FESTO

Product overview
Cleanroom

Components for cleanroom technology

Product overview
Cleanroom

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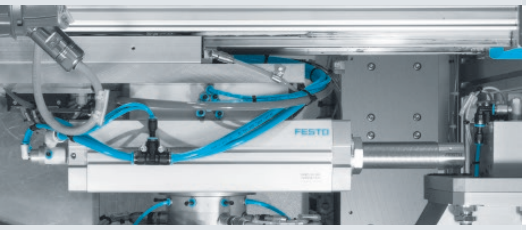
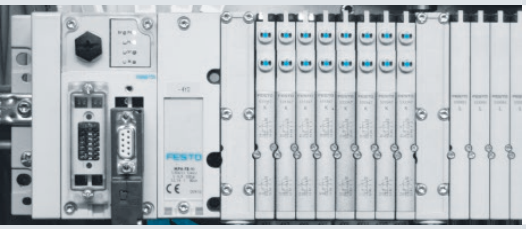
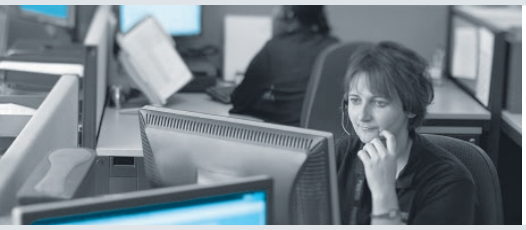






General

In the production environment of the 21st century cleanrooms are playing an ever greater role. In the past, cleanrooms were primarily used as a production environment in the semiconductor industry, but now they are increasingly used in other industries too, such as automotive, pharmaceuticals and the food industry. The objective in all applications is to improve the quality of the manufactured products by ensuring the ambient conditions are controlled and clean.

People are considered to be the biggest emitters of particles. However, with the right equipment they can be effectively separated from the process. This is why particular attention needs to be paid to the machine, its design as well as the components used and their application. These factors play a crucial role in achieving the cleanliness objectives in the production environment. We want to help you to achieve your objectives. In this brochure, we will therefore provide you with an overview of our products for cleanroom applications and give you some information on using them in clean and pure environments.

Which products are suitable for use in cleanrooms?

Whether a product is suitable for cleanrooms depends on its particle emissions. The ISO 14644 standard clearly describes the characteristics required of a product for it to be used in cleanrooms. And we determine the suitability of our products in accordance with ISO 14644. To do this, we try to select a representative, general operating scenario to assess how suitable products are for the cleanroom. All statements in this product overview refer to the emissions of airborne particles by Festo components, and therefore to the suitability of the components for cleanrooms. We have tested a specific selection of our series products to determine if they are fit to be used in cleanrooms. This cross-section of our product portfolio has been specially selected to enable you to solve the majority of automation solutions. In addition, the components should be available at short notice at any time, anywhere in the world.

Notes:

- Classification in accordance with ISO 14644 is not useful for some products, because they do not emit particles when used correctly (e.g. tubing). However, we list them here because this assessment is the result of our experience and testing.
- The values specified are based on products that were cleaned before they were installed in the cleanroom. Please take this into account when using standard components.
- The values specified for the cleanroom class must be considered as reference values that are based on our selection of typical operating scenarios. This means that the values are not guaranteed.

Product overview

Pneumatic cylinders		→ Page 7
Designation	**Type**	**Recommended cleanroom class**
Round cylinder	DSNU	ISO 6
	DSNU-S	ISO 6
	CRDSNU	ISO 6
Standards-based cylinder	DSBC	ISO 6
	DSBF	ISO 6
Compact cylinder	ADN	ISO 6
	ADN-S	ISO 6
	DPDM	ISO 6
Semi-rotary drives	DRVS	ISO 6
	DSM	ISO 6
	DSM-B	ISO 6
	DRRD	ISO 6
Mini slides	DGSS	ISO 6
	DGST	ISO 6
	DGSL	ISO 7
Twin-piston cylinder	DGTZ	ISO 6
Guided drive	DFM-B	ISO 7
	DFM	ISO 7
Stopper cylinders	DFSP	ISO 6

Valves		→ Page 19
Designation	**Type**	**Recommended cleanroom class**
Solenoid valve	VUVG	ISO 5
	VUVG-S	ISO 5
	VUVS	ISO 6
	MH1	ISO 5
	MHE, MHP, MHA	ISO 6
Check valve	HGL	ISO 4
Quick exhaust valve	VBQF	ISO 4[1]
Shut-off valve	HE	ISO 4
Pressure regulator	VRPA	ISO 4
One-way flow control valve	VFOE	ISO 4
	GRLA, GRLZ	ISO 4
Proportional pressure regulators	VPPE	ISO 5
	VEAB	ISO 4
	VEAA	ISO 4
	VPPI	ISO 4

Valve terminals		→ Page 29
Designation	**Type**	**Recommended cleanroom class**
Valve manifold assembly	VTUS	ISO 6
Valve terminal	VTUX	ISO 5
	VTUG	ISO 5
	MPA-L	ISO 5
	MPA-S	ISO 5
	VTOC	ISO 5
	MH1	ISO 5
Motion Terminal	VTEM	ISO 5

Sensors		→ Page 39
Designation	**Type**	**Recommended cleanroom class**
Proximity switch	SDBT-MSX	–[2]
	SMT-8M-A	–[2]
	SMT-10M	–[2]
Position transmitter	SDAT-MHS	–[2]
	SMAT-8M	–[2]
Pressure sensor	SDE5	ISO 4
	SPAE	ISO 4
	SPAN	ISO 4[3]
	SPAN-B	ISO 4[3]
Pressure transmitter	SPTE	ISO 4[3]
Flow transmitter	SFTE	ISO 4
Flow sensor	SFAH	ISO 4[3]

Compressed air preparation		→ Page 45
Designation	**Type**	**Recommended cleanroom class**
Maintenance units and maintenance equipment	MS4	ISO 7
	MS6	ISO 7
Precision pressure regulator	MS6-LRP	ISO 5

Pneumatic connection technology		→ Page 57
Designation	**Type**	**Recommended cleanroom class**
Plastic tubing	PUN-H	–[2]
	PUN-H-SF	–[2]
	PUN-H-F	–[2]
	PTFEN	–[2]
	PEN	–[2]
	PLN	–[2]
	PFAN	–[2]
Push-in fitting	QS/QSM	ISO 4
	NPQH	ISO 4
	NPQE	ISO 4
	NPQR	ISO 4
Quick connector	NPCK	–[2]
	CK	–[2]

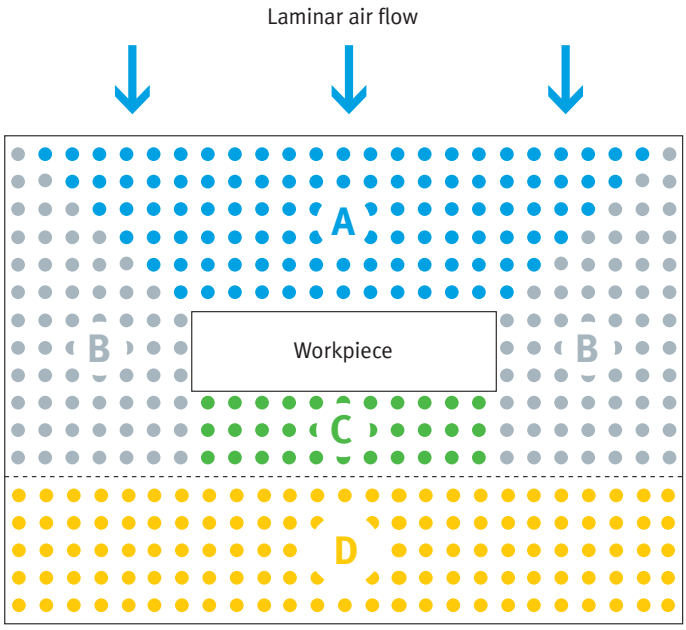
1) Variants with better suitability are available on request
2) Element installed statically, no meaningful evaluation possible according to ISO 14644-1
3) Variants with better suitability are available

Needs-based, multi-stage solution concept

Cleanroom suitability depends primarily on the installation location and the operating parameters of the product, which means that expert advice about the use of our products is very important. If you have any questions about using our products in your application, please contact us.

If you cannot find any suitable components in our standard product portfolio, we can adapt the products to your requirements.

Whether for cleanroom-specific packaging that reduces time and effort in logistics, modifications that are designed to optimise our products for critical applications, or for complex system solutions that suit your particular budget, you will benefit from our experience in cleanroom technology that we have built up over more than 30 years. We will be happy to share this experience with you.



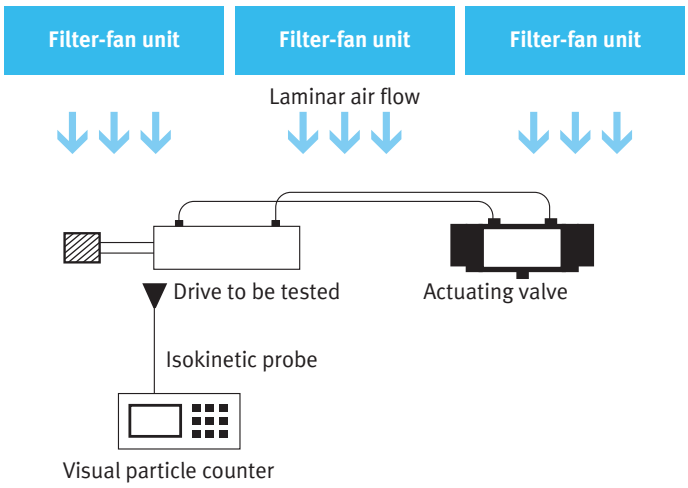
Using components in the laminar air flow in the cleanroom

A) Critical area from which particles can come into contact with the workpiece.
B) Non-critical area from which particles cannot easily come into contact with the workpiece.
C) Area in which obstructions to the laminar air flow should be minimised to prevent particles being transferred to the workpiece.
D) Particles from this area are removed by the laminar air flow and cannot come into contact with the workpiece.

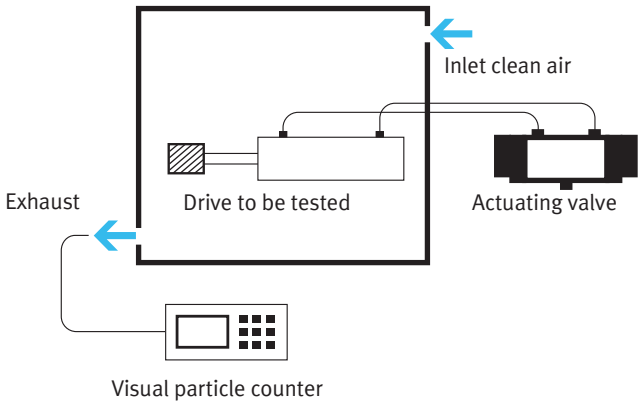
How does Festo test its products?

Products are classified based on their particle emissions in accordance with the ISO 14644 standard. The relevant classification is defined in ISO 14644-1. All Festo products suitable for cleanroom applications conform to the ISO standard. The measurement procedure is focused on those locations where the particle concentration is highest (HPC: highest particle concentration).

The advantage of this procedure compared to others is that it provides clear conclusions about the particle emission characteristics of our automation components. This particular procedure, during which a measuring probe is used in the laminar and isokinetic air flow, represents the situation in an actual cleanroom environment almost perfectly. The measurement depends entirely on the size of the measured environment, not on the size of the measured object. With this method, it is also possible to identify locations that are important for particle emission and to draw the relevant conclusions. First, the HPC locations on the product are identified; these are then measured for at least 100 minutes and evaluated. The subsequent statistical analysis of the measurement results is very reliable. Finally, the classification is determined based on the statistical values.
A significant issue with all product measurements is the parameters under which the measurement is conducted. In addition to the environment, it is the so-called representative operating scenario that plays a crucial role. This refers to the parameters that a manufacturer considers representative when the product is being used. The individual operating scenarios make it very difficult to compare products and their allocated classifications from different manufacturers.



Direct measurement



Process with average values

Festo uses direct measurement with HPC. This method is more accurate and more meaningful.

Classification

Festo bases the measurement of external particle emissions on ISO 14644. This is because we believe it is important to have traceable and repeatable measurements. It is the only way in which we can give you advice for your specific requirements. The associated classification with the particle limits is shown below for reference.
In the past, the US Federal Standard FED 209E also played an important part. However, it has been officially withdrawn. The table for FED 209E is shown below as a reference for customers who still make their comparisons based on this standard. This allows you to transfer the values.

ISO 14644-1 standard compared to US Federal Standard FED 209E

ISO classification number (N)	Maximum particle concentration allowed (particles per cubic metre of air[1])						US Federal Standard 209E
	0.1 µm	0.2 µm	0.3 µm	0.5 µm	1 µm	5 µm	
ISO Class 1	10[2]	[4]	[4]	[4]	[4]	[5]	–
ISO Class 2	100	24[2]	10[2]	[4]	[4]	[5]	–
ISO Class 3	1000	237	102	35[2]	[4]	[5]	1
ISO Class 4	10000	2370	1020	352	83[2]	[5]	10
ISO Class 5	100000	23700	10200	3520	832	[4], [5], [6]	100
ISO Class 6	1000000	237000	102000	35200	8320	293	1000
ISO Class 7	[3]	[3]	[3]	352000	83200	2930	10000
ISO Class 8	[3]	[3]	[3]	3520000	832000	29300	100000
ISO Class 9[7]	[3]	[3]	[3]	35200000	8320000	293000	–

1) All particle concentrations listed in the table are cumulative frequency related, e.g. the 10200 particles at 0.3 µm for ISO Class 5 include all particles equal to or larger than this particle size.
2) These particle concentrations result in large air sample volumes for classification. The sequential sampling procedure may be used.
3) Information on concentration limits in this area of the table is unsuitable due to a very high particle concentration.
4) Sampling and statistical limitations for particles at low concentrations are not suitable for classification.
5) Limitations of collected sampling for both low concentration particles and particles larger than 1 µm: these are not suitable for classification due to possible particle losses during the sampling procedure.
6) To determine this particle size in conjunction with ISO Class 5, the M descriptor for macroparticles may be adapted and applied together with at least one other particle size.
7) This class is only applicable for the operating state "Production".

Note:
We do not include the values in accordance with FED 209E in this product overview, because this standard is not a major consideration for Festo.

Software tools

Pneumatic sizing		Size pneumatic control loop systems quickly and energy-efficiently. In order to survive in a tough competitive environment, many companies are looking for ways to make savings in their production. Such savings can often be found in their existing compressed air systems, which have generally been in place for years. Up to 60% of energy costs can be saved through optimisation at both the production facility and system level. This tool can be found at ➔ **www.festo.com/x/pneumatic-sizing**
Air consumption of cylinders		Calculate your system's air consumption. Calculate your system's air consumption quickly and conveniently. Simply enter all the drives and tubing, set the cycle times and working pressure and the air consumption per minute and per day will be calculated for you. The input table including the result can be exported directly to Excel. This tool can be found at ➔ **www.festo.com/x/air-consumption**
Pneumatic simulation		Perfect simulations replace expensive real-life tests! The tool is an expert system that supports you in the selection and configuration of the entire pneumatic control chain. If one parameter is changed, the program automatically adapts all the others. This tool can be found at ➔ **www.festo.com/x/pneumatic-simulation**
Festo Design Tool 3D		The Festo Design Tool 3D is a 3D product configurator for generating specific CAD product combinations from Festo. The configurator makes your search for the right accessory easier, more reliable and faster. You can then order the module that has been created as a single order item, either completely pre-assembled or as individual parts in a single box. This considerably reduces your bill of materials, and downstream processes such as product ordering, order picking and assembly are significantly simplified. This tool can be found at ➔ **www.festo.com/x/festo-design-tool**
CO2 & TCO Guide		CO2 values and TCO for your application. Take a quantum leap in automation technology. By using suitable components from Festo in an intelligent way, you can reduce the energy consumption of your systems and thus specifically lower your production's carbon emissions. This tool can be found at ➔ **www.festo.com/x/co2-tco**

Piston rod cylinder >

Round cylinders

	 **Standards-based cylinder DSNU** ★	 **Round cylinders DSNU**	 **Round cylinders DSNU-S** ★
Mode of operation	Double-acting	Double-acting	Double-acting
Piston diameter	8 mm, 10 mm, 12 mm, 16 mm, 20 mm, 25 mm	32 mm, 40 mm, 50 mm, 63 mm	8 mm, 12 mm, 16 mm, 20 mm, 25 mm
Theoretical force at 0.6 MPa (6 bar, 87 psi), advancing	23 ... 295 N	482.5 ... 1870.3 N	30.2 ... 294.5 N
Stroke	1 ... 500 mm	1 ... 500 mm	1 ... 200 mm
Cushioning	Elastic cushioning rings/plates at both ends, Self-adjusting pneumatic end-position cushioning, Pneumatic cushioning, adjustable at both ends	Elastic cushioning rings/plates at both ends, Self-adjusting pneumatic end-position cushioning, Pneumatic cushioning, adjustable at both ends	Elastic cushioning rings/plates at both ends, Self-adjusting pneumatic end-position cushioning
Cleanroom class	Class 6 according to ISO 14644-1	Class 6 according to ISO 14644-1	Class 6 according to ISO 14644-1
Suitability for the production of Li-ion batteries	Metals with more than 1% by mass of copper, zinc or nickel by mass are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils, Metals with more than 1% by mass of copper, zinc or nickel are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils	Metals with more than 1% by mass of copper, zinc or nickel by mass are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils	Metals with more than 1% by mass of copper, zinc or nickel by mass are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils, Metals with more than 1% by mass of copper, zinc or nickel are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils
LABS (PWIS) conformity	VDMA24364-B1/B2-L, VDMA24364 zone III	VDMA24364-B1/B2-L, VDMA24364 zone III	VDMA24364-B2-L
Description	• ISO 6432 • Wide range of variants for customised applications • Good running performance and long service life • Self-adjusting pneumatic end-position cushioning saves time during commissioning and adapts optimally to load and speed changes • Piston rod with female or male thread • For position sensing • Variants recommended for production systems for manufacturing lithium-ion batteries	• Wide range of variants for customised applications • Good running performance and long service life • Self-adjusting pneumatic end-position cushioning saves time during commissioning and adapts optimally to load and speed changes • Piston rod with female or male thread • For position sensing • Variants recommended for production systems for manufacturing lithium-ion batteries	• Short variant of ISO cylinder DSNU • Quick and easy installation, even in tight spaces • Light weight • Self-adjusting pneumatic end-position cushioning saves time during commissioning and adapts optimally to load and speed changes • Piston rod with male thread • For position sensing • Variants recommended for production systems for manufacturing lithium-ion batteries • Sustainable in production thanks to reduced use of materials
online: ➔	dsnu	dsnu	dsnu

