Fire tests done at the National Research Center in Egypt

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Housing & Building National Research Center

Vice-Chairman Office
for Research and Studies Affairs

المركز القومي لبحوث الإسكان والبناء

مكتب نائب رئيس مجلس الإدارة
لشئون البحوث والدراسات

مرجعنا : ٢٠٢١/٠٨/٢٤٥

مرجعكم: ٢٠٢١/٠٧/٠٨

الموضوع: اجراء اختبار مقاومة حريق لباب خشبي

الجهة الطالبة: شركة التجهيزات الخشبية (وودك)

تحية طيبة وبعد،،

إيماءً الى خطاب سيادتكم بتاريخ ٢٠٢١/٠٨/٠٨ بخصوص الموضوع عاليه، مرفق طيه التقرير النهائي بالنتائج ، هذا وقد سددت الرسوم بالشيك رقم ٠٠٠١٣٢٤ بتاريخ ٢٠٢١/٠٧/٠٨ .

وتفضلوا بقبول فائق الاحترام،،

مدير المعهد

أستاذ دكتور /

محمود علي حسن

نائب رئيس مجلس الإدارة

لشئون البحوث والدراسات

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٨٧ شارع التحرير الدقى - جيزة
ص.ب. : ١٧٧٠ القاهرة

Client Name: شركة التجهيزات الخشبية (وودك)
Supplier Code: BPI/H/CO.245
Test Specimen Type: Wooden Door Assembly

Testing Name: Fire Resistance Test
Delivery Date: 08/07/2021
Testing Date: 08/08/2021

Test Report

Single swinging wooden door assembly,

Fire Resistance Test; in accordance with NFPA 252,

"Standard Methods of Fire Tests of Door Assemblies"

Client:

Woodek

August 2021

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SUMMARY

The fire resistance (Fr) test has been conducted on 08 August 2021 at the request of **WOODEK** Company. The ambient temperature at the start of the test was 37°C and the mean unexposed face temperature was 38°C. Client representatives were allowed to attend and observe the test as witnesses.

Fr test was conducted in accordance with NFPA 252 (Standard Methods of Fire Tests of Door Assemblies). The test specimen is a wooden single swinging door assembly; the dimensions of the door leaf are (214× 90×4.5) cm. It was installed in an opining in a brick wall nominally 300 cm wide ×280 cm height. The test wooden leaf was installed in a wooden frame with certain hardware and accessories including (Butt hinges, Electronic lock with RFID technology, Stainless steel handle, Intumescent tape and door viewer). The landing side of the door was exposed to the furnace during the test. The installed specimen was tested as described in details hereinafter.

The tested door assembly has succeeded to meet the condition of acceptance as outlined in NFPA 252 for an actual duration of fire test of **30 minutes**. The tested door remained fastened in its original position in the test frame opening during the fire exposure. The fire door assembly did not develop any openings in the door assembly. No flaming occurred on the unexposed surface of the door assembly during 30 minutes of the fire exposure. The maximum temperature recorded for the unexposed surface was 68.4 °C. The test was terminated after 30 minutes according to the client requirement.

The fire rating of the tested door assembly was specified as **1/2-h (30 minutes).**

Tested and report by

H. Shoukry

Dr. Hamada Shoukry

Aya Zaki

Eng. Aya Zaki

Ahmed Adel

Eng. Ahmed Adel

Head of Fire Dept.

2021

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1. INTRODUCTION

The NFPA 252 test procedure is identical or very similar to the following standard test methods:

- UL 10 B /10 A and UL 155
- UBC 48-2/43-3
- ASTM E119
- BS 476 parts 20 and 22

The test samples identification is as provided by the client. Building Physics Institute (BPI) accepts no responsibility for any inaccuracies therein. BPI did not select the test samples and has not verified the composition, manufacturing techniques or quality assurance procedures.

The fire resistance test methods may be cited as the "Standard Fire Tests," and the performance or exposure shall be expressed as "2-h, 6-h, 1/2-h, etc".

Scope

Any combination of a door, frame, hardware and other accessories that is placed in an opining in a wall that is intended primarily for access or for human entrance or exit can be described as door assembly.

This standard of fire test is applicable to door assemblies of various materials and types of construction used in wall openings to retard the passage of fire.

Tests made in conformity with the mentioned test methods will register performance of door assemblies during the test exposure; but such tests shall not be construed as determining their suitability for use after exposure to fire.

It is the intent that tests made in conformity with these test methods will develop data that enables regulatory bodies to determine the suitability of door assemblies for use in locations where fire resistance of a specified duration is required.

Significance

These test methods are intended to evaluate the ability of a door assembly to remain in an opening during a predetermined test exposure.

The tests expose a specimen to a standard fire exposure that is controlled to achieve specified temperatures throughout a specified time period.

Any variation from the construction or conditions that are tested may substantially change the performance characteristics of the assembly.

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The test methods do not provide the following:

1. Full information as to performance of all door assemblies in walls constructed of materials other than those tested.
2. Evaluation of the degree to which the door assembly contributes to the fire hazard through generation of smoke, toxic gases, or other products of combustion.
3. A measurement that determines a limit on the number of openings allowed in glazed areas or the number and size of lateral openings between the door and frame.
4. A measurement of the degree of control or limitation of the passage of smoke pr products of combustion through the door assembly.
5. A measurement that determines a temperature limit on the unexposed side of the door assembly.

Objective

The objective of this standard test is to determine at the request of the client, the fire rate resistance of a door assembly test specimen when tested in accordance with NFPA 252.

2. TEST PROCEDURE

General

The design, construction, materials workmanship, hardware, and size of the fire door assembly shall represent those for which a fire protection rating is desired. A record of the materials and construction details to be used for the purpose shall be kept.

The fire door assembly shall be installed in the test wall opining in the manner in which it is intended to be used. Such mounting shall not prevent unrestricted operation of the fire door. Clearances for doors installed in the test wall opining shall be as indicated at NFPA 252. Swinging doors shall be mounted to swing into furnace chamber.

The test wall in which the fire door assembly is mounted and tested shall have the strength and fire resistance to retain the assembly throughout the fire and hose stream tests. The test wall shall be constructed of materials representative of the wall construction in which the fire door assembly is intended to be installed. When used, wall anchors shall be compatible with the test wall in which the fire door assembly is installed.

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Clearances

Clearances for doors installed in the test wall opining shall be as indicated at NFPA 252.

For swinging doors, it shall be permitted to have a tolerance upto (-1.6 mm):

- 3 mm along the top edge.
- 3 mm along the hinge and latch jambs edge.
- 10 mm at the bottom edge of a single swinging door.

Test Furnace Control

The furnace temperature was measured by means of nine chromel /Alumel (type K) thermocouples arranged symmetrically in three rows of three in the furnace with their measuring junctions located 150 mm away from the exposed face of the specimen. The furnace was controlled so that the mean of these thermocouples readings followed the time/temperature relationship of NFPA 252.

During the performance of a fire exposure test, the furnace temperatures are recorded at least every 60 seconds and displayed for the furnace operator to allow control along the specified temperature curve.

Specimen Unexposed Surface Temperature Measurement

Temperatures of unexposed surfaces are monitored using Copper/Constantan (Type T) thermocouples placed under 30 mm square dry, felted pads. Temperature readings were taken at not less than three points on the surface, at intervals not exceeding 1.0 minute.

