

# INTRODUCTION

• COMPANY •

PRODUCTS

 $\boldsymbol{\cdot}$  TECHNICAL INFORMATION  $\boldsymbol{\cdot}$ 

C12IN/EN

The components illustrated and described in the present calalogue are sold under the trademark BSG Kuhnke Solutions.

BSG Kuhnke Solutions reserves the right to modify the dimensions or technical characteristics of any of its products contained within this catalogue without prior notice. The products included in this catalogue should only be used in applications for which they were originally intended and should only be used by personnel with adequate technical knowledge. Please note that the misuse of this product could cause serious injury. The user should ensure that the product is installed and operated within the operating characteristics shown and that this complies with any health and safety requirements, however should you require any further information please do not hesitate to contact our technical office.

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Best

BSG Kuhnke Solutions is manufacturer of pneumatic components and devices. We design, develop and build products in house, and specialise in integrated mechatronics for worldwide customer specific applications.

COMPANY



BSG Kuhnke Solutions history includes many years of manufacturing both standard and miniature pneumatics. This experience has developed into a specialist knowledge of micro fluid technology, enabling us to offer innovative products including valves, cylinders, components and systems.

Niche applications for BSG Kuhnke Solutions include medical devices, equipment and tools for chemical analysis, orthodontics, trucks, trains, marine applications, conveyors, industrial handling, storage systems and advanced printing machines.



See our complete catalogue online at *www.bsgkuhnkesolutions.com* 



# **Commercial Presence**

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301	100113	

Headquarters	Europe	Africa	America	Asia and Oceania
Limena (Padova - Italy)	Germany, Romania, Denmark, France, Greece, Great Britain, Netherlands, Poland, Portugal, Sweden, Switzerland, Spain, Turkey	South Africa	USA	China, Philippines, Singapore, South Korea, Taiwan, Thailand, Australia





#### **Quality policy**

The Management of *BSG Kuhnke Solutions* pursues a policy which places at the heart of its activities the external and the internal Customer – i.e. the employee, who is our most important intangible capital - and the quality of our products/services.

This is the only thing which guarantees us a real advantage over our competitors, assuring us both the development and success of our company at the same time.

The satisfaction of the internal Customer is achieved through activities such as participation, sharing, training, information, updating and verification of subjects related to the professional and human growth of individuals (Charter of Values) and to the knowledge of our corporate services/products. Our Management works in an open, cooperative and collaborative way, its ultimate aim being the motivation and promotion of the internal Customer identification with BSG Kuhnke Solutions.

The satisfaction of the external Customer is pursued by offering and adjusting all the processes to his/her particular needs, explicit or implicit, as well as monitoring the achievement of the agreed goals during the contractual phase.

The customer acquires a central role for the success of *BSG Kuhnke Solutions*, thus it becomes important to get to know him/her through and through, to supply services/products in compliance with his/her needs and with the quality required by the Customer himself/herself, and to reach a high degree of Customer satisfaction through the product/service reliability and the observation of the delivery terms.

The quality of our products and services is guaranteed by a quality management system corresponding to the state-of-the art technology according to the requirements of ISO 9001:2008 and ISO TS 16949-2009 standards; the Management and each employee are also required to improve the efficiency of the Quality system on a constant basis.

We undertake the obligation to protect the environment without using any natural resource wastefully. Any waste puts at risk the environment itself and leads to cost increases in a mediumand long-term vision.

The goals at which *BSG Kuhnke Solutions* aims, are described in the so-called "turtle diagrams"; the determination of the annual targets is performed by the Management. The communication to all employees and the monitoring of the achievement of said targets is carried out through the reexamination of the QS and periodical corporate meetings.

With the achievement of the above mentioned goals we aim at creating a company highly focusing on its own Customers (internal and external), increasing the efficacy on the market and making Customer satifaction (internal and external) the distinguishing factor in a strong competitive market.

The quality policy applied by our company is communicated and understood by all our employees and is constantly analysed in relation to its being up-tp-date.

Chief Executive Officer Limena (Pp), 07th-April 2011

#### **Company Certification**







#### ISO 9001:2008

ISO 9001:2008 was developed as an international standard to confirm that companies as *BSG Kuhnke Solutions*, have established and maintained a uniform quality management system to better meet the needs of their customers. The standard covers design, development, production and service, and can be used by any business in any industry.

Using the Plan – Do – Check – Act (PDCA) approach, ISO 9001 provides enterprises with the management tools to improve their business performance, such as defining policy and objectives, monitoring and measuring processes and product characteristics, specifying corrective and preventive actions and encouraging continuous improvement.

International experience has shown that significant business benefits are accrued by companies that comply with this standard, including the following.

- Complete customer satisfaction.
- Efficiency and productivity (minimizing defect costs and optimizing process sequences).
- Minimization of risks in product liability.
- Reduced inspection and testing costs.
- Reduced costs through the minimization of communication and manufacturing errors.
- Consistency of service or product performance.
- Increased motivation of employees due to fewer errors and complaints.
- Transparency through clearly defined processes.
- Continuous process and structural improvements.
- Identification and minimization of weaknesses.
- The securing of a competitive edge with an internationally recognized certificate.

#### The ISO 9001:2008 standard and requirements

The ISO 9001:2008 standard focuses on system processes, as opposed to elemental areas. The standard is now divided into the four following areas:

- Management Responsibility
- Product Realization
- Resource Management
- Measurement, Analysis and Improvement

Together, these areas define what companies should consistently do to provide products that meet customer and statutory or regulatory requirements, and highlight areas that companies should seek to enhance customer satisfaction by improving their quality management system.

