

# Tracking down temperature errors

## LTC technology of LABOM



Manufacturing processes in the food and beverage industry often involve fluctuating temperatures - a potential source of error and a challenge for measuring devices. LABOM accepted this challenge and found a way to almost completely avoid temperature errors by the use of LTC technology.

In five factories in China, Red Bull produces around 4.5 million cans of its iconic energy drink per year. To cope with this enormous volume, not only must production run smoothly, the process must also be arranged as efficiently as possible - that is why the company is constantly on the lookout for innovative technologies, to remedy any weak spots in the process flow.

**Pressure transmitter PASCAL CV**  
for diaphragm seal operation, Type series CV3110

### Weak spot: Level measurement

In the past one of these weak spots was measuring the filling level of tanks that are used to mix the liquid ingredients. As often the case in the food and beverage industry, Red Bull utilizes diaphragm seals for filling level measurement to separate the measuring device from the process media and so to satisfy the hygienic requirements of the food and beverage industry. The diaphragm seal transmits the pressure acting on an isolating fluid within the diaphragm to the connected measuring device. The filling level derives from the pressure measured. Regular diaphragm seals intermittently suffer an inherent limitation: fluctuations of temperature in the process leads to inaccuracies in the measured value. Known as a temperature error, this phenomenon can lead to considerable delays in the production process.

One stage of the production process for Red Bull requires heating the liquid mix in a tank from 20 °C to 92 °C. As soon as this temperature is reached, the tank is emptied and refilled with the next batch - again at 20 °C. A temperature error arises at precisely this point: when the tank is emptied and refilled with a colder mix, the isolating fluid within the diaphragm seal - an oil - contracts due to the lower temperature. As a consequence the pressure that is applied to the diaphragm is not correctly transmitted. This means the tank is shown as empty, when it in fact it is already being filled. To avoid such dynamic temperature errors, in the past Red Bull would partly refill the tank, then halt production for a while. Only after reduction of the temperature difference the tank could be filled completely and production continued - an awkward and time-consuming process, for which a solution was urgently needed.

# High-precision diaphragm seal technology installed in Red Bull production

## The crux of the matter: the diaphragm

LABOM were requested to find a solution to this in 2012. The manufacturer of measuring devices based in Hude, Germany has a long-standing reputation especially for individual customer-oriented products. The first thing always necessary at the start of a new venture is to understand the plant where the measuring device will be installed. “Only when we have understood the customer’s processes precisely, we can find an optimal solution,” says Jianren Cong, Sales Manager East Asia at LABOM. “That is why we first got to grips with production at Red Bull intensively, to find the best possible way to help.”



*Fig. 1: Due to their small design, the combination of device and diaphragm seal has sufficient space underneath the tanks.*

There are various ways to reduce the temperature error – it was also necessary to discover which of these worked best in each particular case. In addition to special programming a promising solution appeared to be a diaphragm, so flexible it reports the smallest changes. That would mean contraction or expansion of the isolating fluid caused by temperature fluctuations would no longer result in false readings, because the diaphragm would compensate for changes in the fluid. In turn, pressure would appear correctly on the measuring device. Conventional approaches to achieve this effect are either a much larger or much thinner diaphragm. However, neither of these were considered feasible by LABOM and Red Bull: “There was no space in the production plant for a larger diaphragm and a thinner diaphragm is far too susceptible to cracking or damage – another way needed to be found,” explains Cong.

# High-precision diaphragm seal technology installed in Red Bull production

## LTC technology at a glance

The solution: Red Bull decided on the patented LTC (Low Temperature Coefficient) technology of LABOM. In this case the diaphragm of the diaphragm seal is shaped with a special profile and a slight curvature. This curvature gives the diaphragm two stable positions that it deflects between - one upper and the other lower. In a special, patented manufacturing process the diaphragm seal is filled with pressure transmission fluid so that it aligns exactly between the two stable positions. The result: in this position the diaphragm allows itself to deflect virtually powerless and thus compensates for contraction and expansion of the pressure transmission fluid.

