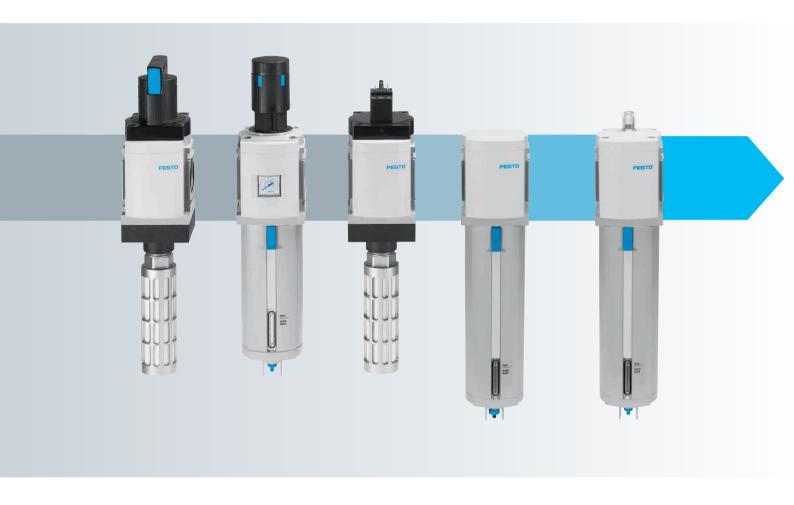
Reliable processes thanks to perfect compressed air preparation

FESTO





Anyone who wants to improve process reliability and machine availability must start at the very beginning – and first analyse the compressed air supply in detail. Particles, water and oil are the natural enemies of perfectly prepared compressed air. They have an adverse effect on the components and cost additional energy.

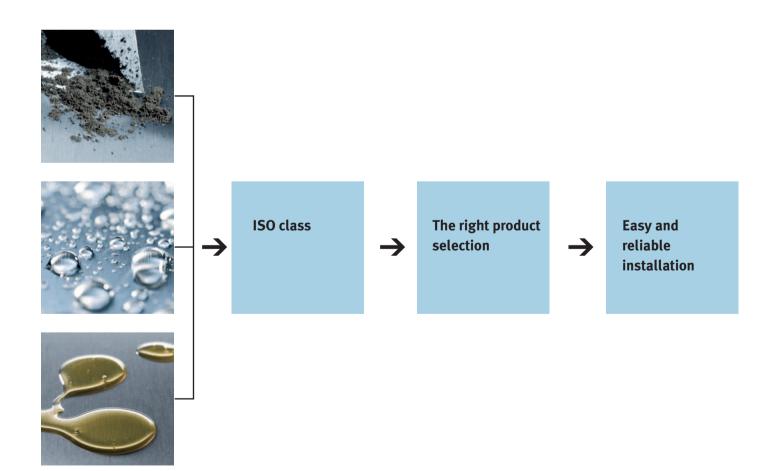




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Process reliability High machine availability



Compressed air preparation is well worth it!

The right compressed air preparation system significantly increases the long service life of Festo components and systems – as well as the process and product reliability.

One cubic metre of compressed air generated contains millions of dirt particles, considerable amounts of water and oil, and even heavy metals like lead, cadmium and mercury. If they are not filtered out, trouble-free operation of the system components cannot be guaranteed in the long term.

Also, these harmful substances substantially reduce product quality. As a result, the right compressed air preparation is essential for reducing machine downtime and idle periods, and for guaranteeing process and product reliability.

Those are good reasons for you to pay attention to the quality of your compressed air!

Poorly prepared compressed air causes faults such as:

- Accelerated seal wear
- Contaminated control valves
- Oil-fouled silencers

Possible effects for the user and the machine:

- Low machine availability
- Higher energy costs due to leakages
- Higher maintenance costs
- Shorter component and system service life









Compressed air quality to ISO 8573-1:2010

ISO 8573 is the name for a group of international standards for the quality – or purity – of compressed air. It represents the quality requirements for compressed air and specifies the maximum amount of contaminants that can be present in the respective classes.