#### **Company Certification**

The requirements of ISO 9001:2008 are based on the following eight management principles that are reflected throughout the standard.

- 1. Customer focus.
- 2. Leadership.
- 3. Involvement of people.
- 4. Process approach.
- 5. Systematic approach to management.
- 6. Continual improvement.
- 7. Factual approach to decision making.
- 8. Mutually beneficial supplier relationship.

ISO 9001:2008 certifications can only be granted by independent certification bodies, such as TÜVRheinland<sup>®</sup>. With our large team of experienced auditors that are located across the world, we offer value-added audits, internationally recognized certificates and a broad service portfolio. Contact TÜVRheinland<sup>®</sup> today for support on your path towards a certified management system.

#### ISO TS 16949

As a harmonized standard, ISO/TS 16949 combines the requirements of QS-9000 and VDA 6.1. The first edition of ISO/TS 16949 was published in 1999 based on the system requirements of ISO 9001:1994.

It was updated in 1999 to be compatible with the ISO 9001:2000 revision.

This standard is the required QMS standard for the global automotive supplier base. Any automotive supplier who supplies a component or system that ends up in an automobile must be certified, along with any automotive supplier who is contractually required by an automotive OEM to be certified. This standard and the associated certification scheme is administered by the International Automotive Task Force (IATF), working in conjunction with the accreditation bodies and ISO.

#### **Pneumatic Products**

BSG Kuhnke Solutions is specialised in:

- standard products
  - valves
  - cylinders
  - accessories
- standard product modification
- customised products
- design of special products
- products to meet specific parameters
   (i.e. voltage, vibration, pressure, temperature, corrosion, safety etc.)

Our team is available to you contact **sales@bsgkuhnkesolutions.com** Or call us at **+39 049 86 57 711** 







#### 1. Pneumatic Products - Valves

- Directional valves
- Solenoid valves
- Mechanically actuated valves
- Pneumatically actuated valves

PRODUCTS

- different voltages available
- protection against corrosion
- wide temperature range (-40 °C /+80 °C)
- Options for ATEX CE Ex II 2 GD c T4 135°C  $-10°C \le Ta \le +50°C$

#### **1. Pneumatic Products – Valve Islands**

- Standard valve island
- Sub-D island
- **Fieldbus island**



Key features:

- protection IP65
- standard up to 8 bar / available up to 10 bar



<u>(x</u>)

# 3. Pneumatic Products - Cylinders

- ISO 15552
- ISO 6432
- Cnomo
- Compact
- Brass
- Short stroke





#### Key features:

- wide temperature range (-40 °C /+80 °C)
- protection against corrosion
- ATEX cylinder CE Ex II 2 GD c T4 135°C  $-10^{\circ}C \le Ta \le +50^{\circ}C$

#### 4. Pneumatic Products - Accessories

- Pressure regulators
- Indicators
- Flow regulators
- Non-return valves
- Timers



Key features:

- wide temperature range (-40 °C /+80 °C)
- protection against corrosion

<u>A</u> (Ex)

#### **Special Products**

Are you looking for a customised product?

... Fill in the pneumatics project list as far as you can.

We are specialised in manufacturing pneumatic components and systems to meet your technical specifications.

Our field staff are available to advise you at all times.

We will develop solutions with you and will do all that is possible to support you in putting your ideas into practice.

Within only a few days we will supply you with a sample valve or cylinder from our standard range for evaluation. After your first trials this product can then be optimised in accordance with your requirements. Or we can possibly solve your pneumatics problem immediately.

We have more than 4000 special products for all types of applications at our disposal.

#### **Special Materials**

In addition to the standard materials used for the product group concerned we are also able to process special materials on request.

#### **Special Seals**

We normally use NBR seals on our standard products, and can fit Viton (FKM) or EPDM on request.

#### **Special Gases**

Some of our products are BAM licensed (BAM = Federal Institute for Material Testing) for applications involving oxygen and are manufactured and labeled correspondingly. Please enquire about applications involving other gases such as helium, argon or  $CO_2$ .

#### **Dimensioning and Selecting Pneumatics Components**

# **Flow Characteristic**

The diagram shows the flow characteristic of a solenoid valve with Kv value 0.18.

In section I of the curve it can be seen that from a certain pressure range onwards no further flow changes take place. This is the hypercritical range, i. e. sonic speed has been reached ( $p_2 < p_1/2$ ).

In section II of the curve the flow decreases elliptically corresponding to the drop in pressure. This is the subcritical range, i. e. the flow values are below sonic speed  $(p_2 \ge p_1/2)$ .



There is at present no standard system for stating the flow rate of solenoid valves. At BSG Kuhnke Solutions we use a parameter referred to as the Kv value.

The Kv value is an empirically recorded comparative unit which is determined for each valve on the basis of measurements.

The following formula is used to determine the through flow quantity:

1. For subcritical flows  $(p_2 \ge p_1/2)$ .

Q = 451.6 • Kv • 
$$\sqrt{\frac{p_2 (p_1 - p_2)}{T_1}}$$

2. For hypercritical flows

$$Q = \frac{227 \cdot Kv \cdot p_1}{\sqrt{T_1}}$$

In the case of hypercritical flows sonic speed is reached in the narrowest cross section.

The abbreviations used in the formula above mean the following:

Q = Flowrate quantity in l/min (760 Torr 0 °C)

- p<sub>1</sub> = Pressure in front of the valve (absolute)
- $p_2 =$  Pressure after the valve (absolute)
- $T_1 =$  Temperature in front of the valve in K (Kelvin)

**Dimensioning and Selecting Pneumatics Components** 



Another example to illustrate the calculation:

The flow rate of a micro solenoid valve NW 1 with the following values is to be determined.