Piston rod cylinder >

Profile and tie rod cylinders

	 Standards-based cylinders pre-configured ★ DSBC	 Standards-based cylinders, Clean Design DSBF
Mode of operation	Double-acting	Double-acting
Piston diameter	32 mm, 40 mm, 50 mm, 63 mm, 80 mm, 100 mm, 125 mm	32 mm, 40 mm, 50 mm, 63 mm, 80 mm, 100 mm, 125 mm
Theoretical force at 0.6 MPa (6 bar, 87 psi), advancing	483 ... 7363 N	415 ... 7363 N
Stroke	1 ... 2800 mm	1 ... 2800 mm
Cushioning	Elastic cushioning rings/plates at both ends, Self-adjusting pneumatic end-position cushioning, Pneumatic cushioning, adjustable at both ends	Elastic cushioning rings/plates at both ends, Self-adjusting pneumatic end-position cushioning, Pneumatic cushioning, adjustable at both ends
Cleanroom class	Class 6 according to ISO 14644-1	Class 6 according to ISO 14644-1
Suitability for the production of Li-ion batteries	Metals with more than 1% by mass of copper, zinc or nickel by mass are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils	
LABS (PWIS) conformity	VDMA24364-B1/B2-L, VDMA24364-C1-L, VDMA24364 zone III	VDMA24364-B2-L, VDMA24364 zone III
Description	• Self-adjusting pneumatic end-position cushioning saves time during commissioning and adapts optimally to load and speed changes • ISO 15552 (ISO 6431, VDMA 24562) • Standard profile with two sensor slots • Wide range of variants for customised applications • Comprehensive range of mounting accessories for just about every type of installation • For position sensing • Variants recommended for production systems for manufacturing lithium-ion batteries	• ISO 15552 • Increased corrosion protection • Easy-to-clean design • FDA-approved lubrication and sealing on the basic version • Long service life thanks to optional dry-running seal • Self-adjusting pneumatic end-position cushioning saves time during commissioning and adapts optimally to load and speed changes • For position sensing
online: →	dsbc	dsbf

Piston rod cylinder >

Compact, short-stroke and flat cylinders

	 **Compact cylinders ADN** ★	 **Compact cylinder ADN-S** ★
Mode of operation	Double-acting	Double-acting
Piston diameter	12 mm, 16 mm, 20 mm, 25 mm, 32 mm, 40 mm, 50 mm, 63 mm, 80 mm, 100 mm, 125 mm	6 mm, 10 mm, 12 mm, 16 mm, 20 mm, 25 mm, 32 mm, 40 mm, 50 mm, 63 mm
Theoretical force at 0.6 MPa (6 bar, 87 psi), advancing	51 ... 7363 N	17 ... 1870 N
Stroke	1 ... 500 mm	5 ... 50 mm
Cushioning	Elastic cushioning rings/plates at both ends, Self-adjusting pneumatic end-position cushioning	Elastic cushioning rings/plates at both ends, No cushioning
Cleanroom class	Class 6 according to ISO 14644-1	Class 6 according to ISO 14644-1
Suitability for the production of Li-ion batteries	Metals with more than 1% by mass of copper, zinc or nickel by mass are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils	Metals with more than 1% by mass of copper, zinc or nickel by mass are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils, Metals with more than 1% by mass of copper, zinc or nickel are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils
LABS (PWIS) conformity	VDMA24364-B1/B2-L, VDMA24364 zone III	VDMA24364-B2-L
Description	• ISO 21287 • Up to 50% less installation space than comparable standards-based cylinders to ISO 15552 • Good running performance and long service life • Wide range of variants for customised applications • For position sensing • Variants recommended for production systems for manufacturing lithium-ion batteries	• Minimal installation space • Very lightweight • Ideal for small movements • Piston rod with female or male thread • For position sensing • Variants recommended for production systems for manufacturing lithium-ion batteries • Sustainable in production thanks to reduced use of materials
online: ➔	adn	adn-s

Piston rod cylinder >

Multimount and cartridge cylinders

	 **Compact cylinders, multimount** **DPDM**
Mode of operation	Double-acting, Pushing, Single-acting, Pulling
Piston diameter	6 mm, 10 mm, 16 mm, 20 mm, 25 mm, 32 mm
Theoretical force at 0.6 MPa (6 bar, 87 psi), advancing	9 ... 483 N
Stroke	5 ... 50 mm
Cushioning	Elastic cushioning rings/plates at both ends
Cleanroom class	Class 6 according to ISO 14644-1
Suitability for the production of Li-ion batteries	Metals with more than 1% by mass of copper, zinc or nickel by mass are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils
LABS (PWIS) conformity	VDMA24364-B2-L
Description	• Mounting using through-hole and female thread • Compact design • Piston rod variants • For position sensing • Sustainable in production thanks to reduced use of materials
online: →	dpdm

Piston rod cylinder >

Stainless steel cylinders

	 **Standards-based cylinder** **CRDSNU, CRDSNU-B**
Mode of operation	Double-acting
Piston diameter	12 mm, 16 mm, 20 mm, 25 mm
Theoretical force at 0.6 MPa (6 bar, 87 psi), advancing	68 ... 295 N
Stroke	1 ... 500 mm
Cushioning	Elastic cushioning rings/plates at both ends, Self-adjusting pneumatic end-position cushioning, Pneumatic cushioning, adjustable at both ends
Cleanroom class	Class 6 according to ISO 14644-1
LABS (PWIS) conformity	VDMA24364-B2-L, VDMA24364 zone III
Description	• ISO 6432 • Corrosion resistant against aggressive ambient conditions • Easy-to-clean design • Long service life thanks to optional dry-running seal • Wide range of variants for customised applications • Self-adjusting pneumatic end-position cushioning saves time during commissioning and adapts optimally to load and speed changes • For position sensing
online: →	crdnsu

Software tools

Mass moment of inertia

Juggling pencils and pocket calculators is now a thing of the past. No matter whether you have discs, blocks, push-on flanges, grippers, etc., this tool does the job of calculating all the mass moments of inertia. Just save, send or print and you're finished.

This tool can be found at
➔ **www.festo.com/x/mass-moment-of-inertia**

Semi-rotary drives >

Semi-rotary vane drives

	 **Semi-rotary drives DRVS** ★	 **Semi-rotary drives DSM**	 **Semi-rotary drives DSM-B, DSM-HD-B**
Size	6, 8, 12, 16, 25, 32, 40	6, 8, 10	12, 16, 25, 32, 40, 63
Theoretical torque at 0.6 MPa (6 bar, 87 psi)	0.15 ... 20 Nm	0.15 ... 1.7 Nm	1.25 ... 80 Nm
Permissible mass moment of inertia	6.5 ... 350 kgcm²	6.5 ... 26 kgcm²	50 ... 5000 kgcm²
Position sensing	Via proximity switch	Via proximity switch, Without	Via proximity switch
Swivel angle	0 ... 270 deg	0 ... 240 deg	0 ... 270 deg
Cleanroom class	Class 6 according to ISO 14644-1	Class 6 according to ISO 14644-1	Class 6 according to ISO 14644-1
LABS (PWIS) conformity	VDMA24364-B2-L	VDMA24364-B2-L, VDMA24364-B1/B2-L	VDMA24364-B2-L, VDMA24364-B1/B2-L
Description	• Double-acting semi-rotary drive with rotary vane • Lighter than other semi-rotary drives • Fixed swivel angle, adjustable swivel angle possible with the help of accessories • Housing protected against splash water and dust • Sustainable in production thanks to reduced use of materials	• Double-acting semi-rotary drive with rotary vane or with tandem rotary vane • Fixed or infinitely adjustable swivel angle • With spigot shaft or hollow flange shaft • With elastic cushioning rings/plates at both ends	• Double-acting semi-rotary drive with rotary vane, with tandem rotary vane or with heavy-duty bearing • Swivel angle is infinitely adjustable over the entire swivel range • With elastic cushioning rings/plates at both ends, adjustable or with shock absorbers at both ends, self-adjusting
online: ➔	drvs	dsm	dsm

Semi-rotary drives >

Semi-rotary drives with rack and pinion

	 **Semi-rotary drives DRRD** ★
Size	8, 10, 12, 16, 20, 25, 32, 35, 40, 50, 63
Theoretical torque at 0.6 MPa (6 bar, 87 psi)	0.2 ... 112 Nm
Permissible mass moment of inertia	15 ... 420000 kgcm²
Position sensing	Via proximity switch
Swivel angle	180 deg
Cleanroom class	Class 6 according to ISO 14644-1
LABS (PWIS) conformity	VDMA24364 zone III
Description	• Twin-piston drive, power transmission via rack and pinion principle • Extremely accurate in the end positions • Very high load bearing capacity • Very good axial run-out at the flanged shaft • Greater stability even with smaller sizes • Supply port on one side • Variants with intermediate position for additional positioning at 90° • Variants with external sensor mounting • Variants with end-position locking on both sides • Sustainable in production thanks to reduced use of materials
online: ➔	drrd

Drives with guides >

Linear slides

	 Mini slide DGSS	 Mini slides DGST ★	 Mini slides DGSL
Piston diameter	6 mm, 10 mm, 16 mm, 20 mm	6 mm, 8 mm, 10 mm, 12 mm, 16 mm, 20 mm, 25 mm	6 mm, 8 mm, 10 mm, 12 mm, 16 mm, 20 mm, 25 mm, 32 mm
Theoretical force at 0.6 MPa (6 bar, 87 psi), advancing	17 ... 188 N	34 ... 589 N	17 ... 483 N
Stroke	5 ... 60 mm	10 ... 200 mm	10 ... 200 mm
Cushioning	Elastomer cushioning, double-sided, stroke not adjustable	Short elastic cushioning rings/pads at both ends, Elastomer cushioning, double-sided, stroke not adjustable, Elastic cushioning rings/plates at both ends, Elastic cushioning rings/pads at both ends with fixed stop, External hydraulic cushioning	Short elastic cushioning rings/pads at both ends, No cushioning, Elastic cushioning rings/plates at both ends, Elastic cushioning rings/pads at both ends with fixed stop, Self-adjusting, progressive shock absorber at both ends, with reducing sleeve, Progressive shock absorber at both ends
Position sensing	Via proximity switch	Via proximity switch	Via proximity switch
Cleanroom class	Class 6 according to ISO 14644-1	Class 6 according to ISO 14644-1	Class 7 according to ISO 14644-1
Suitability for the production of Li-ion batteries	Metals with more than 1% by mass of copper, zinc or nickel by mass are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils, Metals with more than 1% by mass of copper, zinc or nickel are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils	Metals with more than 1% by mass of copper, zinc or nickel by mass are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils	
LABS (PWIS) conformity	VDMA24364-C1-L	VDMA24364-B1/B2-L	VDMA24364-B1/B2-L
Description	• Slim design • Excellent positioning accuracy • Precise and resilient roller bearing guide • Optimum price/performance ratio • Slide and yoke plate from one component • Can be operated without additional cushioning elements • Optional: stroke adjustment and external cushioning using accessories • Recommended for production systems for manufacturing lithium-ion batteries	• Powerful twin-piston drive • Shortest mini slide on the market • Precise recirculating ball bearing guide • Versatile mounting options • Version with mirrored supply port configuration and sensor slots for compact assembly available to order using the configurator • Variants recommended for production systems for manufacturing lithium-ion batteries • Sustainable in production thanks to reduced use of materials	• High load capacity and positioning accuracy • Maximum movement precision thanks to ground-in ball bearing cage guide • Maximum flexibility thanks to 8 sizes and a large selection of cushioning variants • Variants with clamping unit or end-position locking for fixing the guide slide • Wide variety of mounting and attachment options • Compact design
online: →	dgss	dgst	dgsl

Product overview

Drives with guides >

Drives with guide rods

	 Twin cylinder DGTZ	 Guided drives DFM, DFM-B ★
Piston diameter	6 mm, 10 mm, 16 mm, 20 mm, 25 mm, 32 mm	6 mm, 10 mm, 12 mm, 16 mm, 20 mm, 25 mm, 32 mm, 40 mm
Theoretical force at 0.6 MPa (6 bar, 87 psi), advancing	18.6 ... 966 N	17 ... 754 N
Stroke	10 ... 200 mm	5 ... 400 mm
Cushioning	Elastic cushioning rings/plates at both ends	Elastic cushioning rings/plates at both ends, Pneumatic cushioning, adjustable at both ends, Shock absorber, soft characteristic curve
Position sensing	Via proximity switch	Via proximity switch
Cleanroom class	Class 6 according to ISO 14644-1	Class 7 according to ISO 14644-1
Suitability for the production of Li-ion batteries		Metals with more than 1% by mass of copper, zinc or nickel by mass are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils, Metals with more than 1% by mass of copper, zinc or nickel are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils
LABS (PWIS) conformity	VDMA24364 zone III	VDMA24364-B1/B2-L
Description	• Minimal space requirement • Minimal mounting time • High resistance to torques and lateral forces • High rigidity thanks to its guide rods with large diameter and two plain-bearing bushes • Wide range of mounting options • Drive and guide unit in a single housing • Plain bearing	• Drive and guide unit in a single housing • High resistance to torques and lateral forces • Plain or recirculating ball bearing guide • Wide variety of mounting and attachment options • Wide range of variants for customised applications • Variants recommended for production systems for manufacturing lithium-ion batteries
online: →	dgtz	dfm

Stopper cylinders and feed separators >

Stopper cylinders

	 **Stopper cylinders DFSP**
Piston diameter	16 mm, 20 mm, 32 mm, 40 mm, 50 mm
Permissible impact force on the advanced piston rod	710 ... 6280 N
Stroke	5 ... 30 mm
Position sensing	Via proximity switch
Cleanroom class	Class 6 according to ISO 14644-1
LABS (PWIS) conformity	VDMA24364-B1/B2-L
Description	• Trunnion version with/without protection against rotation, with/without female thread • Roller version with protection against rotation • Compact design • Sensor slots on 3 sides • Long service life thanks to very good cushioning characteristics and sturdy piston rod guide • Safe stopping of workpiece carriers, pallets and packages weighing up to 90 kg
online: →	dfsp

Customised components – for your specific requirements

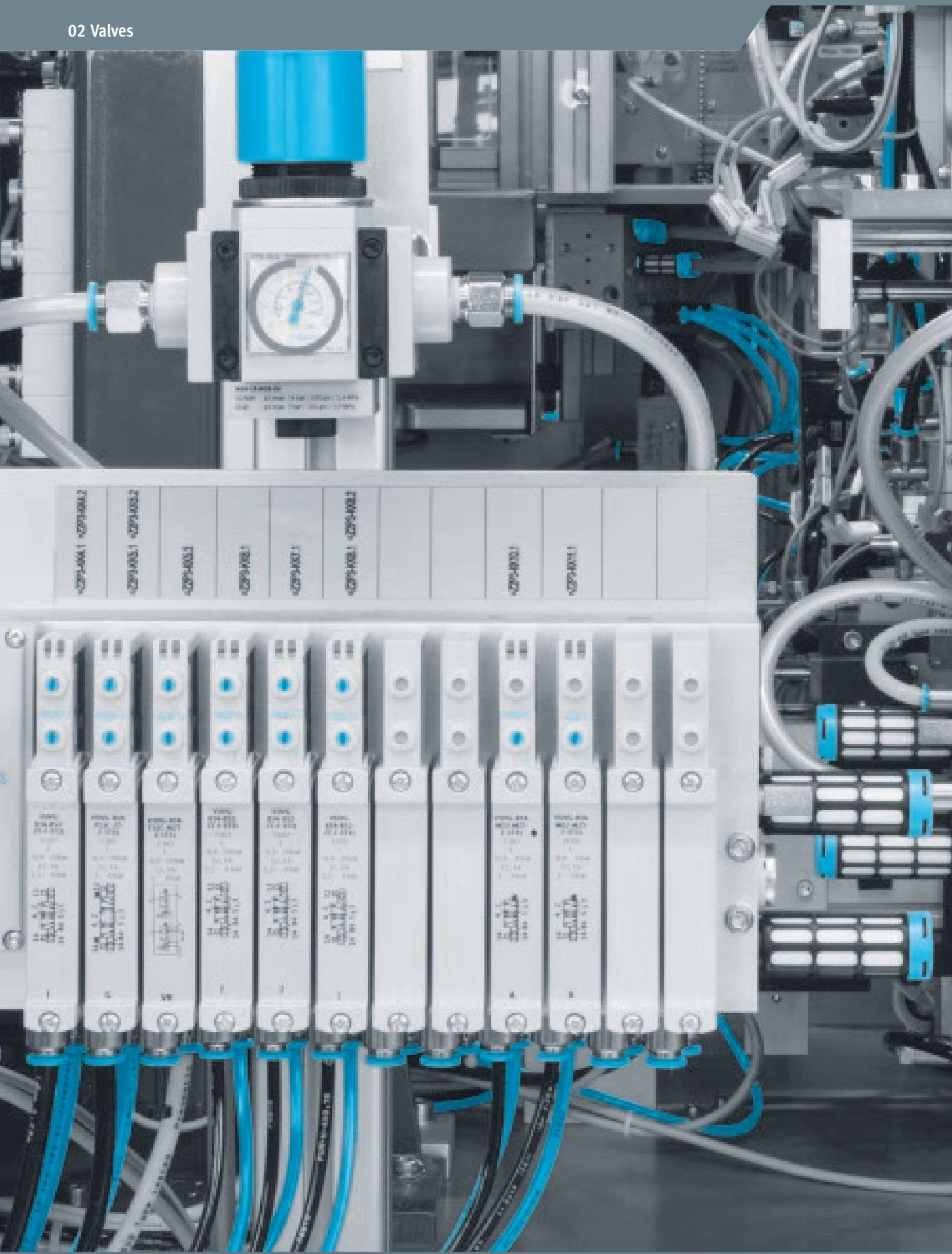
Drives with customised designs

Can't find the pneumatic drive you need in our catalogue?