Clean solution

This standard has been binding for automation using pneumatics since 2010. To ensure that compressed air preparation complies with the standard and is energy efficient, various parameters must be observed.

You should clarify the following questions in advance:

uvance:

- How high is the maximum flow rate required?
- Do all consumers require the same compressed air quality?
- What compressed air quality is provided by the compressor?

ISO 8573-1: 2010	Solid particle	es			Water Oil				
Class		ımber of parti		Mass concentration	Vapour Liquid pressure dew point		Total oil content (liquid, aerosol and mist)		
	0.1 – 0.5 μm 0.5 – 1 μm 1 – 5 μm		mg/m³	°C g/m³		mg/m³			
0	As stipulated	l by the equip	ment user, str	icter requirements tha	n class 1				
1	≤ 20,000	0 ≤ 400 ≤ 10		_	≤ -70	_	0.01		
2	≤ 400,000	≤ 6,000	≤ 100	_	≤ -40	_	0.1		
3	-	≤ 90,000	≤ 1,000	_	≤ -20	_	1		
4	_	_	≤ 10,000	_	≤ +3	_	5		
5	_	_	≤100,000	_	≤ +7	_	_		
6	_	_	_	≤ 5	≤ +10	_	_		
7	_	_	_	5 – 10	_	≤ 0.5	_		
8	_	_	_	_	_	0.5 – 5	-		
9	_	_	_	_	_	5 – 10	-		
Х	-	-	_	> 10	_	> 10	>10		



A perfect match for many industries.

Many industries have strict requirements for compressed air quality. While the priorities for the food and packaging industries are food safety and problem-free consumption, PWIS-free compressed air is essential in paint shops. Festo service units and filters guarantee excellent functionality. Some examples:

For direct contact with "non-dry" foods (e.g. drinks, meat, vegetables etc.).

The compressed air is used for transporting or mixing, or in general food production. It thus comes into direct contact with the food.

In packaging machines

If compressed air comes into direct contact with packaging materials for food, the packaging material is considered part of the food sector.

The following classifications apply for both applications: ISO 8573-1:2010

= Class 1

Particles = Class 1

rarticles — class.

Water = Class 4

Oil

For direct contact with dry foods

The compressed air is used for transporting or mixing, or in general food production.

Therefore, it comes into direct contact with the food. Increased requirements apply in this case since air humidity plays an important role.

As a result, the following compressed air quality classifications in accordance with ISO 8573-1:2010 are recommended in these applications:

Particles = Class 1

Water = Class 2

Oil = Class 1

Compliance with the compressed air quality classes specified here is of great importance to guarantee maximum safety for the food and protect the health of the consumer.





The enjoyment of premium quality coffee demands absolutely clean compressed air.



Perfect gloss: PWIS-free painting (ISO 8573-1:2010 Class 1:4:2)

When painting cars, manufacturers also require a zero-fault rate. As a result, compressed air used for painting applications must be free of particles and oil. To ensure a good bond between the sub-surface and the paint, the surface to be painted must also be cleaned. Otherwise it could lead to complex and costly rework, which reduces the per-car profits for the

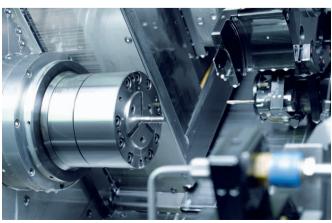
company significantly. Festo service units in painting systems remove water, oil and particles from the compressed air used, minimising the damage to the paint. Festo components for use in the automotive industry are also manufactured PWIS-free (paint-wetting impairment substances). The filter combination for this: 5 + 1 + 0.01 µm

Clear view: visual displacement encoders in machine tools (ISO 8573-1:2010 Class 1:4:1)

