FIRE TEST REPORT

ON

FIRE PROTECTION G.I. DOORS

Submitted to
M/s. Astral Windoors Pvt. Ltd.
10/4, Comfort Manor, Kumara Krupa Road
Bengaluru – 560 001

TC-5939

Report No.: BFRC/DT/2023/110723/14
Date of Testing : 01-08-2023

BFRC

BUILDING FIRE RESEARCH CENTRE
N.I.E., MYSURU, INDIA

Estd. 1946

BUILDING FIRE RESEARCH CENTRE

N.I.E., Mysuru – 8

FOREWORD

Different parts of buildings are separated from each other into compartments by fire resisting walls, partitions, etc., in which openings are closed by Doors, which have precise functions to fullfill in case of a fire. The first and most important function of a Door assembly is to check the passage of excess amount of gases and smoke which can interfere with the safe use of escape routes. Secondly it should maintain the effectiveness as a fire barrier of the wall in which it is installed.

The fire Door is constructed in such a way so that it can withstand the severity of fire for a specified time.

The Building Fire Research Centre (BFRC), Mysuru has provided facilities for fire resistance evaluations of Doors, according to IS 3614: 2021

I hope this report would be useful to M/S. Astral Windoors Pvt. Ltd., Bengaluru, in getting the correct appraisal of the Single Leaf Doors manufactured by them and would be beneficial to building and industrial sectors in reducing loss of life and property.

MYSORE
August 2023

Y. M. Manj

Dr.Y.M.MANJUNATH
Head, BFRC-NIE

BUILDING FIRE RESEARCH CENTRE
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1.0 SUMMARY

A Single leaf door was evaluated in a wall furnace (ANNEXURE 1) regulated according to standard heating condition as specified in IS 3614: 2021.

2.0 OBJECTIVES

A special investigation of Single leaf door to assess its performance for fire resistance was undertaken. The fire door was subjected to standard heating conditions as specified in IS 3614 : 2021 in a wall furnace for classifying, fire resistance rating depending upon its performance.

3.0 CONSTRUCTION

The fire door is constructed to give maximum fire resistance, minimum heat and smoke transfer from one side to another by M/s. Astral Windoors Pvt. Ltd., Bengaluru, the details of fire door is shown in Fig.1.

4.0 TEST PROCEDURE

4.1 General

The fire door was evaluated separately in a wall furnace regulated according to IS 3614: 2021 for obtaining standard conditions of fire severity. The furnace has five flat flame burners positioned in a way to produce even heating over the exposed face of the specimen. For measuring the temperature of the furnace five bare wire thermocouples are provided. (The details of door furnace are given in ANNEXURE-1).

The variation of furnace temperature with time during the evaluations of the door has been shown separately in Table 1 with standard temperature, and the time-temperature curves are plotted in Figure 2. The door was installed in a fixed fire brick wall which forms one side of the wall furnace before each evaluation.

4.2 Furnace Control

The specimen was heated as specified in a furnace which produced a positive pressure. For maintaning standard heating conditions, the temperature of the furnace was controlled to vary with time as closely as possible in accordance with the following relationship:

$$T - T_o = 345 \log_{10} (8t + 1)$$

Where, t = time of test in minutes

T = furnace temperature in o C at time t, and

T_o = initial furnace temperature in ^{0} C

The temperature rise in the furnace computed using the above formula is as shown below.

Time Minutes	Temperature rise in furnace ($T - T_o$)
5	556
10	659
15	718
30	821
60	925
90	986
120	1029

The accuracy of furnace control should be such that:

(i) During the first ten minutes of test the area under the curve of mean furnace temperature does not vary by more than ±15% of the area under the standard curve.

(ii) During the first half-hour of test the area under the curve of mean furnace temperature does not vary by more than ±10% of the area under the standard curve.

(iii) For any period after the first half hour of the test the area under the curve of mean furnace temperature does not vary by more than ±5% of the area under the standard curve.

(iv) At any time after the first ten minutes the mean furnace temperature does not differ from the standard temperature by more than ±100 ° C.

