



GAS SAMPLING APPLICATIONS IN THE CLEANROOM

Lighthouse Worldwide Solutions



Overview

Gas sampling is an important part of the contamination control plan for cleanrooms that use compressed gas as it is a potential source of contamination. This can be done using a variety of tools according to ISO 8573, the international guidance on gas sampling for cleanrooms.

Gas Sampling In Cleanrooms

In cleanrooms classified ISO 5 or cleaner, compressed gasses pose a serious risk of particle contamination. Thus, monitoring compressed gasses for contamination is a critical portion of the contamination control plan.


In recent years, we have seen an increase in regulations centered around comprehensive contamination control plans. For example, the GMP Annex 1 2022 update revolves around building your cleanroom according to a risk based contamination control plan that takes into account higher testing standards and levels. To stay in compliance with these ever stringent and increasing regulations, it is important to consider every factor of your contamination control plan, including monitoring compressed gases. These are regulated by ISO 8573.

ISO 8573

ISO 8573 is considered the international standard for testing compressed gas, oil, and water in cleanroom applications. The document is comprised of 9 parts, with the most recent update being put forward in 2019.

The document outlines acceptable testing methods and limits. ISO 8573:1-2010 is often the section referred to, as it dictates how to represent contamination permitted in each cubic meter of air per the ISO classification of the room. When describing the ISO 8573 class of cleanroom, you will list three numbers representing the particle, water, and oil measurements.

For example, an ISO 8573-1:2010 Class 1.2.1 cleanroom meets class 1 particulate measurements, class 2 water measurements, and class 1 oil measurements. The particle measurement refers to how many particles can be found in one cubic meter of compressed air or gas. The water measurement refers to the pressure dewpoint. Lastly, the oil measurement refers to oil (liquid, aerosol, or vapor) allowed in each cubic meter of air.

 ISO 8573-1:2010 CLASS	Solid Particulate			Mass Concentration mg/m ³	Water		Oil
	Maximum number of particles per m ³				Vapor Pressure Dewpoint	Liquid g/m ³	Total Oil (aerosol, liquid, and vapor)
	0.1 - 0.5µm	0.5 - 1µm	1 - 5µm				mg/m ³
ISO 0	As specified by the equipment, user, or supplier, and more stringent than Class 1						
ISO 1	≤ 20,000	≤ 400	≤ 10	-	≤ -70°C	-	0.01
ISO 2	≤ 400,000	≤ 6,000	≤ 100	-	≤ -40°C	-	0.1
ISO 3	-	≤ 90,000	≤ 1,000	-	≤ -20°C	-	1
ISO 4	-	-	≤ 10,000	-	≤ +3°C	-	5
ISO 5	-	-	≤ 100,000	-	≤ +7°C	-	-
ISO 6	-	-	-	≤ 5	≤ +10°C	-	-
ISO 7	-	-	-	5 - 10	-	≤ 0.5	-
ISO 8	-	-	-	-	-	0.5 - 5	-
ISO 9	-	-	-	-	-	5 - 10	-
ISO X	-	-	-	> 10	-	> 10	> 10

ISO 8573-1:2010 also provides the limits for contamination in cleanrooms.

Gas Sampling Tools

For the sake of this white paper, we'll be referring to ISO 8573 as the guidelines for testing compressed gases, such as oxygen, hydrogen, methane, nitrous oxide, etc. According to ISO 8573, you can use either a particle counter or active air sampler to measure contamination in compressed gases. This includes for sensitive cleanrooms, such as ISO 5 and cleaner.

ISO 8573-4:2019 provides a method for sampling compressed air, as well as a guide for choosing suitable measuring equipment to determine its particle size and concentration by number. It also establishes a minimum sampling volume of 1000L (1m³) and dictates the use of optical particle counters for testing sizes from ≥0.1 to ≤10µm.

Particle Counters

According to ISO 8573, particle counters are an acceptable testing method for compressed gasses with a few guidelines. The particle counter must maintain isokinetic sampling. This is a sampling technique that prevents skewed particle concentration measurements as they enter the sampling nozzles. Particles can often be skewed due to inertia but using a high-pressure diffuser to change the pressure allows the gas stream to maintain the same velocity throughout the entire testing process. This provides a more accurate measurement of concentration.

High Pressure Diffuser

To maintain isokinetic sampling while using a particle counter, ISO 8573 requires you use a high-pressure diffuser (HPD). There are two primary types of HPDs: Vented Return HPDs and Ported Exhaust HPDs.

Which HPD you choose depends on the type of compressed gas you are using. Vented Return HPDs vents the gas back into the environment, whereas Ported Exhaust HPDs releases the air outside of the environment. This is useful for unsafe gasses, such as flammable ones if open flames are present in the environment.

Active Air Sampler

If you use the right Active Air Sampler, it can eliminate the need for attachments like an HDP. For example, the Lighthouse's ActiveCount100H makes gas sampling a breeze.

You'll need to start with a new Petri dish, free of agar. Once the fan is blowing, you'll attach the gas sampler snugly in the sampling head. Next, you'll simply adjust the flow rate to optimize it for gas sampling.

If you need to test for viable contamination, you will need to use an active air sampler. Particle counters are able to tell you the number and size of particles, but not the type. Viable particles are able to grow and multiple, so it can be important in certain application to know if you are dealing with viable particles.

Gas Sampling Applications

Any industry that uses compressed gases will need to comply with ISO 8573 standards for gas particle concentration monitoring. We often see these rules apply in the pharmaceutical, food and beverage, and electronics industries.

Technology Industry Applications

In the technology industry, there is a requirement to sample smaller particle sizes down to 0.1 μm in compressed gases. The most advanced set-up on the market down to 0.1 μm in compressed gases. The most advanced set-up on the market right now is our High-Pressure Controller in combination with Solair 1100 LD (0.1 - 5.0 μm) particle counter.

You can connect the High-Pressure Controller to gas lines with a pressure between 2-10 bar. This high purity gas sampling set-up makes it possible to sample 0.1 μm particles at ISO-1 (8573-1).

Many professionals in the electronics industry do have their own particle control limit which is set at 10 particles 0.1 μm p/m³ (ISO 8573 Class 0). The only way to sample these low particle levels is with this set-up, due to the extreme low zero count level of this whole test set-up.

Viable Contamination Application

An easy way to sample the microbiological contamination in compressed gas is to use Lighthouse ActiveCount100 in conjunction with our gas sampler adapter. You can connect this device to gas lines with 2-10 bar pressure.

With the Gas sampling option implemented in the user interface of the ActiveCount100 it is indeed a plug and play set-up.

In Conclusion

ISO 8573 offers valuable guidelines and regulations for testing compressed gasses, a source of viable and nonviable particle contamination in cleanrooms. This is a critical portion of your contamination control plan and should not be overlooked.

Either particle counters or active air samplers can be used for gas sampling, depending on your needs. Lighthouse Worldwide Solution offers comprehensive and industry standard setting options for both possibilities, designed to meet your needs, abide by regulations, and keep your cleanroom clean.

Visit our Knowledge Center for more information on Cleanroom Technology and its applications.

<https://www.golighthouse.com/en/knowledge-center>