Visual displacement encoders e.g. in milling or machine tools require cleaning air with air quality class 1:4:1 in accordance with ISO 8573-1:2010 for a long service life. The high-purity compressed air is routed inside, preventing ingress of impure ambient air into the housing. That also means that oil mist cannot wet and damage the glass scale – a key requirement for a long service life of the

displacement encoder. The filter combination for this: $5 + 1 + 0.01 \mu m + activated$ carbon filter



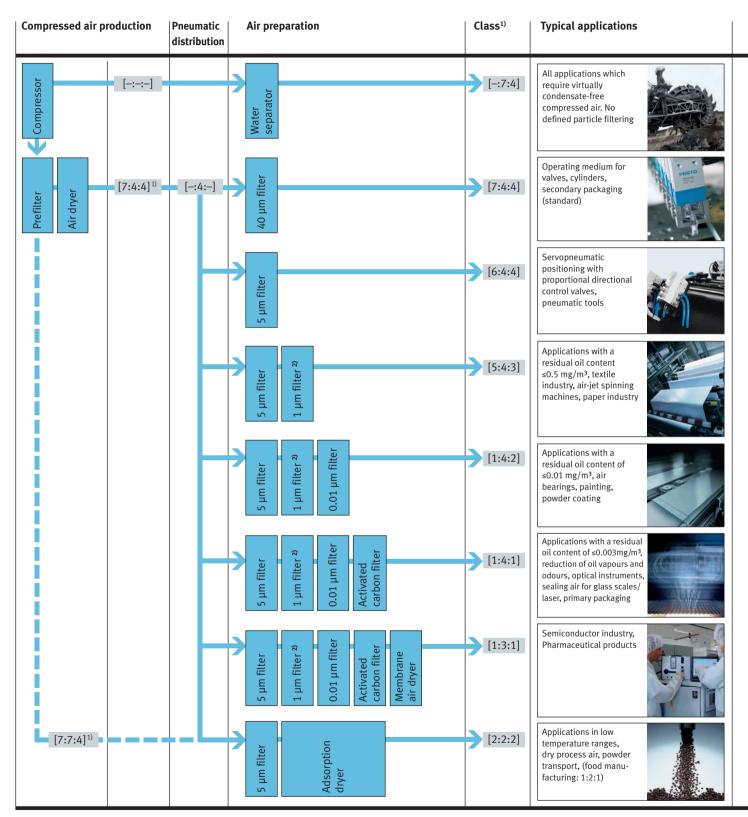


Clearly classified compressed air quality from Festo – the MS series

Which compressed air quality do you need?

Check which products from the MS series are right for your system.

This table contains recommendations from the experts at Festo, based on the limit values specified in ISO 8573-1:2010.



⁽¹⁾ Quality class to ISO 8573-1:2010 [Particles:Water:Oil] Quality class attainable under normal operating and framework conditions for typical compressed air systems.

The 1µm filter extends the maintenance intervals and guarantees the particle class. It can be omitted if the central compressed air quality is good.

Flow at supply pressure of 10 bar, on units with regulator output pressure of 6 bar in Nl/min