4.3 Single leaf Metal Door (Opening outside).

The door was installed in a fire brick wall of the wall furnace opening outside. Evaluation was carried out on First day of August 2023 (01.08.2023). The temperature recorded at five positions on exposed face is given in Table 1. Positions of thermocouples on exposed face are shown in Fig 3.

5. OBSERVATIONS

The observations were made during evaluation of the door for fire resistance. A specimen is considered fire resistant for a particular period for which it satisfies certain criteria with respect to stability & integrity.

Stability

For stability, following considerations were observed:

(i) The deformation of test specimen; extent of separation of door frame from wall; extent of separation of door panel from the frame.

(ii) Temperature and radiation from steel / steel plates.

(iii) Detachment of any locking part.

(iv) Time of occurrence of collapse; if any.

(v) Any other factor which could affect stability.

Integrity

The presence of cracks or other openings developed either in the door panel or between door and door frame were observed. Observation for stability and integrity for single leaf door opening outside is given in Table 2.

Insulation

The average temperature of the unexposed face of the specimen shall not increase above the initial temperature by more than 140^0C. The maximum temperature at any point of unexposed face shall not exceed the initial temperature by more than 180^0C, and shall not exceed 220^0C irrespective of the initial temperature. Observation insulation for single leaf door opening outside is given in Table 3.

Cotton Pad Test

The cotton pad of size 100mm X 100mm of thickness 20mm was administered at a distance approximately 25mm from the surface of the test specimen under test and found no flaming of the cotton pad.

6.0 RESULTS

Single leaf door with vision panel of M/S. Astral Windoors Pvt. Ltd., Bengaluru having dimensions 1200mm X 2400mm and insulated with rockwool was evaluated for fire resistance in the wall furnace as described in earlier sections of the report. The time for which the door stood against a standard fire was obtained after evaluating.

6.1 Single leaf Metal Door (Opening outside)

The door complied with standard heating & pressure conditions of the furnace. There were no cracks or openings developed during the evaluation. Hence there is no failure in stability & Integrity.

6.2 Insulation

The average temperature of the unexposed face of the specimen has not increased above the initial temperature by more than 140^0C. The maximum temperature at any point of the face has also not exceeded the initial temperature by more than 180^0C. Hence there is no failure of Door due to insulation.

7.0 CONCLUSION

SINGLE LEAF DOOR WITH VISION PANEL OF M/S. ASTRAL WINDOORS PVT. LTD., BENGALURU., TESTED ON 01.08.2023 CAN BE ASSIGNED FOR ONE HUNDRED & TWENTY MINUTES (120 MINUTES) FIRE RESISTANCE RATING "FD *120*" WITH 30 MINUTES INSULATION AS PER IS 3614 : 2021

Note: The Authenticity of this certificate can only be verified at the testing laboratory for a period of 1 year from the date of testing of the sample.

Reviewed by

Mr. Sachin Vijay Kumar
Technical Manager

Approved by

Dr.Y.M.Manjunath
Head & QM

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SINGLE LEAF FIRE DOOR M/S. **Astral Windoors. Pvt. Ltd.**
(OPENING OUTSIDE)

Table 1. FURNACE AND EXPOSED FACE TEMPERATURES

Time (min)	Furnace Temperature °C (T – To)		Exposed Face Temperature °C				
	Standard	Actual	T1	T2	T3	T4	T5
05	556	484	500	490	480	480	470
10	659	590	620	580	630	560	560
15	718	656	660	650	650	670	650
30	821	747	750	740	760	745	738
60	925	902	900	920	890	900	900
90	986	958	940	950	980	980	940
120	1029	1005	1010	1008	1010	998	1000

Table 2. TEST OBSERVATIONS OF SINGLE LEAF METAL DOOR

Time (in min.)	Observations
05	Smoke started with small warping on left top corner.
10	Smoke observed near top hinge between door and frame.
16	Smoke observed along the width of the door at the top.
20	Shutter warping increased at left top corner of the door.
27	Smoke stopped at the top corners of the door.
34	Smoke observed near the lock and handle.
44	Discoloration of the shutter started.
45-120	No changes on the door shutter / frame observed.
120	The door successfully resisted 120 min of standard fire and 30 min of insulation as per IS 3614.

