

1. Scope of Test

This report was a record of a fire resistance test conducted by Forte Testing and Consultants Co., Ltd, in conformity with requirements in *BS EN 1364-1: 1999 "Fire resistance tests for non-loadbearing elements – Part 1: Walls"* and particular requirements in *BS EN 1363-1: 1999 "Fire resistance tests – Part 1: General requirements"*.

The test subject was a gypsum block wall of an overall size 3000 mm width by 3040 mm height. The specimen was built with "Jumbo" gypsum blocks jointed together with "Jumbo" premixed gypsum bonding adhesive. The specimen was supplied for test by Fujian Jumbo New Material Corporation Limited, supplier of the specimen.

The specimen achieved the following fire resistance:

INTEGRITY (E)		INSULATION (I)	
Sustained Flaming	242 Minutes	Average Temp. Rise	242 Minutes
Gap Gauge	242 Minutes	Max. Temp. Rise	242 Minutes
Cotton Pad	241 Minutes		

2. Test Information

Test Laboratory:	FORTE Testing and Consultants Company Limited		
Test Location:	West Side of Huan Xiang Shan, Xin Yu Road, Shajin, Baoan District, Shenzhen, Guangdong Province, China.		
Test Sponsor:	Fujian Jumbo New Material Corporation Limited		
Specimen Manufacturer:	Fujian Jumbo New Material Corporation Limited		
ID no. of the Specimen:	QT16-240A		
Date Received:	2016-09-07		
Test Number:	QT16-240		
Date Tested:	2016-09-19	Start Time:	10:13
Approved Test Operators from FORTE:	Ms. Dong Xingmei		
Witness of the Test:	Mr. Tommy Liu – Official Delegate of the Sponsor		
Report Issue Record:	Version 1 - 2016-10-12		

3. Construction Details of Specimen

3.1 Specimen Description

3.1.1 Gypsum block and gypsum bonding adhesive

The specimen sized 3000 mm (width) x 3040 mm (height) was constructed by “Jumbo” gypsum blocks sized 600 mm (width) x 500 mm (height) x 80 mm (thick) with two tongue sides and two groove sides. Drawings and parts specification of the specimen provided by Sponsor were attached in section 3.3. All the blocks were joined by “Jumbo” premixed gypsum bonding adhesive with approximate 3 mm to 5 mm thick. The bottom edge of the block at first level was the grooved edge. The rest levels of the blocks were laid up to 3040 mm height with overlapping staggered joints.

The gypsum block wall was supported on three sides. The wall was tested with freedom of movement along its right vertical edge (Free edge) on the unexposed side. The 40 mm gap of free edge between the specimen and the support frame was sealed with mineral fibre such that the freedom of movement was not restricted from frictional forces, while penetration of hot gases from the furnace was inhibited.

3.2 Material Schedule

Specifications of the specimen were summarized in the following tables.

A star mark “*” indicates those not being verified by FORTE.

Gypsum Block

Manufacturer:	Fujian Jumbo New Material Corporation Limited
Brand:	Jumbo
Model:	B80 *
Material:	Calcium Sulfate (99%) and Additive (1%) *
Nominal Density:	1,100 kg/m ³ ± 55 kg/m ³ (5%)
Measured Density:	1085 kg/m ³
Measured Sizes:	600 mm x 500 mm x 80 mm
Fixing Method:	Using Jumbo Gypsum Bonding Adhesive for Jointing of Blocks & Concrete Testing Frame

Gypsum Bonding Powder

Manufacturer:	Fujian Jumbo New Material Corporation Limited
Brand:	Jumbo
Model:	MB100 *
Material:	Calcium Sulfate (90%) and Additive (10%) *
Nominal Density:	1300 kg/m ³ *
Nominal Cure Time:	12 Hours *
Mixture Ratio:	0.5 kg Tape Water : 1 kg Bonding Powder

5. Test Method

5.1 Ambient Temperature

The ambient temperature was measured by a type K thermocouple. The measuring junction was positioned approximately 1500 mm away the test construction.

5.2 Heating Condition

The average temperature inside the furnace was monitored and controlled throughout the test according to the standard heating curve stated in *BS EN 1363-1:1999* given by the equation:

$$T = 345 \log_{10} (8t+1) + 20$$

Where,

T is the average furnace temperature, in degree Celsius

t is the time, in minutes

The temperature inside the furnace was measured in conformity with *BS EN 1363-1: 1999* by 9 numbers of plate thermometers. These thermometers were evenly distributed over a vertical plane approximately 100 mm from the exposed surface of the test construction.

The positions of furnace thermocouples were shown in *Figure 1*.

