SMC

A GUIDE TO AIR QUALITY IN FOOD & BEVERAGE

Compressed air purity to match your needs

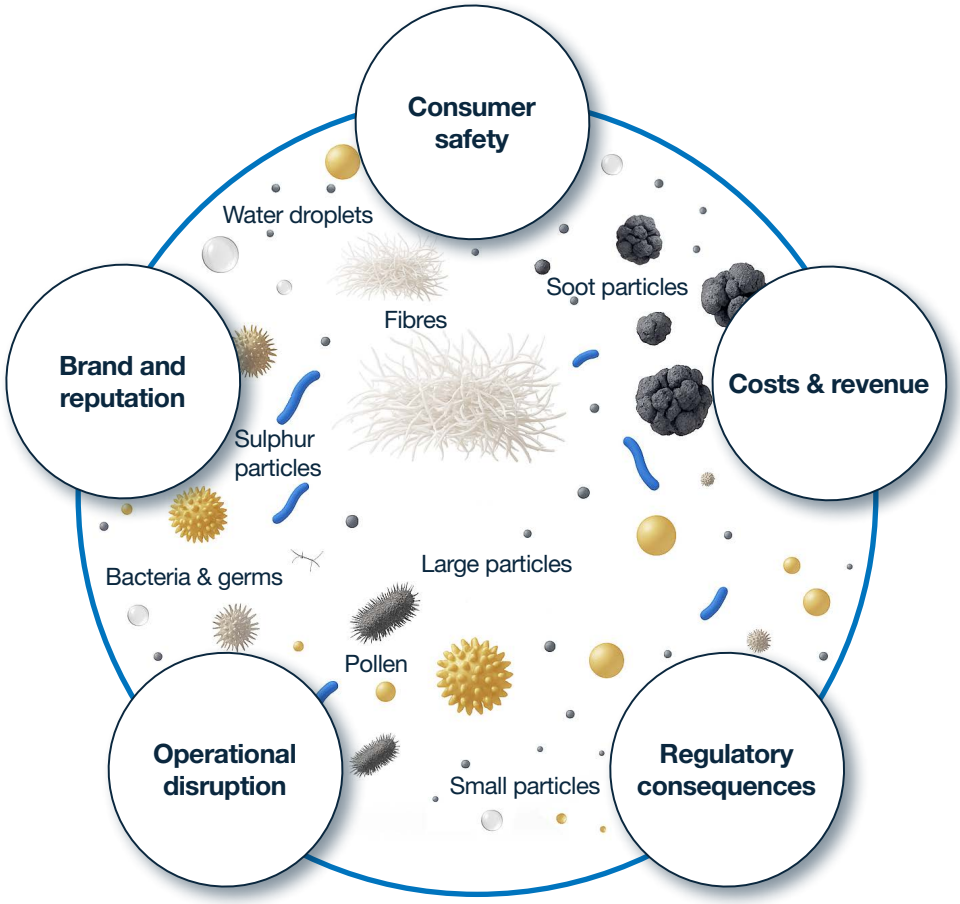
Expertise
Passion
Automation

Clean and safe compressed air is essential for reliable automation. With the proper definition of the air purity class required for your system and a correct implementation of air preparation systems, you not only protect your brand but also maintain efficiency and ensure a safe performance of the equipment.

Why air quality puts your reputation at stake

Poor quality compressed air poses serious but often overlooked risks for food manufacturers. **Contamination from poor hygienic design can lead to food safety failures, recalls, and loss of consumer trust.** Foreign objects, allergens, or harmful bacteria such as Listeria or Salmonella can threaten health and disrupt operations. These issues also increase cleaning time, the use of chemicals, labour, and redesign costs, increasing total cost of ownership. **Ultimately, poor air quality can damage brand reputation, halt production, and result in significant financial losses.**

Discover how SMC's expertise in air treatment solutions can help you keep pneumatic systems operating safely every day.



Setting the framework: international standards

Although no single specification exists, the quality of compressed air used in the food and beverage industry is addressed through a **combination of international standards, industry best-practice guidelines, certification schemes, and codes of practice**.

Together, these resources provide a **common framework** for defining air purity requirements, applying appropriate controls, and supporting compliance with food safety and quality systems.

The following list of standards and guidelines represent the most widely recognised references for managing compressed air quality for food and beverage applications.

