SBG04

Water-cooled heat flux sensor – for cone calorimeters

SBG04 is a water-cooled sensor that measures heat flux. SBG04 is mainly used as a calibration reference standard for testing with cone calorimeters. All specifications and dimensions are standardised for use in cone calorimeters according to ISO 5660 and ASTM E1354 reaction-to-fire tests. The design includes two water cooling tubes fixed at a 90° angle to the sensor body, with a sensor body of a 0.5 inch diameter. The sensor may also be used in flammability, fire resistance, and smoke chamber testing. For other water-cooled heat flux sensors, see the SBG01 and GG01 sensors.

Figure 1 *SBG04 water-cooled heat flux sensor.*

Introduction

SBG04 measures heat flux in the range of (10 to 100) x 10^3 W/m^2. Equipped with a black absorber, heat flux sensors of this type are designed for measurement in an environment in which heat flux is dominated by radiation. SBG04's thermopile sensor generates an output voltage proportional to the incoming irradiance. The sensor is water-cooled. Water cooling is typically supplied by tap water connected to the stainless steel in and outlet tubes. These tubes stand at a 90° angle to the 0.5 inch diameter cylindrical sensor body axis, and parallel to the black sensor surface as required for testing with cone calorimeters.

Next level technology

SBG04 employs a novel sensor design, which combines the benefits of foil technology of the traditional Gardon gauges with those of the thermopile technology of traditional Schmidt-Boelter gauges.

SBG04 has several advantages:

- cone calorimeter compatible
- all specifications and dimensions standardised according to ISO 5660 and ASTM E1354
- reduced diameter of 12.7 mm (0.5 inch)
- reduced installation height
- tubes at 90° angle to the axis of body
- scratch resistant absorber coating (reduced absorber height)
- safe storage with a practical protection cap.

Suggested use

SBG04 is the sensor of choice as calibration reference standard for cone calorimeter test equipment, in accordance to ISO 5660 and ASTM E1354 reaction-to-fire tests. It is also used in flammability, fire resistance and smoke chamber tests.

Measurement uncertainty

The uncertainty of the measurement with SBG04 should be determined case by case. It is a function of:

1. heat flux sensor properties.
2. uncertainty of calibration and quality assurance of the local calibration reference standard.
3. verification of the stability of SBG sensors in day to day measurements, before and after use.
4. application-related uncertainties, for example caused by the unknown contribution of convection and the representativeness of the measurement location.

Hukseflux provides a traceable calibration. The reference standard at Hukseflux is of secondary standard level. It has been calibrated by comparison to the primary standard of the RISE Research Institutes of Sweden AB.
SBG04 sensors as supplied by Hukseflux are calibrated according to ISO 14934-3.
Hukseflux is ISO 9001 certified, but not an accredited measurement laboratory according to ISO 17025.

ISO / ASTM standardised practices

Calibration and use of heat flux sensors (officially "heat flux meters") such as SBG04 are subject to standardised practices according to ISO 14934 "Reaction-to-Fire tests - calibration of heat flux meters" and ISO 5660 "Reaction-to-fire tests — Heat release, smoke production and mass loss rate". The same procedures will be adopted by ASTM. In case the user performs accredited testing or works in an accredited organisation, the user must comply with these standards.

The ISO 14934 standard has 4 parts:
Part 1: general principle.
Part 2: primary calibration methods.
Part 3: secondary calibration methods.
Part 4: guidance on use of heat flux meters.

The most important requirements of the ISO 14934 standards are:

- to have 3 local "secondary standard" calibration reference instruments (i.e. sensors calibrated using the primary standard according to ISO14934-2) for calibration of the "working standards" (i.e. the instruments used for day to day work for calibration of test equipment). This may be done at for example NIST (USA), Of the 3 calibration reference instruments, 2 instruments must be kept unused until unexpected results appear or until the first calibration reference standard is sent away for recalibration.
- to calibrate every 2 years one of the reference standards against the primary standard. After calibration this instrument is used to verify the uncertainty of the other 2 calibration reference standards. A single calibration reference sensor is usually calibrated at multiple heat flux levels. It can be used as a reference in the same heat flux range, and by extrapolation also at higher levels.
- to compare working standards to a local calibration reference standard before every test and preferably after every test, following the method specified in ISO 14934- 3. The comparison requires a local irradiance source, for example a cone calorimeter.