1,000	3,00	00	5,000	7,000	9,000	11,000	13,000	15,000	17,000	19,000	21,000	23,000	
564858 MS6-LWS	-1/2-UV	-WB	567857 MS9-LV	7 NS-1-UV-WI	P								
													Ψ
*531029 MSB4-	*53103 MSB6-1		i:	*552938 MSB9-1:C	2:J73-WP								
1/4:C4: J1-WP	J1-WP												
	*53103 MSB6-1		i:	*552938 MSB9-1:C	2:J71-WP								
1/4:C4: J3-WP	J3-WP												
													m di
200		*5210	600	800	1,000	12,000	3,000	4,000	5,000	6,000	7,000	8,000	
*531029 / 1/4:C4:J3:		*5310 MSB6		:J3:I1-WP		552938 NSB9-1:C2:J	71:l9-WP						
													TUU
*531029 l	MCR/	*5310	130		*55								
1/4:C4:J3: l1:l3-WP				:J3:I1:I3-WF		39-1:C2:J71	:l9:l12-WP						
*531029 l	MSB4-	*5310)30		*55								
1/4:C4:J3: l1:l3:L1-W	:			:J3:l1:l3:L4		39-1:C2:J71	:l9:l12:L2-\	WP					
100	20	00	300	400	500	600	700	800	900	1,000			
*531029 MSB4- 1/4:C4:	*53103 MSB6-1		:J3:l1:l3	:L4:G7-WP									
J3:l1:l3: L1:G7-WP													* 0000
552170	M 5E2	2172	552173			552174		552175			Note:		
PDAD-	552171 PDAD-13 22 25 25 25 25 25 25 25 25 25 25 25 25	AD-	PDAD-5:			PDAD-73		PDAD-1			Please orde MS6-LF-1/2 532799 MS	-CRM and	
	W E 22										in addition t		

 $40~\mu m$ and $5~\mu m$ filters from Festo have an additional mechanism for separating liquids.

Note: For even higher flows, MS12 series components are available.
Ask your sales engineer for the ideal combination.

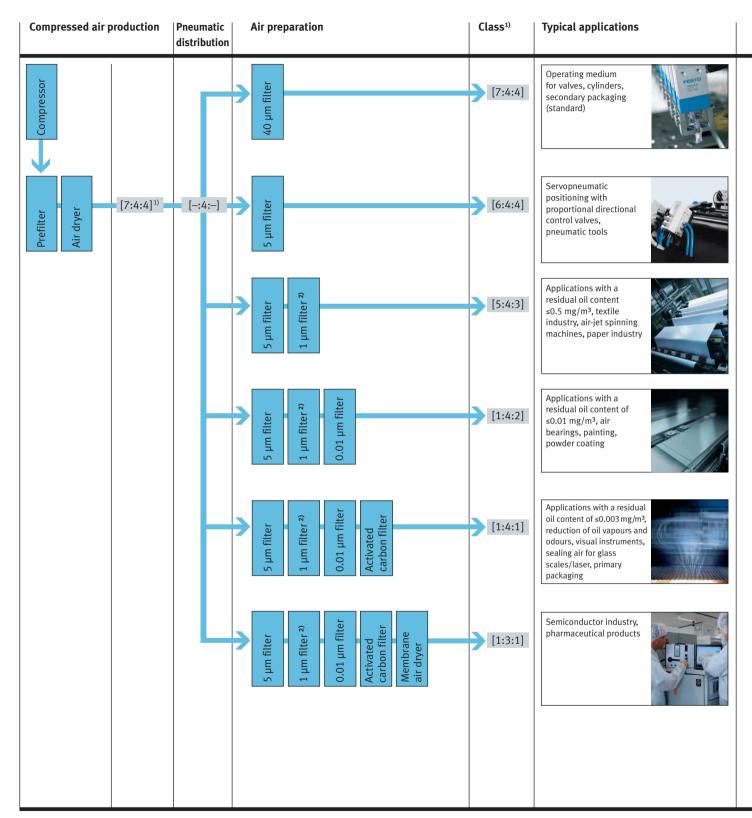
^{*} The overview only shows a selection of devices and possible combinations.

Clearly classified compressed air quality from Festo – the D series

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 $^{^{2)}\,}$ The 1µm filter extends the maintenance intervals and guarantees the particle class. It can be omitted if the central compressed air quality is good.

