

HUKX

Sensor
Technology

Brochure

Water-cooled heat flux sensor

SBG04

SBG04

Water-cooled heat flux sensor

SBG04 is the preferred heat flux sensor for use as a calibration reference standard in cone calorimeter tests. The design includes two water cooling tubes fixed at a 90° angle to the sensor body. All specifications and dimensions are tailored for use in cone calorimeters, according to the standards ISO 5660 and ASTM E1354 reaction-to-fire tests. 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.

Introduction

SBG04 measures heat flux in the range of (10 to 100) x 10³ W/m². Equipped with a black absorber and water-cooled, the sensor is designed to measure heat flux from strong radiative sources. SBG04's thermopile sensor generates an output voltage proportional to the incoming heat flux.

The sensor is cooled, usually via tap water flowing through the stainless steel inlet 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.

Figure 1 SBG04 water-cooled heat flux sensor.



Next-level technology

SBG04 features a novel sensor design that combines the benefits of the technology of traditional Gardon gauges and the more recent thermopile technology of Schmidt-Boelter gauges.

SBG04 has several advantages:

- cone calorimeter compatible
- all specifications and dimensions standardized according to ISO 5660 and ASTM E1354
- small diameter of 12.7 mm (0.5 in)
- tubes at a 90° angle to the axis of the body
- scratch-resistant absorber coating (slightly lowered surface)
- safe transport and storage with a practical protection cap

Suggested use

SBG04 is the sensor of choice as a 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 measurement uncertainty of SBG04 should be determined on a case-by-case basis. It depends on several factors:

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



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

Calibration

With every SBG04 sensor, Hukx provides a calibration traceable to a secondary reference standard.

The reference has been calibrated by comparison to the primary standard of the [RISE Research Institutes of Sweden AB](#).

SBG04 sensors are factory calibrated according to ISO 14934-3. Hukx is ISO 9001 certified but not an ISO / IEC 17025 accredited measurement laboratory.

ISO/ASME standardized practices

Calibration and the use of heat flux sensors (officially "heat flux meters"), such as SBG04, are subject to standardized practices, according to ISO 14934, Reaction-to-Fire tests — Calibration and use of heat flux meters. The same procedures will also be adopted by ASTM.

The use of SBG04 in cone calorimeters is described in ISO 5660 Reaction-to-fire tests — Heat release, smoke production and mass loss rate. If the user performs accredited testing or works in an accredited organization, the user must comply with these standards.

The ISO 14934 standard has 4 parts:

- Part 1: General principles
- Part 2: Primary calibration methods
- Part 3: Secondary calibration methods
- Part 4: Guidance on use of heat flux meters

– **Secondary reference standards:** You should have 3 local "secondary standard" calibration reference instruments (i.e., sensors calibrated using the primary standard per ISO 14934-2) for calibration of your local "working standards" (i.e., instruments used for daily work and test equipment calibration). Calibration of your reference instruments may be done at NIST (USA), RISE (Sweden), or LNE (France). Of the 3 calibration reference instruments, 2 instruments must remain unused until unexpected results appear or the first calibration reference standard is sent away for recalibration.

- Periodic recalibration: Every 2 years, you should calibrate 1 of the reference standards against the primary standard. Then use this instrument to verify the uncertainty of the other 2 calibration reference standards. A single calibration reference sensor is usually calibrated at multiple heat flux levels, allowing it to be used as a reference within that range or at higher levels by extrapolation.
- Appropriate usage: You may only use working standards at an irradiance level close to its calibration reference condition.
- Routine verification: Before (and preferably after) each test, you should compare working standards to a local calibration reference standard following the method specified in ISO 14934

The ISO 5660 standard has 4 parts:

- Part 1: Heat release rate (cone calorimeter method)
- Part 2: Guidance on measurement
- Part 3: Measurement of heat release for determination of low levels of combustibility
- Part 4: 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 center of the specimen face during calibration.
- The receiving target shall be flat and circular, of approximately 12.5 mm (0.5 in) diameter with a durable matt black finish.
- At maximum intervals of 100 working hours, you should 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.