GUIDE/STANDARD	APPROACH
ISO 8573-1:2010 – Compressed air -Part 1: Contaminants and purity classes	General international standard defining classes of compressed air purity levels for particles, water and oil.
ISO 8573-7: test method for viable microbiological contaminant content	Specification of test methods for distinguishing viable, colony-forming, microbiological organisms from other solid particles which may be present in compressed air.
BRCGS 9th Ed. 4.5.3	Globally recognised, GFSI-benchmarked framework for food manufacturers to ensure product safety, legality, authenticity, and quality.
BCAS – BPG-102-1 Food and Beverage Grade Compressed Air	Recommendations of air quality for direct and indirect compressed air that comes into contact with food or food packaging.
SQF Edition 9 11.5.5.1 & 11.5.5.	Recommended safety practices for air quality that comes in contact with food or food-contact surfaces.
ISO/TS2202-1 6.5	Technical Specification that provides detailed requirements for Prerequisite Programmes (PRPs) in food manufacturing to support an ISO 22000 food-safety management system.
FDA Code of Federal Regulations Title 21CFR Part 110.40	Definition of hygienic design and maintenance requirements for food-processing equipment under Current Good Manufacturing Practice (cGMP).
IFS Version 8 4.9.10.1 & 4.9.10.2	Recommendations for control of compressed air and gases contacting food, using a risk-based monitoring and hazard assessment to ensure they pose no contamination risk.

Definition of compressed air quality

There are no rules to define what air grade is suitable for each application, but ISO 8573-1 sets a scale depending on the concentration of different substances in the air. It classifies compressed air impurities into three distinct groups and uses a code of **three numbers** to represent limits on solid particles, moisture and oil contamination. These numbers are used to categorise and specify a **class of compressed air quality**.

ISO 8573-1 air quality classification chart

Class	Solid particles, particle size, d(mm)				Humidity and liquid water		Oil
	Maximum number of particles per cubic meter as a function of particle size d [µm]			Mass concentration Cp	Pressure dew point	Concentration of liquid water Cw	Concentration of total oil
	0.10 <d ≤0.5	0.5 <d ≤1.0	1.0 <d ≤5.0	[mg/m³]	[°C]	[g/m³]	[mg/m³]
0	As specified by the equipment user or supplier and more stringent than class 1						
1	≤20000	≤400	≤10	–	≤-70	–	≤0.01
2	≤400000	≤6000	≤100	–	≤-40	–	≤0.1
3	–	≤90000	≤1000	–	≤-20	–	≤1
4	–	–	≤10000	–	≤3	–	≤5
5	–	–	≤100000	–	≤7	–	–
6	–	–	–	0 <Cp ≤5	≤10	–	–
7	–	–	–	5 <Cp ≤10	–	Cw ≤0.5	–
8	–	–	–	–	–	0.5 <Cw ≤5	–
9	–	–	–	–	–	5 <Cw ≤10	–
x	–	–	–	Cp >10	–	Cw >10	>5

ISO 8573-1 class example

4 : 2 : 2

PARTICLES
Dust and other solid debris

Particle size (d) 1.0 <d ≤5.0 µm
Concentration ≤10000 particles/m³

WATER
Moisture droplets, and vapour

Pressure dew point ≤-40 °C

OIL
Droplets and vapour

Concentration ≤0.1 mg/m³

KEEP IN MIND

The air around us naturally contains varying levels of impurities. **When this air is compressed, those contaminants become concentrated**, amplifying their potential impact on equipment, processes, and end products.

Taking responsibility of the compressed air quality

The quality of compressed air should be defined according to the specific requirements of each application, and usually after the **HACCP process**. This helps identify the level of purity needed at the point of use depends on whether the air comes into direct or indirect contact with the product. In food and beverage manufacturing, this principle is especially critical. Although plenty of guidance exists, **the final air cleanliness criteria is the responsibility of the manufacturer or process owner** themselves after a methodical risk assessment has been conducted.

The **British Compressed Air Society (BCAS)** is a well-established source of guidance and recommends that air used in different food factory environments should comply with **ISO 8573-1:2010** purity classes and be regularly monitored in accordance with its Food and Beverage Grade Compressed Air Best Practice Guideline 102-1, ensuring that air quality remains suitable for its intended use and does not compromise product safety.

The following tables show the BCAS recommendations for different application cases.

Direct and indirect food contact recommendation:

ISO 8573-1:2010	Solid particulate			Water	Oil
	Maximum no of particles per m^3			Vapour pressure dewpoint	Total oil (aerosol liquid and vapour)
	0.1 <d ≤0.5	0.5 <d ≤1.0	1.0 <d ≤5.0	[°C] PDP	[mg/m^3]
	≤20000	≤400	≤10	≤-40	≤0.01
Class	1			2	1

Non-food contact recommendation:

ISO 8573-1:2010	Solid particulate			Water	Oil
	Maximum no of particles per m^3			Vapour pressure dewpoint	Total oil (aerosol liquid and vapour)
	0.1 <d ≤0.5	0.5 <d ≤1.0	1.0 <d ≤5.0	[°C] PDP	[mg/m^3]
	≤400000	≤6000	≤100	≤+3	≤0.1
Class	2			4	2

COMPRESSED AIR AND THE HACCP PROCESS

HACCP (Hazard Analysis and Critical Control Points) is a food safety system used to **identify, evaluate, and control hazards** that could make food unsafe. Compressed air therefore should be a consideration. HACCP is generally used to:

· Identify potential **biological, chemical, and physical hazards**
· Pinpoints **critical control points** where risks can be prevented or reduced
· **Sets limits**, monitoring, and corrective actions to ensure food safety.