We can offer you customised components that are tailored to your specific requirements.

Common product modifications:
- Materials for special environmental conditions
- Customised dimensions
- Special strokes
- Customised mounting options
- Implementation of special cylinder functions (cylinder/valve combinations, single-acting principle, etc.)

Many additional variants are possible.
Ask your Festo sales engineer, who will be happy to help you:
➔ **www.festo.com/contact**



Software tools

Pneumatic sizing

Size pneumatic control loop systems quickly and energy-efficiently.
In order to survive in a tough competitive environment, many companies are looking for ways to make savings in their production.

Such savings can often be made in their existing compressed air systems, which have generally been in use for years. By optimising the compressed air supply at both plant and system level, up to 60% of energy costs can be saved.

This tool can be found at
➔ **www.festo.com/x/pneumatic-sizing**

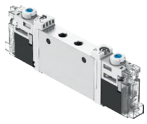
Electrically and pneumatically actuated directional control valves >

Universal directional control valves

	 **Solenoid valves, for individual connection** ★ **VUVG**	 **Solenoid valves, plug-in VUVG-T1**	 **Solenoid valves, plug-in VUVG-B-F1A**
Actuation type	Electric	Electric	Electric
Pneumatic connection 1	G1/4, G1/8, M3, M5, M7		
Pneumatic working port	Flange, G1/4, G1/8, M3, M5, M7, QS-1/4, QS-1/8, QS-10, QS-3, QS-3/16, QS-3/8, QS-4, QS-5/16, QS-5/32, QS-6, QS-8	Flange, G1/4, G1/8, M5, M7	Flange
Operating pressure [MPa]	-0.09 ... 1 MPa	-0.09 ... 1 MPa	-0.09 ... 1 MPa
Operating pressure	-0.9 ... 10 bar	-0.9 ... 10 bar	-0.9 ... 10 bar
Standard nominal flow rate	80 ... 1380 l/min	130 ... 1200 l/min	130 ... 510 l/min
Valve function	2x3/2-way, monostable, closed, 2x3/2-way, open, monostable, 2x3/2-way, open/ closed, monostable, 5/2 double solenoid, 5/2-way, monostable, 5/3-way, pressurised, 5/3 exhausted, 5/3 closed	2x3/2-way, monostable, closed, 2x3/2-way, open, monostable, 2x3/2-way, open/ closed, monostable, 3/2-way, closed, monostable, 3/2 open, single solenoid, 5/2 double solenoid, 5/2-way, monostable, 5/3-way, pressurised, 5/3 exhausted, 5/3 closed	2x3/2-way, monostable, closed, 2x3/2-way, open, monostable, 2x3/2-way, open/ closed, monostable, 5/2 double solenoid, 5/2-way, monostable, 5/3-way, pressurised, 5/3 exhausted, 5/3 closed
Electrical connection	2-pin, 3-pin, Plug pattern H, horizontal connection, M8x1 A-encoded to EN 61076-2-104, Plugs, Via electrical sub-base, Via electric pilot valve	Via sub-base	Via sub-base
Cleanroom class	Class 5 according to ISO 14644-1	Class 5 according to ISO 14644-1	Class 5 according to ISO 14644-1
Suitability for the production of Li-ion batteries			Metals with more than 1% by mass of copper, zinc or nickel by mass are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils
LABS (PWIS) conformity	VDMA24364-B1/B2-L, VDMA24364 zone III	VDMA24364-B2-L, VDMA24364-B1/B2-L	VDMA24364 zone III
Description	• Compact universal valve • Connection technology via electrical connection box (E-box) • High flow rate relative to its size • In-line valves can be used as individual valves or manifold valves	• Sub-base valve, semi in-line valve • For valve terminal VTUG with multi-pin, fieldbus interface • Variants to EU Explosion Protection Directive (ATEX)	• Sub-base valve • For valve terminal VTUG with multi-pin, fieldbus interface • Recommended for production systems for manufacturing lithium-ion batteries
online: ➔	vuvg	vuvg	vuvg_t1_f1a

Electrically and pneumatically actuated directional control valves >

Universal directional control valves

	 **Solenoid valves VUVG-L-F1A**	 **Solenoid valves VUVS** ★
Actuation type	Electric	Electric
Pneumatic connection 1		1/8 NPT, G1/4, G1/8, G3/8
Pneumatic working port	M5	1/8 NPT, 1/4 NPT, 3/8 NPT, G1/4, G1/8, G3/8, QS-1/2, QS-1/4, QS-10, QS-12, QS-3/8, QS-4, QS-5/16, QS-5/32, QS-6, QS-8
Operating pressure [MPa]	0.15 ... 0.7 MPa	-0.09 ... 1 MPa
Operating pressure	1.5 ... 7 bar	-0.9 ... 10 bar
Standard nominal flow rate	180 ... 195 l/min	500 ... 2400 l/min
Valve function	2x3/2-way, monostable, closed, 5/2-way, monostable	2x3/2-way, monostable, closed, 2x3/2-way, open, monostable, 2x3/2-way, open/closed, monostable, 3/2-way, closed, monostable, 3/2 open, single solenoid, 5/2 double solenoid, 5/2-way, monostable, 5/3-way, pressurised, 5/3 exhausted, 5/3 closed
Electrical connection	2-pin, Plug pattern H, horizontal connection, Plugs	3-pin, Socket, Type B, Type C, Screw terminal, To EN 175301-803, To industry standard (11 mm)
Cleanroom class	Class 5 according to ISO 14644-1	Class 6 according to ISO 14644-1
Suitability for the production of Li-ion batteries	Metals with more than 1% by mass of copper, zinc or nickel by mass are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils	
LABS (PWIS) conformity	VDMA24364 zone III	VDMA24364-B1/B2-L, VDMA24364 zone III
Description	• Compact universal valve • Connection technology via electrical connection box (E-box) • High flow rate relative to its size • In-line valves can be used as individual valves or manifold valves • Recommended for production systems for manufacturing lithium-ion batteries	• Universal valve, sturdy and durable • Low cost with no performance limitations • Can be used as individual valves or manifold valves VTUS
online: ➔	vuvg_s_f1a	vuvs

Electrically and pneumatically actuated directional control valves >

Application-specific directional control valves

	 Solenoid valves MHA1, MHP1	 Solenoid valves MHE2, MHP2, MHA2, MHE3, MHP3, MHA3, MHE4, MHP4, MHA4
Design	Poppet valve with spring return	Pressure-relieved poppet valve
Valve function	2/2-way, closed, monostable, 2x2/2-way, monostable, closed, 3/2-way, closed, monostable, 3/2 open, single solenoid	3/2-way, closed, monostable, 3/2 open, single solenoid, 5/2-way, monostable
Operating pressure [MPa]	-0.09 ... 0.8 MPa	-0.09 ... 0.8 MPa
Operating pressure	-0.9 ... 8 bar	-0.9 ... 8 bar
Ambient temperature	-5 ... 50°C	-5 ... 60°C
Pneumatic connection 1	Sub-base, Prepared for QSP10, QS-3, QS-4	Sub-base, G1/4, G1/8, M7, QS-4, QS-6, QS-8
Standard nominal flow rate	10 ... 30 l/min	90 ... 400 l/min
Cleanroom class	Class 5 according to ISO 14644-1	Class 6 according to ISO 14644-1
LABS (PWIS) conformity	VDMA24364-B2-L	VDMA24364-B1/B2-L
Description	• Directly actuated poppet valve • Miniature valve: grid dimension 10 mm • Switching times down to 4 ms • Sub-base valve • Manifold block for 2 ... 10 valves • Use as a pilot valve • UL certification; same connections and cables as for the VUVG	• Directly actuated poppet valve • Fast-switching valve: switching times down to 2 ms • Direct mounting, individual sub-base, manifold assembly • Manifold block for 2 ... 10 valves
online: →	mh1	mh2

Pneumatic shut-off valves >

Check valves

	 Check valves, piloted HGL ★
Pneumatic connection 1	G1/2, G1/4, G1/8, G3/8, M5, QS-10, QS-12, QS-4, QS-6, QS-8
Standard nominal flow rate 1->2 (0.6->0.5 MPa, 6->5 bar, 87->72.5 psi)	130 ... 1600 l/min
Operating pressure [MPa]	0.05 ... 1 MPa
Operating pressure	0.5 ... 10 bar
Cleanroom class	Class 4 according to ISO 14644-1
LABS (PWIS) conformity	VDMA24364-B2-L
Description	• Valve function: piloted non-return function • Screw-in with male thread • Pneumatically piloted • Pilot air connection: M5, G1/8, G1/4, G3/8, QS-4 • Manually actuated exhaust possible with separate accessory
online: →	hgl

Pneumatic shut-off valves >

Quick exhaust valves

	 **Quick exhaust valves** **VBQF**
Pneumatic connection 1	G1/4, G1/8, QS-6, QS-8
Standard nominal flow rate, exhaust 0.6->0.5 MPa (6->5 bar, 87->72.5 psi)	850 ... 2500 l/min
Standard nominal flow rate, pressurisation 0.6->0.5 MPa (6->5 bar, 87->72.5 psi)	350 ... 960 l/min
Operating pressure	0.2 ... 10 bar
Cleanroom class	Class 4 according to ISO 14644-1
LABS (PWIS) conformity	VDMA24364-B1/B2-L
Description	• Minimal height • High flow rate • Reduced noise emission • Available with silencer • Available with ducted or unducted exhaust air • For higher cycle times
online: ➔	vbqf

Pneumatic shut-off valves >

Shut-off valves and ball valves

	 **Shut-off valves** **HE**
Valve function	2/2 double solenoid, 3/2 double solenoid
Pneumatic connection 1	QS-10, QS-12, QS-6, QS-8, R1/2, R1/4, R1/8, R3/8
Standard nominal flow rate	256.5 ... 834.3 l/min
Operating pressure [MPa]	-0.095 ... 1 MPa
Operating pressure	-0.95 ... 10 bar
Cleanroom class	Class 4 according to ISO 14644-1
LABS (PWIS) conformity	VDMA24364-B1/B2-L
Description	• Shut-off valve, manually operated • Connection: thread at both ends, push-in connector at both ends, thread/push-in connector • Different mounting options
online: ➔	he

Pressure regulating valves >

Pressure regulators

	 Pressure regulator VRPA
Pressure regulation range	1 ... 8 bar
Standard nominal flow rate	80 ... 130 l/min
Pneumatic connection 1	M5, QS-4, QS-6, QS-8, R1/4, R1/8
Pneumatic connection 2	QS-4, QS-6, QS-8
Ambient temperature	0 ... 60°C
Cleanroom class	Class 4 according to ISO 14644-1
LABS (PWIS) conformity	VDMA24364-B2-L
Description	• Regulates the operating pressure independently of the fluctuating inlet pressure • With secondary exhaust and with return flow function • Piston regulator with through pressure supply • Greater energy efficiency thanks to movement-specific pressure adjustment • Directly actuated • Available with pressure gauge • Connections: push-in connector at both ends, thread/push-in connector • Sustainable operation thanks to reduced pressure level
online: →	vrpa

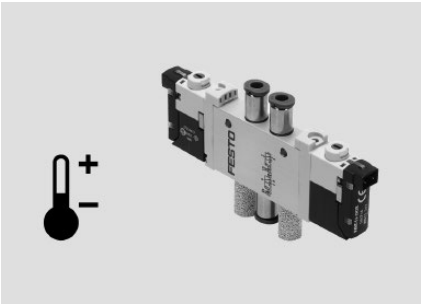
One-way flow control valves

	 **One-way flow control valves VFOE-L** ★	 **One-way flow control valves GRLA, GRLZ, GRLSA, CRGRLA** ★
Valve function	Exhaust air one-way flow control function, Supply air one-way flow control function	Exhaust air one-way flow control function, One-way flow control function, Supply air one-way flow control function
Pneumatic connection 1	QS-10, QS-4, QS-6, QS-8	Female thread G1/4, For barbed connector I.D. 4 mm Via union nut, 6 mm Via union nut, G1/2, G1/4, G1/8, G3/4, G3/8, M3, M5, PK-3, PK-3 Via union nut, PK-4, PK-4 Via union nut, PK-6 Via union nut, QS-10, QS-12, QS-3, QS-4, QS-6, QS-8
Standard nominal flow rate in flow control direction	85 ... 750 l/min	0 ... 4320 l/min
Adjusting element	Rotary knob with detent	Internal hexagon, Knurled screw, Slotted head screw
Cleanroom class	Class 4 according to ISO 14644-1	Class 4 according to ISO 14644-1
Suitability for the production of Li-ion batteries		Metals with more than 1% by mass of copper, zinc or nickel by mass are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils
LABS (PWIS) conformity	VDMA24364 zone III	VDMA24364-B2-L, VDMA24364-B1/B2-L
Description	• Low-cost solution for standard applications • Simple and reliable adjustment of pneumatic cylinder speed • Extremely easy assembly • Fast commissioning • Compact dimensions	• Functional combination of one-way flow control valve and piloted check valve • Flow control valve, flow control at one end • Polymer, metal or stainless steel design • Standard, mini, in-line variants with different flow rates • Connections: thread at both ends, push-in connector at both ends, thread/push-in connector
online: →	vfoe	grla

Pressure regulators

	 Proportional pressure regulators VPPE ★	 Proportional-pressure regulators VEAB	 Proportional-pressure regulators VEAA	 Proportional-pressure regulators VPPI
Valve function	3-way proportional pressure regulator, 3-way proportion-al-pressure regulator, closed	3-way proportional pressure regulator	3-way proportional pressure regulator	3-way proportional pressure regulator
Pneumatic connection 1	G1/8	Flange, QS-4	Flange, QS-4	G1/8
Pressure regulation range [MPa]	0.002 ... 1 MPa			-0.1 ... 1.2 MPa
Pressure regulation range	0.02 ... 10 bar			-1 ... 16 bar
Operating pressure [MPa]	0.8 MPa			
Operating pressure	8 bar			0 ... 13 bar
Standard nominal flow rate	310 ... 1250 l/min	≥4.5 l/min	≥7 l/min	150 ... 1630 l/min
Cleanroom class	Class 5 according to ISO 14644-1	Class 4 according to ISO 14644-1	Class 4 according to ISO 14644-1	Class 4 according to ISO 14644-1
Suitability for the production of Li-ion batteries	Metals with more than 1% by mass of copper, zinc or nickel by mass are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils			
LABS (PWIS) conformity	VDMA24364-B2-L	VDMA24364 zone III	VDMA24364 zone III	VDMA24364-B1/B2-L
Description	• Piloted pressure regulator • Setpoint input as analogue voltage signal (0 ... 10 V) • Electrical connection via M12x1 plug, 4 or 5-pin • Available with setpoint module • Variant with display with three retrievable presets and digital controller electronics • For simple control tasks • Variants recommended for production systems for manufacturing lithium-ion batteries	• Silent operation • Very low power consumption • Highly precise • Integrated piezo technology • Short switching times • Mounting: using through-holes, H-rail mounting • Sustainable operation thanks to reduced pressure level and efficient control	• Silent operation • Very low power consumption • Highly precise • Integrated piezo technology • Durable • Mounting: via through-holes, H-rail mounting, on mounting plate or sub-base • Sustainable operation thanks to reduced pressure level and efficient control	• Select between three predefined and one customer-specific controller preset • With or without display • Low-noise, flexible and highly dynamic • Precise and stable change-over, rapid switching of setpoint by high-performance moving coil actuator • Control via analogue current or voltage signal, digital pattern for adjustable setpoint values or pulse-width modulation signal
online: →	vppe	veab	veaa	vppi

Customised components – for your specific requirements



Valves with customised designs

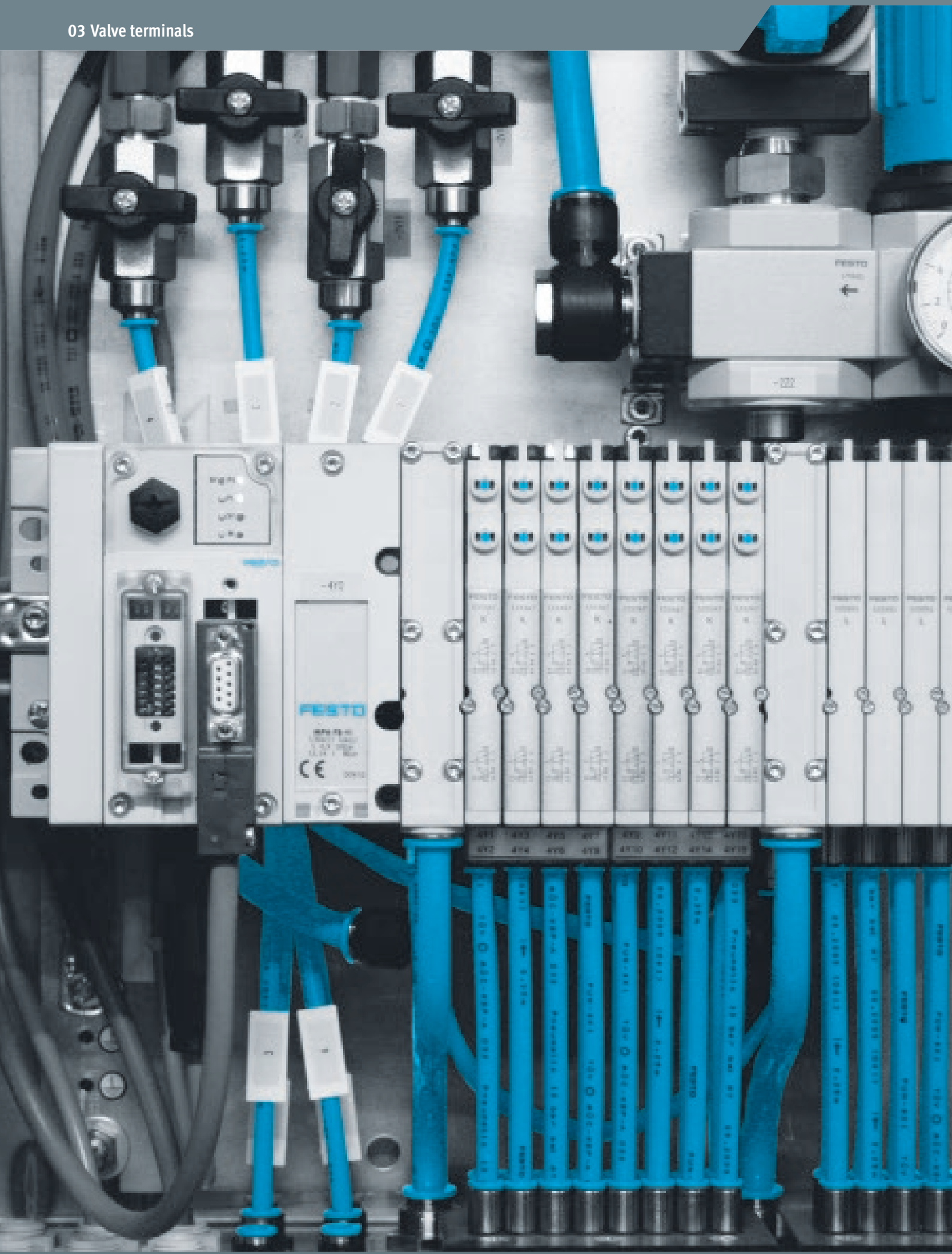
Can't find the valve you need in our catalogue?

