

Determination of the fire resistance according to EN 1634-1:2014 of a Alara Lukagro steel door type AL-D

Report number	2014-Efectis-R0236b
Sponsor	Alara Lukagro BV P.O. Box 15 NL-2964 ZG GROOT-AMMERS The Netherlands
Product name	Alara Lukagro type AL-D
Efectis notified body nr	1234
Authors	W. Scheffer BBE S. Lutz
Project number	2014236
Test date	25 th of April, 2014
Date of issue	October 2014
Issue	1
Number of pages	35

TABLE OF CONTENTS

1. GENERAL	3
1.1 Report	3
1.2 Subject	3
1.3 Investigation	3
1.4 Sponsor and manufacturer	3
1.5 Place and data regarding the examination	3
1.6 Revision information	3
2. TEST SPECIMEN	4
2.1 General	4
2.2 Test specimen	4
2.3 Gap widths	7
2.4 Method of assembly	7
3. ASSEMBLY AND MANUFACTURING OF THE CONSTRUCTION	7
4. RESEARCH METHOD	7
4.1 Verification of the test specimen	7
4.2 Closing forces and locking	7
4.3 Conditioning	7
4.4 Density and moisture content	8
4.5 Fire test	8
5. RESULTS OF THE FIRE RESISTANCE TEST	9
5.1 Observations during heating	9
5.2 Graphs of the fire test	9
5.3 Uncertainty of measurement	9
5.4 Photographs	9
6. SUMMARY OF TEST RESULTS	10
7. FIELD OF DIRECT APPLICATION OF TEST RESULTS	11
7.1 Specific restrictions on materials and constructions	11
7.2 Decorative finishes	11
7.3 Fixings	11
7.4 Building hardware	11
7.5 Permissible size variations	11
7.6 Supporting constructions	13
8. FIGURES	14
APPENDIX A: FURNACE CONDITIONS, PRESSURE AND AMBIENT TEMPERATURE	24
APPENDIX B: POSITION OF THERMOCOUPLES AND TEST RESULTS	27
APPENDIX C: PHOTOS	31

1. GENERAL

1.1 REPORT

This report surveys the building-in of the test specimen, the investigation on fire resistance, the test conditions, measuring results of the fire test and the field of direct application of the test results.

1.2 SUBJECT

A Alara-Lukagro steel double door-set type AL-D, in a steel frame.

1.3 INVESTIGATION

Determination of fire resistance according to EN 1634-1:2014; Fire resistance and smoke control tests for door and shutter assemblies, openable windows and elements of building hardware - Part 1: Fire resistance test for door and shutter assemblies and openable windows.

The steel double door-set was tested with the door leafs turning away from the fire.

1.4 SPONSOR AND MANUFACTURER

Sponsor	Manufacturer
Alara-Lukagro BV	Alara-Lukagro BV
P.O. Box 15	P.O. Box 15
NL-2964 ZG Groot-Ammers	NL-2964 ZG Groot-Ammers
The Netherlands	The Netherlands

1.5 PLACE AND DATA REGARDING THE EXAMINATION

The research was conducted at the laboratory of Efectis Nederland BV in Bleiswijk, the Netherlands.

Assembly-of the test specimen	23 rd of April, 2014
Fire resistance test	25 th of April, 2014

1.6 REVISION INFORMATION

This is the first version of the test report.

2. TEST SPECIMEN

2.1 GENERAL

For the dimensions and specifications of the materials and components of the examined construction, also see the figures in chapter 8. Details of the assembly of the construction are given in the paragraphs below.

2.2 TEST SPECIMEN

The test specimen was a steel double door-set type AL-D, in a steel frame.

2.2.1 Test frame

The test frame was constructed of steel beams with a fire resistant concrete lining.

Dimensions	
Aperture	4000 mm x 3000 mm (w x h)
Width of frame and concrete lining	250 mm

2.2.2 Supporting construction

The door-set was built in a, according to EN 1363-1, standard low density rigid supporting construction.

