

Food Contact Compressed Air Point-of-Use Filtration

Market Application Publication
Quick Study Guide for Food Market Filters



Background

Preventative food safety is at the forefront of awareness not only for food manufacturing facilities, but also for food retailers. This has led to the development and implementation of private industry food safety schemes that augment government regulations to manage this risk. The umbrella these food safety schemes fall under is the Global Food Safety Initiative - GFSI.

What is GFSI?

The Global Food Safety Initiative (GFSI) was established to increase consumer trust by improving food safety through corporate responsibility and safer food supply chains. GFSI, founded in 2000, is a nongovernment, non-profit foundation managed by The Consumer Goods Forum. SQF, BRC, FSSC2000 are all GFSI endorsed Food Safety Schemes.

SQF, BRC, FSSC 2200

SQF, BRC, and FSSC are all voluntary food safety schemes that fall under the umbrella of the Global Food Safety Initiative (GFSI). The focus on these GFSI schemes is driven primarily by major retailers requiring the producers to be certified under one of the endorsed schemes. Simply, if the food company does not get the plant certified the retailers will not purchase from them.

Government Regulating Agencies

The USDA regulates raw meat and poultry processing. The FDA regulates all other foods that don't fall under USDA.

Mandated Food Safety System

Food producers need to comply with all US Government regulations and mandates for the governing agency under which their products fall.

Voluntary Food Safety System

SQF, BRC, and FSSC 22000 are all non government, voluntary food safety schemes that are required by most food retailers.

Obtaining GFSI Certification

To obtain SQF, BRC, or FSSC22000 plants will contract with a consultant to prepare the plant for the certification audit. Then the food plant will employ a third-party certifying body to audit the plant on behalf of the certification agency (SQF, BRC, FSSC2200). Certifications are awarded by each individual plant - not by company.

Good Manufacturing Practices - GMPs

Good manufacturing practices are the foundation of safe food manufacturing. GMPs are the basic operational and

environmental conditions required to produce safe foods. They ensure that ingredients, products and packaging materials are handled safely and that food products are processed in a suitable environment. Every food plant is different, however, there are some basic food safety principles that need to be applied to mitigate risk of food contamination.

Anything contacting the food - or food contact surfaces - can be a risk. Where compressed air contacts food can be a risk.

Risks Associated with Compressed Air in a Food Plant

Compressed air is not as clean as it appears to be. Untreated compressed air contains many potentially harmful or dangerous contaminants that must be removed or reduced to acceptable levels in order to protect the consumer and provide a safe and cost-effective production facility. Along with the air bacteria get compressed and begin their journey through the compressed air system. Introducing this type of microbial contamination to food products is very risky and would be considered a lack of control by the facility. Understanding how to integrate the treatment of compressed air in a facility will help ward off that risk.

Published Requirements, Guidelines and GMPs

Food & Drug Administration (FDA) Code of Federal Regulations (CFR) Title 21, Part 110.40 (g)

“Compressed air or other gases mechanically introduced into food or used to clean food-contact surfaces or equipment shall be treated in such a way that food is not contaminated with unlawful indirect food additives”.

Visit the website.

BRC - British Retail Consortium: BRC Food Standard Version 8, section 4.5.2 states

“Air and other gases used as an ingredient or that are in direct contact with products shall be monitored to ensure this does not represent a contamination risk. Compressed air that is in direct contact with the product shall be filtered at point of use”.

Visit the website.

Food Safety System Certification FSSC22000, ISO 22000:2018

“Prerequisite programs should be in place to address possible contamination sources including those affecting compressed air”.

Visit the website.

Prerequisite program: ISO/TS 22002-1:2009

“Compressed air and gases intended for direct or incidental product contact (including those used for transporting, blowing or drying materials, roducts or equipment) shall be from a source approved for food contact use, filtered to remove dust, oil and water”.

Visit the website.

British Compressed Air Society (BCAS): Best Practice Guideline 102

The BCAS best practice guideline 102 makes references to the ISO 8573-1:2010 for compressed air contamination. Basically their recommendations are: For direct food contact ISO8573-1:2010 class 2:2:1. There is no reference to filter rating specifications; however, there is reference to a recommendation of -40° C/F dew point (Class 2) for the air and a recommended remaining oil content of <=0.01 mg/m3 (Class1).
Visit the website.