We can offer you customised components that are tailored to your specific requirements.

Common product modifications:
- Coatings for special ambient conditions
- Customised cables: length, pin allocation, pre-assembled with plug
- Modified actuating elements
- Modified connecting thread
- Modified valve sub-bases

Many additional variants are possible.
Ask your Festo sales engineer, who will be happy to help you:
➔ **www.festo.com/contact**

Product overview


FESTO
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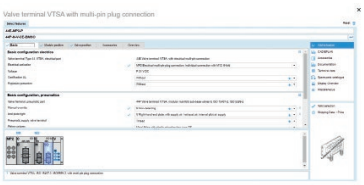
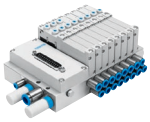
Software tools

Configurator for valve terminals

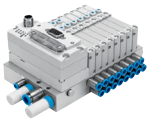


Design a product with numerous features reliably and quickly with the help of the configurator.
Select all the required product features step-by-step. The use of logic checks ensures that only correct configurations are available for selection.
A dynamic graphic generated on the basis of the configuration provides a visual aid for selecting the correct product features.
You can find the configurator for your product
1. at www.festo.com/catalogue/ventilinsel
2. Select the product you want
3. Click on the blue “Configure product” button

Universal valve terminals

	 Valve terminals VTUX-A-P	 Valve terminals with CPX-AP-A terminal VTUX-A-P-APA	 Valve manifolds VTUG-S	 Valve terminals with multi-pin plug/fieldbus connection VTUG
Valve size	10 mm	10 mm	10 mm, 14 mm, 18 mm	10 mm, 14 mm, 18 mm
Valve function	2x3/2-way, monostable, closed, 2x3/2-way, open, monostable, 5/2 double solenoid, 5/2-way, monostable, 5/3 closed	2x3/2-way, monostable, closed, 2x3/2-way, open, monostable, 5/2 double solenoid, 5/2-way, monostable, 5/3 closed	2x3/2-way, monostable, closed, 2x3/2-way, open, monostable, 2x3/2-way, open/closed, monostable, 5/2 double solenoid, 5/2-way, monostable, 5/3-way, pressurised, 5/3 exhausted, 5/3 closed	2x3/2-way, monostable, closed, 2x3/2-way, open, monostable, 2x3/2-way, open/closed, monostable, 3/2-way, closed, monostable, 3/2 open, single solenoid, 5/2 double solenoid, 5/2-way, monostable, 5/3-way, pressurised, 5/3 exhausted, 5/3 closed
Max. standard nominal flow rate			380 l/min at 10 mm, 780 l/min at 14 mm, 1380 l/min at 18 mm	330 l/min at 10 mm, 630 l/min at 14 mm, 1200 l/min at 18 mm
Max. no. of valve positions	32	32	16	24
Max. no. of pressure zones	16	16	9	13
Electrical actuation			Individual connection	AP interface, Individual connection, Fieldbus, I-Port, IO-Link®, Multi-pin plug
Valve terminal design	Modular and expandable	Modular and expandable	Fixed grid	Fixed grid
Cleanroom class	Class 5 according to ISO 14644-1	Class 5 according to ISO 14644-1	Class 5 according to ISO 14644-1	Class 5 according to ISO 14644-1
LABS (PWIS) conformity	VDMA24364-C1-L	VDMA24364-C1-L	VDMA24364-B2-L	VDMA24364-B1/B2-L
Description	• IO-Link® / multipin or bus communication • Actuating switching valves • Modular and cost-effective • High flow rates • Also flexible for decentralised installation • Compact, lightweight yet robust • Versatile options for creating pressure zones • Max. 32 valves	• CPX AP-A remote I/O • Actuating switching valves • Modular and cost-effective • High flow rates • Centralised installation and open for extensions • Compact, lightweight yet robust • Versatile options for creating pressure zones • Max. 32 valves	• Compact with small VUVG valves • Connection technology easy to change via the E-box • Wide range of valve functions • Also with semi in-line valves	• Low-cost fixed grid • Extremely easy assembly • Exchangeable electrical control • IO-Link® capable • Valves VUVG with individual electrical connection can be integrated • Also available with pneumatic multiple connector plate • Part of the VG series • Energy-efficient thanks to reverse operation and targeted pressure reduction • Optimised and space-saving variant available for installation in control cabinets • Variants with hot-swap connections: valves can be replaced during operation • Variants recommended for production systems for manufacturing lithium-ion batteries
online: →	vtux	vtux-ap	vtug	vtug

Universal valve terminals

	 Valve terminal with multi-pin, fieldbus interface VTUG-F1A	 Valve manifolds VTUS	 Valve terminals MPA-L	 Valve terminals MPA-S
Valve size	10 mm, 14 mm	21 mm, 26.5 mm, 31 mm	10 mm, 14 mm, 20 mm	10 mm, 14 mm, 20 mm
Valve function	2x3/2-way, monostable, closed, 2x3/2-way, open, monostable, 2x3/2-way, open/closed, monostable, 3/2-way, closed, monostable, 3/2 open, single solenoid, 5/2 double solenoid, 5/2-way, monostable, 5/3-way, pressurised, 5/3 exhausted, 5/3 closed	2x3/2-way, monostable, closed, 2x3/2-way, open, monostable, 2x3/2-way, open/closed, monostable, 3/2-way, closed, monostable, 3/2 open, single solenoid, 5/2 double solenoid, 5/2-way, monostable, 5/3-way, pressurised, 5/3 exhausted, 5/3 closed	2/2-way, closed, monostable, 2x3/2-way, monostable, closed, 2x3/2-way, open, monostable, 2x3/2-way, open/closed, monostable, 3/2-way, closed, monostable, 3/2 open, single solenoid, 5/2 double solenoid, 5/2-way, monostable, 5/3-way, pressurised, 5/3 exhausted, 5/3 closed	2/2-way, closed, monostable, 2x3/2-way, monostable, closed, 2x3/2-way, open, monostable, 2x3/2-way, open/closed, monostable, 3-way proportional pressure regulator, 3/2-way, closed, monostable, 3/2 open, single solenoid, 5/2 double solenoid, 5/2-way, monostable, 5/3-way, pressurised, 5/3 exhausted, 5/3 closed
Max. standard nominal flow rate	330 l/min at 10 mm, 630 l/min at 14 mm		360 l/min at 10 mm, 670 l/min at 14 mm, 870 l/min at 20 mm	360 l/min at 10 mm, 550 l/min at 14 mm, 700 l/min at 20 mm
Max. no. of valve positions	24	16	32	24, 64
Max. no. of pressure zones	13	9	20	7, 17
Electrical actuation	AP interface, I-Port, IO-Link®, Multi-pin plug	Individual connection	Fieldbus, I-Port, IO-Link®, Multi-pin plug	Fieldbus, Multi-pin plug
Valve terminal design	Fixed grid	Fixed grid	Valve sizes can be mixed	Modular, valve sizes can be mixed
Cleanroom class	Class 5 according to ISO 14644-1	Class 6 according to ISO 14644-1	Class 5 according to ISO 14644-1	Class 5 according to ISO 14644-1
Suitability for the production of Li-ion batteries	Metals with more than 1% by mass of copper, zinc or nickel by mass are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils			
LABS (PWIS) conformity	VDMA24364 zone III	VDMA24364-B1/B2-L	VDMA24364-B1/B2-L	VDMA24364-B1/B2-L
Description	• Recommended for production systems for manufacturing lithium-ion batteries • Low-cost fixed grid • Extremely easy assembly • Exchangeable electrical control • IO-Link® capable • Part of the VG series • Energy-efficient thanks to reverse operation and targeted pressure reduction	• Sturdy valves VUVS with long service life • Individual electrical connection • Pilot air supply in the manifold rail • Comprehensive range of accessories	• Maximum modularity • System can be extended as required with individual sub-bases and modular tie rods • Polymer sub-bases • 3 valve sizes • Tamper-proof fixed flow restrictor • Fieldbus interface via CPX • IO-Link® capable	• Valve terminals for universal applications • High-performance valves in a sturdy metal housing • Metal linking • Two valve sizes can be combined • Excellent communication thanks to serial linking • Fieldbus interface via CPX • Max. 128 valves
online: →	vtug-f1a	vtus	mpa-l	mpa-s

Application-specific valve terminals

	 **Valve terminals VTOC**	 **Valve terminals MH1**
Valve size	10 mm	10 mm
Valve function	2x3/2-way, monostable, closed	2/2-way, closed, monostable, 3/2-way, closed, monostable, 3/2 open, single solenoid
Max. standard nominal flow rate	10 l/min at 10 mm	10 l/min at 10 mm
Operating pressure [MPa]	0 ... 0.8 MPa	
Operating pressure	0 ... 8 bar	-0.9 ... 8 bar
Operating pressure [psi]	0 ... 116 psi	
Electrical actuation	I-Port, IO-Link®, Multi-pin plug	Individual connection, Multi-pin plug
Nominal operating voltage DC	24 V	5 V, 12 V, 24 V
Max. no. of valve positions	24	24
Valve terminal design	Fixed grid	Fixed grid
Cleanroom class	Class 5 according to ISO 14644-1	Class 5 according to ISO 14644-1
LABS (PWIS) conformity	VDMA24364-B2-L	VDMA24364-B2-L
Description	• Compact pilot valves • Compact assembly • Greater safety thanks to interlock function • Multi-pin or fieldbus control • IO-Link® capable	• Miniaturised poppet valves • Multi-pin or electrical individual connection
online: →	vtoc	mh1

Customised components – for your specific requirements

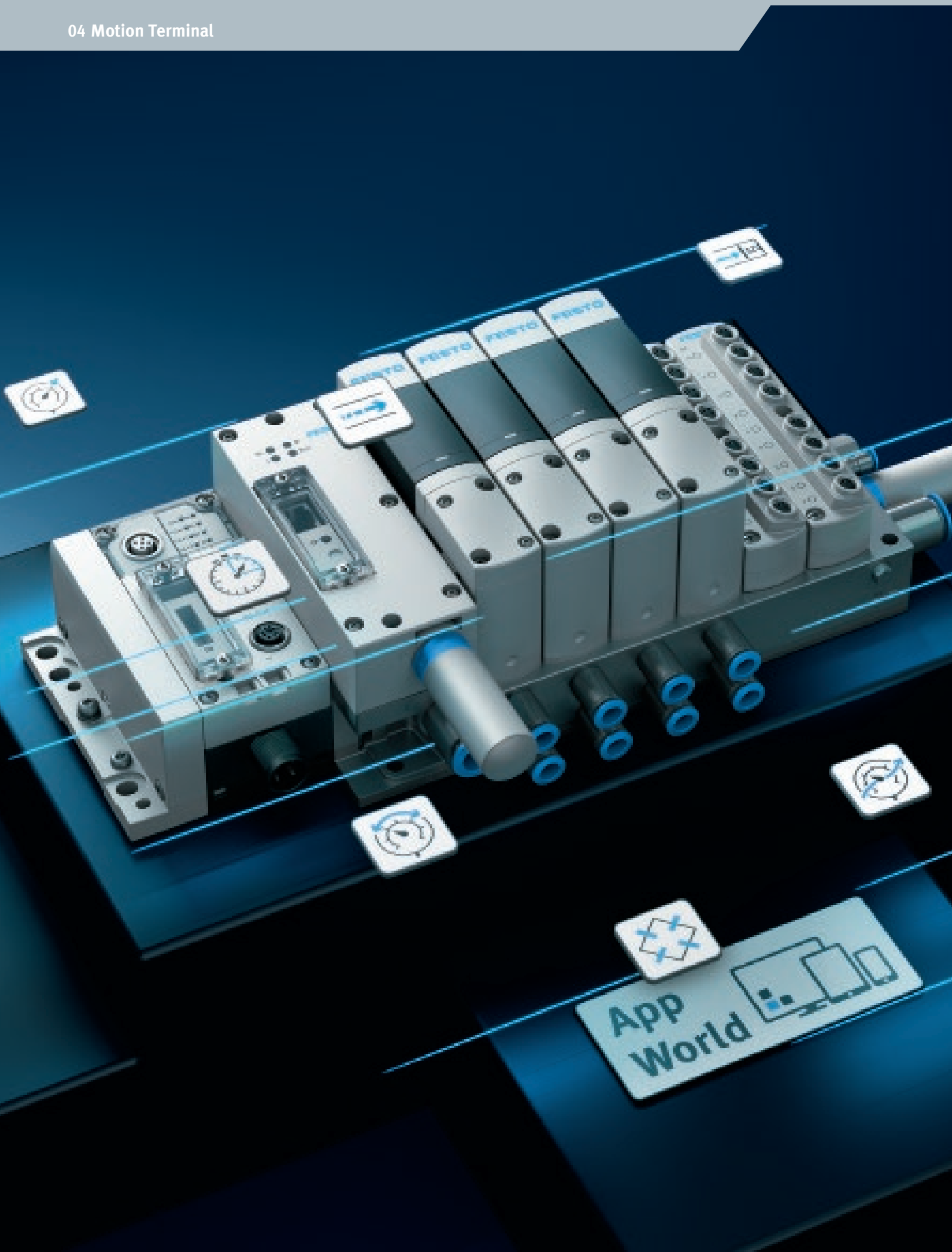
Valve terminals with customised designs

Can't find the valve terminal you need in our catalogue?

We can offer you customised components that are tailored to your specific requirements.

Common product modifications:
- Coatings for special ambient conditions
- Customised cables: length, pin allocation, pre-assembled with plug
- Modified actuating elements
- Modified connecting thread
- Modified valve sub-bases

Many additional variants are possible.
Ask your Festo sales engineer, who will be happy to help you:
➔ **www.festo.com/contact**


App
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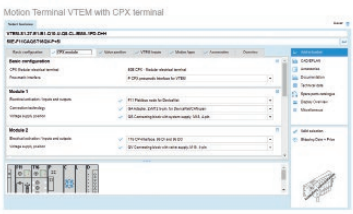
Software tools

Configurator



Design a product with numerous features reliably and quickly with the help of the configurator.
Select all the required product features step-by-step. The use of logic checks ensures that only correct configurations are available for selection.

You will find the configurator
- at www.festo.com/catalogue/vtem
- Click on the product
- Click on the blue “Configure product” button

Connectivity Finder

You can use this tool to find the optimum way to connect a Festo solution to your preferred (non-Festo) controller. In addition, you will be provided with expert knowledge for your selected connection option, making the integration of the Festo solution into your machine extremely easy.

This tool can be found at
➔ **www.festo.com/x/connectivity-finder**

Motion Terminal

	 **Motion Terminal VTEM**
Valve terminal design	Fixed grid
Grid dimension	28 mm
Max. no. of valve positions	8
Valve function	Can be allocated using the Motion App
Standard nominal flow rate, exhaust 6->5 bar	480 l/min
Pneumatic connection 1	G3/8
Operating pressure [MPa]	0.3 ... 0.8 MPa
Operating pressure	3 ... 8 bar
Operating pressure [psi]	43.5 ... 116 psi
Note on operating pressure	0 - 8 bar with external pilot air, Vacuum operation at connection 3 only
Pilot pressure [MPa]	0.3 ... 0.8 MPa
Pilot pressure	3 ... 8 bar
Pilot pressure [psi]	43.5 ... 116 psi
Motion Apps	Leakage diagnostics, Flow control, ECO drive, Positioning, Proportional pressure regulation, Proportional directional control valve, Soft Stop, Presetting of travel time, Directional control valve functions, Supply and exhaust air flow control, Model-based proportional pressure regulation, Selectable pressure head
Actuation type	Electric
Nominal operating voltage DC	24 V
Temperature of medium	5 ... 50°C
Cleanroom class	Class 5 according to ISO 14644-1
LABS (PWIS) conformity	VDMA24364 zone III
Description	• Many functions for movement, pressure and flow in one component – thanks to apps • Maximum repeat accuracy thanks to digital parameter sets • Easy to trace – ideal for the Industry 4.0 • Easy to duplicate the parameters • Increased energy efficiency • Reduced complexity and time to market • Increasing profitability and know-how protection • Predictive maintenance • Minimal installation effort • Sustainable operation with pressure-reduced return stroke and leakage detection
online: →	vtem

Product overview


FESTO

Software tools

Festo Design Tool 3D

The Festo Design Tool 3D is a 3D product configurator for generating specific CAD product combinations from Festo.
The configurator makes your search for the right accessory easier, more reliable and faster.

