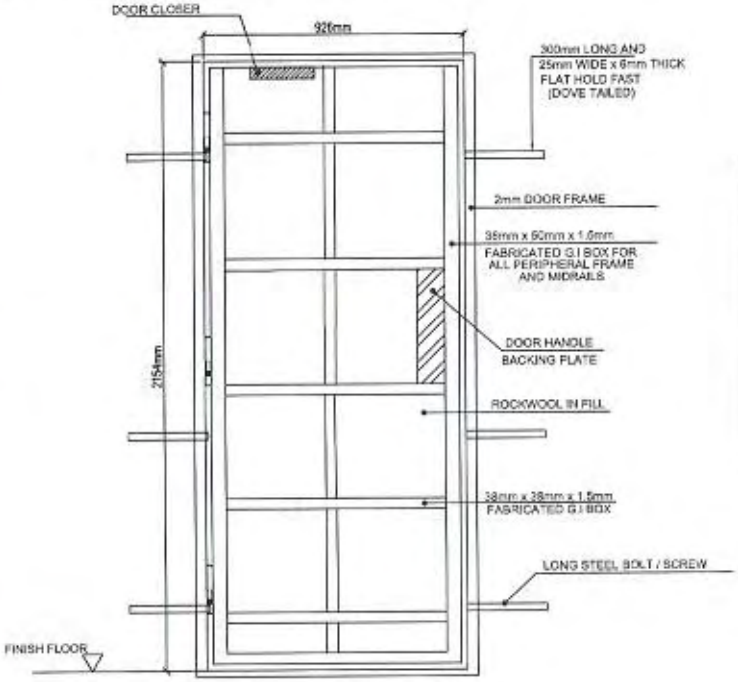
PEMKO SEAL R–80

SUB CONTRACTOR:	KARACHI STEEL SERVICES
SCALE:	NTS
SITE ADDRESS:	GS DOOR (1000X2200 S) SD-14 FD 60 (BS 476-22)
SITE I.D	GETZ PHARMA (ASTOLA)