Flow at supply pressure of 10 bar, output pressure 6 bar in Nl/min

1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000	11,000	12,000
170681 HE-D-MINI + 6841 U-1/8-B + 6842 U-1/4-B + 185733 LFR-1/4-D-MINI 185739 LFR-1/2-D-MIDI			170683 HE-D-MAXI + 6843 U-3/8-B + 159633 LFR-1-D-MAXI					7,000	10,000	11,000	12,000
170681 HE-D-MINI + 6841 U-1/8-B + LFR-1/4-D-5M-MINI	341 U-1/8-B + 6842 U-1/4-B +		170683 HE-D-MAXI + 6843 U-3/8-B + 162617 LFR-1-D-5M-MAXI								
250	500	750	1,000	1,250	1,500	1,750	2,000	2,250	2,500	2,750	3,000
170681 HE-D-MINI + 6841 U-1/8-B + LFR-1/ 192569 LFMB-D-MINI	162722 LF	E-D-MIDI + FR-1/2-D-5N FMB-D-MIDI		-B +				6843 U-3/3 162617 LF	E-D-MAXI + 8-B+ R-1-D-5M-M MB-D-MAXI	AXI +	
170681 HE-D-MINI + 6841 U-1/8-B + 6842 U-1/4-B + 162719 LFR-1/4-D-5M-MINI + 192569 LFMB-D-MINI + 192563 LFMA-D-MINI + 192564 LFMA-D-MIDI				162617 192571	HE-D-MAXI LFR-1-D-5M LFMB-D-MA LFMA-D-MA	-MAXI + XI +	/8-B +				
170681 HE-D-MINI + 6841 U-1/8-B + 162719 LFR-1/4-D-5M 192569 LFMB-D-MINI - 192563 LFMA-D-MINI - 532776 LFX-D-MINI	170683 HE-D-MAXI + 6843 U-3/8-B + 162617 LFR-1-D-5M-MAXI + 192571 LFMB-D-MAXI + 192565 LFMA-D-MAXI + 532778 LFX-D-MAXI										
100	200	300	400	500	600	700	800	900	1,000	1,100	1,200
170681 HE-D-MINI+ 68 162719 LFR-1/4-D-5M 192569 LFMB-D-MINI+ 532776 LFX-D-MINI+ 5 543667 LDM1-1/2-D-M	170682 HE 6842 U-1/4 162722 LFF 192570 LFF 192564 LFF 532777 LFX 151523 ES	-D-MIDI + 4-B + R-1/2-D-5M MB-D-MIDI - MA-D-MIDI -	-MIDI + + +	170683 H 162617 LF 192571 LF 192565 LF 532778 LF	E-D-MAXI + FR-1-D-5M- FMB-D-MAX FMA-D-MAXI FX-D-MAXI - DM1-D-MAX	6843 U-3/ MAXI + (I + (I +	-	1,100	1,200		

 $^{40~\}mu m$ and $5~\mu m$ filters from Festo have an additional mechanism for separating liquids.

^{*} The overview only shows a selection of devices and possible combinations.



The impressive MS and D series – the product range for every requirement

From a simple standard product through to application-specific solutions with the very strictest requirements for compressed air quality, Festo's product range makes it easy to find solutions that meet your needs exactly. Every product is based on decades of expertise and a keen eye for future requirements.

Expertise meets innovation!

The service units from the D series – in metal or polymer designs – and the MS series are ideal for standard tasks. The MS series performs the other tasks, up to the high-end range, finely scaled with the right functions for the required ISO class. Also integrated: diagnostic functions for higher machine availability. Or the safety solutions to ISO 13849-1.

Our finely tuned product range

MS series for safety functions to ISO 13849-1

MS series for more energy efficiency: flow-optimised size mix

MS series for higher machine availability: intelligence with sensors

MS series for application-specific solutions: customised configurations

For standard tasks: D series or MS series

Support

- Complete solutions
- Control cabinets

Services

- Compressed air quality analysis
- Compressed air consumption analysis

The service unit range from Festo grows step by step in line with the task. Also on offer: valuable services and support.