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Table 3. SINGLE LEAF FIRE DOOR UNEXPOSED FACE TEMPERATURES.

Time (min)	Un-Exposed Face Temperature °C				
	T1	T2	T3	T4	T5
05	24.7	25.2	23.8	24.7	25.2
10	35.1	32.4	38.1	34.5	32.1
15	59.4	42.1	58.1	36.1	37.2
30	121.8	108.4	84.2	49.5	52.1

Table 4. FURNACE PRESSURE DIFFERENCE READINGS.

Time (Min)	15	30	60	90	120	Average
Pressure readings in mm of H_2O	2.4	2.4	2.5	2.5	2.6	2.48

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ANNEXURE

Door construction
Enclosed as Annexure - II

Fig.1.The construction details of single leaf fire door.

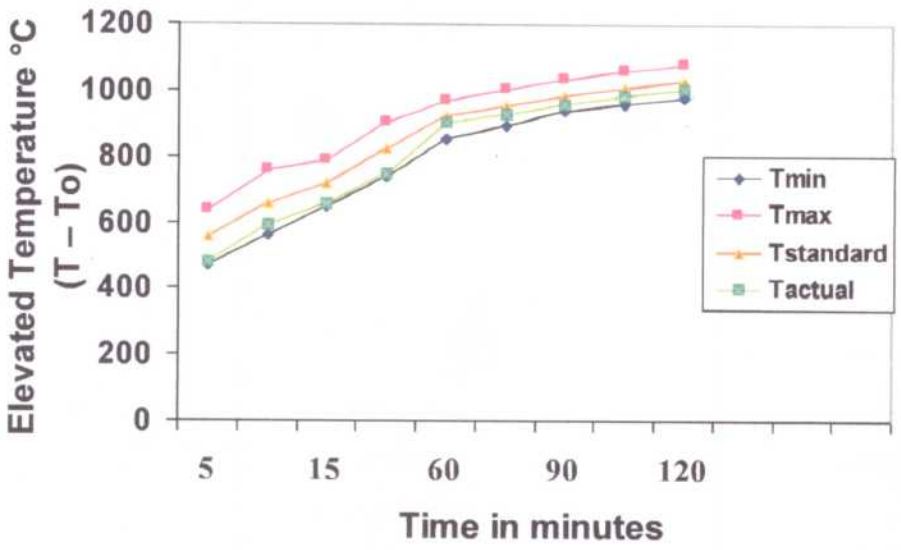

Fig. 2 Furnace Time-Temperature curve for 120 min of single leaf fire door

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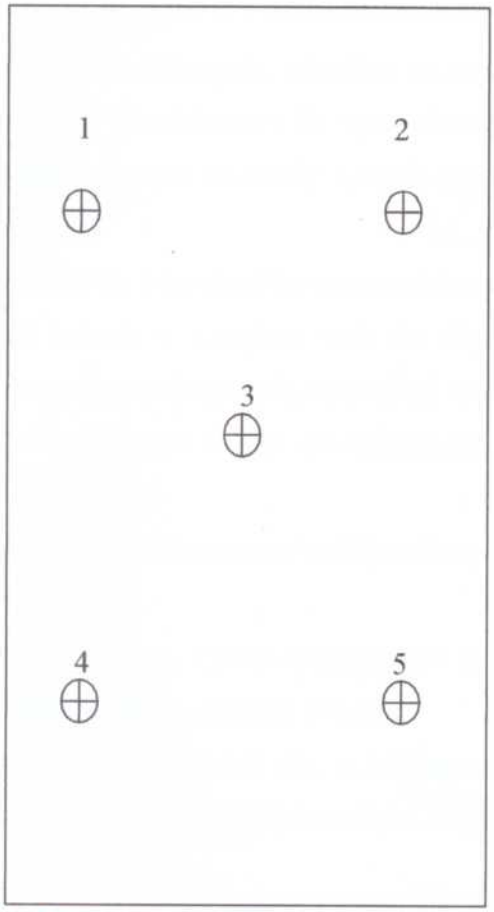

Fig. 3. Position of Thermocouples

⊕ → Thermocouples

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ANNEXURE 1
MULTIPURPOSE FIRE TEST RIG

The wall furnace is a rectangular chamber in construction. The casing is made from steel. The refractory lining consists of front layer of glass wool. The complete furnace assembly consists of a stationery wall which is a specimen itself.

