THERMOCOAX

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AERONAUTIC DEFENSE SPACE

THERMOCOAX Aeronautic Products

Carbon Brake Temperature Monitoring

Aircraft Brake Monitoring System

Author: Olivier HERVE

Thermocoax Pedigree

THERMOCOAX is a worldwide key player since 20 years in designing, developing and manufacturing with thermocouples sensors for aeronautic market.

Based on the 60 years homemade Mineral Insulated Cable, we are providing our customers with solutions for:

- Ground applications:

  - ✓ R&D programs with institutes
  - ✓ Ground aero test equipment

- Flying models:
  - ✓ Thermocouples and RTDs for air cabin management system.
  - ✓ Thermocouples for helicopter engines with 15 000 units installed
  - ✓ Alternator Bearing temperature measurement on twin aisle and double deck platforms

- Scientific Mission:
  - ✓ Skin temperature on supersonic frame
  - ✓ Engine Space launcher

Technical Application of Brake Temperature Sensor

New technologies are going fast and the brake industry is working hard to make safer the aircraft operations and offers to passengers more comfortable travelling conditions.

A new brake generation is implemented on the modern aircraft. Carbone brake developed by brake key makers is the result of a long and costly investment in research and development.

The new carbon disk generation is offering more power braking during the landing operation but also during braking emergency.

Firstly, the brake thermocouple gives in real time the brake temperature and can be transformed in an alarm “hot brake” to the pilot when the value goes over a predetermine temperature threshold.

It gives a precious information to the cockpit regarding the temperature of the right and left brakes. In case of a too much difference, an asymmetric friction on the brake can occur difficulties to maintain heading and keep speed under control.

Thanks to this system, the pilot receives a “Go/No Go” clear message for the takeoff authorization. The brake thermocouple indicates that in case of a braking emergency event during the takeoff operation, the brake will have his full efficiency to stop the aircraft on time for the security of the wholes passengers.

Secondly, when the takeoff is happening in hot environmental conditions, this temperature monitoring avoids a too early re-

entry of the landing gear. This avoids a risk of tyre explosion in the wheel compartment.

The Brake thermocouple is now one of a key equipment solution for the airline companies to reduce per around 30 minutes the Turn Around Time (TAT) when short flight operation.

This new generation of carbon brake replaces the old metallic brake.

Each brake maker develops his own carbon technology. Specialists agreed to confirm carbon technology offers a longer life, more braking cycles and a lot higher efficiency of braking especially for heavy cruisers.

But carbon brake technology is producing high heat energy during braking operation and the temperature can climb very high if the kinetic energy dissipation is not optimum. This temperature could climbs close to 1000°C during normal braking condition. In case of emergency braking at full power during takeoff at full weight, the friction off the carbon disks is so powerful that the energy produced makes rising the temperature up to 2000°C.

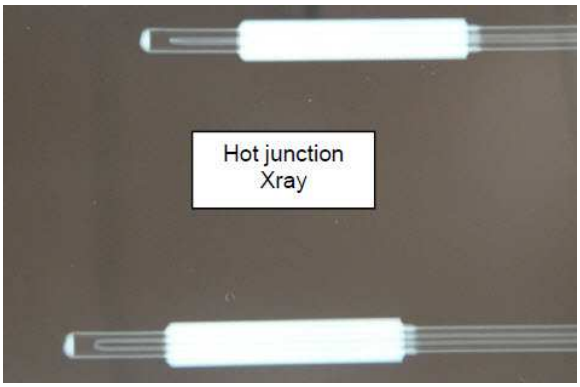
Temperature monitoring is implemented on every aircraft platform, commercial and military. One thermocouple per brake/wheel is the rules. A typical single aisle aircraft is equipped with 4 thermocouple, a twin aisle 8 to 12 thermocouples, double deck 16 thermocouples and military fighter 2.

This is an opportunity for THERMOCOAX to contribute to this program and improve the security of the airframe and passengers every day around the world

echnical Description of Brake Thermocouple

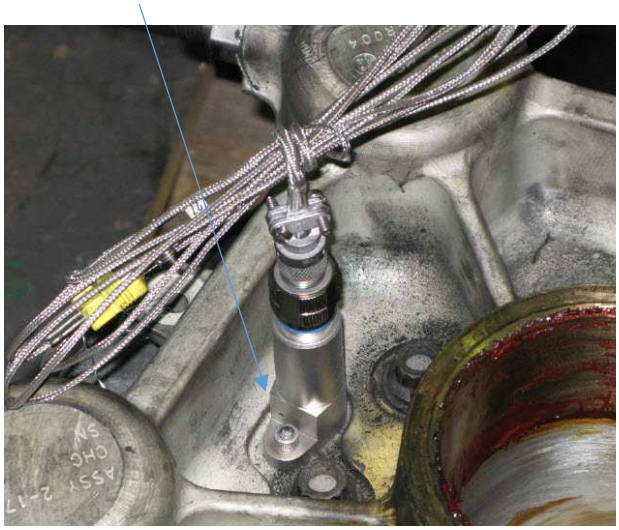
Due to the nominal temperature to measure the thermocouple has the typical following characteristics:

- K type thermocouple
- Single loop, 2 wires

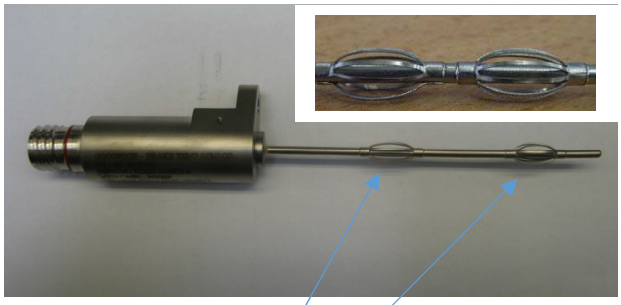


- Class 1 in accordance with IEC and ASME
- Ceramic insulant
- Dielectric under 500V
- Insulation resistance:
  - ✓ 10^{11}Ω.m at room °T
  - ✓ 10^{7} Ω.m at 600°C
- Inconel 600 sheath
- Ø2.5 up to 4,75mm
- Hermetic Connector EN2997
- Hermetic connector D38999
  - ✓ 2 compensated pins

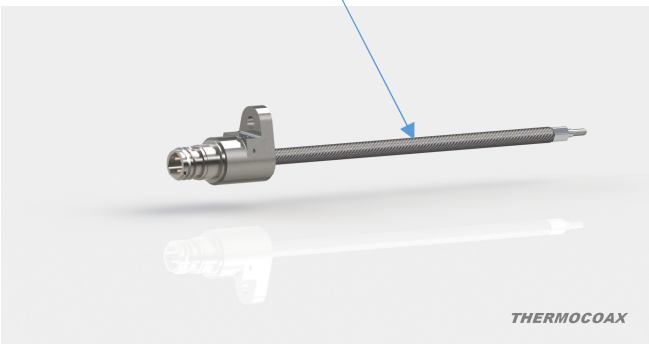
- Flange for fixation on piston housing



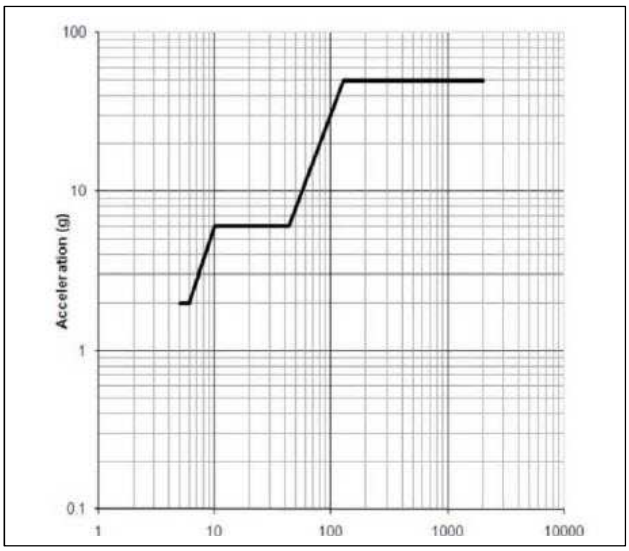
- Oval below or mesh for easy removal from the torque tube when replacement



Easy removal system



- Mass: <100gr
- Environmental and safety of flight tests
- Shock :RTCA/DO160 Sect 7 cat B, D
  - ✓ Cat B
  - ✓ cat D
- Vibration:RTCA/DO160 Sect 8
  - ✓ Cat R curve W
  - ✓ Cat T curve E
  - ✓ 2000 hz, 200G



- HALT Tests

<u>Acceptance Test Criteria of the brake thermocouple:</u>

- ➢ Temperature calibration
- ➢ Helium Leak Test
- ➢ XRay by sampling
- ➢ Time constant
- ➢ Visual and mechanical examination
- ➢ Overvoltage
- ➢ Line Resistance
- ➢ Polarity
- ➢ Insulation Resistance
- ➢ Dielectric 500Vac, 60Hz/60s
- ➢ Mass
- ➢ Final Manufacturing Report

- Packaging and Cleanness:

Hermocoax is focusing on high quality Brake thermocouples product for the best stability and repeatability during functioning.

THERMOCOAX

We understand our customers' challenge to manufacture braking system and make the aeronautic industry reliable and the millions passengers safer.

In HERMOCOAX's we are working hard to participate to this incredible challenging programs

- hermocoax supplied many programs commercial and military platforms.
- Hermocoax designs, develops, qualifies and produces in accordance of the aircraft specifications as:
    - ✓ Airbus 350
    - ✓ Embraer EJet
    - ✓ Mitsubishi Regional Jet
    - ✓ Irkut MC21
    - ✓ Sukhoi Super Jet100
    - ✓ COMAC C919
    - ✓ ….

- Hermocoax is the major player for brake thermocouple and is proud to participate of great aeronautic programs.