

**The Fire Resistance Performance of
Folding, Accordion-Type Doorset Assemblies
with Respect to BS EN 1634-1: 2000**

Report for

Won-Door Corporation
1865 South 3490 West
Salt Lake City
UT 84104
USA

W*arrington*
FIRE
research
CONSULTANCY • TESTING

The Professionals in Fire Safety

TABLE OF CONTENTS		
SECTION		PAGE
1	INTRODUCTION	3
2	ASSUMPTIONS	3
3	PROPOSAL	3
4	DISCUSSION	4
4.1	PREVIOUS TEST EVIDENCE	4
	WARRES No. 117771	4
4.2	ASSESSED PERFORMANCE	4
	4.2.1 MASONRY WALL CONSTRUCTIONS/ STEEL LEADING EDGE POST	4
	4.2.2 INCREASED OPENING DIMENSIONS	5
	4.2.3 CURVED DOORSETS	7
	4.2.4 BI-PARTING DOORSETS	7
5	CONCLUSIONS	8
6	VALIDITY	8
7	SUMMARY OF PRIMARY SUPPORTING DATA	8
8	SUMMARY OF SECONDARY SUPPORTING DATA	9
9	DECLARATION BY WON-DOOR CORPORATION	10
10	SIGNATORIES	10

1 Introduction

This report provides an appraisal of the expected fire resistance performance of modified, folding, accordion-type doorset assemblies.

The proposed folding doorsets, which are similar to that previously tested under the reference WARRES No. 117771, are required to provide 120 minutes integrity performance (not accounting for cotton pad failure), if subjected to a test in accordance with BS EN 1634-1: 2000.

The data referred to in Section 7 and 8 of this report has been considered for the purpose of this appraisal which has been prepared in accordance with the Fire Test Study Group Resolution No. 64A 1993.

2 Assumptions

It is assumed that the proposed assemblies shall be constructed and installed as specified within the report referenced WARRES No. 117771, unless otherwise stated within this report.

3 Proposal

It is proposed that the folding doorset assembly previously tested under the reference WARRES No. 117771, shall provide 120 minutes integrity performance (not accounting for cotton pad failure), if subjected to a test in accordance with BS EN 1634-1: 2000, when modified as follows:

- i) the doorset shall be installed within masonry wall constructions, as opposed to the previously tested timber stud partition assembly,
- ii) the doorset shall incorporate a steel leading edge post as opposed to the tested aluminium edge post,
- iii) the doorset may have an increased opening width of up to 9000 mm and an increased opening height of up to 4500 mm,
- iv) the doorset may be curved over its width by a radius of up to 5000 mm,
- v) the doorset may be constructed as a bi-parting assembly as opposed to the tested side opening assembly.

4 Discussion

4.1 Previous Test Evidence

WARRES No. 117771

A fire resistance test conducted on a specimen of a horizontal sliding, folding doorset, in accordance with BS EN 1634-1: 2000.

The doorset was installed within timber stud, plasterboard clad, side and top pockets to provide an overall clear opening size of 2694 mm high by 2381 mm wide.

Integrity failure (sustained flaming) of the doorset occurred after a period of 18 minutes. A subsequent integrity failure (cotton pad) occurred after a period of 50 minutes. Ignition of the cotton pad was, however, attributable to heat radiation from the unexposed surface of the uninsulated specimen and was not caused by the formation of through gaps or sustained flaming from the specimen. The gap gauge criteria was satisfied for the test duration of 121 minutes.

An addendum to the test report concludes that the flaming from the specimen after a period of 18 minutes was caused by ignition of the control panel and/or battery within the storage pocket, which subsequently caused flames to project out from out of the pocket onto the unexposed surface.

The addendum concludes that if the width of the pocket were increased from the tested dimension of 339 mm to the manufacturers recommended dimension for installation on site of 838 mm, then the flames mentioned after a period of 18 minutes would have been contained within the pocket and would not have protruded to the unexposed surface. The addendum therefore considers that the assembly would have achieved at least 60 minutes performance, with regard to the sustained flaming integrity criteria, had this modification been incorporated for the test.