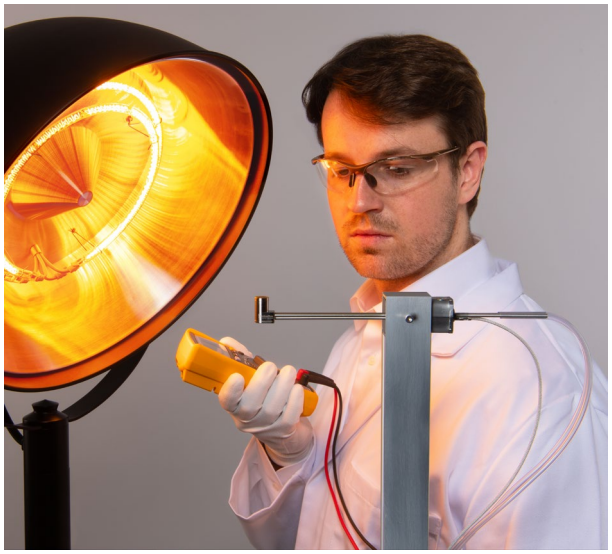


Figure 2 *SBG04 is the sensor of choice for cone calorimeter calibration.*

The ISO 5660 standard has 4 parts:
Part 1: Heat release rate (cone calorimeter method).
Part 3: Guidance on measurement.
Part 4: Measurement of heat release for determination of low levels of combustibility.
Part 5: Heat release rate (cone calorimeter method) and smoke production rate (dynamic measurement) under reduced oxygen atmospheres.

The most important requirements of the ISO 5660 standards for SBG04 are:

- the flux meter shall be positioned at a location equivalent to the centre of the specimen face during calibration.
- the receiving target shall be flat, circular, of approximately 12.5 mm (half inch) in diameter with a durable matt black finish.
- at maximum intervals of 100 working hours, check the operating heat flux meter against the reference heat flux meter.
- the calibration of the working heat flux meter shall be checked by comparison with two instruments of the same type and of similar range held as reference standards and not used for any other purpose. One of the reference standards shall be fully calibrated at a standardizing laboratory at yearly intervals.
- the flux meter shall always be used with water cooling.

