

T-smart Butterfly Valves

Product Group Flow Components
Catalog 2016



gea.com

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Regardless of the application – for our customers product quality and profitability are what matters. This is what GEA Flow Components is known for. Our engineers are specialists in everything that flows.



Around one quarter of the milk processed is handled by GEA equipment



Roughly every second liter of beer is brewed using GEA equipment and solutions



Approx. one in three instant coffee lines has been built by GEA

GEA Group Aktiengesellschaft

GEA is one of the largest suppliers of process technology for the food industry and for a wide range of other industries. As an international technology group, the company focuses on world-leading process solutions and components for sophisticated production processes.

GEA Flow Components

GEA offers well-engineered process components and services to ensure smooth production processes in the treatment of liquid products. We develop and produce a comprehensive product range that includes valve technology for all hygienic classes (Hygienic, UltraClean, Aseptic), hygienic pumps and cleaning technology.

GEA Flow Components products and services are available around the world through the international GEA network.

State-of-the-art hygienic design

GEA Flow Components meet the highest hygienic standards where required, such as EHEDG and 3-A standards.

Hygienic valves and components from GEA form the core component of matrix-piped process plants.

When it comes to sterile applications, GEA offers both UltraClean and Aseptic valves and systems. The hermetic sealing of the product area provides a maximum level of process line isolation and thus contributes to process and product safety.

The hygienic pump range from GEA includes centrifugal pumps (single-stage, multi-stage and self-priming), as well as rotary lobe pumps.

GEA cleaning devices – whether index, orbital, rotary or static – achieve optimum cleaning results in multiple industries. GEA product recovery systems help to recover valuable products and reduce both waste disposal costs as well as water and detergent consumption.

Applikationen

- Beverage
 - Beer, juice, smoothie products ...
- Dairy
 - Milk, yoghurt, cheese ...
- Food
 - Sauces & cremes, ketchup, mayonnaise ...
- Pharma/Biotech
 - Pharmaceuticals, biotechnology products, cosmetics & health care ...
- Chemicals
 - Fine chemicals, bulk chemicals, cleaning chemicals ...
- Dairy farming
 - Raw milk processing ...



Hygienic Valve Technology

A complete range of economically designed Hygienic valves for complex tasks as well as basic functions, helping producers to achieve high product quality and efficiency.



Aseptic Valve Technology

UltraClean and Aseptic valves are suitable for production processes which require a higher safety protection against contamination from the environment and thus warrant microbial stability of the product over the whole process.



Hygienic Pump Technology

A great variety of Hygienic pumps with sensibly rated high efficiency motors and carefully designed flow paths, driving economic efficiency and sustainable operation.



Cleaning Technology

Index, orbital, rotating and static cleaners in a complete range, developed with special emphasis on saving valuable resources in the cleaning process.



GEA Tuchenhausen products are based on future-oriented company and product design principles that include an obligation to economic viability, sustainability and service.

Your investment pays off

The current generation of GEA Tuchenhausen butterfly valves provide users with considerable cost savings. Compact actuators and efficient control technology keep energy consumption as low as possible.

Carefully designed flow paths free from dead corners minimize product loss. Long-life gaskets reduce operating costs. Consumption of time, water and resources is considerably reduced, with a positive impact on staff and process productivity.

Your investment in modern process technology from GEA Tuchenhausen thus provides special advantages to pay off in the shortest time.

Economical
Higher product quality
Reduced consumption of energy, water and cleaning media
Reduced time and personnel costs for maintenance and cleaning



You score points with environmental protection

Lower consumption of energy, water and chemicals means less pollution for the climate and environment. GEA Tuchenhausen meets these requirements by complying with binding international standards.

As a user of GEA Tuchenhausen products, you benefit from proven environmentally-friendly production processes, as well as the high standards for hygienic processing and care of your products. This makes a significant contribution to protecting the global environment and climate.

With our products, you show how important sustainable working processes are to you and that you take responsibility for future generations!

Sustainable

- Lower climate and environmental impact
- Sustainable, environmentally friendly production processes
- High standards for hygienic processing and care of products

Our support is your gain

In addition to our product range, you can also make use of the individualized engineering support from GEA Tuchenhausen. Even before you have started using our products, this support provides you with extensive digital tools – from technical drawings through to 3-D models.

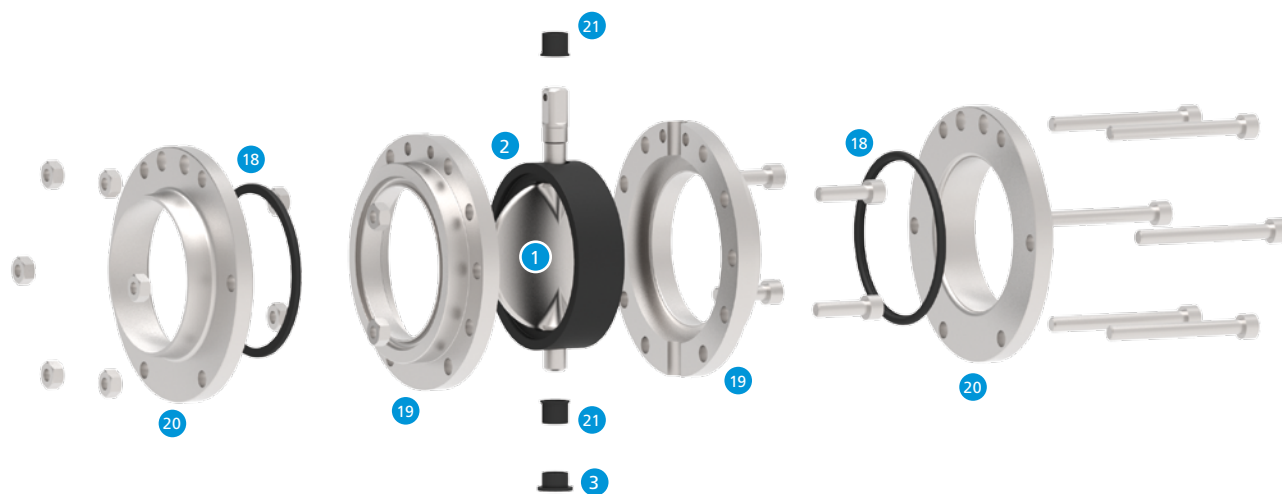
The individualized service concepts from GEA Tuchenhausen ensure that maintenance work is conducted with the lowest amount of production downtime possible.

We look forward to creating and customizing a maintenance plan for you.

Service-oriented

- Individual engineering support
- Shortest possible interruptions of production
- Individual service concept

Butterfly Valves T-smart 7



1 Butterfly valve disk

2 Butterfly valve gasket

3 Plug

18 VARIVENT® O-ring

19 Body flanges (intermediate flange with O-ring groove)

20 Welding flange (outside flange)

21 Bearings

Butterfly valves in the new T-smart 7 series provide a complete range of variants to serve any application. They are used as cost-effective shut-off elements on valve blocks, panels and pipe fences for product and cleaning.

The T-smart 7 series offers the benefits of good hygienic design, higher ease of assembly, shorter assembly and maintenance times and thus higher production uptimes.

The Butterfly Valves T-smart 7 are characterized by their hygienic design without dome and sump. The product flow meets little resistance, product areas drain automatically and cleaning proceeds efficiently.

Significant product features

Robust valve disk

Low switching torque

One-piece flange design

Selection of 2 metallic product wetted materials

Product wetted parts in AISI 304 (1.4301) or AISI 316L (1.4404)

Vacuum-proof

Pneumatic actuators

For narrow mounting situations and low air consumption the pneumatic actuators have been made even more compact. The gap-free design ensures optimum cleanability and fulfils highest demands to hygiene.

Torque maxima towards both end positions enable application on both normally closed and normally open valves. Metallic stops ensure exact disk positioning. There are air-to-spring and air-to-air variants.

The integrated T.VIS® interface also safely accommodates optional accessories – booster cylinder, two-position stop and limit stop. The internal pneumatic system reduces the risk of failures, being without external tubing.

All actuators are by default applicable for Ex zones. Compliance of any electric accessories with Ex regulations must be ensured.



Features
Compact, hygienic design
Metallic stops
Torque maxima towards both end positions
Air-to-spring and air-to-air variants available
Integrated T.VIS® interface
2 actuator dimensions available
<ul style="list-style-type: none"> • DN 15 to DN 100 and ½" OD to 4" OD • DN 125 and DN 150

Actuator bracket

The new actuator bracket can be attached to the flanges more easily because of its one-sided design and integrated threads for the mounting screws.

Two integrated proximity switch holders are located at a 45° angle above one of the two flanges. Turning the bracket 180° places the switches above the other side. This means one side of the valve is always free from structures mounted on top, thus allowing free access to male flanges, for example.

The switches are plugged into half-open holders on the side, which allows for easy mounting since the counter nuts only need to be loosened, not removed.



Intermediate flange variant

The intermediate flange variant offers simple plant extension even during operation while the butterfly valve safely shuts off the process from the atmosphere.

The intermediate flange variant comes as an open design. By screw-by-screw re-clamping, an outside flange can be separated from the inside flange during system operation, so it can be welded to a system extension unit. Upon installation of the extension unit this process is reversed and both parts are again connected.

As before, the actuator is mounted on the inner flanges, as a result of which the valve insert can be removed conveniently without the actuator having to be dismantled first. Apertures in the outer flanges allow the actuator to be mounted or changed at any time without removing the valve from the process line.

The additional intermediate flange seals are built in the proven VARIVENT® seal design.



The open flange design permits a screw-by-screw re-clamping from four to three flanges during operation in order for the removed outer flange to be welded, for example, onto a piping extension.

Technical advantages T-smart 788

Simple valve servicing
System extension at the valve during process operation
Actuator exchange at the valve in the piping
Intermediate flange seals built in the proven VARIVENT® seal design

Gaskets

The vacuum-proof gasket has been completely redeveloped and offers maximum stability and service life. The double-sided valve disk bearing provides a defined seal compression and lowest switch torque. Each nominal size between DN 25 and DN 150, or 1" OD and 4" OD, has its own seal seat geometry. Gaskets of nominal sizes DN 15, DN 20 and ½" OD and ¾" OD are based on the geometry of the 1" OD valve.



Gaskets with decisive advantages

Low torque
Double-sided valve disk bearing
Long service-life
Vacuum-proof
Selection of FDA-approved seal materials
• EPDM
• FKM
• HNBR
• VMQ

Selection of dimensions and connection fittings

Flange variant												
Code	Nominal diameter	DN	15	20	25	40	50	65	80	100	125	150
8	Intermediate flange V		•	•	•	•	•	•	•	•	•	•
1	Welded flange S		•	•	•	•	•	•	•	•	•	•
2	Male flange G (DIN 11851)				•	•	•	•	•	•	•	•
4	Liner K (DIN 11851)				•	•	•	•	•	•	•	•
3	Clamp flange C (DIN 32676, ISO 2852)				•	•	•	•	•	•		

Flange variant										
Code	Nominal diameter	OD	½"	¾"	1"	1 ½"	2"	2 ½"	3"	4"
8	Intermediate flange V		•	•	•	•	•	•	•	•
1	Welded flange S		•	•	•	•	•	•	•	•
2	Male flange G (based on DIN 11851)				•	•	•	•	•	•
2	Male flange SMS (SMS 1146)				•	•	•	•	•	•
4	Liner K (based on DIN 11851)				•	•	•	•	•	•
3	Clamp flange C (DIN 32676, ISO 2852)				•	•	•	•	•	•



8 (T-smart 788)



1 (T-smart 711)



2 (T-smart 722)



4 (T-smart 714)



3 (T-smart 733)

Pipe classes

Dimensions of weld connections comply with the following standards:

- **Metric:** Outside diameter acc. to DIN 11850, series II, DIN 11866, series A
- **Inch OD:** Outside diameter acc. to BS 4825
- **Inch SMS:** Outside diameter acc. to SMS 1146

Surfaces

Product wetted surfaces are by default finished to $R_a \leq 0.8 \mu\text{m}$. Higher-quality surfaces finished to $R_a \leq 0.4 \mu\text{m}$ are optionally available.

Non product wetted surfaces (flanges) are metal blank.

Materials

Product wetted parts of the Butterfly Valves T-smart 7 are built in AISI 304 (1.4301) or AISI 316L (1.4404). Other materials are available on request, e.g. for applications handling aggressive media.

For detailed information regarding properties of the materials consult the **material properties** table.

Test report and inspection certificate

Flanges and disks of the Butterfly Valves T-smart 7 are available with test report 2.2 or inspection certificate 3.1 in compliance with EN 10204 (on request).

Seal materials

Product wetted seals are EPDM (default), HNBR, FKM or VMQ.

Mixing components of our seal materials are included in the FDA "**White List**" and comply with the "**FOOD and DRUG**" (FDA) regulations 21 CFR Part 177.2600 and 21 CFR 177.1550: "Rubber Articles intended for repeated use".

The resistance of the sealing material depends on the type and temperature of the medium conveyed. The contact time can negatively affect the service life of the seals.

For detailed information regarding properties of the seal materials consult the **seal material properties** table.

Conditions for operation

Butterfly Valves T-smart 7 can be operated at ambient temperatures from 0 to 45 °C (32 to 113 °F). The proximity switches are approved for ambient temperatures from -20 to 80 °C (-4 to 176 °F). The Butterfly Valves T-smart 7 can be operated in outdoor areas. However, they need to be protected from frost in those areas or must be de-iced before switching.

Butterfly Valves T-smart 7 must be mounted stress-free. Horizontal lateral forces, e.g. thermal pipe elongation, cannot be compensated for in the valve, which makes damages to the valve a possibility. In such cases, suitable measures to compensate the elongation are recommended, such as using a VARICOMP® expansion compensator.

The clearance required for mounting and demounting Butterfly Valves T-smart is listed together with the respective technical data and dimensions.

Control air

The control air pressure is min. 4.8 bar, max. 8 bar. For lower control air pressure, a booster cylinder can be applied. The quality of the control air must comply with the requirements acc. to ISO 8573-1:2010:

ISO 8573-1:2010	
Particle content	Quality class 6
	Particle size max. 5 µm
	Particle density max. 5 mg/m ³
Water content	Quality class 4
	Max. dew point 3 °C
	For operation locations in higher regions or at low ambient temperatures, the dew point must be re-calculated accordingly.
Oil content	Quality class 3
	Max. 1 mg oil for 1 m ³ air, ideally oil-free

Operating pressure

The valves are vacuum proof up to 0.05 bar (abs). The maximum product pressure for which the valves can be configured is 10 bar.

Actuator selection

The modular concept of the Butterfly Valves T-smart 7 allows for a variety of actuator variants to be fitted. Different manual and pneumatic actuators are available.

The pneumatic actuators are optimized for long-term operation and are maintenance-free. To prevent damages in the pipe-work, the closing speed of the pneumatic actuators can be reduced per air throttle.

For partial opening or closure an optional limit stop and a two-step cylinder are available.

Feedback signal

Proximity switches of M12×1 size indicate the positions "open" and/or "closed". The actuator bracket for pneumatic actuators has two sensor casings, an optional and retro-fittable proximity switch holder is available for standard manual actuators.

All pneumatic actuators can be fitted with the proven T.VIS® control top with all options.

Material properties

Material number	Short name	Similar materials			PREN***	Main alloy elements in % by mass			
						Cr (Chrome)	Ni (Nickel)	Mo (Molybdenum)	C max. (Carbon)
AISI 304* and**	X5CrNi18-10	1.4301	BS 304S15	SS2332	18	17.5–19.5	8.0–10.5	–	0.07
AISI 316L**	X2 CrNiMo 17-12-2	1.4404	BS 316S11	SS2348	25	16.5–18.5	10.0–13.0	2.0–2.5	0.03
1.4410	X2 CrNiMoN 22-5-3	SAF 2507®	–	SS2328	39	24.0–26.0	6.0–8.0	3.0–4.5	0.03
AL-6XN®	–	–	–	–	43	20.0–22.0	23.5–25.5	6.0–7.0	0.03
2.4602	NiCr21Mo14W HASTELLOY C-22	–	–	–	69	20.0–22.5	Rest	12.5–14.5	0.01

* Standard material for components not in contact with the product

** Standard material for components in contact with the product (other materials available on request)

*** Pitting Resistance Equivalent Number = % Cr + 3.3 × (% Mo + 0.5 W) + 20 N

Seal material properties

Seal material			EPDM	FKM	HNBR	VMQ
General application temperature*			–40 to 135 °C –40 to 275 °F	–10 to 200 °C 14 to 392 °F	–25 to 140 °C –13 to 284 °F	–50 to 200 °C –58 to 392 °F
Medium	Concentration	At permitted operating temperature				
Alkali	≤ 3 %	up to 80 °C	+	○	+	○
	≤ 5 %	up to 40 °C	+	○	○	○
	≤ 5 %	up to 80 °C	+	–	–	○
	> 5 %		○	–	–	○
Inorganic acid**	≤ 3 %	up to 80 °C	+	+	+	○
	≤ 5 %	up to 80 °C	○	+	○	○
	> 5 %	up to 100 °C	–	+	–	○
Water		up to 80 °C	+	+	+	+
Steam		up to 135 °C	+	○	○	○
Steam, approx. 30 min		up to 150 °C	+	○	–	○
Hydrocarbons/fuels			–	+	○	–
Products containing grease	≤ 35 %		+	+	+	○
	> 35 %		–	+	+	○
Oils			–	+	+	○

+ = Good resistance

○ = Reduced service life

– = Not resistant

Other applications on request

* Depending on the installation situation

** Inorganic acids include hydrochloric acid, nitric acid, sulphuric acid

Certificates

The certificates listed here are valid for T-smart 7 butterfly valves. Valves conform to the requirements of the European Hygienic Engineering and Design Group (EHEDG) and the

Canadian Registration Number (CRN); further national and international standards are available for numerous fields of applications.

	Index		Standard certificates			Optional certificates					
			FDA	CE*	EHEDG	ADI free	ATEX	CRN	EG Nr. 1935/2004	TA-Luft VDI 2440	USP Class VI
T-smart 7	1	Butterfly Valve type 711	•	•	•	•	•	OC16912.5CL	•	•	•
	1	Butterfly Valve type 721	•**	•	•	•**	•	OC16912.5CL	•**	•	•**
	1	Butterfly Valve type 722	•**	•	•	•**	•	OC16912.5CL	•**	•	•**
	1	Butterfly Valve type 724	•**	•	•	•**	•	OC16912.5CL	•**	•	•**
	1	Butterfly Valve type 714	•	•	•	•	•	OC16912.5CL	•	•	•
	1	Butterfly Valve type 731	•	•	•	•	•	OC16912.5CL	•	•	•
	1	Butterfly Valve type 733	•	•	•	•	•	OC16912.5CL	•	•	•
	1	Butterfly Valve type 788	•	•	•	•***	•	OC16912.5CL	•***	•	•***

* only for valves with pneumatic actuator

** only for center seals

*** for HNBR and VMQ restricted to the center seal



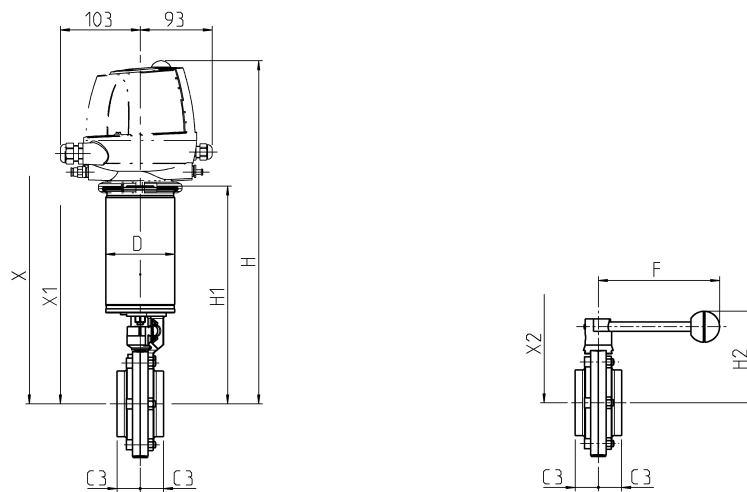
Technical data of the standard version

Product wetted materials	AISI 304
Non product wetted materials	AISI 304
Product wetted gasket material	EPDM
Ambient temperature	0 to 45 °C
Control air pressure	4.8 to 8 bar
Max. product pressure	10 bar
Product wetted surface	R _a 0.8 µm
Non product wetted surface	Metal blank
Pneumatic Actuator	Air-to-spring

Certificates



*The CE-marking is valid for a T-smart Butterfly Valve with pneumatic actuator.



	Pipe	Actuator		Dimensions			Removal space			Flange width	Valve	
Nominal size	Ø [mm]	Ø D [mm]	F [mm]	H [mm]	H1 [mm]	H2 [mm]	X [mm]	X1 [mm]	X2 [mm]	C3 [mm]	KVS [m³/h]	Weight (without actuator) [kg]
DN 15	19 × 1.5	88.9	116	415.0	253.0	83.0	435.0	273.0	103.0	25	10.0	0.7
DN 20	23 × 1.5	88.9	116	415.0	253.0	83.0	435.0	273.0	103.0	25	12.0	0.7
DN 25	29 × 1.5	88.9	116	415.0	253.0	83.0	435.0	273.0	103.0	25	21.0	0.6
DN 40	41 × 1.5	88.9	116	418.5	256.5	86.5	438.5	276.5	106.5	25	72.0	0.8
DN 50	53 × 1.5	88.9	116	427.0	265.0	95.0	447.0	285.0	115.0	25	130.0	1.2
DN 65	70 × 2.0	88.9	116	434.5	272.5	103.0	454.5	292.5	123.0	25	250.0	1.5
DN 80	85 × 2.0	88.9	160	440.5	278.5	114.5	460.5	298.5	134.5	30	340.0	2.0
DN 100	104 × 2.0	114.3	160	456.5	294.5	128.0	476.5	314.5	148.0	30	750.0	2.5
DN 125	129 × 2.0	114.3	220	472.0	310.0	146.0	492.0	330.0	166.0	35	1100.0	5.4
DN 150	154 × 2.0	114.3	220	486.0	324.0	159.0	506.0	344.0	180.0	40	1800.0	6.9
OD ½"	12.7 × 1.6	88.9	116	415.0	253.0	83.0	435.0	273.0	103.0	25	3.5	0.8
OD ¾"	19.05 × 1.6	88.9	116	415.0	253.0	83.0	435.0	273.0	103.0	25	10.0	0.8
OD 1"	25.4 × 1.6	88.9	116	415.0	253.0	83.0	435.0	273.0	103.0	25	23.0	0.7
OD 1 ½"	38.1 × 1.6	88.9	116	420.0	258.0	88.0	440.0	278.0	108.0	25	87.0	0.8
OD 2"	50.8 × 1.6	88.9	116	428.0	266.0	96.0	448.0	286.0	116.0	25	170.0	1.1
OD 2 ½"	63.5 × 1.6	88.9	116	436.5	274.5	105.0	456.5	294.5	125.0	25	240.0	1.5
OD 3"	76.2 × 1.6	88.9	160	444.0	282.0	118.0	464.0	302.0	138.0	30	400.0	1.8
OD 4"	101.6 × 2.0	114.3	160	454.0	292.0	130.5	474.0	312.0	150.5	30	880.0	2.8

Position	Description of the order code			
1	Valve type			
	7	Butterfly Valve		
2	Flange connection			
	11	Weld connection/weld connection		
3	Pipe standard			
	0	OD	1	DN
4	Nominal size			
	012	OD ½"	015	DN 15
	075	OD ¾"	020	DN 20
	010	OD 1"	025	DN 25
	112	OD 1 ½"	040	DN 40
	200	OD 2"	050	DN 50
	212	OD 2 ½"	065	DN 65
	300	OD 3"	080	DN 80
	400	OD 4"	100	DN 100
			125	DN 125
			150	DN 150
5	Product wetted material			
	1	AISI 304 (1.4301)		
	2	AISI 316L (1.4404)		
6	Product wetted gasket material			
	0	EPDM		
	1	HNBR		
	2	FKM		
	6	VMQ		
7	Actuator type			
	0	Manual actuator		
	1	Pneumatic for T.VIS®		
	2	Pneumatic incl. 2 proximity switch holders		
	5	Manual actuator stepless		
	6	Manual actuator with scissors handle (up to OD 4"/DN 100)		
	9	Without actuator		
8	Air connection			
	0	Without		
	1	Metric (only for actuator type 2)		
	2	Inch (only for actuator type 2)		
	3	Metric with air throttle (only for actuator type 2)		
	4	Inch with air throttle (only for actuator type 2)		
9	Fail position of valve			
	0	Closed		
	1	Open		
	2	Air-to-air (actuator types 1 and 2 only)		
10	Accessories			
	0	Without		
	1	Extension piece +80 mm		
	2	Lockable bracket incl. 4 proximity switch holders (actuator type 0 only)		
	3	Limit stop (actuator types 1 and 2 only)		
	5	Two-position stop (actuator type 2 only)		
	7	Booster cylinder (actuator types 1 and 2 only)		
11	Product wetted surface			
	0	0.8 µm		
	1	0.4 µm		
12	Certificate			
	0	Without		
	1	Test report 2.2		
	2	Inspection certificate 3.1		
	3	Certificates 2.2 and 3.1		
13	ATEX approval			
	0	No		
	1	Yes		

The code is composed as follows, depending on the chosen configuration:

Position	1	2	3	4	5	6	7	8	9	10	11	12	13	Code for control + and feedback systems, see section 3
Code	7	1	1											



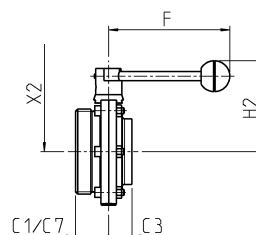
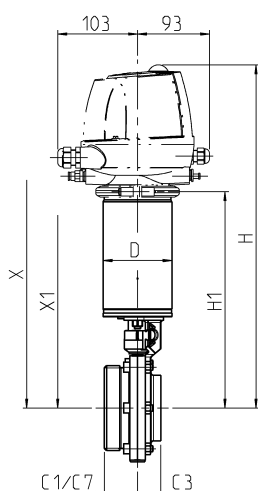
Technical data of the standard version

Product wetted materials	AISI 304
Non product wetted materials	AISI 304
Product wetted gasket material	EPDM
Ambient temperature	0 to 45 °C
Control air pressure	4.8 to 8 bar
Max. product pressure	10 bar
Product wetted surface	R _a 0.8 µm
Non product wetted surface	Metal blank
Pneumatic Actuator	Air-to-spring

Certificates



*The CE-marking is valid for a T-smart Butterfly Valve with pneumatic actuator.