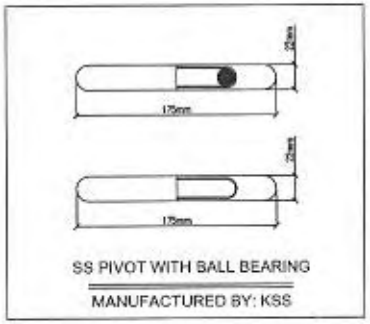
JOB NO.	DRAWING NO.	REV.
13202	LY-01	3

FD 60 MINS. ELEVATION & INTERNAL FRAMING (STIFFENERS, RAILS & STILES



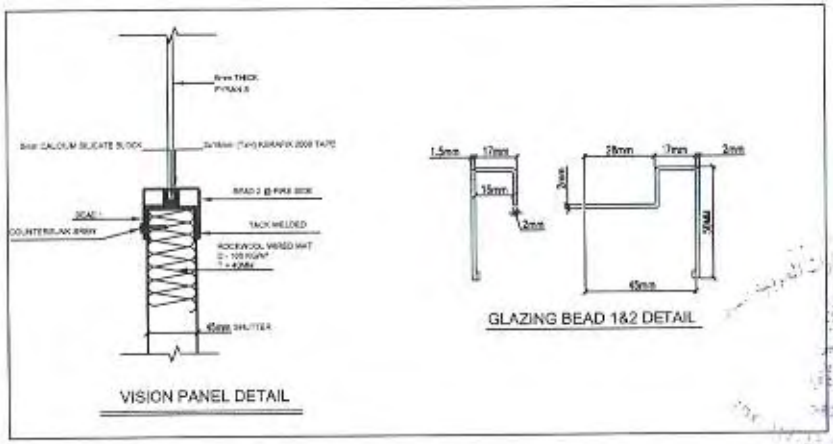


DETAIL DRAWING OF INTERNAL FRAME



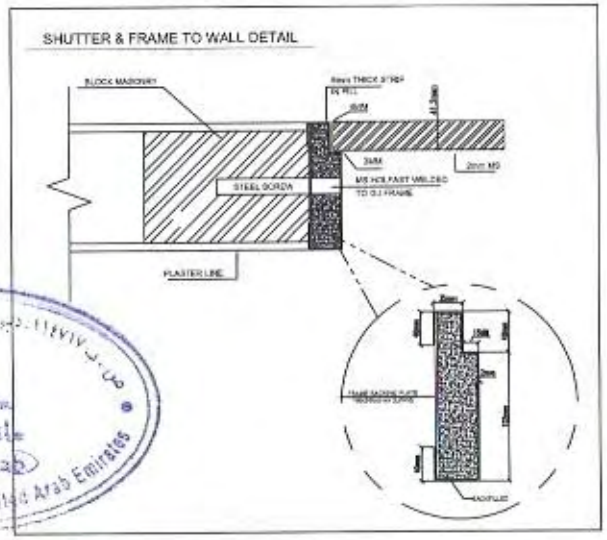
SS PIVOT WITH BALL BEARING

MANUFACTURED BY: KSS



VISION PANEL DETAIL

GLAZING BEAD 1&2 DETAIL



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SITE I.D	GETZ PHARMA (ASTOLA)

JOB NO.	DRAWING NO.	REV.
13202	LY-01	3

Appendix 2:

Data Results & Graphical Illustrations:

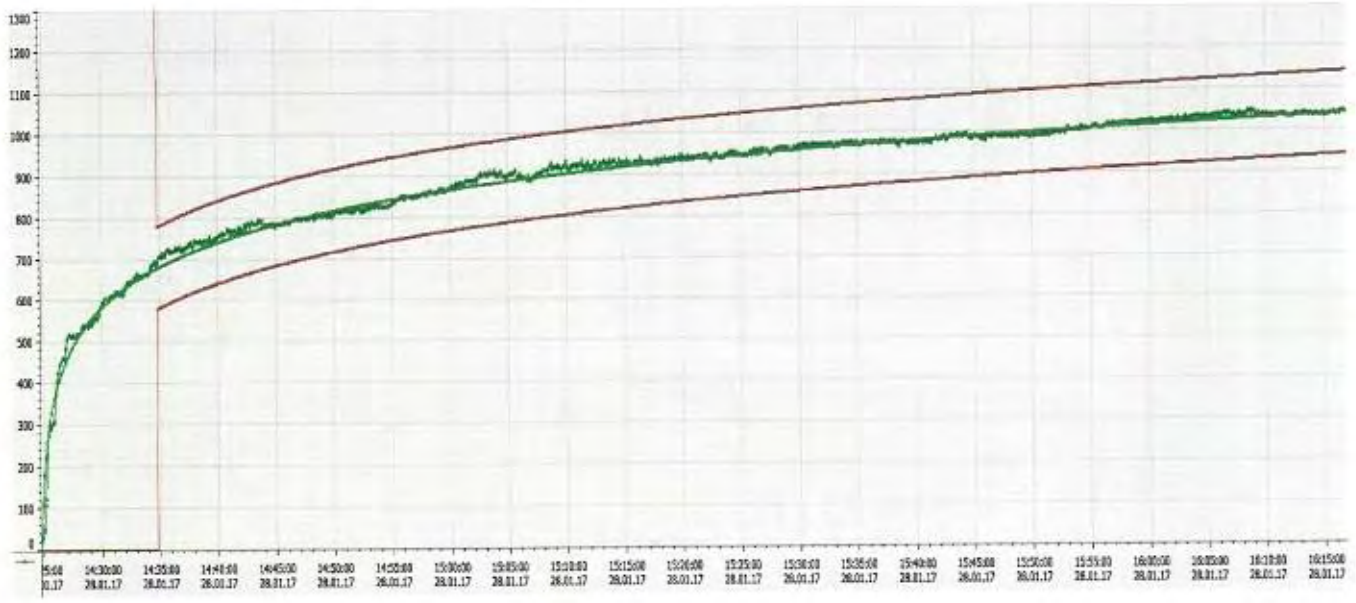

Figure 3: Average Temperature graph of internal furnace thermocouples for complete duration of the test