Kv value = 0.45 l/min  $p_1 = 5.0$  bar (absolute)  $p_2 = 1.5$  bar (absolute)  $T_1 = 293$  K

The flow in this valve is hypercritical since

p<sub>2</sub> < p<sub>1</sub>/2 (1.5 bar < 5/2 bar)

The flow rate can now be calculated simply by inserting the numbers in the formula for hypercritical flow.

Q (l/min) = 
$$\frac{227 \cdot 0.45 \cdot 5.0}{\sqrt{293}}$$

At the pressure values given the valve exhibits a flow of 29.8 l/min.

A special feature is the conversion of the Kv value, which is based on metric units of measurement, to the Cv value based on American measurement units.

The following relationship is valid here:

Kv = 14.275 • Cv Cv = 0.07006 • Kv



# Symbol

Crossing	<u> </u>	Crossing of lines not connected to each other
Exhaust point or vent		
Outlet port		Without fixture for one connection
	↓ ↓	With thread for one connection
Energy tapping point	. <i>.</i>	Pressure connection on devices and lines for tapping energy or for measurements
	$\rightarrow$	With plug
	$\rightarrow \!$	With connecting line
Quick-acting couplings	<i>→</i> ←	Connected, without mechanically opening check valve
	-\$+\$-	Connected, with mechanically opening check valves
	$\rightarrow$	Uncoupled, with open end
	->	Uncoupled, end blocked bycheck valve without spring
Flexible line connection	$\smile$	For connecting moving parts
Electrical lead	<u> </u>	Lead for transmitting electrical energy
line		Fixed connection e.g.
connection		welded, soldered, screwed (including fittings and connectors)
connection Silencer		welded, soldered, screwed (including fittings and connectors)
Connection Silencer Vessel (air reservoir)		welded, soldered, screwed (including fittings and connectors)
Connection Silencer Vessel (air reservoir) Filter		welded, soldered, screwed (including fittings and connectors) Device for removing contaminants
Connection Silencer Vessel (air reservoir) Filter Water separator		Welded, soldered, screwed (including fittings and connectors) Device for removing contaminants Manually operated
Connection Silencer Vessel (air reservoir) Filter Water separator		welded, soldered, screwed         (including fittings and connectors)         Device for removing contaminants         Manually operated         With automatic draining
Connection Silencer Vessel (air reservoir) Filter Water separator Filter with water separator		welded, soldered, screwed         (including fittings and connectors)         Device for removing contaminants         Manually operated         With automatic draining         Manually operated         Manually operated
Connection Silencer Vessel (air reservoir) Filter Water separator Filter with water separator		welded, soldered, screwed         (including fittings and connectors)         Device for removing contaminants         Manually operated         With automatic draining         Manually operated         With automatic draining

Lubircator	$\rightarrow$	Device in which a small amount of oil is added to the air flowing through for lubricating connected devices
Pressure gauge	$\bigtriangledown$	
Pressure source	•	
Working line		Line for transferring energy
Control line (pilot line)		Line for transmitting control energy (including adjusting and regulating)
Exhaust or leakage line		Line for exhausting
Manual operation	۲ <u>–</u>	General (without specifying type of control)
		By pushbutton
	Ľــــــــــــــــــــــــــــــــــــ	By lever
	7	By pedal
Mechanical actuation		By stem or key
	~~	By spring
	0=	By roller
		By roller operating in one direction only (idle return)
Pneumatic actuation		Direct action by application of pressure
		By pressure relief
	[	By different control surfaces. In the symbol the larger rectangle represents the larger control surface, i. e. pressure dominant pilot
		Indirect actuation, piloted By application of pressure to the pilot valve
	ÞK	By relieving the pressure on the pilot valve



# Symbol

Electrical actuation		By solenoid with one coil
		With two in-phase coil
		With two opposing coil
Combined actuation		By solenoid with one valve
	Æ	By solenoid or pilot valve
Detent		Device for maintaining a given position
2/2-way valve		Two closed ports, closed position in neutral position
		One flow path flow in neutral position
3/2-way valve		In 1st switch position inlet is closed (e.g. single acting cylinder is exhausted or connected to return flow line)
	Ţ	In the 2nd position air is exhausted or the return flow line is closed (e.g. single acting cylinder is supplied with air)
4/2-way valve		With two open positions, e. g.for double acting cylinders With one exhaust
5/2-way valve		With two open positions, e. g.for double acting cylinders With two exhausts
3/3-way valve		With closed neutral position and 2 open positions
4/3-way valve		With rotating neutral position and 2 open positions With floating neutral position and 2 open positions
5/3-way valve		With closed neutral position and 2 open positions

Check valve		Unloaded opens when the inlet pressure is higher than the outlet pressure
		Spring-loaded opens when the inlet pressure is higher than the outlet pressure, including the spring contact force
Shuttle valve (OR type)		The inlet port with the higher pressure is automatically connected to the outlet port, whilst the other inlet port is closed
Quick-exhaust valve		When the inlet port is not supplied with air, the outlet port is exhausted directly into the atmosphere
Flow control valve		With adjustable flow control
Flow control valve with one-way adjustment (check valve with flow		Flow control valve with flow in one direction and constant flow control in the other direction
control)		With adjustable flow control
Sequence valve (priority valve)		Valve which, by opening the outlet against the spring force, makes connection with further units
Regulator	[]	Valve which to a large extent holds the outlet pressure at a constant level, even with altered (higher) inlet pressure Without exhaust (does not compensate for over-loads)
		With exhaust (compensates for overloads)
Differential pressure regulator		The outlet pressure is reduced by a fixed value which is related to the inlet pressure
Shut-off valve	->>-	
Two pressure valve (AND type)		The outlet port is only pressurized when pressure is supplied to both of the inlet ports