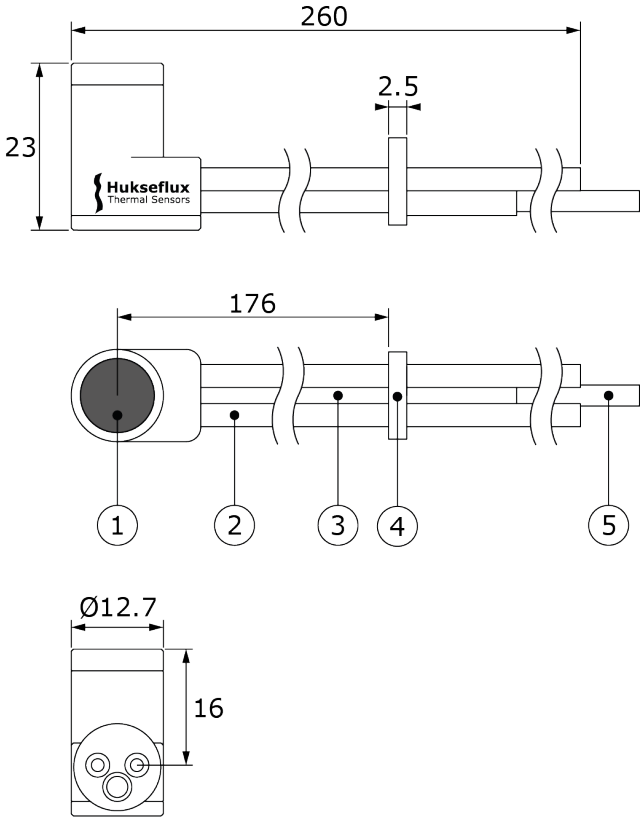


Figure 3 *SBG04-100-02 standard model: (1) thermopile sensor with black coating, (2) water cooling tube, outer diameter tubes 3.2 x 10^{-3} m, (3) sensor wire tube, (4) tube support ring, positioning stop for cone calorimeter, (5) cable, length 2 m. SBG04 is delivered with a practical protection cap for safe storage. All dimensions in x 10^{-3} m.*

SBG04 specifications

Measurand	heat flux
Measurand in SI units	irradiance in W/m^2
Sensor technology	both Gardon and Schmidt-Boelter
Standardisation	all specifications and dimensions standardised for use in cone calorimeters according to ISO 5660 and ASTM E1354
Rated measurement range	100 x 10^3 W/m^2
Limiting measurement range	150 x 10^3 W/m^2
Response time (63 %)	< 250 x 10^{-3} s
Output signal	DC voltage
Output signal range	> 12 x 10^{-3} V at rated measurement range
Spectral range	0 to 50 x 10^{-6} m
Full field of view angle	180°
Black coating emissivity	> 0.90
Calibration traceability	to ITS-90
Rated cooling water temperature range	10 to 30 °C
Rated cooling water flow	> 10 l/h (0.003 l/s), preferably 30 l/h (0.01 l/s)
Calibration laboratory management system certification	ISO 9001
Accreditation	not accredited
Calibration method	SBGC secondary calibration method according to ISO 14934-3
Standard cable length	2 m
Order code standard version	SBG04-100-02

SBG04 mounting

To position SBG04 according to the standard practise of ISO 5660 and ASTM E1354 a "flux meter mount" shall be used. The recommended dimensions for the slot in the mount for SBG04 are provided in figure 4. Contact your cone calorimeter equipment supplier for an suitable mount or modification.

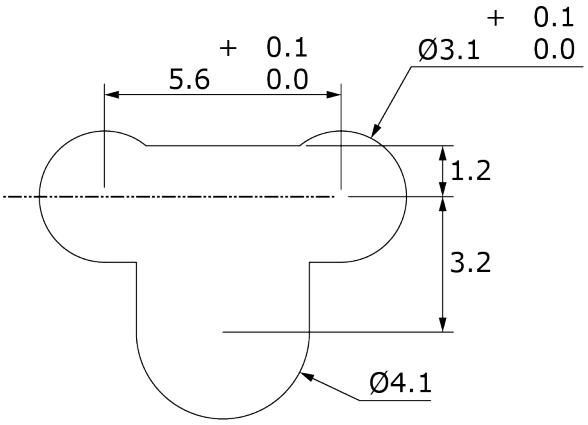


Figure 4 *Suggested slot dimensions for SBG04 cone calorimeter "Flux meter mount".*

See also

- SBG01 water-cooled heat flux sensor with a 1 inch body for measurements < 200 x 10^3 W/m^2.
- GG01 Gardon gauge water-cooled high heat flux sensor for measurements > 250 x 10^3 W/m^2.
- HFS01 is a high intensity heat flux sensor intended for concentrated solar and flammability testing.

About Hukseflux

Hukseflux is the leading expert in measurement of energy transfer. We design and manufacture sensors and measuring systems that support the energy transition. We are market leaders in solar radiation- and heat flux measurement. Customers are served through the main office in the Netherlands, and locally owned representations in the USA, Brazil, India, China, Southeast Asia and Japan.

Interested in this product?
E-mail us at: info@hukseflux.com

SBG04 outperforms competing models: how?