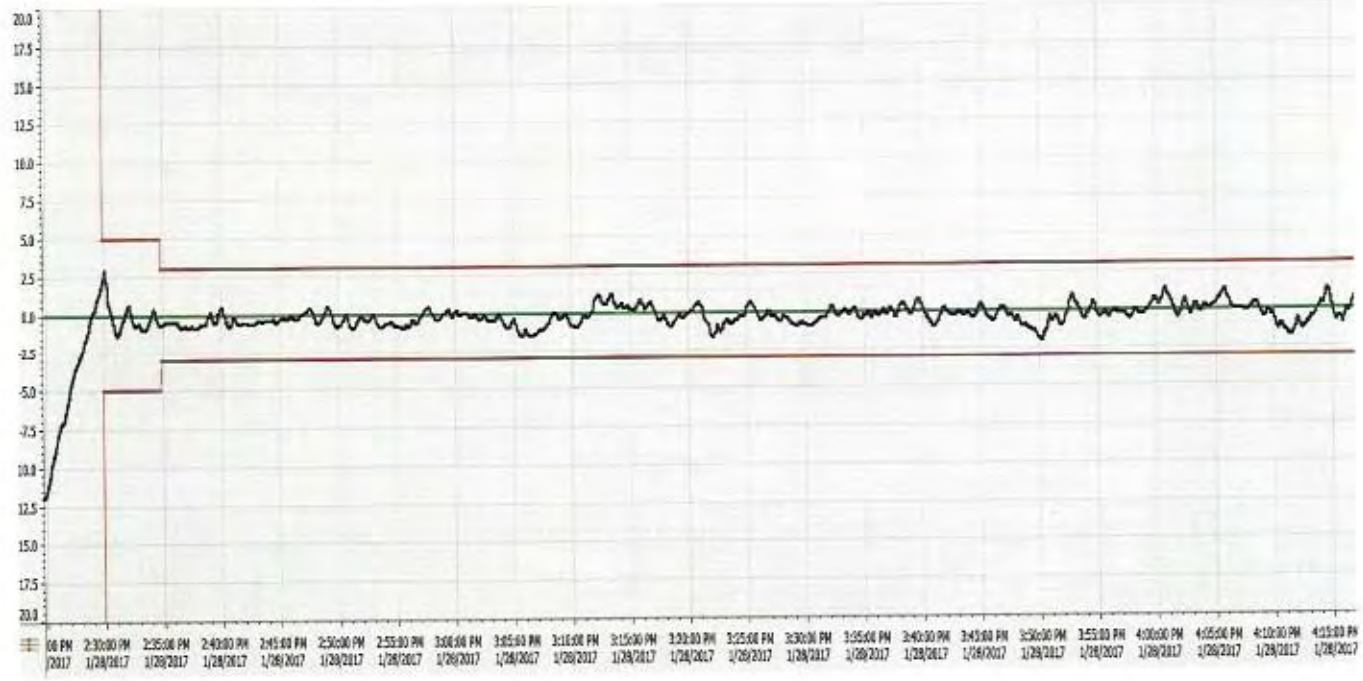

Figure 4: Furnace internal pressure graph for complete duration of the test

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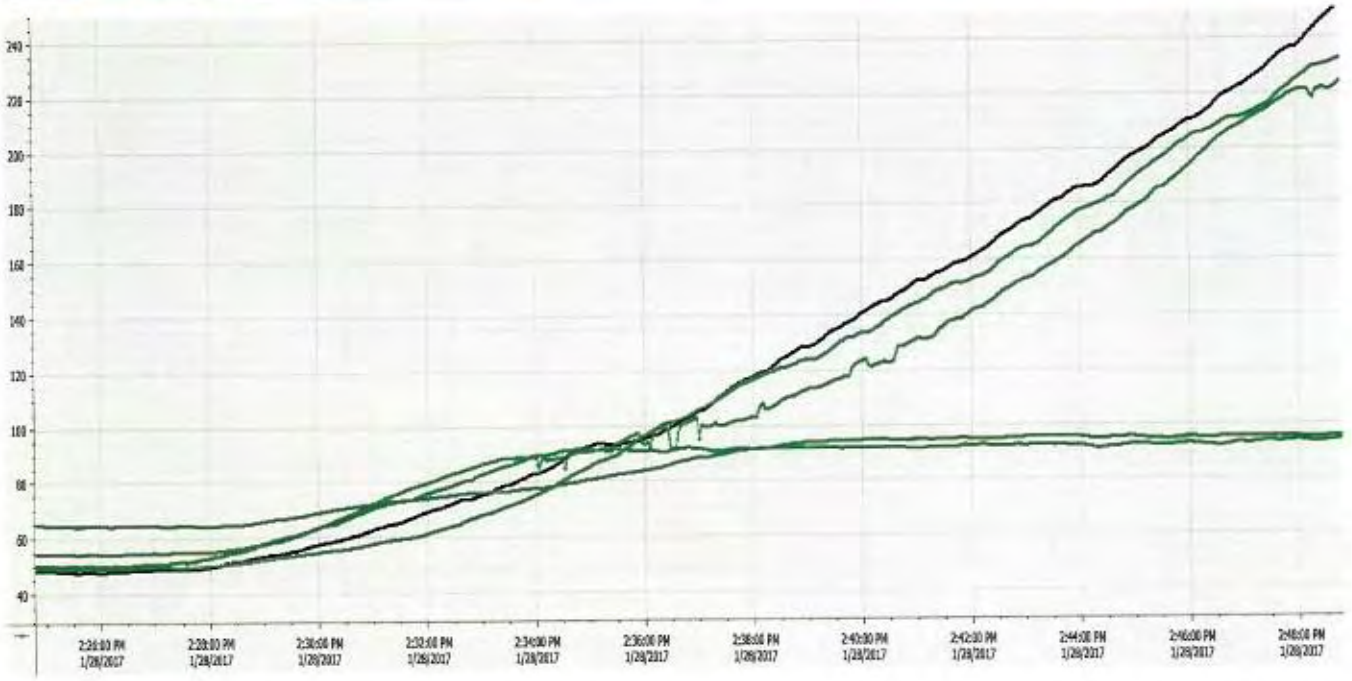