Specifications	
Overall dimensions	4000 mm x 3000 mm (w x h)
Aperture	2250 mm x 2650 mm (w x h)
Material	Low density concrete
Density	1750 kg/m ³ ± 200 kg/m ³
Thickness	150 mm

A calcium silicate board panel was placed under the door-set to simulate a non-combustible floor facing 200 mm from the edges of the door surface, thickness 20 mm.

2.2.3 Door set

Double steel doors, left active, right passive.

Active (left) door-set	
Overall	1120 x 2640 mm (w x h)
Specifications	
Thickness door	80 mm
Material	Zincor steel (powder coated RAL 9010)
Thickness	1.5 mm at heated side 2.0 mm at non-heated side
Edges of doors (inside)	3 layers of Fibrodice 9 mm (see below)
Insulation	Rockwool 750
Thickness	77 mm
Surface density	115 kg/m ³

Passive (right) door-set	
Overall	1120 x 2640 mm (w x h)
Specifications	
Thickness door	80 mm
Material	Zincor steel (powder coated RAL 9010)
Thickness	1.5 mm at heated side 2.0 mm at non-heated side
Edges of doors (inside)	3 layers of Fibrodice 9 mm (see below)
Insulation	Rockwool 750
Thickness	77 mm
Surface density	115 kg/m ³

All the outside edges inside both doors were provided with three layers of 9 mm Fibrodice, glued with Pyrocol 500 gr/m². The steel covering of the middle vertical jamb was also filled with this material.

Underneath the door a threshold with a height of 15 mm was applied. The threshold was filled with Fibrodice 12 mm thick, glued with Pyrocol 500 gr/m².

The door leaves were hung to the frame with each three ALD hinges, with a diameter of 20 mm and a height of 175 mm. The hinges located (centre) 200 mm from the top and bottom, one at 1200 mm from the bottom.

2.2.4 Door frame

Specifications	
Material	Zincor steel (powder coated RAL 9010)
Dimensions	67 x 107 x 2 mm (w x h x t)
Filling (fully filled)	Fibrodice MS6/9
Attachment to supporting construction	ALD adjustable fixing device
Location	200 mm from top and bottom, one at centre

The heated side of the frame was provided with two layers of 9 mm Fibrodice, glued with Pyrocol 500 gr/m².

2.2.5 Intumescent materials

Location	Type and dimensions
Underneath both doors	Two Flexilodice HE strips 20 x 2 mm (w x t)
Vertical edge (lock) active and passive door	Two Flexilodice HE strips 20 x 2 mm (w x t)
Vertical edge (hinge) active and passive door	Two Flexilodice HE strips 20 x 2 mm (w x t)
Inside both doors at the non-heated side	One layer of Interdens Thickness 1 mm

2.2.6 Closing devices

The active and passive door were provided with the following closing devices.

Active door (left)	Passive door (right)
BKS B2331 two-point lock (1200 mm from bottom of frame)	BKS B2390 with internal espagnolette
BKS B1795 snapper	BKS B1895 snapper
Assa Abloy EA 218 connecting cable	Alara-Lukagro strike plate
Assa Abloy EA281 lead cover	
BKS door handle / BKS panic bar B7172 5000	BKS panic bar B7172 5000
GE 1078CW magnetic contact	GE 1078CW magnetic contact
Dog bolts (3x, 50 mm from top and bottom, one at centre)	Dog bolts (3x, 50 mm from top and bottom, one at centre)
Geze TS5000L-E-ISM door closer	Geze TS5000L-E-ISM door closer

The lock was wrapped in Interdens with a thickness of 1 mm.

2.3 GAP WIDTHS

The gap widths are given in chapter 8.

2.4 METHOD OF ASSEMBLY

The door-set was built in the following order:

- Assembly of the low density concrete wall
- Mounting of the door-set including framework in the wall

3. ASSEMBLY AND MANUFACTURING OF THE CONSTRUCTION

Efectis Nederland BV Centre for Fire Safety	<ul style="list-style-type: none">▪ Test frame▪ Support construction▪ Verification of the assembly
Alara Lukagro BV	<ul style="list-style-type: none">▪ Assembly of construction▪ Producing door-set

4. RESEARCH METHOD

4.1 VERIFICATION OF THE TEST SPECIMEN

The materials and components used were inspected during assembly on the basis of the supplied drawings and data. Efectis witnessed the construction of the specimen at the factory of Alara Lukagro, described in report 2014-Efectis-R0236a. The door-set and frame arrived at Efectis as a whole.