Fire Endurance Test

The fire door assembly exposure temperature during the fire test shall be controlled to conform to the standard temperature time relation as shown in the following table.

Standard Temperature Time Relation

Time (min.)	5	10	30	60	120	240	480
Furnace Temperature (°C)	538	704	843	927	1010	1093	1260

The fire exposure is continued on the specimen until the desired fire endurance rating period is reached, or until failure to meet any of the performance criteria specified hereinafter.

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Hose Stream Test

When the hose stream test is required to be performed, the fire exposed side of the fire door assembly shall be subjected to the impact, erosion, and quenching effects of a standard hose stream within the two minutes immediately following the fire test. The tip of the play pipe shall be located 6m from the fire door assembly. The minimum water pressure measured at the base of the play pipe shall be as specified in the following table.

Water Pressure and Duration of Application for Hose Stream

	Water Pressure	Duration of Application
Desired Rating	**psi (kPa)**	**sec/m^2**
3 hr and over	45 (310)	32
1 $^1/_2$ hr and less than 3 hr	30 (207)	16
1 hr and less than 1 $^1/_2$ hr	30 (207)	10
Less than 1 hr	30 (207)	6

3. CONDITIONS OF ACCEPTANCE (PERFORMANCE CRITERIA)

General

The fire door assembly shall meet the performance criteria when:

- The fire door assembly shall remain in the test wall opining during the fire test. For 20-minute fire protection – rated fire door assembly, the hose stream test shall not be required.
- The fire door assembly shall not develop any openings in the door assembly, except as permitted by the next two points.
  - Openings created by glazing material breakage in the central area of each individual glazed light in any vision panel shall not exceed 5 percent of the area of the glazed light.
- Openings created by separation of the glazing material edges from the glazing frame due to movement away from the frame shall not exceed 30 percent of each individual glazed light perimeter.
- No flaming shall occur on the unexposed surface of the door assembly during the first 30 minutes of the fire test, except that intermittent flames not greater than 152 mm in length shall be permitted to occur for periods not to exceed 10 seconds.

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- After 30 minutes of the fire test, some intermittent flames not greater than 152 mm in length shall be permitted to occur along the edges of doors for periods not to exceed 5 minutes.
- For doors having a fire test duration equal to or greater than 45 minutes, flames not greater than 152 mm in length shall be permitted to occur on the unexposed face of the door during the last 15 minutes of the fire test, provided that the flames are contained within a distance of 38 mm from a vertical door edges, within 76 mm from the top edge of the door.
- Where hardware is evaluated for use on fire doors, it shall keep the door in the closed position for fire test duration of not less than 3 hours, and the latch bolt shall remain projected and intact. The hardware shall not be required to be operable following the tests.

Swinging Doors

- For swinging doors, any portion of the edges adjacent to the door frame shall not move from its original position in a direction perpendicular to the plane of the doors for a distance greater than door thickness during the fire test or greater than 1 1/2 times the door thickness.
- A single swinging door shall not separate from the door frame by than 13 mm at the latch location.
- Door frames to be evaluated with doors shall remain fastened to the test wall on all sides and shall not develop openings between the frame and the doors or between the frame and the adjacent test wall.

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4. TEST RESULTS AND OBSERVATIONS

- The test standard NFPA 252 was followed.
- The test assembly was installed under the full responsibility of the client under supervision of fire technologist.
- The test was carried out on 08 August 2021.
- The ambient temperature at the start of the test was 37°C and the mean unexposed face temperature was 38°C.
- The test assembly consisted of a single swinging wooden door, hung in a wooden frame with three butt hinges.
- The test door assembly was installed in an opining in hollow clay brick wall nominally 300 cm wide ×280 height cm.
- **Figure (1)** shows the photo of the unexposed face of the door assembly before the test.
- The test wooden leaf was installed with a wooden frame with certain hardware and accessories including (Butt hinges, Electronic lock with RFID technology, Stainless steel handle, Intumescent tape and door viewer).The hardware and accessories of the test door assembly are introduced in **figure (2)**.
- The Butt hinges and door viewer were manufactured by **Dorma**; while, The electronic door lock was manufactured by **BE-TECH**
- The dimensions of the door assembly including the frame are about (218.5× 97× 4.5) cm.
- The clearances between the door leaf and the frame along the periphery were within the allowable limits of the test method standard.
- A tremendous smoke was generated from the door assembly after 4 minutes of starting the test, as shown in **figure (3).**
- **Figure (4)** presents the unexposed face of the door assembly after 30 minutes of the fire endurance test, no considerable deformations have been observed.
- **Figure (5)** shows the standard time-temperature curve, the actual furnace temperature and the average unexposed surface temperature during the fire test period. The maximum temperature recorded for the unexposed surface during the test was 68.4 °C.
- **Figure (6)** shows the photo of the exposed face of the door assembly after the test.

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Figure (1): The photo of the unexposed face of the door assembly before the test.

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Figure (2): The hardware and accessories of the test door assembly.

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Figure (3): Smoke generation from the door during the first 04-10 minutes of test.

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Figure (4): Photo of the unexposed surface of the door assembly at 30th minute of test

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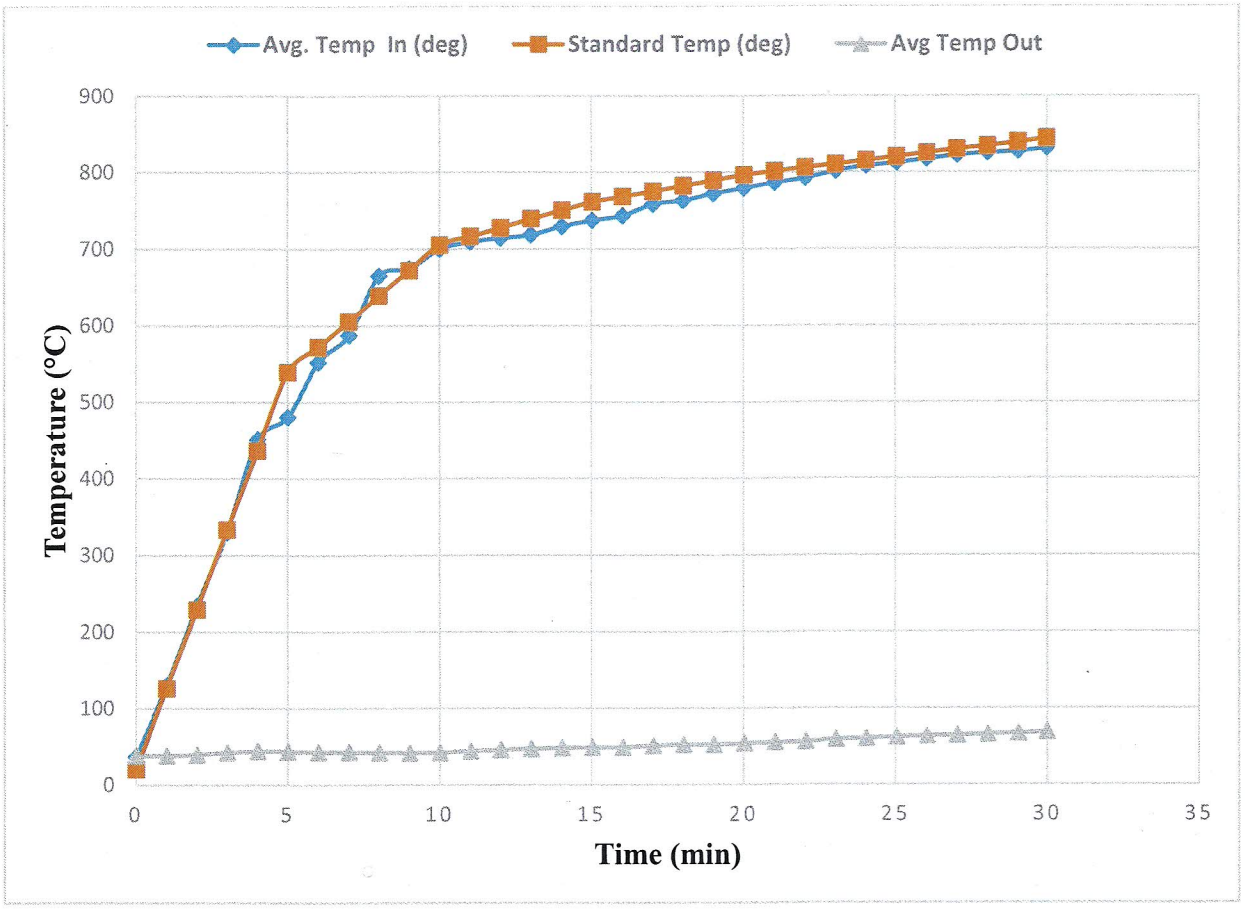

