

*Quality products for  
demanding applications*



**WANDFLUH OIL + GAS**

“ We want to inspire our customers around the world with high-quality products and get engaged as a valuable partner in the development of technically demanding hydraulic systems. ”

————— Hansruedi Wandfluh and Matthias Wandfluh —————

# WANDFLUH OIL+GAS

Work involving highly explosive liquids and gases requires accordingly secured technology. Especially in the oil and gas exploration sectors but also in mines with high dust generation or gas influx, explosion protection is a hugely important issue. In order to carry out heavy work without risks in such hazardous areas, an explosion-protected valve technology was already developed and implemented years ago.

## FOCUS

Apart from explosion protection, the requirements placed on valve technology in the oil and gas sector are extensive, since energy sources are often to be found either in very warm or in extremely cold areas in the world. With valves for ambient temperatures of down to -60 °C or up to +90 °C, a large temperature range can be covered. Explosion-proof valves are often also used outside in harsh environmental conditions. They not only come into contact with salt water but are also exposed to corrosive gases or substances. Explosion-protection valves are therefore mostly made from corrosion-resistant or stainless materials. Over decades, Wandfluh has developed a broad portfolio of valve and amplifier technology that has proven highly successful in numerous projects.

## APPLICATION EXAMPLES

- Oil drilling head control
- Winch power control
- Flap control on oil and LNG tankers
- Process control
- Drilling vessels
- Compressor stations
- Gas separation
- Pipelines

...designed to ensure **safety** and **reliability**



OIL+GAS

## CHARACTERISTICS

- Explosion-protection certification for various countries and regions
- High reliability
- Broad explosion-protection range of switching and proportional valves
- Corrosion-protection valves, from Zi/Ni through to stainless steel
- Redundant systems
- Valve technology with switching position monitoring
- Reduced electrical power
- Individual customer-specific adaptations
- Worldwide customer service





# FIELDS OF **APPLICATION**

In the field of oil and gas production and processing, explosion protected valve technology is generally used. Depending on the field of application, the requirements can be very different. The particular challenges onshore often include extreme temperatures and

## **OIL RIGS**

Oil rigs have extremely high requirements for the technology used. Even the smallest spark can have devastating consequences for people and materials. To guarantee the highest level of safety in those explosion hazard areas atmospheres, all machines and their electrical equipment are subject to stringent explosion protection standards, and compliance with these must be proved by special tests and relevant certificates.



## **OIL + GAS DRILLING SITES**

Probing and drilling for oil and gas fields is not only a technically difficult undertaking, it is also extremely hazardous due to gases and liquids which suddenly appear. Apart from a high explosion protection, the hydraulic valves directly in the drill head in particular must provide a high robustness and reliability, because a failure of a small valve will lead to a long break in drilling and high costs as a result. In addition to the proven explosion protection, the valves must also have a very high corrosion resistance in a salt water environment and still be able to function reliably in temperatures down to -60 °C.



## **GAS TRANSPORT**

The energy sources obtained by the extraction process must be taken away from the extraction site and separated in large quantities. Pipelines or tankers are used for this. To control the huge volume flows of highly explosive gases and liquids when loading the tankers, or in the case of the pipelines so-called ball valves are used. These are often operated by hydraulic valves, and this technology is usually exposed to a harsh environment.





changes in temperatures, while at sea a high corrosion resistance is demanded. In addition, we know of applications that are used just below the water surface or have to withstand the high ambient pressure in a few thousand meters under water.

### SHIP AND SHIP EQUIPMENT

For oil and LNG tankers, similar safety regulations to those on oil rigs apply. There are also all kinds of electronics and mechanics in a very small space here. Examples include loading and unloading equipment on a tanker, lifting and winching systems as well as flap control systems and ball valves.



### ROV (REMOTELY OPERATED VEHICLE)

To maintain an oil rig or pipeline, ROVs are used from a certain water depth. During a mission which lasts several days or weeks in a water depth of up to 4000 m, the ROV can perform the smallest movement sequences with the gripping arms, but also heavy work thanks to the specially developed pressure-compensated hydraulic valves. Precise mobility and manoeuvrability under water is essential. The ROV has this ability from the integrated hydraulic thruster control, which uses a non-polluting fluid like the whole hydraulic system.