5.3 Unexposed Surface Temperature

The unexposed surface temperatures of specimen were measured by 10 numbers of type K thermocouples. These thermocouples were positioned and fixed on unexposed surface of specimen in conformity with *BS EN 1364-1: 1999*.

The positions of unexposed surface temperature measurement points were shown in *Figure 2*. The locations of thermocouples were explained in the following table.

Thermocouple	Area	Description
U1 – U5	Wall	For average and maximum unexposed surface temperature rise
U6 – U10	Wall	For maximum unexposed surface temperature rise

5.4 Pressure Condition

The pressure inside the furnace was continuously monitored in compliance with *BS EN 1363-1: 1999* during the whole test. The pressure at a point 500 mm above the notional floor level was to be maintained 0 ± 5 Pa by five minutes from commencement of the test and 0 ± 3 Pa that from ten minutes onwards with respect to the atmosphere.

5.5 Deflection Measurements

Measurements of the deflection of the specimen were taken with a steel rule from cross line laser across the mid-height of the specimen with reference to *BS EN 1364-1:1999*.

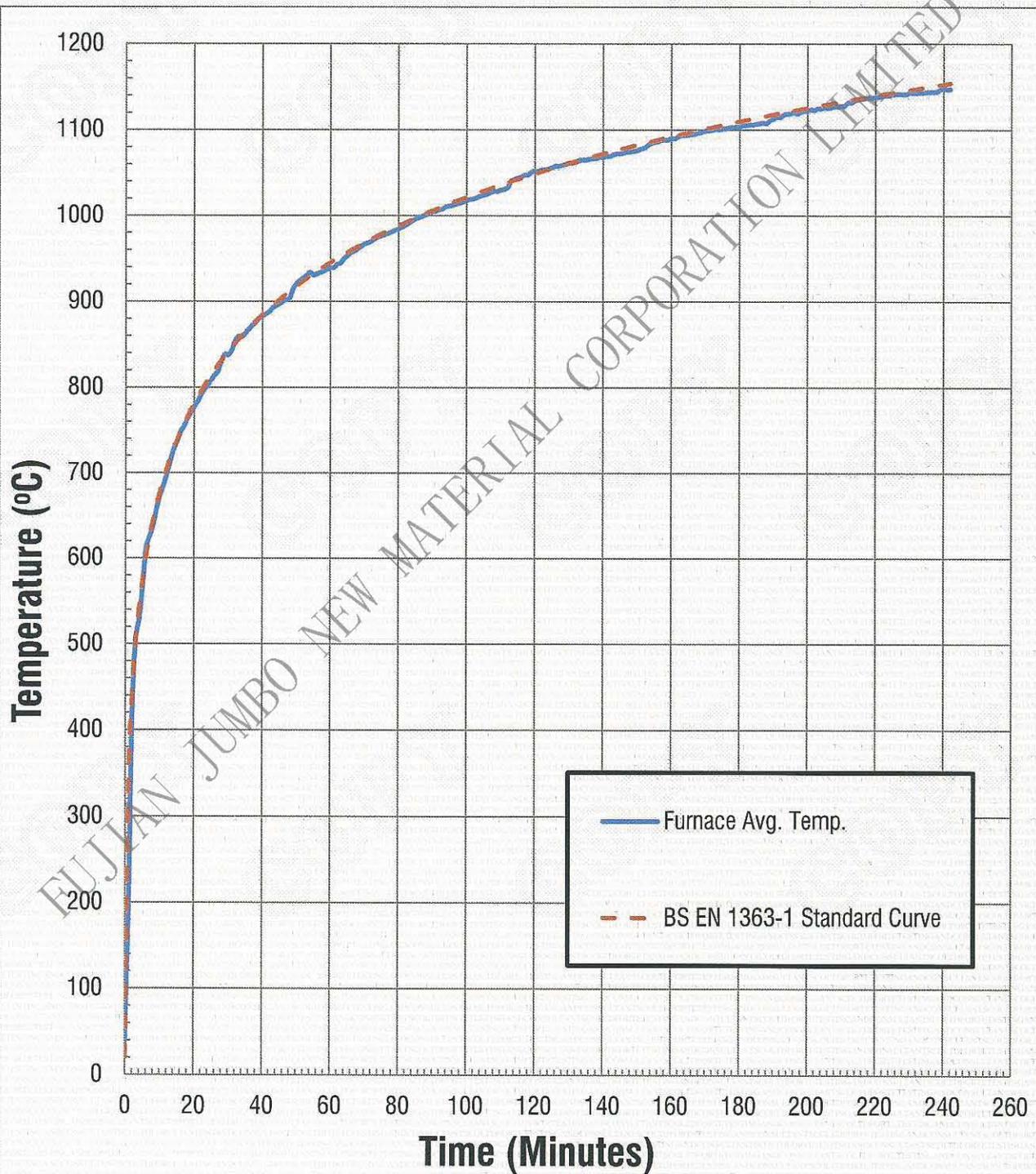
The positions of deflection measurement points were shown in *Figure 2*.

