

CERTIFICATE OF TEST

Applicant: Festec International Co.LTD
e-space Building #505 Guro-dong ,Guro-gu, Seoul, KOREA

Device under test: Smoke Density Chamber Radiometer
Manufacture:
Serial Number:
User:

Date of calibration:**Calibration method and condition**

The Smoke Density Chamber Radiometer was calibrated according to ASTM E6662 in reference to the copper disk calorimeter (CDC). To yield the calibration factor of the DUT, the DUT and the CDC alternatively measures the heat flux of the furnace at 950 °C in the smoke density chamber at the calibration site. The environmental temperature was 25 °C and the relative humidity was 55 %.

Calibration Traceability

The radiant heat flux is derived by the rate of voltage change, and the coefficient which is determined by the mass, the thermocouple conversion factor (TCF) and the radiant absorption coefficient (RAC) of the CDC. The voltage, the mass, the TCF, and absorption coefficient of the CDC is measured traceable to the relevant National Standards. The data digitizing board for the voltage change measurement of the CDC was calibrated with the KRISS voltage source (Keithley 263 calibrator: Serial No.: 02138489-00). The TCF and the RAC were measured with the KRISS platinum resistance thermometer (Rosemount 163 CE) and the KRISS reference spectrophotometer (Varian 5000), respectively.

Results

The table in the next page gives the relation between the radiant heat flux and voltage output of the DUT. The radiometer output of the DUT at 25 kW/m² is obtained by linear regression of 4 sets of data.

Uncertainty

The reported uncertainty is based on a relative standard uncertainty multiplied by a coverage factor $k=2.52$, providing a level of confidence of 95 %. The detailed budget is shown in the results.

We certify that this certificate is based on the calibration by the measurement standards traceable to the national measurement standards being held and operated by the Korea Research Institute of Standards and Science in accordance with the provision of Article 14 of the Framework Act on the National Standards.

Calibrated by:

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Approved by:

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Results of calibration

Radiant heat flux (kW/m ²)	Radiometer Output(mV)
18.22	6.78
20.18	7.87
27.48	10.31
31.29	11.58

Calibration summary by linear regression

Gradient	2.7827
Intercept	-1.1331
Radiometer output* at 25 kW/m ²	9.3928 mV

Calibration Conditions

DUT type	Smoke Density Chamber Radiometer
Calibration range	18 - 32 kW/m ²
Standard detector	Copper Disk Calorimeter
DUT location	38 mm from the Furnace
Cooling water of DUT	Temperature: 95°C

Uncertainty budget of the calibration

	Uncertainty source	Type	Standard Uncertainty (%)
Copper Disk	Gradient measurement repeatability	A	1.85
	Thermocouple constant	B	0.10
	Mass of disk	B	0.10
	Specific heat data	B	0.10
	Absorption constant	B	0.30
	Voltage (A/D converter)	B	0.20
Radiometer	Gradient measurement repeatability	A	2.30
	Combined uncertainty	k=1	2.98
	Expended uncertainty	k=2.52	7.50

* The uncertainty is applied to the radiometer output at 25 kW/m².

** The results are valid only when the integrity of sensor is conserved.

<The end of certificate>