### FURTHER PROCESSING INDUSTRY

Safety is also the highest priority in the further processing of the extracted energy sources. Refineries are technically complex industrial facilities with countless pipes, valves and separation plants. The entire area inside and outside a refinery is one of the highest rated protection zones for explosion hazard areas.



# EX-PROTECTION STANDARDS

## DESIGNATION OF ELECTRICAL EQUIPMENT

ATEX	I	M1	Ex	ia	I		Ma
IEC			Ex	ia	I		Ma
ATEX	II	1G	Ex	ia	IIC	T5/T6	Ga
IEC			Ex	ia	IIC	T5/T6	Ga
ATEX	I	M2	Ex	d, db	I		Mb
IEC			Ex	d, db	I		Mb
ATEX	II	2G	Ex	d, db	IIC	T4/T6	Gb
IEC			Ex	d, db	IIC	T4/T6	Gb
ATEX	II	2D	Ex	tb	IIIC	T80 °C/T130 °C	Db
IEC			Ex	tb	IIIC	T80 °C/T130 °C	Db
NEC 505	Class I, Zone 1		AE x	d	IIC	T4	Gb
NEC 500	Class I, Division 1				ABCD	T4	

## ZONES





dangerous explosive atmosphere		continuously, frequently or long-term	occasionally	not likely to occur and for short periods only
Gas	ATEX / IEC / NEC 505	Zone 0	Zone 1	Zone 2
	NEC 500 (Class I)	Division 1		Division 2
Dust	ATEX / IEC / NEC 505	Zone 20	Zone 21	Zone 22
	NEC 500 (Class II, III)	Division 1		Division 2

**Zone 0 (20) includes zones 1 and 2 (21 and 22)**


## EQUIPMENT CATEGORY AND EQUIPMENT PROTECTION LEVEL (EPL)

ATEX		IEC		
Equipment group	Equipment category	EPL	sufficient security	
mines susceptible to firedamp				
I	M1	Ma		during rare malfunctions
I	M2	Mb		until de-energizing of the equipment
gas explosion hazard areas				
II	1G	Ga	Zone 0	during rare malfunctions
II	2G	Gb	Zone 1	during expected malfunctions
II	3G	Gc	Zone 2	in normal operation
dust explosion hazard areas				
II	1D	Da	Zone 20	during rare malfunctions
II	2D	Db	Zone 21	during expected malfunctions
II	3D	Dc	Zone 22	in normal operation

## TYPES OF PROTECTION FOR ELECTRICAL EQUIPMENT IN GAS EXPLOSION HAZARD AREAS

TYPE OF PROTECTION	SYMBOL	ZONE	DIAGRAM	STANDARD
increased safety	e	1		IEC 60079-7 EN 60079-7 (ATEX)
flameproof enclosure	d	1		IEC 60079-1 EN 60079-1 (ATEX)
intrinsic safety	ia	0		IEC 60079-11 EN 60079-11 (ATEX)
encapsulation	m	1		IEC 60079-18 EN 60079-18 (ATEX)

## TYPES OF PROTECTION FOR ELECTRICAL EQUIPMENT IN AREAS WITH COMBUSTIBLE DUST

TYPE OF PROTECTION	SYMBOL	ZONE	DIAGRAM	STANDARD
protection by enclosures	tb	21		IEC 60079-31 EN 60079-31 (ATEX)

old identification: tD A21 = under procedure A for zone 21 (EN 61241-1)

## GROUPS

ATEX / IEC / NEC 505		NEC 500	
Group I	mines susceptible to firedamp	—	
	Methan		
Group II	gas explosion hazard areas	Class I	
subdivisions	typical gas	subdivisions	
IIA	Propane	Propane	Class I Group D
IIB	Ethylene	Ethylene	Class I Group C
IIC	Hydrogen	Hydrogen	Class I Group B
	Acetylene	Acetylene	Class I Group A
Groupe III	dust explosion hazard areas	Class II/III	
subdivisions	type of dust	subdivisions	
IIIA	combustible flyings	fibres and fluff	Class III
IIIB	non-conductive dust	non-conductive dust	Class II Group G
IIIC	conductive dust	carbonaceous dust	Class II Group F
		combustible metal dust	Class II Group E