4.2 CLOSING FORCES AND LOCKING

The closing force of the active door leaf was 6.9 kg, of the passive door leaf 5.9 kg. The top lock of both doors was locked during the test and the doors were held in the closed position by a closing device. The active door was latched during the fire test.

4.3 CONDITIONING

From the moment of assembly until the fire test the construction was stored in the laboratory of Efectis Nederland BV.

Conditions	
Ambient temperature:	23 °C
Relative humidity:	50 ± 10 %

4.4 DENSITY AND MOISTURE CONTENT

Material	Density (kg/m ³)	Moisture (%)
Low density concrete (sandstone)	1750	0.7
Mineral wool	115	0.3

4.5 FIRE TEST

4.5.1 Test conditions

The fire test was carried out according to EN 1634-1:2014 and EN 1363-1:2012.
The aimed overpressure in the furnace was maximum 20 Pa at the top of the specimen.

Conditions test area	
Ambient temperature:	10 - 40°C
Relative humidity:	50 ± 10 %

4.5.2 Measurements

During the heating the following data was measured and registered:

Furnace conditions

- The temperatures in the furnace using plate thermocouples, equally spread over the heated surface
- The pressure in the furnace.

Specimen

- Surface temperatures of the specimen
- Radiation level at 1.0 m from the specimen
- Deflection of the specimen.

Environment

- The temperature in the laboratory outside the furnace.
- The positions of the thermocouples are given in appendix B.

5. RESULTS OF THE FIRE RESISTANCE TEST

5.1 OBSERVATIONS DURING HEATING

Time (min)	F/N	Observations F = Fire side, N = Non-fire side
0	F	Start of heating
2	N	Top right corner of left door leaf moving away from the fire
9	N	Short flame flash from bottom connection both door leafs
14	N	Short flame flash from bottom connection both door leafs
31	N	Smoke from seam between both doors
34	N	No more flash flames
46	N	White substance leaking from bottom connection both door leafs
66	N	Short flame flash middle bottom right door leaf
69	N	Flames > 10 sec. middle bottom right door leaf
71	N	Cotton pad test, ignites
73	F	End of heating

5.2 GRAPHS OF THE FIRE TEST

The test results are shown as graphs in appendix B. During the heating of the specimen the ambient temperature met the requirements of EN 1363-1: 2012.

5.3 UNCERTAINTY OF MEASUREMENT

Because of the nature of fire resistance testing and the consequent difficulty in quantifying the uncertainty of measurement of the fire resistance, it is not possible to provide a stated degree of accuracy of the result.

5.4 PHOTOGRAPHS

The photographs during assembly, before, during and (when applicable) after the fire test are shown in appendix C.

6. SUMMARY OF TEST RESULTS

Determination of the fire resistance according to EN 1634-1: 2014 of a Alara-Lukagro steel double door-set type AL-D/D50, in a steel frame, mounted in an aerated concrete supporting construction, both door leaves turning away from the fire.

Criterion	Time (min.)	Result
Integrity, (E)		
- Cotton pad	69	Not determined
- Gap Gauge Ø 6 mm	69	Not determined
- Gap Gauge Ø 25 mm	69	Not determined
- Sustained flaming > 10 sec.:	69	Failure
Insulation (I)		
- Average temperature	69	No failure
- Maximum temperature I ₁	60	Failure
- Maximum temperature I ₂	69	No failure
Heat radiation (W)	69	No failure, 0.23 kW/m ² at 60 min.
The heating was terminated after 73 minutes in concurrence with the client.		
Classification according to EN 13501-2:2007 + A1:2009 is described in a separate report.		
The construction will be classified as follows: E 60, EI ₁ 60, EI ₂ 60, EW 60		

7. FIELD OF DIRECT APPLICATION OF TEST RESULTS

This report details the method of construction, the test conditions and the results obtained when the specific element of construction described herein was tested following the procedure outlined in EN 1634-1:2014. Any significant deviation with respect to size, constructional details, load stresses, edge or end conditions other than those allowed under the field of direct application in the relevant test method is not covered by this report.