You can then order the module that has been created as a single order item, either completely pre-assembled or as individual parts in a single box. This considerably reduces your bill of materials, and downstream processes such as product ordering, order picking and assembly are significantly simplified.

This tool can be found at
➔ **www.festo.com/x/festo-design-tool**

Proximity switches >

Proximity switches for T-slot

		
	Proximity sensors SMT-8M-A ★	**Proximity sensors SDBT-MSX** ★
Electrical connection, connection type	Cable, Cable with plug	Cable, Cable with plug
Electrical connection, connection technology	M12x1, A-coded to EN 61076-2-101, M8x1, A-coded, to EN 61076-2-104, Open end	M8x1, A-coded, to EN 61076-2-104, Open end
Operating voltage range DC	5 ... 30 V	10 ... 30 V
Switching element function	N/C contact, N/O contact	N/C or N/O contact, switchable
Switching output	NPN, PNP, Non-contacting, 2-wire	PNP/NPN, switchable
Cleanroom class	Element installed statically, no meaningful evaluation possible according to ISO 14644-1	Element installed statically, no meaningful evaluation possible according to ISO 14644-1
Suitability for the production of Li-ion batteries	Metals with more than 1% by mass of copper, zinc or nickel by mass are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils, Metals with more than 1% by mass of copper, zinc or nickel are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils	Metals with more than 1% by mass of copper, zinc or nickel by mass are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils
LABS (PWIS) conformity	VDMA24364-B2-L	VDMA24364-B2-L
Description	• Measuring principle: magneto-resistive • For universal use • Individually configurable or pre-assembled • Inserted in the slot from above, flush with the cylinder profile • LED switching status indication • LED operating reserve indication • Cable length 0.1 ... 30 m	• Measuring principle: magnetic Hall • Auto teach-in: automatic teach-in of the switching point at system start-up • Programmable: PNP/NPN, NO/NC and switching window range between 2 ... 15 mm • Insertable in the slot from above, screw-clamped • LED status indicator • Cable length 0.3 ... 5 m
online: ➔	smt-8m	sdbt

Proximity switches >

Round slot proximity switch

	 **Proximity switch SMT-10M** ★
Electrical connection, connection type	Cable, Cable with plug
Electrical connection, connection technology	M12x1, A-coded to EN 61076-2-101, M8x1, A-coded, to EN 61076-2-104, Open end
Electrical connection, number of pins/wires	2, 3
Operating voltage range DC	5 ... 30 V
Switching element function	N/O contact
Switching output	NPN, PNP, Non-contacting, 2-wire
Cleanroom class	Element installed statically, no meaningful evaluation possible according to ISO 14644-1
Suitability for the production of Li-ion batteries	Metals with more than 1% by mass of copper, zinc or nickel by mass are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils
LABS (PWIS) conformity	VDMA24364-B2-L
Description	• Measuring principle: magneto-resistive • For universal use • Individually configurable or pre-assembled • Inserted in the slot from above, flush with the cylinder profile • LED switching status indication • Cable length 0.3, 2.5 m
online: →	**smt-10M**

Position sensors

	 **Position transmitters SDAT-MHS**	 **Position transmitter SMAT-8M**
Design type	For T-slot	For T-slot
Sensing range	0 ... 160000 µm	52000 µm
Analogue output	0 - 10 V, 4 - 20 mA	0 - 10 V
Electrical connection, connection type	Cable with plug	Cable with plug
Electrical connection, connection technology	M8x1, A-coded, to EN 61076-2-104	M8x1, A-coded, to EN 61076-2-104
Electrical connection, occupied pins/wires	4	4
Cleanroom class	Element installed statically, no meaningful evaluation possible according to ISO 14644-1	Element installed statically, no meaningful evaluation possible according to ISO 14644-1
Suitability for the production of Li-ion batteries	Metals with more than 1% by mass of copper, zinc or nickel by mass are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils	Metals with more than 1% by mass of copper, zinc or nickel by mass are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils
LABS (PWIS) conformity	VDMA24364-B2-L	VDMA24364-B2-L
Description	• Measuring principle: magnetic Hall • Analogue output 0 ... 10 V or 4 ... 20 mA • Programmable IO-Link®/switching output • Insertable in the slot from above, screw-clamped • LED status indicator • Cable length 0.3 m • Suitable for T-slot	• Measuring principle: magnetic Hall • Analogue output 0 ... 10 V • Very compact design makes the unit especially well suited to work with grippers, compact cylinders and any application in a tight space • Insertable in the slot from above, screw-clamped • LED status indicator • Cable length 0.3 m • Suitable for T-slot
online: →	sdat	smat-8m

Pressure and vacuum sensors

	 **Pressure sensors SDE5** ★	 **Pressure sensors SPAN, SPAN-B** ★	 **Pressure sensors SPAE**	 **Pressure transmitters SPTE**
Pressure measuring range [MPa]		-0.1 ... 1.6 MPa	-0.1 ... 1 MPa	-0.1 ... 1 MPa
Pressure measuring range	-1 ... 10 bar	-1 ... 16 bar	-1 ... 10 bar	-1 ... 10 bar
Pressure measuring range [psi]		–14.5 ... 232 psi	–14.5 ... 145 psi	–14.5 ... 145 psi
Switching element function	N/C contact, N/O contact, Switchable	N/C or N/O contact, switchable	N/C contact, N/O contact, Switchable	
Switching output	NPN, PNP	2 x PNP or 2 x NPN, switchable, PNP/NPN, switchable	PNP/NPN, switchable	
Pneumatic connection	QS-1/4, QS-4, QS-5/32, QS-6	Male thread 1/8 NPT, Female thread G1/8, M5, For tubing O.D. 4 mm, Male thread G1/8, R1/8	Flange, Cartridge 10 mm, Push-in sleeve QS-4, QS-6, QS-3, QS-4	Flange, Cartridge 10 mm, Push-in sleeve QS-4, QS-6, QS-3, QS-4
Electrical connection	3-wire, 3-pin, Cable, Plugs, To EN 60947-5-2, Round design, M8x1		3-wire, Cable, Open end	3-wire, Cable, Open end
Electrical connection 1, connection type		Plugs		
Display type		Illuminated LCD	LED indicator, 2-digit	
Cleanroom class	Class 4 according to ISO 14644-1	Class 4 according to ISO 14644-1	Class 4 according to ISO 14644-1	Class 4 according to ISO 14644-1
Suitability for the production of Li-ion batteries		Metals with more than 1% by mass of copper, zinc or nickel by mass are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils, Metals with more than 1% by mass of copper, zinc or nickel are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils	Metals with more than 1% by mass of copper, zinc or nickel by mass are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils	Metals with more than 1% by mass of copper, zinc or nickel by mass are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils
LABS (PWIS) conformity	VDMA24364-B1/B2-L	VDMA24364-B1/B2-L	VDMA24364-B2-L	VDMA24364-B2-L
Description	• Programmable and configurable pressure switch for simple pressure sensing tasks • Threshold/window comparator • Switching point adjustment via teach-in function • Integrated microprocessor • Switching status indicated by an LED visible from all sides • Certification: c UL us listed (OL), C-Tick	• For monitoring compressed air and non-corrosive gases • For network monitoring, regulator monitoring, leak testing, object detection • Relative measurement method based on a piezoresistive measuring cell • Serial communication integrated using IO-Link® 1.1 • Compact design 30x30 mm • High-contrast display with blue backlight	• Electronic pressure sensor with piezoresistive pressure measuring cell, integrated signal processing, numeric pressure indicator in percent, operating key and a switching output, PNP/NPN switchable • Display of minimum and maximum measured value • All parameters entered can be transferred to other SPAEs (replicating function) • Communication interface IO-Link®	• Piezoresistive pressure sensor • Measured variable: relative pressure • Cable length 2.5 m • Compact: 8-bracket wall mount for manifold mounting
online: →	sde5	span	spae	spte

Flow sensors

	 **Flow transmitters SFTE**	 **Flow sensors SFAH**
Flow measuring range	0 ... 10 l/min	0.002 ... 200 l/min
Operating medium	Nitrogen, Compressed air ISO 8573-1:2010 [6:4:4]	Argon, Nitrogen, Compressed air ISO 8573-1:2010 [6:4:4]
Operating pressure	-0.9 ... 10 bar	-0.9 ... 10 bar
Pneumatic connection	Female thread M5, For push-in connector O.D. 3 mm, 4 mm	Female thread G1/4, G1/8, For tubing O.D. 4 mm, 6 mm, 8 mm
Switching output		2 x PNP or 2 x NPN, switchable
Electrical connection, connection type	Cable, Cable with plug	Plugs
Electrical connection, connection technology	M8x1, A-coded, to EN 61076-2-104, Open end	Connection pattern L1J, M8x1, A-coded, to EN 61076-2-104
Cleanroom class	Class 4 according to ISO 14644-1	Class 4 according to ISO 14644-1
Suitability for the production of Li-ion batteries	Metals with more than 1% by mass of copper, zinc or nickel by mass are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils	Metals with more than 1% by mass of copper, zinc or nickel by mass are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils
LABS (PWIS) conformity	VDMA24364-B2-L	VDMA24364-B2-L
Description	• Compact design • Universal flow detection • Simple installation • Reliable pick & place application for extremely small workpieces	• Process air, compressed air, forming gas consumption and pneumatic object monitoring, handling ultra-small parts, leak test • Compact design 20x58 mm • Clear 2-line display • Mounting: H-rail mounting, wall or surface mounting, front panel mounting • Serial communication integrated using IO-Link® 1.1
online: →	sfte	sfah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Edit

Software tools

Air consumption		Calculate your system's air consumption quickly and conveniently. Simply enter all the drives and tubing, set the cycle times and working pressure and the air consumption per minute and per day will be calculated for you. It includes a feature for exporting the input table together with the result directly to Excel. This tool can be found at ➔ **www.festo.com/x/air-consumption**
Configurator		Design a product with numerous features reliably and quickly with the help of the configurator. Select all the required product features step-by-step. The use of logic checks ensures that only correct configurations are available for selection. A dynamic graphic generated on the basis of the configuration provides a visual aid for selecting the correct product features. This tool can be found at ➔ **www.festo.com/x/service-unit-sizing**

Service units for compressed air >

MS-B Series

Service units
MS4-EM1FR, MS6-EM1FR ★

Size	4, 6
Pressure indication	Prepared for G1/8, With pressure gauge
Operating pressure [MPa]	0.1 ... 1 MPa
Operating pressure	1 ... 10 bar
Standard nominal flow rate	1500 ... 5300 l/min
Type of mounting	Either:, In-line installation, Via mounting bracket, With accessories
Cleanroom class	Class 7 according to ISO 14644-1
LABS (PWIS) conformity	VDMA24364-B1/B2-L
Description	• Combination of on/off valve and filter regulator • With manual or fully automatic condensate drain • For filtered and unlubricated compressed air supply • Supply pressure can be switched on or off • Output pressure is continuously adjustable within the pressure regulation range • Grid dimensions 40, 62 mm (size 4, 6)
online: ➔	ms4-em1fr

Service units for compressed air >

MS series

	 **Service unit combinations MSB4, MSB6** ★
Pneumatic connection 1	G1/2, G1/4, G1/8
Standard nominal flow rate	750 ... 5500 l/min
Pressure regulation range	0.5 ... 12 bar
Operating pressure	0.8 ... 20 bar
Grade of filtration	0.01 ... 40 µm
Cleanroom class	Class 7 according to ISO 14644-1
LABS (PWIS) conformity	VDMA24364-B1/B2-L
Description	• Combination of filter regulator, filter, lubricator, on/off valve, soft-start valve • Grid dimension 40, 62, 90 mm (size 4, 6, 9)
online: ➔	msb4

Filter regulators/lubricators >

MS series

	 **Service unit combinations MSB4-FRC, MSB6-FRC** ★
Pneumatic connection 1	G1/2, G1/4, G1/8, G3/8
Standard nominal flow rate	850 ... 4800 l/min
Pressure regulation range	0.3 ... 12 bar
Operating pressure	0.8 ... 20 bar
Grade of filtration	5 µm, 40 µm
Cleanroom class	Class 7 according to ISO 14644-1
LABS (PWIS) conformity	VDMA24364-B1/B2-L
Description	• Filter, regulator and lubricator functions in a single unit • High flow rate and highly efficient in removing contaminants • Good control characteristics with minimal pressure hysteresis • Grid dimension 40, 62 mm (size 4, 6)
online: ➔	msb4-frc

MS-B Series

	 **Filter regulators** **MS4-LFR-B, MS6-LFR-B** ★
Pneumatic connection 1	G1/2, G1/4
Standard nominal flow rate	1500 ... 5300 l/min
Pressure regulation range [MPa]	0.03 ... 0.7 MPa
Pressure regulation range	0.3 ... 7 bar
Grade of filtration	5 µm, 40 µm
Operating pressure [MPa]	0.1 ... 1 MPa
Operating pressure	1 ... 10 bar
Cleanroom class	Class 7 according to ISO 14644-1
Suitability for the production of Li-ion batteries	Metals with more than 1% by mass of copper, zinc or nickel by mass are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils
LABS (PWIS) conformity	VDMA24364-B1/B2-L
Description	• Competitively priced basic component focused on the most important technical functions • Lightweight and sturdy thanks to modern polymer materials • Compatible with the MS series for the ideal combination of low-cost basic functionality and high-end functional requirements • Stabile control response • With or without pressure gauge • Rotary knob with latch • With integrated secondary exhausting and primary exhausting with return flow function • MS2: Directly operated diaphragm regulator • MS4, MS6: directly actuated piston regulator • Grid dimension 25, 40, 62 mm (sizes 2, 4, 6)
online: →	ms2-lfr

Filter regulators >

MS series

	 **Filter regulators** **MS4-LFR, MS6-LFR** ★
Pneumatic connection 1	G1/2, G1/4, G1/8, G3/8
Standard nominal flow rate	850 ... 7200 l/min
Pressure regulation range	0.3 ... 16 bar
Operating pressure	0.8 ... 20 bar
Grade of filtration	5 µm, 40 µm
Cleanroom class	Class 7 according to ISO 14644-1
LABS (PWIS) conformity	VDMA24364-B1/B2-L
Description	• MS4-LFR, MS6-LFR: directly actuated diaphragm regulator, MS9-LFR: piloted or directly actuated filter-diaphragm regulator, MS12-LFR: piloted diaphragm regulator without internal air consumption • Good control characteristics with minimal pressure hysteresis and primary pressure compensation • Good particle and condensate separation • With or without secondary exhausting • High flow rate • Lockable rotary knob • Return flow option for exhausting from output 2 to input 1 already integrated • Variants to EU Explosion Protection Directive (ATEX) • With or without pressure gauge • Grid dimension 40, 62, 90, 124 mm (size 4, 6, 9, 12)
online: →	ms4-lfr

Compressed air filters >

MS series

	 **Filters** **MS4-LF, MS6-LF**	 **Fine filters** **MS4-LFM-B, MS6-LFM-B**	 **Micro filters** **MS4-LFM-A, MS6-LFM-A**
Pneumatic connection 1	G1/2, G1/4, G1/8, G3/8	G1/2, G1/4, G1/8, G3/8	G1/2, G1/4, G1/8, G3/8
Standard nominal flow rate	1000 ... 4100 l/min		
Operating pressure	0 ... 20 bar	0 ... 20 bar	0 ... 20 bar
Grade of filtration	5 µm, 40 µm	0.01 µm, 1 µm	0.01 µm, 1 µm
Cleanroom class	Class 7 according to ISO 14644-1	Class 7 according to ISO 14644-1	Class 7 according to ISO 14644-1
LABS (PWIS) conformity	VDMA24364-B1/B2-L	VDMA24364-B1/B2-L	VDMA24364-B1/B2-L
Description	• Good particle and condensate separation • High flow rate performance with minimal pressure drop • Available with manual, semi-automatic, fully automatic or fully automatic, electrically actuated condensate drain • Grid dimension 40, 62, 90, 124 mm (size 4, 6, 9, 12)	• High-efficiency filter for exceptionally clean compressed air • Removing oil aerosols from compressed air • Optionally with differential pressure indicator for indication of contamination • Available with electronic filter contamination indicator • Grid dimension 40, 62, 90, 124 mm (size 4, 6, 9, 12)	• High-efficiency filter for exceptionally clean compressed air • Removing oil aerosols from compressed air • Optionally with differential pressure indicator for indication of contamination • Available with electronic filter contamination indicator • Grid dimension 40, 62, 90, 124 mm (size 4, 6, 9, 12)
online: →	ms4-lf	ms4-lfm-b	ms4-lfm-a

MS-B Series

	 **Pressure regulators** **MS4-LR-B, MS6-LR-B** ★
Pneumatic connection 1	G1/2, G1/4
Standard nominal flow rate	1800 ... 6000 l/min
Pressure regulation range	0.3 ... 7 bar
Operating pressure [MPa]	0.1 ... 1 MPa
Operating pressure	1 ... 10 bar
Cleanroom class	Class 7 according to ISO 14644-1
Suitability for the production of Li-ion batteries	Metals with more than 1% by mass of copper, zinc or nickel by mass are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils, Metals with more than 1% by mass of copper, zinc or nickel are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils
LABS (PWIS) conformity	VDMA24364-B1/B2-L
Description	• Competitively priced basic component focused on the most important technical functions • Lightweight and sturdy thanks to modern polymer materials • Compatible with the MS series for the ideal combination of low-cost basic functionality and high-end functional requirements • Stabile control response • With or without pressure gauge • Rotary knob with latch • With integrated secondary exhausting and primary exhausting with return flow function • MS2: Directly operated diaphragm regulator • MS4, MS6: directly actuated piston regulator • Grid dimension 25, 40, 62 mm (sizes 2, 4, 6) • Sustainable operation thanks to reduced pressure level
online: ➔	ms-lr-b

