



AN IMPROVED FIRE DOOR

FIELD OF THE INVENTION

The present invention relates to an improved fire door. In particular, the present invention pertains to a door having timber frames and composite panel for achieving superior dimensional stability, meeting stringent fire resistant tests while allowing building professionals the flexibility and versatility to specify the same in designing modern building structures.

BACKGROUND OF THE INVENTION

Conventional doors are made mostly out of fibrewood, MDF board or plywood facings. These materials absorb moisture, and over time the conventional doors swell or sag. With repeating opening and shutting of the door, the lockset jams because loose particles from the compressed fibreboard or chipboard enter the lockset mechanism.

Safety regulators and building professionals require doors and windows to achieve certain fire ratings or pass fire resistant tests before they are allowed to be used in modern building structures. An example of such fire resistant tests is British Standard BS 476: Part 22: 1987. Specimen of doors are assessed in a timed, one side flame burn against at least two criteria: (1) loss of integrity and (2) loss of insulation.

Loss of integrity refers to either one of three failures: (i) when cracks or other openings exist in the specimen through flame or hot gases can pass through and would cause ignition of a cotton wool pad, (ii) when the cotton wool pad test cannot be used because of the level of radiation from the door, and when an unobstructed gap or fissure exceeding 6mm in width by 150mm in length



exists or develops in the specimen, or (iii) when sustaining flaming for more than 10 seconds occurs on the unexposed face of the specimen.

5 Loss of insulation refers to either one of two types of failures: (i) when the mean temperature on the unexposed face of the specimen increases by more than 140° C above the initial temperature on the unexposed face of the specimen, or (ii) when the temperature on the unexposed face of the specimen increases at any point by more than 180° C above the initial temperature on the unexposed face of the specimen.

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Notwithstanding the variety and appeal of timber doors, most timber specimen doors could not sustain the integrity test for over half an hour while even fewer timber specimen surpass the insulation criterion by more than 30 minutes. As such, building professionals are restricted in the choice of material for fire
15 doors.



OBJECT OF THE INVENTION

It is therefore an object of the present invention to achieve superior dimensional stability for doors having timber frames and composite panels.

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It is a further object of the present invention to meet stringent fire resistant tests for doors having timber frames and composite panels.

It is yet another object of the present invention to allow building professionals the flexibility and versatility to specify doors with timber frames and composite panels in designing modern building structures.

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SUMMARY OF THE INVENTION

The present invention is an improved fire resistant door having timber frames and at least one leaf incorporating at least one composite panel. The frame comprises rails and stiles made from hardwood. The inner edges of the rails and stiles have grooves to receive the outer edges of the panels. The composite panel comprises at least three layers. The exposed layer (facing the flame) and the unexposed layer (facing away from the flame) comprise subpanels made from hardwood. Sandwiched between the exposed and unexposed layers is an intermediate layer comprising either an insulation or fire resistant material such as calcium silicate board. In the preferred embodiment of the present invention, a double doorset incorporating various three layer panels sustained fire integrity test for approximately an hour under British Standard BS 476: part 22: 1987.

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BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front elevational view of a single action double doorset incorporating a preferred embodiment of the present invention where the raised panels and flat panels are placed alternatively on both sides of a door leaf.

FIG. 2 is a horizontal, cross section elevational view of the double doorset according to line A-A in FIG. 1.

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FIG. 3 is another horizontal, cross section elevational view of the fixed panelled leaf according to line B-B in FIG. 1.



DETAILED DESCRIPTION OF THE EMBODIMENT

A door for achieving improved fire resistance test for timber door is described.

In the following description, numerous specific details are set forth such as

5 frames and panels, etc. in order to provide a thorough understanding of the present invention. It will be obvious to one skilled in the art that the present invention may be practiced without these specific details. In other instances, well-known parts such as those related to the testing furnace and hardware for securing the specimen to the testing chamber are not shown in order not to
10 obscure the present invention.

FIG. 1 is a front elevational view of a single action double doorset 10 incorporating a preferred embodiment of the present invention. The doorset 10 comprises a top fixed panel 12, a multiple panel leaf 22, a single panelled
15 leaf 32, and plurality of supporting frames 42. Although not shown in the figures, the doorset 10 is installed within a reinforced concrete restraint frame in order to receive a timed, one side flame burn on the exposed face of the doorset. Various temperature and pressure sensors are placed strategically on both sides of the doorset to monitor and the measure the temperature on or
20 near the surfaces of the doorset.

Referring to FIG. 1, the top fixed panel 12 comprises a top rail 14, a bottom rail 16, at least two stiles 18 and a top flat panel 20. In the preferred embodiment of the present invention, the top rail 14, bottom rail 16 and stiles 18 were
25 formed from a frame of hardwood such as Nyatoh, Oak, Ash or other equivalent thereof, and having a thickness of 45mm. A top flat panel 20 is attached to the inner edges of the rails and stiles. The top flat panel 20 is a composite panel comprising at least three layers, and is identical to that of the



panels of the single panelled leaf 32 and multiple panelled leaf 22. Details of the construction and composition of the panel 20 shall be elaborated further below.