Subdivision IIC (IIIC) includes subdivisions IIA and IIB (IIIA and IIIB)

## TEMPERATURE CLASSIFICATION

Maximum surface temperature	Temperature classes for gases	Maximum surface temperature	Temperature classes for gases
	ATEX / IEC / NEC 500 / 505		ATEX / IEC / NEC 500 / 505
450 °C	T1	200 °C	T3
300 °C	T2	135 °C	T4
for dusts: indication of the maximum surface temperature in °C		100 °C	T5
		85 °C	T6

## TYPE OF PROTECTION

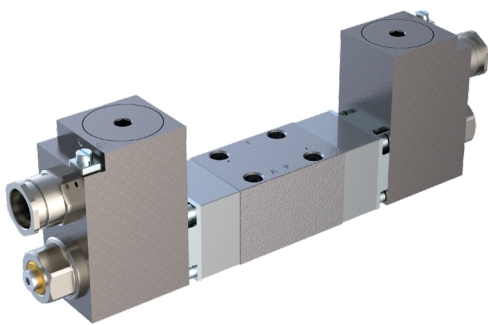
IP Type of protection according to IEC/EN 60529



# TYPICAL VALVES AND ELECTRONICS

Valves adapted to the various applications ensure that the different requirements such as small leakage, freely adjustable volume flows or pressures as well as seat tight closing of control lines can be readily realised. The solenoid actuated valves can be used in zones 0 to 2 depending on the solenoid

## POPPET VALVES AEXD, SVYP



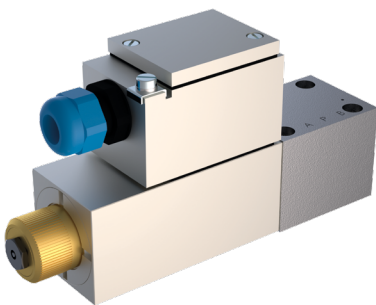
### FEATURES

For tight closing functions such as leakage-free load holding, clamping and gripping or for pilot control of larger valves.

### CHARACTERISTICS

- Excellent durable tightness as a result of metallically sealing seat
- Flange or cartridge construction
- 2/2- or 3/2-way execution
- Direct or pilot operated
- Detented execution
- Position monitoring with limit switch (Z104)
- Ex d or Ex i execution
- Low power execution with 6 watt solenoid

## SPOOL VALVES WDZF, WDYF



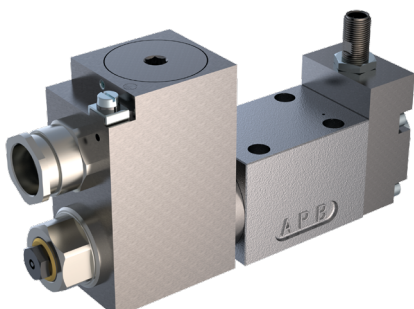
### FEATURES

Control of the oil flow in two different directions.

### CHARACTERISTICS

- Direct and pilot operated
- 4/2- and 4/3-way execution
- Detented execution
- Position monitoring with limit switch (Z104)
- Ex d or Ex i execution
- Pressure max. 350 bar
- Flow max. 160 l/min
- Nominal sizes NG4, NG6, NG10

## SPOOL / POPPET VALVES WITH LIMIT SWITCH WDYF, AEXD



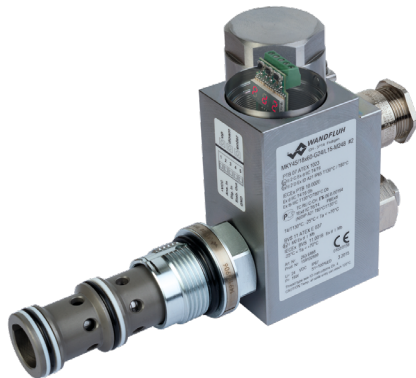
### FEATURES

Monitoring and display of valve switching position. The position of the valve spool is detected with a proximity switch.