Pressure regulators >

MS series

	 Pressure regulators MS4-LR, MS6-LR ★	 Pressure regulators MS4-LRB, MS6-LRB	 Precision pressure regulators MS6-LRP, MS6-LRPB
Pneumatic connection 1	G1/2, G1/4, G1/8, G3/8	G1/2, G1/4	G1/4, G3/8, G1/2, G3/4, 1/4 NPT, 3/8 NPT, 3/4 NPT, G1/2, G1/4, G3/8
Standard nominal flow rate	1000 ... 7500 l/min	300 ... 7300 l/min	800 ... 9000 l/min
Pressure regulation range	0.3 ... 16 bar	0.3 ... 16 bar	0.05 ... 12 bar
Operating pressure [MPa]	0.08 ... 1.4 MPa		0.1 ... 1.4 MPa
Operating pressure	0.8 ... 20 bar	0.8 ... 20 bar	1 ... 14 bar
Cleanroom class	Class 7 according to ISO 14644-1	Class 7 according to ISO 14644-1	Class 5 according to ISO 14644-1
LABS (PWIS) conformity	VDMA24364-B1/B2-L	VDMA24364-B1/B2-L	VDMA24364-B1/B2-L
Description	• High flow rate performance with minimal pressure drop • Good control characteristics with minimal pressure hysteresis and primary pressure compensation • With or without secondary exhausting • Lockable rotary knob • Optional pressure sensor and rotary knob pressure gauge • Grid dimension 25, 40, 62, 90 mm (size 2, 4, 6, 9)	• To build a regulator manifold with through air supply for pressure ranges that can be adjusted independently of one another • Good control characteristics with minimal pressure hysteresis and primary pressure compensation • Lockable rotary knob • With or without secondary exhausting • Integrated return flow option for exhausting from output 2 to input 1 • Optional pressure sensor and rotary knob pressure gauge • Variants to EU Explosion Protection Directive (ATEX) • Grid dimension 40, 62 mm (size 4, 6)	• As individual device and for manifold assembly • Manifold assembly with through air supply • Good control characteristics with minimal pressure hysteresis and primary pressure compensation • High secondary exhausting • Lockable rotary knob • Optional pressure sensor and rotary knob pressure gauge • Grid dimension 62 mm (size 6)
online: →	ms4-lr	ms4-lrb	ms6-lrp

MS-B Series

	 **Soft-start valves** **MS4-EDE-B, MS6-EDE-B** ★	 **On/off valves** **MS4-EE-B, MS6-EE-B** ★
Design	Poppet valve, electrically actuated	Poppet valve, electrically actuated
Pneumatic connection 1	G1/2, G1/4	G1/2, G1/4
Operating pressure [MPa]	0.3 ... 0.7 MPa	0.3 ... 0.7 MPa
Operating pressure	3 ... 7 bar	3 ... 7 bar
Standard nominal flow rate	2000 ... 5000 l/min	2000 ... 5000 l/min
Exhaust air function	Without flow control option	
Electrical connection	Type C, To EN 175301-803	Type C, To EN 175301-803
Cleanroom class	Class 7 according to ISO 14644-1	Class 7 according to ISO 14644-1
LABS (PWIS) conformity	VDMA24364-B1/B2-L	VDMA24364-B1/B2-L
Description	• Very compact and extremely lightweight series for use close to the process directly in the machine • Electrically operated 3/2-way valve for slowly pressurising and exhausting pneumatic systems • The switching pressure can be precisely controlled with a solenoid valve • Adjustable switching time delay • Built-in connections into which the tubing can be directly inserted • Detenting and non-detenting manual override • Supply voltage 24 V DC • With solenoid coil, without plug socket • Variants recommended for production systems for manufacturing lithium-ion batteries • Grid dimension 40, 62 mm (size 4, 6)	• Very compact and extremely lightweight series for use close to the process directly in the machine • Electrically operated 3/2-way valve for pressurising and exhausting pneumatic systems • Ducted exhaust air possible via threaded connection with silencer • Detenting and non-detenting manual override • Supply voltage 24 V DC • With solenoid coil, without plug socket • Variants recommended for production systems for manufacturing lithium-ion batteries • Grid dimension 40, 62 mm (size 4, 6)
online: ➔	ms-ede-b	ms-ee-b

On/off and soft-start valves >

MS series

	 Soft-start/quick exhaust valves MS6-SV-E, MS6-SV-D	 Soft-start/quick exhaust valves MS6-SV-C	 On/off valves MS4-EM1, MS6-EM1 ★
Pneumatic connection 1	G1/2	G1/2	G1/2, G1/4, G1/8, G3/8
Standard nominal flow rate	4300 ... 5700 l/min	4300 ... 5700 l/min	1200 ... 8700 l/min
Operating pressure	3 ... 10 bar	3 ... 10 bar	0 ... 18 bar
Actuation type	Electric	Electric	Manual
Safety integrity level (SIL)	Exhaust/SIL 3, Prevention of unexpected start-up (pressurisation)/SIL 3		
Performance level (PL)	Exhaust/category 3, performance level d, Exhausting/up to category 4, performance level e, Prevention of unexpected start-up (pressurisation)/category 3, performance level d, Prevention of unexpected start-up (pressurisation)/up to category 4, performance level e	Exhausting/category 1, performance level c, Prevention of unexpected start-up (pressurisation)/category 1, performance level c	
Cleanroom class	Class 7 according to ISO 14644-1	Class 7 according to ISO 14644-1	Class 7 according to ISO 14644-1
LABS (PWIS) conformity	VDMA24364-B1/B2-L	VDMA24364-B1/B2-L	VDMA24364-B1/B2-L
Description	• With safety functions • For reducing pressure quickly and reliably and for building up pressure gradually • Adjustable pressure build-up time • Available with silencer • Supply voltage 24 V DC • Grid dimension 62 mm (size 6)	• With safety functions • For reducing pressure quickly and reliably and for building up pressure gradually • Adjustable pressure build-up time • Adjustable switch-through pressure • Supply voltage 24 V DC • Grid dimension 62, 90 mm (size 6, 9)	• Manual 3/2-way valve for pressurising and exhausting pneumatic systems • A silencer can be attached or the exhaust air ducted at port 3 • Switching position is immediately recognisable • Optionally with pressure gauge and pressure sensor • Variants to EU Explosion Protection Directive (ATEX) • Variants recommended for production systems for manufacturing lithium-ion batteries • Grid dimension 40, 62, 90, 124 mm (size 4, 6, 9, 12)
online: →	ms6-sv-e	ms6-sv-c	ms4-em1

Product overview

On/off and soft-start valves >

MS series

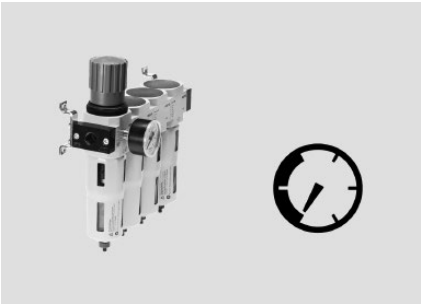
	 On/off valves MS4-EE, MS6-EE ★	 Soft-start valves MS4-DE, MS6-DE
Pneumatic connection 1	G1/2, G1/4, G1/8, G3/8	G1/2, G1/4, G3/8
Standard nominal flow rate	1000 ... 7000 l/min	1000 ... 6450 l/min
Operating pressure	4 ... 18 bar	4 ... 18 bar
Actuation type	Electric	Electric
Cleanroom class	Class 7 according to ISO 14644-1	Class 7 according to ISO 14644-1
LABS (PWIS) conformity	VDMA24364-B1/B2-L	VDMA24364-B1/B2-L
Description	• Electric 3/2-way valve for pressurising and exhausting pneumatic installations • A silencer can be attached or the exhaust air ducted at port 3 • Supply voltage 24 V DC, 110, 230 V AC • Optionally with pressure gauge and pressure sensor • With solenoid coil, without plug socket • Variants to EU Explosion Protection Directive (ATEX) • Grid dimension 40, 62, 90, 124 mm (size 4, 6, 9, 12)	• 2/2-way valve for slowly pressurising pneumatic installations with electrically switchable pressure switchover point • Supply voltage 24 V DC, 110, 230 V AC • Switchable pressure switching point • For advancing the drives slowly and reliably into the initial position • For avoiding sudden and unexpected movements • Adjustable pressure build-up time • Variants to EU Explosion Protection Directive (ATEX) • Grid dimension 40, 62, 124 mm (size 4, 6, 12)
online: →	ms4-ee	ms4-de

Compressed air distributors >

MS series

	 Branching modules MS4-FRM, MS6-FRM ★	 Distributor blocks MS4-FRM-FRZ, MS6-FRM-FRZ ★
Pneumatic connection 1	G1/4, G1/2, G1/2, G1/4, G1/8, G3/8	G1/4, G1/2
Standard nominal flow rate in main flow direction 1->2	1200 ... 14700 l/min	4050 ... 14600 l/min
Operating pressure	0 ... 20 bar	0 ... 20 bar
Cleanroom class	Class 7 according to ISO 14644-1	Class 7 according to ISO 14644-1
LABS (PWIS) conformity	VDMA24364-B1/B2-L	VDMA24364-B1/B2-L
Description	• Optionally with integrated non-return function and pressure switch • Outlet at top and bottom • Can be used as an intermediate distributor for varying air qualities • Optionally with pressure sensor • Variants recommended for production systems for manufacturing lithium-ion batteries • Grid dimension 40, 62, 90, 124 mm (size 4, 6, 9, 12)	• Slim compressed air distributor • Outlet at top and bottom • Can be used as an intermediate distributor for varying air qualities • Can be used as an adapter between two pressure regulators size 4 with pressure gauge with large rotary knob • Grid dimension 40, 62 mm (size 4, 6)
online: →	ms*-frm	ms*-frm-frz

Customised components – for your specific requirements



Components for compressed air preparation with customised designs

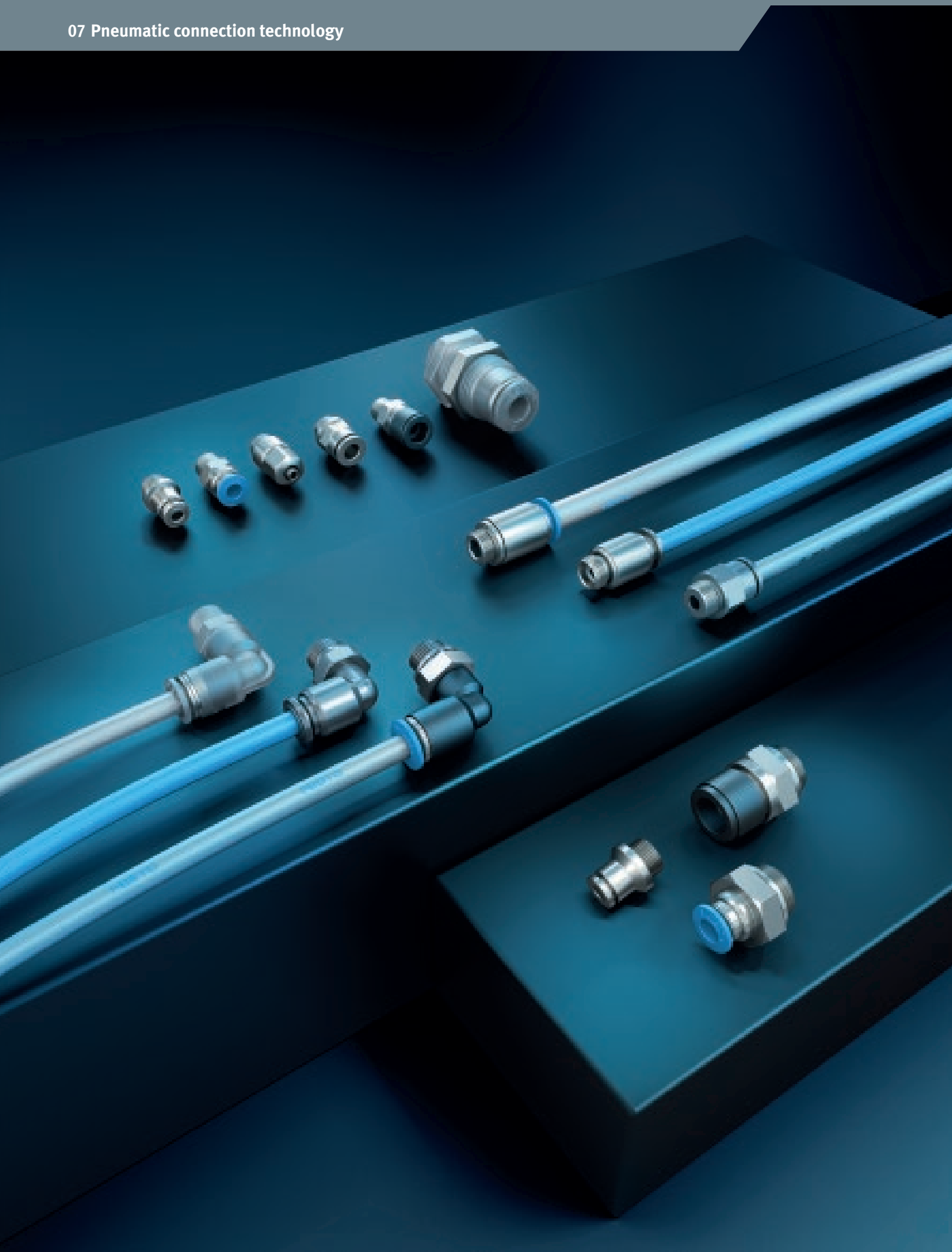
Can't find the compressed air preparation components you need in our catalogue?

We can offer you customised components that are tailored to your specific requirements.

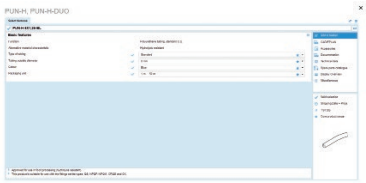
Common product modifications:
- Modified pressure range
- Rotary knob: in a special colour, with protection against rotation
- Fitting: integrated throttling port, special thread
- Tubing with special printing
- Pressure gauge with red-green range

Many additional variants are possible.
Ask your Festo sales engineer, who will be happy to help you:
→ **www.festo.com/contact**

Product overview

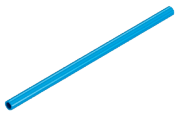


Software tools

Calculating the media resistance		Which Festo tubing is resistant to benzene? Can elastomers withstand contact with glycol? Which type of stainless steel can be used in acetic acid? You can find the answer to these and many other questions about media resistance right here. You can search for chemical reactions from A to Z. You can filter the media either by name or chemical formula and/or select the material in question. This tool can be found at ➔ **www.festo.com/x/media-resistance**
Configurator for tubing		Design a product with numerous features reliably and quickly with the help of the configurator. Select all the required product features step-by-step. The use of logic checks ensures that only correct configurations are available for selection. You will find the configurator for your desired product • at www.festo.com/catalogue/tubing • Select your desired product • Click on the blue “Configure product” button
Festo Design Tool 3D		The Festo Design Tool 3D is a 3D product configurator for generating specific CAD product combinations from Festo. The configurator makes your search for the right accessory easier, more reliable and faster. You can then order the module that has been created as a single order item, either completely pre-assembled or as individual parts in a single box. This considerably reduces your bill of materials, and downstream processes such as product ordering, order picking and assembly are significantly simplified. This tool can be found at ➔ **www.festo.com/x/festo-design-tool**

Pneumatic tubing >

Standard O.D. pneumatic tubing

	 Plastic tubing PUN-H, PUN-H-DUO ★	 Plastic tubing PUN-H-SF	 Plastic tubing PUN-H-F	 Plastic tubing PTFEN
Outside diameter	2 ... 16 mm	4 ... 25 mm	6 ... 16 mm	4 ... 16 mm
Inside diameter	1.2 ... 11 mm	2.3 ... 15.3 mm	4 ... 11 mm	2.9 ... 11 mm
Temperature-dependent operating pressure [MPa]	-0.095 ... 1 MPa	-0.095 ... 1.3 MPa	-0.095 ... 1 MPa	-0.095 ... 1.5 MPa
Temperature-dependent operating pressure	-0.95 ... 10 bar	-0.95 ... 13 bar	-0.95 ... 10 bar	-0.95 ... 15 bar
Temperature-dependent operating pressure [psi]	-13.775 ... 145 psi	-13.775 ... 188.5 psi	-13.775 ... 145 psi	-13.775 ... 217.5 psi
Ambient temperature	-35 ... 60°C	-35 ... 80°C	-35 ... 60°C	-20 ... 150°C
Cleanroom class	Element installed statically, no meaningful evaluation possible according to ISO 14644-1	Element installed statically, no meaningful evaluation possible according to ISO 14644-1	Element installed statically, no meaningful evaluation possible according to ISO 14644-1	Element installed statically, no meaningful evaluation possible according to ISO 14644-1
Suitability for the production of Li-ion batteries	Metals with more than 1% by mass of copper, zinc or nickel by mass are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils			
LABS (PWIS) conformity	VDMA24364-B2-L	VDMA24364-B2-L	VDMA24364-B2-L	VDMA24364-B1/B2-L
Description	• Polyurethane • High resistance to microbes and hydrolysis • Suitable for use with energy chains • Clean room-compatible combination with fitting NPKA • Also available as DUO plastic tubing • Operating media compressed air, vacuum, water. Water as per the manufacturer's declaration, see www.festo.com/certificates/PUN_H	• Polyurethane • Very resistant to kinking and extremely sturdy thanks to increased wall thickness • Maximum flexibility despite increased wall thickness • High resistance to microbes and hydrolysis • Suitable for use with energy chains • Operating medium: compressed air, vacuum, water	• Polyurethane • High resistance to microbes and hydrolysis • For food safety certificates, see www.festo.com/certificates/PUN_H_F • Operating medium: compressed air, vacuum, water	• Polytetrafluoroethylene • Food grade see www.festo.com/certificates/PTFEN • High resistance to chemicals • High temperature resistance • Operating medium: compressed air, vacuum
online: →	pun-h	pun-h-sf	pun-h-f	ptfen

