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HFH SERIES

Resistance Strain Gages
For High Temperature Static Measurements

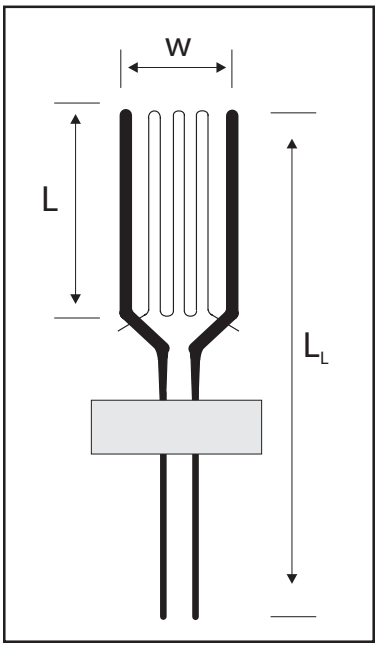


Figure 1

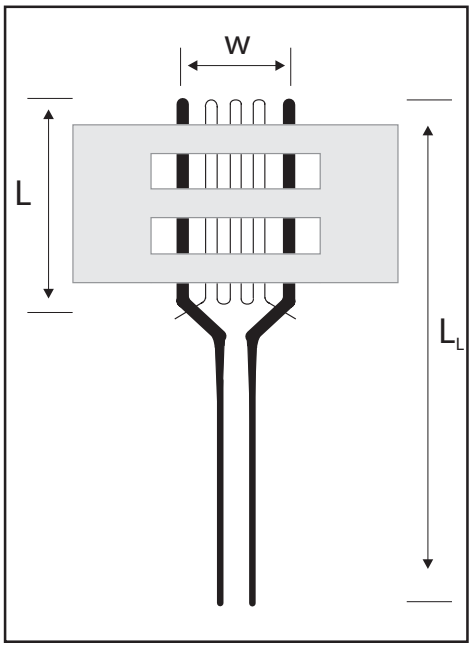


Figure 2

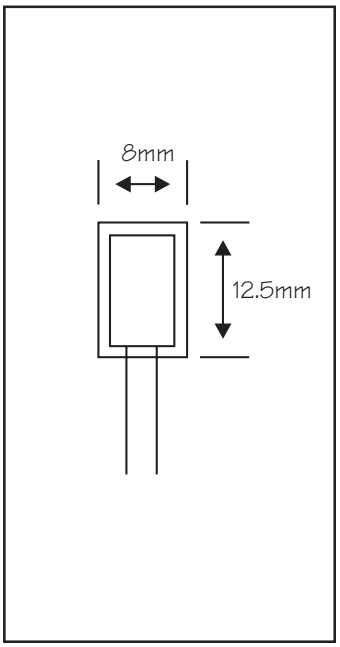
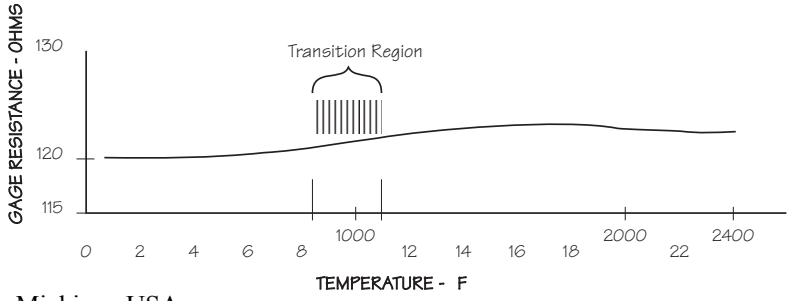


Figure 3

DESCRIPTION:

The HFH is an Iron Chrome Aluminum alloy wire resistance strain gage of the Hoskins* 875 (Kanthal** A-1) type alloy. It is intended for static strain measurements where a compensating gage, a half bridge, or full bridge configuration is used. The gage is available in three basic types: a free filament gage with leads (Figure 1), a free filament with temporary tape carrier (Figure 2), or a pre-installed weldable type strain gage (Figure 3). Leads are .008mm diameter (.003") Fe Cr Al alloy same as the sensor grid.