### CHARACTERISTICS

- Inductive proximity switch
- Proximity switch Ex-protection certified
- Nominal size NG6

## ÉLECTRONIQUE INTÉGRÉE POUR VALVES PROPORTIONNELLES \_M248



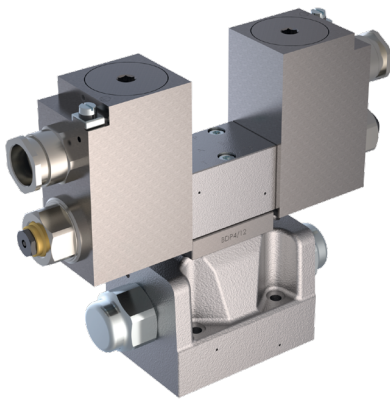
## SPÉCIFICITÉS

Electronique intégrée dans la bobine électro-magnétique pour le pilotage des valves proportionnelles.

## CARACTÉRISTIQUES

- Amplificateur proportionnel
- Paramétrable
- Pilotage avec signal analogique
- Electronique installé dans boîtier robuste
- Etanche à l'eau
- Réduction de puissance pour valves de commutation

## PROPORTIONAL SPOOL VALVES WVBF, WDBF



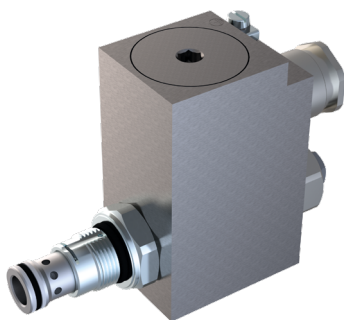
## FEATURES

The volume flow is controlled proportionally to the solenoid current.

## CHARACTERISTICS

- Progressive characteristic
- Good repeatability
- Direct or pilot operated
- Pressure max. 350 bar
- Flow max. 200 l/min
- Nominal sizes NG4, NG6, NG10

## PROPORTIONAL PRESSURE VALVES BDBP, MVBP



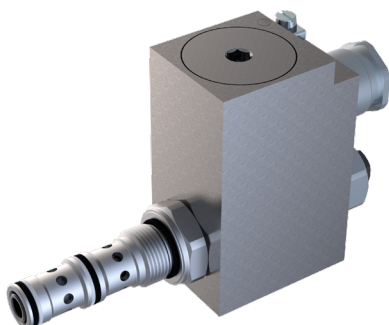
## FEATURES

Relieving or reducing of the pressure to the electrically specified value at the output of the valve.

## CHARACTERISTICS

- Pressure relief and pressure reducing function
- Linear characteristic and good repeatability
- Direct or pilot operated
- Pressure max. 350 bar
- Flow max. 160 l/min
- Nominal sizes M16, M22, M33

## PROPORTIONAL FLOW CONTROL VALVES DNBP, QNBP



## FEATURES

Control or regulation of the oil volume flow through the valve proportional to the electrically adjusted solenoid current.

## CHARACTERISTICS

- Linear characteristic and good repeatability
- Throttle or flow control function
- Direct or pilot operated
- Pressure max. 350 bar
- Flow max. 70 l/min
- Nominal sizes M22, M33

# EX-PROTECTION OVERVIEW


## VALVES EX D

Solenoid, Equipment Protection Level (EPL). Mb, Gb, Db or Division 1 / 2 (only MKU)