Compressed air quality should be considered a prerequisite program (PRP) within the HACCP framework. **However, it can be overlooked, with responsibility assumed to lie elsewhere in an organisation.**

Other well established associations and organisations also classify the recommended air used around food and beverage production to similar quality levels in relation to ISO 8573-1 but show more specific categories. For example,the widely used German standard VDMA15390, offers the following examples:

VDMA 15390-2 Dec 2016

Compressed air purity – Part 2: typical application specific purity classes according to ISO 8573-1:2010 and instructions for generation and verification of appropriate compressed air purity for applications in the sector of food and pharma technology.

Compressed air application	Purity classes				
	Particle	Humidity (vapour) [°C]		Total oil content	Sterile
		Ambient >+10	Ambient ≤+10		
No or indirect contact with the packaging material or product (control air and blast air outside the production area)	2	4	2 - 3	2	—
Indirect contact with the packaging material or product (control air in the production area)				1	
Direct contact of the compressed air with the material of a non-sterile packaging (process air)					
Direct contact of compressed air with the material of sterile packaging (process air)	1				Yes
Direct contact of compressed air with non – dry products that are non-sterile (process air)	2				—
Direct contact of compressed air with non – dry products that are sterile packed (process air)	1				Yes
Direct contact of the compressed air with dry products that are non-sterile packaged (process air)	2	2	2		—
Direct contact of the compressed air with dry products that are sterile packed become (process air)	1				Yes

FOOD GRADE LUBRICANTS

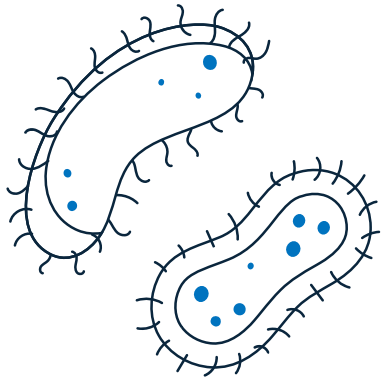
Maintaining air purity also extends to the choice of lubricants used in compressors, vacuum pumps and, in some cases pneumatic components. **Class H1 food-grade lubricant** is formulated specifically for environments where incidental contact with food may occur. Where required, it provides reliable lubrication and protection against wear while minimising the risk of contamination, helping manufacturers meet both hygiene and performance standards in accordance with BCAS and food safety requirements.

SMC offers a wide range of products self lubricated with H1 grade grease.

Micro-organisms

ISO 8573-1:2010 is widely referenced for clearly categorising compressed air quality classes in terms of particulate matter, moisture, and oil concentration. However, it **does not specifically address microbiological contamination**, including micro-organisms typically ranging in size from 0.02 µm to 10 µm. **If left uncontrolled, contamination levels can increase**, and the presence of micro-organisms may adversely affect food quality and safety.

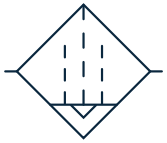
ISO 8573-7:2003 specifies a test method for detecting viable, colony-forming micro-organisms in compressed air, supporting the verification of microbial purity where required, such as in certain food manufacturing applications. While **ISO 8573-7 does not define acceptable microbial limits**, it provides a standardised methodology for assessing and monitoring contamination levels.



SMC can support you in selecting and implementing the solution best suited to your process requirements.

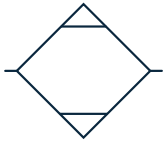
Without full sterilisation, there are three common methods for preventing contamination by micro-organisms:

- Fine filtration
- Reducing the moisture content of compressed air
- Dedicated anti-bacterial and bacteria-removal filters.



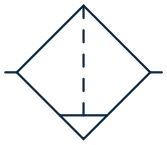
FINE PARTICULATE FILTERS

- Simple, lower cost and widely available solution
- Depending on element rating and efficiency, difficult to remove all micro-organisms.



COMPRESSED AIR DRYER FOR ≤-40 °C PRESSURE DEW POINT

- Reliable means of mico-organism growth prevention
- Higher running and maintenance costs.



DEDICATED ANTI-BACTERIAL AND BACTERIAL REMOVAL FILTERS

- Simple and reliable with a low operating cost
- Better suited to lower flow rate point of use demands rather than factor-wide supplies.

Quality at point of use

Selecting the appropriate air quality level to meet specific process and area requirements is essential for ensuring performance, reliability, and compliance. Drawing on the sources referenced above, as well as SMC's extensive industry experience, the following examples highlight typical applications and provide indicative air quality levels for each:

Non-food contact

General purpose compressed air used away from the food production or process area

- Workshops
- Finished product conveyer controls
- Warehouse transfer.

Indirect food contact

Compressed air not intended for direct contact but used in the production or process area

- Secondary packaging machinery
- Stacking of finished goods
- Reject systems.