	Pipe	Actuator		Dimensions			Removal space			Flange width		Valve	
Nominal size	Ø [mm]	Ø D [mm]	F [mm]	H [mm]	H1 [mm]	H2 [mm]	X [mm]	X1 [mm]	X2 [mm]	C1 [mm]	C3 [mm]	KVS [m³/h]	Weight (without actuator) [kg]
DN 25	29 × 1.5	88.9	116	415.0	253.0	83.0	435.0	273.0	103.0	35	25	21	0.8
DN 40	41 × 1.5	88.9	116	418.5	256.5	86.5	438.5	276.5	106.5	35	25	72	1.1
DN 50	53 × 1.5	88.9	116	427.0	265.0	95.0	447.0	285.0	115.0	35	25	130	1.5
DN 65	70 × 2.0	88.9	116	434.5	272.5	103.0	454.5	292.5	123.0	38	25	250	1.9
DN 80	85 × 2.0	88.9	160	440.5	278.5	114.5	460.5	298.5	134.5	43	30	340	2.5
DN 100	104 × 2.0	114.3	160	456.5	294.5	128.0	476.5	314.5	148.0	43	30	750	3.2
DN 125	129 × 2.0	114.3	220	472.0	310.0	146.0	492.0	330.0	166.0	55	35	1100	6.8
DN 150	154 × 2.0	114.3	220	486.0	324.0	159.0	506.0	344.0	180.0	80	40	1800	9.0

OD 1"	25.4 × 1.6	88.9	116	415.0	253.0	83.0	435.0	273.0	103.0	47	25	23	0.8
OD 1 ½"	38.1 × 1.6	88.9	116	420.0	258.0	88.0	440.0	278.0	108.0	47	25	87	1.0
OD 2"	50.8 × 1.6	88.9	116	428.0	266.0	96.0	448.0	286.0	116.0	48	25	170	1.4
OD 2 ½"	63.5 × 1.6	88.9	116	436.5	274.5	105.0	456.5	294.5	125.0	50	25	240	1.9
OD 3"	76.2 × 1.6	88.9	160	444.0	282.0	118.0	464.0	302.0	138.0	55	30	400	2.2
OD 4"	101.6 × 2.0	114.3	160	454.0	292.0	130.5	474.0	312.0	150.5	60	30	880	3.5

	Pipe	Actuator		Dimensions			Removal space			Flange width		Valve	
Nominal size	Ø [mm]	Ø D [mm]	F [mm]	H [mm]	H1 [mm]	H2 [mm]	X [mm]	X1 [mm]	X2 [mm]	C7 [mm]	C3 [mm]	KVS [m³/h]	Weight (without actuator) [kg]
SMS 1"	25.4 × 1.6	88.9	116	415.0	253.0	83.0	435.0	273.0	103.0	36	25	23	0.8
SMS 1 ½"	38.1 × 1.6	88.9	116	420.0	258.0	88.0	440.0	278.0	108.0	41	25	87	1.0
SMS 2"	50.8 × 1.6	88.9	116	428.0	266.0	96.0	448.0	286.0	116.0	41	25	170	1.4
SMS 2 ½"	63.5 × 1.6	88.9	116	436.5	274.5	105.0	456.5	294.5	125.0	45	25	240	1.9
SMS 3"	76.2 × 1.6	88.9	160	444.0	282.0	118.0	464.0	302.0	138.0	45	30	400	2.2
SMS 4"	101.6 × 2.0	114.3	160	454.0	292.0	130.5	474.0	312.0	150.5	51	30	880	3.5

Position	Description of the order code for the standard version			
1	Valve type			
	7	Butterfly Valve		
2	Flange connection			
	21	Male/weld connection		
3	Pipe standard			
	0	OD	1	DN
4	Nominal size			
	010	OD 1"	025	DN 25
	112	OD 1 ½"	040	DN 40
	200	OD 2"	050	DN 50
	212	OD 2 ½"	065	DN 65
	300	OD 3"	080	DN 80
	400	OD 4"	100	DN 100
			125	DN 125
			150	DN 150
5	Product wetted material			
	1	AISI 304 (1.4301)		
	2	AISI 316L (1.4404)		
6	Product wetted gasket material			
	0	EPDM		
	1	HNBR*		
	2	FKM		
	6	VMQ*		
7	Actuator type			
	0	Manual actuator		
	1	Pneumatic for T.VIS®		
	2	Pneumatic incl. 2 proximity switch holders		
	5	Manual actuator stepless		
	6	Manual actuator with scissors handle (up to OD 4"/DN 100)		
	9	Without actuator		
8	Air connection			
	0	Without		
	1	Metric (only for actuator type 2)		
	2	Inch (only for actuator type 2)		
	3	Metric with air throttle (only for actuator type 2)		
	4	Inch with air throttle (only for actuator type 2)		
9	Fail position of valve			
	0	Closed		
	1	Open		
	2	Air-to-air (actuator types 1 and 2 only)		
10	Accessories			
	0	Without		
	1	Extension piece +80 mm		
	2	Lockable bracket incl. 4 proximity switch holders (actuator type 0 only)		
	3	Limit stop (actuator types 1 and 2 only)		
	5	Two-position stop (actuator type 2 only)		
	7	Booster cylinder (actuator types 1 and 2 only)		
11	Product wetted surface			
	0	0.8 µm		
	1	0.4 µm		
12	Certificate			
	0	Without		
	1	Test report 2.2		
	2	Inspection certificate 3.1		
	3	Certificates 2.2 and 3.1		
13	ATEX approval			
	0	No		
	1	Yes		

* For SMS dimensions the seal ring G is not part of the delivery.

The code is composed as follows, depending on the chosen configuration:

Position	1	2	3		4	5		6	7	8	9		10	11	12	13	
Code	7	2	1	-			-					-					Code for control + and feedback systems, see section 3



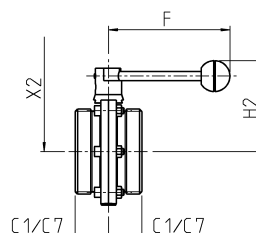
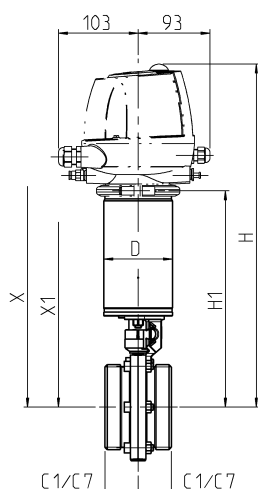
Technical data of the standard version

Product wetted materials	AISI 304
Non product wetted materials	AISI 304
Product wetted gasket material	EPDM
Ambient temperature	0 to 45 °C
Control air pressure	4.8 to 8 bar
Max. product pressure	10 bar
Product wetted surface	R _a 0.8 µm
Non product wetted surface	Metal blank
Pneumatic Actuator	Air-to-spring

Certificates



*The CE-marking is valid for a T-smart Butterfly Valve with pneumatic actuator.



	Pipe	Actuator		Dimensions			Removal space			Flange width	Valve	
Nominal size	Ø [mm]	Ø D [mm]	F [mm]	H [mm]	H1 [mm]	H2 [mm]	X [mm]	X1 [mm]	X2 [mm]	C1 [mm]	KVS [m³/h]	Weight (without actuator) [kg]
DN 25	29 × 1.5	88.9	116	415.0	253.0	83.0	435.0	273.0	103.0	35	21	1.0
DN 40	41 × 1.5	88.9	116	418.5	256.5	86.5	438.5	276.5	106.5	35	72	1.3
DN 50	53 × 1.5	88.9	116	427.0	265.0	95.0	447.0	285.0	115.0	35	130	1.8
DN 65	70 × 2.0	88.9	116	434.5	272.5	103.0	454.5	292.5	123.0	38	250	2.4
DN 80	85 × 2.0	88.9	160	440.5	278.5	114.5	460.5	298.5	134.5	43	340	3.1
DN 100	104 × 2.0	114.3	160	456.5	294.5	128.0	476.5	314.5	148.0	43	750	3.9
DN 125	129 × 2.0	114.3	220	472.0	310.0	146.0	492.0	330.0	166.0	55	1100	8.1
DN 150	154 × 2.0	114.3	220	486.0	324.0	159.0	506.0	344.0	180.0	80	1800	11.0

OD 1"	25.4 × 1.6	88.9	116	415.0	253.0	83.0	435.0	273.0	103.0	47	23	0.9
OD 1 ½"	38.1 × 1.6	88.9	116	420.0	258.0	88.0	440.0	278.0	108.0	47	87	1.1
OD 2"	50.8 × 1.6	88.9	116	428.0	266.0	96.0	448.0	286.0	116.0	48	170	1.6
OD 2 ½"	63.5 × 1.6	88.9	116	436.5	274.5	105.0	456.5	294.5	125.0	50	240	2.2
OD 3"	76.2 × 1.6	88.9	160	444.0	282.0	118.0	464.0	302.0	138.0	55	400	2.6
OD 4"	101.6 × 2.0	114.3	160	454.0	292.0	130.5	474.0	312.0	150.5	60	880	4.2

	Pipe	Actuator		Dimensions			Removal space			Flange width	Valve	
Nominal size	Ø [mm]	Ø D [mm]	F [mm]	H [mm]	H1 [mm]	H2 [mm]	X [mm]	X1 [mm]	X2 [mm]	C7 [mm]	KVS [m³/h]	Weight (without actuator) [kg]
SMS 1"	25.4 × 1.6	88.9	116	415.0	253.0	83.0	435.0	273.0	103.0	36	23	0.9
SMS 1 ½"	38.1 × 1.6	88.9	116	420.0	258.0	88.0	440.0	278.0	108.0	41	87	1.1
SMS 2"	50.8 × 1.6	88.9	116	428.0	266.0	96.0	448.0	286.0	116.0	41	170	1.6
SMS 2 ½"	63.5 × 1.6	88.9	116	436.5	274.5	105.0	456.5	294.5	125.0	45	240	2.2
SMS 3"	76.2 × 1.6	88.9	160	444.0	282.0	118.0	464.0	302.0	138.0	45	400	2.6
SMS 4"	101.6 × 2.0	114.3	160	454.0	292.0	130.5	474.0	312.0	150.5	51	880	4.2

Position	Description of the order code			
1	Valve type			
	7	Butterfly Valve		
2	Flange connection			
	22	Male/male		
3	Pipe standard			
	0	OD	1	DN
4	Nominal size			
	010	OD 1"	025	DN 25
	112	OD 1 ½"	040	DN 40
	200	OD 2"	050	DN 50
	212	OD 2 ½"	065	DN 65
	300	OD 3"	080	DN 80
	400	OD 4"	100	DN 100
			125	DN 125
			150	DN 150
	5	Product wetted material		
1		AISI 304 (1.4301)		
2		AISI 316L (1.4404)		
6	Product wetted gasket material			
	0	EPDM		
	1	HNBR*		
	2	FKM		
7	Actuator type			
	0	Manual actuator		
	1	Pneumatic for T.VIS®		
	2	Pneumatic incl. 2 proximity switch holders		
	5	Manual actuator stepless		
	6	Manual actuator with scissors handle (up to OD 4"/DN 100)		
	9	Without actuator		
8	Air connection			
	0	Without		
	1	Metric (only for actuator type 2)		
	2	Inch (only for actuator type 2)		
	3	Metric with air throttle (only for actuator type 2)		
9	Fail position of valve			
	0	Closed		
	1	Open		
	2	Air-to-air (actuator types 1 and 2 only)		
10	Accessories			
	0	Without		
	1	Extension piece +80 mm		
	2	Lockable bracket incl. 4 proximity switch holders (actuator type 0 only)		
	3	Limit stop (actuator types 1 and 2 only)		
	5	Two-position stop (actuator type 2 only)		
11	Product wetted surface			
	0	0.8 µm		
	1	0.4 µm		
12	Certificate			
	0	Without		
	1	Test report 2.2		
	2	Inspection certificate 3.1		
	3	Certificates 2.2 and 3.1		
13	ATEX approval			
	0	No		
	1	Yes		

* For SMS dimensions the seal ring G is not part of the delivery.

The code is composed as follows, depending on the chosen configuration:

Position	1	2	3	4	5	6	7	8	9	10	11	12	13	Code for control + and feedback systems, see section 3
Code	7	2	2											



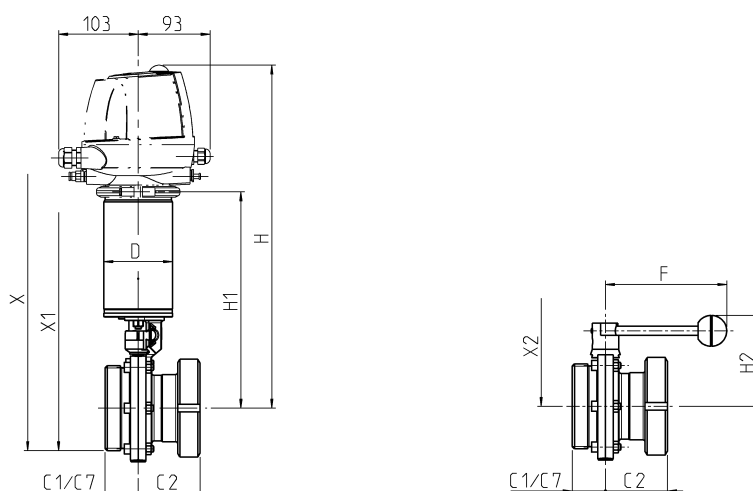
Technical data of the standard version

Product wetted materials	AISI 304
Non product wetted materials	AISI 304
Product wetted gasket material	EPDM
Ambient temperature	0 to 45 °C
Control air pressure	4.8 to 8 bar
Max. product pressure	10 bar
Product wetted surface	R _a 0.8 µm
Non product wetted surface	Metal blank
Pneumatic Actuator	Air-to-spring

Certificates



*The CE-marking is valid for a T-smart Butterfly Valve with pneumatic actuator.



	Pipe	Actuator		Dimensions			Removal space			Flange width		Valve	
Nominal size	Ø [mm]	Ø D [mm]	F [mm]	H [mm]	H1 [mm]	H2 [mm]	X [mm]	X1 [mm]	X2 [mm]	C1 [mm]	C2* [mm]	KVS [m³/h]	Weight (without actuator) [kg]
DN 25	29 × 1.5	88.9	116	415.0	253.0	83.0	435.0	273.0	103.0	35	47	21	1.2
DN 40	41 × 1.5	88.9	116	418.5	256.5	86.5	438.5	276.5	106.5	35	51	72	1.6
DN 50	53 × 1.5	88.9	116	427.0	265.0	95.0	447.0	285.0	115.0	35	53	130	2.2
DN 65	70 × 2.0	88.9	116	434.5	272.5	103.0	454.5	292.5	123.0	38	57	250	3.2
DN 80	85 × 2.0	88.9	160	440.5	278.5	114.5	460.5	298.5	134.5	43	67	340	4.2
DN 100	104 × 2.0	114.3	160	456.5	294.5	128.0	476.5	314.5	148.0	43	74	750	5.5
DN 125	129 × 2.0	114.3	220	472.0	310.0	146.0	492.0	330.0	166.0	55	69	1100	9.9
DN 150	154 × 2.0	114.3	220	486.0	324.0	159.0	506.0	344.0	180.0	80	77	1800	13.5

OD 1"	25.4 × 1.6	88.9	116	415.0	253.0	83.0	435.0	273.0	103.0	47	47	23	1.0
OD 1 ½"	38.1 × 1.6	88.9	116	420.0	258.0	88.0	440.0	278.0	108.0	47	51	87	1.4
OD 2"	50.8 × 1.6	88.9	116	428.0	266.0	96.0	448.0	286.0	116.0	48	53	170	1.9
OD 2 ½"	63.5 × 1.6	88.9	116	436.5	274.5	105.0	456.5	294.5	125.0	50	57	240	2.8
OD 3"	76.2 × 1.6	88.9	160	444.0	282.0	118.0	464.0	302.0	138.0	55	67	400	3.3
OD 4"	101.6 × 2.0	114.3	160	454.0	292.0	130.5	474.0	312.0	150.5	60	74	880	5.3

	Pipe	Actuator		Dimensions			Removal space			Flange width		Valve	
Nominal size	Ø [mm]	Ø D [mm]	F [mm]	H [mm]	H1 [mm]	H2 [mm]	X [mm]	X1 [mm]	X2 [mm]	C7 [mm]	C2* [mm]	KVS [m³/h]	Weight (without actuator) [kg]
SMS 1"	25.4 × 1.6	88.9	116	415.0	253.0	83.0	435.0	273.0	103.0	36	47	23	1.0
SMS 1 ½"	38.1 × 1.6	88.9	116	420.0	258.0	88.0	440.0	278.0	108.0	41	51	87	1.4
SMS 2"	50.8 × 1.6	88.9	116	428.0	266.0	96.0	448.0	286.0	116.0	41	53	170	1.9
SMS 2 ½"	63.5 × 1.6	88.9	116	436.5	274.5	105.0	456.5	294.5	125.0	45	57	240	2.8
SMS 3"	76.2 × 1.6	88.9	160	444.0	282.0	118.0	464.0	302.0	138.0	45	67	400	3.3
SMS 4"	101.6 × 2.0	114.3	160	454.0	292.0	130.5	474.0	312.0	150.5	51	74	880	5.3

* Flange width C2 measures from center line to liner end

Position	Description of the order code			
1	Valve type			
	7	Butterfly Valve		
2	Flange connection			
	24	Male/liner		
3	Pipe standard			
	0	OD	1	DN
4	Nominal size			
	010	OD 1"	025	DN 25
	112	OD 1 ½"	040	DN 40
	200	OD 2"	050	DN 50
	212	OD 2 ½"	065	DN 65
	300	OD 3"	080	DN 80
	400	OD 4"	100	DN 100
			125	DN 125
			150	DN 150
	5	Product wetted material		
1		AISI 304 (1.4301)		
2		AISI 316L (1.4404)		
6	Product wetted gasket material			
	0	EPDM		
	1	HNBR*		
	2	FKM		
7	Actuator type			
	0	Manual actuator		
	1	Pneumatic for T.VIS®		
	2	Pneumatic incl. 2 proximity switch holders		
	5	Manual actuator stepless		
	6	Manual actuator with scissors handle (up to OD 4"/DN 100)		
	9	Without actuator		
8	Air connection			
	0	Without		
	1	Metric (only for actuator type 2)		
	2	Inch (only for actuator type 2)		
	3	Metric with air throttle (only for actuator type 2)		
9	Fail position of valve			
	0	Closed		
	1	Open		
	2	Air-to-air (actuator types 1 and 2 only)		
10	Accessories			
	0	Without		
	1	Extension piece +80 mm		
	2	Lockable bracket incl. 4 proximity switch holders (actuator type 0 only)		
	3	Limit stop (actuator types 1 and 2 only)		
	5	Two-position stop (actuator type 2 only)		
11	Product wetted surface			
	0	0.8 µm		
	1	0.4 µm		
12	Certificate			
	0	Without		
	1	Test report 2.2		
	2	Inspection certificate 3.1		
	3	Certificates 2.2 and 3.1		
13	ATEX approval			
	0	No		
	1	Yes		

* For SMS dimensions the seal ring G is not part of the delivery.

The code is composed as follows, depending on the chosen configuration:

Position	1	2	3	4	5	6	7	8	9	10	11	12	13
Code	7	2	4										

Code for control + and feedback systems, see section 3



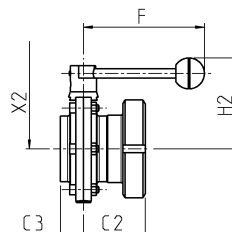
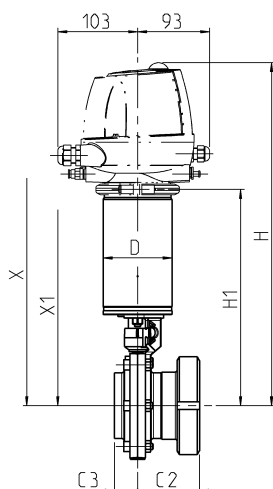
Technical data of the standard version

Product wetted materials	AISI 304
Non product wetted materials	AISI 304
Product wetted gasket material	EPDM
Ambient temperature	0 to 45 °C
Control air pressure	4.8 to 8 bar
Max. product pressure	10 bar
Product wetted surface	R _a 0.8 µm
Non product wetted surface	Metal blank
Pneumatic Actuator	Air-to-spring

Certificates



*The CE-marking is valid for a T-smart Butterfly Valve with pneumatic actuator.



	Pipe	Actuator		Dimensions			Removal space			Flange width		Valve	
Nominal size	Ø [mm]	Ø D [mm]	F [mm]	H [mm]	H1 [mm]	H2 [mm]	X [mm]	X1 [mm]	X2 [mm]	C3 [mm]	C2* [mm]	KVS [m³/h]	Weight (without actuator) [kg]
DN 25	29 × 1.5	88.9	116	415.0	253.0	83.0	435.0	273.0	103.0	25	47	21	0.9
DN 40	41 × 1.5	88.9	116	418.5	256.5	86.5	438.5	276.5	106.5	25	51	72	1.3
DN 50	53 × 1.5	88.9	116	427.0	265.0	95.0	447.0	285.0	115.0	25	53	130	1.9
DN 65	70 × 2.0	88.9	116	434.5	272.5	103.0	454.5	292.5	123.0	25	57	250	2.8
DN 80	85 × 2.0	88.9	160	440.5	278.5	114.5	460.5	298.5	134.5	30	67	340	3.6
DN 100	104 × 2.0	114.3	160	456.5	294.5	128.0	476.5	314.5	148.0	30	74	750	4.9
DN 125	129 × 2.0	114.3	220	472.0	310.0	146.0	492.0	330.0	166.0	35	69	1100	8.5
DN 150	154 × 2.0	114.3	220	486.0	324.0	159.0	506.0	344.0	180.0	40	77	1800	11.5

OD 1"	25.4 × 1.6	88.9	116	415.0	253.0	83.0	435.0	273.0	103.0	25	47	23	0.9
OD 1 ½"	38.1 × 1.6	88.9	116	420.0	258.0	88.0	440.0	278.0	108.0	25	51	87	1.2
OD 2"	50.8 × 1.6	88.9	116	428.0	266.0	96.0	448.0	286.0	116.0	25	53	170	1.7
OD 2 ½"	63.5 × 1.6	88.9	116	436.5	274.5	105.0	456.5	294.5	125.0	25	57	240	2.4
OD 3"	76.2 × 1.6	88.9	160	444.0	282.0	118.0	464.0	302.0	138.0	30	67	400	2.9
OD 4"	101.6 × 2.0	114.3	160	454.0	292.0	130.5	474.0	312.0	150.5	30	74	880	4.6

	Pipe	Actuator		Dimensions			Removal space			Flange width		Valve	
Nominal size	Ø [mm]	Ø D [mm]	F [mm]	H [mm]	H1 [mm]	H2 [mm]	X [mm]	X1 [mm]	X2 [mm]	C3 [mm]	C2* [mm]	KVS [m³/h]	Weight (without actuator) [kg]
SMS 1"	25.4 × 1.6	88.9	116	415.0	253.0	83.0	435.0	273.0	103.0	25	47	23	0.9
SMS 1 ½"	38.1 × 1.6	88.9	116	420.0	258.0	88.0	440.0	278.0	108.0	25	51	87	1.2
SMS 2"	50.8 × 1.6	88.9	116	428.0	266.0	96.0	448.0	286.0	116.0	25	53	170	1.7
SMS 2 ½"	63.5 × 1.6	88.9	116	436.5	274.5	105.0	456.5	294.5	125.0	25	57	240	2.4
SMS 3"	76.2 × 1.6	88.9	160	444.0	282.0	118.0	464.0	302.0	138.0	30	67	400	2.9
SMS 4"	101.6 × 2.0	114.3	160	454.0	292.0	130.5	474.0	312.0	150.5	30	74	880	4.6

* Flange width C2 measures from center line to liner end




Position	Description of the order code					
1	Valve type					
	7	Butterfly Valve				
2	Flange connection					
	14	Weld connection/liner				
3	Pipe standard					
	0	OD	1	DN	7	SMS
4	Nominal size					
	010	OD 1"	025	DN 25	010	OD 1"
	112	OD 1 ½"	040	DN 40	112	OD 1 ½"
	200	OD 2"	050	DN 50	200	OD 2"
	212	OD 2 ½"	065	DN 65	212	OD 2 ½"
	300	OD 3"	080	DN 80	300	OD 3"
	400	OD 4"	100	DN 100	400	OD 4"
			125	DN 125		
			150	DN 150		
5	Product wetted material					
	1	AISI 304 (1.4301)				
	2	AISI 316L (1.4404)				
6	Product wetted gasket material					
	0	EPDM				
	1	HNBR				
	2	FKM				
	6	VMQ				
7	Actuator type					
	0	Manual actuator				
	1	Pneumatic for T.VIS®				
	2	Pneumatic incl. 2 proximity switch holders				
	5	Manual actuator stepless				
	6	Manual actuator with scissors handle (up to OD 4"/DN 100)				
	9	Without actuator				
8	Air connection					
	0	Without				
	1	Metric (only for actuator type 2)				
	2	Inch (only for actuator type 2)				
	3	Metric with air throttle (only for actuator type 2)				
	4	Inch with air throttle (only for actuator type 2)				
9	Fail position of valve					
	0	Closed				
	1	Open				
	2	Air-to-air (actuator types 1 and 2 only)				
10	Accessories					
	0	Without				
	1	Extension piece +80 mm				
	2	Lockable bracket incl. 4 proximity switch holders (actuator type 0 only)				
	3	Limit stop (actuator types 1 and 2 only)				
	5	Two-position stop (actuator type 2 only)				
	7	Booster cylinder (actuator types 1 and 2 only)				
11	Product wetted surface					
	0	0.8 µm				
	1	0.4 µm				
12	Certificate					
	0	Without				
	1	Test report 2.2				
	2	Inspection certificate 3.1				
	3	Certificates 2.2 and 3.1				
13	ATEX approval					
	0	No				
	1	Yes				

The code is composed as follows, depending on the chosen configuration:

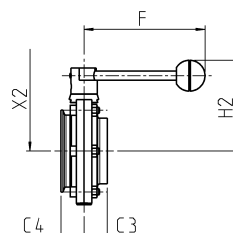
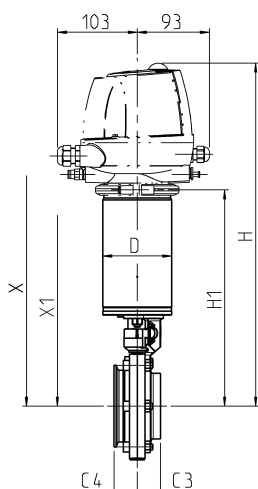
Position	1	2	3	4	5	6	7	8	9	10	11	12	13	Code for control + and feedback systems, see section 3
Code	7	1	4											



Technical data of the standard version

Standards	DN OD	DIN 32676 ISO 2852
Product wetted materials	AISI 304	
Non product wetted materials	AISI 304	
Product wetted gasket material	EPDM	
Ambient temperature	0 to 45 °C	
Control air pressure	4.8 to 8 bar	
Max. product pressure	10 bar	
Product wetted surface	R _a 0.8 µm	
Non product wetted surface	Metal blank	
Pneumatic Actuator	Air-to-spring	
Certificates	  	

*The CE-marking is valid for a T-smart Butterfly Valve with pneumatic actuator.



