

SUBJECT:

Fire resistance test on a non-loadbearing Yumen Board partition wall system submitted by PT. Indo Yumen Board.

DATE SUBMITTED:

25 Oct 2011

DATE OF TEST:

14 Nov 2011

PURPOSE OF TEST:

1. To determine the fire resistance of the specimen when tested in accordance with BS 476 Part 22:1987 "Methods for Determination of the Fire Resistance of Non-loadbearing-Elements of Construction-Determination of the Fire Resistance of Partition."

TEST PROCEDURE:

1. Before the commencement of the test, the ambient temperature in the general vicinity of the test specimen construction was ensured to be not exceeding 33C. The datum values for each individual temperature and deflection measurements were also taken more than 15 minutes before the commencement of test.
2. During the test, with commencement of heating of the specimen, the furnace temperature and pressure were controlled to comply with the requirements specified in BS 476: Part 20: 1987 clause 3.1 and 3.2 respectively. The pressure was controlled such that a linear pressure gradient of 8.5(+/-)2 Pa per 1000mm height exist above a neutral pressure axis at a height of approximately 1000mm above the notional floor level. However, the maximum pressure at the top a vertical test construction shall not exceed 20 Pa.
3. Throughout the heating period, the behavior of the specimen was observed and monitored for compliance with the relevant performance criteria stated in clause 10 of BS 476: Part 20: 1987 (A summary is given in clause 9 of this report) and the appropriate clause of BS 476: Part 22: 1987.
4. For insulated specimen, the mean temperature on the unexposed face were measured by five number of surface mounted thermocouples, with one placed approximately at the center of each quadrant. In the presence of stiffener, through member of jointing, the thermocouples were located at least 50mm away.

5. For insulated specimen, the maximum temperature on the unexposed face were measured by thermocouples placed on location on one vertical jointing and one at stiffeners which may be hotter than the average on the face. The thermocouples were placed at least 50mm away.
6. Observations on the behavior of the test specimen throughout the heating period were made and recorded. As appropriate, cotton pads, gap gauges and roving thermocouple were used to establish the occurrence of failure.
7. The test was terminated when one or more failures as stated in the performance criteria occurred, or otherwise at a time agreed between the sponsor of the test and the test laboratory.

PERFORMANCE CRITERIA:

1. The specimen is assessed against the following test criteria:

- Lost of integrity

Failure shall be deemed to have occurred when one of the following occurs:

When collapse or sustained flaming for more than 10 seconds on the unexposed face.

When the cotton pad test is conducted, flames and/or hot gas causing flaming or glowing of the cotton pad.

Where the cotton pad test cannot be conducted because of the level of radiation from specimen, a through gap into furnace exceeding 6mm in width by 150mm in length exists or develops in the specimen.

When a through gap into furnace exceeding 25mm diameter exists or develops in the specimen.

- Insulation

Failure shall be deemed to have occurred when one of the following occurs:

If the mean unexposed face temperature increases by more than 140C above its initial value.

If the temperature recorded of at any position on the unexposed face is in excess of 180C above the initial mean unexposed face temperature.

When integrity failures occur.

DESCRIPTION OF THE SPECIMEN:

1. The test specimen consisted of a non-loadbearing 3000mm (width) x 2400mm (height) Yumen Board partition wall system constructed using “Wood Wool Cement Board” panels. The nominally 75mm thick wall was constructed vertically within a test frame with ordinary bricks bedded along the base as lateral support and along two vertical sides of the wall. An overhead concrete lintel as constructed above the specimen wall and a free edge clearance of approximately 20mm wide filled ceramic wool was provided along one vertical side. The test frame was mounted onto the furnace (PSB Asset No. 20009077) and the fire resistance test was conducted at TUV SUD PSB’s laboratory located at No. 10 Tuas Avenue 10, Singapore 639134.

The partition wall system was-constructed of

Panel : 5 pieces of 75mm thick “Wood Wool Cement Board” panel, each measuring 600mm (width) x 2400mm (height).

Composition : Wood wool, cement and water as binder.

Density : 413KG/M3 nominal

Method of joint : Butt jointed along longitudinal direction, trowelled and feathered with Portland cement along jointing, base and top of panels.

2. An inspection on the partition wall was conducted during the construction stages by a TUV SUD PSB’s officer to verify on its material used, dimension and designs. Details of the wall panels construction are as shown in Drawing Plate 1 and 2.
3. Installation of the test specimen onto the test furnace was arranged and carried out by TUV SUD PSB Pte Ltd.