4.2 Assessed Performance

4.2.1 Masonry Wall Constructions/ Steel Leading Edge Post

As discussed in the addendum to the original test report, the previously tested assembly would be expected to satisfy the sustained flaming integrity criteria for a period of 60 minutes and the gap gauge criteria for a period of 121 minutes, if the larger pocket dimension were incorporated.

Although cotton pad ignition occurred after a period of 50 minutes, this was caused by radiated heat from the uninsulated specimen.

Although the modified assembly would therefore be expected to provide 60 minutes performance, with regard to the sustained flaming criteria, subsequent flaming from the specimen after periods of 71 minutes, 96 minutes and 110 minutes, indicate that a performance of 120 minutes would be unlikely unless these failures could be overcome.

The sustained flaming from the bottom leading edge corner of the doorset after a period of 71 minutes was attributed to ignition of the PVC bottom sweep. It was noted that molten aluminium from the extruded leading edge cap had accumulated on the cill at this position, which is considered to be the likely cause of ignition of the PVC. This is further corroborated by the fact that there was no flaming from any other position along the bottom sweep during the test duration of 121 minutes.

It is therefore considered that if the aluminium cap were replaced for a steel cap, this would be expected to remain intact and in position for the test duration, thereby eliminating the source of ignition along the cill. The sustained flaming which was observed after a period of 71 minutes would not therefore be expected if a steel leading edge post were incorporated.

The additional flaming which was observed after periods of 96 and 110 minutes is deemed to have been caused by flaming of the timber studs which provided the structural framework to the pocket. Observations contained in the report indicate that the plasterboard cladding to the exposed face of the partition had started to detach after a period of 90 minutes, leaving the timber studding exposed.

The flaming mentioned after periods of 96 and 110 minutes, which continued for the remaining test duration, occurred from the left hand pocket of the construction (as viewed from the unexposed face) at positions not coincident with any combustible items incorporated within the doorset assembly.

This flaming is therefore attributed to flaming from the timber studs positioned on or close to the exposed face which were, at this stage, directly exposed to the heating conditions of the test.

It is considered that had the associated construction been manufactured from masonry or reinforced concrete, which was capable of providing a minimum of 120 minutes integrity performance, it would not only have remained intact and provided additional protection to the edges of the doorset for the required period, but would have also resisted ignition and the subsequent flaming observed after periods of 96 and 110 minutes.

It is therefore considered that had the doorset referred to in the previous test report and addendum been constructed incorporating a steel leading edge post and had been installed within a masonry or reinforced concrete wall construction (of minimum 120 minutes integrity performance), the expected integrity performance would be as follows:

Integrity	Cotton Pad	50 minutes
	Sustained Flaming	120 minutes
	Gap Gauge	121 minutes

4.2.2 Increased Opening Dimensions

The previous test has proven the ability of the doorset to provide an adequate level of stability and resist the formation of through gaps for the test duration of 121 minutes, at clear opening dimensions of 2694 mm high by 2381 mm wide.

An increase in dimensions for most doorset assemblies would be expected to provide an associated increase in deformation when exposed to fire test conditions, which could cause the formation of through gaps. It is, however, considered that the tested assembly differs from most traditional types of doorset in that a significant degree of restraint is provided along the vertical and top edges. In addition, a significant overlap between the doorset and the associated construction reduces the likelihood of through gaps forming should undue deformation of the assembly occur.

The top edge of the doorset was fully restrained by the track, which was fixed directly to the supporting construction via the plasterboard and plywood header. This is corroborated by deflection data contained within the report, which indicates that a maximum deformation of only 14 mm, compared to that recorded on commencement of the test, occurred across the head of the doorset during the test duration of 121 minutes.

Although deflection measurements along the vertical edges of the doorset were not recorded during the test, the fixing of the floating jambs to the associated construction restricts any deformation along this edge of the doorset. In addition, the engagement of the leading edge of the doorset into the recessed striker within the pocket fully restrains this edge of the door.

The only potential for increased deformation associated with doorsets of larger dimensions would therefore be across the unrestrained, bottom edge. Despite this edge of the assembly being unrestrained, the maximum deformation measured at its mid-width was only approximately 39 mm, compared to that recorded on commencement of the test. This maximum deformation was attained at a relatively early stage of the test (approximately 15 minutes) and was maintained for the remaining test duration.

