Lab UL723 ASTM E84 Building Materials Surface Burning Characteristics Testing Equipment

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Application:

This method is applicable to determine surface burning characteristics of building materials and flame propagation rate of exposed surfaces such as walls and ceilings (including solid plastics), at the same time measure smoke density.

This test method applies to the exposed surface which includes ceiling or walls, provided that the materials or the whole assembly, with its own structural quality or the aspect in which is tested and intended to use is able to support itself in position or being supported during the period of test. The method is used to determine the corresponding burning behavior of the material by observing the flame spread along the test specimen.

Reports are made for the flame spread and smoke density developed and it is not necessarily a relationship between the two measurements.

Standard:

ASTM E84: standard test method for surface burning characteristics of building materials
UL723: test for surface burning characteristics of building materials

Parameters:

1. Power: AC380V±10%
2. Max Power: 5KW
3. Test tunnel furnace: length 7.62M, open end cross section 0.45M * 0.3M, firebrick max temperature 2500℃
4. The test chamber is made of 16 isometric observation windows, and one fire observation window, which is a double-layer high-temperature quartz glass, SUS304 stainless steel frame.
5. Adopt water seal structure, the two sides of sample cover plate are broken into the tank during test, in order to sealing performance is better.
6. Air inlet is adjustable shutter, which could control air flow inside furnace more accurately.
7. Thermocouple: K-type, diameter 3mm, 3 sets, Omega USA imported, high precision, long service life, measuring range: ≤1300 ℃
8. Exhaust port: which is from rectangle to round, diameter 406mm
9. Smoke density measurement: install position is distance tunnel furnace 4.9~12.2M.
10. Gas burner installation: the burner shall be spaced 305mm from the fire end of the test chamber, and 190mm below the under surface of the test sample.
11. The light source: two gas burners, around nozzle distance 203mm, energy output 5.3Mj/min.
12. Ignition system: high voltage electronic ignition.
13. Component material and function:
①. Test furnace size: L9456*W1067*H1400, not including flue.
②. Furnace base is made of 100*50 channel steel welded together, surface spray treatment
③. Flue: double-layer flue, the center filled with high temperature asbestos, inner layer SUS304 stainless steel plate, outer layer galvanized sheet with T1.2
④. Sample plate: calcium silicate cement board, high temperature resistant to 1300℃
⑤. Sample cover: T2.0 SUS304 stainless steel
⑥. Control box: adopts T1.2 cold plate, CNC machine tool is formed, arc shape beautiful, surface is white paint.
14. Gas and gas flow control system:
①. Gas: gas (purity 99%), by your own.
②. Gas control system, includes flow meter, U type pressure gauge, pressure gauge, pressure regulating valve.

③. Flow meter: domestic brand, range 2~20L/min, accuracy 2%.
④. U type pressure gauge: original from USA, water column 0~36 inches, analysis degree 0.1 inch.
⑤. Pressure gauge: 0~200Kpa(0~30psi), resolution 5Kpa.
⑥. Pressure regulating valve: 0~10kg/min continuously adjustable.
15. Smoke density measurement system:
①. Light source: imported quartz halogen lamp.
②. Nominal power: 100W.
③. Nominal voltage: 12V.
④. Nominal light return amount: 2000~3000Lm.
⑤. Receiver: spectral response matches light meter of international lighting commissioner (CIE).
⑥. Installation: install at one end of the pipe with length 150, the other end is a dustproof window, inner wall of pipe is glossy black and anti-reflection.
⑦. Light transmittance 0% means no light passing, 100% means without shade, all pass through.

Features:

1. Measure flame propagation speed is based on the time of flame through the window to estimate after lit sample, get flame propagation speed curve, which method is to draw the distance and time flame propagation through window. The equipment should be calibrated firstly when do test, and then do two preliminary tests. The first preliminary test is to detect red oak specimen, artificially set its flame propagation and smoke generation as 100(this method also measures material's smoke generation). The second preliminary test is to detect asbestos cement specimen, set its above two values as 0. Then determine specimen smoke and flame propagation velocity curve, calculate flam spread index (FSI), the method is: if this total area is less than or equal to 29.7m·min, that is FSI=0.515AT; if the total area is greater than 29.7m·min, that is FSI=4900∕(195-AT).
2. The flame propagation rate of various unprocessed wood is 60 to 230, the smoke generated is also measured during combustion, and its rank is divided in the same range.
3. The FSI value of the material measured with tunnel method is between 0 and 200, the smaller the FSI value is, the less the fire risk is. The high buildings and corridor, should use FSI<25 material, 25<FSI<100 material only could be used for fire requirement not very strict, while FSI>100 material don't meet the requirement of flame retardant.
4. Class A is 0-25, Class B is 26-75, Class C is 76-200, the sample that smoke index less than 450and flame spread rate curve, then calculate flame spread index(FSI) of the sample, the method is: if this total area is less than or equal to 29.7m·min, that is FSI=0.515AT; if the total area is greater than 29.7m·min, that is FSI=4900∕(195-AT).

Procedure:

1. Six pcs samples, placed under 12mm thick calcium silicate cement.
2. Observe data:
A. Measure the time on flame arrived at each observation point
B. Measure the flame spread distance on the first 1.5 minute
C. Measure the flame spread distance during all the test (10 minutes)
D. Measure the flame spread max distance and time
3. Judgment method:

Classification	Flame spread at 1.5 min (mm)	Final flame spread (mm)
Class 1	165 (+25)	165 (+25)
Class 2	215 (+25)	455 (+25)
Class 3	265 (+25)	710 (+25)
Class 4	Exceeding Class 3 limits	

BS Class 1 judge standard:
①. During six pcs samples, the sample that biggest "1.5 minutes flame spread value" and "last flame spread value", shall not exceed the max allowance (that is the sum of internal and external value)
②. The "1.5 minutes flame spread value" and "last flame spread value" of another five pcs samples should not exceed standard value (that is the external value)
Part 6: Fire propagation
①. Test method: measure temperature change (heating) by thermocouple sensor through sealing space when burning sample.
②. Observe data: the temperature is measured every 30 seconds within 0-3 minutes ignition; the temperature is measured every 1 minute within 4-10 minutes ignition; the temperature is measured every 2 minute within 12-20 minutes ignition, and only measure 3 times.
③. Judgment method:
S1 = S2 = S3 =
S = S1 + S2+ S3
t----- time, in minutes, 0 when ignition
--sample temperature, in ℃, on time t
---standard temperature, in ℃, on time t
BS Class 0 judgment standard: Class 1 material total index S is not more than 12; the first sub-index is not more than 6, which could be determined as Class 0.

Environmental conditions:

1. Ground level, well ventilated, non-flammable, explosive, corrosive gases and dust.
2. There is no strong source of electromagnetic radiation nearby.
3. Leave adequate space around the equipment for maintenance.
4. Temperature: 5 ℃ ~ 30 ℃.
5. Pressure: 86 ~ 106kpa.
6. AC3800V / 50HZ.
7. Fluctuation range: 380V ± 10%.
8. Frequency fluctuation range allowed: 50Hz ± 1%.

9. The user is required to configure the device with the appropriate capacity of air and power switches at the installation site, and the equipment must independently and exclusively use this switch.

10. If the equipment is not working, the ambient temperature should be maintained within 0 ~ 45 ℃