Figure (5): The standard time – temperature curve, the actual furnace temperature and the average unexposed surface temperature during fire resistance test

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Figure (6): The photo of the exposed face of the door after the test.

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CONCLUSION

The single swinging wooden door assembly supplied by **WOODEK** was subjected to a fire resistance test in accordance with test procedure NFPA 252. It has succeeded to fulfill the requirements of the test standard for fire rating of **30 minutes** as illustrated in the following table.

Test Sample	Property	Result
Single swinging wooden door assembly *Supplier:* **Woodek**	**Fire rating**	**$^1/_2$ - h**

Tested and report by

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Aya Zaki

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Head of Fire Dept.

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مكتب نائب رئيس مجلس الإدارة
لشئون البحوث والدراسات

مرجعنا : ٢٠٢١/٠٤/١٠٣

مرجعكم: ٢٠٢١/٠٢/١٨

الموضوع: اجراء اختبار مقاومة حريق لباب خشبي مفصلي

الجهة الطالبة: شركة التجهيزات الخشبية (وودك)

تحية طيبة وبعد،،

إيماءً الى خطاب سيادتكم بتاريخ ٢٠٢١/٠٢/١٨ بخصوص الموضوع عاليه، مرفق طيه التقرير النهائي بالنتائج ، هذا وقد سددت الرسوم المقررة علي دفعتين دفعة بالقسيمة رقم ٠١٦١٧٣٦ بتاريخ ٢٠٢١/٠٢/٢٢ ، والدفعة الثانية بالشيك رقم (٠٠٠١٢٨٢) .

وتفضلوا بقبول فائق الاحترام،،

مدير المعهد

أستاذ دكتور /

محمود علي حسن

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المركز القومي لبحوث الأسكان والبناء
إدارة السكرتارية والمحفوظات
التاريخ ١٤/٤/٢٠٢١
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٨٧ شارع التحرير الدقى - جيزة
ص.ب. : ١٧٧٠ القاهرة

Client Name: شركة التجهيزات الخشبية (وودك)
Supplier Code: BPI/H/CO.103
Test Specimen Type: Wooden Door Assembly

Testing Name: Fire Resistance Test
Delivery Date: 18/02/2021
Testing Date: 01/04/2021

Test Report

Single swinging wooden door assembly,

Fire Resistance Test; in accordance with NFPA 252,

"Standard Methods of Fire Tests of Door Assemblies"

Client:

Woodek

April 2021

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SUMMARY

The fire resistance test was carried out on 01 April 2021 at the request of **WOODEK** Company. The ambient temperature at the start of the test was 23°C and the mean unexposed face temperature was 22°C. Client representatives were allowed to attend and observe the test as witnesses.

A fire resistance test was conducted in accordance with NFPA 252 (Standard Methods of Fire Tests of Door Assemblies). The test specimen is a wooden single swinging door assembly; the dimensions of the door leaf are (213.8× 89.6×5) cm. It was installed in an opining in a brick wall nominally 300 cm wide ×280 cm height which was built from hollow clay bricks. The test wooden leaf was installed in a wooden frame with certain hardware and accessories including (Butt hinges, Electronic lock with RFID technology, Stainless steel handle and door viewer). The landing side of the door was exposed to the furnace during the test. The INSTALLED specimen was tested as described in details hereinafter.

The tested door assembly has succeeded to meet the condition of acceptance as outlined in NFPA 252 for an actual duration of fire test of **30 minutes**. The tested door remained fastened in its original position in the test frame opening during the fire exposure. The fire door assembly did not develop any openings in the door assembly. No flaming occurred on the unexposed surface of the door assembly during 30 minutes of the fire exposure. The maximum temperature recorded for the unexposed surface was 49 °C. The test was stopped after the end of 30 minutes according to the client requirement.

The fire rating of the tested door assembly was specified as **1/2-h (30 minutes).**

Tested and report by

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1. INTRODUCTION

The NFPA 252 test procedure is identical or very similar to the following standard test methods:

- UL 10 B /10 A and UL 155
- UBC 48-2/43-3
- ASTM E119
- BS 476 parts 20 and 22

The test samples identification is as provided by the client. Building Physics Institute (BPI) accepts no responsibility for any inaccuracies therein. BPI did not select the test samples and has not verified the composition, manufacturing techniques or quality assurance procedures.

The fire resistance test methods may be cited as the "Standard Fire Tests," and the performance or exposure shall be expressed as "2-h, 6-h, 1/2-h, etc".

Scope

Any combination of a door, frame, hardware and other accessories that is placed in an opining in a wall that is intended primarily for access or for human entrance or exit can be described as door assembly.

This standard of fire test is applicable to door assemblies of various materials and types of construction used in wall openings to retard the passage of fire.

Tests made in conformity with the mentioned test methods will register performance of door assemblies during the test exposure; but such tests shall not be construed as determining their suitability for use after exposure to fire.

It is the intent that tests made in conformity with these test methods will develop data that enables regulatory bodies to determine the suitability of door assemblies for use in locations where fire resistance of a specified duration is required.

Significance

These test methods are intended to evaluate the ability of a door assembly to remain in an opening during a predetermined test exposure.

The tests expose a specimen to a standard fire exposure that is controlled to achieve specified temperatures throughout a specified time period, followed by the application of a specified standard fire hose stream.

Any variation from the construction or conditions that are tested may substantially change the performance characteristics of the assembly.

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The test methods do not provide the following:

1. Full information as to performance of all door assemblies in walls constructed of materials other than those tested.
2. Evaluation of the degree to which the door assembly contributes to the fire hazard through generation of smoke, toxic gases, or other products of combustion.
3. A measurement that determines a limit on the number of openings allowed in glazed areas or the number and size of lateral openings between the door and frame.
4. A measurement of the degree of control or limitation of the passage of smoke pr products of combustion through the door assembly.
5. A measurement that determines a temperature limit on the unexposed side of the door assembly.