# Symbol

Compressor	Č=	With constant displacement volume (one direction of rotation only)	Single acting cylinder		Cylinder in which the pressure only acts in one direction (advance stroke) Return stroke by non-defined force
Pneumatic motor	1	With constant displacement motor volume		-244441)	Return stroke by spring
		With one direction of rotation	Double acting cylinder		Cylinder in which the pressure may act in both directions (advance and return strokes)
	$\bigcirc$ =	With two directions of rotation			With single-ended piston rod
	_	With variable displacement volume			With double-ended piston rod
		With one direction of rotation	Cylinder with cushioning		With non-adjustable cushioning at one end (only acts in one direction)
	Ø=	With two directions of rotation			With non-adjustable cushioning at both ends (acts in two directions)
Oscillating motor rotary	=	Pneumatic Cylinder with Rotary Drive limited range of orcillation			With cushioning adjustable at one end
מנונוסו	7			Ţ	With cushioning adjustable at both ends

Short designation of connections in figures in accordance with ISO 5599 (5/2 and 5/3 valves)

- 1 Compressed air connection
- 2, 4 Operating connections
- 3, 5 Vents
- 12, 14 Control connections
- 10 Control connection which deletes the output signal
- 81, 91 Additional control air connection

Short designation of connections in letters (still commonly found in practice)

- A, B, C Operating connection
- P Compressed air connection
- R, S, T Outlet, vents
- L Leakage connection
- X, Y, Z Control connections

Comparison of designations:

ISO 5599	Letter designations
1	Р
2	А
3	R
4	В
5	S
(10)	(Z)
12	Z
14	Y

## Further code designations

Al	=	Aluminium
BSP	=	British Standard Pipe Thread
CETOP	=	Comité Europée des Transmissions Oléhydrauliques et Pneumatiques
db	=	Decibel (sound pressure level)
DIN	=	German Standards Institute
G	=	Symbols for thread in accordance with ISO 228
Gd	=	Die-casting
Hz	=	Hertz (frequency)
IP	=	Protection class in accordance with DIN 40 050 and IEC 144
ISO	=	International Standardization Organization
Μ	=	Metric thread
MS	=	Brass
NW	=	Orifice
Pg	=	Armoured conduit thread
SW	=	Width across flats
UL	=	Underwriters Laboratories



# SI Units

Siza Formula			SI-unit		Permitte	ed units	Commiss forten
symbol	Name	unit	Multiple	Name	Unit	Conversion factor	
Length	I	Metre	m	km cm mm			
Area	A	Square metre	m²	cm² mm²	Are Hectare	A ha	1 a = 102 m² 1 ha = 104 m²
Volume	V	Cubic metre	m³	cm³ mm³	Litre	I	1 l = 1 dm <sup>3</sup> = 0.001 m <sup>3</sup>
Mass	m	Kilogram	kg	mg g mg	Ton	t	1 t = 1000 kg = 1 Mg
Time Time period	t	Second	S		Minute Hour Day	Min h d	1 min = 60 s 1 h = 60 min = 3600 s 1 d = 24 h = 86400 s
Revolutions	n	Reciprocal second	1/s s -1		Reciprocal minute	1/min min <sup>-1</sup>	1/min = 1/60 s
Speed	v	Metre per second	m/s		Kilometre per hour	km/h	1 km/h =1 m/s 3.6
Volume cur- rent	V	Cubic metre per second	m³/s	m³/h I/min I/s			1 m³/h = 16.67 l/min = 0.28 l/s 1 m³/s = 60000 l/min
Force	F	Newton	Ν				1 N ≈ 1 kg m/s² 1 kp = 9.81 N ≈ 10 N 1 kp ≈ 1 da N
Pressure	р	Newton per square metre, Pascal	N/m² Pa		Bar	bar	1 N/m² = 1 Pa 1 bar = 105 Pa
Energy Work Quantity heat	W E	Joule	J		Kilowatthour	kWh	1 J = 1 Nm = 1 Ws = 1 kg m <sup>2</sup> /s <sup>2</sup> 1 kWh = 3.6 MJ 1 kpm = 9.81 J
Torque	М	Newton-metre	Nm				1 kpm = 9.81 Nm
Power Energy curr. Heat current	Р	Watt	W				1 W = 1 J/s = 1 Nm/s 1 kpm/s = 9.81 W
Dyn. Viscosity	η (μ)	Pascal-second					1 Pas = 1 Ns/m <sup>2</sup> = 1000 mPas 1 cp = 1 mPas
Kinematic Viscosity	v	Square metre per second	m²/s				1 cST = 10 <sup>-6</sup> m²/s 1 cST = 1 mm²/s
Temparature		Kelvin	К		Deg. celsius	°C	
Frequency	f	Hertz	Hz				