6. Test Data

6.1 Furnace Temperature

The furnace average temperature over the test period was shown in *Figure 3*.

Figure 3. Furnace average temperature over the test period.



6.3 Pressure

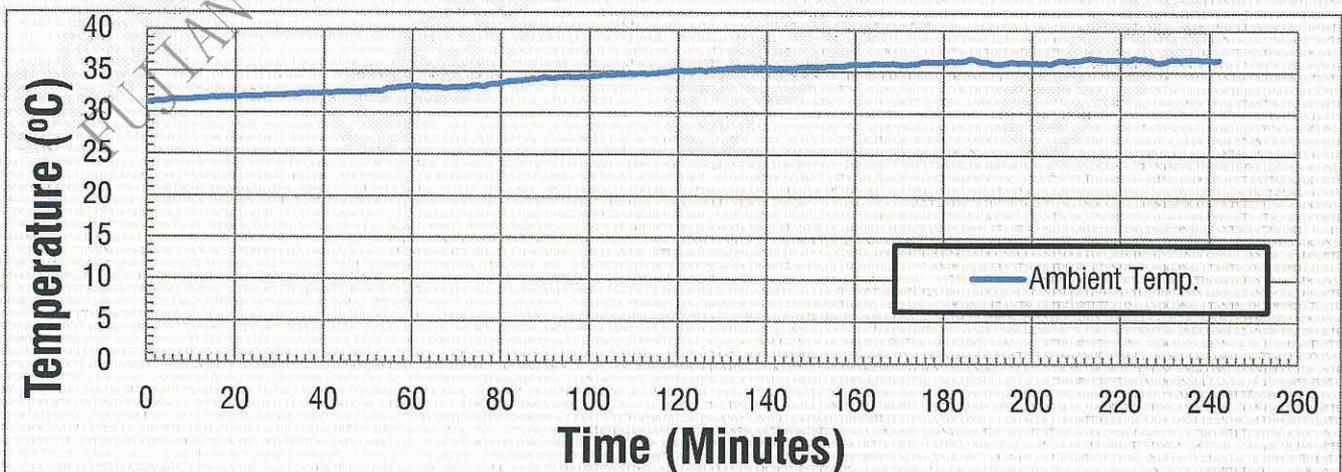
The furnace pressure over the test period was summarized in the following table.

Time (min)	Pressure (Pa)	Time (min)	Pressure (Pa)	Time (min)	Pressure (Pa)
6	1.0	90	-1.4	175	-1.3
10	-1.3	95	1.6	180	0.4
15	0.9	100	1.6	185	0.1
20	0.5	105	0.0	190	-1.8
25	1.8	110	-0.4	195	-0.4
30	-0.4	115	-0.1	200	-0.6
35	0.4	120	-0.7	205	-0.1
40	1.0	125	-0.8	210	2.6
45	0.1	130	-1.4	215	0.9
50	-0.2	135	0.9	220	-0.5
55	0.2	140	0.0	225	1.9
60	0.5	145	0.6	230	0.4
65	-0.8	150	1.9	235	0.7
70	-0.7	155	1.1	240	-1.0
75	-0.4	160	0.8	242	0.1
80	-0.4	165	0.0		
85	2.4	170	-0.3		

6.4 Ambient Temperature

The ambient temperature over the test period was recorded and was shown in *Figure 5*. The ambient temperature at the commencement of test was 31.2°C.

Figure 5. Ambient temperature over the test period.



6.5 Lateral Deflections

Measured lateral deflections over the test period were summarized in the following table. A positive measurement indicates a movement towards into the furnace and vice versa.

Measurements were taken in mm.

Maximum deflection value of the specimen was bolded in the following table.

Due to safety reason, no deflection data was recorded after 220 minute of test.

Position \ Time (min)	0	30	60	90	120	150	180	210	220
D1	+0	+6	+1	-2	-5	-10	-14	-30	-42
D2	+0	-4	-7	-12	-14	-17	-22	-24	-26

6.6 Observations

Significant behaviours on the specimen during the test period were summarized in the following table.

Photos taken during the test period were also attached.