The conclusions in this chapter apply exclusively to all door-set types mounted on an aerated concrete wall which are equivalent in detail, including fittings/furniture and materials used, to the structure described in this report and that also comply with the following conditions:

7.1 SPECIFIC RESTRICTIONS ON MATERIALS AND CONSTRUCTIONS

The type of metal shall not be changed from that tested.

7.2 DECORATIVE FINISHES

7.2.1 Paint

Where the paint finish is not expected to contribute to the fire resistance of the door, alternative paints are acceptable and may be added to door leaves or frames.

7.2.2 Decorative laminates

Decorative laminates and timber veneers up to 1.5 mm thickness may be added to the faces (but not the edges) of doors that satisfy the insulation criteria (normal or supplementary procedure).

7.3 FIXINGS

The number of fixings per unit length used to attach door-sets to supporting constructions may be increased, but shall not be decreased and the distance between fixings may be reduced but shall not be increased.

7.4 BUILDING HARDWARE

The number of hinges and dog bolts may be increased but shall not be decreased.

7.5 PERMISSIBLE SIZE VARIATIONS

7.5.1 General

Door-sets of sizes different from those of tested specimens are permitted within certain limitations, but the variations are dependent on product type and the length of time that the performance criteria are fulfilled. The increase and decrease of dimensions permitted by the field of application are applicable to the overall size and to each door leaf.

7.5.2 Test periods

The amount of variation of size permitted is dependent on whether the classification time was just reached (category 'A') or whether an extended time (category 'B') in accordance with the values shown in Table 1 in EN 1634-1:2014 were fulfilled before the test was concluded.

7.5.3 Hinged and pivoted door-sets

Category 'B' overrun is applicable for EI₂ 60.

Limits of permitted size increase			
Width (mm)	1120	Increase width 15%	1288
Height (mm)	2640	Increase height 15%	3036
Total surface (m ²)	2.96	Increase surface 20%	3.55

7.5.4 Other changes

For smaller door-set sizes the relative positioning of movement restrictors (e.g. hinges and latches) shall remain the same as tested or any change to the distances between them will be limited to the same percentage reduction as the decrease of test specimen size.

For larger door-set sizes the following shall also apply:

- The height of the latch above floor level shall be equal to or greater than the tested height, and such increase in height shall be at least proportional to the increase in door height;
- The distance of the top hinge from the top of door leaf shall be equal to or less than that tested;
- The distance of the bottom hinge from bottom of door leaf shall be equal to or less than that tested;
- Where three hinges or distortion preventers are used, the distance between the bottom of the door leaf and centre restraint shall be equal to or greater than that tested.

7.5.5 Specific rules

The rules governing the applicability of tests carried out in one direction to other directions are given in Table 2 in EN 1634-1:2014 and are based on the following premises:

- That each of the door leaves are themselves of symmetrical construction with the exception of the edges (e.g. lock/leading edge and hinge edge or double rebated doors);
- That any restraining/supporting elements of building hardware has been included in a test to EN 1634-1 when exposed in both directions so that they will retain their function when exposed to the heat of the test;
- That there is no change in the number of leaves or the mode of operation (e.g. sliding, swinging, single action or double action);
- That side, over and transom panels are excluded from Table 2 unless they are fully symmetrical.

The test results are also valid for the opposite direction (of fire) for integrity and radiation, not for insulation.

7.6 SUPPORTING CONSTRUCTIONS

7.6.1 Rigid standard supporting constructions

The test results are valid for low density rigid supporting constructions with a density and thickness of the wall that are equal to or greater than that in which the door-set was tested (low density concrete (sandstone) $1750 \pm 200 \text{ kg/m}^3$, thickness 150 mm).

A handwritten signature in blue ink, appearing to read "WScheff".

W. Scheffer BBE
Project leader resistance and reaction to fire

A handwritten signature in black ink, appearing to read "S. Lutz".

S. Lutz
Project leader fire resistance