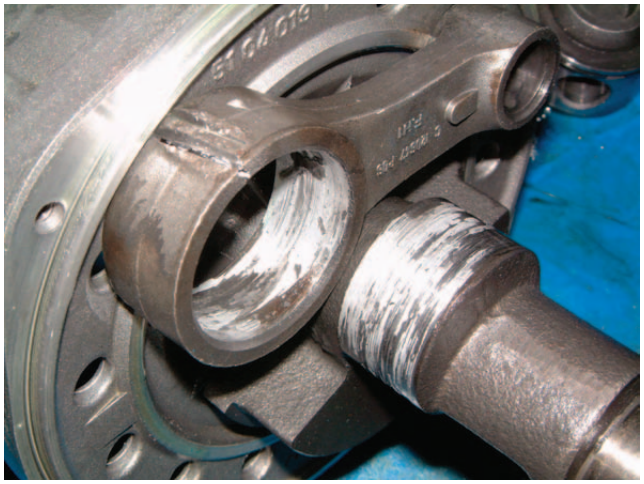
Think Differently: Prevent Ammonia Compressor Failures

Ammonia Compressors are critical machines in the Food and Beverage Industry where the chilling or freezing of products is a requirement

Introduction

Ammonia compressors are widely used in the food and beverage industries to chill or freeze products. Failures are normally catastrophic and very expensive and time consuming to repair. The financial impact is not only restricted to physical replacement or repair costs but also loss of product and sales.

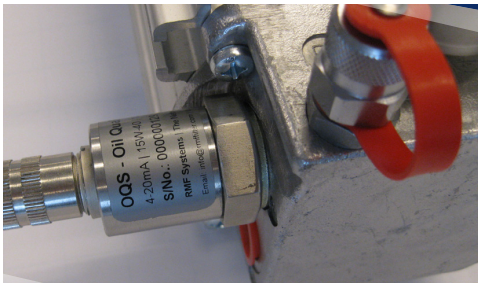


Screw and Piston compressors are the most widely used compressors. Analysing the failures of these compressors a few root causes can be identified. The root causes for both the screw type and piston type compressors are the same. These include Refrigerant flood back, Flooded start and Liquid Slugging. These are all related to the leaking of Ammonia back into the compressor and settling in the sump together with the lubrication oil. With the Ammonia density higher than the oil density the Ammonia settles at the bottom of the sump where it is picked up first by the oil pick-up line and circulated throughout the compressor. Ammonia is not a lubricant and as a result causes major damage to bearings and moving components. Ammonia also absorbs water which causes further damage.

Other root causes are overheating of the compressor and subsequent damage to the lubrication oil (carbonising), lack of lubrication oil due to oil being trapped in the system and not returning to the sump or due to leaks or insufficient top-up.

Other problems are related to electrical issues like failing to change electrical contacts after compressor failures, no electrical overload fitted as well as metallic debris and dirt in the system.

All of the above have one thing in common and that is the **lubrication oil**. Thus if one is able to find a means to monitor the lubrication oil quality in real-time one is able to monitor the operating condition of the compressor.

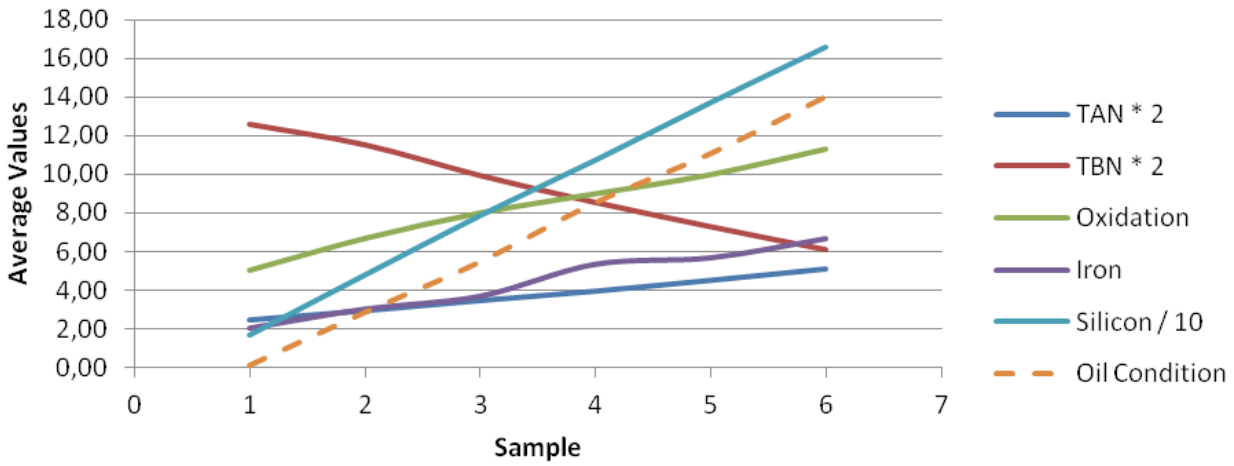


Oil Quality Sensor and installation

An Oil Quality Sensor is able to monitor the oil quality in real time. The oil quality sensor uses the base oil used in the compressor as reference and determines the oil quality index. The OQS works in a similar way to dielectric sensors but measures both the capacitance and the conductance (a combined measure known as permittivity) of the oil The combined data provides a reading that is much more accurate to changes in the quality of the oil. The permittivity is influenced by the following oil parameters which includes the viscosity, TAN, TBN, wear particles (Fe, Cu, etc.), contamination (Si, Moisture, NH3 etc.) and oxidation. Thus any change in any of these parameters will influence the OQS output reading. The sensitivity of the sensor is 16ppm. The OQS takes oil temperature into consideration when calculating the oil quality.

