Cone Calorimeter

(CC-5660, ISO 5660, ASTM E 1354, BS 476 Pt. 15)



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A) Cone Calorimeter_ ISO 5660

• **ISO 5660 : Reaction to fire tests**

– Heat release, smoke production and mass loss rate







1) Main Frame Assembly (included Flow Control)

- Main Frame : Dimension : 1,870(W)x900(D)x2,650(H) mm
- Color : Black
- Blower : Electric Power : AC220V, Φ3 phase / Inverter (flow control)
- Thermocouple : Type : K-type, Stainless Steel
- Differential Pressure Transducer : Range : 0~500Pa

2) Gas Flow Sampling System

- Cold Trap included Temperature Controller (Power : AC220V, 1/4HP)
- Vacuum Pump (Type) : Dual Headed Type
- Ambient Pressure Transducer : Range : 800~1,300mbar
- Drierite & Housing / Filter (Hepavent & BA-100)

3) Data Acquisition System

- DAQ Acquisition / Switch Unit
- 16-Ch Reed Multiplexer Module for 34970A
- USB/GPIB Interface
- Industrial PC with 24 inch monitor

4) Smoke Detection System

- He-Ne Laser (0.5 mW, 633nm)
- ND-Filter

5) Conical Heater Assembly (Vertical and Horizontal)

- Conical Heater ; Material : Inconel / - Auto split shutter
- Electric Power : AC220V / 5,000W
- Heat Fluxmeter (with water cooling assembly) : **Range: 100kW/m2**
- Load Cell Assembly ; Max. Weight : 5 kg, Accuracy: 0.1g

B) Gas Analyzer

- Servopro MultiExact 4100 (UK)
- O2 , Sensor (Paramagnetic) 0~100% , 1EA
- DP : 3 decimal places
- CO2 , Sensor (Infrared) 0~10% (100,000ppm) , 1EA
- CO , Sensor (Infrared) 0~1% (10,000ppm) , 1EA
- Included By-PASS
- Built-in Flow meter

C) Heated Line & Filter for Toxic Analysis (5 Meters Length)

- Temperature Range (10℃ ~ 250℃); Included Temperature Controller

■ 제품소개 (Introduction)

• Conical Heater의 열원 하의 시험시편에서 발생하는 열방출률, 연기발생률, 착화시간, 산소 소모량, 일산화 및 이산화탄소의 생성량, 질량감소율 등을 측정하는 장비이다.

■ 대표규격 (Standard)

• ISO 5660 : Reaction to fire tests – Heat release, smoke production and mass loss rate

• ASTM E 1354 : Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter

• BS 476 Pt.15 : Fire tests on building materials and structures – Method for measuring the rate of heat release of products

Specification	
크 기	19“ 1,800(W)×900(D)×2,700(H) 24” 1,930(W)×900(D)×2,700(H)
전 력	AC 220V, 60Hz, 40A
무 게	570kg
배 기	최소 1.5㎥/min
고객준비사항 (유틸리티)	메탄가스, 산소가스, 혼합가스(CO 0.8%, CO2 8%), 고순도 질소가스, 에어컴프레셔, 후드, 덕트, 집진기 ->유틸리티 사항은 당사와 선 협의 필수!

■ 특 징 (Features)

• 일체형 Body 와 분리가 가능한 19” & 24“ Analysis rack

• 모든 제어와 자동 시험수행을 위한 전용 소프트웨어 보조(Lab-View)

• 착화시간측정을 용이하게 해주는 자동 Spark Igniter

• 시편에 복사열을 전달하기 위해 자동으로 열리는 Auto Split Shutter

• Laser Calibration을 자동으로 진행 가능하게 하는 Filter Carrousel

• 시험 중 시편의 관찰을 용이하게 하며 손쉽게 열리고 닫힐 수 있도록 Absorber type의 Glass protection door

• O2 및 CO, CO2의 농도를 0.02%까지 정확하게 측정해주는 영국 Servomex사의 Gas Analyzer

• 유독성 가스를 측정할 수 있는 Port 와 Heated filter, Heated line

• 모든 Gas flow는 MFC(Mass Flow Controller)를 사용하여 유량에 대한 정확성 향상 및 자동제어

• Heat Flux meter(for ISO 5660) 사용시 수도배관공사가 필요 없는 Portable water cooling system 사용

• Mass loss rate를 측정하기 위한 정확성이 향상된 Load cell 사용

• PC를 사용하여 제어하는 CC 2024 DAQ(Data Acquisition) Program 구성

• Sampling Probe 및 Bi-directional Probe의 압축공기를 이용한 자동 Purging System

■ **시험결과 (Test Result)**

- 시편에 가해지는 복사열 (Heat Flux, 단위: kW/㎡)
- 연소가스 배출속도 (Exhaust duct flow rate, 단위: l/s)
- Orifice 교정상수 (C factor, 단위:1/kg.m.K)
- 착화시간 및 소화시간 (Ignition time and Extinguishment time, 단위: s)
- 전체 산소소모량 (Total oxygen consumption, 단위: g)
- 전체 연소가스 배출량 (Total Smoke Release, 단위: m/㎡)
- 질량감소양 및 질량 감소율 (Mass loss and Mass loss rate, 단위: g, g/s)
- 열방출률 (Heat release rate, 단위: MJ/kg, kw/㎡)
- 유효연소열 (Effective heat of combustion, 단위: MJ/kg)
- 일산화탄소 발생량 (Carbon monoxide yield, 단위: kg/kg)
- 이산화탄소 발생량 (Carbon dioxide yield, 단위: kg/kg)

1. LABORATORY ENVIRONMENT

1.1 For testing of FESTEC's Cone Calorimeter, it should be installed to avoid where to directly affected light and scattering of light. Light will be influence to Test Results.