	Pipe	Actuator		Dimensions			Removal space			Flange width		Valve	
Nominal size	Ø [mm]	Ø D [mm]	F [mm]	H [mm]	H1 [mm]	H2 [mm]	X [mm]	X1 [mm]	X2 [mm]	C3 [mm]	C4 [mm]	KVS [m³/h]	Weight (without actuator) [kg]
DN 25	29 × 1.5	88.9	116	415.0	253.0	83.0	435.0	273.0	103.0	25	40	21	0.8
DN 40	41 × 1.5	88.9	116	418.5	256.5	86.5	438.5	276.5	106.5	25	30	72	0.9
DN 50	53 × 1.5	88.9	116	427.0	265.0	95.0	447.0	285.0	115.0	25	30	130	1.2
DN 65	70 × 2.0	88.9	116	434.5	272.5	103.0	454.5	292.5	123.0	25	30	250	1.7
DN 80	85 × 2.0	88.9	160	440.5	278.5	114.5	460.5	298.5	134.5	30	30	340	2.1
DN 100	104 × 2.0	114.3	160	456.5	294.5	128.0	476.5	314.5	148.0	30	30	750	2.6
OD 1"	25.4 × 1.6	88.9	116	415.0	253.0	83.0	435.0	273.0	103.0	25	40	23	0.9
OD 1 ½"	38.1 × 1.6	88.9	116	420.0	258.0	88.0	440.0	278.0	108.0	25	30	87	0.8
OD 2"	50.8 × 1.6	88.9	116	428.0	266.0	96.0	448.0	286.0	116.0	25	30	170	1.2
OD 2 ½"	63.5 × 1.6	88.9	116	436.5	274.5	105.0	456.5	294.5	125.0	25	30	240	1.5
OD 3"	76.2 × 1.6	88.9	160	444.0	282.0	118.0	464.0	302.0	138.0	30	30	400	1.9
OD 4"	101.6 × 2.0	114.3	160	454.0	292.0	130.5	474.0	312.0	150.5	30	30	880	3.0

Position	Description of the order code			
1	Valve type			
	7	Butterfly Valve		
2	Flange connection			
	31	Clamp flange/weld connection		
3	Pipe standard			
	0	OD	1	DN
4	Nominal size			
	010	OD 1"	025	DN 25
	112	OD 1 ½"	040	DN 40
	200	OD 2"	050	DN 50
	212	OD 2 ½"	065	DN 65
	300	OD 3"	080	DN 80
	400	OD 4"	100	DN 100
	5	Product wetted material		
1		AISI 304 (1.4301)		
2		AISI 316L (1.4404)		
6	Product wetted gasket material			
	0	EPDM		
	1	HNBR		
	2	FKM		
	6	VMQ		
7	Actuator type			
	0	Manual actuator		
	1	Pneumatic for T.VIS®		
	2	Pneumatic incl. 2 proximity switch holders		
	5	Manual actuator stepless		
	6	Manual actuator with scissors handle (up to OD 4"/DN 100)		
	9	Without actuator		
8	Air connection			
	0	Without		
	1	Metric (only for actuator type 2)		
	2	Inch (only for actuator type 2)		
	3	Metric with air throttle (only for actuator type 2)		
	4	Inch with air throttle (only for actuator type 2)		
9	Fail position of valve			
	0	Closed		
	1	Open		
	2	Air-to-air (actuator types 1 and 2 only)		
10	Accessories			
	0	Without		
	1	Extension piece +80 mm		
	2	Lockable bracket incl. 4 proximity switch holders (actuator type 0 only)		
	3	Limit stop (actuator types 1 and 2 only)		
	5	Two-position stop (actuator type 2 only)		
	7	Booster cylinder (actuator types 1 and 2 only)		
11	Product wetted surface			
	0	0.8 µm		
	1	0.4 µm		
12	Certificate			
	0	Without		
	1	Test report 2.2		
	2	Inspection certificate 3.1		
	3	Certificates 2.2 and 3.1		
13	ATEX approval			
	0	No		
	1	Yes		

The code is composed as follows, depending on the chosen configuration:

Position	1	2	3	4	5	6	7	8	9	10	11	12	13	Code for control + and feedback systems, see section 3
Code	7	3	1											



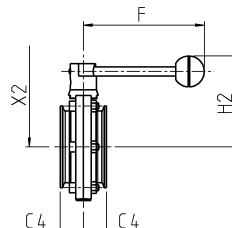
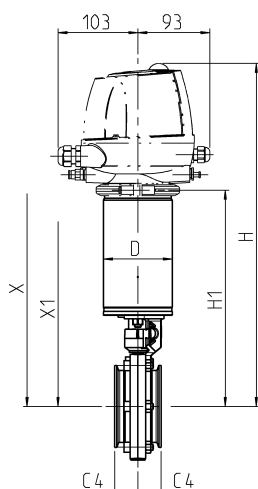
Technical data of the standard version

Standards	DN OD	DIN 32676 ISO 2852
Product wetted materials	AISI 304	
Non product wetted materials	AISI 304	
Product wetted gasket material	EPDM	
Ambient temperature	0 to 45 °C	
Control air pressure	4.8 to 8 bar	
Max. product pressure	10 bar	
Product wetted surface	R _a 0.8 µm	
Non product wetted surface	Metal blank	
Pneumatic Actuator	Air-to-spring	

Certificates



*The CE-marking is valid for a T-smart Butterfly Valve with pneumatic actuator.



	Pipe	Actuator		Dimensions			Removal space			Flange width	Valve	
Nominal size	Ø [mm]	Ø D [mm]	F [mm]	H [mm]	H1 [mm]	H2 [mm]	X [mm]	X1 [mm]	X2 [mm]	C4 [mm]	KVS [m³/h]	Weight (without actuator) [kg]
DN 25	29 × 1.5	88.9	116	415.0	253.0	83.0	435.0	273.0	103.0	40	21	1.0
DN 40	41 × 1.5	88.9	116	418.5	256.5	86.5	438.5	276.5	106.5	30	72	0.9
DN 50	53 × 1.5	88.9	116	427.0	265.0	95.0	447.0	285.0	115.0	30	130	1.3
DN 65	70 × 2.0	88.9	116	434.5	272.5	103.0	454.5	292.5	123.0	30	250	1.9
DN 80	85 × 2.0	88.9	160	440.5	278.5	114.5	460.5	298.5	134.5	30	340	2.3
DN 100	104 × 2.0	114.3	160	456.5	294.5	128.0	476.5	314.5	148.0	30	750	2.7
OD 1"	25.4 × 1.6	88.9	116	415.0	253.0	83.0	435.0	273.0	103.0	40	23	1.1
OD 1 ½"	38.1 × 1.6	88.9	116	420.0	258.0	88.0	440.0	278.0	108.0	30	87	0.9
OD 2"	50.8 × 1.6	88.9	116	428.0	266.0	96.0	448.0	286.0	116.0	30	170	1.3
OD 2 ½"	63.5 × 1.6	88.9	116	436.5	274.5	105.0	456.5	294.5	125.0	30	240	1.6
OD 3"	76.2 × 1.6	88.9	160	444.0	282.0	118.0	464.0	302.0	138.0	30	400	2.0
OD 4"	101.6 × 2.0	114.3	160	454.0	292.0	130.5	474.0	312.0	150.5	30	880	3.1

Position	Description of the order code			
1	Valve type			
	7	Butterfly Valve		
2	Flange connection			
	33	Clamp flange/clamp flange		
3	Pipe standard			
	0	OD	1	DN
4	Nominal size			
	010	OD 1"	025	DN 25
	112	OD 1 ½"	040	DN 40
	200	OD 2"	050	DN 50
	212	OD 2 ½"	065	DN 65
	300	OD 3"	080	DN 80
	400	OD 4"	100	DN 100
	5	Product wetted material		
1		AISI 304 (1.4301)		
2		AISI 316L (1.4404)		
6	Product wetted gasket material			
	0	EPDM		
	1	HNBR		
	2	FKM		
	6	VMQ		
7	Actuator type			
	0	Manual actuator		
	1	Pneumatic for T.VIS®		
	2	Pneumatic incl. 2 proximity switch holders		
	5	Manual actuator stepless		
	6	Manual actuator with scissors handle (up to OD 4"/DN 100)		
	9	Without actuator		
8	Air connection			
	0	Without		
	1	Metric (only for actuator type 2)		
	2	Inch (only for actuator type 2)		
	3	Metric with air throttle (only for actuator type 2)		
	4	Inch with air throttle (only for actuator type 2)		
9	Fail position of valve			
	0	Closed		
	1	Open		
	2	Air-to-air (actuator types 1 and 2 only)		
10	Accessories			
	0	Without		
	1	Extension piece +80 mm		
	2	Lockable bracket incl. 4 proximity switch holders (actuator type 0 only)		
	3	Limit stop (actuator types 1 and 2 only)		
	5	Two-position stop (actuator type 2 only)		
	7	Booster cylinder (actuator types 1 and 2 only)		
11	Product wetted surface			
	0	0.8 µm		
	1	0.4 µm		
12	Certificate			
	0	Without		
	1	Test report 2.2		
	2	Inspection certificate 3.1		
	3	Certificates 2.2 and 3.1		
13	ATEX approval			
	0	No		
	1	Yes		

The code is composed as follows, depending on the chosen configuration:

Position	1	2	3	4	5	6	7	8	9	10	11	12	13	Code for control + and feedback systems, see section 3
Code	7	3	3											



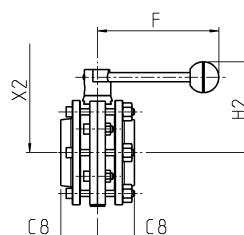
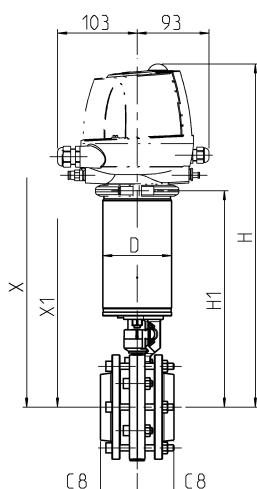
Technical data of the standard version

Product wetted materials	AISI 304
Non product wetted materials	AISI 304
Product wetted gasket material	EPDM
Ambient temperature	0 to 45 °C
Control air pressure	4.8 to 8 bar
Max. product pressure	10 bar
Product wetted surface	R _a 0.8 µm
Non product wetted surface	Metal blank
Pneumatic Actuator	Air-to-spring

Certificates



*The CE-marking is valid for a T-smart Butterfly Valve with pneumatic actuator.



	Pipe	Actuator		Dimensions			Removal space			Flange width	Valve	
Nominal size	Ø [mm]	Ø D [mm]	F [mm]	H [mm]	H1 [mm]	H2 [mm]	X [mm]	X1 [mm]	X2 [mm]	C8 [mm]	KVS [m³/h]	Weight (without actuator) [kg]
DN 15	19 × 1.5	88.9	116	415.0	253.0	83.0	435.0	273.0	103.0	47.5	10.0	1.6
DN 20	23 × 1.5	88.9	116	415.0	253.0	83.0	435.0	273.0	103.0	47.5	12.0	1.6
DN 25	29 × 1.5	88.9	116	415.0	253.0	83.0	435.0	273.0	103.0	47.5	21.0	1.5
DN 40	41 × 1.5	88.9	116	418.5	256.5	86.5	438.5	276.5	106.5	47.5	72.0	1.8
DN 50	53 × 1.5	88.9	116	427.0	265.0	95.0	447.0	285.0	115.0	47.5	130.0	2.4
DN 65	70 × 2.0	88.9	116	434.5	272.5	103.0	454.5	292.5	123.0	47.5	250.0	3.2
DN 80	85 × 2.0	88.9	160	440.5	278.5	114.5	460.5	298.5	134.5	47.5	340.0	3.8
DN 100	104 × 2.0	114.3	160	456.5	294.5	128.0	476.5	314.5	148.0	47.5	750.0	4.7
DN 125	129 × 2.0	114.3	220	472.0	310.0	146.0	492.0	330.0	166.0	55.0	1100.0	8.7
DN 150	154 × 2.0	114.3	220	486.0	324.0	159.0	506.0	344.0	180.0	60.0	1800.0	12.2
OD ½"	12.7 × 1.6	88.9	116	415.0	253.0	83.0	435.0	273.0	103.0	47.5	3.5	1.6
OD ¾"	19.05 × 1.6	88.9	116	415.0	253.0	83.0	435.0	273.0	103.0	47.5	10.0	1.6
OD 1"	25.4 × 1.6	88.9	116	415.0	253.0	83.0	435.0	273.0	103.0	47.5	23.0	1.6
OD 1 ½"	38.1 × 1.6	88.9	116	420.0	258.0	88.0	440.0	278.0	108.0	47.5	87.0	1.7
OD 2"	50.8 × 1.6	88.9	116	428.0	266.0	96.0	448.0	286.0	116.0	47.5	170.0	2.3
OD 2 ½"	63.5 × 1.6	88.9	116	436.5	274.5	105.0	456.5	294.5	125.0	47.5	240.0	3.1
OD 3"	76.2 × 1.6	88.9	160	444.0	282.0	118.0	464.0	302.0	138.0	47.5	400.0	3.5
OD 4"	101.6 × 2.0	114.3	160	454.0	292.0	130.5	474.0	312.0	150.5	47.5	880.0	5.3

Position	Description of the order code			
1	Valve type			
	7	Butterfly Valve		
2	Flange connection			
	88	Intermediate flange variant		
3	Pipe standard			
	0	OD	1	DN
4	Nominal size			
	012	OD ½"	015	DN 15
	075	OD ¾"	020	DN 20
	010	OD 1"	025	DN 25
	112	OD 1 ½"	040	DN 40
	200	OD 2"	050	DN 50
	212	OD 2 ½"	065	DN 65
	300	OD 3"	080	DN 80
	400	OD 4"	100	DN 100
			125	DN 125
			150	DN 150
5	Product wetted material			
	1	AISI 304 (1.4301)		
	2	AISI 316L (1.4404)		
6	Product wetted gasket material			
	0	EPDM		
	1	HNBR		
	2	FKM		
	6	VMQ		
7	Actuator type			
	0	Manual actuator		
	1	Pneumatic for T.VIS®		
	2	Pneumatic incl. 2 proximity switch holders		
	5	Manual actuator stepless		
	6	Manual actuator with scissors handle (up to OD 4"/DN 100)		
	9	Without actuator		
8	Air connection			
	0	Without		
	1	Metric (only for actuator type 2)		
	2	Inch (only for actuator type 2)		
	3	Metric with air throttle (only for actuator type 2)		
	4	Inch with air throttle (only for actuator type 2)		
9	Fail position of valve			
	0	Closed		
	1	Open		
	2	Air-to-air (actuator types 1 and 2 only)		
10	Accessories			
	0	Without		
	1	Extension piece +80 mm		
	2	Lockable bracket incl. 4 proximity switch holders (actuator type 0 only)		
	3	Limit stop (actuator types 1 and 2 only)		
	5	Two-position stop (actuator type 2 only)		
	7	Booster cylinder (actuator types 1 and 2 only)		
11	Product wetted surface			
	0	0.8 µm		
	1	0.4 µm		
12	Certificate			
	0	Without		
	1	Test report 2.2		
	2	Inspection certificate 3.1		
	3	Certificates 2.2 and 3.1		
13	ATEX approval			
	0	No		
	1	Yes		

The code is composed as follows, depending on the chosen configuration:

Position	1	2	3	4	5	6	7	8	9	10	11	12	13	Code for control + and feedback systems, see section 3
Code	7	8	8											

**Manual actuator**

Material	AISI 304 and phenolic resin (ball head)
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Dimensions

Nominal size	OD/SMS DN	½" – 2 ½" 15–65	3" – 4" 80–100	125–150
Length of lever		116 mm	160 mm	220 mm
Weight		0.3 kg	0.4 kg	0.4 kg
Article No.		224-001054	224-001055	224-001056

**Pneumatic actuator for T.VIS®**

Actuator type	Air-to-spring	Air-to-air
Material	AISI 304	AISI 304
Ambient temperature	0 to 45 °C	0 to 45 °C
Control air pressure	4.8 to 8 bar	4.8 to 8 bar
Surface	Metal blank	Metal blank

Dimensions

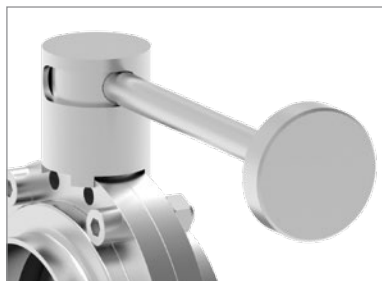
Nominal size	OD/SMS DN	½" – 2 ½" 15–65	3" 80	4" 100	125–150
Ø Cylinder pipe	Air-to-spring	88.9 mm	88.9 mm	114.3 mm	114.3 mm
	Air-to-air	88.9 mm	88.9 mm	88.9 mm	88.9 mm
H		223.0 mm	223.0 mm	223.0 mm	223.0 mm
Weight	Air-to-spring	4.1 kg	4.1 kg	5.5 kg	5.5 kg
	Air-to-air	2.9 kg	2.9 kg	2.9 kg	2.9 kg
Article No	Air-to-spring	224-001503	224-001505	224-001660	224-001509
	Air-to-air	224-001504	224-001506	224-001506	224-001508

**Pneumatic actuator**

See entry for: Pneumatic actuator for T.VIS®

Dimensions

Nominal size	OD/SMS DN	½" – 2 ½" 15–65	3" 80	4" 100	125–150
Ø Cylinder pipe	Air-to-spring	88.9 mm	88.9 mm	114.3 mm	114.3 mm
	Air-to-air	88.9 mm	88.9 mm	88.9 mm	88.9 mm
Ø Connecting plate		97 mm	97 mm	97 mm	97 mm
H		223.0 mm	223.0 mm	223.0 mm	223.0 mm
Weight	Air-to-spring	4.1 kg	4.1 kg	5.5 kg	5.5 kg
	Air-to-air	2.9 kg	2.9 kg	2.9 kg	2.9 kg
Article No	Air-to-spring	224-001503	224-001505	224-001660	224-001509
	Air-to-air	224-001504	224-001506	224-001506	224-001508

**Manual actuator stepless**

Material	AISI 304
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Dimensions

Nominal size	OD/SMS DN	½" – 2 ½" 15–65	3" – 4" 80–100	125–150
Length of lever		109 mm	154 mm	154 mm
Weight		0.6 kg	0.6 kg	0.6 kg
Article No.		224-000235	224-000236	224-000237

**Manual actuator scissors handle**

Material	AISI CF-8
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Dimensions

Nominal size	OD/SMS DN	½" – 2 ½" 15–65	3" – 4" 80–100
Length of lever		162 mm	162 mm
Weight		0.5 kg	0.5 kg
Article No.		224-000544	224-000545

Position	Description of the order code					
1	Valve type					
	7	Butterfly Valve				
2	Flange connection					
	99	Actuator only				
3	Pipe standard					
	0	OD	1	DN	7	SMS
4	Nominal size					
	012	OD ½"	015	DN 15		
	075	OD ¾"	020	DN 20		
	010	OD 1"	025	DN 25	010	OD 1"
	112	OD 1 ½"	040	DN 40	112	OD 1 ½"
	200	OD 2"	050	DN 50	200	OD 2"
	212	OD 2 ½"	065	DN 65	212	OD 2 ½"
	300	OD 3"	080	DN 80	300	OD 3"
	400	OD 4"	100	DN 100	400	OD 4"
			125	DN 125		
			150	DN 150		
	5	Product wetted material				
9		Not applicable				
6	Product wetted gasket material					
	9	Not applicable				
7	Actuator type					
	0	Manual actuator				
	1	Pneumatic for T.VIS®				
	2	Pneumatic incl. 2 proximity switch holders				
	5	Manual actuator stepless				
	6	Manual actuator with scissors handle (up to OD 4"/DN 100)				
8	Air connection					
	0	Without				
	1	Metric (only for actuator type 2)				
	2	Inch (only for actuator type 2)				
	3	Metric with air throttle (only for actuator type 2)				
	4	Inch with air throttle (only for actuator type 2)				
9	Fail position of valve					
	0	Closed				
	1	Open				
	2	Air-to-air (actuator types 1 and 2 only)				
10	Accessories					
	0	Without				
	1	Extension piece +80 mm				
	2	Lockable bracket incl. 4 proximity switch holders (actuator type 0 only)				
	3	Limit stop (actuator types 1 and 2 only)				
	5	Two-position stop (actuator type 2 only)				
	7	Booster cylinder (actuator types 1 and 2 only)				
11	Product wetted surface					
	9	Not applicable				
12	Certificate					
	0	Without				
13	ATEX approval					
	0	No				
	1	Yes				

The code is composed as follows, depending on the chosen configuration:

Position	1	2	3	4	5	6	7	8	9	10	11	12	13
Code	7	9	9		9	9					9	0	

Code for control and feedback systems, see section 3



Extension piece

To encapsulate the valve together with the pipe the actuator interface needs to be relocated to the outside. The extension piece for all actuator types shifts the actuator 80 mm to the outside.

Technical data				
Material		AISI 304		
Surface		Metal blank		
Dimensions				
Nominal size	OD/SMS DN	½" – 2 ½" 15–65	3" – 4" 80–100	125–150
H		80 mm	80 mm	80 mm
Weight		0.8 kg	0.8 kg	0.8 kg
Article No.		224-001241	224-001242	224-001243



Lockable bracket incl. 4 proximity switch holders

The fit-on bracket offers two horizontal and two vertical mounting options, which means up to eight different configurations for mounting proximity in M12×1 size. The bracket also features an eyelet to fit a padlock in order to secure the mechanical standard manual actuator in closed valve position. The depicted padlock is merely an example.

Technical data			
Material		PA12	
Dimensions			
Nominal size	OD/SMS DN	½" – 2 ½" 15–65	3" – 4" 80–100
Weight		36 g	42 g
Article No.		224-001057	224-001058



Limit stop

The mechanically adjustable limit stop is used to limit the stroke length of a butterfly valve. Both the opening and the closing stroke can be adjusted individually and separately.

Technical data				
Material		AISI 304		
Surface		Metal blank		
Dimensions				
Nominal size	OD/SMS DN	½" – 2 ½" 15–65	3" – 4" 80–100	125–150
H		182 mm	182 mm	182 mm
Weight		1.5 kg	1.5 kg	1.5 kg
Article No.		224-001249	224-001249	224-001249



Limit stop for control and feedback system

The mechanically adjustable limit stop is used to limit the stroke length of a butterfly valve. Both the opening and the closing stroke can be adjusted individually and separately. This variant includes the T.VIS® connection for mounting a control and feedback system.

Technical data				
Material		AISI 304		
Surface		Metal blank		
Dimensions				
Nominal size	OD/SMS DN	½" – 2 ½" 15–65	3" – 4" 80–100	125–150
H (without T.VIS®)		103 mm	103 mm	103 mm
Weight		1.7 kg	1.7 kg	1.7 kg
Article No.		224-001250	224-001250	224-001250



Two-position stop

Using a two-position stop, a pneumatically controlled valve can be driven – in addition to the opened and closed position – into one partial opening position with individually adjustable mechanical stop. Actuation is accomplished through a second air connection. The installation of a control and feedback system on the two-position stop is not possible.

Technical data				
Material		AISI 304		
Surface		Metal blank		
Dimensions				
Nominal size	OD/SMS DN	½" – 2 ½" 15 – 65	3" – 4" 80 – 100	125 – 150
H		225 mm	225 mm	225 mm
Weight		3.3 kg	3.3 kg	3.3 kg
Article No.		224-001017	224-001017	224-001017



Booster cylinder

The booster cylinder is used for enlarging the piston surface area that allows to open the valve with a lower air pressure.

