

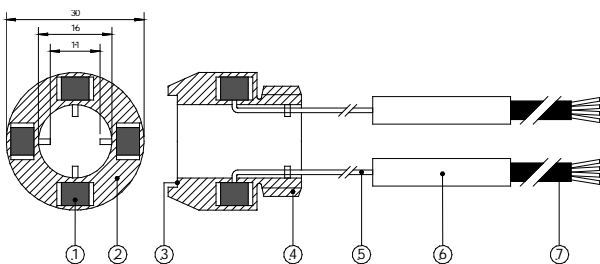
# RHF SERIES

## Ring heat flux sensors

The RHF series consists of customer-specific heat flux sensors incorporated in a stainless steel ring. They are used as building blocks in larger measuring systems, for example to study fouling and slagging in combustion processes. Many RHF's are eventually part of so-called "deposition probes" or "fouling sensors" designed by the customer. It is particularly suitable for trend monitoring that is necessary for this application. A typical sensor contains 4 separate heat flux and 4 temperature sensors, so that fouling behaviour can be studied at different locations on the sensor at different angles relative to the local gas flow.



**Figure 1** example of an RHF series version with 2 x heat flux and temperature sensors and high temperature metal sheathed cables.



**Figure 2** example of RHF01 ring heat flux sensor with 4 x heat flux / temperature sensors (1), in a stainless steel body (2), with either a flat connection for welding (3) or a threaded connection (4). High temperature cable (5) is usually extended with low temperature extension cable (7). Cooling must be provided by air, oil or water. RHF design is user-specific. Dimensions in the drawing serve as an example only. Dimensions in  $10^{-3}$  m.

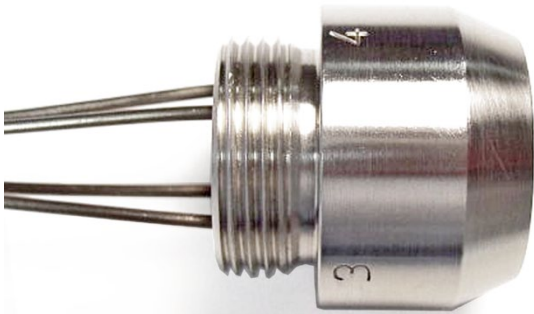
### Introduction

Sensors of the RHF series are used in scientific as well as operational experiments to study fouling and slagging behaviour. RHF may be employed as a building block, when designing a deposition probe or a fouling sensor. Many RHF sensors are part of multi-purpose probes that also measure local gas temperature and take gas samples (so-called suction probes). RHF's can be manufactured in many different geometries and dimensions. RHF01 is a version incorporating 4 heat flux / temperature sensors. Usually the RHF is cooled by compressed air or water.

Using RHF has the advantage that the sensor is small, so that multiple sensors fit in one tube, providing "directional" information. Also the RHF has a fast response. Hukseflux is specialised in design and manufacturing of slagging and fouling sensors. RHF design is user-specific; geometry and cabling are designed in cooperation with the user for the specific application. We can also build your entire deposition probe.

### Calibration

RHF is most suitable for relative measurements using one sensor, i.e. monitoring of trends relative to a certain reference point in time or comparing heat flux at one location to the heat flux at another location. The heat flux sensor calibration depends on the way the sensors are built-in and may also depend on the flow rate of the gas or liquid used for cooling. RHF01 is provided with a factory calibration of every sensor which is suitable for relative measurements. If you want to perform accurate absolute measurements with RHF, as opposed to relative measurements, it is necessary to calibrate the RHF incorporated in the final design under operating conditions, possibly as a function of water or air flow. Hukseflux can provide dedicated heaters to perform such calibration.



**Figure 3** example of an RHF01 ring heat flux sensor with 4 x heat flux / temperature sensors

### Suggested use

- building block for customer-specific sensors
- deposition sensors
- fouling sensors
- heat flux sensors



**Figure 4** we provide many different models of heat flux sensors for different applications: the picture shows a typical boiler fouling sensor for electrical power plants.

### RHF series specifications

|   |  |
|---|--|
| Measurand   | heat flux  |
| Measurand   | temperature  |
| Heat flux sensor  | thermopile   |
| Temperature sensor  | thermocouple type K                                |
| Sensitivity (nominal)   | $4 \times 10^{-9} \text{ V}/(\text{W}/\text{m}^2)$ |
| Rated measurement range                                       | 0 to $300 \times 10^3 \text{ W}/\text{m}^2$        |
| Rated operating temperature sensor and high temperature cable | -30 to +800 °C                                     |
| Response time (95 %)  | 180 s (depends on cooling)                         |
| Cooling   | by air, water or oil (user responsibility)         |

Validity of calibration: factory calibration may be used for trend monitoring. For absolute measurements re-calibrate when the sensor is built-in.

RHF design is user-specific; geometry and cabling are designed in cooperation with the user for the specific application.

### Accessories

- heater for calibration

### See also

- [SBG01](#) for high accuracy radiative flux measurements
- [HF03](#) for study of flares / mobile measurements
- [HF02](#) for flare measurement
- view our complete [product range of heat flux sensors](#)

### About Hukseflux

Hukseflux Thermal Sensors offers measurement solutions for the most challenging applications. We design and supply sensors as well as test & measuring systems, and offer related services such as engineering and consultancy. With our laboratory facilities, we provide testing services including material characterisation and calibration. Our main area of expertise is measurement of heat transfer and thermal quantities such as solar radiation, heat flux and thermal conductivity. Hukseflux is ISO 9001:2008 certified. Hukseflux sensors, systems and services are offered worldwide via our office in Delft, the Netherlands and local distributors.

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