Direct food contact

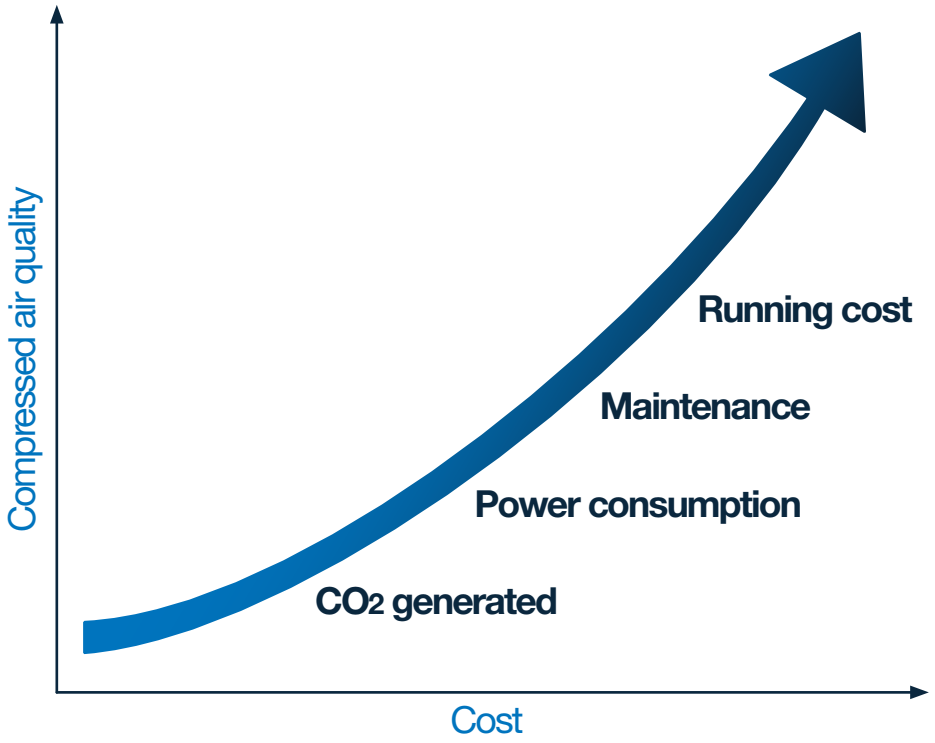
Compressed air used with product, ingredients and work surfaces

- Primary packaging machinery
- Sorting of ingredients
- Cutting and forming product
- Mould release
- Cleaning
- Blowing & cooling.

In addition to the recommendations of international standards, it is important to recognise that an assessment for each application and process should be carried out.

Appreciating the cost of high purity compressed air

Understandably, it may seem simpler to specify the same air quality level to meet the most stringent on-site demand. However, selecting an air quality level that accurately matches process requirements is essential, as **an over-specified air treatment system can lead to inefficiencies, reduced product quality, or even system malfunctions**. For example, excessively dry air can directly impact the taste, appearance, or shelf life of some food products.



AVOID EXCESSIVE COMPRESSED AIR QUALITY TO SAVE COSTS

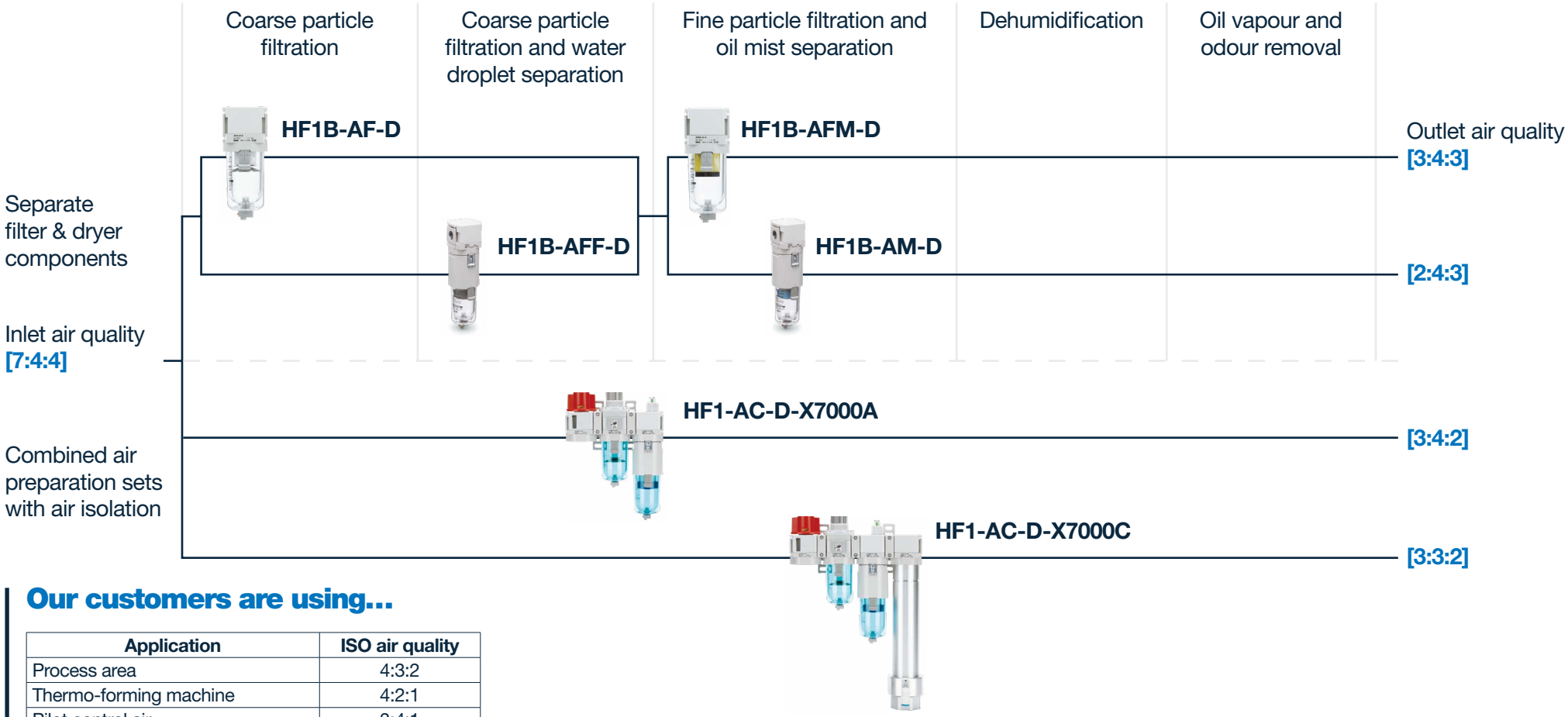
Always select an air quality level that meets the specific demands of your application. From an energy-efficiency standpoint, finer filters create higher pressure differentials, which can mean an increase in supply pressure. Absorption dryers provide a low dew point for higher flow rates and control the growth of micro-organisms. However, they are costly to operate and demand routine maintenance. Local membrane dryers can provide comparable dew points with potentially lower operational demands.