FEATURES:
- Round wire sensor for superior bondability and performance
- Flame spray or ceramic cement installation or pre- bonded weldable
- Fatigue resistant "Z" lead configuration



* ™ Hoskins Manufacturing. Company, Detroit, Michigan USA
** Kanthal Corporation, Bethel, Connecticut USA

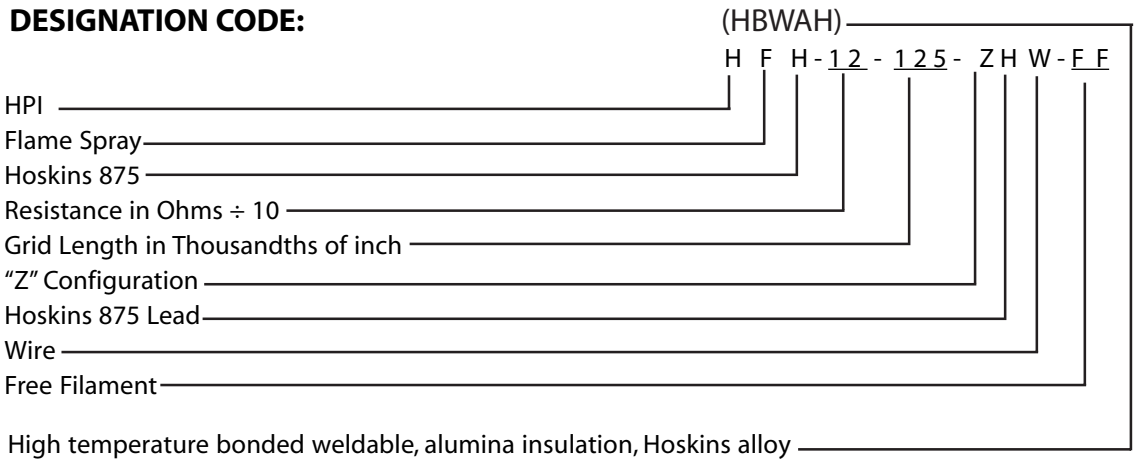
SPECIFICATIONS:

Gage Grid: ..... Fe Cr Al Alloy (.001") .003mm diameter round wire
Leads: ..... Fe Cr Al Alloy (.003") .008mm diameter round wire with "Z" configuration flattened to (.0015") .004 mm in grid area
Carrier: ..... Fiberglass reinforced Teflon tape carrier with silicone adhesive (shelf life of grid carrier [Figure 2] is 9 months)
Resistance: ..... 120.0 ohms ± 2.0 ohms at 20°C (68°F)
Gage Factor: ..... 2.4 nominal at 20°C (68°F)
Gage Current: ..... 30 Milliamperes, max.
Temperature Range: ..... Cryogenic to 850°C (1560°F)

Weldable Gage ONLY:
Shim Material: ..... Hastelloy X
Bonding Matrix: ..... Alumina
Shelf Life: ..... Unlimited

Gage Type	Grid Length (L)	Grid Width (W)	Grid Length (L_L)	Figure #
HFH-12-125-ZHW	3.175 (0.125")	5.0mm (0.200")	70mm (2.75")	2
HFH-12-250-ZHW	6.3mm (0.250")	3.0mm (0.120")	70mm (2.75")	2
HFH-12-125-ZHW-FF	3.0mm (0.120")	5.0mm (0.200")	70mm (2.75")	1
HFH-12-250-ZHW-FF	6.3mm (0.250")	3.0mm (1.120")	70mm (2.75")	1
HBWAH-12-250-6-NL	12.5mm (0.50")	8mm (0.30")	70mm (2.75")	3

DESIGNATION CODE:



APPLICATION:

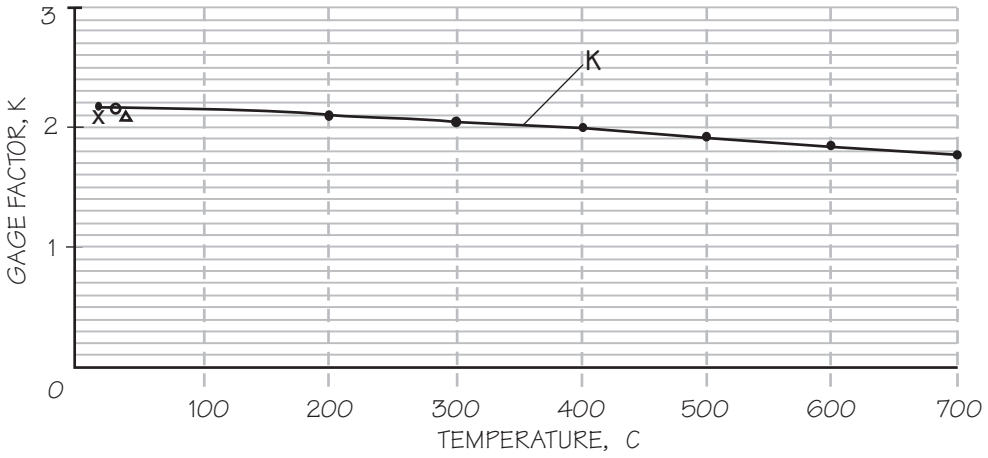
Free filament gages can be bonded by flame spraying rod or powder, or bonded using ceramic cement. Weldable gages are pre-bonded on shim and are attached by spot welding shim to the structure. See accessories catalog for cements, adhesives or spot welding equipment and accessories. Terminals and lead cable are also available.

PACKAGING: Mounted on glass slides, 5 gages per package

HFH STRAIN GAGES

ENGINEERING DATA:

Density:	7.1 Mg/m^3 (0.256 lb./in^3)
Chemical Analysis, Approx.:	72 Fe 22.5 Cr 5.5 Al
Resistivity @ 20°C (68°F):	875, ohms - cmf
Max. Operating Temperature:	1375°C (2500°F)
Melting Point, Approx.:	1510°C (2750°F)
Temperature Factor, Resistant Max. Temp.:	1.044
Thermal Expansion, ppm/°F:	20 - 250°C = 6.1 (68 - 482°F)
	20 - 500°C = 6.9 (68 - 932°F)
	20 - 750°C = 7.7 (68 - 1382°F)
	20 - 1000°C = 8.3 (68 - 1832°F)
Gage Factor K @ 20°C (68°F):	2.3 to 2.6
Gage Factor vs. Temperature Coefficient:	-5.73 x 10^{-4}/°C
Tensile Strength, PSI:	140,000 (hard), 92,000 (soft)
Tensile Strength, MPa:	965 (hard), 690 (soft)
Elongation, % (Soft):	22%
Magnetic:	Yes, below 540°C (1000°F)
Thermoelectric Potential vs. Cu:	-2.6µV/°C (0-100°C)



Gage Factor (K) vs. Temperature*

• -20, 200, 300, 400, 500, 600, 700 C

x , O , Δ -20 C after 400, 500, 600 respectively

**K factor tests were performed at the I.I. Pulzunov Scientific and Development Association in St. Petersburg, Russia.*

NOTES:

1. Caution should be exercised when bonding to high expansion materials such as shown in the example below. From the stress vs. temperature curve, an Fe Cr Al alloy wire bonded to an austinetic stainless steel will induce tensile stress in the wire because of the differences in thermal expansion (9ppm/°F for austinetic stainless steel and 6 ppm/°F for Feretic Fe Cr Al wire). Above the curie temperature, both materials expand the same and result in no additional induced stress with increased temperature. Note the thermally induced stress at 1500°F is well above the 10 hour stress to rupture point and hence early failure at high temperature on high expansion materials is expected. But for gages bonded to a 6 ppm/°F Feretic or similar material, no thermally induced stress exists until the gage is taken above the curie temperature whereby the wire goes into compression as the temperature is increased. Therefore, Fe Cr Al gages should be used primarily on low expansion materials.

2. Rapid heating or cooling should be avoided while in the transition zone. Rates > 25°F/sec. (14°C/sec) are excessive and may cause a change in the resistance temperature curve of the sensor wire. The temperature differences between gages in the bridge should also be minimal.