Product overview

Pneumatic tubing >

Standard O.D. pneumatic tubing

	 Plastic tubing PEN	 Customised tubing PAN, PEN, PLN, PUN	 Plastic tubing PLN	 Plastic tubing PFAN
Outside diameter	4 ... 16 mm	4 ... 16 mm	4 ... 16 mm	3 ... 12 mm
Inside diameter	2.7 ... 10.8 mm	2.7 ... 12 mm	2.9 ... 12 mm	2.3 ... 8.4 mm
Temperature-dependent operating pressure [MPa]	-0.095 ... 1 MPa		-0.095 ... 1.4 MPa	-0.095 ... 1.6 MPa
Temperature-dependent operating pressure	-0.95 ... 10 bar	-0.95 ... 14 bar	-0.95 ... 14 bar	-0.95 ... 16 bar
Temperature-dependent operating pressure [psi]	-13.775 ... 145 psi		-13.775 ... 203 psi	-13.775 ... 232 psi
Ambient temperature	-30 ... 60°C	-30 ... 80°C	-30 ... 80°C	-20 ... 150°C
Cleanroom class	Element installed statically, no meaningful evaluation possible according to ISO 14644-1	Element installed statically, no meaningful evaluation possible according to ISO 14644-1	Element installed statically, no meaningful evaluation possible according to ISO 14644-1	Element installed statically, no meaningful evaluation possible according to ISO 14644-1
LABS (PWIS) conformity	VDMA24364-B2-L	VDMA24364-B1/B2-L	VDMA24364-B2-L	VDMA24364-B2-L
Description	• Polyethylene • High resistance to chemicals and very high resistance to hydrolysis • Resistant to most cleaning agents and lubricants • Suitable for use with energy chains • Operating media compressed air, vacuum, water. Water as per the manufacturer's declaration, see www.festo.com/certificates/PEN_S	• Individual lengths: delivered in units of 25, 50, 100, 200 ... 500 m • Minimum order quantity: from 1500m/3000 m (or less depending on type) depending on diameter • Customised design: specific printing possible • Easy to recognise and handle: individual colour selection • Choose from 9 basic colours; further colours available on request • Select, size and order quickly, easily and reliably with the configurator	• Polyethylene • High resistance to chemicals, microbes and hydrolysis • Food grade see www.festo.com/certificates/PLN • Resistant to most cleaning agents and lubricants • Operating media compressed air, vacuum, water. Water as per the manufacturer's declaration, see www.festo.com/certificates/PLN	• Perfluoroalkoxy alkane • Pneumatic tubing with resistance to high temperatures and chemicals • Food grade see www.festo.com/certificates/PFAN • High resistance to chemicals, microbes, UV radiation, hydrolysis and stress cracks • Operating media compressed air, vacuum, water. Water as per the manufacturer's declaration, see www.festo.com/certificates/PFAN
online: →	pen	pan	pln	pfan

Pneumatic fittings >

Pneumatics push-in fittings

	 **Push-in fittings/connectors, standard series** **QS** ★
Pneumatic connection 1	Push-in sleeve Ø 4 mm, Push-in sleeve Ø 6 mm, Push-in sleeve Ø 8 mm, Push-in sleeve Ø 10 mm, Push-in sleeve Ø 12 mm, Push-in sleeve Ø 16 mm, Female thread G1/2, G1/4, G1/8, G3/8, For tubing O.D. 10 mm, 12 mm, 16 mm, 4 mm, 6 mm, 8 mm, Male thread G1/2, G1/4, G1/8, G3/4, G3/8, M5, R1/2, R1/4, R1/8, R3/8
Pneumatic connection 2	Push-in sleeve Ø 4 mm, Push-in sleeve Ø 6 mm, Push-in sleeve Ø 8 mm, Push-in sleeve Ø 10 mm, Push-in sleeve Ø 12 mm, Push-in sleeve Ø 16 mm, Female thread G1/2, G1/4, G1/8, G3/8, For tubing O.D. 10 mm, 12 mm, 16 mm, 22 mm, 4 mm, 6 mm, 8 mm
Design type	45° angle, 45° angle, long, Blanking plug, L-shape, L-shape, dual, parallel, L-shape, long, L-shape, additional connection, female thread, lengthwise, T-shape, additional push-in connector, lengthwise, Bulkhead, T-shape, X-shape, Y-shape, Straight design
Temperature-dependent operating pressure	-0.95 ... 14 bar
Operating pressure for entire temperature range	-0.95 ... 14 bar
Ambient temperature	-20 ... 80°C
Cleanroom class	Class 4 according to ISO 14644-1
LABS (PWIS) conformity	VDMA24364-B1/B2-L
Description	• Standard series • Wide range of variants: wide selection for maximum flexibility in standard applications • PBT and nickel-plated brass • Operating media compressed air, vacuum, water. Water as per the manufacturer's declaration, see www.festo.com/certificates/QS • Straight shape, L-shape, T-shape, at 45° angle, X-shape, Y-shape, push-in bulkhead connector
online: ➔	qs

Product overview

Pneumatic fittings >

Pneumatics push-in fittings

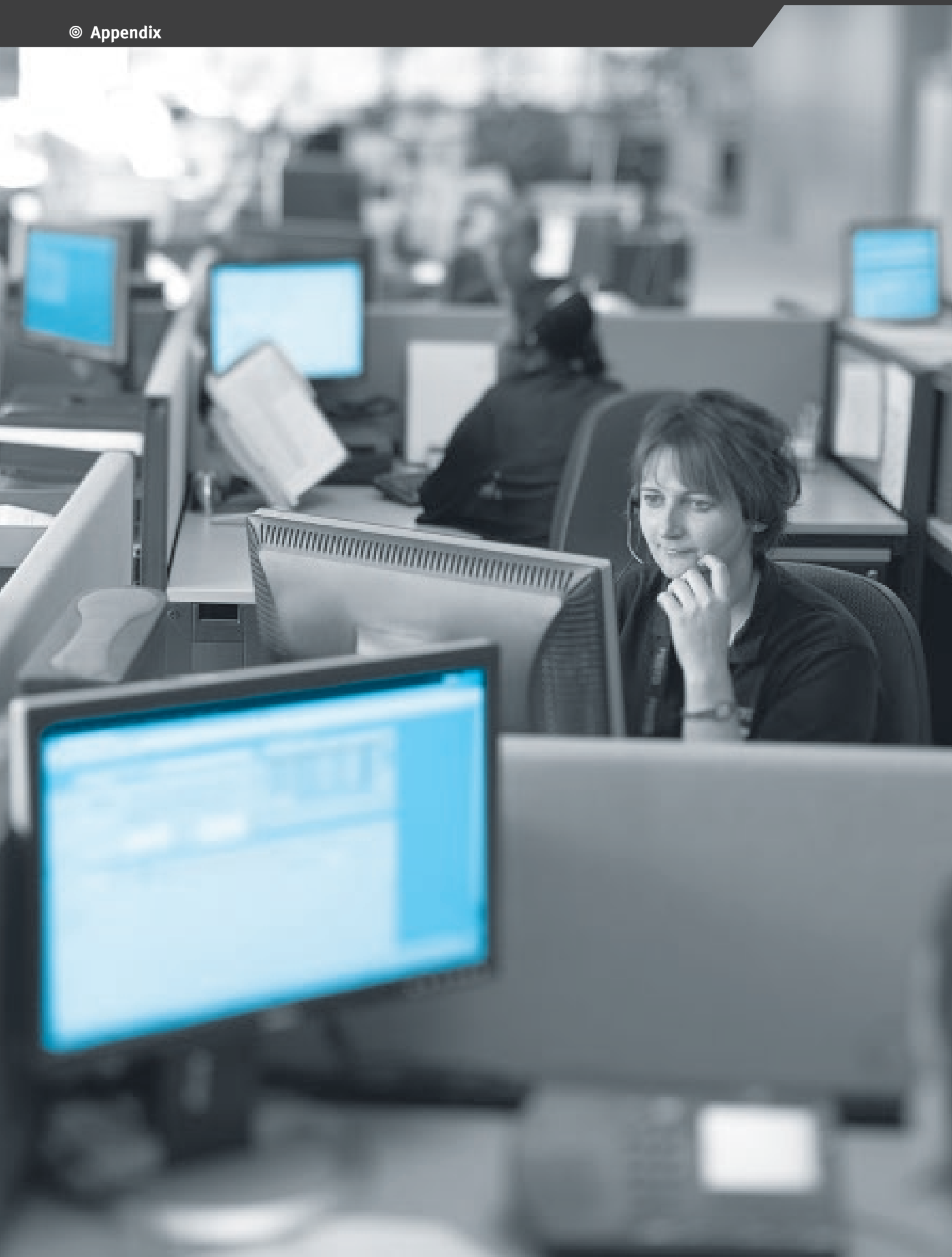
			
	Push-in fittings/connectors NPQH	**Push-in fittings/connectors NPQE-F1A**	**Push-in fittings/connectors NPQR**
Pneumatic connection 1	Push-in sleeve Ø 4 mm, Push-in sleeve Ø 6 mm, Push-in sleeve Ø 8 mm, Push-in sleeve Ø 10 mm, Push-in sleeve Ø 12 mm, Push-in sleeve Ø 14 mm, Female thread G1/4, G1/8, For tubing O.D. 10 mm, 12 mm, 14 mm, 4 mm, 6 mm, 8 mm, Male thread G1/2, G1/4, G1/8, G3/8, M5, M7	Male thread G1/4, G1/8, M5, M7	For tubing O.D. 10 mm, 12 mm, 14 mm, 16 mm, 4 mm, 6 mm, 8 mm, Male thread G1/2, G1/4, G1/8, G3/8, M5, M7
Pneumatic connection 2	Push-in sleeve Ø 4 mm, Push-in sleeve Ø 6 mm, Push-in sleeve Ø 8 mm, Push-in sleeve Ø 10 mm, Push-in sleeve Ø 12 mm, Push-in sleeve Ø 14 mm, For tubing O.D. 10 mm, 12 mm, 14 mm, 4 mm, 6 mm, 8 mm	For tubing O.D. 10 mm, 12 mm, 4 mm, 6 mm, 8 mm	For tubing O.D. 10 mm, 12 mm, 14 mm, 16 mm, 4 mm, 6 mm, 8 mm
Design type	Blanking plug, L-shape, L-shape, long, Bulkhead, T-shape, Plug screw, Y-shape, Straight design	Straight design	L-shape, Bulkhead, T-shape, Plug screw, Y-shape, Straight design
Operating pressure for entire temperature range	-0.95 ... 20 bar	-0.95 ... 8 bar	-0.95 ... 16 bar
Ambient temperature	0 ... 150°C	-5 ... 60°C	-20 ... 150°C
Cleanroom class	Class 4 according to ISO 14644-1	Class 4 according to ISO 14644-1	Class 4 according to ISO 14644-1
Suitability for the production of Li-ion batteries		Metals with more than 1% by mass of copper, zinc or nickel by mass are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils, Metals with more than 1% by mass of copper, zinc or nickel are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils	Metals with more than 1% by mass of copper, zinc or nickel by mass are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils, Metals with more than 1% by mass of copper, zinc or nickel are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils
LABS (PWIS) conformity	VDMA24364-B1/B2-L	VDMA24364 zone III	VDMA24364-B2-L
Description	• Solid-metal brass, chemically nickel-plated • High corrosion and chemical resistance • Highly resistant to temperatures and pressure • Food grade see www.festo.com/certificates/NPQH • Operating media compressed air, vacuum, water. Water as per the manufacturer's declaration, see www.festo.com/certificates/NPQH • Straight shape, L-shape, T-shape, Y-shape, push-in bulkhead connector	• Economical push-in fittings for pneumatic applications • Recommended for production systems for manufacturing lithium-ion batteries • Tapered thread in accordance with JIS B0203 and compatible with pressure-tight media to DIN EN 10226 • Operating medium: compressed air, vacuum • Straight shape, T-shape, L-shape, Y-shape	• Very easy to clean thanks to chamfered O-ring and fewer edges where dirt can accumulate • Optimal price/performance ratio, perfect for applications from a single source • Maximum corrosion resistance (corrosion resistance class CRC 4 to Festo standard 940 070) and chemical resistance • High temperature resistance • Stainless steel • Operating media: compressed air, vacuum, (water) • Straight shape, L-shape, T-shape, Y-shape, push-in bulkhead connector
online: →	npqh	npqe	npqr

Pneumatic fittings >

Barbed fittings

	 Quick connectors NPCK	 Quick connectors ACK, CK, CV, FCK, GCK, LCK, QCK, SCK, TCK
Nominal size	2 ... 6.2 mm	2 ... 11.7 mm
Pneumatic connection 1	Male thread G1/4, G1/8, G3/8, M5	Male thread G1/2, G1/4, G1/8, G3/8, M5
Pneumatic connection 2	For tubing O.D. 10 mm, 4 mm, 6 mm, 8 mm	For barbed connector I.D. 13 mm Via union nut, 3 mm Via union nut, 4 mm Via union nut, 6 mm Via union nut, 9 mm Via union nut, For tubing O.D. 4 mm, 6 mm, 8 mm
Design type	Straight design	Straight design
Operating pressure for entire temperature range	-0.95 ... 12 bar	-0.95 ... 10 bar
Ambient temperature	-20 ... 120°C	-10 ... 60°C
Cleanroom class	Element installed statically, no meaningful evaluation possible according to ISO 14644-1	Element installed statically, no meaningful evaluation possible according to ISO 14644-1
Suitability for the production of Li-ion batteries	Metals with more than 1% by mass of copper, zinc or nickel by mass are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils, Metals with more than 1% by mass of copper, zinc or nickel are excluded from use. Exceptions are nickel in steel, chemically nickel-plated surfaces, printed circuit boards, cables, electrical plug connectors and coils	
LABS (PWIS) conformity	VDMA24364-B2-L, VDMA24364 zone III	VDMA24364-B1/B2-L
Description	• Stainless steel design • Food grade see www.festo.com/certificates/NPCK • Fulfils all clean design requirements • Operating media compressed air, vacuum, water. Water as per the manufacturer's declaration, see www.festo.com/certificates/NPCK • Straight shape	• Bulkhead quick connector • Sealing cap for plastic tube fittings and barbed fittings • Multiple distributor • Union nut for CK tube fitting • Operating media: compressed air, vacuum, (water) • Aluminium, steel, POM or zinc • Straight design, L-shaped, T-shaped
online: →	npck	ck

Product overview



Tips for cleanroom design – which principles are appropriate for automation?

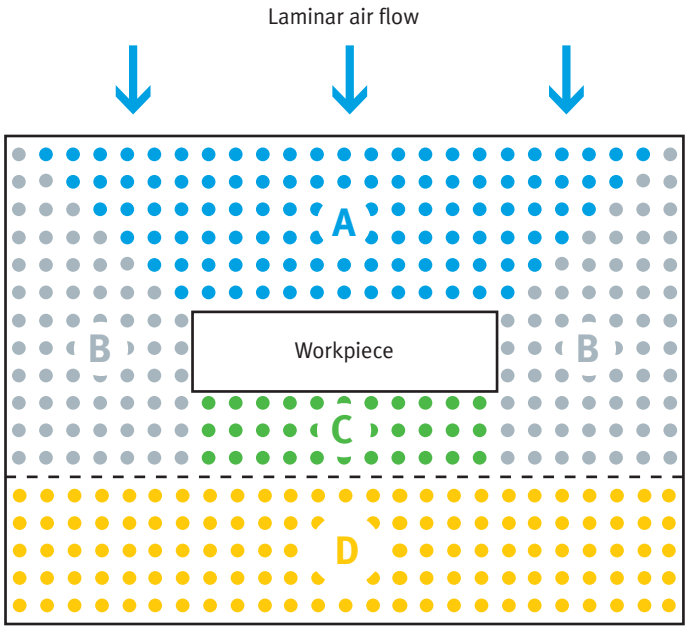
These tips are our recommendations for general and product-specific design principles for machines in cleanroom environments. They should be taken into account when preparing a solution for your application requirements.

We have divided them into three categories:

1) General considerations
2) Design decisions and product selection
3) Important factors for using the products

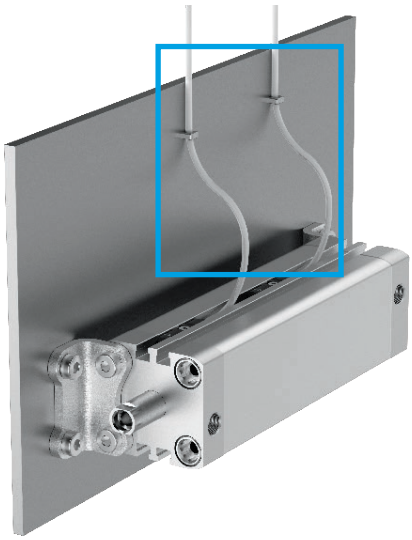
1) General considerations

- Minimise sliding friction as much as possible. For example, use roller guides instead of plain-bearing guides.
- Try to integrate several tasks into one solution. Reduce the number of parts to a minimum and where possible use single parts instead of several parts.
- Other measures:
  - Cover potential particle sources.
  - Enclose all moving parts and isolate them from the workpiece as much as possible.
  - Use a precisely positioned air flow to remove particles.
- Position your automation equipment so any particle emissions will be in non-critical areas.