Technical data				
Material		AISI 304		
Surface		Metal blank		
Dimensions				
Nominal size	OD/SMS DN	½"–2 ½" 15–65	3"–4" 80–100	125–150
H		95 mm	95 mm	95 mm
Weight		2.3 kg	2.3 kg	2.3 kg
Requested control air pressure (min.)		3 bar/44 psi	3 bar/44 psi	3.5 bar/50 psi
Article No.		224-001258	224-001258	224-001258

Seal kits for Butterfly Valves T-smart 711, 721, 722, 724, 714, 731, 733

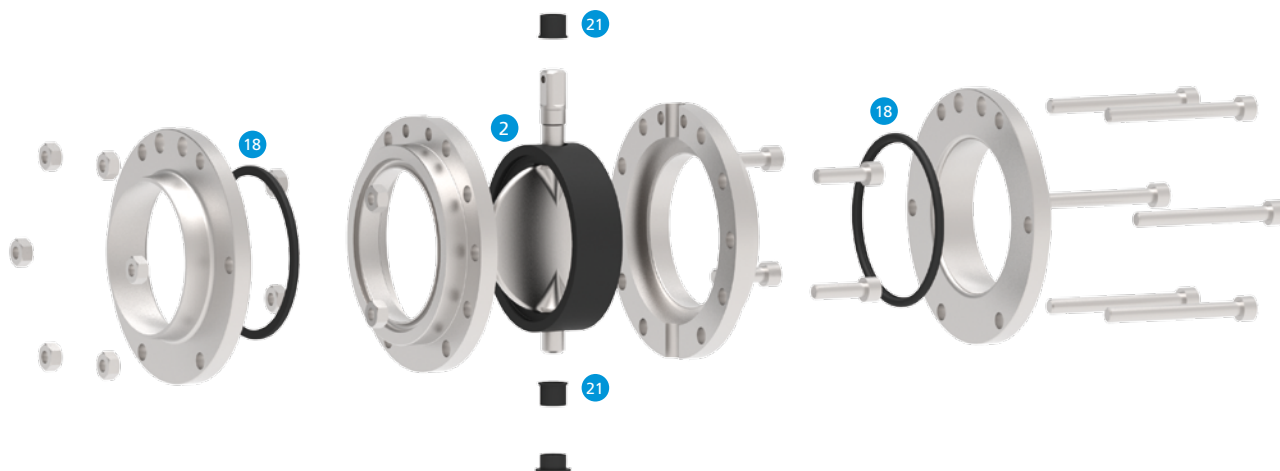


Included in the seal kit

Position	Quantity	Designation
2	1	Butterfly valve gasket
21	2	Bearings

	EPDM	HNBR	FKM	VMQ
Nominal size	Article No.	Article No.	Article No.	Article No.
DN 15	224-001332	224-001334	224-001333	224-001335
DN 20	224-001332	224-001334	224-001333	224-001335
DN 25	224-001300	224-001302	224-001301	224-001303
DN 40	224-001304	224-001306	224-001305	224-001307
DN 50	224-001308	224-001310	224-001309	224-001311
DN 65	224-001312	224-001314	224-001313	224-001315
DN 80	224-001316	224-001318	224-001317	224-001319
DN 100	224-001320	224-001322	224-001321	224-001323
DN 125	224-001324	224-001326	224-001325	224-001327
DN 150	224-001328	224-001330	224-001329	224-001331
OD ½"	224-001332	224-001334	224-001333	224-001335
OD ¾"	224-001332	224-001334	224-001333	224-001335
OD 1"	224-001332	224-001334	224-001333	224-001335
OD 1 ½"	224-001336	224-001338	224-001337	224-001339
OD 2"	224-001340	224-001342	224-001341	224-001343
OD 2 ½"	224-001344	224-001346	224-001345	224-001347
OD 3"	224-001348	224-001350	224-001349	224-001351
OD 4"	224-001352	224-001354	224-001353	224-001355

Seal kits for Butterfly Valves T-smart 788



Included in the seal kit		
Position	Quantity	Designation
2	1	Butterfly valve gasket
21	2	Bearings
18	2	VARIVENT® O-ring

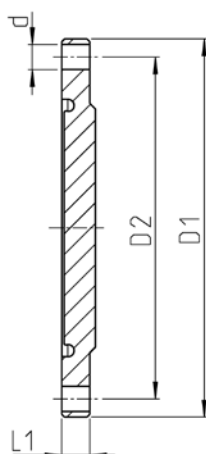
		EPDM	HNBR	FKM	VMQ
Nominal size		Article No.	Article No.	Article No.	Article No.
DN	15	224-001388	224-001390	224-001389	224-001391
DN	20	224-001388	224-001390	224-001389	224-001391
DN	25	224-001356	224-001358	224-001357	224-001359
DN	40	224-001360	224-001362	224-001361	224-001363
DN	50	224-001364	224-001366	224-001365	224-001367
DN	65	224-001368	224-001370	224-001369	224-001371
DN	80	224-001372	224-001374	224-001373	224-001375
DN	100	224-001376	224-001378	224-001377	224-001379
DN	125	224-001380	224-001382	224-001381	224-001383
DN	150	224-001384	224-001386	224-001385	224-001387
OD	½"	224-001388	224-001390	224-001389	224-001391
OD	¾"	224-001388	224-001390	224-001389	224-001391
OD	1"	224-001388	224-001390	224-001389	224-001391
OD	1 ½"	224-001392	224-001394	224-001393	224-001395
OD	2"	224-001396	224-001398	224-001397	224-001399
OD	2 ½"	224-001400	224-001402	224-001401	224-001403
OD	3"	224-001404	224-001406	224-001405	224-001407
OD	4"	224-001408	224-001410	224-001409	224-001411



Blind Grooved Flange

The range also contains blind grooved flanges for butterfly valves T-smart 7. The blind grooved flange can be set against the butterfly valve's outside flange in order to make a later installation of the butterfly valve possible.

Technical data	
Material	AISI 316 L (1.4404)
Surface in contact with the product	$R_a \leq 0.8 \mu\text{m}$
Certificates	3.1/AD2000W2
Seal materials	EPDM (FDA), FKM (FDA), HNBR (FDA)



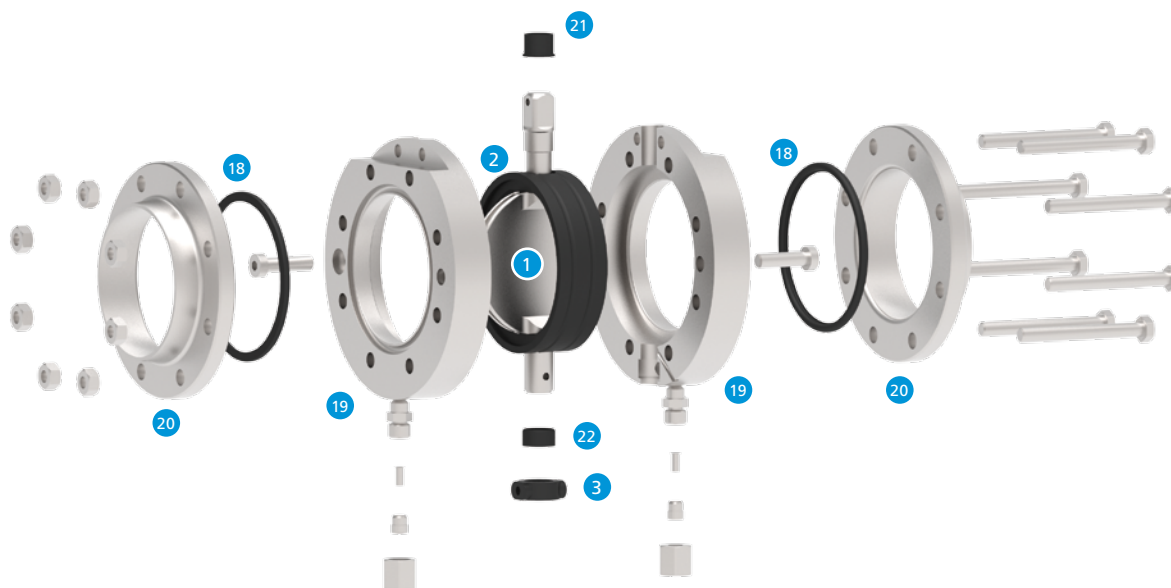
Blind grooved flange



O-ring

Blind grooved flange								O-ring			
Dimensions							Article No.	Dimensions	Article No.		
Nominal width	D1 [mm]	D2 [mm]	d [mm]	L1 [mm]	PN	Weight [kg]		D1 x L1 [mm]	Material		
									EPDM	FKM	HNBR
DN 25	78	68	4 x Ø 7	10	10	0.4	224-001673	25.0 x 5.0	930-393	930-564	930-551
DN 40	87	77	4 x Ø 7	10	10	0.4	224-001671	36.0 x 5.0	930-545	930-566	930-552
DN 50	103	90	4 x Ø 9	10	10	0.6	224-001669	47.0 x 5.0	930-546	930-567	930-553
DN 65	120	107	6 x Ø 9	10	10	0.9	224-001667	62.0 x 5.0	930-547	930-526	930-554
DN 80	135	122	6 x Ø 9	10	10	1.1	224-001665	75.0 x 5.0	930-450	930-527	930-555
DN 100	155	142	8 x Ø 9	10	10	1.5	224-001663	92.0 x 5.0	930-549	930-568	930-556
DN 125	191	175	8 x Ø 11	10	10	2.3	224-001661	115.0 x 5.0	930-550	930-569	930-557
DN 150	219	200	8 x Ø 13	15	10	4.6	224-001662	134.2 x 5.7	930-574	930-575	930-872
OD 1"	78	68	4 x Ø 7	10	10	0.4	224-001674	22.0 x 5.0	930-376	930-593	930-851
OD 1 1/2"	84	74	4 x Ø 7	10	10	0.4	224-001672	33.5 x 5.0	930-497	930-570	930-852
OD 2"	101	88	4 x Ø 9	10	10	0.6	224-001670	45.0 x 5.0	930-559	930-571	930-853
OD 2 1/2"	116	103	6 x Ø 9	10	10	0.8	224-001668	56.0 x 5.0	930-560	930-572	930-854
OD 3"	128	115	6 x Ø 9	10	10	1.0	224-001666	68.0 x 5.0	930-319	930-666	930-652
OD 4"	160	147	8 x Ø 9	10	10	1.6	224-001664	90.0 x 5.0	930-561	930-573	930-855

Mixproof Butterfly Valves T-smart 9



1 Butterfly valve disk

2 Butterfly valve gasket

3 Radial seal

18 VARIVENT® O-ring

19 Body flanges (intermediate flange with O-ring groove)

20 Welding flange (outside flange)

21 Upper bearing

22 Lower bearing

The Mixproof Butterfly Valve T-smart 9 offers an interesting valve variant for the mixproof separation of media. Highly functional, CIP/SIP-enabled and easy to service, this valve supplies continuous safety to production processes. In addition to the main opening, the rotating valve disk enforces the mechanical opening or closing of drain ports, depending on the valve position. This minimizes switching losses and ensures the functionality of four valve disks – without further actuation – and the need of the corresponding control system.

Application examples

CIP systems

Flush-out processes

Water management

Use as CIP return valve in a valve matrix

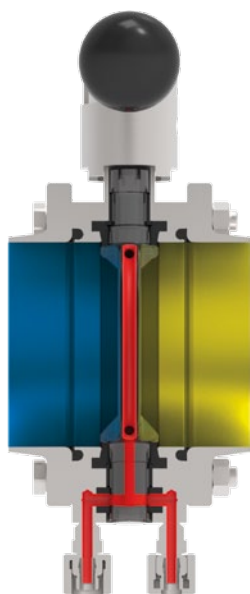


The Mixproof Butterfly Valves T-smart 9 are characterized by their hygienic design without dome and sump, offering all before mentioned advantages.

Significant product features

Valve disk made from solid material
Compact build
Minimum switching loss
Optimum cleanability
Simple and safe leakage indication
Only one product wetted seal
Hygienically placed drain paths
Product wetted parts in 316L (1.4404)
Intermediate flange seals in proven VARIVENT® seal design
Long service life, high productivity in process
Vacuum-proof

Mixproof separation of the two product areas, when the valve disk is closed, is achieved through two peripheral sealing edges with the leakage cavity between them.



Mixproof product area separation with the leakage cavity open to the atmosphere so any leakage becomes visible immediately.

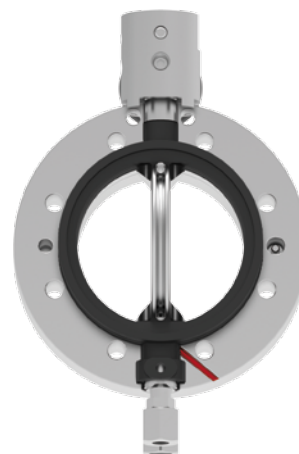
The leakage cavity itself drains automatically and is designed in such a way that it can be flushed, from one drain port to the other, without dead areas or short-cuts. With little resources applied, products are successfully and completely flushed out, for optimum cleanability.



Upon closing of the valve disk the drain ports are opened. Remaining product from the switching operation can drain, and be flushed out, immediately after switching.



Upon opening of the valve disk the drain ports are automatically closed and reliably prevent product loss.



Specially positioned leakage apertures allow immediate detection of any leakage between the two seals.

Pneumatic actuators

For narrow mounting situations and low air consumption the pneumatic actuators have been made even more compact. The gap-free design ensures optimum cleanability and fulfils highest demands to hygiene.

Torque maxima towards both end positions enable application on both normally closed and normally open valves. Metallic stops ensure exact disk positioning. There are air-to-spring and air-to-air variants.

The integrated T.VIS® interface also safely accommodates optional accessories – booster cylinder, two-position stop and limit stop. The internal pneumatic system reduces the risk of failures, being without external tubing.

All actuators are by default applicable for Ex zones. Compliance of any electric accessories with Ex regulations must be ensured.



Features

Compact, hygienic design
Metallic stops
Torque maxima towards both end positions
Air-to-spring and air-to-air variants available
Integrated T.VIS® interface

Actuator bracket

The new actuator bracket can be attached to the flanges more easily because of its one-sided design and integrated threads for the mounting screws.

Two integrated proximity switch holders are located at a 45 ° angle above one of the two flanges. Turning the bracket 180 ° places the switches above the other side. This means one side of the valve is always free from structures mounted on top, thus allowing free access to male flanges, for example.

The switches are plugged into half-open holders on the side, which allows for easy mounting since the counter nuts only need to be loosened, not removed.



Gaskets

The vacuum-proof gasket has been completely redeveloped and offers maximum stability and service life. The double-sided valve disk bearing provides a defined seal compression and lowest switch torque.

Gaskets with decisive advantages
Low torque
Double-sided valve disk bearing
Long service-life
Vacuum-proof
FDA-approved EPDM seal material

Selection of dimensions and connection fittings

Flange variant						
Code	Nominal size	DN	50	65	80	100
8	Intermediate flange V		•	•	•	•

Flange variant						
Code	Nominal size	OD	2"	2½"	3"	4"
8	Intermediate flange V		•	•	•	•



8 (T-smart 988)

Pipe classes

Dimensions of weld connections comply with the following standards:

- **Metric:** Outside diameter acc. to DIN 11850, series II, DIN 11866, series A
- **Inch OD:** Outside diameter acc. to BS 4825

Surfaces

Product wetted surfaces are by default finished to $R_a \leq 0.8 \mu\text{m}$. Higher-quality surfaces finished to $R_a \leq 0.4 \mu\text{m}$ are optionally available.

Non product wetted surfaces (flanges) are metal blank.

Materials

Product wetted parts of the Mixproof Butterfly Valves T-smart 9 are built in AISI 304 (1.4301). Other materials are available on request, e.g. for applications handling aggressive media.

For detailed information regarding properties of the materials consult the **material properties** table.

Test report and inspection certificate

Flanges and disks of the Mixproof Butterfly Valves T-smart 9 are available with test report 2.2 or material inspection certificate 3.1 in compliance with EN 10204 (on request).

Seal materials

Product wetted seals are EPDM.

Mixing components of our seal materials are included in the FDA "**White List**" and comply with the "**FOOD and DRUG**" (FDA) regulations 21 CFR Part 177.2600 and 21 CFR 177.1550: "Rubber Articles intended for repeated use".

The resistance of the sealing material depends on the type and temperature of the medium conveyed. The contact time can negatively affect the service life of the seals.

For detailed information regarding properties of the seal materials consult the **seal material properties** table.

Conditions for operation

Mixproof Butterfly Valves T-smart 9 can be operated at ambient temperatures from 0 to 45 °C (32 to 113 °F). The proximity switches are approved for ambient temperatures from -20 to 80 °C (-4 to 176 °F). The Butterfly Valves T-smart 9 can be operated in outdoor areas. However, they need to be protected from frost in those areas or must be defrosted before switching.

Mixproof Butterfly Valves T-smart 9 must be mounted stress-free. Horizontal lateral forces, e.g. thermal pipe elongation, cannot be compensated for in the valve, which makes damages to the valve a possibility. In such cases, suitable measures to compensate the elongation are recommended, such as using a VARICOMP® expansion compensator.

The clearance required for mounting and demounting Butterfly Valves T-smart is listed together with the respective technical data and dimensions.

Control air

The control air pressure is min. 4.8 bar, max. 8 bar. For lower control air pressure, a booster cylinder can be applied. The quality of the control air must comply with the requirements acc. to ISO 8573-1:2010:

ISO 8573-1:2010	
Particle content	Quality class 6
	Particle size max. 5 µm
	Particle density max. 5 mg/m ³
Water content	Quality class 4
	Max. dew point 3 °C
	For operation locations in higher regions or at low ambient temperatures, the dew point must be re-calculated accordingly.
Oil content	Quality class 3
	Max. 1 mg oil for 1 m ³ air, ideally oil-free

Operating pressure

The valves are vacuum proof up to 0.05 bar (abs). The maximum product pressure for which the valves can be configured is 10 bar.

Actuator selection

The modular concept of the Mixproof Butterfly Valves T-smart 9 allows for a variety of actuator variants to be fitted. Different manual and pneumatic actuators are available.

The pneumatic actuators are optimized for long-term operation and are maintenance-free. To prevent damages in the pipe-work, the closing speed of the pneumatic actuators can be reduced per air throttle.

Feedback signal

Proximity switches of M12×1 size indicate the positions “open” and/or “closed”. The actuator bracket for pneumatic actuators has two sensor casings, an optional and retro-fittable proximity switch holder is available for standard manual actuators.

All pneumatic actuators can be fitted with the proven TVIS® control top with all options.

Material properties

Material number	Short name	Similar materials			PREN***	Main alloy elements in % by mass			
						Cr (Chrome)	Ni (Nickel)	Mo (Molybdenum)	C max. (Carbon)
AISI 304* and**	X5CrNi18-10	1.4301	BS 304S15	SS2332	18	17.5–19.5	8.0–10.5	–	0.07
AISI 316L**	X2 CrNiMo 17-12-2	1.4404	BS 316S11	SS2348	25	16.5–18.5	10.0–13.0	2.0–2.5	0.03

* Standard material for components not in contact with the product

** Standard material for components in contact with the product (other materials available on request)

*** Pitting Resistance Equivalent Number = % Cr + 3.3 × (% Mo + 0.5 W) + 20 N

Seal material properties

Seal material			EPDM
General application temperature*			–40 to 135 °C –40 to 275 °F
Medium	Concentration	At permitted operating temperature	
Alkali	≤ 3 %	up to 80 °C	+
	≤ 5 %	up to 40 °C	+
	≤ 5 %	up to 80 °C	+
	> 5 %		○
Inorganic acid**	≤ 3 %	up to 80 °C	+
	≤ 5 %	up to 80 °C	○
	> 5 %	up to 100 °C	–
Water		up to 80 °C	+
Steam		up to 135 °C	+
Steam, approx. 30 min		up to 150 °C	+
Hydrocarbons/fuels			–
Products containing grease	≤ 35 %		+
	> 35 %		–
Oils			–

+ = Good resistance

○ = Reduced service life

– = Not resistant

Other applications on request

* Depending on the installation situation

** Inorganic acids include hydrochloric acid, nitric acid, sulphuric acid

Certificates

The certificates listed here are valid for the T-smart 9 mixproof butterfly valves.

			Standard certificates			Optional certificates					
	Index		FDA	CE*	EHEDG	ADI free	ATEX	CRN	EG Nr. 1935/2004	TA-Luft VDI 2440	USP Class VI
T-smart 9	2	Mixproof Butterfly Valve type 988	•	•		•	•	OC14737.5CL	•		•

* only for valves with pneumatic actuator

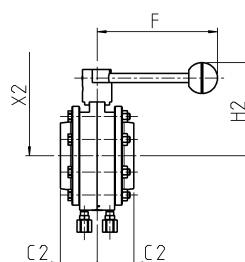
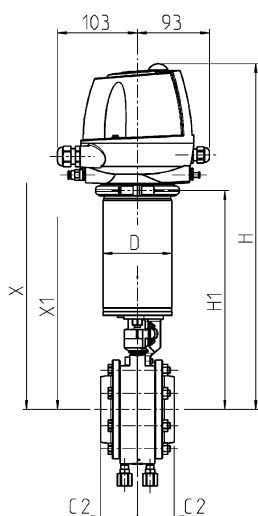

Technical data of the standard version

Product wetted materials	AISI 316L
Non product wetted materials	AISI 304
Product wetted gasket material	EPDM
Ambient temperature	0 to 45 °C
Control air pressure	4.8 to 8 bar
Max. product pressure	10 bar
Product wetted surface	R _a 0.8 µm
Non product wetted surface	Metal blank
Pneumatic Actuator	Air-to-spring

Certificates



*The CE-marking is valid for a T-smart Butterfly Valve with pneumatic actuator.



	Pipe	Actuator		Dimensions			Removal space			Flange width	Valve	
Nominal size	Ø [mm]	Ø D [mm]	F [mm]	H [mm]	H1 [mm]	H2 [mm]	X [mm]	X1 [mm]	X2 [mm]	C2 [mm]	KVS [m³/h]	Weight (without actuator) [kg]
DN 50	53 × 1.5	88.9	160	469	310	105	520	360	130	47.5	On request	4.0
DN 65	70 × 2.0	88.9	160	478	319	114	520	360	139	47.5	On request	5.0
DN 80	85 × 2.0	114.3	220	488	329	121	535	380	146	47.5	On request	5.9
DN 100	104 × 2.0	114.3	220	501	342	134	550	390	159	47.5	On request	8.3
OD 2"	50.8 × 1.6	88.9	160	469	310	105	520	360	130	47.5	On request	4.0
OD 2 ½"	63.5 × 1.6	88.9	160	478	319	114	520	360	139	47.5	On request	5.1
OD 3"	76.2 × 1.6	114.3	220	485	329	121	535	380	146	47.5	On request	6.1
OD 4"	101.6 × 2.0	114.3	220	501	342	134	550	390	159	47.5	On request	8.3

Position	Description of the order code			
1	Valve type			
	9	Mixproof Butterfly Valve		
2	Flange connection			
	88	Intermediate flange variant		
3	Pipe standard			
	0	OD	1	DN
4	Nominal size			
	200	OD 2"	050	DN 50
	212	OD 2 ½"	065	DN 65
	300	OD 3"	080	DN 80
	400	OD 4"	100	DN 100
5	Product wetted material			
	2	AISI 316L (1.4404)		
6	Product wetted gasket material			
	0	EPDM		
7	Actuator type			
	0	Manual actuator		
	1	Pneumatic for T.VIS®		
	2	Pneumatic incl. 2 proximity switch holders		
	9	Without actuator		
8	Air connection			
	0	Without		
	1	Metric (only for actuator type 2)		
	2	Inch (only for actuator type 2)		
	3	Metric with air throttle (only for actuator type 2)		
	4	Inch with air throttle (only for actuator type 2)		
9	Fail position of valve			
	0	Closed		
10	Accessories			
	0	Without		
	1	Extension piece +80 mm		
	2	Lockable bracket incl. 4 proximity switch holders (actuator type 0 only)		
	7	Booster cylinder (actuator types 1 and 2 only)		
11	Product wetted surface			
	0	0.8 µm		
	1	0.4 µm		
12	Certificate			
	0	Without		
	1	Test report 2.2		
	2	Inspection certificate 3.1		
	3	Certificates 2.2 and 3.1		
13	ATEX approval			
	0	No		
	1	Yes		

The code is composed as follows, depending on the chosen configuration:

Position	1	2	3		4	5		6	7	8	9		10	11	12	13	
Code	9	8	8	-		2	-	0			0	-					Code for control + and feedback systems, see section 3



Manual actuator		
Material		AISI 304 and phenolic resin (ball head)
Dimensions		
Nominal size	OD/SMS DN	2" – 2 ½" 50–65
		3" – 4" 80–100
Length of lever		160 mm
Weight		0.4 kg
Article No.		224-001055
		224-001056



Pneumatic actuator for T.VIS®		
Material		AISI 304
Ambient temperature		0 to 45 °C
Control air pressure		4.8 to 8 bar
Surface		Metal blank
Actuator type		Air-to-spring
Dimensions		
Nominal size	OD/SMS DN	2" – 2 ½" 50–65
		3" – 4" 80–100
Ø		88.9 mm
H		223 mm
Weight		4.1 kg
Article No.		224-001586
		224-001509



Pneumatic actuator		
Material		AISI 304
Ambient temperature		0 to 45 °C
Control air pressure		4.8 bis 8 bar
Surface		Metal blank
Actuator type		Air-to-spring
Dimensions		
Nominal size	OD/SMS DN	2" – 2 ½" 50–65
		3" – 4" 80–100
Ø Cylinder pipe		88.9 mm
Ø Connecting plate		97 mm
H		223 mm
Weight		4.1 kg
Article No.		224-001586
		224-001509



Extension piece

To encapsulate the valve together with the pipe the actuator interface needs to be relocated to the outside. The extension piece for all actuator types shifts the actuator 80 mm to the outside.