#### SI Units - Pressure Units Conversion Table

bar $\rightarrow$ Pa $\rightarrow$ psi (pound/square inch)
1 bar = 100000 Pa = 100 kPa = 14.5 psi
1 Pa = 0.00001 bar = 0.000145 psi
1 psi = 0.069 bar = 6897.8 Pa

bar	kPa	psi
0.0005	0.05	0.0073
0.001	0.10	0.0145
0.005	0.5	0.0725
0.01	1	0.145
0.05	5	0.725
0.069	6.9	1.000
0.1	10	1.450
0.25	25	3.625
0.5	50	7.250
0.75	75	10.875

bar	kPa	psi
1.0	100	14.500
1.5	150	21.750
2.0	200	29.000
2.5	250	36.250
3.0	300	43.500
3.5	350	50.750
4.0	400	58.000
4.5	450	65.250
5.0	500	72.500
5.5	550	79.750

bar	kPa	psi
6.0	600	87.000
7.0	700	101.500
8.0	800	116.000
9.0	900	130.500
10.0	1000	145.000
12.0	1200	174.000
14.0	1400	203.000
16.0	1600	232.000
18.0	1800	261.000
20.0	2000	290.000

#### SI Units - Temperature Units Conversion Table

- $1 \text{ degree} = 1^\circ = 1 \text{ Grad}$
- 1 degree centigrade = 1 °C = 1 Grad Celsius

Celsius temperature:

- = (Fahrenheit temperature 32) 5/9
- = Kelvin temperature 273.15
- = (Rankine temperature 5/9) 273.15

Kelvin temperature:

- = Celsius temperature + 273.15
- = (Fahrenheit temperature 5/9) + 255.37
- = Rankine temperature 5/9

Fahrenheit temperature:

- = (Celsius temperature 1.8) + 32
- = (Kelvin temperature 255.37) 1.8
- = Rankine temperature 459.67

## SI Units - International Units Conversion Table

# American and English units of measurement in SI units

Unit	Symbol	SI unit	Conversion factor *	Unit	Symbol	SI unit	Conversion factor *
Linear measure				Cubic measure			
1 inch	in	2.54 cm	0.393701	1 quart = 2 pints (GBr)	(liq) qt	1.13652 dm³	0.87988
1 mil		25.4 µm	0.03937	1 quart = 2 pints (USA)	liq qt	0.94636 dm³	1.05668
1 line		0.635 mm	1.5748	1 dry quart	dry qt	1.10123 dm³	0.908077
1 foot = 12 in	ft	30.48 cm	0.0328084	1 quarter = 64 gal		290.950 dm³	0.003437
1 yard = 3 feet	yd	0.9144 m	1.09361	1 gallon = 2 pottles (GBtr)	gal	4.54609 dm³	0.219969
1 fathom = 2 yd	fath	1.8288 m	0.546807	1 gallon (USA)	gal	3.78543 dm³	0.26417
1 mile (Landmeile)	mi	1.60934 km	0.62137	1 bushel = 4 pecks (GBr)	bu	36.3687 dm³	0.0274962
1 nautical mile (internat.)	n mi. NM	1.852 km	0.539957	1 bushel = 4 pecks (USA)	bu	35.2393 dm³	0.0283774
1 knot (Knoten)	kn	1.852 km/h	0.539957	1 dry barrel		115.628 dm³	0.0086484
_				1 petroleum barrel		158.762 dm³	0.0062987
Square measure							
1 square inch	sq in	6.4516 cm <sup>2</sup>	0.155	Avour dupois weight			
1 circular inch		5.0671 cm <sup>2</sup>	0.197352	1 ounce	oz	28.3495 g	0.0352739
1 square foot = 144 sq in	sq ft	929.03 cm <sup>2</sup>	1.19599 • 10 <sup>-3</sup>	1 pound = 16 oz	lb	0.453592 kg	2.204622
1 square yard = 9 sq ft	sq yd	0.83613 cm <sup>2</sup>	1.19599	1 quarter = 28 lb (lbs)		12.7006 kg	0.078737
1 acre		4046.8 m²	2.4711 • 10 <sup>-4</sup>	1 hundredweight = 112 lb	cwt	50.8024 kg	0.0196841
1 square mile = 640 cres	sq mi	2.5900 km <sup>2</sup>	0.3861	1 long hundredweight	l cwt	50.8024 kg	0.0196841
				1 short hundredweight	sh cwt	45.3592 kg	0.0220462
Cubic mearsure				1 ton = 1 long ton	tn, l tn	1.016047 t	0.984206
1 cubic inch	cu in	16.387 cm <sup>3</sup>	0.061024	1 short ton = 2000 lb	sh tn	0.907185 t	1.102311
cu in	cu ft	28.317 dm <sup>3</sup>	0.035315				
1 cubic yard = 27 cu ft	cu yd	0.76455 m³	1.30795	Force units			
1 register ton = 100 cu ft		2.8317 m³	0.35314	1 pound-weight	lb wt	4.448221 N	0.2248089
1 shipping ton		1.13268 m³	0.88286	1 pound-force	LB, lbf	4.448221 N	0.2248089
1 fluid ounce (GBr)	fl oz	0.028413 dm³	35.195	1 poundal	pdl	0.138255 N	7.23301
1 fluid once (USA)	fl oz	0.029574 dm³	33.8138	1 kilogramme-force	kgt, kgp	9.80665 N	0.1019716
1 pint = 4 gills (GBr)	(liq) pt	0.56826 dm³	1.75975	1 short ton-weight	sh tn wt	8.896444 kN	0.1124045
1 pint = 4 gills (USA)	liq pt	0.47318 dm³	2.11336	1 long ton-weight	l tn wt	9.964015 kN	0.1003611
1 dry pint	dry pt	0.55061 dm³	1.81616	1 ton-force	Ton, tonf	9.964015 kN	0.1003611