Figure 5: Thermocouple graphs used for obtaining average unexposed surface temperature of steel door assembly, Specimen – 1, (TC1 to TC5) up till 24mins

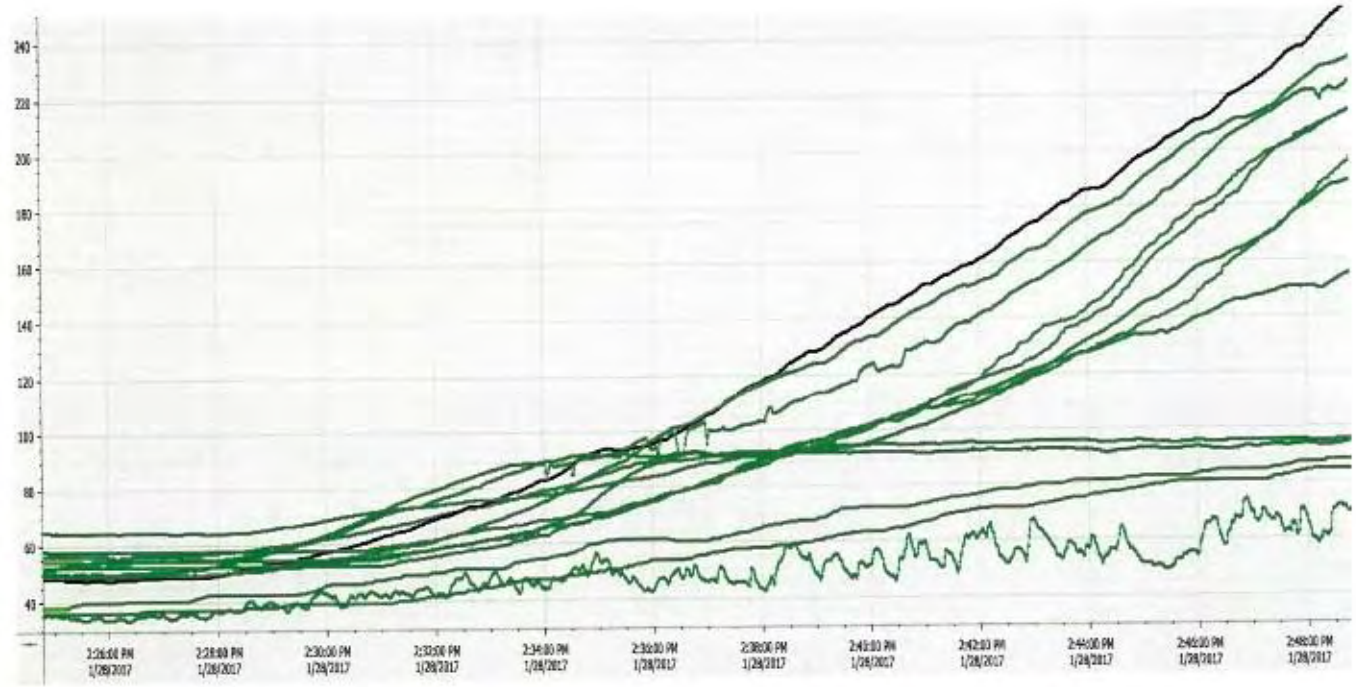

Figure 6: Thermocouple graphs used for obtaining maximum unexposed surface temperature of steel door assembly, Specimen – 1, (TC1 to TC13) up till 24mins

