

Load cells temperature effect in force applications for automotive industry requirements

González Espinosa David, Pérez Ramírez Edgar

Desarrollo Técnico, Vehículo Completo. Volkswagen de México S. A. de C. V.

E-mail: david2.gonzalez@vw.com.mx

Abstract

In Technical Development Department of Volkswagen de México (VWM) have been make test to some parts of the cars like body, chassis, interiors, safety and electric. Examples of these tests are the life time of covering of the doors, servo-brake, brake pedal, and others. For these tests generally the standard requirement are -35 °C, ambient temperature (23 °C ± 5 °C) and 80 °C with force applying on the functional parts e. g. 8 000 cycles applying 100 N at every temperature on interior covering of the door; but what happened with the load cell at these different temperature that ambient. This article describes two different responses of the two load cell @ -35 °C and +80 °C.

Introduction

When the Test Department make different parts tests in Temperature Chambers, the devices like cylinders pneumatic, electric motor or another kind of actuators are cover with electrical resistances for protect against the environment conditions, but the load cell is not protected, thinking that these transducer is not an element with influence on the test. But really is the principal device for measure and control of the force of the test. Normally the calibrations of the load cell have make at ambient temperature and the temperature variation is applied by the next equation:

$$D_t = D_e [1+K(t-t_e)]$$

Where,

- D_t is the deflection at the temperature t °C;
- D_e is the deflection at the calibration temperature t_e °C;
- K is the temperature coefficient of the instrument, in reciprocal degrees Celsius.

But the use of the equation is limited to the range of 18 °C to 28 °C.

What happened with the load cell on different temperature that ambient?

We have a Temperature Chamber that works from -70 °C to 200 °C ideal for the load cells calibration. The Chamber works with Electrical Resistances for control at high temperatures and liquid Nitrogen for low temperatures; the nitrogen

come to the chamber download at low temperatures in short times generating stability into the chamber at long times at Low and High temperatures.

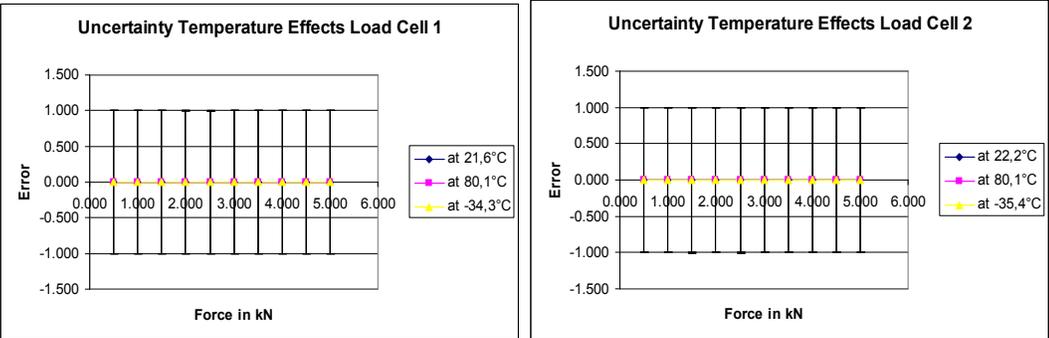


The interior of the chamber permits the facility of montage and electrical accommodation for all the accessories of the load cell

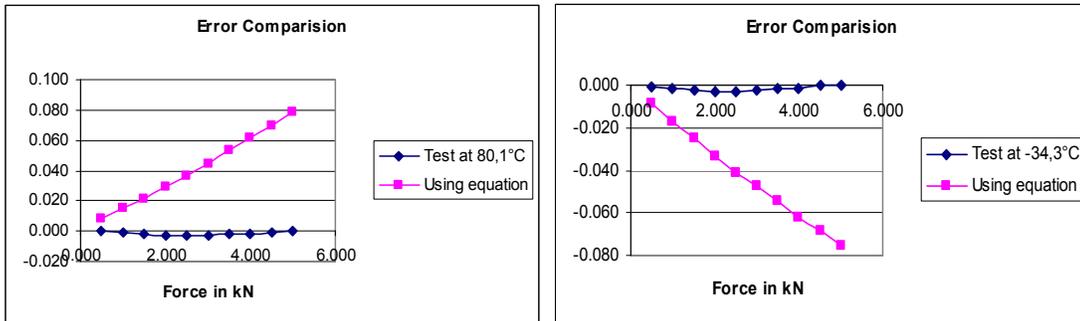


Development of the Test

The development of the test was to verify in the same points of calibration of the load cell at three different temperatures (-35, environment and 80 °C) in 2 load cells HBM Type U2B. Find it unobserved differences in Error and Uncertainty, This is shown in the following graphics.



The results obtained are similar with the results of the calibration at ambient temperature. But if we use the equation for temperature correction notice a great error tendency.



According to the results the equation for correction at different temperatures over and below 10 degrees Celsius (18 at 28) that ambient temperature have not confidence.

In this case, the tendency positive in the first two graphs is produced by internal temperature compensation resistance that has into the load cell, and confirm the specifications of the manufacturer, these specifications have a range of operation between -10 °C to 70 °C.

The result obtained shown and confirm a very good temperature compensation over the specification in manufacturer data sheet.

Conclusions

This results of the assurance that the test parts are submit under temperature conditions, the results of the test have a constant force applied, and the load cell specifications have a good performance at high and low temperatures, the equation for compensation temperature not have validation for these kind of equipments.

We are working with other manufacturers load cells to review that the temperature compensation will work at the same way

References

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