Let SMC help you match your requirements with the most suitable products.

Choose your combination

SMC can provide the right combination to reach the air quality specified for your application. The following pages show different examples adapted to each case.

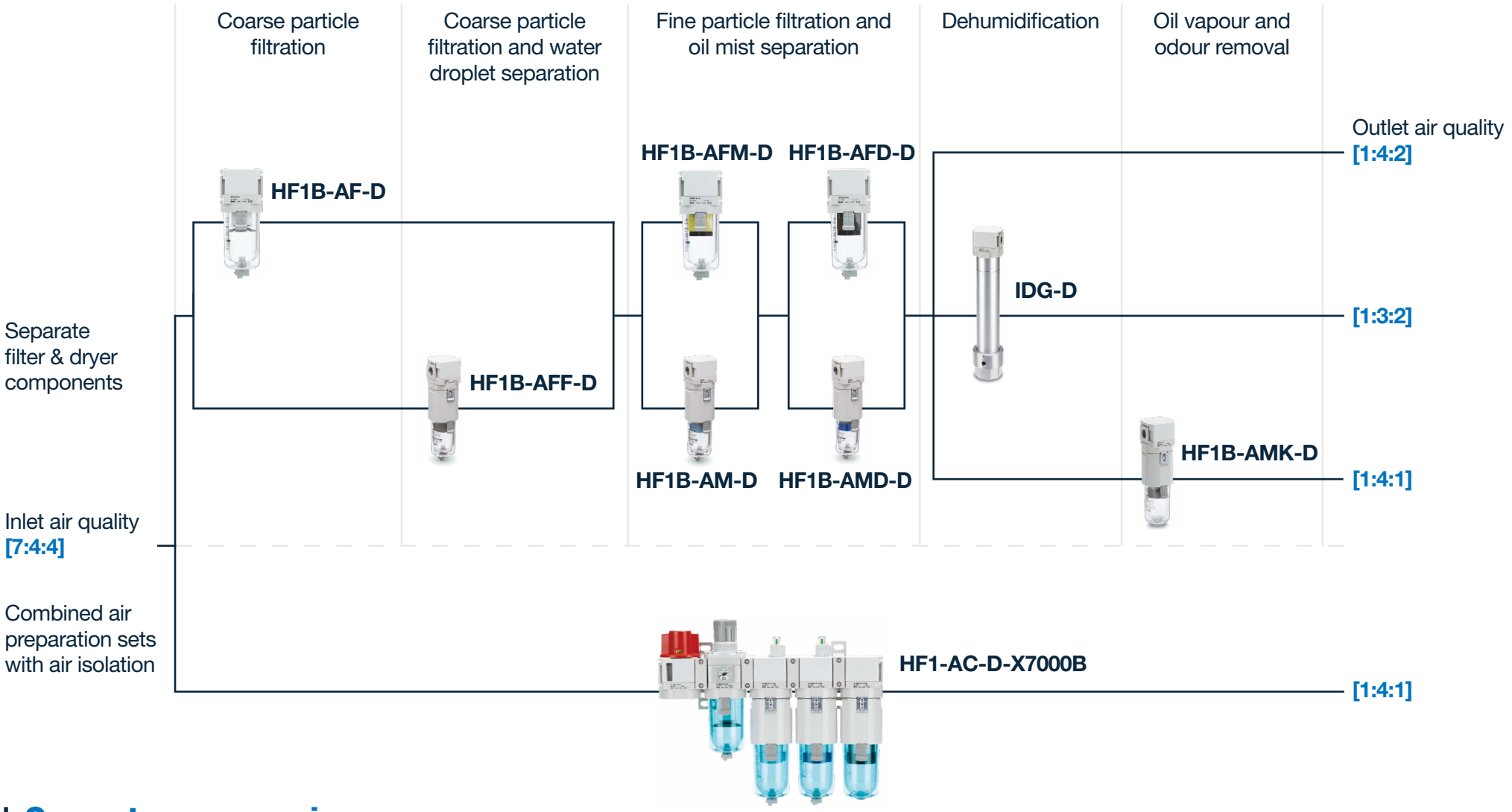