Objective

The objective of this standard test is to determine at the request of the client, the fire rate resistance of a door assembly test specimen when tested in accordance with NFPA 252.

2. TEST PROCEDURE

General

The design, construction, materials workmanship, hardware, and size of the fire door assembly shall represent those for which a fire protection rating is desired. A record of the materials and construction details to be used for the purpose shall be kept.

The fire door assembly shall be installed in the test wall opining in the manner in which it is intended to be used. Such mounting shall not prevent unrestricted operation of the fire door. Clearances for doors installed in the test wall opining shall be as indicated at NFPA 252. Swinging doors shall be mounted to swing into furnace chamber.

The test wall in which the fire door assembly is mounted and tested shall have the strength and fire resistance to retain the assembly throughout the fire and hose stream tests. The test wall shall be constructed of materials representative of the wall construction in which the fire door assembly is intended to be installed. When used, wall anchors shall be compatible with the test wall in which the fire door assembly is installed.

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Clearances

Clearances for doors installed in the test wall opining shall bc as indicated at NFPA 252.

For swinging doors, it shall be permitted to have a tolerance upto (-1.6 mm):

- 3 mm along the top edge.
- 3 mm along the hinge and latch jambs edge.
- 10 mm at the bottom edge of a single swinging door.

Test Furnace Control

The furnace temperature was measured by means of nine chromel /Alumel (type K) thermocouples arranged symmetrically in three rows of three in the furnace with their measuring junctions located 150 mm away from the exposed face of the specimen. The furnace was controlled so that the mean of these thermocouples readings followed the time/temperature relationship of NFPA 252.

During the performance of a fire exposure test, the furnace temperatures are recorded at least every 60 seconds and displayed for the furnace operator to allow control along the specified temperature curve.

Specimen Unexposed Surface Temperature Measurement

Temperatures of unexposed surfaces are monitored using Copper/Constantan (Type T) thermocouples placed under 30 mm square dry, felted pads. Temperature readings were taken at not less than three points on the surface, at intervals not exceeding 1.0 minute.

Fire Endurance Test

The fire door assembly exposure temperature during the fire test shall be controlled to conform to the standard temperature time relation as shown in the following table.

Standard Temperature Time Relation

Time (min.)	5	10	30	60	120	240	480
Furnace Temperature (°C)	538	704	843	927	1010	1093	1260

The fire exposure is continued on the specimen until the desired fire endurance rating period is reached, or until failure to meet any of the performance criteria specified hereinafter.

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Hose Stream Test

When the hose stream test is required to be performed, the fire exposed side of the fire door assembly shall be subjected to the impact, erosion, and quenching effects of a standard hose stream within the two minutes immediately following the fire test. The tip of the play pipe shall be located 6m from the fire door assembly. The minimum water pressure measured at the base of the play pipe shall be as specified in the following table.

Water Pressure and Duration of Application for Hose Stream

	Water Pressure	Duration of Application
Desired Rating	**psi (kPa)**	**sec/m²**
3 hr and over	45 (310)	32
1 ½ hr and less than 3 hr	30 (207)	16
1 hr and less than 1 ½ hr	30 (207)	10
Less than 1 hr	30 (207)	6

3. CONDITIONS OF ACCEPTANCE (PERFORMANCE CRITERIA)

General

The fire door assembly shall meet the performance criteria when:

- The fire door assembly shall remain in the test wall opining during both the fire test and the hose stream test. For 20-minute fire protection – rated fire door assembly, the hose stream test shall not be required.
- The fire door assembly shall not develop any openings in the door assembly, except as permitted by the next two points.
  - Openings created by glazing material breakage in the central area of each individual glazed light in any vision panel shall not exceed 5 percent of the area of the glazed light during the hose stream test
  - Openings created by separation of the glazing material edges from the glazing frame due to movement away from the frame shall not exceed 30 percent of each individual glazed light perimeter during the hose stream test.
- No flaming shall occur on the unexposed surface of the door assembly during the first 30 minutes of the fire test, except that intermittent flames not greater than 152 mm in length shall be permitted to occur for periods not to exceed 10 seconds.

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- After 30 minutes of the fire test, some intermittent flames not greater than 152 mm in length shall be permitted to occur along the edges of doors for periods not to exceed 5 minutes.
- For doors having a fire test duration equal to or greater than 45 minutes, flames not greater than 152 mm in length shall be permitted to occur on the unexposed face of the door during the last 15 minutes of the fire test, provided that the flames are contained within a distance of 38 mm from a vertical door edges, within 76 mm from the top edge of the door.
- Where hardware is evaluated for use on fire doors, it shall keep the door in the closed position for fire test duration of not less than 3 hours, and the latch bolt shall remain projected and intact. The hardware shall not be required to be operable following the tests.

Swinging Doors

- For swinging doors, any portion of the edges adjacent to the door frame shall not move from its original position in a direction perpendicular to the plane of the doors for a distance greater than door thickness during the fire test or greater than 1 1/2 times the door thickness during the hose stream test.
- A single swinging door shall not separate from the door frame by than 13 mm at the latch location.
- Door frames to be evaluated with doors shall remain fastened to the test wall on all sides and shall not develop openings between the frame and the doors or between the frame and the adjacent test wall.

4. TEST RESULTS AND OBSERVATIONS

- The test standard NFPA 252 was followed.
- The test assembly was installed under the full responsibility of the client under supervision of fire technologist.
- The test was carried out on 01 April 2021.
- The ambient temperature at the start of the test was 23°C and the mean unexposed face temperature was 22°C.
- The test assembly consisted of a single swinging wooden door, hung in a wooden frame with three butt hinges.

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- The test door assembly was installed in an opining in hollow clay brick wall nominally 300 cm wide ×280 height cm.
- **Figure (1)** shows the photo of the unexposed face of the door assembly before the test.
- The test wooden leaf was installed with a wooden frame with certain hardware and accessories including (Butt hinges, Electronic lock with RFID technology, Stainless steel handle and door viewer).The hardware and accessories of the test door assembly are introduced in **figure (2)**.
- The Butt hinges and door viewer were manufactured by **Dorma**; while, The electronic door lock was manufactured by **BE-TECH**
- The dimensions of the door assembly including the frame are about (218.5× 97× 5) cm.
- The clearances between the door leaf and the frame along the periphery were within the allowable limits of the test method standard.
- A light-to-moderate smoke was generated from the door assembly after 10minutes of starting the test, as shown in **figure (3).**
- **Figure (4)** presents the unexposed face of the door assembly after 30 minutes of the fire endurance test, no considerable deformations have been observed.
- **Figure (5)** shows the standard time-temperature curve, the actual furnace temperature and the average unexposed surface temperature during the fire test period. The maximum temperature recorded for the unexposed surface during the test was 49 °C.
- **Figure (6)** shows the photo of the exposed face of the door assembly after the test.

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Figure (1): The photo of the unexposed face of the door before the test.

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Figure (2): The hardware and accessories of the test door assembly,

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Figure (3): Smoke generation from the door during the first 10-15 minutes of test.