TYPE	TYPE DESIGNATION	DATA SHEET NO.	SIZE	HYDRAULIC VALUES		ELECTRONICS M248
Solenoid	MKY45 MKU45	1.1-183 1.1-184	Square 45 mm	$Q_{max}$ [l/min]	$P_{max}$ [bar]	
Solenoid operated spool valve direct operated	WDYFA04 WDYFA06	1.3-24 1.3-34	NG4 NG6	30 80	350 350	
Solenoid operated spool valve pilot operated	WVYFA10	1.9-38	NG10	160	350	
Proportional spool valve	WDBFA06 WVBF10	1.10-88 1.10-3520	NG6 NG10	25 200	350 350	X X
Solenoid operated poppet valve cartridge direct operated	SDYPM18 SDYPM22	1.11-2052 1.11-2064	M18x1,5 M22x1,5	20 40	350 350	
Solenoid operated poppet valve cartridge pilot operated	SVYPM22 SVYPM33	1.11-2084 1.11-2085	M22x1,5 M33x2	80 150	350 350	
Solenoid operated poppet valve direct operated	BEXd2204 AEXd2206	1.11-3132 1.11-3143	NG4-Mini NG6	15 40	350 350	
Pressure relief cartridge direct operated	BDBPM22	2.3-547	M22x1,5	25	350	X
Pressure relief cartridge pilot operated	BVBPM22	2.3-536	M22x1,5	100	350	X
Pressure reducing cartridge direct operated	MDBPM16 MGBPM16	2.3-602 2.3-608	M16x1,5 M16x1,5	6 6	40 100	X X
Pressure reducing cartridge pilot operated	MVBPM22 MQBPM22 MVBPM33	2.3-635 2.3-644 2.3-654	M22x1,5 M22x1,5 M33x2	60 40 160	350 350 350	X X X
Trottle cartridge	D.BPM22	2.6-535	M22x1,5	25	350	X
2-way flow control cartridge	QNBPM22 QNBPM33	2.6-634 2.6-655	M22x1,5 M33x2	25 70	350 350	X X
3-way flow control cartridge	QDBPM22	2.6-648	M22x1,5	25	350	X



## VALVES EX IA

Solenoid, Equipment Protection Level (EPL): Ma, Ga						
TYPE	TYPE DESIGNATION	DATA SHEET NO.	SIZE	HYDRAULIC VALUES		ELECTRONICS M248
Solenoid	MKZ45 MDZ45	1.1-185	Square 45mm	Qmax [l/min]	pmax [bar]	
Solenoid operated spool valve direct operated 	WDZFA04 AEXi4x6 WDZFA06-Z546	1.3-28 1.3-40 1.3-42	NG4 NG6 NG6	10 20 10	350 300 350	

## CERTIFICATIONS

FIELDS OF APPLICATIONS						
	Surface	Mining	Standard -25°C up to...	M224 -40°C to	M238 -60°C to...	M248 Electronics
<b>ATEX</b>	Ex d / Ex ia	Ex d / Ex ia	Ex d / Ex ia	Ex d	Ex d	Ex d
<b>IECEX</b>	Ex d / Ex ia	Ex d / Ex ia	Ex d / Ex ia	Ex d	Ex d	Ex d
<b>EAC</b>	Ex d	Ex d	Ex d	Ex d	Ex d	Ex d
<b>Australia</b>	Ex d	Ex d	Ex d	Ex d		
<b>MA</b>		Ex d	Ex d			Ex d
<b>UL / CSA</b>	Ex d		Ex d			

# CORROSION PROTECTION

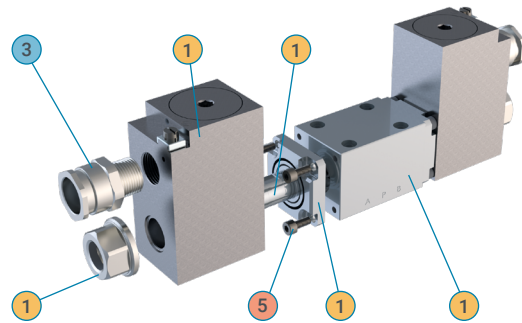
It is the constant contact with salt water and salty atmospheres which requires the use of components with enhanced corrosion protection.

The ranges of the materials used allow appropriate anti-corrosion protection of the external parts of the valve.