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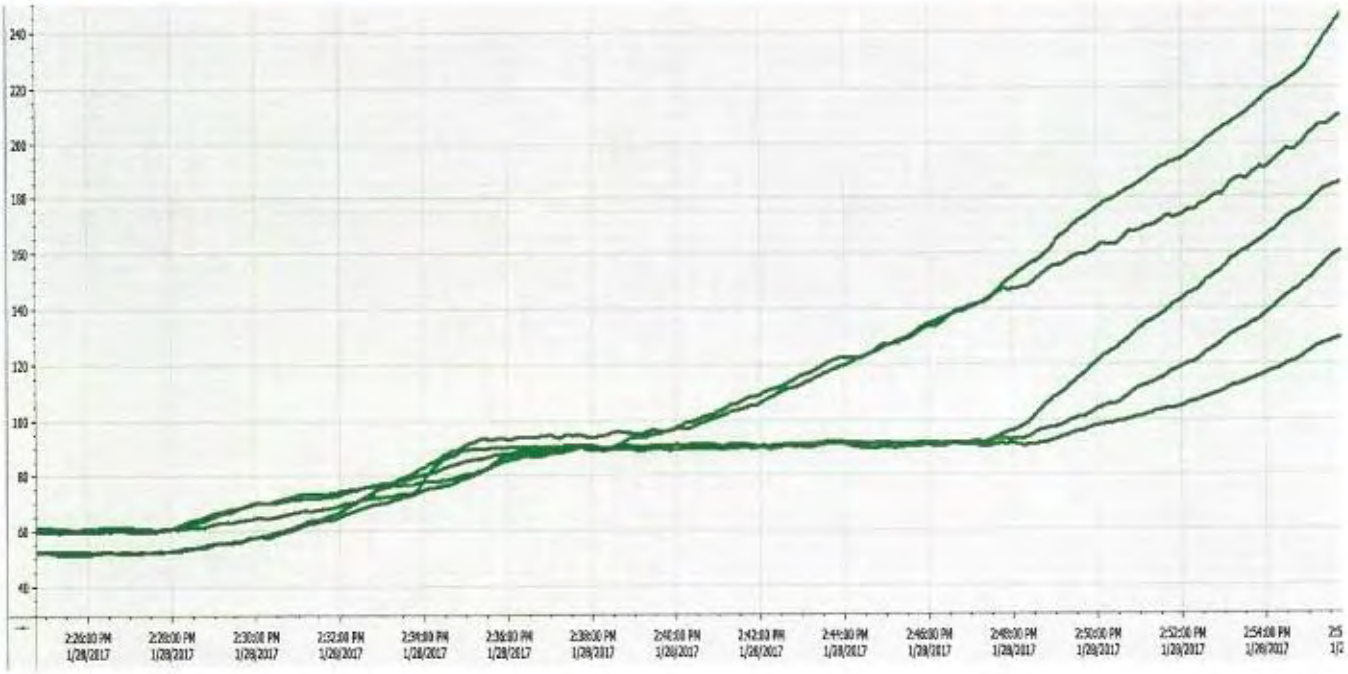

Figure 7: Thermocouple graphs used for obtaining average unexposed surface temperature of FD 60 door assembly, Specimen – 2, (TC1 to TC5) up till 31mins