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Figure (4): Photo of the unexposed surface of the door assembly at 30th minute of test

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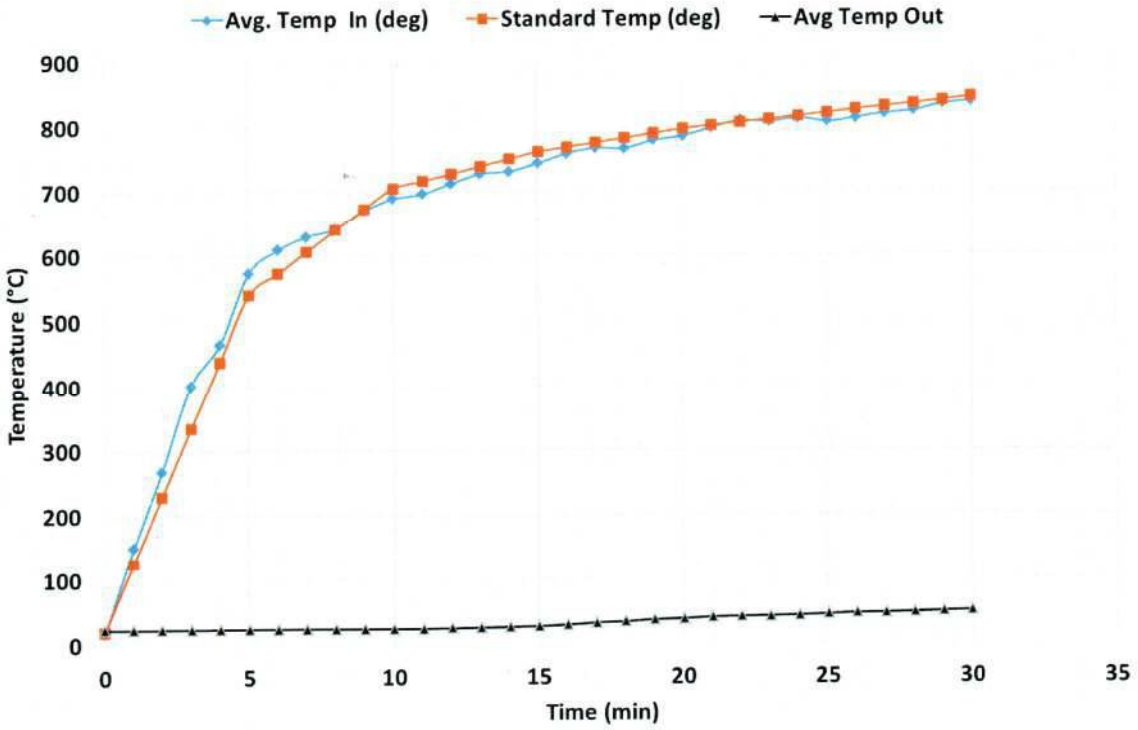

Figure (5): The standard time – temperature curve, the actual furnace temperature and the average unexposed surface temperature during fire resistance test

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Figure (6): The photo of the exposed face of the door after the test.

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CONCLUSION

The single swinging wooden door assembly supplied by **WOODEK** was subjected to a fire resistance test in accordance with test procedure NFPA 252. It was succeeded to fulfill the requirements of the test standard for fire rating of **30 minutes** as illustrated in the following table.

Test Sample	Property	Result
Single swinging wooden door assembly *Supplier:* **Woodek**	**Fire rating**	**½ - h**

Tested and report by

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Housing & Building National Research Center

Vice-Chairman Office
for Research and Studies Affairs

المركز القومي لبحوث الإسكان والبناء

مكتب نائب رئيس مجلس الإدارة
لشئون البحوث والدراسات

مرجعنا : ٢٠١٩/٠٨/١٣١

مرجعكم : ٢٠١٩/٠٧/٢٥

الموضوع: إجراء اختبار مقاومة الحريق علي باب خشب

الجهة الطالبة: شركة التجهيزات الخشبية

تحية طيبة وبعد،،

إيماءً الى خطاب سيادتكم والوارد برقم ٤٩٤ بتاريخ ٢٠١٩/٠٧/٢٥ بخصوص الموضوع عاليه، مرفق طيه التقرير النهائي بالنتائج. هذا وقد سددت الرسوم المقررة علي دفعتين الدفعة الأولي بالقسيمة رقم ٠١٩٧٣٢٣ بتاريخ ٢٠١٩/٠٧/٢٥ والدفعة الثانية بالقسيمة رقم ٠١٩٧٧٢١ بتاريخ ٢٠١٩/٠٧/٣٠.

وتفضلوا بقبول فائق الاحترام،،

مدير المعهد

أستاذ دكتور /

محمود علي حسن

المركز القومي لبحوث الاسكان والبناء
إدارة السكرتارية والمحفوظات
التاريخ ٢٢/٨/٢٠١٩ المرفقات : لا يوجد
رقم الصادر : ٨١

نائب رئيس مجلس الإدارة

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٨٧ شارع التحرير الدقي - جيزة
ص.ب : ١٧٧٠ القاهرة

Client Name: شركة التجهيزات الخشبية(وودك) **Delivery Date: 25/07/2019**

Testing Name: Fire Behavior Test **Testing Date: 06/08/2019**

Supplier Code: BPI/H/CO.131 **Sample Description: Wooden Door Assembly**

Test Report

Fire Resistance Test of Door Assembly in accordance with NFPA 252 and BS 476 parts 20 and 22

Client:

شركة التجهيزات الخشبية (وودك)

August 2019

Hesham
20/08/2019

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SUMMARY

The test was carried out on 6 August 2019. The ambient temperature at the start of the test was 34°C and the mean unexposed face temperature of test door was 37°C. Client representatives were allowed to attend and observe the test as witnesses.

A fire resistance test was conducted in accordance with NFPA 252 (Standard Methods of Fire Tests of Door Assemblies) and BS 476 parts 20 and 22. The test specimen was a wooden single swinging door. **HALSPAN** core material was used with tested door. The dimensions of the door assembly are (219×97×5.6) cm. It was installed in an opining in a brick wall nominally 300 cm wide ×280 cm height with 25cm thickness which is composed of hollow clay bricks. The test specimen was installed with an oak wooden frame with its accessories including (latch, door lock and three hinges) and without a door closer and with Halspan fire seals.

The landing side of the door was exposed to the furnace during the test. The test specimen was tested as described in details hereinafter.

The tested door assembly has succeeded to meet the condition of acceptance as outlined in NFPA 252 and BS 476 parts 20 and 22 for an actual duration of fire test of **60 minutes.** The fire door assembly did not develop any openings in the door assembly. No continuous flaming occurred on the unexposed surface of the door assembly during the test.

The test was stopped after the end of **60 minutes** of test, according to the customer requirements.

Tested and reported by

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1. INTRODUCTION

The NFPA 252 and BS 476 parts 20 and 22 test procedure is identical or very similar to the following standard test methods:

- UL 10 B /10 A and UL 155
- UBC 48-2/43-3
- ASTM E119

The test samples identification is as provided by the client. Building Physics Institute (BPI) accepts no responsibility for any inaccuracies therein. BPI did not select the test samples and has not verified the composition, manufacturing techniques or quality assurance procedures.

The fire resistance test methods may be cited as the "Standard Fire Tests," and the performance or exposure shall be expressed as "2-h, 6-h, 1/2-h, etc".

Scope

Any combination of a door, frame, hardware and other accessories that is placed in an opining in a wall that is intended primarily for access or for human entrance or exit can be described as door assembly.

This standard of fire test is applicable to door assemblies of various materials and types of construction used in wall openings to retard the passage of fire.