It is considered that although the bottom edge of the assembly was subject to deformation during the initial stages of the test, the vertical expansion of the steel panels when subjected to elevated temperatures caused the steel panels to lock against the cill shortly prior to 15 minutes, thereby restricting any further deformation at this position. Although no mention of any such occurrence is recorded in the observations contained within the report referenced WARRES No. 117771, photographs contained within Annex D of this report depict that the clearance gap between the panels and cill had progressively reduced during the initial stages of the test.

It is therefore considered that although an increase in the width of the assembly may increase the deflection at mid-span of the lower edge during the initial stages of the test, the vertical expansion of the panels would still be expected to lock the doorset against the cill after a corresponding period, thereby restricting further deformation. The formation of a 25 mm through gap at this position, which would constitute integrity failure under the gap gauge criteria, is therefore considered to be improbable.

Furthermore, it is considered that an increase in the height of the doorset would provide an increase in the overall expansion of the steel panels, causing the doorset to lock against the cill at an earlier stage of the test.

It is therefore considered that in lieu of the significant restraint provided across the vertical and top edges of the tested doorset and the tendency of the lower edge of the assembly to lock against the cill, it is considered reasonable for the doorset to be increased in dimensions to provide an overall clear opening size of 4500 mm high by 9000 mm wide.

4.2.3 Curved Doorsets

It is proposed that the previously tested, side opening doorset may be curved over its width, over a maximum radius of 5000 mm.

The proposed curved doorset shall be identical in construction to that previously tested except that the inner track is of different cross sectional shape and the track system shall be curved as opposed to straight.

It is expected that the components of such an assembly would interact in a similar manner to those of the previously tested assembly. The vertical and top edges of the doorset would still be fully restrained and the lower edge of the doorset would still be expected to lock against the cill after the panels have expanded.

It is therefore considered that, provided the supporting construction can adequately accommodate such an assembly without detracting from the previously tested specification, and that the minimum pocket depth as specified in the addendum to the test report can be retained, side-opening, curved doorsets may be positively appraised at the maximum dimensions permitted for straight doorsets, i.e. 4500 mm high by 9000 mm wide.

4.2.4 Bi-Parting Doorsets

The testing of the doorset in a side-opening configuration is deemed to present a less onerous configuration to that of a bi-parting assembly. The positive engagement of the leading edge post into the recessed striker is considered more favourable than the meeting edge detail utilised for a bi-parting assembly.

The test referenced R6799-6 does, however, provide evidence to support the performance of the proposed assembly when tested in a bi-parting configuration. The test was conducted utilising the heating conditions specified in UL 10 (B), which apart from minor deviations, are otherwise similar to those utilised for a test in accordance with BS EN 1634-1: 2000.

The test specimen had an overall clear opening size of approximately 3550 mm high by 3785 mm wide. The meeting edges of the two door panels, which formed a labyrinth arrangement, incorporated a fusible link operated latching mechanism which was observed to have activated after approximately 3 ½ minutes of the test, securely locking the leading edges together.

Observations contained within this test report state that the meeting edges remained in position and that no through gaps were visible within the assembly for the full test duration of 180 minutes, i.e. for a duration 50 % in excess of the 120 minutes required.

The bi-parting doorset has therefore demonstrated its ability to provide the required degree of stability when exposed to very similar heating conditions to those of the required test method.

The only concern with the proposed assembly is that the previous test was conducted utilising a neutral furnace pressure, whereas BS EN 1634-1: 2000 would require such a specimen to be subjected to a positive furnace pressure over its upper area. This positive pressure would promote flaming from the meeting edges of the assembly, should any combustible components be incorporated in the vicinity. It is therefore a requirement of this report that the meeting edges of the door leaves shall be constructed utilising non-combustible components.

It is therefore considered that the fire test referenced R6799-6 provides sufficient justification for the use of the proposed meeting edge detail utilised within bi-parting doorset assemblies. Furthermore, the assembly has proven its performance at dimensions in excess of those of the assembly previously tested to BS EN 1634-1: 2000.

It is therefore considered that the opening height of bi-parting assemblies may be increased from the tested height of 3550 mm to 4000 mm. This increase in height would not be expected to significantly increase the distortion along the meeting edges of the door leaves and a positive engagement of the meeting edges would still be expected for the required test duration of 120 minutes.