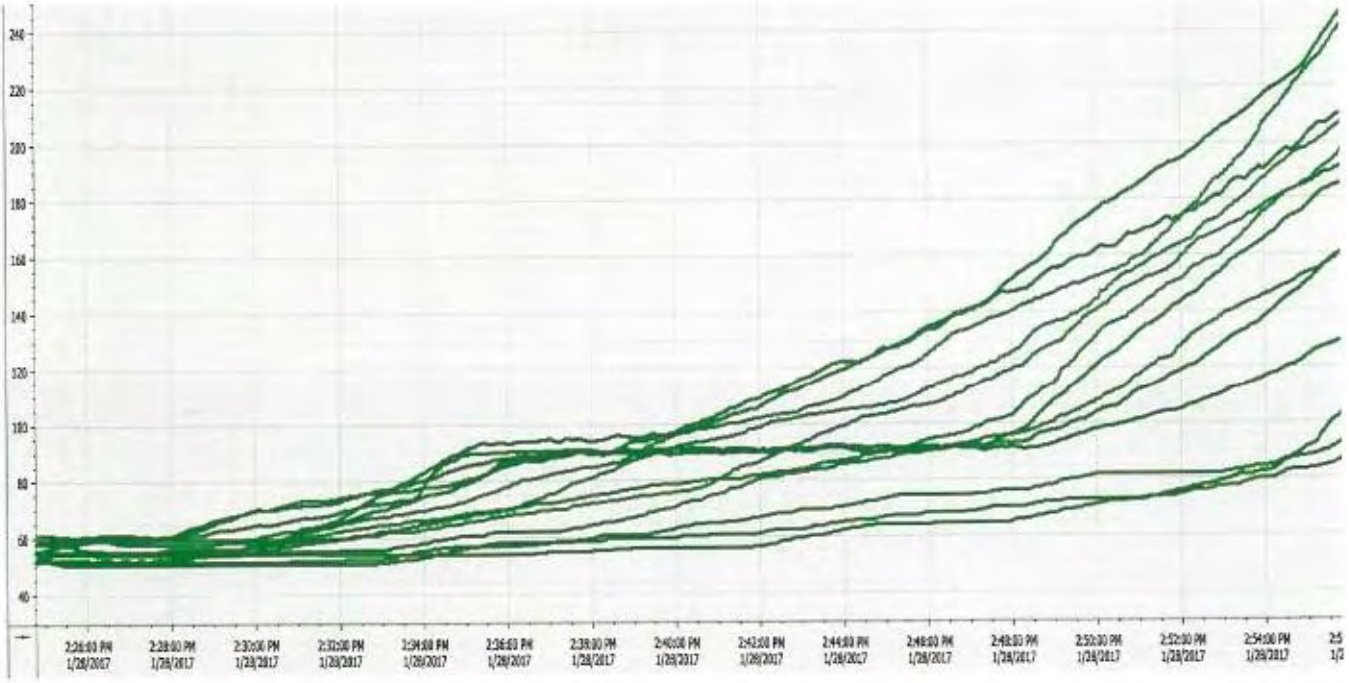

Figure 8: Thermocouple graphs used for obtaining maximum unexposed surface temperature of FD 60 door assembly, Specimen – 2, (TC1 to TC13) up till 31mins

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Appendix 3:

Instrumentation Positioning: (Not to scale, all dimensions in 'mm')

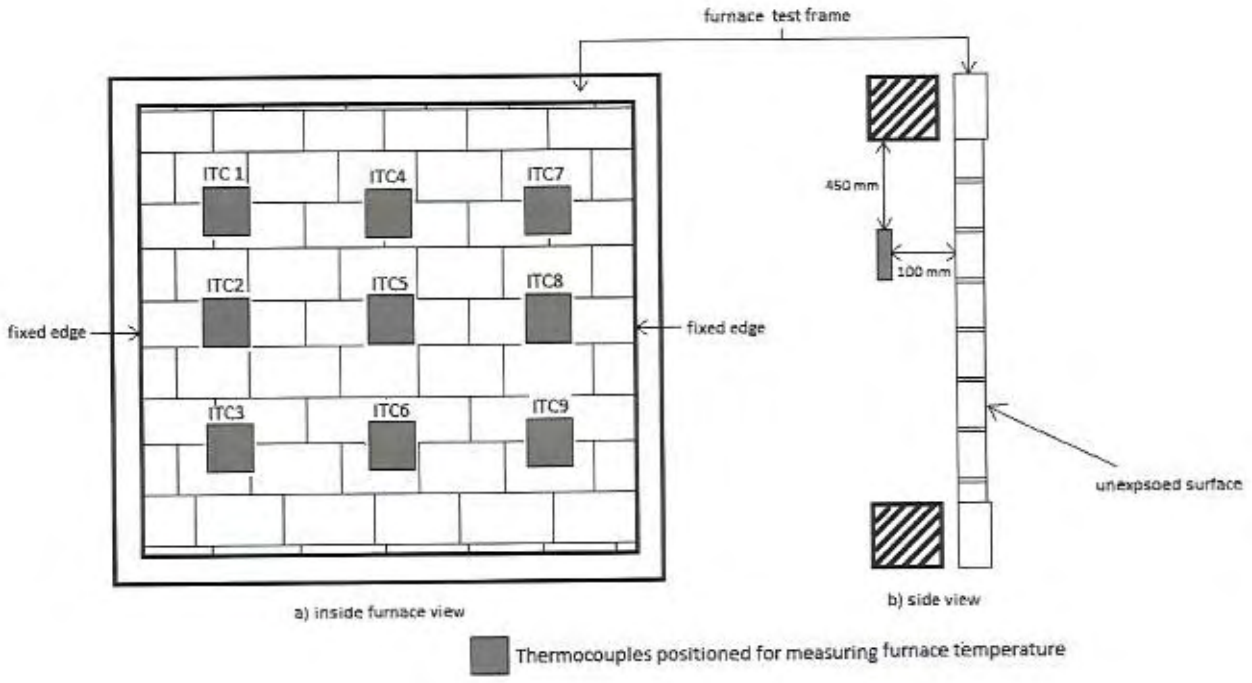

Figure 8: Front view of furnace showing positions of furnace internal thermocouple