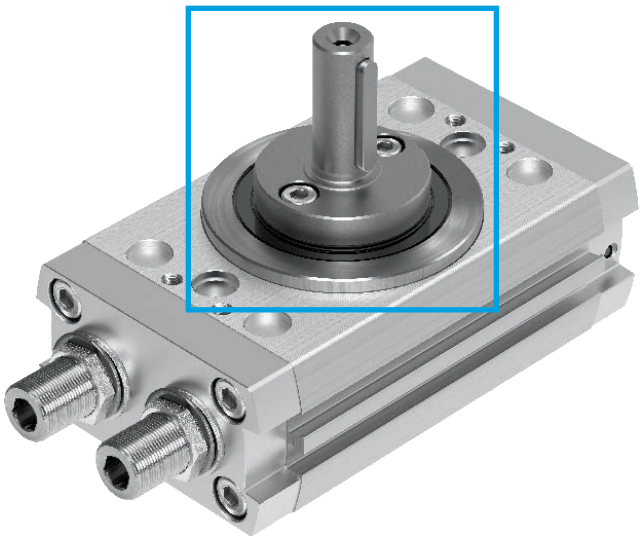


A) Critical area from which particles can come into contact with the workpiece.
B) Non-critical area from which particles cannot easily come into contact with the workpiece.
C) Area in which obstructions to the laminar air flow should be minimised to prevent particles being transferred to the workpiece.
D) Particles from this area are removed by the laminar air flow and cannot come into contact with the workpiece.

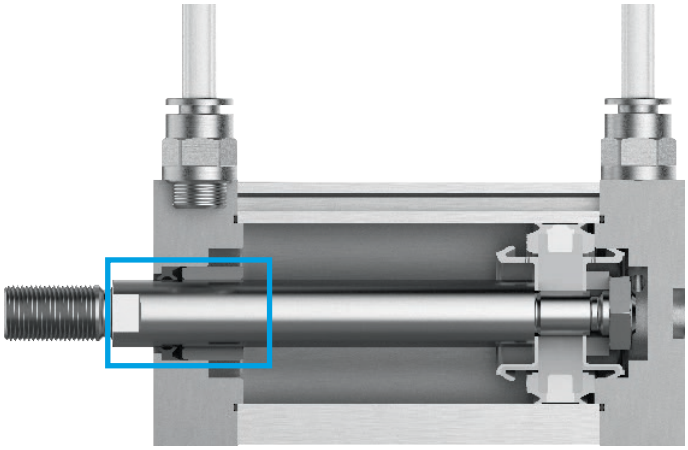
2) Design decisions and product selection



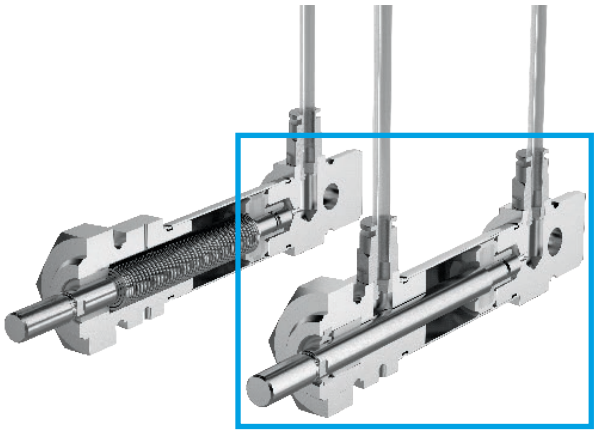
The right wiring and tubing will prevent particle emissions caused by friction.



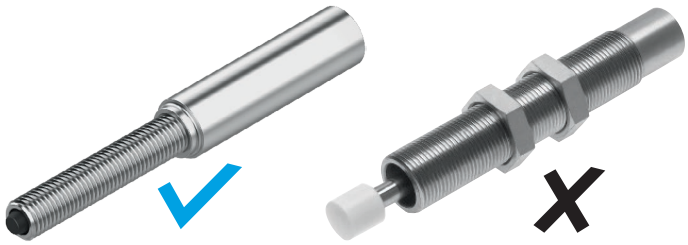
Use rotary drives wherever possible, as they are easier to seal than linear drives.



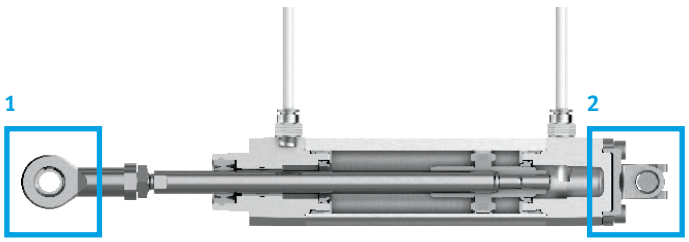
You should avoid high-force impacts in the end position. That's what cylinder cushioning is for. Adjustable and self-adjusting variants PPV and PPS significantly reduce particle emissions.



Use double-acting drives wherever possible. This will prevent increased particle emissions at the exhaust opening and the piston rod seal. Air leaking at the piston rod can be aspirated with an additional vacuum port.

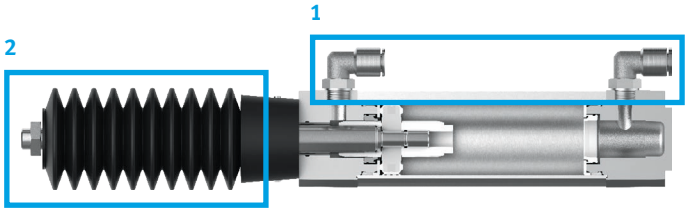


Use polymer shock absorbers. This will eliminate particle emissions from metal abrasion and oil mist, which can occur when using hydraulic cushioning.

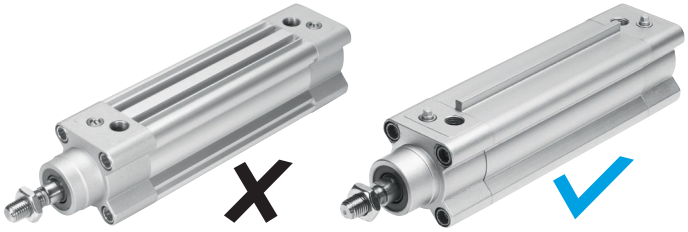


Avoid designs with rod eyes [1], self-aligning rod couplers, rotatable flanges [2] and swivel flanges. These mechanical components generate friction and thus particle emissions that are not taken into account in catalogues and datasheets.

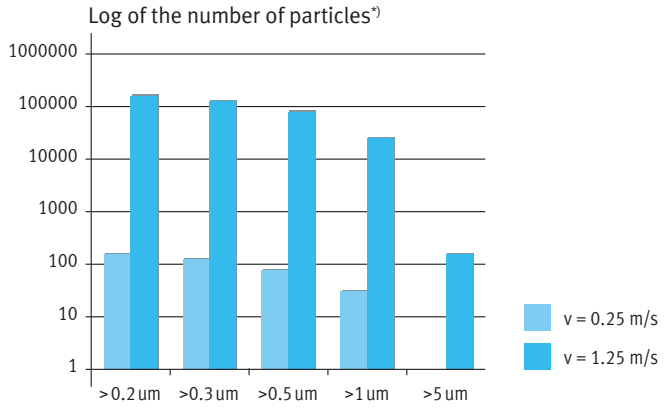
Tips for cleanroom design



Use push-in fittings [1]. When correctly mounted, they are generally are leak-free. Protective bellows [2] prevent the emission of particles, and vacuum ports reliably extract emissions at the piston rod seal.

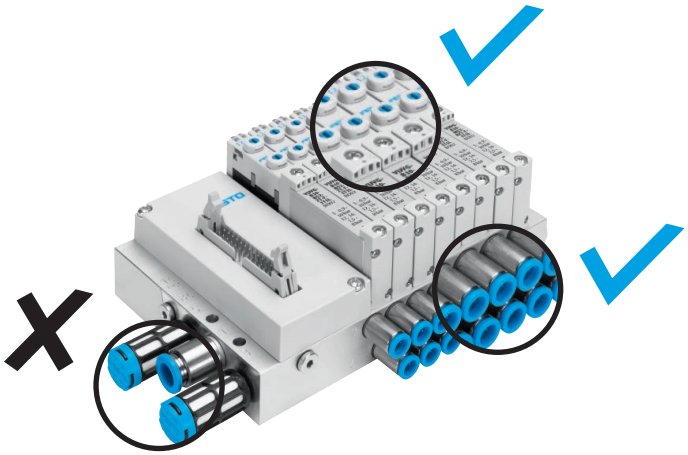


Use products with smooth surfaces and clean design. This prevents deposits of particles that could be discharged later.

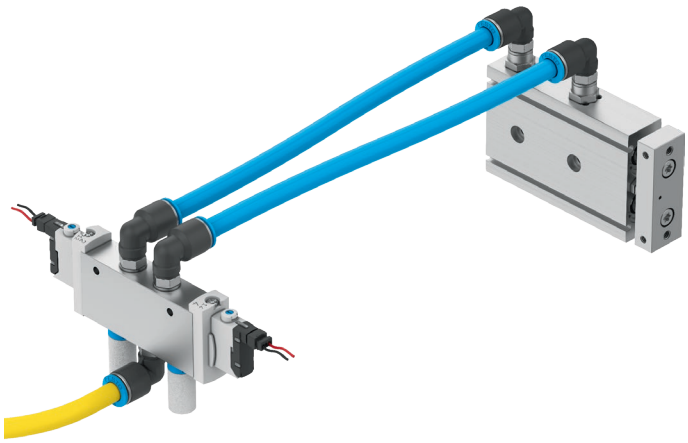


*) Sample measurement at a round cylinder DSNU

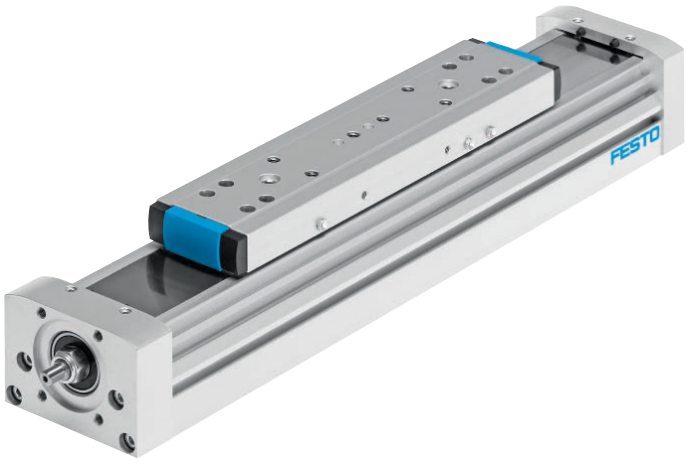
Try to reduce the speed of the drive as much as possible, as this will reduce friction and emissions.
Remember that reduced speed means reduced number of particles!



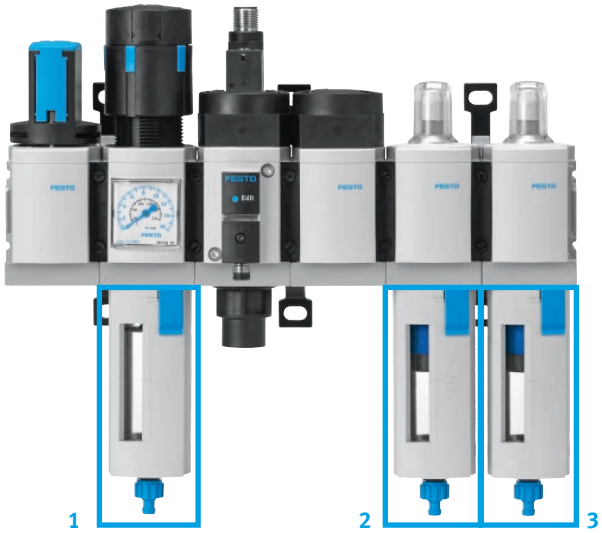
Carefully mount the fittings on the valve terminals, duct the exhaust air and remove it from the clean environment. Do not use silencers.



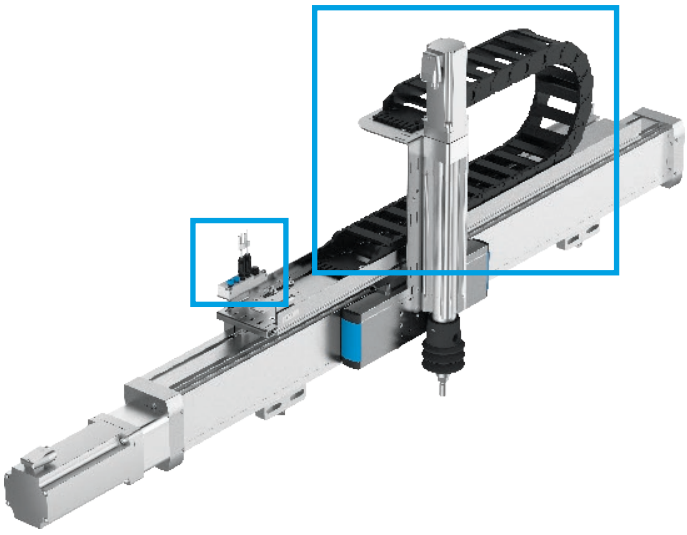
If particle emissions cannot be avoided with conventional operation, then change the operating mode of the cylinder to vacuum.



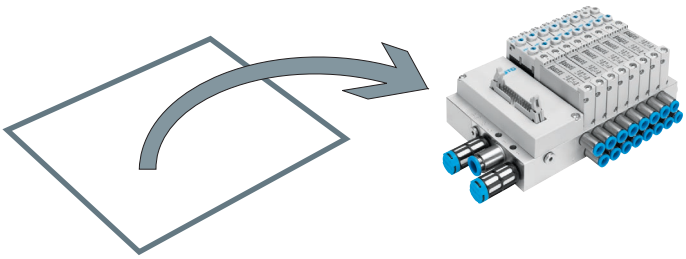
Use spindle axes with internal guides rather than electric drives. Here too, vacuum ports will help to eliminate particle emissions from the working area and improve the cleanroom class.



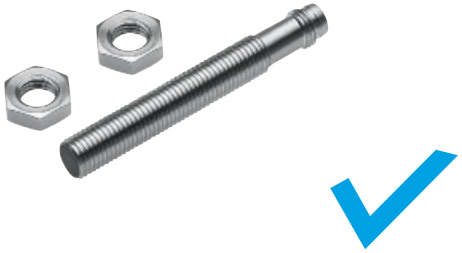
Install a filter cascade to keep the air as pure as possible [1 ... 3], e.g. with 40 µm, 5 µm and 1 µm. In addition, you can use finer filters behind the service unit MS, if necessary.



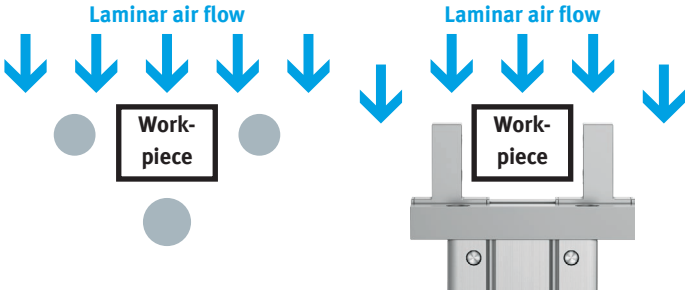
Position handling systems under the workpiece so particles will not fall on the product. Use special energy chains for the cleanroom.



Try to install valve terminals and other control components away from the working area.



Use stainless steel screws, washers and nuts.



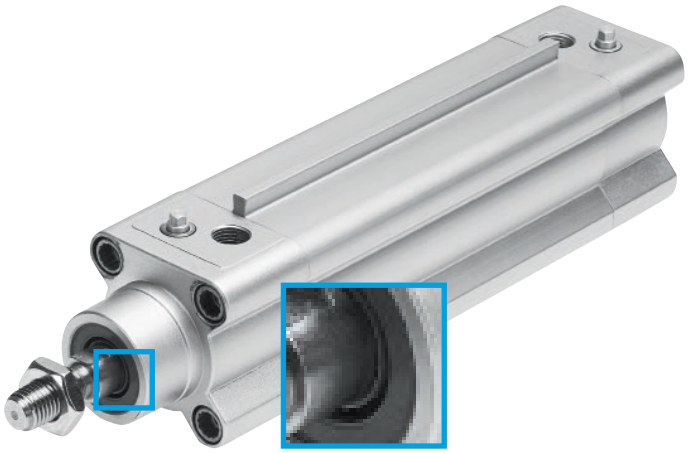
Ensure that the laminar air in your design flows from the top to the bottom and position the automation equipment so that the air reaches the product from the side or from below. This will enable an undisturbed air flow; the particles will fall down and not land on the product. This also applies to the grippers.

3) Other important factors for using products

General:
Consider potential sources of hydrocarbons or gases released by materials that are used in equipment and processes (cleaning agents, packaging materials etc.).

If necessary, avoid contamination with metal particles, such as copper, zinc and nickel. Festo offers a range of products that contain a reduced amount of these critical metals.

Make sure that there are no unconventional sources of contamination in your production process, such as reaction layers of chemical compounds, hydrocarbons, humidity or other impurities.



Check drives regularly for contamination and clean them. This prevents additional particle emissions.

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The limit values specified in the technical data and any specific safety instructions must be adhered to by the user in order to ensure correct functioning.

The pneumatic components must be supplied with properly prepared compressed air without aggressive media.
Take the ambient conditions at the place of use into consideration. Corrosive, abrasive and dusty environments (e.g. water, ozone, grinding dust) will reduce the service life of the product.
Check the resistance of the materials of Festo products to the media used or the environmental media.

When using Festo products in safety-oriented applications, all national and international laws and regulations, for example the EC Machinery Directive, must be observed and complied with together with the relevant references to standards, trade association rules and the applicable international regulations.

Unauthorised conversions or modifications to products and systems from Festo constitute a safety risk and are thus not permitted.
Festo doesn't accept any liability for any resulting damage.

You should consult Festo if one of the following applies to your application:
- The ambient conditions and operating conditions or the operating medium differ from the specified technical data.
- The product is to perform a safety function.
- A risk or safety analysis is required.
- You are unsure about the product's suitability for the planned application.
- You are unsure about the product's suitability for use in safety-oriented applications.

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Cleanroom product overview

Components for cleanroom technology

135645
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