TEST RESULTS:

1. Table 1 shows the temperature rise for the furnace curve and the standard curve. In addition, the table shows the percentage difference between the area under the standard curve and the area under the furnace curve compared with the percentage tolerance allowable within the standards.
2. Figure 1 shows the actual time-temperature curve of furnace in relation to the specified time-temperature curve.

3. Table 2 and 3 show the mean and maximum unexposed face temperature above the initial temperature.
4. Table 4 shows the deflection measurement of the partition wall system towards the furnace along its mid-height.
5. Photographs of the test are shown in Plates 1 to 6.
6. Observations were made during the test on the unexposed face of the test specimen and these are given in Appendix 1 of this report.
7. The results only relate to the behavior of the specimen of the element of construction under the particular conditions of the test. They are not intended to be sole criteria for assessing the potential fire performance of the element in use nor do they reflect the actual behavior in fires.

CONCLUSION:

1. The specimen satisfied the requirements of the BS 476: Part 22: 1987 for the periods stated below:

Integrity	:	43 minutes
Insulation	:	19 minutes

REMARKS:

1. Integrity
A through opening into furnace of more than 25mm diameter developed at bottom left corner of partition wall at 43 minutes and 25 seconds. Therefore, the integrity of the 75mm thick Yumen Board partition wall system meets the standard for 43 minutes.
2. Insulation
At 20 minutes of test, the maximum mean temperatures rise and maximum temperature rise above initial temperature on the unexposed face of the specimen were 85.5C and **299.2C** respectively. Therefore, the insulation of the 75mm thick Yumen Board partition wall system meets the standard for 19 minutes.

Table 1 : Comparison of area under the curve

Time (min)	Temperature rise (°C)		Area under curve (°C min)		Percentage difference (%)	Standard tolerance ±%
	Standard	Furnace	Standard	Furnace		
5.0	556.4	544.7	2038.1	2056.9	0.9	15.0
10.0	658.4	659.6	5102.7	5123.6	0.4	
15.0	718.6	718.1	8554.8	8567.2	0.1	10.0
25.0	794.6	794.6	16152.3	16163.9	0.1	
30.0	821.8	819.8	20195.3	20208.5	0.1	5.0
40.0	864.7	874.8	28638.1	28651.3	0.0	