The furnace is fired by 5 rows of burners each located at different levels. Each row of burners is complete with the necessary pressure regulator and pressure gauges and manually controlled valves.

The products of combustion escape through the flue duct which is located at the top of the furnace.

The pressure in the furnace is controlled by a damper drive located in the passage of the flue gases.

The induced draft chimney system is connected to the flue gas to allow the necessary draft for the movement of gases.

There are peep holes to observe the condition of the specimen during the course of the test. The specimen is held in place by a frame called the test rig.

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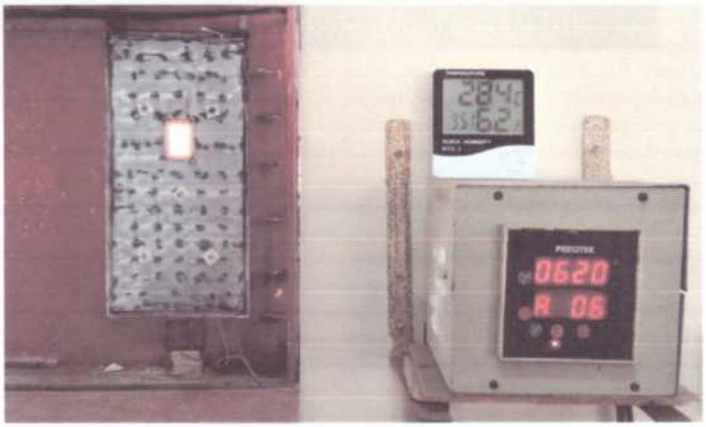
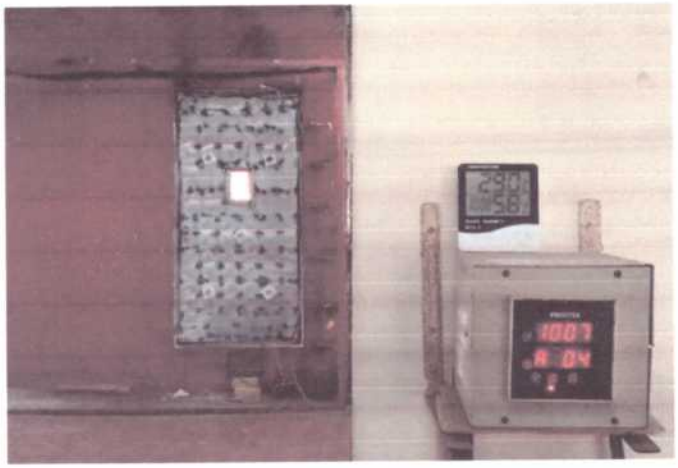
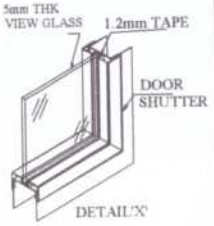
PHOTOGRAPHS

