

# **WHITE PAPER**

## **Problems with condensation and moisture in industrial process environment**

**How to avoid moisture problems in SIGRIST photometers?**

## 1. Preface

Moisture on optical and electronic parts inside an optical instrument is causing wrong measurements and instrument defects. This fact is therefore also a main concern in breweries worldwide, as in the brewing process there are various liquids involved and in many places there is a big temperature difference between medium (beer) and the environment (room temperature).

The design of a SIGRIST Photometer is as such, that in spite of those difficult conditions the correct handling and an appropriate maintenance prevents any moisture problems. What should be the concern?

## 2. Where does the moisture come from?

### 2.1. From a liquid that enters in the instrument.

The optic head of the latest generation of SIGRIST instruments (TurBiScat, TurbiGuard and PhaseGuard) has no seals.

Hence the media from the line cannot reach the inside of the instrument anymore. But liquids outside the line, around the instrument can enter inside if:

- the instrument is partially disassembled
- the instrument is opened
- some parts of the housing (end cap or cable gland) are loose
- a seal is missing, defective or incorrectly positioned (refer to corresponding MODEL/SEAL drawing).
- the desiccant bag is absent or has been removed.

Those points can be checked and prevented easily. With the older instrument generation (DualScat & ColorPlus), some leakage on the product line could occur.

With correct preventive maintenance, mainly the replacement of the measuring cell window and optic head seals, any leaking can be avoided.

### 2.2. From the humidity in the environmental air.

The housing will not be 100% air tight. However the humidity level inside the instrument will be reduced with the desiccant bag absorbing the moisture.

But after a certain time (see instruction manual) the desiccant bag will be saturated and the humidity level will start to increase and condensation will occur.

## 3. Under which conditions does condensation appear?

Air can be loaded with a certain amount of water in gas form. The maximum concentration of water in gas form in the air depends on the pressure and the temperature.

In our case the pressure is roughly atmospheric, but the temperature of the air and the different components of the instrument will be more or less different.

The maximum possible concentration of water in form of gas in the air increases with the increase of the air temperature.

When the temperature of the air decreases, a limit will be reached where the water cannot stay in gas form, and falls out in form of droplets. This limit is called the dew point.

Condensation will appear inside the instrument on the parts that have a temperature below the dew point of the air. When the desiccant is active the dew point is below the temperature of the coldest part of the instrument. But after a certain time the desiccant bag will be saturated, the dew point increases, and condensation will begin on the coldest parts of the instrument, which is the optic head cooled down by the liquid in the line (e.g. the beer).

## 4. What happens in presence of moisture inside the instrument?

The first, main and most common consequence of moisture inside the instrument is wrong, too high or instable readings.

## 5. How can the moisture problems be avoided?

As mentioned above, it can be prevented by a correct handling and an appropriate maintenance.

Basically, the instrument should always stay closed and completely assembled.

If an instrument must be opened for any reason, the desiccant should be replaced. If the yearly replacement of the desiccant bag occurs under appropriate conditions, meaning when the instrument is at ambient temperature or warmer (e.g. during a CIP/SIP cycle), the instrument will work without any problem for years.

## 6. What to do if the instrument has become wet inside?

If for any reason, the instrument is wet inside, visible moisture anywhere inside or the moisture measurement, if available, higher than 30%, it must be dried out before a new and active desiccant bag is inserted.

To dry out the inside of the instrument, first make sure that it's warm, else condensation will permanently build up on the cold parts.

Then wipe away the visible humidity. If the instrument is mounted on the production line, leave it opened during a CIP/SIP cycle. **However this is recommended only if it is 100% sure that no water is splashed around the instrument during this time!**

Else, remove the instrument from the line and place it opened in an oven at 40°C for 1 hour. Before the instrument is cooled down, insert a new and active desiccant bag and close it tightly.

After a successful replacement of the desiccant bag, the moisture value, if available, should drop below **1%**. If not, find out why and correct the situation.

## 7. Why does the moisture problem persist?

- Most of the time, the reason for a persisting high moisture level is a desiccant bag that is already half or completely saturated. The status indicator on the bag must be completely blue. The correct handling of the desiccant bags is very important. As soon as it is in contact with air it starts to lose efficiency. It must always be placed in the instrument immediately after it has been unpacked. The instrument must of course be closed immediately afterwards. The drying capacity of a desiccant bag is limited. If there is too much humidity inside the photometer, the desiccant bag will be saturated, before the inside is completely dry (see: **6. What to do if the instrument has become wet inside?**).
- The photometer is leaking (see: **2. Where does the moisture come from?**)