Data contained within the report referenced R6799-6 indicates that the bi-parting assembly was subjected to a similar level of distortion as the previously tested side opening assembly, despite having greater opening dimensions. It is therefore considered that an increase in opening width to 9000 mm, as appraised for the side opening assembly, is reasonable. Each door leaf within the assembly shall be of identical dimensions.

The proposed bi-parting doorsets assemblies may therefore be positively appraised for a maximum opening size of 4000 mm high by 9000 mm wide, for up to 120 minutes integrity performance (excluding cotton pad failure), dependent upon the supporting construction.

5 **Conclusions**

It is expected that the proposed folding, accordion-type doorsets discussed within this report, which are similar to that previously tested under the reference WARRES No. 117771, will provide up to 120 minutes integrity performance (excluding cotton pad failure), if subjected to a test in accordance with BS EN 1634-1: 2000.

6 **Validity**

This assessment is issued on the basis of test data and information available at the time of issue. If contradictory evidence becomes available to WFRC the assessment will be unconditionally withdrawn and Won-Door Corporation will be notified in writing. Similarly the assessment is invalidated if the assessed construction is subsequently tested because actual test data is deemed to take precedence over an expressed opinion. The assessment is valid initially for a period of two years, i.e. until 1st October 2003, at which time it is recommended that it be returned for re-appraisal.

7 **Summary of Primary Supporting Data**

Warrington Fire Research Centre WARRES No. 117771

A fire resistance test conducted on a specimen of a horizontal sliding, folding doorset, in accordance with BS EN 1634-1: 2000.

The doorset was installed within timber stud, plasterboard clad, side and top pockets to provide an overall clear opening size of 2694 mm high by 2381 mm wide.

Integrity	Cotton Pad	50 minutes
	Sustained Flaming	18 minutes
	Gap Gauge	121 minutes

An addendum to the test report concludes that the flaming from the specimen after a period of 18 minutes was caused by ignition of the control panel and/or battery within the storage pocket, which subsequently caused flames to project out from out of the pocket onto the unexposed surface.

The addendum concludes that if the width of the pocket were increased from the tested dimension of 339 mm to the manufacturers recommended dimension for installation on site of 838 mm, then the flames mentioned after a period of 18 minutes would have been contained within the pocket and would not have protruded to the unexposed surface. The addendum therefore considers that the assembly would have achieved at least 60 minutes performance, with regard to the sustained flaming integrity criteria, had this modification been incorporated for the test.

Test Date : 28th June 2001
 Test Sponsor : Won-Door Corporation

8 Summary of Secondary Supporting Data

Underwriters Laboratories R6799-6

A fire resistance test conducted in accordance with the Standard for Fire Tests of Door Assemblies, UL 10(B).

The test was conducted on a horizontal sliding, bi-parting, accordion-type doorset having an overall clear opening size of approximately 3550 mm high by 3785 mm wide. The meeting edges of the two door panels, which formed a labyrinth arrangement, incorporated a fusible link operated latching mechanism.

On completion of the fire test after a period of 180 minutes, no through gaps were evident and the meeting edges remained in position. There was no evidence of flaming on the unexposed surface throughout the test duration.

Immediately after the fire test the assembly was subjected to the impact and cooling effects of a 45 psi hose stream.

Report Date : 3rd May 1985
 Test Sponsor : Won-Door Corporation

9 Declaration by Won-Door Corporation

We the undersigned confirm that we have read and complied with the obligations placed on us by the UK Fire Test Study Group Resolution No. 64A: 1993.

We confirm that the component or element of structure, which is the subject of this assessment, has not to our knowledge been subjected to a fire test to the Standard against which the assessment is being made.

We agree to withdraw this assessment from circulation should the component or element of structure be the subject of a fire test to the Standard against which this assessment is being made.

We are not aware of any information that could adversely affect the conclusions of this assessment.

If we subsequently become aware of any such information we agree to cease using the assessment and ask Warrington Fire Research Centre to withdraw the assessment.

Signed:

For and on behalf of:

10 Signatories

Prepared by:*

D. Hankinson

Reviewed by:*

D. Williams

* For and on behalf of Warrington Fire Research Centre.

The assessment report is not valid unless it incorporates the declaration duly signed by the applicant. This is included in Section 9 to this report.

Report Issued: 11th September 2001