# **Material Information**

Description	Chemically compatible with:	Not compatible with:	
Polyurethane			
This material is the best in terms of duration (long-life), resistance to wear and reduced friction.	Aluminum Salts Barium Salts Boric Acid Pure aliphatic hydrocarbons (butane, propane, gasoline), but the impurities can ruin the gasket. Calcium Chlorite Cupric Chloride Methanol Gycol Ether Hexane Jet Fuel (JP-5), Kerosene, Naphtha Mineral Oil and grease Propylene Glycol Sodium Hydroxide (50%) Tetrachloroethylene Triethylamine Turpentine Water (up to +50°C) Triethylamine Turpentine Water (up to +50°C)	Methyl Chloroform Acetone Acetonitrile Benzyl Alcohol Carbon Disulfide Cyclohexanone Dichloromethane Diethylamine Diethylformamide Ethyl Acetate Hydrochloric Acid (37%) Hydrogen Peroxide (30%) Methyl Ethyl Ketone Nitrobenzene Phenol Sulfuric Acid (50%) Tetrahydrofuran Toluene Trichloroethylene	
NBR These gaskets have a shorter life than polyurethane gaskets. However, they are recommended for use in environments causing the formation of water condensate, such as tropical climates, where polyurethane gaskets may tend to deteriorate quickly due to hydrolysis.	Methane, butane, propane, oily acids Aliphatic hydrocarbons Lubrication oils Gasoline	Ozone and exposure to sunlight	
VITON (FKM/FPM)	-		
Can withstand temperatures as high as 150°C. This makes them ideal for use on rodless cylinders, high-speed applications, involving high temperatures at the sliding lips.	Mineral oil and grease, slight swelling with oil grade ASTM 1 & 3 Silicon oil and grease Animal and vegetable oil and fat Aliphatic hydrocarbons (gasoline, butane, propane, natural gas) Aromatic hydrocarbons (benzol, toluene) Chlorinated hydrocarbons (tetrachloroethylene) Fuels Ozone, atmospheric agents, ageing	Polar solvents (acetone, diethyl ether, dioxane) Glycol-based brake fluids Ammonia gas, amines, alkali Superheated water vapours Low molecular organic acids (formic and acetic acid)	

Pneumatic products include elastomeric gaskets that are made of acryl-nitrile butadiene (NBR), polyurethane or fluorocarbon rubber (FKM/FPM). It is important for them to not meet incompatible substances, which could cause them to swell or crack and subsequently malfunction.

In particular, it is necessary to check compatibility of:

- the oil used in the air compressor;
- any oil used in the lubricator;

• the oil or cutting fluids used on the machine, which could get into the cylinders and from there the valves.

#### How to make proper use of compressed air

Our products are designed for operation with compressed air. The person creating the pneumatic system (circuit diagram) or its specifications is also responsible for ensuring the compatibility or suitability of the pneumatic components selected. Detailed analyses and/or tests are a mandatory requirement for deciding whether or not pneumatic products supplied by BSG Kuhnke Solutions are suitable for a particular application. Compressed air can be dangerous if an operator does not exactly know how to handle it. Operation and servicing of pneumatically operated machines and systems is therefore strictly limited to trained persons observing all applicable safety regulations. To ensure proper operation of our components, please note the following:

#### Accessories

We recommend the use of our fittings and accessories because they are perfectly adapted to our products. To avoid problems, care should be taken to only use clean accessory and other pneumatic elements.

#### Cylinders

To maintain a long and untroubled service life of the cylinders, try to avoid shearing forces on the piston rod and to install external stroke arresters whenever possible. Only use accessories and mounting material originally manufactured by BSG Kuhnke Solutions.

#### Valves

Depending on type, our spool valves are mounted either using a central mounting device or screws. If screwing down the valves, ensure that the valves are flat down on the mounting surface. Always look at the port labeling of valve symbols and connectors.

#### **AirBox**

The poppet valves of the AirBoxes are of a very rugged design. They are pneumatically pilot-controlled valves made for pressures between 3 and 8 bar (including peak pressures). Install technically accepted means to avoid peak pressures going beyond the admissible operating pressure. Likewise, the minimum rated pressure must be maintained. The latter specifically applies to restarting the system or following an emergency stop. To also control the pneumatically pilot-controlled AirBox at lower pressures (e.g. soft start) or at vacuum pressure, supply separate control air.

## Purity of compressed air

Long life and safe operation of pneumatic components depends on operating pressures and most particularly on quality of the compressed air. Air should be clean and free from all pollutants (and in certain cases microbiological organisms). The very nature of air being compressed requires consideration of many factors:

- Chemical impurities in air at atmospheric pressure become more concentrated and aggressive once compressed.
- Dust.
- Compressed air has less capacity to hold water than atmospheric air. This unwanted water condenses as compressed air cools.

The basis of air quality assessment is ISO 8573, part 1.

#### How to make proper use of compressed air



#### Compressed air purity specification

The purity of the air is measured and graded compliant to the three classes set by ISO 8573-1:2001:

- 1. The purity class of solid impurities
- 2. The purity class of humidity content
- 3. The purity class of total oil content

If not otherwise stated, BSG Kuhnke Solutions products can be operated with compressed air of purity class:

6 - 3 - 4

Explanation:

1. Solid impurities compliant to class 6: Max. particle size = 5  $\mu$ m, max. particle density = 5 mg/m<sup>3</sup>

 Max. humidity content compliant to class 3: pressure dew point -20 °C (see following "humidity content and pressure dew point")

3. Max. total oil content compliant to class 4: ≤ 5 mg/m<sup>3</sup>

#### **General information**

The above specifications are minimum requirements, i.e., the products can be even more durable if the particle concentration and humidity content are lower and if very little or no oil is added.

Due to their initial lubrication the valves, cylinders and AirBoxes need not be run on oiled air. Using oiled air will remove the initial lubrication where products have been exposed to oiled air then it is vital that oiled air continues to be used.