Tests made in conformity with the mentioned test methods will register performance of door assemblies during the test exposure; but such tests shall not be construed as determining their suitability for use after exposure to fire.

It is the intent that tests made in conformity with these test methods will develop data that enables regulatory bodies to determine the suitability of door assemblies for use in locations where fire resistance of a specified duration is required.

Significance

These test methods are intended to evaluate the ability of a door assembly to remain in an opening during a predetermined test exposure.

The tests expose a specimen to a standard fire exposure that is controlled to achieve specified temperatures throughout a specified time period, followed by the application of a specified standard fire hose stream.

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Any variation from the construction or conditions that are tested may substantially change the performance characteristics of the assembly.

The test methods do not provide the following:

1. Full information as to performance of all door assemblies in walls constructed of materials other than those tested.
2. Evaluation of the degree to which the door assembly contributes to the fire hazard through generation of smoke, toxic gases, or other products of combustion.
3. A measurement that determines a limit on the number of openings allowed in glazed areas or the number and size of lateral openings between the door and frame.
4. A measurement of the degree of control or limitation of the passage of smoke pr products of combustion through the door assembly.
5. A measurement that determines a temperature limit on the unexposed side of the door assembly.

Objective

The objective of this standard test is to determine at the request of the customer, the fire rate resistance of a door assembly test specimen when tested in accordance with NFPA 252.

2. TEST PROCEDURE

General

The design, construction, materials workmanship, hardware, and size of the fire door assembly shall represent those for which a fire protection rating is desired. A record of the materials and construction details to be used for the purpose shall be kept.

The fire door assembly shall be installed in the test wall opining in the manner in which it is intended to be used. Such mounting shall not prevent unrestricted operation of the fire door. Clearances for doors installed in the test wall opining shall be as indicated at NFPA 252. Swinging doors shall be mounted to swing into furnace chamber.

The test wall in which the fire door assembly is mounted and tested shall have the strength and fire resistance to retain the assembly throughout the fire and hose stream tests. The test wall shall be constructed of materials representative of the wall construction in which the

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fire door assembly is intended to be installed. When used, wall anchors shall be compatible with the test wall in which the fire door assembly is installed.

Clearances

Clearances for doors installed in the test wall opining shall be as indicated at NFPA 252.

For swinging doors, it shall be permitted to have a tolerance upto (-1.6 mm):

- 3 mm along the top edge.
- 3 mm along the hinge and latch jambs edge.
- 10 mm at the bottom edge of a single swinging door.

Test Furnace Control

The furnace temperature was measured by means of nine chromel /Alumel (type K) thermocouples arranged symmetrically in three rows of three in the furnace with their measuring junctions located 150 mm away from the exposed face of the specimen. The furnace was controlled so that the mean of these thermocouples readings followed the time/temperature relationship of teat standard.

During the performance of a fire exposure test, the furnace temperatures are recorded at least every 60 seconds and displayed for the furnace operator to allow control along the specified temperature curve.

Specimen Unexposed Surface Temperature Measurement

Temperatures of unexposed surfaces are monitored using Copper/Constantan (Type T) thermocouples placed under 30 mm square dry, felted pads. Temperature readings were taken at not less than three points on the surface, at intervals not exceeding 1.0 minute.

Fire Endurance Test

The fire door assembly exposure temperature during the fire test shall be controlled to conform to the standard temperature time relation as shown in the following table.

Standard Temperature Time Relation

Time (min.)	5	10	30	60	120	240	480
Furnace Temperature (°C)	538	704	843	927	1010	1093	1260

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The fire exposure is continued on the specimen until the desired fire endurance rating period is reached, or until failure to meet any of the performance criteria specified hereinafter.

Hose Stream Test

When the hose stream test is required to be performed, the fire exposed side of the fire door assembly shall be subjected to the impact, erosion, and quenching effects of a standard hose stream within the two minutes immediately following the fire test. The tip of the play pipe shall be located 6m from the fire door assembly. The minimum water pressure measured at the base of the play pipe shall be as specified in the following table.

Water Pressure and Duration of Application for Hose Stream

	Water Pressure	Duration of Application
Desired Rating	**psi (kPa)**	**sec/m²**
3 hr and over	45 (310)	32
1 ½hr and less than 3 hr	30 (207)	16
1 hr and less than 1 ½hr	30 (207)	10
Less than 1 hr	30 (207)	6

3. CONDITIONS OF ACCEPTANCE (PERFORMANCE CRITERIA)

General

The fire door assembly shall meet the performance criteria when:

- The fire door assembly shall remain in the test wall opining during both the fire test and the hose stream test.
- The fire door assembly shall not develop any openings in the door assembly, except as permitted by the next two points.
  - Openings created by glazing material breakage in the central area of each individual glazed light in any vision panel shall not exceed 5 percent of the area of the glazed light during the hose stream test

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- Openings created by separation of the glazing material edges from the glazing frame due to movement away from the frame shall not exceed 30 percent of each individual glazed light perimeter during the hose stream test.

- No flaming shall occur on the unexposed surface of the door assembly during the first 30 minutes of the fire test, except that intermittent flames not greater than 15.2 cm in length shall be permitted to occur for periods not to exceed 10 seconds.
- After 30 minutes of the fire test, some intermittent flames not greater than 15.2 cm in length shall be permitted to occur along the edges of doors for periods not to exceed 5 minutes.
- For doors having a fire test duration equal to or greater than 45 minutes, flames not greater than 15.2 cm in length shall be permitted to occur on the unexposed face of the door during the last 15 minutes of the fire test, provided that the flames are contained within a distance of 3.8 cm from a vertical door edges, within 7.6 cm from the top edge of the door.
- Where hardware is evaluated for use on fire doors, it shall keep the door in the closed position for fire test duration of not less than 3 hours, and the latch bolt shall remain projected and intact. The hardware shall not be required to be operable following the tests.

Swinging Doors

- For swinging doors, any portion of the edges adjacent to the door frame shall not move from its original position in a direction perpendicular to the plane of the doors for a distance greater than door thickness during the fire test or greater than 1 1/2 times the door thickness during the hose stream test.
- A single swinging door shall not separate from the door frame by than 1.3 cm at the latch location.
- Door frames to be evaluated with doors shall remain fastened to the test wall on all sides and shall not develop openings between the frame and the doors or between the frame and the adjacent test wall.

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4. TEST RESULTS AND OBSERVATION

- The test assembly was selected and delivered to HBRC fire lab by the client without any responsibility of the HBRC fire lab. The client, consultant and owner representatives were allowed to attend and observe the test as witnesses.
- The ambient temperature at the start of the test was 34°C and the mean steel surface temperature was 37°C.
- The test assembly was installed under the full responsibility of the client under supervision of fire technologist.
- Figure (1) shows the drawing sheet of the tested door.
- The test assembly consisted of a single swinging wooden door with **Halspan internal fire core material (Optima FD60)**, hung in an oak wooden frame with three hinges fixed with four bolts at each leg of each hinge and with **Halspan fire seals**. It was installed in an opining in brick wall nominally 300 cm wide ×290 cm height with 25 cm thickness, made of hollow clay brick.
- The leaf is surrounded by an oak wood texture with a thickness of 8 mm, and the leaf is coated with the oak crust on both sides, as shown in figure (1).
- Figure (2) shows the photo of the unexposed face of the door assembly before the test.
- Figure (3) shows the photo of the exposed face of the door assembly before the test.
- Figure (4) shows the door lock of the door assembly.
- The clearances between the installed door and the frame along the periphery were within the allowable limits of the test method standard.
- The landing side of the door exposed to the furnace chamber during the test.
- The fire door assembly did not develop any opening or cracks on the unexposed surface of the door assembly until the end of test.
- Heavy smoke was developed after 15 minutes as shown as in figure (5).
- The upper edge of the door leaf was burned after 54 minutes as shown in figures (6). Some intermittent flames was also noticed.
- Figure (7) shows the standard time-temperature curve, the actual furnace temperature and the average temperature of the unexposed surface.
- Figure (8) shows the photo of the exposed face of the door assembly after the test.

