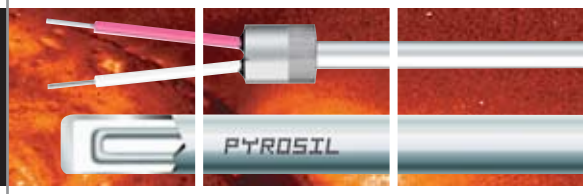
Pyrosil®
Technical Data

Ref: TMTB 2/IMP

tyco / Flow Control / Tyco Thermal Controls

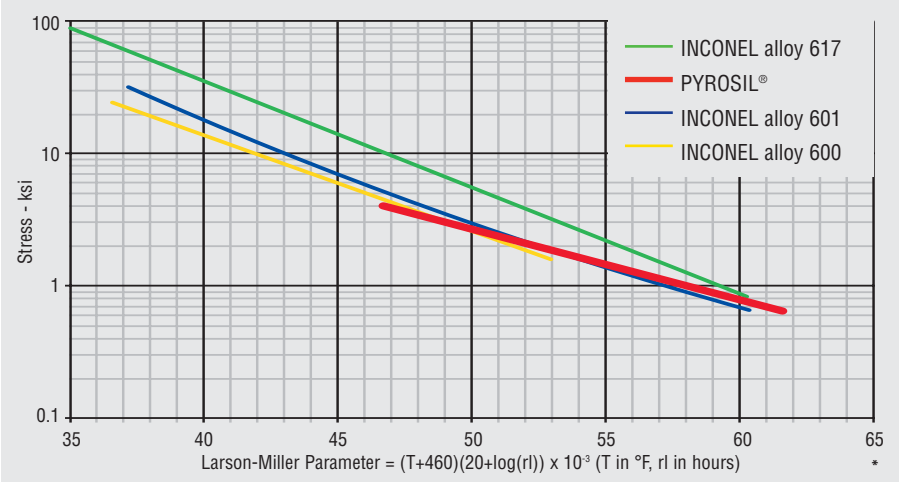
Pyrosil®. The ultimate protection for thermocouples at high temperatures



Exceptional Mechanical Strength

Stress Rupture Strength

Pyrosil® has good stress rupture strength in comparison with other Nickel-Base heat resistant alloys.



Coefficient of Thermal Expansion

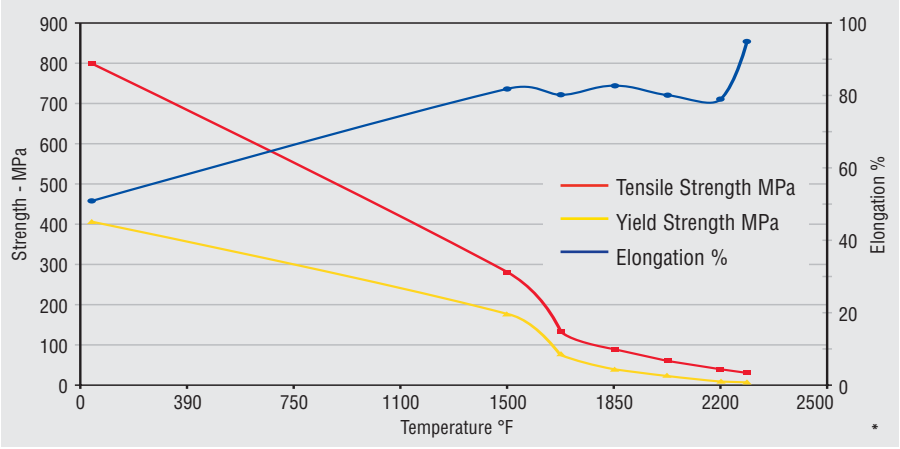
(from 68°F to temperature shown)

°C	500	600	700	800	900	1000
µ m/m/°C	14.56	14.98	15.59	16.15	16.81	17.30

With a coefficient of thermal expansion close to that of the core rods the fatigue and conductor breakage associated with differential expansion is minimized, resulting in longer life for N type thermocouples made with this sheath.

Tensile Strength

The chart shows the tensile and elongation properties of Pyrosil®.