## K8: 500 -1000 H SALT SPRAY TEST

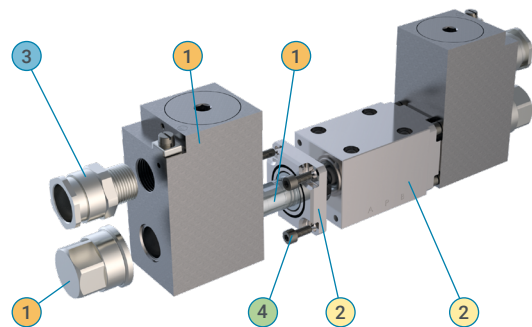
All external elements on the valve which are in contact with the environment are surface-treated with a zinc-nickel coating or are made of stainless materials. Control knobs and partially knurled nuts are made of plastic.

K8 will increasingly become the normal standard in the future. Only the valve flange bodies are painted and the screws zinc coated.



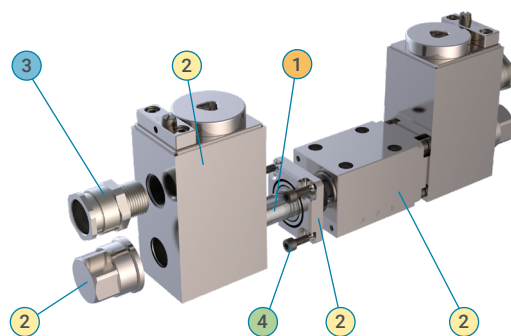
## K9: > 1000 H SALT SPRAY TEST

All external elements, apart from the solenoids, are made of stainless materials. Stainless, acid-resistant AISI 316L high-grade steels are used if feasible. The solenoids are zinc-nickel coated.



## K10: > 1000 H SALT SPRAY TEST

All external elements are made of stainless materials or coated with stainless materials. Stainless, acid-resistant AISI 316L high-grade steels are used if feasible.



Pos	Corrosion protection
1	Zinc-nickel coated
2	Stainless steel AISI 316L
3	Nickel coated brass
4	Stainless steel screws
5	Zinc coated screws

\* The **salt spray test** exposes the valve to a salt spray with a five percent NaCl solution in accordance with ISO 9227. The number of hours it takes for red rust to appear is measured.

# LOW TEMPERATURE

For extreme applications in cold environments, there are valves in two low temperature executions. They distinguish themselves in particular through the materials used that have to resist high pressures and loads even at temperatures of down to -60° C.

## CRUDE STEELS USED

The steels used in the valves were selected for use also in cold ambient temperatures. In the extreme range between -60 °C to -40 °C particularly cold resistant steels are used for the most stressed valve parts, to take account of the extreme additional loads.



## SPECIAL SEALS

For low operating temperatures, special sealing materials are used that guarantee a stable and secure long-term operation with a high level of availability, due to their low-temperature flexibility. Depending on the needs, the materials required for temperature ranges down to -40 °C and down to -60 °C are distinguished.



## LOW TEMPERATURE EXECUTIONS

Specification	Steel	O-ring	Fit
Z604 (-40 °C)	–	x	(x)
Z591 (-60 °C)	x	x	x

– no adaptation required  
 (x) partial adaptation necessary  
 x adaptation absolutely necessary

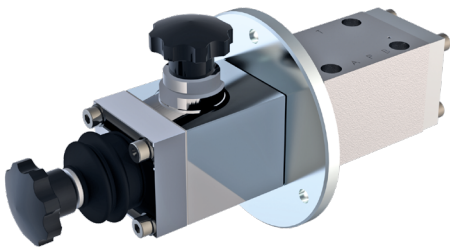




# INDIVIDUAL SOLUTIONS

Wandfluh valves are modular in structure and can therefore be put together very flexibly. This allows different standard functional elements to be combined, so that individual solutions can be easily realised.

## SPOOL VALVES MANUALLY ACTUATED WITH DETENT FUNCTION



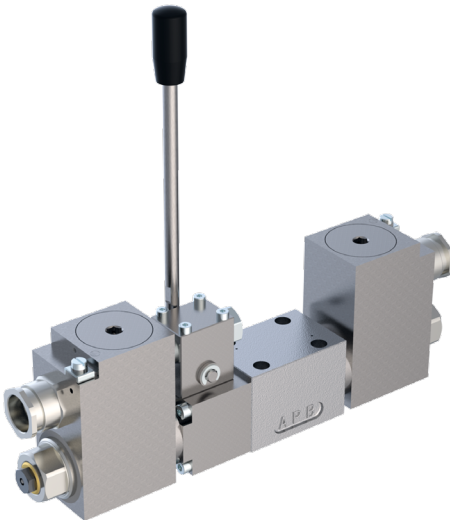
### FEATURES

The directional valve is manually actuated and has to be unlocked manually in addition.