Non-food contact



Our customers are using...

Application	ISO air quality
Process area	4:3:2
Thermo-forming machine	4:2:1
Pilot control air	3:4:1
General purpose compressed air	3:4:2

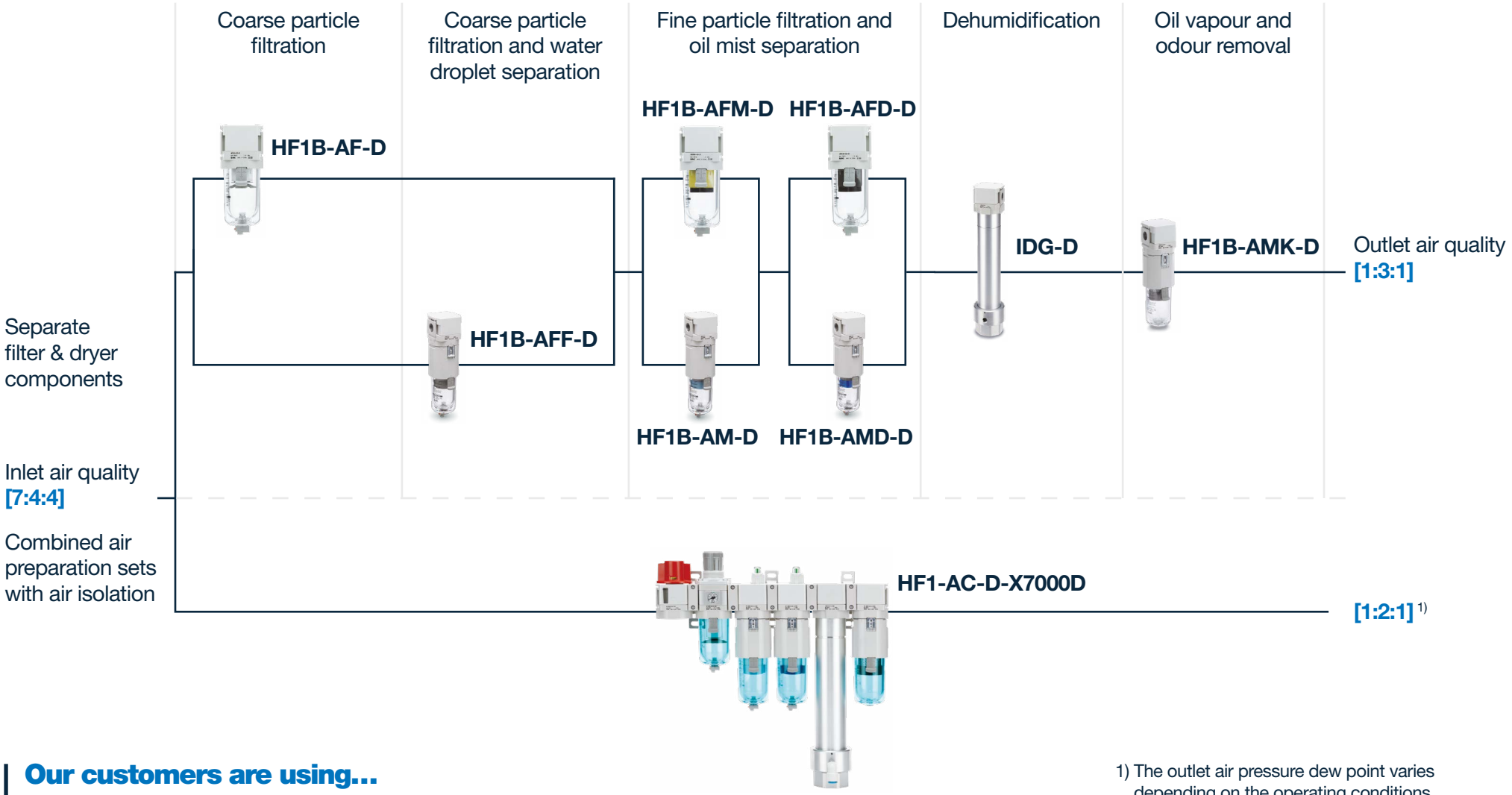
Indirect food contact



Our customers are using...