The almost unlimited options of the MS series

From highly sensitive applications in the pharmaceutical or food industry to application-specific solutions with sturdy flow performance for the automotive industry, the service units from the MS series are used almost anywhere, either centrally or decentrally.

Tailor-made solutions - Product range summary



From individual devices ...

A variety of individual devices as **standard components** direct from the catalogue or **individually selected** using the free configurator.



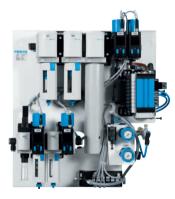
... to pre-assembled standard combinations ...

One packaging unit, one delivery, one price. Quick delivery: the ten most common combinations are always in stock.



... or from individually configurable combinations ...

Custom-made for your requirements: service unit combinations MSB4 and MSB6. Optionally available with safety functions and integrated sensors. Supplied ready assembled and checked.



... to ready-to-install complete solutions.

Fully assembled and tested complete solutions with Festo plug and work®.

Simply added value: complete system solutions

- Everything with 1 part number, 1 contact, 1 delivery date
- Complete solutions: assembled, tested, ready to install
- Install and get started minimised assembly
- Significantly reduced times for goods-in and warehousing



Forward-looking: MS series with integrated sensors and safety functions

The MS series sets new standards in enhanced safety, machine availability and efficient energy usage. This is thanks to the many functions you can integrate effortlessly.



Flow sensor SFAM and MS

Can be integrated in MS without additional installation work!
They are just made for each other. Characteristics:

- Highly-dynamic starting point of 1%
- Extremely precise within an enormous measuring range of up to 15,000 l/min
- Absolute flow rate information and consumption values
- Convenient operation





Pressure and vacuum sensor SDE1 with MS6-FRM

Sensor SDE1 for pressure measurement, monitoring and sensing keeps all pressure values under control, thus increasing productivity and speeding up system commissioning. Combined with compressed air distributor MS6-FRM here.

Filter MS-LFM-...-DP

Differential pressure measurement with filter contamination indicator for preventive maintenance and for improved compressed air quality and compliance with ISO guidelines. This prevents an excessive pressure drop through the filter, which costs additional energy.

Soft-start and exhaust valves MS-SV

MS6-SV-E

To ensure maximum safety for man and machine in the event of sudden emergency stops in safety-critical areas, MS6-SV-E exhausts reliably and quickly. This includes as AS-interface Safety-at-Work bus connection with integrated switching status and pressure sensing via the bus.

IFA certification

Documented safety – to DIN EN ISO 13849-1, category 4 Performance Level e.

MS6-SV-C and MS9-SV-C

The low-cost alternative to MS6-SV-E for medium safety requirements, e.g. to Performance Level c to DIN EN ISO 13849-1. For higher flow requirements, MS9-SV-C is recommended.









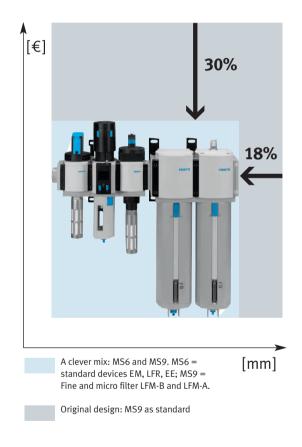


Unique and energy-efficient: the mix of sizes in the MS series

Combines optimum flow rate and compact design

Simply choose a smaller size. An intelligent mix of sizes is one of the hallmarks of the MS series and offers you crucial advantages. Our mix provides combinations optimised in terms of both installation space and cost. An example is the combination of MS6 and MS9.

With the combined service unit shown in the diagram for requirements of 6 bar, a flow rate of 5,000 NI/min and a grade of filtration of 0.01 μ m, you can save up to 30% of the component costs and up to 18% on space!



