Compressed Air Contaminants, Purity Classes, & Methods

ISO 8573 on compressed air is comprised of nine documents that describe compressed air contaminants and purity classes plus the sampling and analytical techniques to be used. The standard is widely used in the instrument air, medical device, food, and pharmaceutical industries. A drawback of ISO 8573 is the complexity of sampling and the associated expense of re-plumbing the compressed air system to accommodate air quality testing. Trace Analytics has developed an approach that allows determination of compliance in a cost-effective and straightforward manner that does not compromise the quality of the results.

The performance of a compressed air system may be evaluated in terms of compressor output at the compressor itself, in the piping downstream of the compressor, and at the various points of use. Knowledge of the compressor output is important in terms of selecting downstream filtration and assessing gross contamination of the piping system. Trace Analytics provides the capability to extract a sample from the main air stream; however, experience has shown that users collect far more samples at points of use.

Choosing Purity Classes for Your Application

We recommend that you purchase the set of ISO 810 documents (available at www.iso.org or webstore.ansi.org for purchase and download) in order to fully understand the implications of complying with its requirements. Before adopting any classes for limits of contamination in your system, we recommend that you consider the requirements for your product and perform a baseline study. Adopting classes that are too stringent for your application is not only more expensive from the point of view of compressed air production, but forces you to meet those specifications even though they may far exceed your application's requirements. Most users find that a hybrid standard in which portions of ISO 8573 are adopted is optimal for their application. Trace can customize an air specification based on your SOP requirements.

Sampling - Full Flow versus Partial Flow

Partial flow sampling is used for aerosols (both solid and liquid) when you wish to know the concentration within a pipe and the sampling equipment does not have the capacity for the entire output of the compressor system. This requires insertion of a probe into the pipe and a correlation of linear flow rates between the system and sampling probe (this is termed isokinetic sampling). It is somewhat complex and time consuming and is generally used during an initial evaluation of the compressor system. ***NOTE***: Partial flow sampling is inappropriate in systems where steady-state flow, temperature, and pressure cannot be maintained.

Full flow sampling may be used at any point in a compressed air system and requires a sampling device that has the capacity to handle the full flow at that point in the system. This accounts for the vast majority of samples, as most users wish to know the air purity at the point of use where air may come in direct or indirect contact with the product.

Sampling with Trace Analytics' AirCheck Kit K810™

The AirCheck Kit Model K810 series have been designed to perform either full flow sampling for point-of-use or partial flow sampling.

The full flow sampling kit consists of a stainless steel adapter to connect to the point being sampled, a flow-controlled outlet for oil vapor, water vapor, and specific gases, and a filter stack for collection of solid particles and oil aerosol.

The partial flow sampling kit adds a sampling probe and downstream filter flow controller. Trace Analytics' sampling probe is curved (after EPA sampling specifications) where the one recommended by ISO 8573 is straight. Testing in our laboratory on 2 µm oil aerosol showed the two probes to be comparable. Trace Analytics' partial sampling probe requires a 1/4" NPT thread in the pipe and the pipe must be > 2 inches in diameter. The flow in the pipe must be known so that the filter sampling rate can be adjusted to provide isokinetic sampling.

The AirCheck Kit K810 models can be readily adapted to collect any portion or all of the contaminants, and the microbial sampler KPSII collects microbiological contaminants.

Solid Particles are collected for microscopic examination on a filter as per ISO 8573. Trace Analytics' method is not applicable for particle range 0.1 – 0.5 micron, which requires a direct-reading device such as a laser particle counter. Trace Analytics' method is acceptable for ranges 0.5 – 1 and 1 – 5 of class 1 and 2 and classes 3-7 and X. For classes 6, 7 and X, which require a mass determination, the filter is extracted to remove oil and the concentration of particles by both size and mass are determined.

Water is comprised of vapor and liquid.

Water vapor is determined on-site with the use of a color-indicating detector tube as allowed by ISO 8573.

Oil is comprised of liquid, aerosol, and vapor components. Per ISO 8573, oil is defined as a mixture of hydrocarbons composed of six or more carbons.

Oil liquid as described in ISO 8573-2 must be measured on-site from a set of high efficiency coalescing filters. ISO sampling Method A may be used at any point in a compressed air system where heavy contamination levels of oil are believed to exist and for a contamination range from 1mg/m3 to 40 mg/m3. The testing time (50-200 hours) makes it unreasonable when numerous samples are required. Trace Analytics has developed an alternative sampling method that requires a sample time between 14 and 100 minutes depending on obtainable flow rate. Two high efficiency coalescing filters are used to collect liquid oil. The filters are returned to Trace's lab extraction and gravimetric determination of the oil aerosol and oil liquid fractions of the sample. The sampling method is based on ISO 8573-2 Method A.

Oil aerosol is collected on a set of 3 filters in series as per ISO 8573. The inlet filter is also used for particle counting, thus saving time in sampling. In the laboratory, the pre-weighed filter is extracted and the difference between the weight after extraction and that before sampling is used to determine oil aerosol. ISO 8573 calls for analysis of the extract with infrared spectrometry. Trace's alteration to the method drastically reduces the cost of analysis for oil aerosol. The Trace Analytics method has been verified to achieve >99.5% recovery for oil aerosol fortified filters. The sampling method is based on ISO 8573-2 Method B1.

Oil vapor is collected simultaneously with oil aerosol on a commercially available charcoal tube, rather than the special stainless steel tube called for in ISO 8573. Analysis is performed using gas chromatography-mass spectrometry as required by ISO 8573. Oil vapor is required for Classes 1 and 2 only.

Gases (carbon monoxide, carbon dioxide, sulfur dioxide, nitrogen dioxide, nitric oxide, and C1-C5 hydrocarbons) have no classes set by ISO 8573. They are collected in a gas sampling bag from which gases are determined by using color-indicating detector tubes on-site. As an alternative, Trace Analytics can perform analyses using gas chromatography from a glass vial for carbon monoxide, carbon dioxide, and C1-C5 hydrocarbons. Sulfur dioxide and nitrogen oxides can be determined on-site with the use of color-indicating detector tubes as allowed by ISO 8573.

Microbiological contaminants are required to be collected using a type of impaction tester that employs agar plate with culturable media. The samples are incubated and the surface visually examined to confirm the presence of viable, colony-forming microorganisms. No limits have been established by ISO 8573 to date. Sterilization of sampling equipment shall be performed with a suitable cleansing agent immediately before use. The Microbial Sampler KPSII will allow you to perform this type of analysis.

In Conclusion

Trace Analytics' AirCheck Kit K810 and Microbial Sampler KPSII provide a cost-effective and convenient manner to comply with ISO 8573 purity classes. The few modifications made to the sampling and analytical techniques provide equivalent results at a fraction of the cost. In addition, you gain the expertise and credibility of a laboratory that has been accredited since 1991 and currently performs over 25,000 compressed air analyses each year.

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