Application	ISO air quality
Compressor output	2:3:1
Sterile bottling line	2:4:1
Slaughter area	2:3:2
Hamburger cutting	1:4:1

Direct food contact



Our customers are using...

Application	ISO air quality
Chocolate powder dosing	1:3:1
Biscuit dough stirring	1:2:1
Hazle nut processing	1:3:1

1) The outlet air pressure dew point varies depending on the operating conditions.

Application-ready products

Air filter
HF1B-AF20-60-D Series

- Coarse particle filtration
- 5 µm nominal rating
- Flow rate up to 14550 l/min.

Mist separator
HF1B-AFM20-40-D Series

- Fine particle filtration and oil mist separation
- 0.3 µm nominal rating
- 99.9 % filtration efficiency
- Oil concentration ≤1 mg/m^3
- Flow rate up to 1100 l/min.

Micro mist separator
HF1B-AFD20-40-D Series

- Ultra fine particle filtration and oil mist separation
- 0.01 µm nominal rating
- 99.9 % filtration efficiency
- Oil concentration ≤0.1 mg/m^3
- Flow rate up to 600 l/min.

Line filter
HF1B-AFF20-60-D Series

- Coarse particle filtration and water droplet separation
- 1 µm nominal rating
- 99 % filtration efficiency
- Flow rate up to 3700 l/min.

Mist separator
HF1B-AM20-60-D Series

- Fine particle filtration and oil mist separation
- 0.1 µm nominal rating
- 99 % filtration efficiency
- Oil concentration ≤1 mg/m^3
- Flow rate up to 3700 l/min.

Micro mist separator
HF1B-AMD20-60-D Series

- Ultra fine particle filtration and oil mist separation
- 0.01 µm nominal rating
- 99.9 % filtration efficiency
- Oil concentration ≤0.1 mg/m^3
- Flow rate up to 3700 l/min.

Membrane air dryer
IDG-D Series

- Dehumidification
- Equivalent outlet dew point up to -40 °C (ISO class 2)
- Flow rate up to 500 l/min.

Activated carbon filter
HF1B-AMK20-60-D Series

- Oil vapour and odour removal
- Oil concentration ≤0.003 mg/m^3
- Flow rate up to 3700 l/min.

Air combination units for food & packaging

HF1-AC-X7000 Series

- Port sizes: 1/8 to 1
- Maximum flow rate up to 8000 l/min (ANR)
- Inch and metric port threads
- Element service indicator.

Antibacterial air combination unit

HF2-BAC Series

- NSF-H1 grade grease and FDA compliant
- Max. flow rate 800 l/min
- Modular connection
- Port sizes: 1/4, 3/8, 1/2.

In-line bacteria removal filter

HF2B-SFDA Series

- Parts in contact with fluid compliant with FDA
- Port sizes: 1/4, 3/8
- NSF-H1 lubrication for flow path.

Exhaust cleaner

AMC Series

- Noise reduction: 35 db or more
- Oil mist removal: 99.9 % or more
- Element supply pressure: 0.1 MP or less
- Ambient & fluid temperature: 5 to 60° C.

If you want to see our full portfolio of food-compatible products, visit our website

