

Cone Calorimeter Specifications

- The Cone Calorimeter should be capable of measuring:
 - Heat Release Rate
 - Mass Loss Rate
 - Time to Ignition
 - Effective Heat of Combustion
- The apparatus should meet the standards prescribed in ISO 5660 and ASTM E 1354.
- For the following subsystems of cone calorimeter, the vendors are required to provide detailed specification of each component supplied by them in their technical quote.
 - (1) Conical Heater:
 - The heater element should be rated at 5 kW (or better) at 240 V
 - The heater should be able to produce uniform irradiance over the range 0 to 100 kW/m² (or more)
 - The heater should be encased on the outside with a double-wall stainless steel cone, packed with a refractory fiber material of approximately 100 kg/m³ density
 - The heater should be capable of horizontal and vertical orientation arrangements
 - The heater should have three K-type stainless steel sheathed thermocouples, connected but not welded to heater element
 - The heater should have a shutter mechanism (automatic or manual) to protect the sample area before the test
 - (2) Temperature Controller:
 - The temperature controller for heater should be capable of holding the element temperature steady to within $\pm 2^{\circ}\text{C}$ or better, over the range of 0°C to 1000°C using a suitable 3-term PID controller and thyristor unit capable of switching currents up to 25 A at 240 V
 - (3) Ignition Circuit:
 - External ignition should be by 10 kV discharge across a 3 mm spark gap
 - A power source should be a transformer designed for spark-ignition or a spark generator.
 - (4) Load Cell:
 - Load cell should be compensating for imbalance in the fuel
 - It should have a readout resolution of 0.1 g or better
 - Total weighing range of minimum 3.5 kg of which more than 500 g should be available for direct monitoring during single test

(5) Specimen Mountings:

- The specimen holder should be manufactured from 2.5 mm thick stainless steel material
- The inside dimensions of holder should be 100 mm×100 mm and 25 mm height
- Retainer frame and wire grid arrangements for specimen holder should be provided

(6) Heat Flux Meter:

- Gardon or Schmidt-Boelter type heat flux meter to calibrate the heater temperature controller
- The design range should be at least 0 to 100 kW/m² with an accuracy of ± 3 %
- The sensing surface should be circular and flat
- The flux meter should be water cooled

(7) Calibration Burner:

- Calibration burner to be provided to calibrate the heat release rate of the apparatus using methane of at least 99.5% purity
- Mass Flow Controller (MFC) to control the gas flow is preferred.

(8) Exhaust System:

- The exhaust system should consists of a variable speed exhaust blower capable of developing flow over a range 0.012 to 0.035 m³/s
- A restrictive orifice of 57 mm inside diameter should be placed between the hood and the duct for mixing and a sharp-edged orifice of 57 mm inside diameter should be located at least 350 mm downstream from the blower as per ASTM E 1354, ISO 5660
- The duct should be 114 mm inside diameter and manufactured from 0.6 mm thick stainless steel plate
- K-type stainless steel sheathed thermocouples to measure temperature of gas stream
- Material of complete exhaust system should be stainless steel

(9) Smoke Detection System

- Helium-Neon laser beam (0.5mW, 633nm) system, silicon photodiodes as a main beam and reference detectors.
- 2 number of ND filters for calibration with optical density anywhere between 0.1 to 1

(10) Gas sampling and analysis system:

- Capable of measuring O₂, CO₂, CO
- Should incorporate a ring sampler, soot filter, cold trap, pump, desiccant, bypass system and flow controller
- The gas sample lines should be constructed noncorrosive material like nylon and plumbing should be using Swagelok fittings
- The gas sampling & analysis rack should be modular for use with both cone calorimeter and well as large scale calorimetry.

O₂ Analyser:

- Paramagnetic type gas analyser with a range of 0 to 25 % oxygen
- The analyser should exhibit a linear response
- The drift of not more than ± 50 ppm of oxygen and noise of not more than 50 ppm of oxygen (root mean square value) over a period of 30 min.
- The analyser should have 10 to 90% response time of less than 12 s
- Intrinsic error (accuracy) should be less than 0.02% Oxygen
- Absolute pressure transducer arrangement for analyser

CO₂ Analyser:

- Non-dispersive Infra-red (NDIR) type with a range of 0 to 10 % CO₂ (v/v)
- The response time should be less than 20 s
- Intrinsic error (accuracy) should be at least 1% of range

CO Analyser:

- Non-dispersive Infra-red (NDIR) type with a range of 0 to 1 % CO (v/v)
- The response time should be less than 20 s
- Intrinsic error (accuracy) should be at least 1% of range

(11) Digital Data Collection System:

- The system must have facilities to record output from the analysers, the thermocouples, the orifice meter, the load cell and the smoke measuring system.
- The system should be capable of recording test data at least 1 scan per 1 second or better.
- Mention the hardware and software (OS) specification of computer system (personal computer/laptop) to be provided by the user.