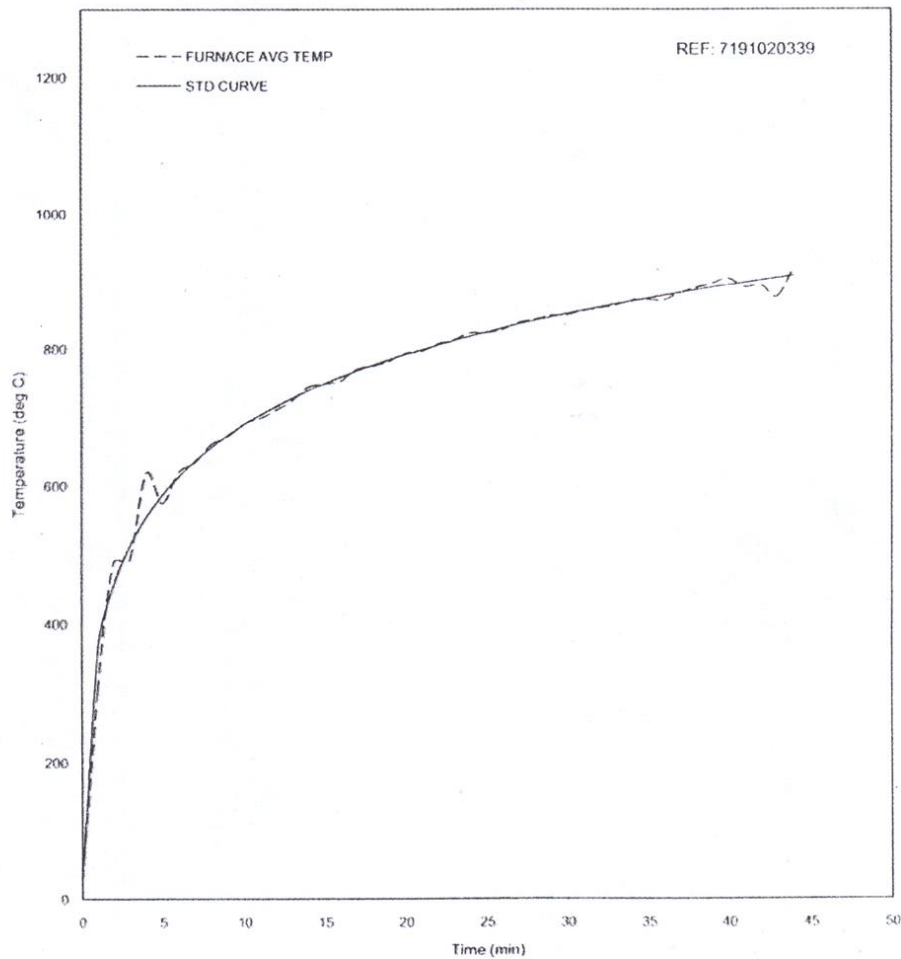


FIGURE 1: FURNACE AVERAGE TEMPERATURE

Table 2: Unexposed face temperature of the partition wall

Time (min)	Thermocouple no.					Mean Temp (°C)	Above initial mean temp (°C)	
	100	101	102	104	105		Mean temp	Max. temp
0.0	31.3	31.5	31.6	31.6	31.5	31.5	-	-
5.0	71.3	70.7	32.0	31.8	31.8	47.5	16.0	39.8
10.0	83.4	77.8	32.5	32.2	32.2	51.6	20.1	51.9
15.0	81.0	77.7	32.7	32.4	36.8	52.1	20.6	49.5
19.0	77.6	83.7	33.7	33.8	157.7	77.3	45.8	126.2
20.0	76.9	105.8	36.2	35.6	330.7	117.0	85.5	299.2

Table 3: Additional unexposed face temperature of the partition wall

Time (min)	Thermocouple no.		Mean Temp (°C)	Max. temp above initial temp (°C)
	106	108		
0.0	31.4	30.9	31.2	-
5.0	86.3	56.9	71.6	55.1
10.0	85.0	80.1	82.6	53.9
15.0	81.4	78.8	80.1	50.2
19.0	77.7	74.3	76.0	46.5
20.0	76.3	74.0	75.2	45.1

Table 4 : Deflection of the partition wall

Time (min.)	Measurement of deflection (mm)				
	A	B	C	D	E
10.0	0	0	0	-10	0
20.0	-5	-15	-10	-10	-10
30.0	-10	-25	-25	-20	-20

Note:

The deflection measurement points at mid-height of wall are indicated in Drawing Plate 1.
A negative value indicates deflection away from furnace.

APPENDIX 1

Time (min:sec)	Observation on the unexposed face
00:00	Test commenced.
01:00	Smoke emitted from the wall.
03:00	Heavy volume of smoke released from the wall.
05:00	Smoke emission subsided.
10:00	Upper half of wall surface discoloured.
15:00	Scattered hot spots seen around the location of thermocouple point 105.
16:00	Hot spots smouldered into a wider area.
17:00	Cotton pad applied at above location for 10 seconds and no ignition.
20:00	More hot spots appeared at lower half of the wall. Insulation deemed to have failed.
25:00	Lower half of the wall discoloured.
30:00	Integrity remained intact.
38:00	Radiating fissures emerged along upper half of wall.
43:25	A through opening into furnace of more than 25mm diameter developed at bottom left corner of partition wall.
44:00	Test was terminated as the wall was deemed to be unstable.

Please note that this Report is issued under the following terms:

1. This report applies to the sample of the specific product/equipment given at the time of its testing/calibration. The results are not used to indicate or imply that they are applicable to other similar items. In addition, such results must not be used to indicate or imply that TUV SUD PSV approves, recommends or endorse the manufacturer, supplier or user of such product/equipment, or that TUV SUD PSB in any way “guarantees” the later performance of the product/equipment. Unless otherwise stated in this report, no tests were conducted to determine long term effects of using the specific product/equipment.
2. The samples mentioned in this report is/are submitted/supplied/manufactured by the Client TUV SUD PSB therefore assumes no responsibility for the accuracy of information on the brand name, model number, origin of manufacture, consignment or any information supplied.
3. Nothing in this report shall be interpreted to mean that TUV SUD PSB has verified or ascertained any endorsement or marks from any other testing authority or bodies that may be found on the sample.
4. This report shall not be reproduced wholly or in parts and no reference shall be made by the Client to TUV SUD PSB or the report or results furnished by TUV SUD PSB in any advertisements or sales promotion.
5. Unless otherwise stated, the tests were carried out in TUV SUD PSB Pte Ltd, No.1 Science Park Drive Singapore 118221.