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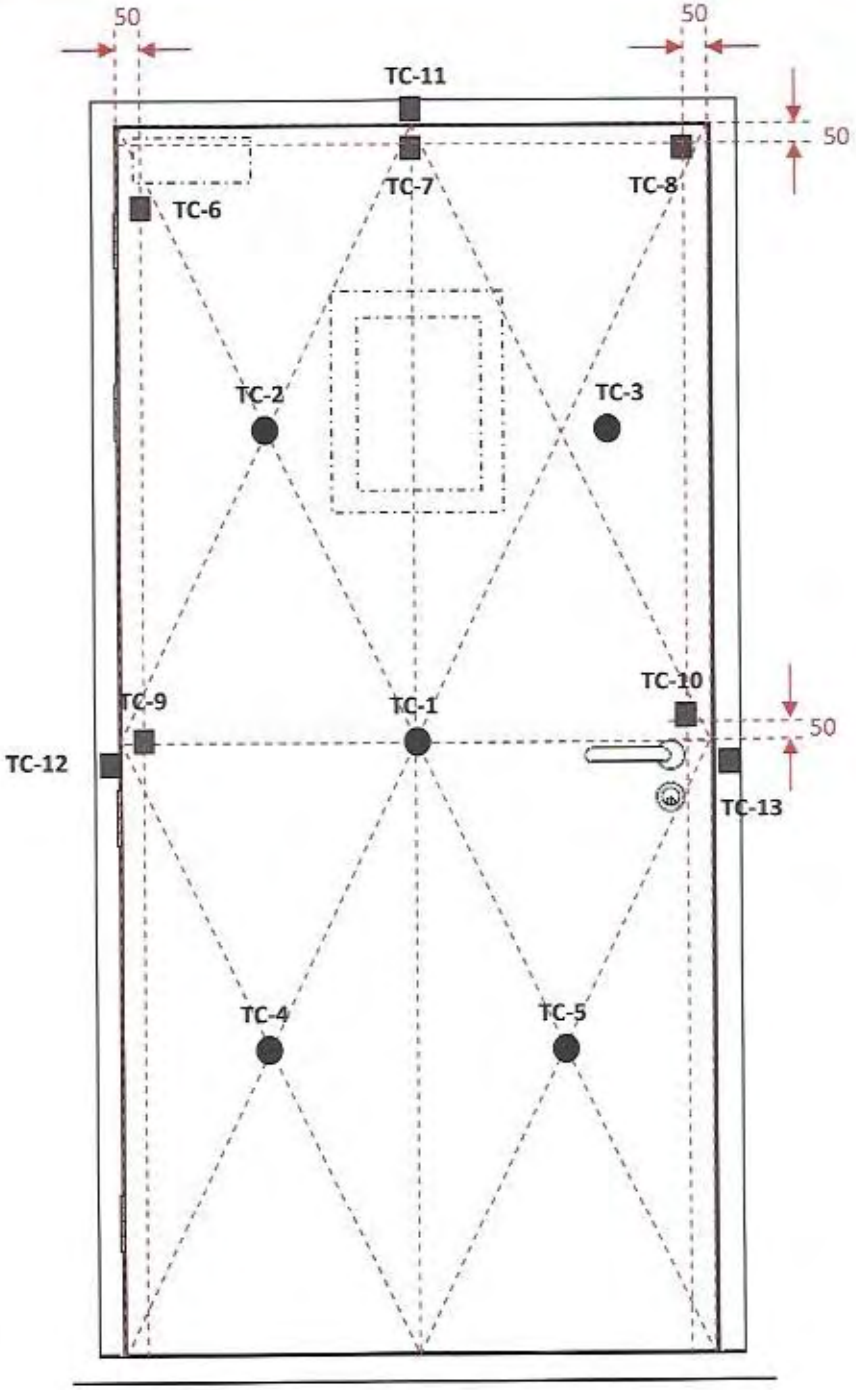

Figure 9: Positioning of thermocouples used to determine average and maximum temperature of unexposed surface of steel door sets (Specimen – 1 & Specimen – 2). Average TCs are represented by round blobs while maximum TCs are shown by rectangular blobs