Some applications such as packaging machines and food processing have much stricter air quality requirements. Please observe the existing regulations.

It is recommended to filter the compressed air as closely to the valve or AirBox as possible. This is the only effective way of ensuring that dirt and corrosion from steel pipelines does not enter inlet ports. Mixing synthetic oil with mineral oil may provoke agglomeration and clotting and, thus, may cause moving parts to fail.

BSG Kuhnke Solutions valves, cylinders and AirBoxes can be operated at different temperature ranges. Please take note of the ratings of every product (catalogue, technical information etc.). If used at temperatures below 0 °C, take extra precautions to prevent condensation, humidity etc. from freezing or solidifying.

#### How to make proper use of compressed air



#### Humidity content and pressure dew point

Ambient air contains water vapour. The ability of air to carry water solely depends on the temperature. The ratio of the quantity of water actually carried and the maximum quantity that could be carried at a given temperature is referred to as relative humidity. A relative humidity of 100% means that, at a given temperature and pressure, the air can absorb no more water. It is saturated.

Warm air can absorb more water than cold air. Cooling down saturated air leads to a condensation of fog. The temperature at which water vapour starts condensation is called dew point.

Condensation also occurs if saturated air is compressed without changing the temperature. Thus, increasing the air pressure from 1 bar to 2 bar turns 50% relative humidity air into 100% relative humidity air. Further compressing this air leads to condensation. However, compressing the air also heats it up, which means that it can hold all of the water. As the air leaves the compressor and enters the pneumatic tubing, it starts to cool down. When it reaches the dew point the water vapour condensates and will cause damage to the system unless it is removed. To supply dry air to the system, the pressure dew point should be set to at least 10 °C below the lowest ambient temperature of the air pipe.

Drying the air to an even lower dew point will only cause more costs. Always keep in mind that there is a large difference between the atmospheric dew point and the pressure dew point. For example, an atmospheric dew point of -15 °C corresponds to a pressure dew point of 10 °C at 5.5 bar. Always dry the air down to the pressure dew point.

At an ambient temperature of 21 °C, a pressure dew point of 10 °C should be enough to avoid further condensation.

#### Admissible lubricants

Oil used to lubricate the compressed air must comply with class 1 (no additives) of ISO VG10. The oil used must not corrode the materials it contacts. If in doubt, please contact the manufacturer.

#### Protection Degree - Standard EN 60529 and CEI 529

The IP Code consists of the letters IP followed by two digits or one digit and one letter and an optional letter. As defined in international standard IEC 60529, IP Code classifies and rates the degrees of protection provided against the intrusion of solid objects (including body parts like hands and fingers), dust, accidental contact, and water in mechanical casings and with electrical enclosures



FIRST DIGIT Level of protection against access to hazardous parts and ingress of solid foreign objects.

	DESCRIPTION
0	Not protected
1	Protected against solid bodies greater than Ø 50 mm
2	Protected against solid bodies greater than Ø 12 mm
3	Protected against solid bodies greater than Ø 2.5 mm
4	Protected against solid bodies greater than Ø 1 mm
5	Protected against dust
6	Totally protected against dust



#### SECOND DIGIT Level of protection against the penetration of liquids

	DESCRIPTION
0	Not protected
1	Protected against water falling vertically (condensate)
2	Protected against drops of water falling up to 15° off the vertical
3	Protected against rain water up to 60° off the vertical
4	Protected against sprays of water from any direction.
5	Protected against jets of water fired from any direction
6	Protected against sea waves or the like
7	Protected against the effects of immersion

#### ATEX - Pneumatics and potentially explosive atmospheres

All products marketed in the European Union and intended for use in potentially explosive atmospheres, from 1st July 2003 must be approved in compliance with European Directive 94/9/EC, also known as ATEX.

This new directive also applies to non-electrical components, such as pneumatic controls, for which approval is mandatory.

The innovations introduced by the new directive 94/9/EC are:

- ✓ All products must have the CE marking.
- ✓ Inclusion of non-electrical equipment and devices, such as pneumatic cylinders.
- $\checkmark$  Each device is assigned a category associated to certain potentially
- ✓ explosive atmospheres.
- $\checkmark$  Instructions for use and declarations of conformity must be supplied
- $\checkmark$  for each product sold for use in potentially explosive atmospheres.
- $\checkmark$   $\;$  Products intended for use in potentially explosive atmospheres due
- $\checkmark$   $\,$  to the presence of dust come under this directive, as do products
- $\checkmark$  destined for areas in which hazardous gases are present.

A potentially explosive atmosphere may contain gases, mists, vapours or dust that form in factories or other areas in which flammable substances are continuously or occasionally present. An explosion can occur when flammable substances and a source of ignition are present simultaneously in a potentially explosive atmosphere.

There are some different source of ignition: an electrical origin (electric arcs, induced currents, heat by Joule effect), a mechanical origin (hot surfaces generated by friction, sparks, electrostatic discharge, adiabatic compression), a chemical origin (exothermic reactions between materials) or a naked flame.

Products subject to approval are all those which, during normal use or due to a malfunction, present one or more sources of ignition for potentially explosive atmospheres.

Responsibility lies both with the manufacturer of the device and whoever installs it in equipment that is to operate in a hazardous atmosphere. This requires co-operation between the parties to ensure correspondence between the category of device and the hazardous area in which it is to operate.

The manufacturer of the device must comply with the specifications and classify the product according to directive 94/9/EC. The manufacturer of the equipment, who knows the area in which the device will be operating, must select a suitable device according to the category, pursuant to directive 99/92/EC.