### CHARACTERISTICS

- 2-way or 3-way function
- Electrical actuation with standard or Ex d solenoids
- Combination of an electrical and mechanical actuation possible
- Valve state can be displayed with position sensor

## SPOOL VALVES SOLENOID AND MECHANICALLY ACTUATED



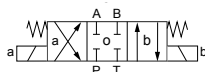
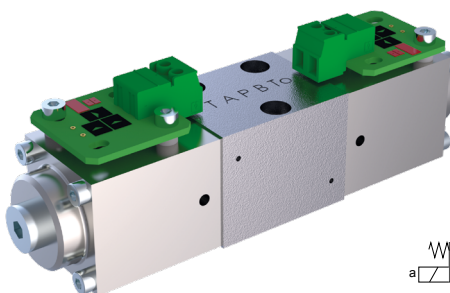
### FEATURES

The valve can either be remotely actuated or manually actuated on site.

### CHARACTERISTICS

- Supplements the electrical actuation with a hand lever actuation for 3-way valves
- For switching and proportional valves
- In combination with standard and Ex d / Ex i solenoids

## ROV CONTROL VALVES FOR WATER DEPTH UP TO 6000 M



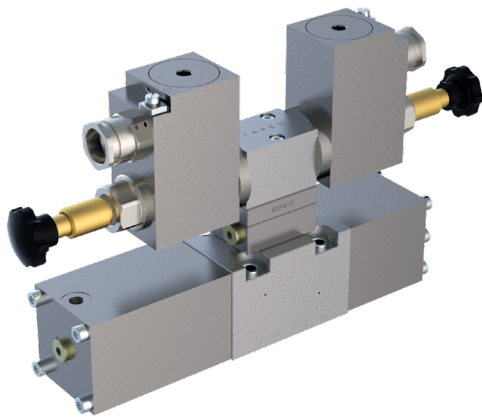
### FEATURES

The valve utilisation in ROVs (Remotely Operated Vehicle) in the underwater area requires a resistance to a high external pressure.

### CHARACTERISTICS

- Different solenoids with pressure compensation bore
- With screw terminal connections
- Potted loose cables without connectors
- Status display by means of LED

## PILOT OPERATED SPOOL VALVES WITH DETENT FUNCTION



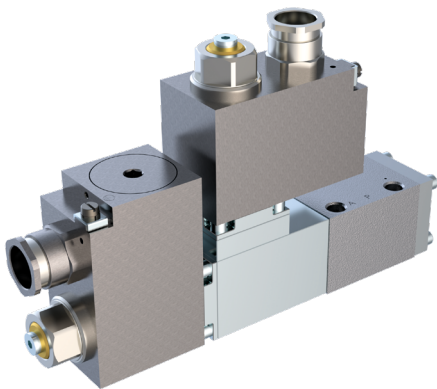
### FEATURES

Combined valve actuation function. The valve can be actuated in three different ways.

### CHARACTERISTICS

- Solenoid actuation in standard or Ex d execution
- Manual override
- Parallel hydraulic actuation of the main stage
- Position sensor displays the switching status of the valve

## OPTIONAL MECHANICAL ACTUATION FOR STANDARD VALVES



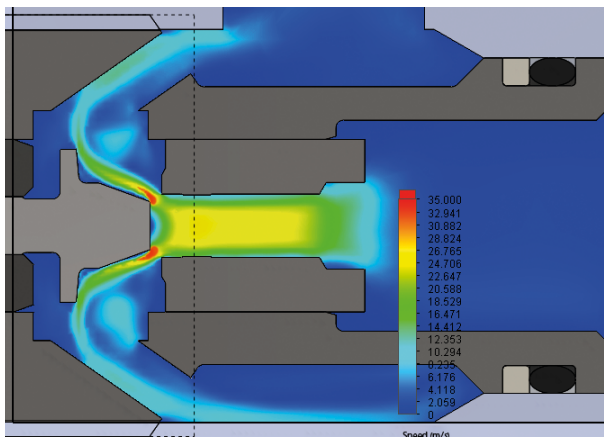
### FEATURES

The poppet valve can be actuated by two separate solenoids. This allows a redundant actuation of the valve. In case of a failure of the main control, a safety control can switch the valve.