(12) Software:

- Software for showing the status of the instrument, calibrating the instrument and storage of calibration results, collecting data generated during a test, calculating the required parameters, presenting the results in a manner approved by the standards should be provided on a media.

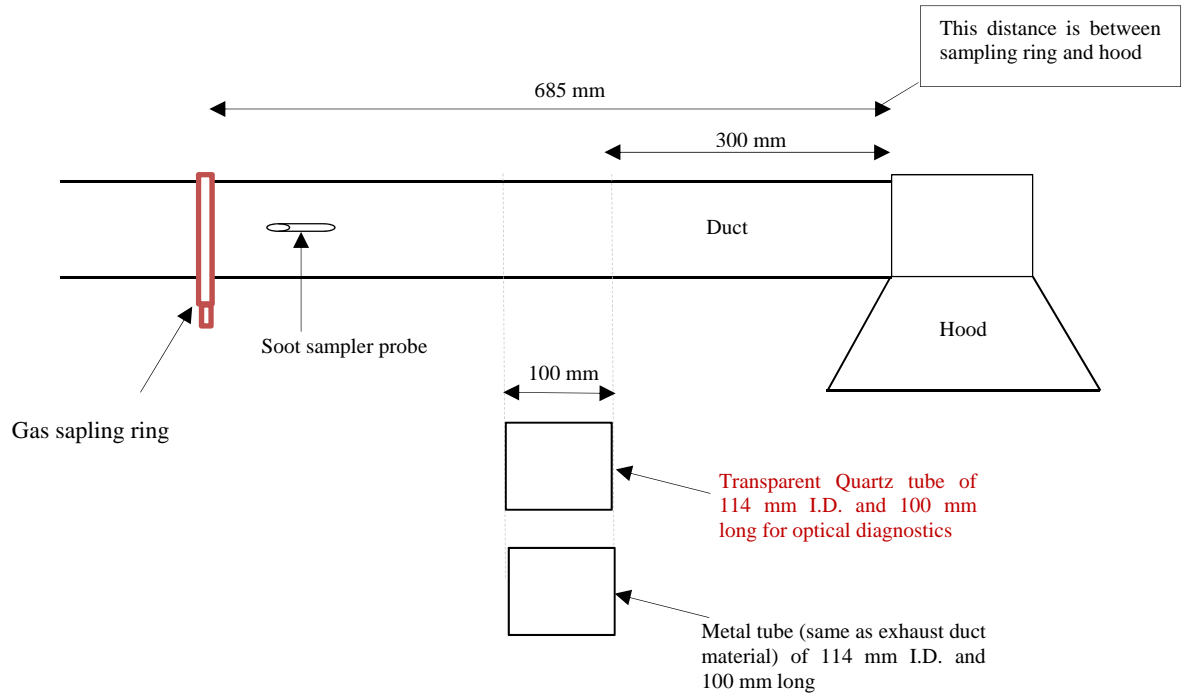
Optionals:

Kindly mention ability to provide the following optionals. For each option please give the technical specifications (drawings if applicable) in the technical quote and extra cost of each individual option in the budgetary quote.

- Additional heated analytical line (3 meter) and filter to enable taking combustion gases for further analysis
- Step temperature controller (for adjusting conical heater's heat flux in steps)
- A larger cone, which can be used for larger samples (say 150 mm×150 mm) for low heat release materials
- A quartz tube of 114 mm I.D. and length 100 mm should be incorporated before gas sampling ring (see the sketch below).
- Personal computer in case the user opts for vendor to provide the same.
- CACC (Controlled Atmosphere Cone Calorimeter) attachment.

Warranty:

12 months from the date of installation or 18 months from the date of invoice. Also, mention AMC (annual maintenance cost) after expiration of warranty.



NOTE: Figure is not to the scale