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- The test was terminated after 60 minutes, according to the client request.
- These results are only valid for sample delivered to the Laboratory.
- This report is valid for only one year.

CONCLUSION

The single swinging metal door assembly was subjected to a fire resistance test in accordance with test procedure NFPA 252 and BS 476 parts 20 and 22. It was succeeded to fulfill the requirements of the test standard for fire rating of **60 minutes** as requested by the client.

Property	Result
Fire rating for 1-h	**pass**

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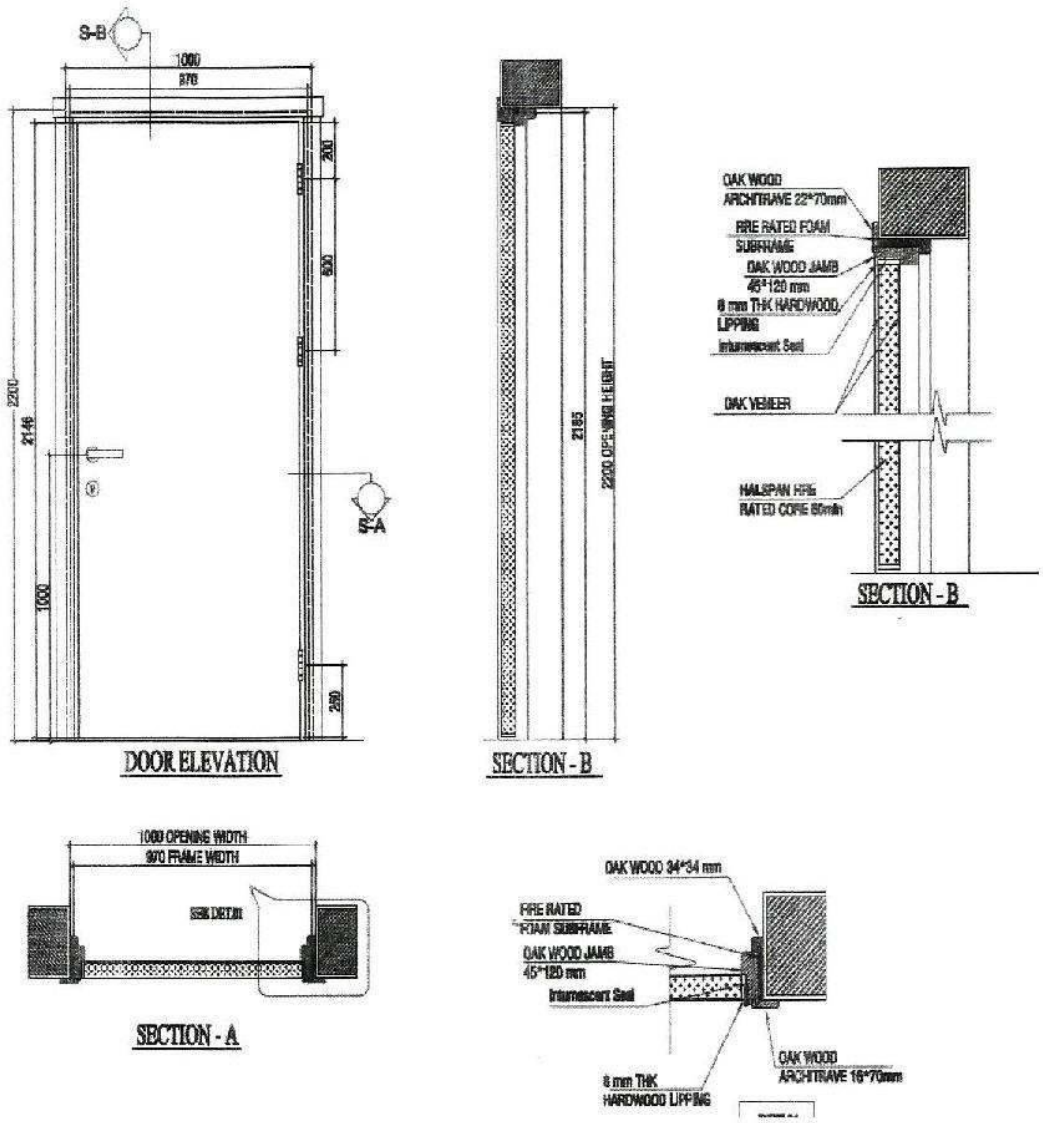

Figure (1): The drawing sheet of the tested door.

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Figure (2): The photo of the unexposed face of the door before the test.

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Figure (3): The photo of the exposed face of the door before the test.

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Figure (4): The accessories of the door assembly.

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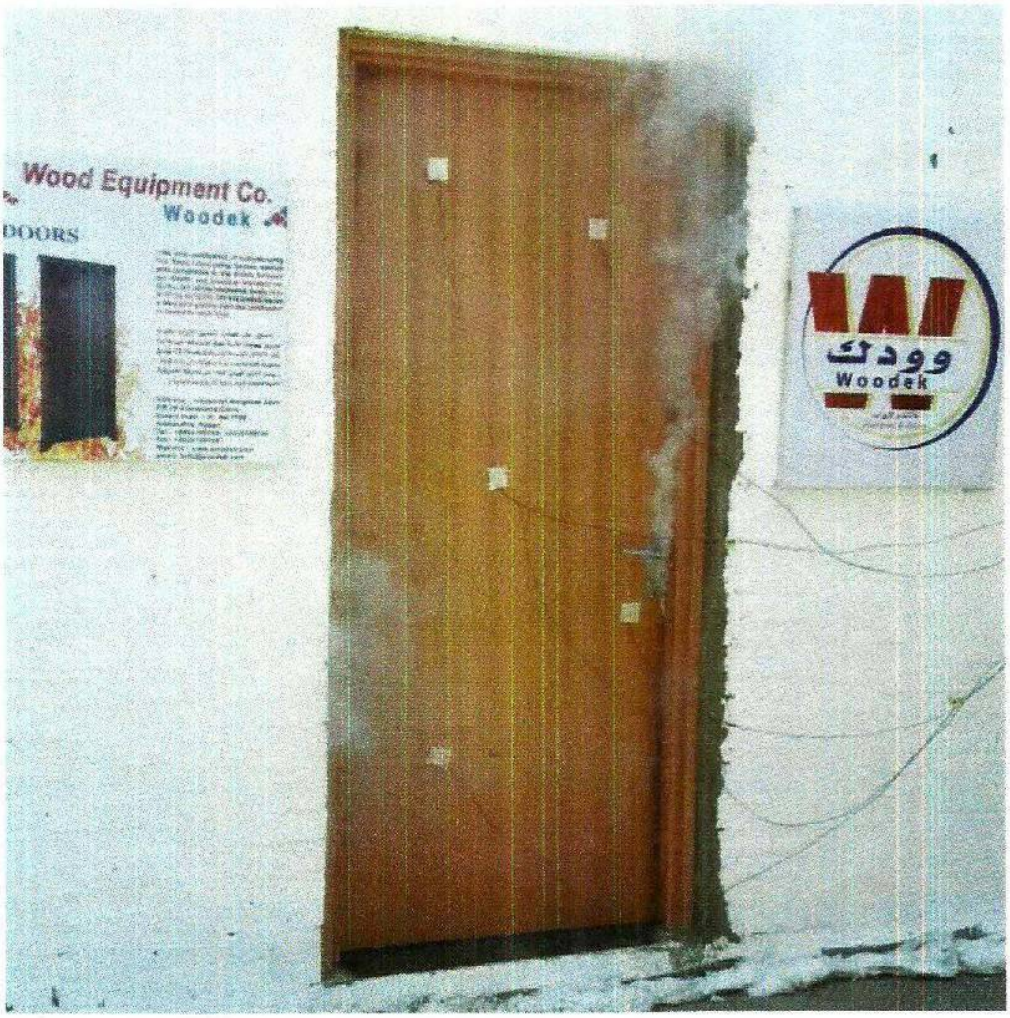