Time (min.sec)	Observation (from unexposed side)
00.00	Test Started.
01.45	Horizontal crack appeared along the joint between the 2 nd and 3 rd course of gypsum block from sill level at middle portion of the specimen.
05.37	Crack appeared across the bottom left corner on the gypsum block on the bottom left corner of the specimen.
07.22	Crack appeared across the top left corner to bottom right corner on the gypsum block on the top left corner of the specimen.
12.16	Horizontal crack appeared along the joint between the 5 th and 6 th course of gypsum block from sill level at right portion.
30.00	NO INTEGRITY FAILURE HAD OCCURRED.
40.00	(From exposed side) Crack marks observed on the gypsum blocks.
56.40	Cotton fibre pad test was carried out on crack mentioned at 07.22 minute of test. No flaming or glowing on the cotton pad was observed.
60.00	NO INTEGRITY FAILURE HAD OCCURRED.
75.37	The sizes of the crack mentioned on 12.16 minute of test reduced.
90.00	NO INTEGRITY FAILURE HAD OCCURRED.
110.00	No significant changes were observed from the specimen.
120.00	NO INTEGRITY FAILURE HAD OCCURRED.
135.00	The centre of the specimen bended slightly outward away from the furnace.
150.00	NO INTEGRITY FAILURE HAD OCCURRED.
164.15	Horizontal crack appeared along the joint between the 2 nd and 3 rd course of gypsum block from sill level at left portion of the specimen.
165.20	Glowing appeared from the crack mentioned at 07.22 minute of test.
175.08	Cotton fibre pad test was carried out on crack mentioned at 07.22 minute of test. No flaming or glowing on the cotton pad was observed.
180.00	NO INTEGRITY FAILURE HAD OCCURRED.

Time (min.sec)	Observation (from unexposed side) Cont'd
190.20	Cotton fibre pad test was carried out on crack mentioned at 07.22 minute of test. No flaming or glowing on the cotton pad was observed.
198.02	Glowing appeared from the crack mentioned at 164.15 minute of test. The crack was approximately 3 mm width.
199.40	Cotton fibre pad test was carried out on crack mentioned at 07.22 minute of test. No flaming or glowing on the cotton pad was observed.
206.50	Cotton fibre pad test was carried out on crack mentioned at 164.15 minute of test. No flaming or glowing on the cotton pad was observed.
207.30	Vertical creak appeared between the joint of the gypsum block at the centre of the 2 nd course from the sill level.
210.00	NO INTEGRITY FAILURE HAD OCCURRED.
212.27	Vertical creak appeared across the gypsum block at the centre of the 3 rd course from the sill level.
216.30	Cotton fibre pad test was carried out on crack mentioned at 164.15 minute of test. No flaming or glowing on the cotton pad was observed.
223.35	Glowing appeared from the crack mentioned at 212.27 minute of test. Cotton fibre pad test was carried out on crack mentioned at 212.27 minute of test. No flaming or glowing on the cotton pad was observed.
226.22	The vertical crack mentioned at 212.27 minute of test extended to the middle of the gypsum block at 4 th course from the sill level. Cotton fibre pad test was carried out on crack mentioned on 207.30 minute of test. No flaming or glowing on the cotton pad was observed.
230.00	The vertical crack mentioned at 212.27 minute of test extended to the top edge of the specimen.
233.25	Glowing appeared from the crack mentioned at 230.00 minute of test at upper portion. The crack was approximately 4 mm width.
235.45	Cotton fibre pad test was carried out on crack mentioned at 164.15 minute of test. No flaming or glowing on the cotton pad was observed.
237.11	Cotton fibre pad test was carried out on crack mentioned at 212.27 minute of test. No flaming or glowing on the cotton pad was observed.
239.57	Cotton fibre pad test was carried out on crack mentioned at 212.27 minute of test. No flaming or glowing on the cotton pad was observed.
240.00	NO INTEGRITY FAILURE HAD OCCURRED.
241.30	Cotton fibre pad test was carried out on crack mentioned at 212.27 minute of test and the cotton pad was Ignited. INTEGRITY FAILURE OCCURRED.
242.28	TEST WAS TERMINATED AT REQUEST OF THE SPONSOR.