1.2 Size of Cone Calorimeter is 1,800(W) X 900(D) X 2,650(H)mm.
For installation, it required enough space (at least 2,500(W) X 1,500(D) X 3,000(H)) as considering of size of cone calorimeter.

1.3 It required space for Calibration Gas (CO/CO2, N2) storage.

1.4 Laboratory should be maintain temp. 23±2℃.

1.5 It must install fire extinguisher nearby equipment.

2. VENTILATION (EXTRACTION)

2.1 During test, it occurs combustion gas. A hood system is required that there must be installed for exhaust of combustion gas.
Hood is connected with Duct. Hood size is at least Ø600 × 250(H)mm.
It recommends that hood shape is pyramid shape of hood.
The recommended duct diameter is 200 mm (a minimum of 150 mm is suggested to avoid jet effects in the extraction duct)

2.2 Minimum exhaust flow : at least more than 24 L/s in a temperature of 298K.
But, in Measurement Station, consider to loss of pressure.

2.3 Damper system : Recommend to install "Percentage Adjustable Damper" (for adjust optimum flow rate in the ventilation duct)

2.4 To install for Cone Calorimeter, recommend at least 2500(W)X1,500(D)X2,700(H)mm.

3. ELECTRIC POWER

3.1 Electrical power providing AC 220V, 60/50 Hz, 50A Fuse for safe of equipment at the instrument must be available on the floor or wall. (for control circuit)

** If power does not stable, it requires A.V.R system (Automatic Voltage Regulator) or U.P.S.

3.2 The instrument is supplied with a bare 50Ampere cable, with live neutral and earth (ground) conductors. This should be connected to the user's isolation box either by direct wiring or by a 3 pin plug.

(Attention : Isolation box [Main electric power] to be grounded should be prepared)

4. GAS SUPPLY

4.1 Methane (Calibration Burner) Propane Gas

a. Methane gas of at least 99.9% purity line at the rear of back side of Cone Calorimeter equipment should be connected with Connector (Tube fitting - 1/4" Female), and On/Off Valve(1/4" Lock type) for safety should be installed from bottled Methane gas cylinder.

b. The pressure operated condition of the MFC (Mass Flow Controller) is required at pressure 2kg/cm²(2bar) and flow rate is at least 10L/min.
Install pressure regulator at the front of On/Off Valve.







4.2 CO/CO2 Gas (Mixing Gas) for Calibration

a. CO/CO2 Gas is required analyzer for calibration.

b. CO/CO2 has maximum 0.8kg/cm² with 3.0 L/min of maximum flow rate, stays on 80~90% range of Full Scale of Analyzer.

c. Calibration gas of CO/CO2 which should be in the range of 0.8% of CO and 8.0% of CO2.

d. A hose has 1/4"(6mm) external diameter or pipe connector is required to able to connect to Stainless tube.

e. Note that this is only required if a CO/CO2 analyzer is fitted to the instrument. This span gas is used to span the CO/CO2 analyzer. Spanning the analyzer is performed at least once a day. The spanning process takes about 5 minutes at a flow rate of 3.5 l/min.

f. Please contact FESTEC before purchasing the calibration gas to confirm the analyzer ranges that will be supplied.

Install pressure regulator at the front of On/Off Valve.



4.3 Oxygen & CO/CO2 Free Nitrogen.

a. Nitrogen Gas is required analyzer for calibration.

b. Oxygen free Nitrogen is required to zero the oxygen analyzer with a maximum flow of 3.5 l/min at a maximum pressure of 0.8 bar (10 psi)

c. A hose has 1/4"(6mm) external diameter or pipe connector is required to able to connect to Stainless tube.

d. Nitrogen is used to zero the oxygen analyzer and CO/CO2 analyzer (if fitted) and also in troubleshooting the Cone. Zeroing the analyzer is performed at least once a day.

The zeroing process takes about 5 minutes at a flow rate of 3.5 l/min to the oxygen analyzer and 3.5 l/min to the CO/CO2 analyzer.

(Note that there are additional procedures for determining the drift and noise of the oxygen analyzer that require the oxygen analyzer to be purged with nitrogen for 60 minutes this is performed on commissioning at FESTEC but can be performed by the client on an annual basis.)
Install pressure regulator at the front of On/Off Valve.





5. Compressed Air

5.1 Filtered Compressed Air

Compressed air lines through moisture removal filter should be installed at the rear side of Cone Calorimeter and connected with Connector(Tube fitting - 1/4" Female), and also install On/Off valve(1/4") for safety.

6. Drying Agents

6.1 "Drying Agents" involved the first equipment. If bule color change to violet (purple) color, it must be replaced by new ones.

7. Aluminum Foil

Aluminum foil (less than 40 ㎛) is required for wrapping the specimen.