Tailor-made solutions - Sizes





Same performance with lower operating pressure = Save costs

The intelligent combination of sizes also offers great potential for reducing energy consumption and saving costs. The combination of standard devices of size MS6 with fine and micro filters in MS9 reduces the pressure drop of the overall unit considerably compared to a unit consisting only of MS6 systems. That allows you to reduce the pressure in the main line network at the same flow performance! This service unit example allows the line network pressure to be reduced from

8 bar to 6 bar without any problem. Each bar in pressure drop is equivalent to energy cost savings of approx. 6%, while higher investment costs already pay off after a short time. As a result, this unique combination option contributes to energy-efficient use of compressed air in automation.

Typical areas of application for service units with fine and micro filters include the painting industry, for instance.





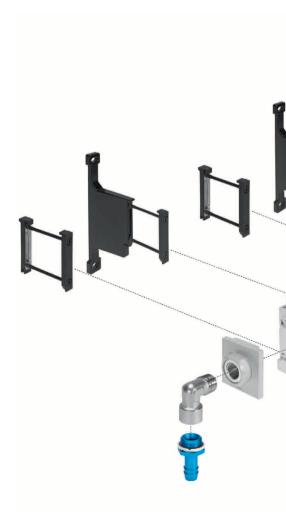
Multiplying the advantages of the MS series with pre-assembled modules

Pre-assembled modules reduce purchasing complexity, increase process reliability and boost your productivity. They save you up to 50% on time and money.

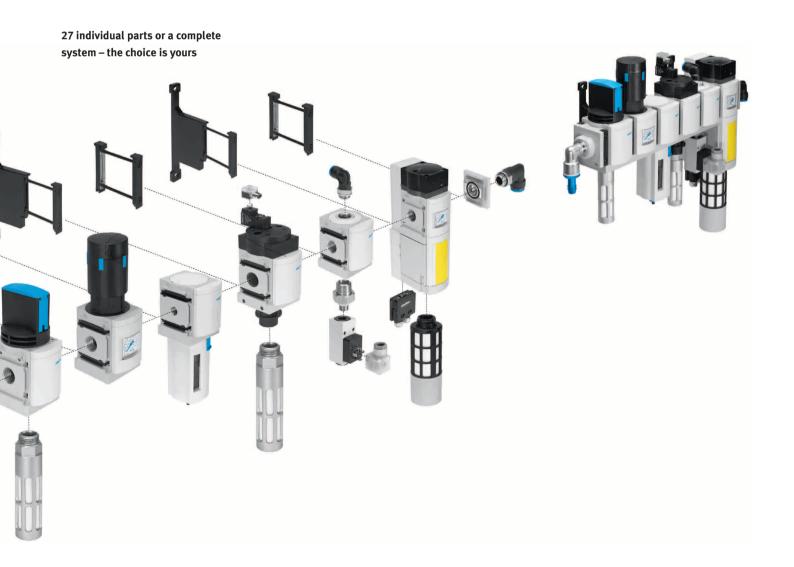
If you choose a ready-to-install module instead of individual components, you can save yourself lots of work, such as the effort involved in selecting 27 items from the catalogue, ordering them, storing them, assembling all 27 of them, integrating them into the system and documenting the whole process. These are just some of the time and cost-intensive activities involved.

The advantages of all-inclusive packages with pre-assembled modules

- Engineering expertise from Festo specialists
- Order the entire system with a single ID number
- Reduced logistics costs
- Delivery of a single item on one date
- Fully assembled and checked system
- Warranty on components and function









The proven standard of the D series in metal or polymer

The D series is available in sturdy metal for standard applications and basic logic functions for decentralised preparation. Or in the attractively priced polymer variant DB for reliable and economical compressed air preparation in uncritical environments. This is ideal for moving machine components, where low weight is required, for example.

A real classic: the D series

Millions of these service units are in use around the world. It has all of the basic functions that are needed for compressed air preparation in the standard range. The strong metal housing and sturdy connection technology give the D series a long service life, even in harsh environments, e.g. the automotive industry. It is economical to operate thanks to the four sizes ranging from Micro to Maxi. That facilitates precision

solutions with a broad spectrum of flow values up to 11,000 NI/min.