Technical data			
Material	AISI 304		
Surface	Metal blank		
Dimensions			
Nominal size	OD/SMS DN	2" – 2 ½" 50 – 65	3" – 4" 80 – 100
H		80 mm	80 mm
Weight		0.8 kg	0.8 kg
Article No.		224-001608	224-001243



Lockable bracket incl. 4 proximity switch holders

The fit-on bracket offers two horizontal and two vertical mounting options, which means up to eight different configurations for mounting proximity in M12×1 size. The bracket also features an eyelet to fit a padlock in order to secure the mechanical standard manual actuator in closed valve position. The depicted padlock is merely an example.

Technical data			
Material		PA12	
Dimensions			
Nominal size	OD/SMS DN	2" – 2 ½" 50 – 65	3" – 4" 80 – 100
Weight		42 g	42 g
Article No.		224-001057	224-001058



Booster cylinder

The booster cylinder is used for enlarging the piston surface area that allows to open the valve with a lower air pressure.

Technical data			
Material		AISI 304	
Surface		Metal blank	
Dimensions			
Nominal size	OD/SMS DN	2" – 2 ½" 50–65	3" – 4" 80–100
H		95 mm	95 mm
Weight		2.3 kg	2.3 kg
Requested control air pressure (min.)		3 bar/44 psi	3 bar/44 psi
Article No.		224-001258	224-001258

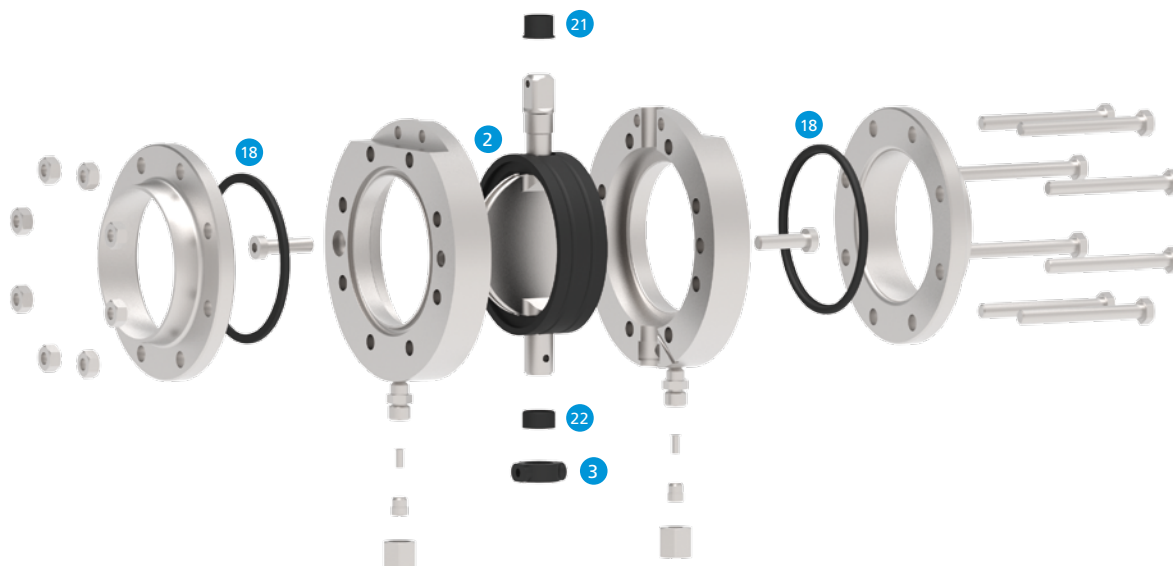


Service adapter

For the manual commissioning of Mixproof Butterfly Valves T-smart 9 that are to be equipped with a pneumatic actuator at a later point in time. The manual actuator that is additionally necessary for this is not included in the scope of delivery and must be ordered separately.

Technical data			
Material	AISI 304		
Surface	Metal blank		
Dimensions			
Nominal size	OD/SMS DN	2" – 2 ½" 50 – 65	3" – 4" 80 – 100
Article No.	224-000660		224-000661

Seal kits



Included in the seal kit		
Position	Quantity	Designation
2	1	Butterfly valve gasket
3	1	Radial seal
18	2	VARIVENT® O-Ring
21	1	Upper bearing
22	1	Lower bearing

EPDM	
Nominal size	Article No.
DN 50	224-000696
DN 65	224-000697
DN 80	224-000698
DN 100	224-000699
OD 2"	224-000700
OD 2 ½"	224-000701
OD 3"	224-000702
OD 4"	224-000703

T.VIS® control top

The T.VIS® control top is an optimal system for controlling and monitoring GEA Tuchenhausen valves.

This is available in several variants depending on the valve type, tasks and user convenience.

Common features of all T.VIS® variants are:

- Flexible modular system for optimum variant configuration for the particular task (e.g. type of interface module, number of solenoid valves, etc.)
- Internal air supply for high security against failure of the main valve functions because no external air hose is required
- Characteristic design
- High Protection class (min. IP66, optional IP67 or IP69k)
- Ease of cleaning without dead zones, whatever the installation orientation
- Clear visualization of the valve status via a light dome visible 360°, which is illuminated by colored LEDs
- Low energy consumption
- Ease of handling
- Maintenance-free electronic modules
- Many special options, e.g.:
 - Air throttles
 - Cable connections, etc.

For maintenance work on the valve, the control tops can be removed from the valve actuator by loosening two bolts on the clamp, without electrical or pneumatic connections having to be disconnected.

T.VIS® concept – for valves with pneumatic actuator



T.VIS® M-15 – control top with manual sensor setting

- For open/close position feedback and actuator control
- Proven sensor technology
- Modules and solenoid valves can be retrofitted



T.VIS® A-15 – control top with automatic set-up

- For open/close position feedback and actuator control
- Automatic set-up
- Semi-automatic setup



T.VIS® P-15 – positioning of the valve disc

- For infinitely definable positioning of the valve disc between the open/close positions
- Automatic set-up



SES – control top for potentially explosive areas

- For open/close position feedback and actuator control
- Intrinsically safe sensors and solenoid valves



Proximity switch holder in bracket

- For 2 proximity switches M12x1

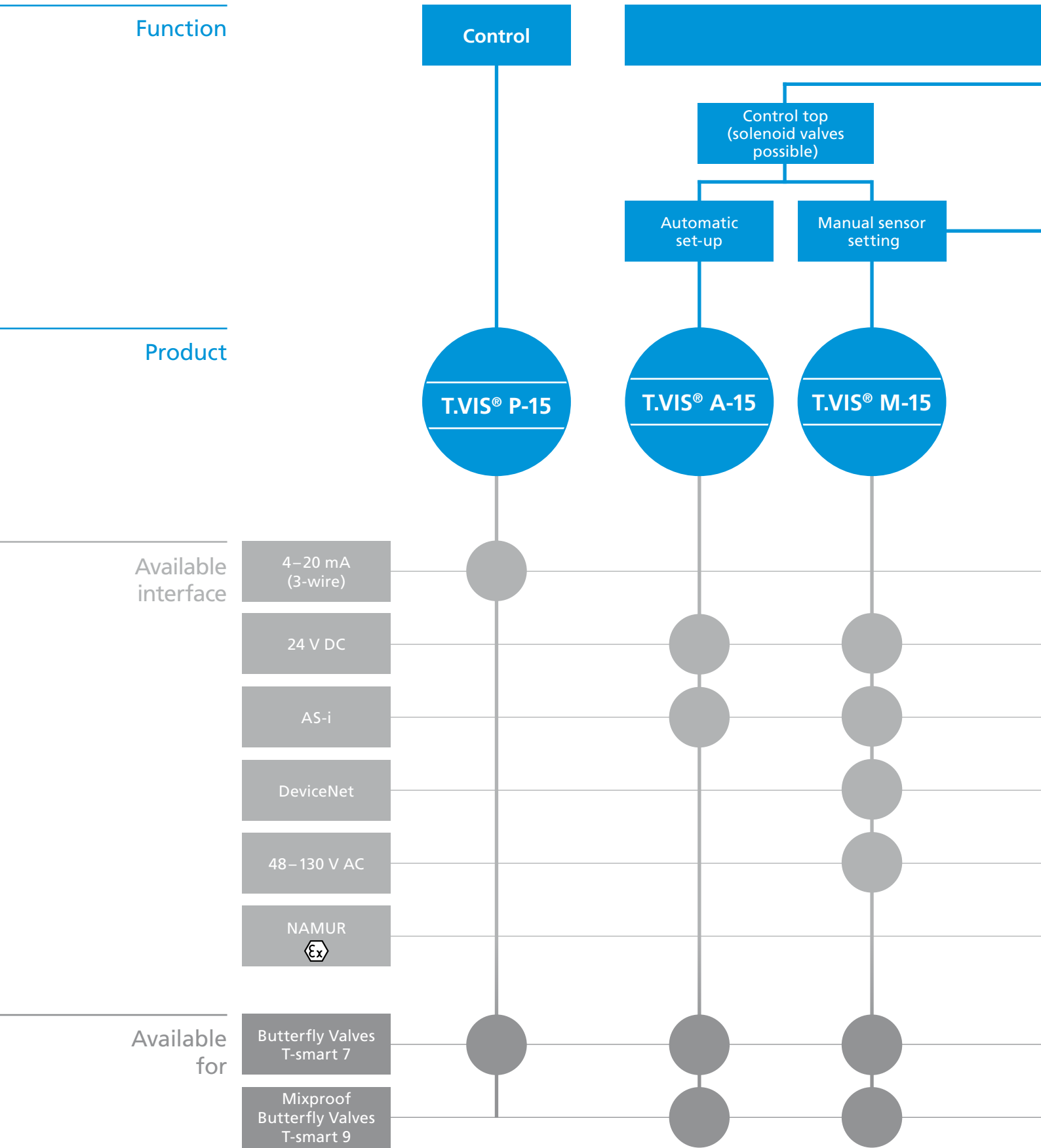
Certificates

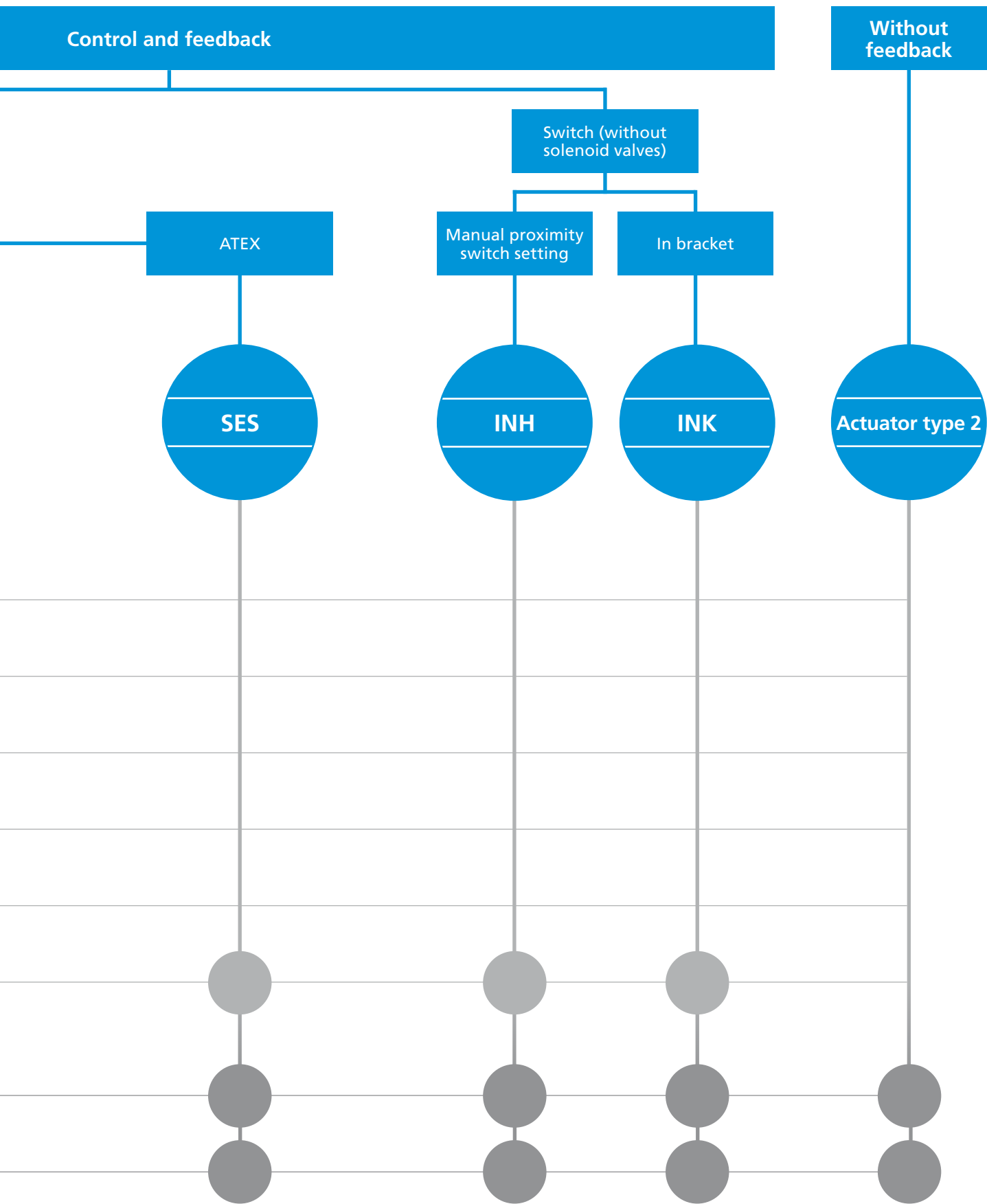
The certificates listed here are valid for corresponding GEA control and feedback systems. Components conforming to the requirements of the European Hygienic Engineering and Design Group (EHEDG) as well as 3-A Sanitary Standards, Inc. (3-A SSI) are available for numerous fields of applications.

EHEDG certificates apply only to the specific control head type as listed. However, they can be transferred to other types, owing to identical design characteristics.

Moreover, independent, standardized tests have confirmed the efficient, problem-free cleanability of numerous components – for optimum safety and economic gain.

			Optional Certificates			
	Index		ATEX	GOST	International protection code IP67, IP66, IP69k	UL / CSA
Control and Feedback Systems	10	T.VIS® M-15		•	•	
	10	T.VIS® A-15		•	•	•
	10	T.VIS® P-15		•	•	
	10	SES	•	•		
	10	INH	•			
	10	INK	•			





Concept

The T.VIS® M-15 is equipped with manually adjustable sensors and a modular system of options, all of which form the basics of the T.VIS® feedback technology. This means it is optimally adapted to the basic requirements of the process system.

With proven sensor technology, it offers the advantages of the modern T.VIS® series in an inexpensive manner.

Standard variant



- 1 Pneumatic block
- 2 24 V DC interface module
- 3 Sensors
- 4 Solenoid valves
- 5 LED lighting
- 6 Central compressed air connection with replaceable filter
- 7 Cable gland

Features

Flexible modular system
Use of proven sensor technology
Quick and easy adjustment of the sensors
Valve status indication by LED
Various communication standards available
Components can be upgraded/converted subsequently
Filter protects solenoid valves
High-quality pneumatic fittings
Exchangeable compressed air connection
Supply and exhaust air throttles can be fitted
Standard protection class IP66

Structure

The T.VIS® M-15 is characterized by proven sensor technology. The basic equipment of the control top comprises of the 24 V DC interface module with two sensors for feedback of the valve position and three solenoid valves which can be installed subsequently, if necessary.

In the interface types with AC (alternating current), DeviceNet and AS-Interface, an adapter module is connected ahead of the standard interface module, and can also be retrofitted or converted.

A replaceable filter in the supply air connection protects the solenoid valves.

Position detection

Inductive sensor system – The valve positions are detected using two manually adjustable sensors.

Setting

Mechanical – the sensors are calibrated mechanically using the positioning spindles, which are subsequently secured to prevent self-adjustment.

Visualization

LED display:

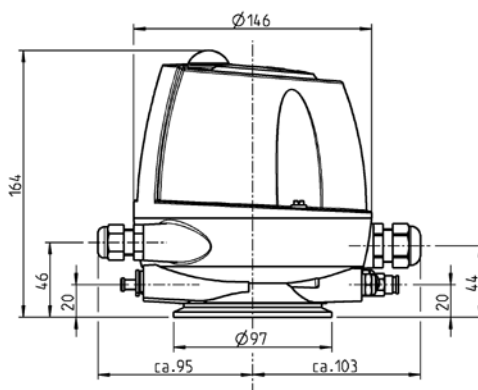
- green
- yellow





Technical data of the standard version

Position detection	Sensors	
Housing material	PA 12/L	
Ambient temperature	-20 to +60 °C	
Air supply	Pressure range	2 to 8 bar
	Standard	acc. to ISO 8573-1:2010
	Solid content	Quality class 6
	Water content	Quality class 4
	Oil content	Quality class 3
Dimensions of air connections	Metric 6/4 mm, inch 6.35/4.31 mm (1/4")	
Protection class	IP66 (powerful water jet)	
Sound pressure level via exhaust air throttle	Max. 72 dB	
Visualization	LED (green, yellow)	



Type of interface	24 V DC, 3-wire, PNP 24 V DC, 3-wire, NPN	48–130 V AC
Supply		
Operating voltage	24 V DC (+20 %, -12.5 %)	48–130 V AC
No-load current	≤ 40 mA	≤ 51 mA
Maximum current consumption	285 mA	185 mA
Polarity reversal protection	Yes	Yes
Inputs		
Activation voltage	21–28.8 V = high; < 16 V = low	48–130 V = high*; < 30 V = low > 1.5 mA = high*; < 0.4 mA = low
Current consumption per input	≤ 35 mA	≤ 3 mA
Activation "PV Y1"	Direct PV activation	Electronic input
Activation "PV Y2"	Direct PV activation	Electronic input
Activation "PV Y3"	Direct PV activation	Electronic input
Outputs		
Connection type	24 V DC (PNP/NPN switchable)	
Maximum current capacity per feedback output	50 mA	≤ 100 mA
Voltage drop on the outputs	≤ 3 V	≤ 5 V
Feedback "start position"	Electronic outputs	Electronic outputs
Feedback "end position"	Electronic outputs	Electronic outputs
Feedback "seat lift position"	Electronic outputs	Electronic outputs

* Leakage currents can arise if PLC modules with electronic outputs are used. If the leakage currents are more than 1.5 mA, it is essential to use a load resistor in parallel with the interface module. Recommendation: 15 kΩ / 2 W

Position	Description of the order code
1	Feedback location
	TM15 Control top T.VIS® M-15
2	Control top type
	N Without solenoid valve
	P 1 solenoid valve Y1
	R 1 solenoid valve Y1 (retrofitable: Y2, Y3)
	I 2 solenoid valves Y1, Y2 (retrofitable: Y3)
	J 2 solenoid valves Y1, Y3 (retrofitable: Y2)
	L 3 solenoid valves Y1, Y2, Y3
3	Feedback
	2 2 feedbacks
4	Type of interface
	B 24 V DC, 3-wire, PNP
	N 24 V DC, 3-wire, NPN
	C 48–130 V AC
5	Solenoid valve
	A 24 V DC, 0.85 W
	0 Without
6	Screw fitting
	M Metric air connection, M20×1.5 cable gland
	Z Inch air connection, 0.5" NPT cable gland
	J Metric air connection, 5-pin M12 plug (1 solenoid valve, 2 feedbacks)
	P Inch air connection, 5-pin M12 plug (1 solenoid valve, 2 feedbacks)
	H Metric air connection, 8-pin M12 plug (> 1 solenoid valve, > 2 feedbacks)
	I Inch air connection, 8-pin M12 plug (> 1 solenoid valve, > 2 feedbacks)
	B Inch air connection, Brad Harrison 0.5" NPT 5-pin plug (US)
	Options (multiple selection possible)
	/18 Supply Air throttle: regulates the opening speed of the valve
	/19 Exhaust air throttle: regulates the closing speed of the valve
	/22 5-pin M12 connection socket for screw fitting J, P (Article No. 508-963) 8-pin M12 connection socket for screw fitting H, I (Article No. 508-061)
	/67 Protection class IP67 (temporary immersion)
	/69k Protection class IP69k (high pressure spray down)
	/UC Certification UL/CSA

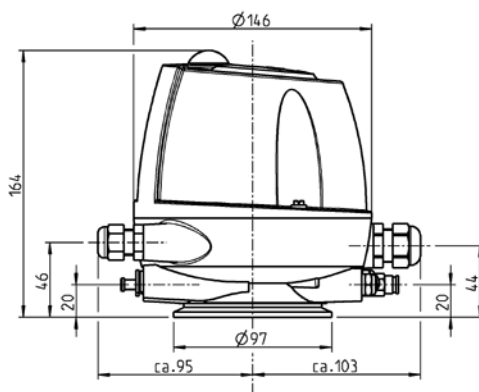
The code is composed as following, depending on the chosen configuration:

Position	1	2	3	4	5	6	Options					
Code	TM15		2									



Technical data of the standard version

Position detection	Sensors	
Housing material	PA 12/L	
Ambient temperature	-20 to +60 °C	
Air supply	Pressure range	2 to 8 bar
	Standard	acc. to ISO 8573-1:2010
	Solid content	Quality class 6
	Water content	Quality class 4
	Oil content	Quality class 3
Dimensions of air connections	Metric 6/4 mm, inch 6.35/4.31 mm (¼")	
Protection class	IP66 (powerful water jet)	
Sound pressure level via exhaust air throttle	Max. 72 dB	
Visualization	LED (green, yellow)	



Type of interface	AS-Interface Bus	DeviceNet
Supply		
Operating voltage	25.0–31.6 V DC	21–26 V DC
No-load current	≤ 62 mA	≤ 58 mA (at 24 V DC)
Maximum current consumption	225 mA	235 mA
Polarity reversal protection	Yes	Yes
Specification	AS-i V3.0 (max. 62 slaves with master V3.0)	ODVA conforming
Additional information	IO.ID.ID2-Code: 7.A.E	EDS-File: F1022_R4.eds
Certificate	AS-i Association/ cCSAus	ODVA
Inputs		
Feedback "start position"	Data bit DI 0	Data bit I-0
Feedback "end position"	Data bit DI 1	Data bit I-1
Feedback "seat lift position" (ext. NI)	Data bit DI 2	Data bit I-2
Collective fault		Data bit I-7
Outputs		
Activation "PV Y1"	Data bit DO 0	Data bit O-0
Activation "PV Y2"	Data bit DO 1	Data bit O-1
Activation "PV Y3"	Data bit DO 2	Data bit O-2

Position	Description of the order code
1	Feedback location
	TM15 Control top T.VIS® M-15
2	Control top type
	N Without solenoid valve
	P 1 solenoid valve Y1
	R 1 solenoid valve Y1 (retrofitable: Y2, Y3)
	I 2 solenoid valves Y1, Y2 (retrofitable: Y3)
	J 2 solenoid valves Y1, Y3 (retrofitable: Y2)
	L 3 solenoid valves Y1, Y2, Y3
3	Feedback
	2 2 feedbacks
4	Type of interface
	A AS-Interface BUS
	D DeviceNet
5	Solenoid valve
	A 24 V DC, 0.85 W
	0 Without
6	Screw fitting
	A Metric air connection M20×1.5 cable gland with connection box on cable 1 m (AS-i)
	S Inch air connection M20×1.5 cable gland with connection box on cable 1 m (AS-i)
	L Metric air connection, 2-pin M12 plug (AS-i)
	U Inch air connection, 2-pin M12 plug (AS-i)
	D Metric air connection, 5-pin M12 plug (DeviceNet)
	K Inch air connection, 5-pin M12 plug (DeviceNet)
	Options (multiple selection possible)
	/18 Supply air throttle: regulates the opening speed of the valve
	/19 Exhaust air throttle: regulates the closing speed of the valve
	/22 5-pin M12 connection socket for screw fitting L, U, D, K (A-coded, article no. 508-963)
	/67 Protection class IP67 (temporary immersion)
	/69k Protection class IP69k (high pressure spray down)
	/81 AS-i connection box on cable 1 m with M12 connection socket (article no. 508-027) for screw fitting L, U
	/82 AS-i connection box on cable 2 m with M12 connection socket (article no. 508-028) for screw fitting L, U
	/UC Certification UL/CSA

The code is composed as following, depending on the chosen configuration:

Position	1	2	3	4	5	6	Options					
Code	TM15		2									

Concept

The T.VIS® A-15 is equipped with a high-precision path measuring system. This automatic open/close position recognition is available on any valve from GEA Tuchenhausen, along with a T.VIS® feedback system.

Development has focussed on the requirements and necessities of our customers from the fluid-processing industry. In addition to safe control and monitoring of all functions of the process valves in breweries, dairies, plants for manufacturing fruit juices as well as pharmaceuticals, the T.VIS® A-15 offers significant advantages that are directly reflected in lower total cost of ownership.

Standard variant



- 1 Pneumatic block
- 2 Control unit
- 3 Path measuring system
- 4 Solenoid valves
- 5 LED lighting
- 6 2 push buttons
- 7 Central compressed air connection with replaceable filter
- 8 M12 plug connection

Features

Quick, automatic initialization
Tamper-proof setting of tolerances
Reduced energy consumption
Reduction in operating costs
Valve status display by LED
Basic LED colors can be selected specifically for the customer
Filter protects solenoid valves
High-quality pneumatic fittings
Exchangeable compressed air connection
Supply and exhaust air throttles can be fitted
Semi-automatic setup
Standard protection class IP66
Semi-automatischer Setup
Semi-automatischer Setup

Structure

The T.VIS® A-15 is equipped with a precise path measuring system for detecting its position.

The necessary wiring for control and feedback is performed, depending on the requirements, via the M12 plug connections accessible from the outside or through direct wiring and cable glands.

The control top can be opened for this.

Operation and configuration of the T.VIS® A-15 takes place either by the two push buttons mounted on the cap or, with the cap removed, via the buttons below. The push buttons are secured electronically against inadvertent or incorrect operation, while in operating mode.

A replaceable filter, in the supply air connection protects the solenoid valves.