Operating temperature

Recommended for continuous use up to 2280°F, brief excursions to 2335°F are possible although life may be considerably shortened.

Pyrosil® products from Tyco Thermal Controls provide exceptional mechanical strength, good corrosion resistance and low drift for N and K type thermocouples.

Applications

Pyrosil® thermocouple cable and protection tube performs well in these industrial processes: Heat treatment, chemical and petrochemical processing, furnaces, steel works, flue gases (especially in aluminum anode bake furnaces), ceramics industry, automotive, power generation, and most general industrial processes.

In some applications Pyrosil® sheathed thermocouples can replace R and S types at significantly lower cost.

This bulletin concentrates on the performance elements of the product. For size, construction or other elements, refer to other technical bulletins.

Physical Properties

	Pyrosil®	Inconel® 601
Density lb/in³	0.308	0.29
Melting Range °F	2516-2552	2408-2498

Pyrotenax® BRAND

Excellent Corrosion Resistance

Pyrosil® sheathed thermocouples give excellent oxidation and nitridation corrosion resistance. They also have excellent resistance to degradation in carbon based atmospheres.

Pyrosil® is not recommended above 930°F in reducing sulphurous atmospheres.

Oxidation Resistance

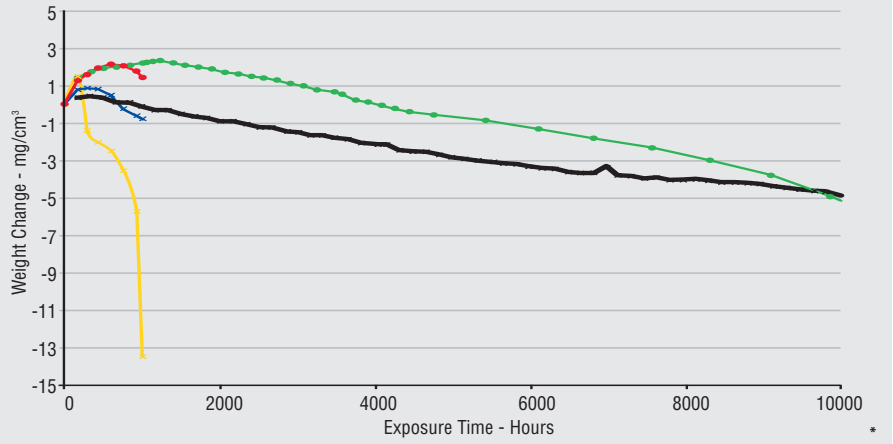
The alloy has been tailored to provide improved oxidation resistance over stainless steels and higher nickel alloys at temperatures up to 2282°F. The resistance to oxidation corrosion is the result of a strongly adhering protective high temperature oxide film - one that does not affect the stability of the thermocouple alloys and that reduces the rate of mass change.

1850°F

Oxidation Resistance at 1850°F (Air + 5% H_2O)

At 1850°F Pyrosil® sheaths have a stable oxide with very little spalling, when compared with other materials - especially the Steel 310 in this example.

- INCONEL alloy HX
- AISI 310
- INCONEL alloy 600
- INCONEL alloy 617
- PYROSIL®

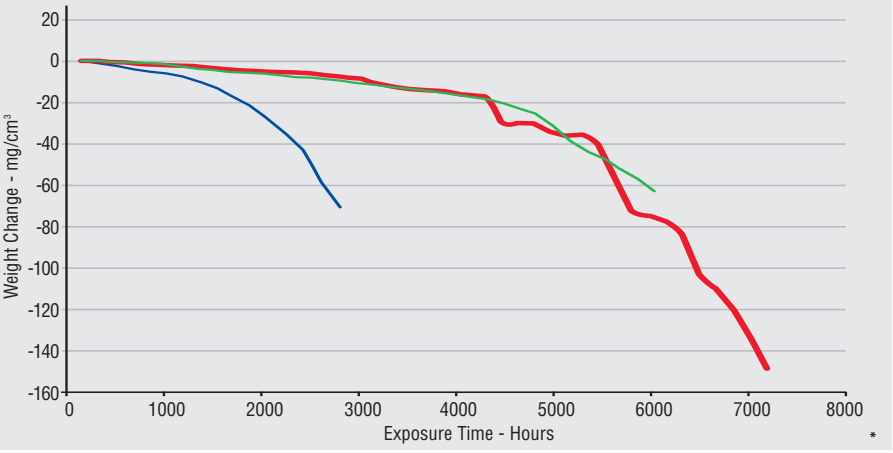


2000°F

Oxidation Resistance at 2000°F (Air + 5% H_2O)

At the higher temperature of 2000°F the effect is more pronounced, with Pyrosil® exhibiting significantly better resistance to corrosion than 601.