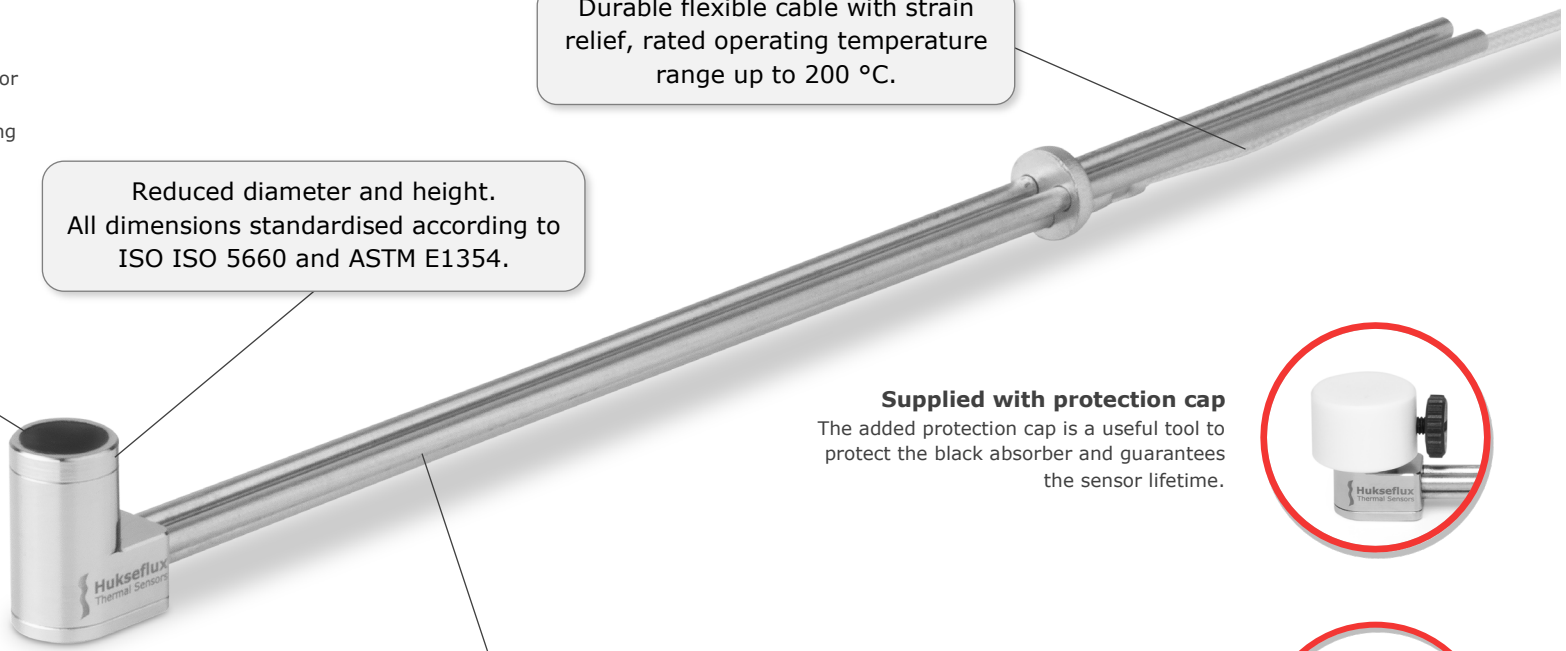
SBG04 is the standard heat flux sensor used as calibration reference standard for cone calorimeter test equipment.

World market leader
SBG series is on the market for around 10 years and used by the vast majority of fire testing institutes.

Durable flexible cable with strain relief, rated operating temperature range up to 200 °C.

Reduced diameter and height.
All dimensions standardised according to ISO ISO 5660 and ASTM E1354.

Carbon black absorbing paint, extremely stable, black surface slightly retracted to reduce risk of scratching the sensor surface.



Supplied with protection cap
The added protection cap is a useful tool to protect the black absorber and guarantees the sensor lifetime.

Employed with a variety of sources
Cone calorimeters, IR emitters, fires, flares etc.

Best paperwork
Hukseflux has the paperwork covered; SBG04 is provided with formally traceable calibration certificates. We use a secondary calibration method according to ISO 14934-3.

Robust water supply tubes at 90° angle for cone calorimeter mounting.