Position detection

Path measuring system – the valve position is registered by means of a highly modern path measuring system.

Setting

Automatic – following unlocking, simply pressing the two buttons on the cap of the T.VIS® A-15 starts the initialization process which runs fully automatically. There is no need to open the control top for this purpose, resulting in particularly quick, easy and safe commissioning of the control top (on average < 1 minute).

Immediately following the set-up, it is possible to set the open/close position tolerances and signal attenuation in the parameter menu.

Semi-automatic setup

As a new feature, our control top T.VIS® A-15 has the option of semi-automatic set-up that permits uncomplicated exchange in the current process.

For more information about the semi-automatic setup, refer to the end of this section.

Visualization

LED display:

- Green
- Yellow
- Red



Protection class IP66

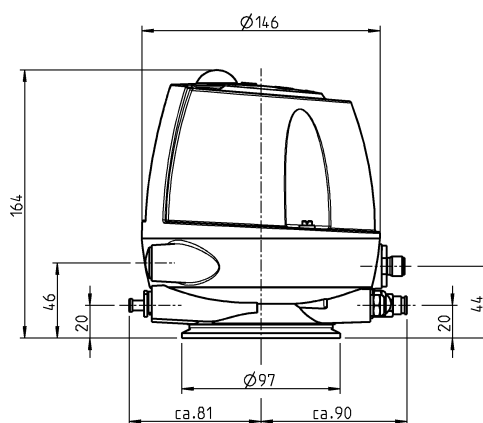
The programmable color change allows the display of colors yellow and green to be swapped over.



Technical data of the standard version

Position detection	Path measuring system	
Housing material	PA 12/L	
Ambient temperature	-20 to +60 °C	
Air supply	Pressure range	2 to 8 bar
	Standard	acc. to ISO 8573-1:2010
	Solid content	Quality class 6*
	Water content	Quality class 4
	Oil content	Quality class 3
Dimensions of air connections	Metric 6/4 mm, inch 6.35/4.31 mm (¼")	
Protection class	IP66 (powerful water jet)	
Sound pressure level via exhaust air throttle	Max. 72 dB	
Visualization	LED (green, yellow, red)	

* Recommended



Type of interface	24 V DC, 3-wire, PNP	AS-Interface Bus
Supply		
Operating voltage	24 V DC (+20 %, -12.5 %)	26.5–31.0 V DC
No-load current	≤ 25 mA	≤ 25 mA
Maximum current consumption	265 mA	65 mA*
Polarity reversal protection	Yes	Yes
Specification		AS-i V3.0 (max. 62 slaves)
Additional information		IO.ID.ID2-Code: 7.A.E
Certificate		AS-i association
Inputs		
Connection type	24 V DC (PNP)	
Short circuit proof	Yes	
Overload-proof	Yes	
Maximum current carrying per feedback output	100 mA	
Voltage drop at the outputs	≤ 1 V	
Feedback "start position"	Electronic output	Data bit DI 0
Feedback "end position"	Electronic output	Data bit DI 1
Feedback "seat lift position"	Electronic output	Data bit DI 2
Outputs		
Activation voltage	> 13V = high; < 6V = low	
Current consumption per input	< 10 mA	
Activation "PV Y1"	Electronic input	Data bit DO 0
Activation "PV Y2"	Electronic input	Data bit DO 1
Activation "PV Y3"	Electronic input	Data bit DO 2

* This value is valid only with an activated solenoid valve.

Position	Description of the order code
1	Feedback location TA15 Control top T.VIS® A-15
2	Control top type N Without solenoid valve P 1 solenoid valve Y1 I 2 solenoid valves Y1, Y2 J 2 solenoid valves Y1, Y3 L 3 solenoid valves Y1, Y2, Y3
3	Feedback 8 2 digital feedbacks
4	Type of interface A AS-Interface BUS B 24 V DC PNP
5	Solenoid valve A 24 V DC, 0.85 W 0 Without
6	Screw fitting J Metric air connection, 5-pin M12 plug for 24 V DC (1 PV, 2 feedbacks), AS-i P Inch air connection, 5-pin M12 plug for 24 V DC (1 PV, 2 feedbacks), AS-i H Metric air connection, 8-pin M12 plug for 24 V DC (> 1 solenoid valve, > 2 feedbacks) I Inch air connection, 8-pin M12 plug for 24 V DC (> 1 solenoid valve, > 2 feedbacks) M Metric air connection, M20x1,5 cable gland with integrated terminal strip Z Inch air connection, 0.5" NPT cable gland with integrated terminal strip
	Options (multiple selection possible) /18 Supply Air throttle: regulates the opening speed of the valves /19 Exhaust air throttle: regulates the closing speed of the valves /22 24 V DC/AS-i: 5-pin connection socket for screw fitting J, P (article no. 508-963) 24 V DC: 8-pin connection socket for screw fitting H, I (article no. 508-061) /67 Protection class IP67 (temporary immersion) /69k Protection class IP69k (high pressure spray down) /81 AS-i connection box on cable 1 m with 5-pin M12 connection socket (article no. 508-027) /82 AS-i connection box on cable 2 m with 5-pin M12 connection socket (article no. 508-028) /UC Certification UL/CSA

The code is composed as following, depending on the chosen configuration:

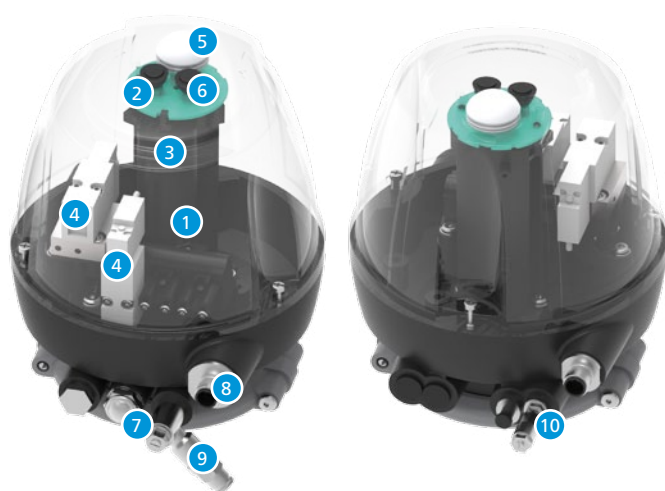
Position	1	2	3	4	5	6	Options					
Code	TA15		8									

Concept

As a controller based on the technology of the T.VIS® A-15 with path measuring system, the T.VIS® P-15 in combination with an air-spring actuator can move to any required valve position between the open/close positions.

The T.VIS® P-15 is characterized not only by its performance but also by its ease of operation and outstanding price/performance ratio.

Standard variant



- 1 Pneumatic block
- 2 Control unit
- 3 Path measuring system
- 4 Solenoid valves
- 5 LED lighting
- 6 2 push buttons
- 7 Exchangeable filter
- 8 M12 plug connection
- 9 Supply air throttle
- 10 Exhaust air throttle

Features

Automatic initialization
Simple and safe operation
Manual operation of the process valve
Valve status display by LED
Open/close position feedback (optional)
Selectable dead band (control hysteresis)
High-quality pneumatic fittings
High potential for cost reduction
Standard protection class IP66

Structure

The T.VIS® P-15 is equipped with a precise path measuring system for detecting its position.

The necessary wiring for control and feedback is configured using M12 plug connections that can be accessed externally.

The control top can be opened for this.

Operation and configuration of the T.VIS® P-15 takes place either by the two push buttons mounted on the cap or, with the cap removed, via the buttons below. The push buttons are secured electronically against inadvertent or incorrect operation, while in operating mode.

The T.VIS® P-15 is equipped as standard with adjustable supply and exhaust air throttles.

Position control

The T.VIS® P-15 position controller works with an integrated microprocessor which contains the software for operation, visualization as well as intelligent position detection and evaluation. When a nominal value is specified (4 – 20 mA), e.g. by the PLC, the process valve can be set to any required position. The push buttons on the cap also make it possible to specify a nominal value manually, in order to set the process valve to the required position. The position is detected using a position transducer and is automatically controlled using two integrated solenoid valves. The valve disc position can also be permanently evaluated using the analog actual value output, as well as, three binary outputs in the PLC.

Setting

Automatic – following unlocking, simply pressing the two buttons on the cap of the T.VIS® P-15 starts the initialization process which runs fully automatically. There is no need to open the position controller for this purpose, resulting in particularly quick, easy and safe commissioning of the position controller (on average < 1 minute).

Directly following the set-up, the open/close position tolerances, the control hysteresis and control characteristics can be set in the parameter menu.



Visualization

LED display:

- Green
- Yellow
- Red
- Blue
- Blue flashing

Feedback

- Standard: valve position 0 – 100 %, travel (4 – 20 mA)
- Optional: 24 V DC binary signals for closed and opened position

Field of application

The T.VIS® P-15 can be used on VARIVENT® and ECOVENT® valves for controlling the valve disc position. Opening the valves to specific intermediate positions makes it possible to influence the hydraulic characteristics of the system. In N-valves, a control cone is available as an option which permits precise hydraulic setting.

Flow control

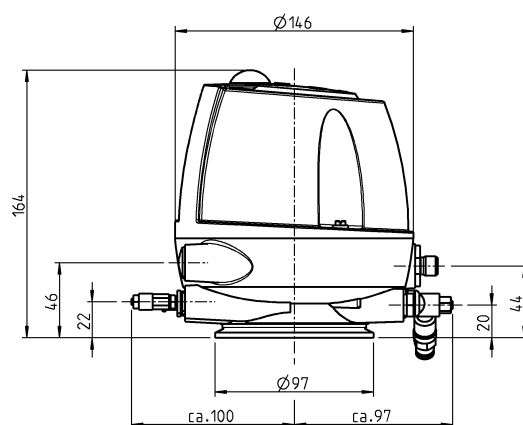
The T.VIS® P-15 position controller offers not only linear position signal transformation, but also the possibility of equal percentage position signal transformation. This permits significantly more precise position control of the valve disc in positions close to the non-actuated position.



Technical data of the standard version

Position detection	Path measuring system	
Housing material	PA 12/L	
Ambient temperature	–20 to +60 °C	
Air supply	Pressure range	2 to 8 bar
	Standard	acc. to ISO 8573-1:2010
	Solid content	Quality class 6*
	Water content	Quality class 4
	Oil content	Quality class 3
Dimensions of air connections	Metric 6/4 mm, inch 6.35/4.31 mm (¼")	
Protection class	IP66 (powerful water jet)	
Sound pressure level via exhaust air throttle	Max. 72 dB	
Visualization	LED (green, yellow, red, blue)	

* Recommended



Type of interface	24 V DC programmable
Supply	
Supply voltage U_v	24 V DC (+20 %, –12.5 %)
No-load current	≤ 20 mA
Maximum power consumption	$\Sigma I = (I_{T,VIS} + I_{PV} + I_{RM}) \pm 10 \% 260$ mA
Maximum residual ripple	5 %
Inputs	
Control voltage max. 28.8 V DC	High = ≥ 13 V DC Low = ≤ 6 V DC
Pilot current	≤ 10 mA
Outputs	
Output voltage	High = $U_v - \leq 5 \%$ Low = ≤ 5 V
Max. current	(ΣI_{RM}) 200 mA short circuit proof
Switching frequency	(resistive + inductive loads ≤ 25 mH) 2 Hz
Operating current	internal solenoid valve (I_{PV}) 35 ... 45 mA
Analog input	Nominal valve 4–20 mA/0–100 % stroke
Analog output	Actual valve 4–20 mA/0–100 % stroke
Load	max. 600 Ω

Position	Description of the order code
1	Feedback location TP15 Control top T.VIS® P-15
2	Control top type I 2 solenoid valves
3	Feedback 4 T.VIS® P-15 (with analog module) 5 T.VIS® P-15 (with analog module + 2 feedbacks/error output)
4	Type of interface P 24 V DC programmable
5	Solenoid valve A 24 V DC, 0.85 W
6	Screw fitting (with analog module) J Metric air connection, 5-pin M12 plug, A-coded With feedback code 5: additional M12 plug B-coded inclusive P Inch air connection, 5-pin M12 plug, A-coded With feedback code 5: additional M12 plug B-coded inclusive IMPORTANT: Please also order the appropriate connection sockets as well.
	Options (multiple selection possible) /22 5-pin connection socket for A-coded plug (article no. 508-963) 5-pin connection socket for B-coded plug (article no. 508-964) /67 Protection class IP67 (temporary immersion) /69k Protection class IP69k (high pressure spray down)

The code is composed as following, depending on the chosen configuration:

Position	1	2	3	4	5	6	Options					
Code	TP15	I		P	A							

Concept

The SES is characterized by proven sensor technology. The control top consists of an interface module, up to 2 sensors for valve position feedback and up to 3 solenoid valves which can also be installed subsequently.

The SES is only available in PA 12/L material, because conductivity of the material is required for use in ATEX/Ex areas.

Features

Proven NAMUR sensors
Simple and quick adjustment of sensors
Flexible modular system
Selection of various solenoid valves
Retro-fittable



- 2 Interface module
- 3 Proximity switches
- 4 Solenoid valves
- 8 Cable gland

Position detection

Proximity switches – the valve positions are recorded using two manually adjustable proximity switches for the non-actuated and actuated position.

Setting

Mechanical – the sensors are calibrated mechanically using the positioning spindles, which are subsequently secured to prevent adjustment.

Field of application

Use in potentially explosive atmospheres is permitted:*

- **With proximity switch** up to zone 1 and 20**
 - For connection to approved intrinsically safe equipment
 - ATEX identification:
 - II 2G Ex ia IIC T6
 - II 1D Ex iaD 20 T97 °C
- **With solenoid valve up to zone 0 and 20**
 - For connection to approved intrinsically safe equipment
 - ATEX identification:
 - II 2G Ex ia IIC T6
- **With interface module**
 - Not subject to Ex approval because it is a purely passive component

Please note

- *) There is no ATEX certification for the complete control top. Certifications can only be issued for the individual components of the control top. Please note that the permitted Ex-zone/ATEX category of the complete control top depends on the approval of the component with the lowest protection level. The entire control top with all components is optionally certified according to:
- CSA C22.2
 - ANSI/ISA 82.02.01-1999
 - UL 1203, 4th Ed.
 - UL 429, 6th Ed.
 - ISA/ANSI 12.12.01-2011
- **) The intrinsically safe components are only allowed to be individually connected to an approved safety barrier. This arrangement permits use in a risk area.


Visualization

The position of the switch bar projecting from the control top makes it possible to detect what the position of the valve is.



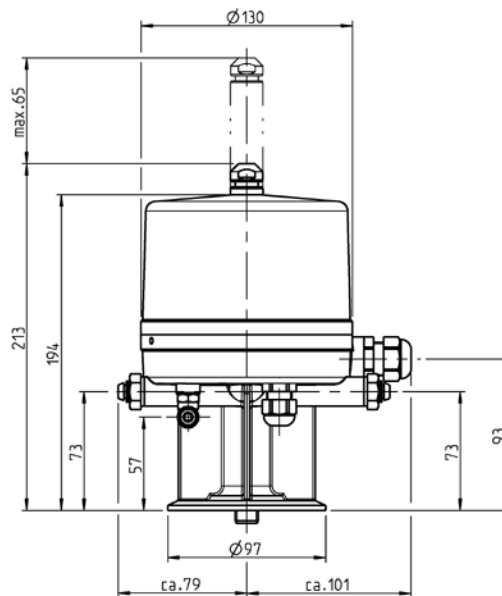



Technical data of the standard version

Position detection	Inductive proximity switches	
Housing material	PA 12/L	
Ambient temperature	0 to 45 °C	
Air supply	Pressure range	1.5 to 7 bar
	Standard	acc. to ISO 8573-1:2010
	Solid content	Quality class 6
	Water content	Quality class 4
	Oil content	Quality class 3
Dimensions of air connections	Metric 6/4 mm, inch 6.35/4.31 mm (¼")	
Protection class	IP65*	
Sound pressure level via exhaust air throttle	Max. 72 dB	
Visualization	Position of switch rod	
Certificates		

• II 2G EEx ia IIC T6**

* Not for overhead installation ** Standard for SES



Type of interface	EEx / ATEX (12 V DC)	EEx / ATEX (24 V DC)
Sensor		
Communication	NAMUR 8.2 VDC (operating voltage 6–30 V DC)	NAMUR 8.2 VDC (operating voltage 6–30 V DC)
Equipment category	II 2G Eex ia IIC T6 and Ex iaD 20 T97 °C	II 2G Eex ia IIC T6 and Ex iaD 20 T97 °C
Article no.	505-093	505-093
Solenoid valve		
Rated voltage	12 V DC –10 % / +25 %	24 V DC –10 % / +15 %
Rated power	0.5 W	0.5 W
Equipment category	II 1GD Eex ia IIC T6	II 1GD Eex ia IIC T6
Article no.	512-124	512-155
Certificates (optional)		
	<ul style="list-style-type: none"> • CSA C22.2 • ANSI/ISA 82.02.01-1999 • UL 1203, 4th Ed. • UL 429, 6th Ed. • ISA/ANSI 12.12.01-2011 	

Position	Description of the order code
1	Feedback location SES. Control top sensor technology
2	Control top type N Without solenoid valve P 1 solenoid valve Y1 I 2 solenoid valves Y1, Y2 L 3 solenoid valves Y1, Y2, Y3
3	Feedback 0 Without 1 1 feedback 2 2 feedbacks
4	Type of interface E EEx/ATEX
5	Solenoid valve 0 Without E 12 V DC, ATEX X 24 V DC, ATEX
6	Screw fitting E Metric air connection, Pg 13.5 cable gland N Inch air connection, Pg 13.5 cable gland
	Options (multiple selection possible) /43 Material PA 12/L: UV, oil and grease resistant (standard in control top SES) /UC Certification UL/CSA

The code is composed as following, depending on the chosen configuration:

Position	1	2	3	4	5	6	Options					
Code	SES.			E			/43					



INK – Proximity switch holder with bracket for 2 proximity switches M12x1

The proximity switch holder with bracket can be used as an alternative to feedback systems if a control top is not desired above the actuator. The holders are integral parts of the bracket for the pneumatic actuator. The order code INK allows for a choice of proximity switches to be ordered for the valve.

Technical data

Material	AISI 304
Surface	Metal blank



INH – Proximity switch holder for manual actuator for 2 proximity switches M12x1

This clip-on bracket can be installed in two horizontal positions and two vertical positions, thereby offering up to 8 different configurations for proximity switches of size M12x1 as well as an eyelet for a padlock to secure the mechanical, standard manual actuator in the closed valve position. The depicted lock is only an example. The holders are integral parts of the optional bracket for the manual actuator. The order code INH allows for a choice of proximity switches to be ordered for the valve.

Technical data

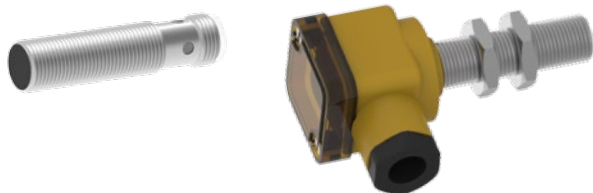
Material	PA12
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Position	Description of the order code
1	Feedback location
	INK. Proximity switch holder with bracket for 2 proximity switches M12×1 (only actuator type 2)
	INH. Proximity switch holder for manual actuator for 2 proximity switches M12×1 (only actuator type 0)
2	Feedback
	0 Without
	1 1 feedback
	2 2 feedbacks
3	Type of switch
	0 Without
	B NI 24 V DC 3-wire PNP M12×1 with terminal chamber (Article No. 505-088)
	F NI 24 V DC 2-wire M12×1 with terminal chamber (Article No. 505-104)
	E NI NAMUR M12×1 with terminal chamber (Article No. 505-085)
	X NI 24 V DC 3-wire opened with terminal chamber (Article No. 505-089)
	S NI 24 V DC 3-wire PNP M12×1 with connector (Article No. 505-096)

The code is composed as following, depending on the chosen configuration:

Position	1	2	3
Code			

External proximity switches M12×1 for mounting on the actuator or in the lantern.



Technical data

Nominal switching distance	2 to 4 mm
Protection class	IP 67
Operating voltage	10–30 V DC/NAMUR
Material	PA 12/L GF 30/VA
Permitted ambient temperature	–30 to 85 °C

Proximity switch M12×1 for INA, LAT	Article no.
2-wire (terminal chamber)	505-104
3-wire PNP (M12 plug)	505-088

Technical data

Nominal switching distance	4 mm
Operating voltage	10–30 V DC
Permitted ambient temperature	–30 to 85 °C

Proximity switch M12×1 for T.VIS®	Article no.
3-wire PNP (plug connector)	505-096

Technical data

Nominal switching distance	3 mm
Operating voltage	10–65 V DC
Permitted ambient temperature	–30 to 85 °C

Proximity switch M12×1 for T.VIS® – normally open	Article no.
4-wire PNP (terminal chamber)	505-089

Technical data

Nominal switching distance	2 mm
Operating voltage	8.2 V DC norm.
Permitted ambient temperature	–25 to 70 °C

Proximity switch M12×1 for SES	Article no.
NAMUR (terminal chamber)	505-085

Switch bars and adapters

The following components are required for subsequent installation of a control and feedback system on a Butterfly Valve T-smart.

Butterfly Valve T-smart 7			
	T.VIS® M-15	T.VIS® A-15/ T.VIS® P-15	SES
Switch bar	224-001697	224-001696	224-001548
Adapter switch bar	–	–	224-001549

Mixproof Butterfly Valve T-smart 9			
	T.VIS® M-15	T.VIS® A-15	SES
Switch bar	224-001697	224-001696	224-001548
Adapter switch bar	–	–	224-001549



Switch bar 224-001697
for T.VIS® M-15



Switch bar 224-001696
for T.VIS® A-15/T.VIS® P-15

The IP protection classes inform about the scope at which the housing of an electrical device is protected against ingress of solids (first number) and moisture (second number).

So called IP-codes are assigned to the protected systems. Their index figures represent common error options against which the system is protected. The code starts with the letters IP for "International Protection".

Meaning of the index numbers

1. Index*	Protection from solids
6	Dust-tight
2. Index*	Protection from moisture
6	Protection from powerful water jet
7	Protection from temporary immersion
9k	Protection from water at high pressure/ steam jet cleaning

* Further indices and more precise explanations can be found in the corresponding standard.

If an index number is not to be stated, it is replaced by the letter x (e.g. IPx6).

For the 2nd index figure (protection from moisture), the following applies:

- The protection class IPx6 includes all protection classes below.
- **This does not apply to the higher protection class IPx7.** If this protection class is to include a lower protection class, this is to be indicated by a combination of index figures (e.g. IP67/69k).











The TVIS® control top designs of the M-15 and A-15 comply with the requirements of protection class IP66 (DIN EN 60529) as standard. Designs in the stronger protection classes IP67 or IP69k (both DIN EN 60529) are also available.

By means of the semi-automatic setup, a control top can be replaced without interrupting the current process.

For this, an employee only needs to perform the simple configuration once on site: in the version in protection class IP66 with two push buttons on the T.VIS® cap, and for the optional protection classes IP67 and IP69k with the cap removed right with the two buttons below.

For the semi-automatic set-up, the control top initially only learns the position of the valve disc on the non-actuated position and then remains until the valve is actuated in the scope of a running process. Only then will the end position of the valve be stored. The process thus does not need to be stopped!

The semi-automatic set-up is integrated into the T.VIS® A-15 as standard and does not require any additional hardware.

	Order code for air connection		In conjunction with screw fitting or plug	Use	Matching connection socket		
	Metric	Inch			Option	Article no.	Designation
	M		M20×1.5 cable gland	T.VIS® M-15 T.VIS® A-15	–	–	–
	E		Pg 13.5 cable gland	SES	–	–	–
		Z	0.5" NPT cable gland	T.VIS® M-15 T.VIS® A-15	–	–	–
		N	Pg 13.5 cable gland	SES	–	–	–
	A	S	M20×1.5 cable gland with connection box on cable 1 m	T.VIS® M-15 (AS-i)	–	–	–
	L	U	2-pin M12-plug (A-coded)	T.VIS® M-15 (AS-i)	/22	508-963	5-pin M12 connection socket (A-coded)
					/81	508-027	AS-i connection box on cable 1 m with 5-pin M12 connection socket (A-coded)
					/82	508-028	AS-i connection box on cable 2 m with 5-pin M12 connection socket (A-coded)
	D	K	5-pin M12 plug (A-coded)	T.VIS® M-15 (DeviceNet)	/22	508-963	5-pin M12 connection socket (A-coded)
			5-pin M12 plug (B-coded)	T.VIS® M-15 (DeviceNet)		508-964	5-pin M12 connection socket (B-coded)
	J	P	5-pin M12-plug (A-coded)	T.VIS® M-15 (24 V DC) T.VIS® M-15 (48–130 V AC) T.VIS® A-15 (24 V DC) T.VIS® A-15 (AS-i) T.VIS® A-15 (DeviceNet) T.VIS® P-15	/22	508-963	5-pin M12 connection socket (A-coded)
			5-pin M12 plug (B-coded)	T.VIS® P-15		508-964	5-pin M12 connection socket (B-coded)
	H	I	8-pin M12-plug (A-coded)	T.VIS® M-15 (24 V DC) T.VIS® M-15 (48–130 V AC) T.VIS® A-15 (24 V DC)	/22	508-061	8-pin M12 connection socket (A-coded)
		B	Brad Harrison 0.5" NPT 5-pin plug	T.VIS® M-15 (24 V DC) T.VIS® M-15 (48–130 V AC)	–	–	–

24 V (PNP/NPN)

In 24 V parallel wiring digital signals are exchanged between a terminal unit and generally the corresponding input and output modules of a PLC. In this case, it is necessary to have a separate wire for each signal, usually in the form of a multi-core cable.

PNP (current-supplying) indicates signal transfer against reference potential L-.

NPN (current-drawing) indicates signal transfer against reference potential L+.