- PYROSIL®
- INCONEL alloy 601
- INCONEL alloy 617

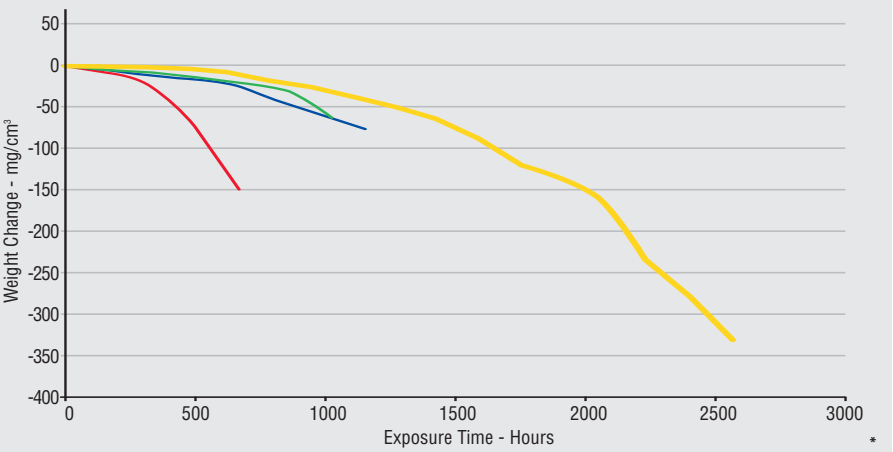


2200°F

Oxidation Resistance at 2200°F (Air + 5% H_2O)

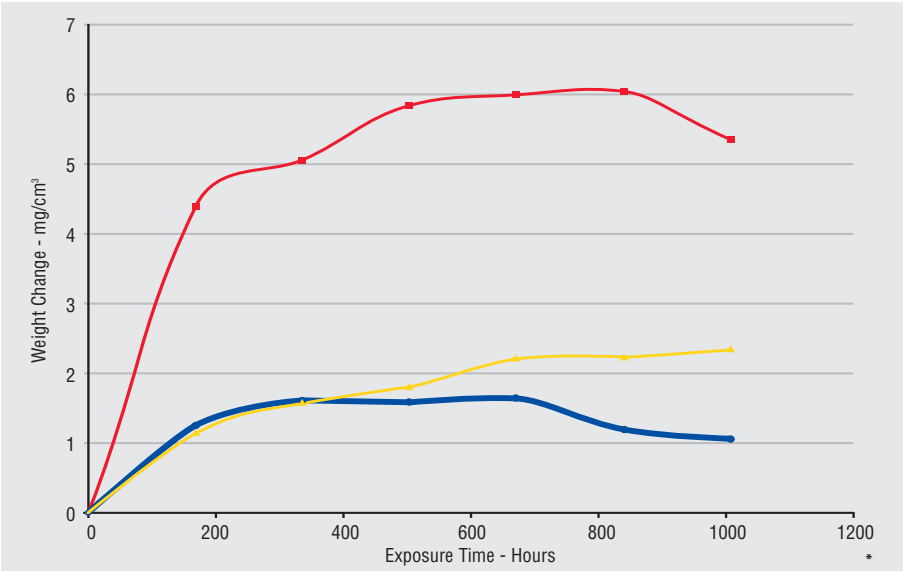
At 2200°F Pyrosil® gives excellent performance compared to other common thermocouple sheathing materials.