5 FIG. 2 is a horizontal, cross section elevational view of the double doorset 10 according to line A-A in FIG. 1. The double doorset comprises one multiple panelled leaf 22 and a single panelled leaf 32. The doorset is secured to the door frames 42 by means known in the art. As the doorset comprises two door leaves 22 and 32, meeting stiles 25 and 36 are rebated centrally to support
10 the respective leaves. The mutin 24, stiles 25 of the multiple panelled leaf 22 have on their inner edges grooves 38 for receiving the outer edges of composite panels 30. Similarly, the stiles 36 of the single panelled leaf 32 have on their inner edges grooves 38 for receiving the outer edges of composite panels 40. The tongue and groove connection between the panels
15 and the mutins/stiles not only provides superior dimensional stability to the doorset, but also minimizes the infiltration of air and moisture through the doorset. The mutins 24, rails (not shown in figures), stiles 25 and 36 are all made from hardwood; all joints are mortice and tenon incorporating hardwood dowels (not shown in figures).

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In FIG. 2, the panels 26 and 30 are installed forward and reverse across the face of the multiple panelled leaf 22. Each of the panels 26 and 30 comprises of three layers: (i) an exposed layer 27, (ii) unexposed layer 29, and (iii) an intermediate layer 28. The layers are bonded with adhesive or other means
25 well known in the art to form the composite panel. The exposed layer 27 and the unexposed layer 29 are made of timber, while the intermediate layer 28 comprises either insulation material or fire resistant material. In the preferred embodiment of the present invention, the exposed layer comprises integrated



raised panel moulding of Nyatoh, while the unexposed layer comprises plywood. The intermediate layer, on the other hand, comprises preferably calcium silicate board. It should be understood by one skilled in the art that any timber or hardwood may be used for the exposed layer and the unexposed layer. For the purpose of passing stringent fire resistant tests such as British Standard BS 476: part 22: 1987, hardwood such as Nyatoh, Oak, Ash or other hardwood of density of 550 kg/m^3 is recommended for the exposed layer. Actual fire test results also confirm that timber of lesser density may be used. It should also be understood by one skilled in the art that the intermediate layer is not restricted to calcium silicate board; any fire retardant material may be suitable to meet the overall objective of the present invention.

FIG. 3 is another horizontal, cross section elevational view of the single panelled leaf 32 according to line B-B in FIG. 1. As mentioned briefly above, the mutins (not shown in figures), the rails (not shown in figures), the stiles 36 of the single panelled leaf 32 comprise of timber or hardwood. Just as the multiple panelled leaf 22, the single panelled leaf 32 also features a composite panel in the single raised panel 40. The panel is identical to the top flat panel 20, the raised panels 26 and 30. In other words, panel 40 comprises of three layers - an exposed layer 27, an intermediate layer 28, and an unexposed layer 29. The outer edges of the panel 40 functions as the tongue to connect interlockingly with the grooves 38 in the inner edges of the stiles 36. This interlocking connection is not only simple to fabricate, but it also allows building professionals the flexibility and versatility to match and design timber panels for doors without concerning themselves with the door's ability to withstand fire.

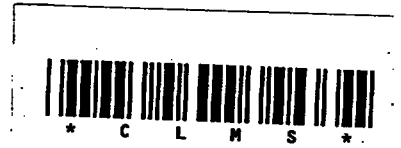


- A specimen of door constructed in accordance with that in FIGS 1 - 3 underwent testing by Warrington Fire Research Centre in Surrey, United Kingdom under British Standard BS 476: part 22: 1987. The single action double doorset with over panel performed the loss of integrity criterion at 54 minutes and the loss of insulation criterion at 47 minutes. The results of the Warrington Fire Research Centre shows that door structure of the present invention can be specified by building professionals for a variety of building uses where metal doors and wood flush doors were previously used.
- 10 While the present invention has been described particularly with reference to FIGS. 1 to 3 with emphasis on an improved fire resistant door, it should be understood that the figures are for illustration only and should not be taken a limitation on the invention. In addition, it is clear that the method and apparatus of the present invention has utility in many applications where fire
- 15 safety for building material is required. It is contemplated that many changes and modifications may be made by one of ordinary skill in the art without departing from the spirit and the scope of the invention as described.



CLAIMS

- 1 1. An improved fire door comprising:
2 a support frame structure for rebating a panel assembly within
3 the interior edges of said frame structure, said support frame comprising a
4 plurality of rails stiles and mutins, the inner edges of said rails, stiles and
5 mutins having grooves;
6 said panel assembly comprising at least one panel, said panel
7 having outer edges for connecting into said grooves for enhancing the
8 dimensional stability of said door;
9 said panel further comprising at least three layers, said three
10 layers comprising an exposed layer, an intermediate layer and an unexposed
11 layer for meeting fire resistant tests,
12 whereby the selection of exposed and unexposed layers of said
13 panel allowing building professionals the flexibility and versatility to specify
14 said doors in designing modern building structures.
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- 1 2. An improved fire door as in claim 1 wherein said support frame is
2 made from timber.
- 1 3. An improved fire door as in claim 1 wherein said support frame is
2 made from hardwood.
- 1 4. An improved fire door as in claim 1 wherein said exposed layer
2 is made from timber.
- 1 5. An improved fire door as in claim 1 wherein said exposed layer
2 is made from hardwood.
- 1 6. An improved fire door as in claim 1 wherein said unexposed
2 layer is made from timber.
- 1 7. An improved fire door as in claim 1 wherein said intermediate
2 layer is made of fire resistant material.



- 1 8. An improved fire door as in claim 1 wherein said intermediate
2 layer is made of calcium silicate board.
- 1 9. An improved fire door substantially as described with reference
2 to the accompanying drawings

This Sheet Has Been Replaced