BUS AS-Interface



AS-Interface (Actuator-Sensor Interface) is a standard in fieldbus communication that was developed for connecting actuators and sensors. This is to replace parallel cabling used in the past. The AS-Interface has been an international standard acc. to EN 50295 and IEC 62026-2 since 1999. AS-i products are certified by the AS International Association, thereby, ensuring that equipment from different manufacturers will work together in the same system. The transmission medium is an unshielded, two-core yellow cable which also carries the electrical power supply (24–30 V direct current voltage) for the communication electronics and the slaves. A maximum of 62 slaves can be used per AS-i master. The slaves are addressed manually using a manual addressing unit or automatically by the master. The maximum length of the AS-i cable is 100 m, although by using repeaters it is possible to extend the entire length up to 400 m.

DeviceNet bus

DeviceNet is a CAN-based fieldbus that is chiefly used in automation engineering. DeviceNet was developed by Allen-Bradley (part of Rockwell Automation) and later transferred to the ODVA (Open DeviceNet Vendor Association) as an open standard. DeviceNet is chiefly used in the USA and, to a certain extent, Asia. A maximum of 64 network nodes can be used per fieldbus segment. The nodes address is set either using dial or DIP switches on the device, or can be configured using the bus on the basis of software. The maximum length of the DeviceNet cable depends on the selected cable type and baud rate, although it cannot exceed 500 m.

48–130 V AC

This is also parallel wiring but with alternating current voltage signals that are processed in the control top using a wide-band I/O module. This communication technology is chiefly used in the United States and Canada with 110 V, although it can also be encountered in southern Europe with 48 V.

NAMUR

The 2-wire NAMUR sensors and solenoid valves used here can be operated in the Ex area because of their “intrinsically safe” ignition protection type. Using external isolating switching amplifiers, it is possible to operate control tops with this communication technology up to zone 1 or 21.

4–20 mA (3-wire)

In industrial automation engineering, the 4–20 mA current signal is the one most frequently used for analog measured value transmission. The enormously widespread use of this type of signal is explained by its ease of handling and, above all, its resistance to interference.

Using 4 mA as the initial value instead of 0 mA makes it very easy to detect and evaluate a wire break. As a rule, 4–20 mA corresponds to 0–100 % of the physical measuring range of an analog sensor or the working range of an actuator set in the parameters; the nominal value is supplied or the actual value is returned via an interface of this kind.

Valve selection

Position	Description of order code			
1	Valve type			
	7	Butterfly Valve		
2	Flange connection			
	11	Weld connection/weld connection		
3	Pipe standard			
	0	OD	1	DN
4	Nominal size			
	012	OD ½"	015	DN 15
	075	OD ¾"	020	DN 20
	010	OD 1"	025	DN 25
	112	OD 1 ½"	040	DN 40
	200	OD 2"	050	DN 50
	212	OD 2 ½"	065	DN 65
	300	OD 3"	080	DN 80
	400	OD 4"	100	DN 100
			125	DN 125
			150	DN 150
	5	Product wetted material		
1		AISI 304 (1.4301)		
	2	AISI 316L (1.4404)		
6	Product wetted gasket material			
	0	EPDM		
	1	HNBR		
	2	FKM		
	6	VMQ		
7	...			











Feedback system selection

Position	Description of order code	
1	Location of feedback	
	TM15	Control top T.VIS® M-15
2	Control top type	
	N	Without solenoid valve
	P	1 solenoid valve Y1
	R	1 solenoid valve Y1 (retro-fittable: Y2, Y3)
	I	2 solenoid valves Y1, Y2 (retro-fittable: Y3)
	J	2 solenoid valves Y1, Y3 (retro-fittable: Y2)
	L	3 solenoid valves Y1, Y2, Y3
3	Feedback	
	2	2 feedbacks
	3	2 feedbacks with external initiator
4	...	

Example of complete order code, including valve and feedback system:

Position	1	2	3	4	5	6	7	8	9	10	11	12	13
Code	7	1	1	0	1	1	2	1	0	1	0	0	0

Position	1	2	3	4	5	6	Options						
Code	TM15	P	2	B	A	M	-0						

AS-i		Actuator Sensor interface. BUS system for the lowest field level.
ATEX		Atmosphères Explosibles. ATEX comprises the directives of the European Union in the area of explosion protection. For one thing, this is the ATEX equipment directive 94/9/EC, for another, the ATEX workplace directive 1999/92/EC.
cCSAus		Test of a product by CSA according to applicable safety standards in Canada and the USA.
CE		Conformité Européenne. By affixing the CE mark, the manufacturer confirms that the product complies with the European directives applicable to the specific product.
CSA		Canadian Standards Association. A non-governmental Canadian organization which issues standards as well as checking and certifying the safety of products. It is now globally active.
cULus		Test of a product by UL according to applicable safety standards in Canada and the USA.
DeviceNet		BUS system of the ODVA organization for complex communication on various field levels.
EG 1935/2004		Materials in contact with the product used in valves from GEA Tuchenhausen GmbH are in accordance with EC regulation 1935/2004. This defines a general framework for materials and objects intended to come into contact with foodstuffs.
EHEDG		European Hygienic Engineering & Design Group. European supervisory authority for foodstuffs and pharmaceuticals. This authority issues approvals and certificates for products and materials that are used in the foodstuffs and pharmaceuticals industries.
FDA		Food and Drug Administration. US supervisory authority for foodstuffs and pharmaceuticals. This authority issues approvals and certificates for products and materials that are used in the foodstuffs and pharmaceuticals industries.
ODVA		ODVA is a worldwide association comprising leading automation companies. It develops network protocols and standards in the joint interests of its members, which are used for the international interoperability of production systems.
TA-Luft		If a product is certified according to TA Luft it meets the requirements for proof of high grade performance according to TA Luft of 1.0×10^{-4} mbar \times l / (s \times m) at service conditions under the VDI guideline 2440. The product will hence be tested for tightness.
TÜV		Technischer Überwachungs-Verein. The German TÜV is a private company which carries out technical safety checks as prescribed in national legislation or regulations.
UL		Underwriters Laboratories. An organization founded in the USA for checking and certifying products and their safety.

Abbreviation	Meaning
°C	Degree Celsius, unit of measurement for temperature
°F	Degree Fahrenheit, unit of measurement for temperature
A	Ampere, unit of measurement of current intensity or Output, term used in automation
AC	Alternating Current
AISI	American Iron and Steel Institute, association of the American steel industry
ANSI	American National Standards Institute, American body for standardizing industrial processes
AS-i	Actuator Sensor interface, standard for fieldbus communication
ASME	American Society of Mechanical Engineers, professional association of mechanical engineers in the USA
ASME-BPE	Standard of the ASME's bioprocessing equipment association
ATEX	Atmosphères Explosibles, synonymous with the directives of the European Union for potentially explosive areas
bar	Unit of measurement for pressure. All pressure values [bar/psi] refer to positive pressure [bar _g /psi _g], unless specifically stated otherwise.
CAN	Controller Area Network; asynchronous serial bus system
CE	Conformité Européenne, administrative symbol for the free movement of industrial products
CIP	Cleaning In Place, designates a process for cleaning technical process systems.
CSA	Canadian Standards Association, a non-governmental Canadian Standardization organization
dB	Decibel, one tenth of a bel, named after Alexander Graham Bell and used for identifying levels and dimensions
DC	Direct Current
DIN	Deutsches Institut für Normung e. V. Standardization organization in the Federal Republic of Germany, DIN = synonym for standards issued by the organization
DIP	Dual Inline Package, design of a switch
DN	Diameter Nominal, DIN nominal width
E	Input, term used in automation
EHEDG	European Hygienic Engineering and Design Group. Consortium of equipment manufacturers, food industries, research institutes as well as public health authorities
EN	European standard, rules of the European Committee for Standardization
EPDM	Ethylene propylene diene rubber, acronym acc. to DIN/ISO 1629
Ex	Synonym for ATEX
FDA	Food and Drug Administration, official foodstuffs monitoring in the United States

Abbreviation	Meaning
FKM	Fluorinated rubber, acronym acc. to DIN/ISO 1629
H	Henry, unit of measurement for inductance
HNBR	Hydrated acrylonitrile butadiene rubber, acronym acc. to DIN/ISO 1629
Hz	Hertz, unit of frequency named after Heinrich Hertz
I	Formula symbol for electrical current
IEC	International Electrotechnical Commission, international standardization organization for electrical and electronic engineering
IP	Ingress Protection/International Protection, index of protection class acc. to IEC 60529
ISA	International Society of Automation, international US organization of the automation industry
ISO	International Organization for Standardization, international organization that produced international standards, ISO = synonym for standards from the organization
kg	Kilogram, unit of measurement for weight
Kvs	The Kv values of a valve at nominal stroke (100 % opening) is designated the Kvs value
L	Conductive
LED	Light-Emitting Diode
mm	Millimeter, unit of measurement for length
M	Metric, system of units based on the meter or Mega, one million times a unit
m ³ /h	Cubic meters per hour, unit of measurement for volumetric flow
max.	Maximum
NAMUR	Standardization working association for measuring and control technology in the chemical industry, synonym for the interface type of the organization, especially for potentially explosive atmospheres
NPN	Signal transmission against reference potential, current-consuming
NPT	National Pipe Thread, US thread standard for self-sealing pipe fittings
OD	Outside Diameter, pipe dimension
ODVA	Open DeviceNet Vendor Association, global association for network standards
PA 12/L	Polyamide
Pg	Armoured thread
PLC	Programmable Logic Controller, device for controlling a machine or system on a digital basis
PNP	Signal transmission against reference potential, current-supplying

Abbreviation	Meaning
PV	Solenoid valve
Ra in μm	Average roughness value, describes the roughness of a technical surface
RM	Feedback
SES	GEA Tuchenhausen control head for Ex areas, control top system of GEA Tuchenhausen
SET-UP	Self-learning installation, the SET-UP procedure carries out all necessary settings for generating messages during commissioning and maintenance.
SIP	Sterilization in Place, refers to a process for cleaning technical process systems
SMS	Svensk Mjöl Standard, Scandinavian pipe dimension
T.VIS®	GEA Tuchenhausen valve information system, control top system from GEA Tuchenhausen
T-smart	Valve series from GEA Tuchenhausen
UL	Underwriters Laboratories, a certification organization established in the USA
UV	Ultraviolet, ultraviolet radiation is a wavelength of light
V	Volt, unit of measurement for voltage
VARICOMP®	Pipe expansion compensator from GEA Tuchenhausen
VMQ	High-polymer vinyl methyl polysiloxane, silicone rubber, MVQ = synonym
W	Watt, unit of measurement for power
Y	Control air connection for the working cylinder, designation from pneumatic systems
μ	Micro, one millionth of a unit
Ω	Ohm, the unit of electrical resistance named after Georg Simon Ohm

Any contract placed with us (hereinafter referred to as "the Seller") by any private-law corporation, company or other business or any public-law legal person or other entity (hereinafter referred to as "the Buyer") shall exclusively be subject to these Standard Sales Terms and these Standard Sales Terms shall be applicable to any transaction agreed between the Seller and the Buyer thereafter even if no express reference to these Standard Sales Terms is made in connection with any such further transaction. The Seller hereby expressly refuses to accept any standard terms of the Buyer referred to in any correspondence or other document placing any such order. Notwithstanding any reference of the Buyer to any standard terms of the Buyer, the Buyer shall, upon the acceptance of any delivery by the Seller to the Buyer, be deemed to have accepted these Standard Sales Terms. No standard terms of the Buyer shall be applicable to any contract or order placed by the Buyer with the Seller unless such terms have been accepted expressly by the Seller in writing and the performance of any such contract or order by the Seller shall not be deemed to be an acceptance of any terms of the Buyer by the Seller.

Unless otherwise provided for in these Standard Sales Terms, the relationship between the Seller and the Buyer shall be governed by the provisions of applicable law.

If these Standard Sales Terms are otherwise inapplicable or ineffective for any reason whatsoever, the sale of any goods delivered by the Seller to the Buyer ("the Goods") shall be subject to the reservations of Clause 6 in Article V hereinbelow.

I General Terms

- 1 Any bid or offer submitted by the Seller to the Buyer shall not be binding upon the Seller and unless otherwise expressly agreed upon by the Seller and the Buyer, no contract placed by the Buyer shall be effective unless expressly accepted by the Seller in writing.
- 2 The title to any sample, drawing or other document or information, whether reduced to writing or in electronic form, including but not limited to any copyrights or other rights associated therewith, which may be provided by the Seller to the Buyer shall remain vested in the Seller and no such sample, drawing or other document or information may be made accessible by the Buyer to any third party.
- 3 Any performance or other data or description of any Goods by the Seller in any brochure, price list, bid, proposal, offer or any other document which may form part of any such bid, proposal or offer shall be deemed to be approximate in accordance with standard industry practices and shall not be binding upon the Seller unless expressly accepted as binding by the Seller and the Seller does not make any warranties whatsoever with respect to any properties of any of the Goods.
- 4 Commercial terms agreed between the Seller and the Buyer shall be interpreted in accordance with Incoterms 2000.

II Price and Payment

- 1 Unless expressly otherwise agreed upon, any price agreed between the Seller and the Buyer shall be exclusive of any packaging. Each such price shall be exclusive of any sales tax which shall be billed by the Seller in addition to said price at the rate which may be applicable at any time and from time to time.
- 2 Unless otherwise agreed upon, the price of any of the Goods shall be paid without any deduction for any reason whatsoever as follows:
 - One third upon the receipt of the Seller's acceptance of the contract placed by the Buyer
 - One third upon the receipt by the Buyer of the Seller's notice that all main components of the Goods are ready for shipment
 - The remaining sum upon the transfer of the risks of the Goods to the Buyer and upon the issuance of the Seller's final invoice for the Goods
- 3 The Buyer shall not have the right to retain any payment due to the Seller for any reason whatsoever and shall not deduct from any moneys due to the Seller any money owed or allegedly owed by the Seller to the Buyer unless any such counterclaim is undisputed by the Seller or has been awarded to the Buyer by a judgment from which no appeal can be taken.
- 4 If, during the period between the date on which any contract was awarded by the Buyer to or any order was placed by the Buyer with the Seller and the date on which production for the performance of said contract or order commences, any labor, material and/or production costs associated with said contract or order increase for any reason for which the Seller is not liable and the cost of any of the Goods (as defined in Section 255 of the German Commercial Code) as determined in accordance with generally accepted German accounting principles is shown by the Seller to have risen by more than twenty percent (20 %) since the date of contract award or order placement, then the Seller shall have the right to redetermine the price of any such Goods payable by the Buyer under said contract or order provided however that the Seller shall not be entitled to increase said price by more than the increase in said cost.
- 5 The Buyer shall pay any amount owing to the Seller within seven (7) calendar days from the due date for the payment of said amount.

III Delivery Time and Late Delivery

- 1 The time available to the Seller for the delivery of the Goods ("Delivery Time") shall be as agreed between the Parties in the contract placed. The Seller shall not be obligated to deliver within said Delivery Time unless all technical and commercial details have been agreed upon order placement and the Buyer performs all of its obligations under said contract or order such as, without limitation, any obligation to obtain necessary certificates, approvals or permits from agencies or authorities and the obligation to make any advance payment provided that any non-satisfaction of any of the preceding conditions

shall operate to increase the Delivery Time reasonably and further provided that no delay for which the Seller may be liable shall operate to increase the Delivery Time.

- 2 The Seller shall not be obligated to deliver any Goods within the Delivery Time unless the Seller receives deliveries from its suppliers as and when ordered by the Seller provided that the Seller shall notify the Buyer as soon as reasonably possible of any delay in delivery it may become aware of.
- 3 The Seller shall be deemed to have delivered within the Delivery Time if the Goods have left the Seller's works prior to the expiry of the Delivery Time or the Seller has notified the Buyer prior to the expiry of the Delivery Time that the Goods are ready for Delivery.
- 4 If the Buyer fails to make any payment to the Seller under any contract or order whatsoever when said payment is due, the Seller shall, upon notice to the Buyer, have the right to discontinue performance under the contract awarded or the order placed for the Goods until the payment the Buyer has failed to make when due has been received provided however that the Seller shall not have said right if the payment so due but not made is immaterial.
- 5 If the Seller is unable to deliver any Goods within the Delivery Time for reasons of force majeure, due to any labor dispute or due to any circumstances beyond the reasonable control of the Seller then the Delivery Time shall be extended reasonably. The Seller shall notify the Buyer of the commencement and the end of any such circumstances as soon as may be reasonably possible.

IV Transfer of Risk and Acceptance

- 1 Unless expressly otherwise agreed upon between the Seller and the Buyer, the Goods shall be delivered ex works.
- 2 If the Goods to be delivered by Seller to the Buyer are divisible, then the Seller shall have the right to deliver and to invoice to the Buyer said Goods in reasonable parts and the Buyer shall not have the right to retain payment for any such reasonable part on the grounds of the non-delivery of any other parts of the Goods.
- 3 If any delivery by the Seller to the Buyer requires acceptance by the Buyer under any express provision of the order placed by the Buyer or at law, then any delivery by the Seller to the Buyer shall be deemed to have been accepted by the Buyer if and in as far as
 - any Goods manufactured or processed by the Seller are, after delivery, sold to or allowed to be used by any third party or
 - any Goods manufactured or processed by the Seller are, after delivery, processed or mixed or combined with any other things with the agreement of the Buyer or
 - any Goods manufactured or processed by the Seller are, beyond trials or tests, used by the Buyer or by any third party with the agreement of the Buyer or
 - the Goods are accepted by any purchaser from the Buyer.

Whatever may be earlier provided that any prior acceptance under the contract awarded or the order placed by the Buyer or at law shall take precedence over any acceptance under this Clause.

V Retention of Title

- 1 The title to all Goods delivered by the Seller to the Buyer shall remain vested in the Seller until the full payment of all accounts receivable by the Seller from the Buyer for any reason whatsoever provided that under current account arrangements the title so retained shall be deemed to be security for any balance owed to the Seller.

The Buyer shall not dispose of any of the Goods the title to which is so vested in the Seller ("Title Reservation Goods") other than in the Buyer's ordinary course of business provided that the Buyer shall no longer have the right so to dispose of any Title Reservation Goods if and as soon as the Buyer fails to make payments when payments are due. The Buyer shall not have the right to pledge or to transfer by way of security the title to any Title Reservation Goods. The Buyer shall be obligated to maintain the rights of the Seller if the Title Reservation Goods are sold by the Buyer to any third party under credit arrangements. The Buyer shall promptly notify the Seller of any lien of attachment, execution or garnishment or any seizure or the like relating to any Title Reservation Goods.

The Buyer hereby assigns to the Seller and the Seller hereby accepts the Buyer's assignment of any title to payment for any of the Goods resold by the Buyer to any purchaser and any security received by the Buyer from any such purchaser for any such payment provided however that the Buyer shall, subject to any notice to the contrary given by the Seller, have the right to collect any such payment and to enforce any such security at its cost. Upon the request of the Seller, the Buyer shall notify the Seller of the debtors against which titles to payment so assigned are held, the securities provided therefor, the type and the amount of the debt of each such debtor and the type and the amount of each such security and deliver to the Seller all documents which may be necessary to collect any amount so owed by any such debtor. Upon notice to the Buyer, the Seller shall have the right to notify any such debtor of the assignment of the title to payment by the Buyer to the Seller hereunder.

- 2 If the Goods are sold by the Buyer to any purchaser together with any other goods the title to which is not vested in the Seller, then a share of the full title to payment of the Buyer under said sale to said purchaser equal to the price of said Goods agreed between the Buyer and the Seller shall be deemed to have been assigned by the Buyer to the Seller.
- 3 Upon the request of the Buyer, the Seller shall waive any title to Goods delivered by the Seller to the Buyer in as far as the value of all Goods the title to which has been retained by the Seller hereunder exceeds one hundred ten percent (110 %) of the value of all titles to payment the Seller holds against the Buyer.

4 The Buyer shall, as of the transfer of risks associated with Title Reservation Goods, insure all Title Reservation Goods against any damage or loss or destruction as a result of any fire, inundation, flooding or theft or any destruction or loss or damage in transit provided that the Buyer shall notify the Seller promptly of any such destruction or loss or damage and shall, upon the request of the Seller, provide to the Seller any documentation of any such loss or damage such as, without limitation, any expert report on said destruction or loss or damage, the names of the insurers of said Goods and, as requested by the Seller, the insurance policy or policies relating to the Title Reservation Goods or insurance certificates issued by the insurer or the insurers for the Title Reservation Goods. The Buyer hereby assigns to the Seller, conditionally as of the time of any such destruction or loss of or damage to any Goods, any title against any insurer or any party liable for any such destruction or loss or damage to a maximum amount equal to the price agreed for any such Goods affected by any such destruction or loss or damage by way of security for all moneys owed by the Buyer to the Seller.

5 Any processing of any Title Reservation Goods by the Buyer shall be for the Seller and the Seller shall be deemed to be the processor for the purposes of Section 1050 of the German Civil Code. If Title Reservation Goods are processed, combined or mixed with other goods the title to which is not vested in the Seller, then a fraction of the title to the new product equal to the ratio between the price invoiced to the Buyer for the Goods so processed, combined or mixed and the sum of the price invoiced to the Buyer for the Goods so processed, combined or mixed and the price or prices invoiced to the Buyer for the other goods so processed, combined or mixed shall be vested in the Seller. The Buyer shall be the custodian of any such new product the title to which is vested in the Seller in total or in part for the Seller. If any such Title Reservation Goods are processed, combined or mixed with goods of the Buyer and the goods of the Buyer are the main constituents of the new product thereby created, then the Buyer shall be deemed to have transferred to the Seller a fraction of the title to any such new product computed in accordance with the principles of the preceding sentence and shall be the custodian of said new product for the Seller.

The provisions of Clauses 1 through 4 hereinabove applicable to Title Reservation Goods shall apply mutatis mutandis to any new product obtained by processing, combination or mixing in which the Seller acquires in total or in part a title through the operation of this Clause.

6 If these Standard Sales Terms have not been agreed effectively, any transfer of title to any of the Goods shall be subject to the Seller receiving the full price agreed between the Seller and the Buyer therefor.

VI Defects

1 General

1.1 If Section 377 or Sections 377 and 381 of the German Commercial Code (sales and contract manufacture

agreements between business organizations as defined in Section 1 et seq. of the German Commercial Code) are applicable to the order placed, the Buyer shall notify the Seller promptly of any patent defect in any of the Goods provided that said notice shall be given no later than on the fourth (4th) working day following the delivery of said Goods. Any latent defect in any of said Goods shall be notified promptly by the Buyer to the Seller provided that said notice shall be given no later than on the fourth (4th) working day following the discovery of said defect. Each such notice of any defect in any of the Goods shall be in writing. The conditions applicable to any such notice and the effects of a late notice of any defect in any of the Goods shall furthermore be governed by the conditions of law (Sections 377, respectively 377 and 381 of the German Commercial Code).

1.2 If the Buyer is not a business organization, notice of any patent defect in any of the Goods delivered by the Seller to the Buyer shall be given by the Buyer to the Seller within two (2) weeks following the delivery of said Goods in the case of sales and contract manufacture agreements and within two (2) weeks following acceptance in the case of service agreements. The term provided for hereinbefore shall be deemed to have been complied with if said notice is forwarded by the Buyer within said term and received by the Seller within four (4) weeks from such delivery or acceptance as the case may be. The Buyer shall not be entitled to any remedy for any patent defect in any of the Goods if the Buyer fails to give notice as aforesaid unless and in as far as

- the Seller is liable for said defect due to willful act, neglect or omission, any act of bad faith or any gross negligence,
- said defect is covered by a warranty of the Seller in accordance with Section 443 of the German Civil Code or
- said defect is claimed in connection with loss of human life, injury, impairment of health or loss of freedom.

Provided that any liability of the Seller for any such defect shall be excluded in accordance with the provisions of law such as but not limited to the provisions of Section 640, paragraph 2, or Section 442 of the German Civil Code if the Buyer had known said defect or did not know said defect due to its own gross negligence.

2 Product Defects

2.1 If any of the Goods delivered by the Seller to the Buyer is defective, the Seller shall remedy said defect by repair or replacement. If said remedial action fails, then, subject to the provisions on damages in Article VII hereinbelow, the Buyer shall be entitled to any of the remedies provided for by law.

2.2 If any remedial action is taken by the Seller, then the Seller shall bear all costs and expenses occasioned by the removal of said defect such as, without limitation, any transportation or traveling expenses or any labor or material costs provided however that any extra costs occasioned by the Buyer moving the Goods after delivery to a place other than the registered premises of the Buyer shall be carried by the Buyer unless the removal of said Goods is a use for which the Goods are intended.

2.3 The Buyer shall give the Seller the time and the opportunity which may be needed to remove any defect in any of the Goods provided that the Seller shall not be held liable for any consequences of not being given such time and opportunity.

2.4 Any repair or replacement by the Seller with respect to any Goods shall irrespective of the scope of any such repair or replacement not be deemed to be an acceptance of any liability for any defect in any of the Goods claimed by the Buyer provided that no persons other than legal representatives or procurators under Sect. 49 German Commercial Code ("Prokuristen") of the Seller shall have the right to accept any liability for any defect on behalf of the Seller.

2.5 If any defect in any of the Goods claimed by the Buyer shows not to be a defect for which the Seller is liable, then the Buyer shall reimburse to the Seller all costs reasonably incurred by the Seller to remove said alleged defect in good faith provided that material and labor costs so incurred by the Seller shall be reimbursed at the Seller's standard rates applicable at the time when the alleged defect was so removed.

2.6 The Buyer shall not be entitled to the removal by the Seller of any defect due to any of the following:

- Improper use of any Goods or use of any Goods for a purpose for which the Goods are not fit or defective installation or commissioning of the Goods by the Buyer or any third party
- Natural wear and tear, improper or negligent handling, improper maintenance or use of any unfit consumables or utilities
- Defective construction work, unsuitable foundations or chemical, electrochemical or electrical interference unless caused by the Seller

2.7 The Seller shall not be held liable for the consequences of any improper or inappropriate removal of any defect in any of the Goods by the Buyer or any third party or any modification to any of the Goods made without the Seller's prior consent.