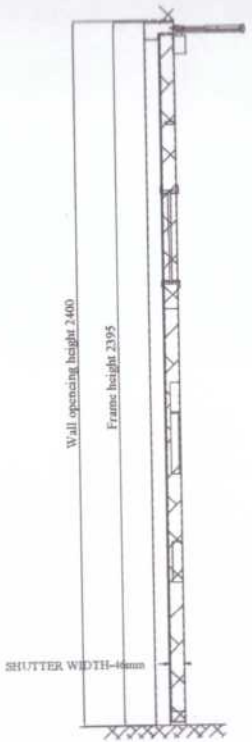


PHOTOGRAPHS

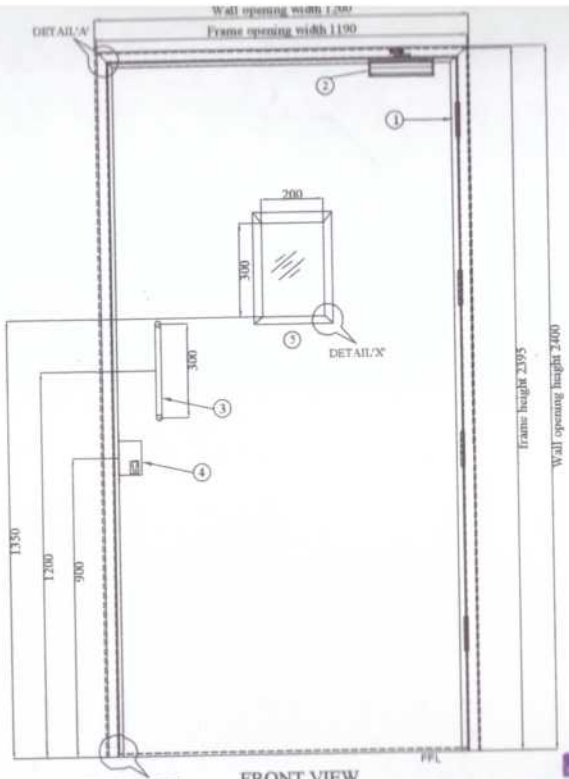


SINGLE DOOR FRAME
KNOCKED DOWN
DETAIL'A'





SIDE VIEW



DETAIL'B' FRONT VIEW

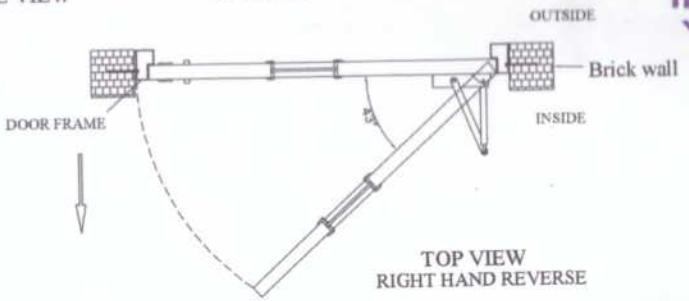
Mounting of the Door	Block Wall Mounted
Type	Single Door
Rebate Size & Profile	Single Rebate-100x58mm
Material of the Construction	Galvanised Iron(G.I)Sheet
Sheet Thickness of the frame	1.2mm
Sheet Thickness of the shutter	1.0mm
Infill Material of the Shutter	Rockwool 96kg/m3
Colour of Finishing	RAL - RED

SL. No	Door Code/No	Room Name	Wall Opening WidthxHeight	Frame WidthxHeight	Door Orientation	Qty
1.			1200x 2400mm	1190x 2390mm	RHR	1

SL. No	Door Hardware	Description	Qty
1.	SS Ball Bearing Butt Hinges	101x76x3mm	4Nos
2.	Door Closer		1Nos
3.	SS304 - D Handle -300mm pair		1Nos
4.	Dead Lock with Cylinder		1No
5.	Fire rated Glass-200mmx300mmx6mm	Schott Pyran	1Nos
6.	Sleeve anchor HLC 8 X 70/40		10Nos

ORIENTATION

RIGHT
HAND REVERSE



TOP VIEW
RIGHT HAND REVERSE

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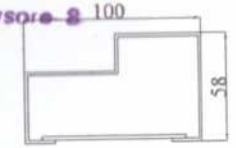

100x58 SINGLE REBATE
DETAIL'B'

APPROVED BY CLIENT WITH OFFICE STAMP SEAL

DRAWING NO: 01	DRAWN BY : CHETHAN	SCALE: 1:1	CLIENT NAME: M/s.Building Fire Research Centre (BFRC)	P.O. NO. & DATE.	ASTRAL WINDOORS PVT. LTD. #10/4, 1st Floor, Comfort Manor, Kumara Krupa Road, Opp. Chitrakala Parishat, Bangalore - 560 001
DATE: 31.07.2023	CHECKED BY : DILIP	NOTE: ALL DIMENSIONS ARE IN mm	PROJECT: NIE, Mysore		