Figure (5): Heavy smoke was developed during the test.

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Figure (6): burning and flaming at the top of the door.

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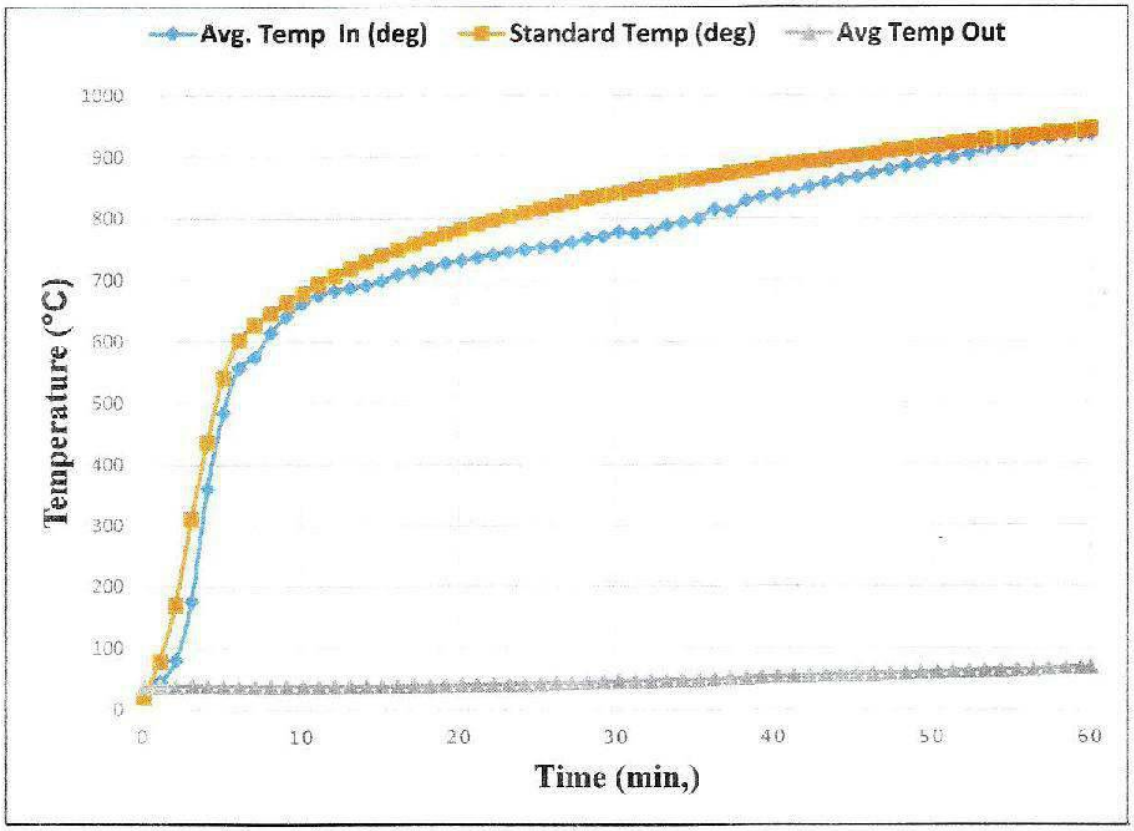

Figure (7): The standard time – temperature curve, the actual furnace temperature and the average temperature of the unexposed surface.

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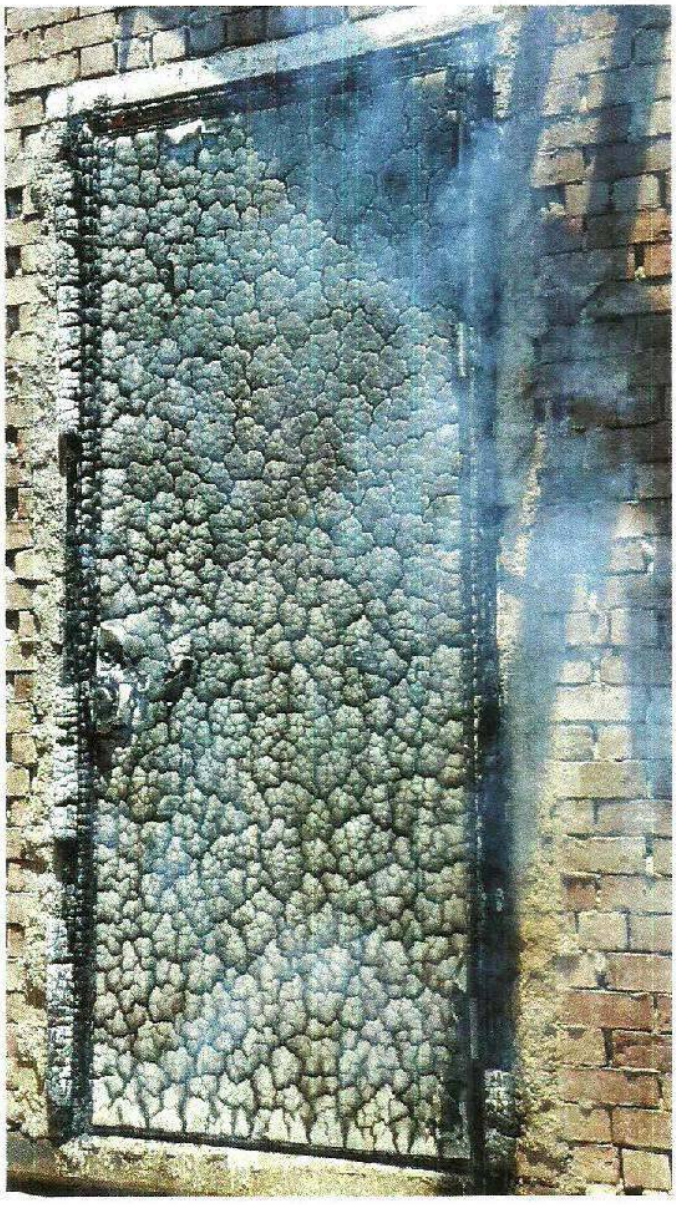

Figure (8): The photo of the exposed face of the door after the test.

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