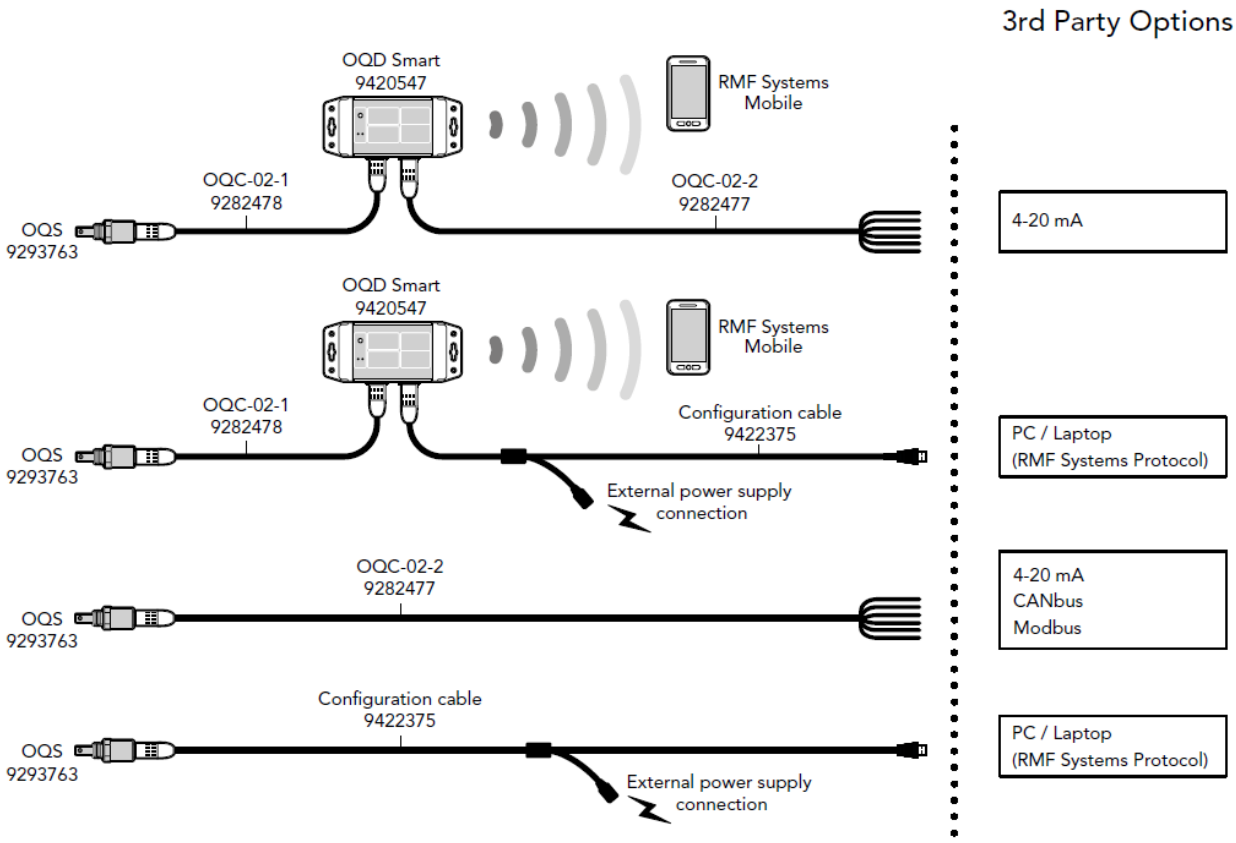
The oil quality is expressed as an oil quality index number between 0 and 21. This is based on the loss factor, in other words how much of its original lubrication quality has the oil lost. Significant loss is above 25%, or 13 on the OQS index scale.

Below is a graph depicting the change in OQS index influenced by the change in oil parameters as determined by oil analysis samples. The sample interval in the case below is about 100 operating hours



Alarms can be set for a specific OQS index level (normally 13) as well as for a rate of change in the OQS value. Thus one is able to immediately shut down the compressor should any parameter cause a rapid change in oil condition even before it reaches the set alarm level.

There are various output options available as per diagram below.



The OQS can be connected to a programmable local display unit or linked directly to the plant SCADA or compressor control system. The OQS provides 2 values, the Oil Quality Index number and the Oil temperature.

The Oil Quality Sensor is a cost effective sensor that is able to monitor the compressor operating condition accurately in real-time. It is able to protect the compressor from catastrophic failure caused by any of the well known problems by providing accurate and immediate indication of any change in lubrication oil caused by any contamination or wear.

The OQS saves money by providing an indication when oil need to be changed rather than on a fixed time basis (extending oil change intervals based on oil quality)

Thus in summary:

The Oil Quality Sensor Provides

Real time, 24x7x365, accurate trending of the oil Quality

It shows the rate of change in oil quality over time

It responds to Dynamic Application like Stop/Start, Speed and Load

It responds to Dynamic Process changes like top-ups, total loss, additives and oil changes

The OQS is a simple, yet powerful and cost effective sensor that provides peace of mind, while saving money.