- PYROSIL®
- INCONEL alloy 617
- INCONEL alloy 601
- INCONEL alloy HX



Good Corrosion Resistance

Nitridation Resistance



Nitridation Resistance at 2050°F

Compared to other sheath materials, Pyrosil® absorbs less nitrogen and so is more stable in the process. Lacking the alloying elements that form internal nitrides such as Nb or Al, Pyrosil® sheaths exhibit freedom from microstructural degradation and brittleness. This makes Pyrosil® especially valuable where mechanical damage is likely.

- PYROSIL®
- AISI 314
- INCONEL alloy 600

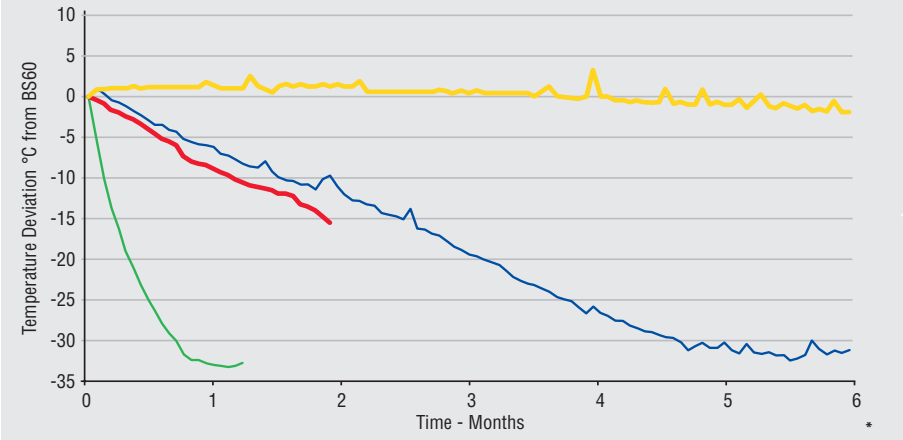
2050°F

Low Drift for N Type

The compatibility of the sheath and conductor material gives Pyrosil® outstanding performance characteristics in terms of stability and range.

As the chemistry of the Pyrosil® sheaths and N type conductors are similar, this reduces the potential for diffusion of elements between the alloy thus reducing the change in output and subsequent drift. In addition the lack of Mn and Al also prevents cross contamination - and drift - of the thermocouple legs.

Low Drift at High Temperatures



- K 310 at 1150°C (2100°F)
- N PYROSIL® at 1150°C (2100°F)

2100°F

- N 310 at 1300°C (2370°F)
- N PYROSIL® at 1300°C (2370°F)

2370°F

Chemical Composition

Sheath Alloys

	Cr	Si	Mg	Nb	Others
Pyrosil® A	14.2	1.4	0.15	-	Bal Nickel
Pyrosil® B	14.7	1.4	0.15	1.5	Bal Nickel
Pyrosil® C	24	1.4	0.15	0.5	Bal Nickel
Pyrosil® D	22	1.4	-	-	Mo 3%, rare earths trace Bal Nickel

Core Rods

N Pos	14.3	1.5	-	-	Bal Ni (Nicrosil)
N Neg	-	4.5	-	-	Bal Ni (Nisil)
K Pos	9.2	0.4	-	-	Bal Ni
K Neg	-	2.5	-	-	Co 1.2, Cu 2.4, Bal Ni

Product Range

Thermocouple Cable:

- Type N and K EMF outputs
- Diameters of 0.040"* to 0.500"
- Simplex, Duplex and Triplex conductor configuration
- Standard and Heavy Wall designs

Note: Not all variants possible in 1 cable

Protection Products:

- Tubes at 1" outside diameter and $^{3}/_{4}$" outside diameter

**Smaller diameters by special request.*



Low Drift

www.tycothermal.com

*Data Courtesy of Special Metals

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Tyco Thermal Controls UK Limited

3 Rutherford Road,
Stephenson Industrial Estate,
Washington, Tyne & Wear,
NE37 3HX. United Kingdom

Tel: +44 (0) 191 419 8200
Fax: +44 (0) 191 419 8201

Tyco Thermal Controls Canada Limited

250 West Street,
Trenton, Ontario,
Canada.
K8V 5S2

Tel: (1) 613-392-6571
Fax: (1) 613-392-3999

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