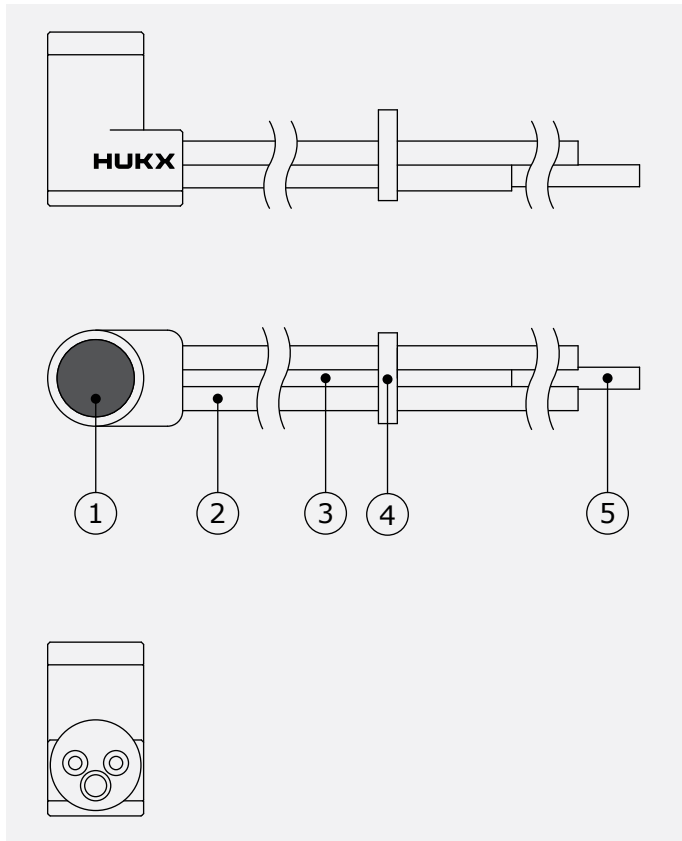


Figure 3 Overview of SBG04-100-02 standard model: (1) thermopile sensor with black coating, (2) water cooling tube, outer diameter tubes 3.2×10^{-3} m, (3) sensor wire tube, (4) tube support ring, positioning stop for cone calorimeter, (5) cable, length 2 m. SBG04 is delivered with a practical protection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

SBG04 mounting

To position SBG04 according to the standard practice 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 a suitable mount or modification.

See also

- **SBG01** water-cooled heat flux sensor with a 1 inch body for measurements $< 200 \times 10^3 \text{ W/m}^2$
- **GG01** Gardon gauge water-cooled high heat flux sensor for measurements up to $2500 \times 10^3 \text{ W/m}^2$
- **HFS01** for concentrated solar flames

SBG04 specifications

General specifications

| | |
|----------------------------|---|
| measurand | heat flux |
| measurand in SI units | irradiance in W/m^2 |
| sensor technology | both Gardon and Schmidt-Boelter |
| standardization | all specifications and dimensions standardized for use in cone calorimeters, according to ISO 5660 and ASTM E1354 |
| rated measurement range | $100 \times 10^3 W/m^2$ |
| limiting measurement range | $150 \times 10^3 W/m^2$ |
| response time (63 %) | $< 250 \times 10^{-3} s$ |
| output signal | DC voltage |
| output signal range | $> 12 \times 10^{-3} V$ at rated measurement range |
| spectral range | 0 to $50 \times 10^{-6} m$ |

| | |
|--|--|
| 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 |

About Hukx

Hukx is the leading innovator in solar radiation and heat flux sensor technology. We are proud to set the standard in high-accuracy measurement, and to be working at the heart of the energy transition.

Customers worldwide rely on our bestselling pyranometers and heat flux sensors. From sensor design and selection to supply and recalibration, we support you across the entire lifecycle.

Hukx is headquartered in the Netherlands, with locally owned representative sales offices in the USA, Brazil, India, China, Southeast Asia, and Japan.

Let us help you select the best sensor for your application. Get in touch with our experts today via: info@hukx.com

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We reserve the right to change specifications without prior notice.

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