### CHARACTERISTICS

- Easy installation of the hand lever on the valve
- Especially suitable for 1-solenoid valves
- In combination with standard and Ex d solenoids

## DESIGNED FOR FLUIDS WITH LOW VISCOSITY AND HIGH WATER CONTENT



### FEATURES

Valves for operation with low-viscosity fluids, sometimes require special construction features.

### CHARACTERISTICS

For fluids such as HFC/HFA

- The functional components are mostly made of stainless steel
- This also results in a higher resistance to cavitation (see picture)

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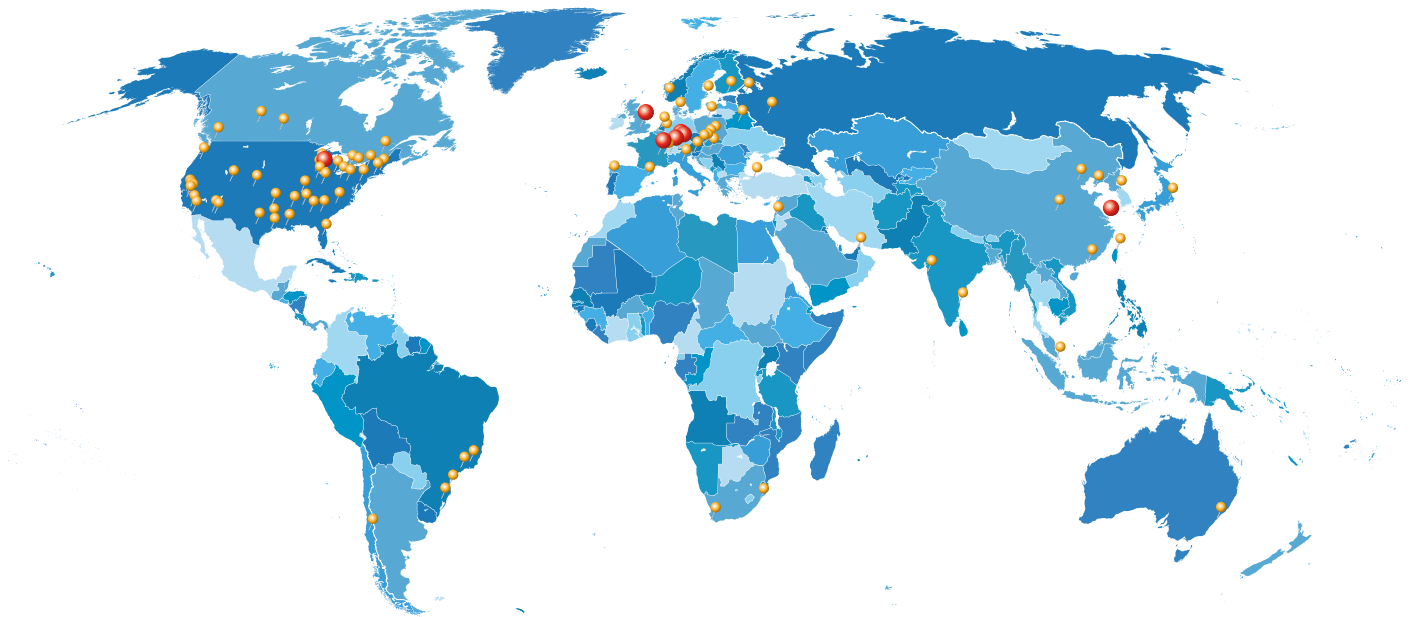
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