6.7 Photos

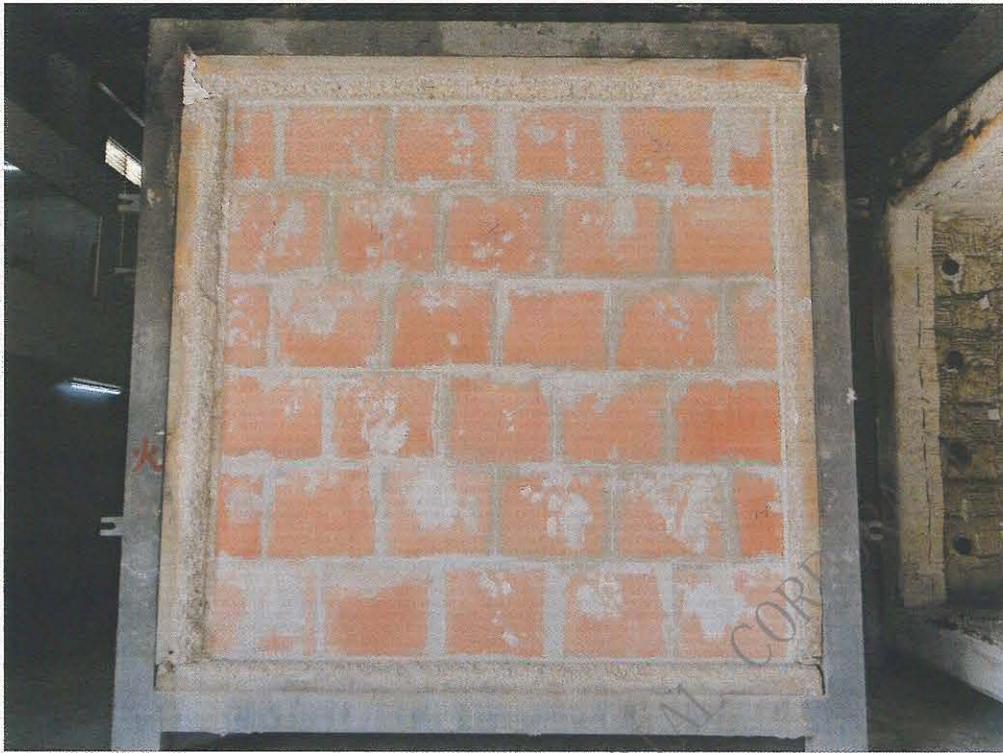


Photo 1. Exposed surface of the specimen before test.



Photo 2. Unexposed surface of the specimen before the commencement of test.



Photo 5. Unexposed surface of the specimen at 60 minutes of test.



Photo 6. Unexposed surface of the specimen at 90 minutes of test.



Photo 7. Unexposed surface of the specimen at 120 minutes of test.



Photo 8. Unexposed surface of the specimen at 150 minutes of test.



Photo 9. Unexposed surface of the specimen at 180 minutes of test.



Photo 10. Unexposed surface of the specimen at 210 minutes of test.



Photo 13. Fire exposed side of a portion of the specimen on the test rig after the test.

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7. Test Results

Test was terminated after a period of 242 minutes at request of the Sponsor.

The test data obtained from the fire resistance test was assessed against performance criteria given in *BS EN 1364-1: 1999*. The test results were summarized in the following table.

Performance Criteria		
Integrity (E)		
Criteria of Failure	Description	Elapsed Time before Failure Occurrence
Sustained Flaming	Continuous flaming for a period of time greater than 10 seconds on unexposed surface	242 minutes (No Failure)
Gap Gauge	Ø6 mm Penetration of the gauge into the furnace through the specimens and movable along a 150 mm gap	242 minutes (No Failure)
	Ø25 mm Penetration of the gauge into the furnace through the specimens	
Cotton Pad	Ignition of the cotton pad	241 minutes
Performance Criteria		
Insulation (I)		
Criteria of Failure	Description	Elapsed Time before Failure Occurrence
Integrity Failure	The performance criterion "insulation" shall automatically be assumed not to be satisfied when the "integrity" criterion ceases to be satisfied	241 minutes
Average Temperature Rise	An increase of the average temperature of unexposed surface of the specimens above the initial average temperature by more than 140 °C	242 minutes (No Failure)
Maximum Temperature Rise	An increase of temperature at any other point of the specimens above the initial average temperature by more than 180 °C	242 minutes (No Failure)

8. Limitations

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 *BS EN 1363-1*, and where appropriate *BS EN 1363-2*. Any significant deviation with respect to size, construction details, loads, stresses, edge or end conditions other than those allowed under the field of direct application in the relevant test method was not covered by this report.

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

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9. Field of Direct Applications of Test Results

The field of direct application defines the allowable changes to the test specimen following a successful fire resistance test. These variations can be introduced automatically without the need for the sponsor to seek additional evaluation, calculation or approval.

The series of rules and guidelines were defined in *Clause 13 "Field of direct application of test results"*, *BS EN 1364-1: 1999* and relevant clauses and annexes.

The field of direct applications may only be defined following the identification of classification(s). The field of direct and, where applicable, extended application will be included in classification relevant documents.

END OF REPORT

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