Discover SMC's solutions for food safety

Auto drain valve

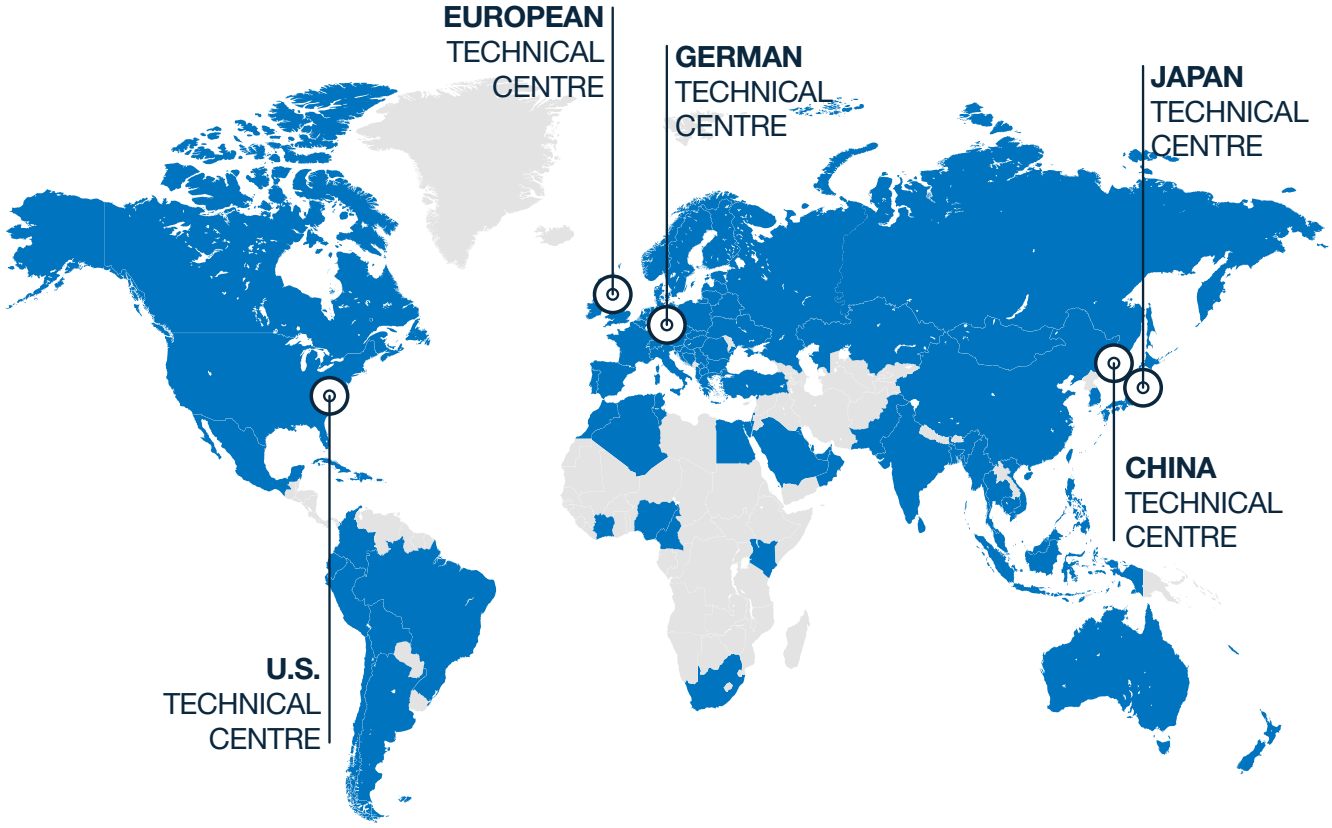
AD402-A Series

- Port size: 1/4, 3/8, 1/2
- Drain discharge: max.100 cm^3/cycle
- Transparent bowl guard.

Our support network

SMC's worldwide commitment

One of the things we do best at SMC is **being close to our customers**. Local support, on a global scale.



With **support** in over **500 locations** across **80 countries** and regions **worldwide**, our sales force of **7000 experts** maintains **close communication with customers**.

Expertise
Passion
Automation

SMC Corporation
1-5-5, Kyobashi,
Chuo-ku, Tokyo
104-0031, Japan
Telephone: 03-6628-3000
https://www.smcworld.com

Austria	+43 (0)2262622800	www.smc.at	office.at@smc.com
Belgium	+32 (0)33551464	www.smc.be	info@smc.be
Bulgaria	+359 (0)2807670	www.smc.bg	sales.bg@smc.com
Croatia	+385 (0)13707288	www.smc.hr	sales.hr@smc.com
Czech Republic	+420 541424611	www.smc.cz	office.at@smc.com
Denmark	+45 70252900	www.smcdk.com	smc.dk@smc.com
Estonia	+372 651 0370	www.smcee.ee	info.ee@smc.com
Finland	+358 207513513	www.smc.fi	smc.fi@smc.com
France	+33 (0)164761000	www.smc-france.fr	supportclient.fr@smc.com
Germany	+49 (0)61034020	www.smc.de	info.de@smc.com
Greece	+30 210 2717265	www.smchellas.gr	sales@smchellas.gr
Hungary	+36 23513000	www.smc.hu	office.hu@smc.com
Ireland	+353 (0)14039000	www.smcautomation.ie	technical.ie@smc.com
Italy	+39 03990691	www.smcitalia.it	mailbox.it@smc.com
Latvia	+371 67817700	www.smc.lv	info.lv@smc.com
Lithuania	+370 5 2308118	www.smclt.lt	info.lt@smc.com
Netherlands	+31 (0)205318888	www.smc.nl	info@smc.nl
Norway	+47 67129020	www.smc-norge.no	post.no@smc.com
Poland	+48 22 344 40 00	www.smc.pl	office.pl@smc.com
Portugal	+351 214724500	www.smc.eu	apoiocliente.pt@smc.com
Romania	+40 213205111	www.smcromania.ro	office.ro@smc.com
Russia	+7 (812)3036600	www.smc.eu	sales@smcru.com
Slovakia	+421 (0)413213212	www.smc.sk	sales.sk@smc.com
Slovenia	+386 (0)73885412	www.smc.si	office.si@smc.com
Spain	+34 945184100	www.smc.eu	post.es@smc.com
Sweden	+46 (0)86031240	www.smc.nu	order.se@smc.com
Switzerland	+41 (0)523963131	www.smc.ch	helpcenter.ch@smc.com
Turkey	+90 212 489 0 440	www.smcturkey.com.tr	satis.tr@smc.com
UK	+44 (0)845 121 5122	www.smc.uk	sales.gb@smc.com
South Africa	+27 10 900 1233	www.smcza.co.za	Sales.za@smc.com

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