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Appendix 4:

Photographs

Specimens after 15mins of testing

Specimens after 30mins of testing

Figure 11.1: Unexposed side of specimens during exposure to fire (Specimen – 2 on left & Specimen – 1 on right)

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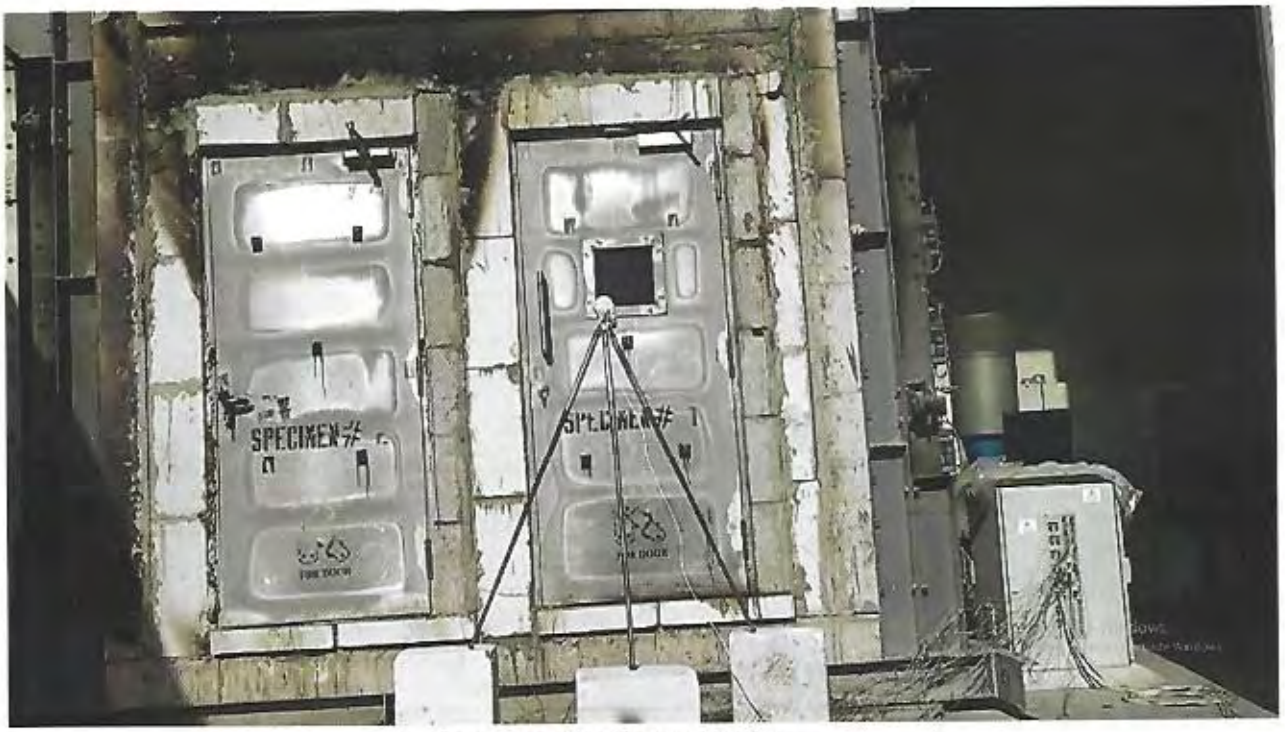
Specimens after 45mins of testing



Specimens after 60mins of testing

Figure 11.2: Unexposed side of specimens during exposure to fire (Specimen – 2 on left & Specimen – 1 on right)

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أبوظبي : صندوق بريد : ٦١٨٣١، هاتف: ٥٥٠٣٠٤٠+٩٧١ ٢، فاكس : ٥٥٠٣٠٤١+٩٧١ ٢
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Specimens after 90mins of testing

Specimens after 105mins of testing

Figure 11.3: Unexposed side of specimens during exposure to fire (Specimen – 2 on left & Specimen – 1 on right)

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Specimens after 110mins of testing

Specimens after 112mins of testing

Figure 11.3: Unexposed side of specimens during exposure to fire (Specimen – 2 on left & Specimen – 1 on right)

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Sustained flaming from door closer located at top right corner of Specimen – 2 leaf after 112mins of testing

Figure 11.3: Unexposed side of specimens during exposure to fire (Specimen – 2 on left & Specimen – 1 on right)

- - - END OF TEST REPORT - - -

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