

Instruction manual

Oil and leakage detection for CO₂/Ammonia cascade systems

HBAC - For oil level control as well as detection of leakage of CO₂ into NH₃



Introduction

This switch can be used both to detect oil and a leakage of CO₂ when installed in a low location in liquid ammonia. Anyone who designs and operates CO₂/NH₃ Cascade systems should be aware of the fatal consequences a leaking heat exchanger may have. If CO₂ leaks into ammonia, ammonium carbamate will be formed.

The major benefit of the sensor is to detect small leaks before they get critical. Large and sudden leaks can of course be detected, but that will stop the system anyhow.

If an alarm occurs the first thing to do is start monitoring. If you have a leak the measurement will continue to increase. An increasing water or dirt content in the ammonia will increase the measurement slowly, but this will be very slow.

Ammonia carbamate is a salt which crystalizes as a chemical reaction between Ammonia and CO₂. The salt is corrosive, becomes solid and may cause system breakdown and possible damage to the entire system if not stopped.

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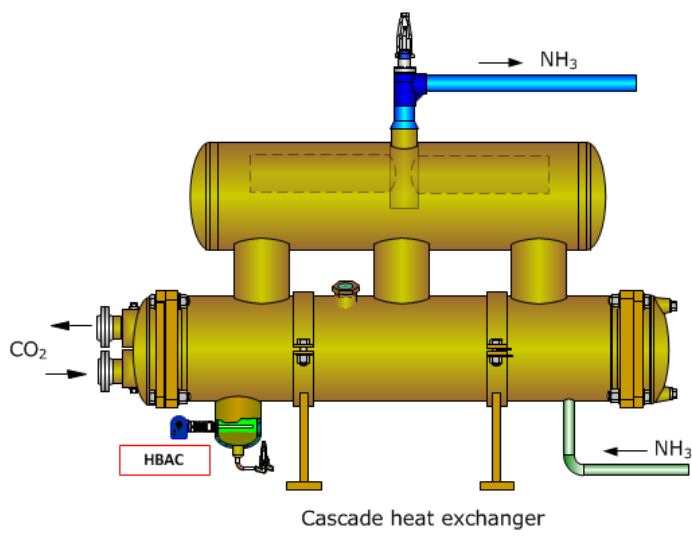
Installation instructions

Ammonia carbamate has a higher density than liquid ammonia which means it will sink to the bottom of the vessel like oil. The sensor must be positioned as low as possible to get fast detection. The flow of liquid might move the salt around.

The detection will be delayed if covered by oil, but it can detect oil via the analog output to avoid this happening.

The following applies during installation:

- 1)The sensor must be installed in a threaded sleeve/pipe stub, this should be welded in a Horizontal position.
- 2)The installation length of the sensor must be considered since there must be at least 20 mm between the sensor's mechanical part and other fixed or moving parts.
- 3) The sensor must be placed in the NH3 section in a position where the leakage



will appear. preferably as close to the bottom of the cascade heat exchanger, as the salty crystal will sink to the bottom.

4) If the sensor should be used for oil level control it must be installed in the reservoir for oil collection at the bottom of the vessel

Power connection

HBAC can be delivered with a NO or NC output. The setting can be changed in the HB tool which can be downloaded from the HB products webpage

The sensor can provide two types of alarm depending on the device connected to the sensor.



It can provide a digital alarm on pin 3, when a leak occurs and at the same time the mA signal exceeds 16mA. Both or one of the two alarm outputs can be used.

When the sensor is used for both oil detection and CO₂ leakage it must be installed at the bottom of a shell and plate or shell and tube vessel where the oil is collected.

The analog output on pin4 is used when oil is detected

- When the sensor is in oil it will deliver less than 8 mA
- When the sensor is in liquid ammonia it will deliver around 15 mA
- When there is leakage, it will deliver more than 16 mA typically around 18 mA

When there is leakage there will alarm output on pin3 as well.

When you get an alarm

An alarm means you should be aware and start monitoring the system. The mA signal from the sensor on pin4 must be observed. If the increase is higher than 0,2 mA per year you probably have a leakage. Increasing dirt and water content will slowly increase the output.

Testing of the sensor

If you would like to test the sensor it can be done in a grounded metal container filled with salty water (3% NaCl) that should trigger the alarm. An extra mechanical part can be used for the testing.

The table below shows measurements done in a grounded 50 mm steel pipe

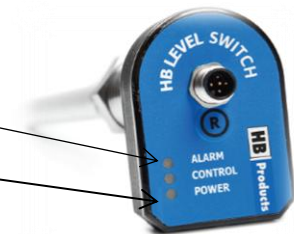
Liquid	pF measurement	% reading	mA output
None (dry)	22	2,6	4,4
Oil (mineral)	33,8	18	6,9
Ammonia	68	64	14,2
Water	77	76	16,2
Salty water 3%	82	83	17,2

LED indication

Irrespective of the output function NO/NC, Alarm LED is activated at a leakage.

Alarm LED is activated when sensor detects leakage

Power LED flash green when the power is on



Sensor repair

The sensor electronics are completely sealed and cannot be repaired.

In case of faults with the sensor, it will typically only be necessary to replace the electronics.

Complaint cases are handled by the HB Products dealers/distributors.

Their complaints procedures must be followed before returning the sensor

For any inquiries or further information, please don't hesitate to contact us at support@hbproducts.dk.

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