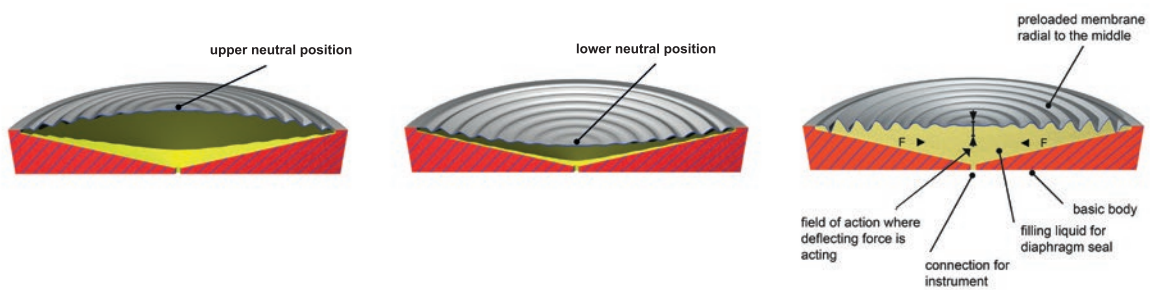


Fig. 2: The first two illustrations show the upper and lower stable positions, the third indicates the operational state of the diaphragm seal: The diaphragm is located exactly between the two stable positions and the reactively weak contact area permits reactionless deflection of the diaphragm up and down.

The result exceeded all expectations: it was possible to almost completely eliminate the temperature error at Red Bull; now only a minimal inaccuracy at the start of filling process is observed. In contrast to before, this minimal difference disappears rapidly and correct and reliable readings are achieved long before the tank reaches its required level. It is no longer necessary to halt production until temperature stability is reached, which has saved a massive amount of time - and led to an overall more effective, error-free process.

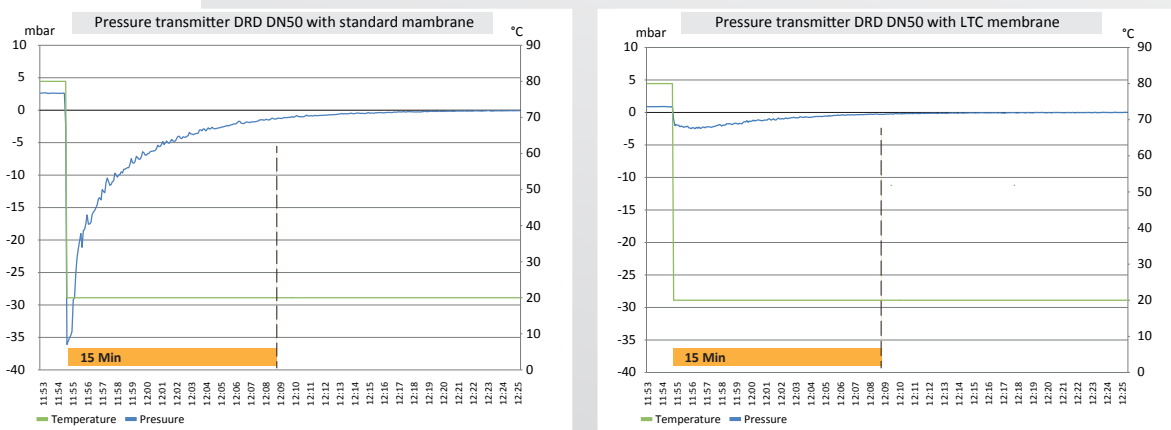


Fig. 3: Left the (erroneous) deviation of a diaphragm without LTC while the hot liquid is discharged and the cold liquid is introduced. Right the same process with an LTC diaphragm: the temperature error has almost completely disappeared, the filling level can reliably read at any time.

## High-precision diaphragm seal technology installed in Red Bull production

“The LTC diaphragm so effectively compensates for the temperature error, it can be made much thicker than normal - this increases the safety, without an impact on the accuracy of the reading,” explains Cong. Of course, with LTC diaphragms the principle still holds: the larger the diaphragm the less temperature error there is. At Red Bull pressure transmitters are installed with a diameter of 50 mm - these permit practically error-free measurement.

“At present over 100 of our pressure transmitters with LTC technology are in use in three Red Bull factories in China,” says Cong. “The devices are so robust that they will almost never need replacement - everyone involved is most satisfied with the success of our cooperation.” Cong also sees much more potential in Germany for this LTC technology. As they practically eliminate temperature errors, LTC diaphragm seals by LABOM represent a real alternative to expensive temperature-tolerant methods of filling level measurement, such as by measurement by weight, for example.