3 Legal Defects

3.1 The liability of the Seller for the Goods not to be in breach of any third-party industrial property rights or copyrights shall be limited to the Federal Republic of Germany and the country in which the Buyer is registered. The Seller shall have no such liability for any other country, such as any country to which the Goods may be moved by the Buyer, unless such other country has been notified by the Buyer to the Seller prior to awarding the contract or placing the order for the Goods.

3.2 If the use of the Goods delivered by the Seller to the Buyer is in breach of any third-party industrial property rights or copyrights and the Seller is liable for said breach according to Clause 3.1 hereinabove, the Seller shall, at its cost, obtain for the Buyer the right to continue the use of said Goods or modify said Goods in a manner reasonably acceptable to the Buyer so that said Goods will no longer be in breach of any such industrial property rights or copyrights. If such rights cannot be obtained

at reasonable commercial terms or within a reasonable period of time and if the Goods cannot be so modified, then the Buyer shall have the right, at its discretion, to rescind the contract awarded by the Buyer to the Seller or the order placed by the Buyer with the Seller or to obtain from the Seller a reasonable reduction in the price of said Goods.

The Seller shall in any such event further indemnify the Buyer against any undisputed claims or any claims determined by non-appealable court decision of the owners of such industrial property rights or copyrights.

3.3 Subject to Clause 3.4 hereinbelow, the Buyer shall not have the rights under Clause 3.2 hereinabove, unless

- the Buyer notifies the Seller promptly of any breach of industrial property rights or copyrights claimed by any third party,
- the Buyer reasonably supports the defense of any such claims by the Seller and allows the Seller to make modifications as referred to in Clause 3.2 hereinabove,
- the Buyer allows the Seller to defend at its own cost any such claim or to make any out-of-court settlement with respect to any such claim as the Seller may think fit,
- the legal defect is not due to any instructions given by the Buyer to the Seller and
- the legal defect is not due to any modification of the Goods by the Buyer or any use of the Goods not in conformity with the intended use.

3.4 Notwithstanding the limitations in Clauses 3.2 and 3.3 hereinabove, the provisions laid down by law shall apply, if and in as far as

- the title of the Buyer against the Seller is held under Section 478 or under Sections 651 and 478 of the German Civil Code,
- the Seller is liable for the breach of the industrial property rights or the copyrights due to any willful act, neglect or omission or any gross negligence on the part of the Seller,
- the Seller warranted (as provided for in Section 443 of the German Civil Code) that the Goods will not violate any industrial property rights or copyrights or
- any damages claimed as a result of any breach of any industrial property rights or copyrights are on the grounds of any loss of life, injury, loss of health or loss of freedom.

4 Warranties Under Section 443 of the German Civil Code

No person other than a legal representative or a procurator under Sect. 49 German Commercial Code ("Prokuristen") of the Seller will have the right to agree any warranties according to Section 443 of the German Civil Code.

VII Liability and Damages

1 The Seller shall be liable for any willful acts, neglects and omissions and any gross negligence of its legal representatives and/or any other persons authorized by the Seller to perform any of the obligations of the Seller under any contract awarded to the Seller or order placed with the Seller ("Agent or Employee").

- 2** In the event of any ordinary negligence of any legal representative, Agent or Employee of the Seller, the liability of the Seller shall be limited to liability for any loss or damage the Seller foresaw when the contract was awarded or the order was placed by the Buyer or should have foreseen when the contract was awarded or the order was placed by the Buyer considering the circumstances the Seller knew or should have known when the contract was awarded or the order was placed by the Buyer.

If and in as far as any loss or damage suffered by the Buyer due to the ordinary negligence of any legal representative, Agent or Employee of the Seller is compensated by any final payment by any insurer under any insurance contract against loss or indemnity concluded by the Buyer or for the Buyer such as, but not limited to any liability, all-risks, transportation, fire or business interruption insurance, the liability of the Seller shall be limited to any losses incurred by the Buyer as a result of any such insurance claim such as, without limitation, any increase in insurance premium. Any liability of the Seller for any loss or damage caused by the ordinary negligence of any of the legal representatives, Agents or Employees of the Seller and covered by a final insurance payment to the Buyer shall be excluded.

Subject to the limitations provided for hereinbefore, any liability of the Seller for any loss or damage caused by the ordinary negligence of any legal representative, Agent or Employee of the Seller shall for each incident be limited to an amount of two hundred fifty thousand Euros (250,000 €).

- 3** The exclusions and limitations of liability provided for hereinabove shall not apply,
- if and in as far as the Seller is held liable for any human loss of life, injury or loss of health,
 - if and in as far as the Seller is held liable under the German Product Liability Act or
 - if and in as far as the Seller is held liable under any warranty in accordance with Section 443 of the German Civil Code agreed by the Seller to provide security to the Buyer with respect to the loss or damage incurred by the Buyer.
- 4** The provisions of Clauses 1 through 3 hereinabove shall not operate to alter any of the provisions of law regarding the onus probandi.

VIII Limitation

- 1** The period of limitation with respect to any defect shall be a period of one (1) year provided that said period shall be five (5) years for any defect in any Goods serving as civil engineering structure or structures or any defect in any civil engineering structure caused by any Goods ordinarily used in civil engineering structures.
- 2** The period of limitation with respect to any other cause under the contract awarded or the order placed by the Buyer or any other cause outside said contract or order shall be a period of eighteen (18) months.

- 3** Notwithstanding the provisions of Clauses 1 and 2 hereinabove, the periods of limitation allowed by law shall apply, if and in as far as
- the title held by the Buyer against the Seller is under Section 478 or Sections 651 and 478 of the German Civil Code,
 - the title of the Buyer is held on the grounds of any willful act, neglect or omission, any act of bad faith or any gross negligence on the part of any of the legal representatives, Agents or Employees of the Seller,
 - the title held by the Buyer against the Seller is on the grounds of any loss of life, injury, loss of health or loss of freedom of any person,
 - the title held by the Buyer against the Seller is under the German Product Liability Act,
 - the title held is on the grounds of a third party title in rem which grants any such third party a title to the surrender of the Goods (Sect. 438 para.1 subsubpara. a German Civil Code) or
 - the title held is on the grounds of any title recorded in any register of deeds (Sect. 438 para.1 subpara. b German Civil Code).

The provisions in Clauses 1 and 2 shall further not apply if the title is held by the Buyer under a warranty of the Seller in accordance with Section 443 of the German Civil Code provided that any such title shall exclusively be subject to the provisions of Clause 4 hereinbelow.

- 4** The period of limitation applicable to any warranty of the Seller in accordance with Section 443 of the German Civil Code shall commence upon the delivery of the Goods to the Buyer or, if acceptance by the Buyer is required by law, upon the acceptance of the Goods by the Buyer provided that, in the event of bad faith, said period shall commence as provided for in Section 438, paragraph 3, of the German Civil Code. Said period shall terminate as provided for in Section 438 of the German Civil Code unless a shorter period has been agreed according to the terms of the warranty under Section 443 of the German Civil Code.
- 5** Clauses 1 through 4 hereinabove shall not operate to alter any of the provisions of Sections 196, 197 and 479 of the German Civil Code or any of the provisions of law applicable to the onus probandi.

IX Software Use

If the contract awarded by the Buyer to the Seller or the order placed by the Buyer with the Seller provides for the supply of software, the Buyer will be granted a non-exclusive right to use said software and any documentation of said software. Said software will be supplied by the Seller to the Buyer for use with the Goods delivered by the Seller to the Buyer provided that the Buyer shall not have the right to use said software on more than one system.

Any copying, modification or translation of said software or any conversion of the object code of said software into source code shall be limited as provided for in Section 69 et seq. of the German Copyright Act. The Buyer agrees

not to remove from said software any reference to the developer of said software such as, without limitation, any copyright reference and not to modify any such reference unless the prior express content of the Seller has been obtained.

Any other rights associated with such software and any documentation of said software and any copies thereof shall remain vested in the Seller or the supplier of said software as the case may be. The Buyer shall not grant any sub-license.

X Applicable Law and Jurisdiction

- 1 The relationship between the Seller and the Buyer shall exclusively be governed by the law of the Federal Republic of Germany as the same may be applicable to the relationship between two German parties provided however that the application of the United Nations Convention on Contracts for the International Sale of Goods of 11 April 1980 shall be excluded.
- 2 If the Buyer is a business or any public-law legal person or other entity, any dispute between the Seller and the Buyer shall be settled by the courts having jurisdiction at the registered offices of the Seller provided however that the Seller shall have the right to bring action against the Buyer in the courts having jurisdiction at the registered offices of the Buyer.
- 3 If any of the terms and conditions of the Contract or these Standard Sales Terms is or become ineffective, the remaining provisions of the Contract and these Standard Sales Terms shall remain in full force and effect. Any such ineffective provision shall be deemed to have been replaced by the Seller and the Buyer by an effective provision which shall have commercial, financial and economic implications which shall be as close to those of said ineffective provision as may be reasonably.

These Terms for Sales shall apply to quotations and contracts for sales and/or services executed by GEA Tuchenhausen GmbH ("Seller") with customers ("Buyer"). Such quotations and sales are expressly conditioned upon acceptance of these Terms for Sales. Any provision of a purchase order or other document of Buyer that is inconsistent with or additional to these Terms for Sales is not accepted by Seller, unless expressly and specifically agreed to by an authorized representative of Seller. The "Contract" shall consist in the following order of priority of

- (i) Seller's order confirmation
- (ii) Seller's quotation and
- (iii) These Terms for Sales.

"Equipment" shall mean the equipment and other items to be supplied by Seller as per the scope of supply under the Contract. All references to days are to calendar days.

1 Scope of Supply

Seller's scope of supply shall be limited to the Equipment and/or services expressly stated in the Contract. All other goods, documents and services are expressly excluded from Seller's scope of supply and shall be the sole responsibility of Buyer to supply.

2 Payment

Unless contemplated otherwise in the Contract Buyer on its cost shall provide Seller within ten days after formation of the Contract with an irrevocable letter of credit in compliance with UCP 600 rules covering the full contract price ("Contract Price") and being confirmed by Seller's bank. Unless agreed otherwise, the letter of credit shall be payable as follows:

- 30 % upfront payment at sight; 70 % of the Contract Price at sight against presentation of ready for shipment notice

The letter of credit must be at least valid for a period equivalent to the agreed delivery period for the last item to be supplied hereunder plus 45 days. The mere establishment of a letter of credit does not release Buyer from its obligation to effect payments under the Contract. In case Seller waived the requirement to establish a letter of credit any payment is to be made net cash without deduction in the currency and on the dates stated in the Contract. In case the Contract stipulates EURO as applicable currency for payments such payments shall be effected in the currency applicable in Germany on the date of payment. Payment shall not be deemed effected until irrevocable available funds have been received by Seller in its account. If no payment milestones are stated in the Contract, a down payment equivalent to 40 % of the Contract Price shall be received within 10 days of the date of formation of the Contract and the residual 60 % of the Contract Price shall be paid latest upon receipt by Buyer of Seller's ready for shipment notice. All bank and other transaction costs are for Buyer's account. Buyer may not refrain from making any payments when the conditions for payment cannot be fulfilled due to reasons beyond Seller's control. Buyer shall notify Seller of its objections to any invoice within five days of receipt, absent which the invoice shall be deemed to be approved.

No offset or retention of payments by Buyer is allowed. If payment is delayed or only made in part without Seller's prior written consent, the unpaid balance shall bear interest at 1.5 % per month and Seller may immediately suspend its performance under the Contract. Seller shall be entitled to payment of its resulting costs including without limitation overhead, insurance and financial costs. If the delay in payment exceeds 30 days, Seller shall be entitled to terminate the contract for cause and to claim all losses and damages incurred due to the termination from Buyer.

3 Taxes

The Contract Price and any other amounts to be paid to Seller are exclusive of and the Buyer shall be responsible for all duties, taxes (including without limitation value added, sales, use, business, excise or withholding taxes), assessments or charges of any kind. If any duties, taxes, assessments or charges are imposed on Seller by authorities in the country where the Equipment will be installed in connection with any work performed by Seller under the Contract, or in the country where the service works under the Contract take place Buyer shall reimburse Seller all such amounts.

4 Delivery / Risk of Loss / Delays

Risk of loss and damage to the Equipment shall be in accordance with the stipulated Incoterm applicable at the date of Seller's quotation. If no Incoterm is stipulated, delivery shall be Ex Works manufacturer plant as specified by Seller. If no manufacturer plant is specified then delivery shall be Ex Works Seller's premises. Statements of packing measurements and gross weight are an approximate guide and not binding on Seller. Seller may deliver the Equipment from multiple locations, including different countries and may use different types of transport. Partial deliveries are allowed. In case the respective stipulated Incoterm obliges Seller to perform any import formalities for the import into the country of delivery, Buyer on its cost is strictly obliged to support Seller in any way required by Seller.

To the extent Seller's completion of the works is or will be delayed or disrupted due to any instructions or other acts or omissions of Buyer or its representatives, suppliers or contractors or any event or circumstance beyond its control, the delivery schedule shall be extended accordingly and Seller shall be entitled to its resulting additional costs.

If Seller is more than two weeks late in shipping the Equipment and when compared to the time specified by the time schedule for reasons attributable solely to the negligence or wilful misconduct of Seller, Buyer shall be entitled to, as liquidated damages and not as a penalty and upon prior written request, an amount equal to 0.1 % of the portion of the contract price attributable to the value of the delayed portion of the Equipment for each full week of delay after said request up to a maximum of 2.5 % of the contract price, provided that such liquidated damages shall not be due where Seller has failed to

deliver only minor portions of the Equipment that do not delay Seller's implementation of its works or where Buyer has not incurred any resulting loss or damage. No adjustment for partial weeks shall be allowed. Payment of the liquidated damages shall constitute full and complete satisfaction of any claim of Buyer against Seller arising from or in connection with any delay of the Seller. No other claims against Seller for late performance in respect of any other scheduled date shall be allowed, such scheduled dates, if any, being indicative only.

Seller shall be excused from any obligation to the extent of delays in completion caused by acts of war or terrorism, riots, civil commotion, embargoes, epidemics, strikes, fires, delays in transport or customs clearance, earthquakes, flood, hurricanes, typhoon, storm, other acts of God or government or any circumstances beyond the control of Seller. Seller shall give written notice of the occurrence of any such circumstance within 14 days of becoming aware of its occurrence. Seller shall be entitled to its reasonable costs and expenses incurred as a result of any such circumstances and a corresponding extension of time.

In case such delays should exceed in the aggregate three months, Seller shall be entitled, in the absence of an equitable adjustment agreed in writing by Seller and Buyer, to terminate the Contract. In case of termination, Seller shall be entitled to the following:

- (a) all amounts payable for work carried out for which a price is stated in the Contract;
- (b) the costs and expenses for all work in progress, components and other scope of supply ordered, prepared or fabricated for the Equipment for which Seller is liable to pay and which is not covered in (a) above;
- (c) the costs and expenses of Seller in removing its equipment from the site and in the repatriation of Seller's personnel;
- (d) the costs and expenses incurred by Seller in protecting the scope of supply and complying with any instructions of Buyer;
- (e) reimbursement for any subcontractor termination costs; and
- (f) any other costs or expenses reasonably incurred by Seller in the expectation of completing the scope of supply or resulting from such termination.

5 Ownership

The Equipment shall remain the property of Seller until it has received payment in full. The retention of title shall not affect the passing of risk of loss or damage. Until payment is received in full, the Equipment shall not be sold, pledged or otherwise encumbered or used for commercial production without Seller's prior written consent.

6 Warranties

The parts comprising the Equipment shall be free of defects in workmanship and materials for a period of 12 months from delivery. (hereinafter referred to as "Warranty Period").

Seller's warranty is conditioned on Buyer notifying Seller in writing of any defects discovered during the Warranty Period promptly and in any event no later than 5 days after discovery. Seller's warranty is limited to and the Buyer's sole remedies in the event of a defect shall consist of Seller repairing or replacing, in its sole discretion, the parts determined by its authorized representative to be defective in materials or workmanship at the time of delivery. For the avoidance of doubt the warranty period for repaired or replaced parts ceases at the same date as the Warranty Period of the Equipment.

Process or performance warranties are not Seller's liability (i.e. technical data in the contractual documents shall not constitute a warranty hereunder; service works in no case shall be subject to process or performance warranties).

Buyer is responsible for all labour, equipment, costs, expenses and charges used or incurred in the removal, transport, installation and commissioning of repaired or replaced parts. Seller's warranties do not cover and Buyer assumes full responsibility for all losses and damages arising from or relating to: wear and tear parts; use of non-original spare parts; use of unsuitable or out-of-spec lubricants, consumables or utilities; use of unsuitable, insufficient or out-of-spec feed; faulty or nonperformance of upstream and downstream equipment; modifications without Seller's express written consent; corrosive or abrasive substances; faulty maintenance or operation, including failure to comply with Seller's manuals or instructions (written or oral); information, services, personnel or items supplied by Buyer or any third party (other than a subcontractors or sub suppliers of Seller); failure of Buyer to provide sufficient protection for the Equipment against external conditions; or other conditions or circumstances not due to the fault of Seller.

The Seller hereby excludes and disclaims to the fullest extent permissible in law, all conditions, warranties and stipulations, express (other than those expressly set out in this Contract) or implied, statutory, customary or otherwise which, but for such exclusion, would or might subsist in favour of Buyer, including without limitation any warranties as to fitness for purpose or merchantability. The Seller shall not be liable for any loss or damage any defect may cause, including without limitation any loss or damage described in clause 10.3 below.

The expiry of the Warranty Period shall, to the maximum extent permitted by law, but save as set out below, constitute conclusive evidence for all purposes and in any proceedings whatsoever between the parties that the Seller has completed its obligations under or arising out of the Contract and delivered the Equipment and made good all defects therein in accordance with its obligations under the Contract. The Buyer hereby agrees at the end of the Warranty Period to waive all claims of any nature whatsoever it may have against the Seller, whether known or not, under or arising out of the Contract and the use of the Equipment (including but not limited to any intellectual property rights), and any related cause of action and or remedy shall be deemed to be barred and extinguished. Provided always that this provision shall not apply in the case of fraud or to the

extent any proceedings were commenced and served on the Seller within the Warranty Period.

7 Confidentiality and IP

All documentation and information of any kind (whether disclosed orally, in writing, electronically or otherwise) furnished or made available, directly or indirectly, to Buyer or any person engaged by or acting on behalf of Buyer, by either Seller or any of its affiliates, subcontractors or sub-suppliers shall, as between Buyer and Seller, remain the proprietary and confidential property of Seller and shall be used by Buyer only in respect of the operation, maintenance and repair of the Equipment, and for no other purpose. Such proprietary and confidential information and data shall not be disclosed to any third party at any time without Seller's prior written consent. Buyer shall not allow any reverse engineering of Seller's scope of supply without Seller's prior written consent. Any such proprietary and confidential information that Buyer determines must be disclosed to its employees shall only be disclosed to its employees on a need-to-know basis for permitted purposes. The intellectual property in any equipment, document or other information given or made available to Buyer under the Contract shall remain the exclusive property of Seller (or its subcontractors and/or sub-suppliers), provided that the Buyer shall have a non-exclusive, royalty free right to use such intellectual property for the sole purpose of operating the Equipment so long as Buyer pays all amounts as they become due under the Contract.

8 Remedies and Limitations

Notwithstanding anything to the contrary:

8.1 Termination

Either party may terminate the Contract if: (a) the other party fails to perform any material obligation under the Contract and has not taken action to commence to cure the failure within 30 days of written notice of such failure or does not diligently pursue such cure thereafter, (b) the other party becomes bankrupt, insolvent or otherwise unable to pay its bills when due.

8.2 Exclusive Remedies

BUYER'S RIGHTS AND REMEDIES AS STATED IN THIS CONTRACT (WHETHER BY WAY OF REIMBURSEMENT OF COSTS, LIQUIDATED DAMAGES OR OTHERWISE) SHALL BE ITS EXCLUSIVE RIGHTS AND REMEDIES REGARDLESS OF THE THEORY OR CIRCUMSTANCES (INCLUDING BREACH OF CONTRACT OR STATUTORY DUTY, NEGLIGENCE OR OTHER TORT, INDEMNITY, BREACH OF WARRANTY OR OTHERWISE).

8.3 No Consequential Damages

EXCEPT ONLY TO THE EXTENT THE EXCLUSION OF SELLER'S LIABILITY IS PROHIBITED BY APPLICABLE

LAW (IN WHICH CIRCUMSTANCES SELLER'S LIABILITY SHALL ONLY BE LIMITED TO THE EXTENT PERMITTED BY APPLICABLE LAW), SELLER SHALL IN NO CASE BE LIABLE FOR ANY LOSS OF REVENUES OR PROFITS; LOSS OF OPPORTUNITY, PRODUCTION OR CONTRACTS; LOSS OF USE; LOSS OF OR DAMAGE TO RAW MATERIALS OR PRODUCT; EQUIPMENT DOWNTIME OR DELAYS; LIQUIDATED DAMAGES OR PENALTIES IMPOSED ON BUYER BY ITS CUSTOMERS OR THIRD PARTIES; RECALL COSTS; ANY DAMAGES OR PENALTIES PAYABLE BY BUYER; OR OTHERWISE FOR ANY FINANCIAL OR ECONOMIC, CONSEQUENTIAL, SPECIAL, PUNITIVE, EXEMPLARY, INDIRECT OR INCIDENTAL LOSSES OR DAMAGES HOWSOEVER CAUSED IRRESPECTIVE WHETHER THE LOSS OR DAMAGE IN QUESTION IS DEEMED TO BE DIRECT OR INDIRECT.

8.4 Aggregate Liability

EXCEPT ONLY TO THE EXTENT THE EXCLUSION OR LIMITATION OF SELLER'S LIABILITY IS PROHIBITED BY LAW (IN WHICH CIRCUMSTANCES SELLER'S LIABILITY SHALL ONLY BE LIMITED TO THE EXTENT PERMITTED BY APPLICABLE LAW), SELLER'S AGGREGATE LIABILITY TO BUYER UNDER OR IN CONNECTION WITH THE CONTRACT SHALL IN NO CASE EXCEED 10 % OF THE CONTRACT PRICE RECEIVED BY THE SELLER, or shall by no means exceed the value of 200,000 €, IRRESPECTIVE WHETHER SUCH LIABILITY ARISES IN CONTRACT, STATUTE, IN TORT BREACH OF WARRANTY, BY PRICE REDUCTION, MAKE GOOD OR OTHERWISE.

9 Directives / Permits / Safety

The Equipment as delivered by Seller shall comply with the directives, laws, rules, regulations, codes and standards, if any, that are expressly stated in Seller's quotation and in effect on the date of Seller's quotation. If the quotation is silent in this regard the Equipment shall comply with all mandatory German laws and regulations in effect on the date of Seller's quotation. If after said date any stated directives, laws, rules, regulations, codes or standards are changed or enacted, or there are new or different interpretations thereof, which require a change in the Equipment or otherwise adversely affect Seller's obligations or compensation under this Contract, an equitable adjustment shall be made to the contract price, delivery schedule, payment terms and other provisions of the Contract (which must be agreed in writing prior to Seller having any obligation to implement the change). Buyer shall be responsible for all permits in connection with owning, erecting, testing, commissioning, operating and maintaining the Equipment. Seller's obligations under the Contract are subject to all required export and import permits including without limitation all export and import permits required for the scope of supply as per the Contract. Buyer shall be responsible for maintaining the site in a safe working condition, following all safety operating and maintenance procedures as prescribed by applicable directives, laws, rules, regulations, codes and standards and as set forth in the operating and maintenance manuals and instruction sheets furnished

by Seller, and Buyer shall not remove or modify any safety device, guard or warning sign. If the Buyer fails to strictly observe any of these safety obligations, Buyer shall indemnify, defend and hold Seller harmless from any resulting losses, injuries or damages incurred by Seller or its affiliates, directors, officers, employees, agents, subcontractors or sub-suppliers.

10 Change Orders / Instructions

All change orders must be mutually agreed by the parties in writing prior to the Seller having any obligation to perform. All instructions of Buyer must be given in writing.

11 Governing Law and Disputes

The Contract shall be governed by and construed according to the laws of Switzerland without reference to its conflicts of law provisions. All disputes arising out of or in connection with the provisions of this Contract shall be finally and without recourse to the ordinary courts settled under the Rules of Arbitration of the International Chamber of Commerce by one or more arbitrators appointed in accordance with the said Rules. The venue of such arbitration shall be in Zürich, Switzerland. All documentation and oral proceedings shall be in the English language. In case the Contract shall be applicable for business transaction with Buyer residing in the territory of the Republic of India the following shall additionally apply: Buyer and Seller shall expressly agree to exclude (for the avoidance of any doubt) the applicability of the provisions of Part I of the Indian Arbitration and Conciliation Act 1996 [save and except Section 9 and Section 27 thereof] to any arbitration under this section 13.

12 Miscellaneous

If any provision of the Contract is determined to be invalid or unenforceable, this shall not affect the validity or enforceability or the remaining provisions and the parties shall agree on substitute provisions that achieve as closely as possible the same economic effect. Buyer shall not be entitled to a termination for convenience during the term of the Contract. Captions are for convenience only. Seller's data in product information and price lists are binding only if expressly stated in the Contract. The Contract may not be assigned by either party without the other party's prior written consent. Seller however shall be entitled to engage subcontractors or sub-suppliers for the performance of its works. No change in, addition to, or waiver of the provisions of this Contract shall be binding upon Seller or Buyer, unless approved in writing by authorized representatives of both parties.

We live our values.

Excellence • Passion • Integrity • Responsibility • GEA-versity

GEA Group is a global engineering company with multi-billion euro sales and operations in more than 50 countries. Founded in 1881, the company is one of the largest providers of innovative equipment and process technology. GEA Group is listed in the STOXX® Europe 600 Index.

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