

Kiel temperature probes

Flow total temperature measurement.

General

Vectoflow's *Kiel temperature probes* can capture the total temperature of the flow at an angle of attack of up to 50°. At the same time, it offers all advantages of additive manufacturing, like geometric flexibility and robustness. *Vectoflow Kiel temperature probes* can be purchased either as a single unit or as part of a probe rake, with a specified number of probe heads.



Figure 1: Kiel probe (left side) and rake with several Kiel probe heads installed (right side)

Kiel temperature Probes characteristics

Geometry	Straight, L-shaped, Cobra, custom
Max length	Up to 100 mm (one part) > 100 mm (multi-part designs)
Min. typ. diameter	Ø 1.65 mm (micro Kiel probe) Ø 2 mm standard Kiel
Material	Stainless steel, Titanium, Inconel
Fastening type	None, square, hexagonal, one-sided flattened, cylinder, threaded or custom
Thermometer type	Pt100 or Thermocouple (Typically Type K.)
Temperature range	Up to 800°C, depending on material and thermistor
Angular range	±50° for Kiel probes ±45° for micro-Kiel probes
Velocity range	From 3 m/s to > 343 m/s

Time constants

The settling time of a *Kiel temperature probe* on a flow at a steady temperature depends on the probe's geometry, ranging from 1 second for smaller *Kiel temperature probes* to over 10 seconds for a probe with a diameter of 3.5 mm. The acquisition time to ensure properly converging data is typically no more than 3 seconds for all probes.

Recovery factor

For correction of the measured temperature with respect to the true total or stagnation temperature a recovery factor RT is defined as:

$$RT = \frac{T_c}{T_{tot}}$$

Where T_c is the temperature measured by the *Kiel temperature probe*, and T_{tot} is the total temperature measured in the wind tunnel's settling chamber. The average recovery factor of a *Kiel temperature probe* with a diameter of 3.5 mm as a function of the yaw angle, is shown on Figure 2:

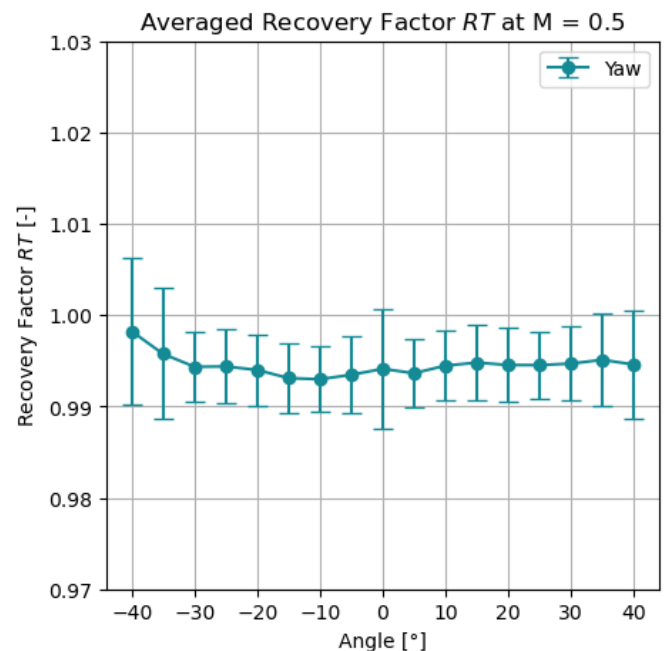


Figure 2: Recovery factor as function of yaw angle, with a flow Mach number of $Ma = 0.5$. The values were averaged over thirty-three similar probe heads. Error bars show the standard deviation.

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