Safe Quality Foods (SQF): SQF Code Edition 8.1 - Section(s): 3.5.6; 4.5.5; 9.5.6; 10.5.5; 11.5.5; 12.5.6

An excerpt from the SQF Guidance Document is as follows:

“Compressed air or other gases used in the manufacturing process shall be clean and present no risk to food safety. Air or gases that come into contact with food packaging are filtered using an appropriate filter capable of removing dust, oil, moisture and microorganisms to avoid cross-contamination to packaged material.

The recommended final stage of filtration in these food contact areas should have a rating of 0.01 micron with an efficiency of 99.999% (or as determined by appropriate risk analysis). Sufficient filtration is to be in place directly upstream of the final stage to protect the final stage from oil and water aerosols”.

Visit the website.

Demystifying the Requirements

SQF, BRC, and FSSC22000 are all risk-based food safety schemes based on Good Manufacturing Practices (GMPs) with some general published guidelines. None of the schemes are particularly prescriptive (see: Published Compressed Air Requirements, Guidelines and GMPs.)

The SQF Guidance Document does provide the most guidance recommending the following point-of-use filtration be in place:

“The recommended final stage of filtration in these food contact areas should have a rating of 0.01 micron with an efficiency of 99.999% (or as determined by appropriate risk analysis). Sufficient filtration is to be in place directly upstream of the final stage to protect the final stage from oil and water aerosols.”

<https://www.sqfi.com/wp-content/uploads/2019/09/Mod-11-manufacturing-Guidance-with-cover.pdf>

3-Stage Compressed Air Filtration

for Point-of-Use Areas

When designing a compressed air system, use point-of-use filtration wherever compressed air comes in contact with the food — either directly or indirectly. Point-of-use filtration is the best line of defense against microbial contamination of food in a compressed air system. Even the best compressor room system filtration does not eliminate harborage sites and biofilm buildup in the downstream compressed air piping system. The following three stages of filtration will significantly reduce the risk of microbial contamination of the food.

Stage 1: Remove bulk liquid and particulate matter down to 0.01 micron at $\geq 93\%$ coalescing efficiency. Automatic drain in filter. (ISO 8573-1:2010 Class 2.4.2)

Stage 2: Remove oil and water aerosols and smaller particulate matter down to 0.01 micron at $\geq 99.99\%$ coalescing efficiency. Automatic drain in filter. (ISO 8573-1:2010 Class 2.2.2 [combination of stage 1 + stage 2]).

Stage 3: Remove microbial contamination down to 0.01 micron at $\geq 99.999\%$ particulate removal efficiency (5-log reduction) with a sterile air filter. (ISO 8573-1:2010 Class 1.2.2. Class 1 – or better – particulate is key. [combination of stage 1 + stage 2 + stage 3]).

Drying the air: The best practice for food safety is to incorporate an air dryer to dry the compressed air to a dew point of -40° F/C (class 2). This will prevent the growth of microbes within the compressed air system. Sometimes this is not possible which makes the filters even more critical. (ISO 8573-1:2010 Class 2 [the middle number] for moisture is best, Class 4 a recommended minimum).

Filtration Efficiency and Log Reduction

Filtration Efficiency

Filtration efficiency is a filter's ability to remove particles or aerosols of a stated size. Particulate removal efficiency relates to solid particles and coalescing efficiency relates to oil & water aerosol removal. Although both efficiency ratings are important, the most important for the food contact air applications is particulate efficiency rating. The risk in a food plant is microbiological matter, and that is particulate. The SQF guidance document – as well as the FDA's recommendation for sanitization is 99.999% (or better), which is a 5-log reduction.

Log Reduction

Log reduction is a direct reference to efficiency and the filter's ability to remove microbiological (approx. 0.2 micron and larger) sized particles from the airstream. Food Safety & Quality Managers will be very familiar with this term.

Filtration Efficiency	Log Reduction
90%	1-log reduction
99%	2-log reduction
99.9%	3-log reduction
99.99%	4-log reduction
99.999%	5-log reduction
99.9999%	6-log reduction



Figure 1. Top: Finite 3 Stage Aluminum Filters deliver up to 99.9999+% efficiency at 0.01 microns. Finished with a durable powder coating that will hold up to the dirtiest compressed air systems.

Figure 2. Bottom: Finite 3 Stage Stainless Steel Filters deliver up to 99.9999+% efficiency at 0.01 microns. 304 stainless steel construction will hold up to the harshest washdown chemicals.

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