Quick delivery – just choose and install!

A variety of pre-assembled and checked standard combinations accelerate your processes. Over 400 different pre-assembled service units with various features are available. Fast delivery and installation thanks to Festo plug and work®!



Tailor-made solutions - Sizes











Reliable, economical, attractively-priced: the DB series

The DB series with its light and very strong polymer housing is ideally suited to the core functionalities of compressed air preparation. It provides reliable compressed air preparation in proven Festo quality for applications in uncritical environments. The sturdy connection technology also guarantees a long service life.

Its main functions as pressure regulator, filter regulator, combined filter/lubricator regulator are compatible with other components from the metal version. The polymer series is also ideal as a starter model when flows up to 2,000 Nl/min and max. 7 bar are required at the output (p2). In typical compressed air systems, combined service units reach a compressed air quality class of 7:4:4.

Safer systems

Another bonus is the standard return flow feature via the main valve seat for pressure regulators. The rapid return flow also increases system safety further.

Pre-assembled and checked: standard combinations

There are four additional, preassembled and tested standard combinations available for immediate delivery with the new manual soft-start valves HE and distributors FRZ. That means you benefit from shorter delivery times, better availability and easier assembly – and accelerate your time-to-market.

Standard combinations		Soft-start valve	Filter regulators	Distributor	Lubricator	Part no.
	LFR-1/4-DB-7- MINI-KB	Х	Х	Х		8002798
	LFR-1/4-DB-7- MINI-KC	Х	Х			8002799
	FRC-1/4-DB-7- MINI-KA		Х	Х	Х	8002800
	FRC-1/4-DB-7- MINI-KC	Х	Х	Х	Х	8002801



Compatible and customised components

Do you have a specific requirement and cannot find the right product in our catalogue? If so, we can offer you customised special designs – from minor product modifications through to completely new developments or ready-to-install solutions.

Use the extensive expertise of our automation specialists and demand nothing less than an innovative and economic solution in keeping with the latest technological standards. Comprehensive product tests guarantee maximum quality. And precisely defined interfaces ensure smooth integration in your machine.

Ask your Festo sales engineer. They will be happy to help.



Ready-to-install control cabinet for compressed air preparation and distribution, individually tailored to your application



Reach your goals more quickly and easily: Festo's engineering tools

The new user-friendly and simple selection tool

It helps you put together the right service unit combination for you. Using the "Typical application" parameter, the tool produces a recommendation for the air quality class and components. Alternatively, you can also specify a compressed air quality class or put together a series of filters yourself. If you add the most popular service modules, the tool recommends the right layout and size of the units in accordance with the flow so the service unit is pre-

configured. That makes oversizing a thing of the past!

Free 2D/3D CAD models in many native formats

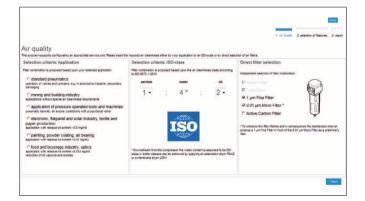
Reduce your workload and integrate CAD models for over 25,000 products in your design. In over 45 exchange formats, with many advantages for native formats, e.g. dynamically generated data. For more, see: www.festo.com/catalogue

Planning support with the product configurator

Configurable combinations and individual devices can be configured and ordered quickly and easily using the free configurator in the electronic catalogue.

Online Shop and Support Portal for Purchasing and After Sales

With just a few clicks, ordering in the Online Shop is quick and easy. It includes delivery dates, personal price information and an order tracking function. It shows you clearly where your order is at all times. The Support Portal provides you with all the product details, including after sales information. It is the central point for all information on the product, even for products which are no longer available. In that case, the Support Portal suggests alternatives. To find out more, go to: www.festo.com/sp





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