According to Directive 94/9/EC, both electrical and mechanical devices are subject to approval. It is important to note that the component which is classified in the lowest category defines the Category of the entire device of which it is a part.





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*TECHNICAL INFORMATION* 

#### ATEX - Pneumatics and potentially explosive atmospheres and Zone

#### Responsibility

Responsibility lies both with the manufacturer of the device and whoever installs it in equipment that is to operate in a hazardous atmosphere. This requires co-operation between the parties to ensure correspondence between the category of device and the hazardous area in which it is to operate.

The manufacturer of the device must comply with the specifications and classify the product according to directive 94/9/EC. The manufacturer of the equipment, who knows the area in which the device will be operating, must select a suitable device according to the category, pursuant to directive 99/92/EC.

According to Directive 94/9/EC, both electrical and mechanical devices are subject to approval. It is important to note that the component which is classified in the lowest category defines the Category of the entire device of which it is a part.



#### Gases, Mists or Vapours Zone

#### ZONE 0

An atmosphere where a mixture of air and flammable substances in the form of gas, vapour or mist is present frequently, continuously or for long periods (more than 1000 hours/year or > 10% of time).

#### ZONE 1

An atmosphere where a mixture of air and flammable substances in the form of gas, vapour or mist is likely to occur in normal operation occasionally (10 - 1000 hours/year or > 1% of time).

#### ZONE 2

An atmosphere where a mixture of air and flammable substances in the form of gas, vapour or mist is not likely to occur in normal operation but, if it does occur, will persist for only a short period (<10 hours/year or 0.01% of time).

#### Dust Zone

#### ZONE 20

An atmosphere where a cloud of combustible dust in the air is present frequently (more than 1000 hours/year or > 10% of time), continuously or for long periods.

#### ZONE 21

An atmosphere where a cloud of combustible dust in the air is likely to occur in normal operation occasionally (10 - 1000 hours/year or > 1% of time).

## ZONE 22

An atmosphere where a cloud of combustible dust in the air is not likely to occur in normal operation but, if it does occur, will persist for only a short period (<10 hours/year or 0.01% of time).

#### ATEX - Group and categories

#### Group I - Category M1 and M2

Group I comprises equipment intended for use in mines, above and below ground.

<u>Category M1:</u> equipment in this category is required to remain functional with an explosive atmosphere present. There are also special additional protection device:

- there is a second independent protection device;
- if whole device will fail the safety required level will be granted.

<u>Category M2:</u> equipments design for a high protection level. This equipment is intended to be de-energised in the event of an explosive atmosphere forming.

#### Group II – Category 1, 2 and 3

Group II comprise equipment intended for use in other locations (different from those of group I) endangered by explosive atmospheres.

- <u>Category 1:</u> equipment in this category is intended for use in areas in which explosive atmospheres caused by mixtures of air and gases, vapours or mists or by air/ dust mixtures are present continuously, for long periods or frequently. There are also special additional protection device:
  - there is a second indipendent protection device;
  - if whole device will fail the safety required level will be granted.
- <u>Category 2:</u> equipment in this category is intended for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures are likely to occur.
- <u>Category 3:</u> equipment in this category is intended for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures are unlikely to occur or, if they do occur, are likely to do so only infrequently and for a short period only.



#### **ATEX** – **Products Classification**

#### Group and Categories Table

Zone		Evaluative Atmosphere	Equipment		Protection	Application
Gases	Dust	Explosive Atmosphere	Group	Category	level	Application
			1	M1	Very high	Minor
•	-	-	1	M2	High	wittes
0		Continuous presence or		1G	· Very high	
	20	for a long period		1D		
1		Occasional processo		2G	Llink	Environment
	21	Occasional presence		2D	High	from Mines
2				3G	Nermal	
	22	improbable presence		3D	Normal	

#### ATEX classification for 76 series solenoids (electrical)







not necessary if -20°C ≤ Ta ≤ +40°C

## ATEX - Pneumatics and potentially explosive atmospheres

#### Electrical protection class

Protection Concept		Zone of use	ATEX Cat- egory	Methodology
	ia	0, 1, 2	1	Limited energy - will not cause ignition in normal operation, with one fault and with any combination of two faults applied
Intrinsic Safety	ib	1, 2	2	Limited energy - will not cause ignition in normal operation, with one single fault applied
	ic	2	3	Limited energy - will not cause ignition in normal operation
Flameproof	d	1, 2	2	Explosion containment, will not allow transmission of an internal explosion to the surrounding environment
Increased Safety	е	1, 2	2	Prevention of arcs, sparks and hot surfaces in normal operation
Pressurization	р	1, 2	2	Excludes the hazardous atmospheres by 50Pa positive pressure of inert gas
Powder Filled	q	1, 2	2	High power electronics, such as solenoids, capacitors etc. prevents the explosive atmosphere reaching a hazard
Encapsulation	m	1, 2	2	Light current applications and instrumentation
Oil Filled	o	1, 2	2	High current switchgear, transformers etc. prevents the explosive atmosphere reaching a hazard
Non Sparking	n	2	3	Is not capable of causing an ignition and faults are unlikely to oc- cur

#### Mechanical protection class

Protection Concept		Zone of use	ATEX Cat- egory	Methodology
Constructional Safety	c	0, 1, 2	1	Constructional measures are applied so as to protect against the possibility of ignition from hot surfaces, sparks and adiabatic compression generated by moving parts
Inherent Safety	g	1, 2	2	Prevention of arcs, sparks and hot surfaces in normal operation
Control of Ignition	b	1, 2	2	Automatic/manual ignition prevention measures, to prevent po- tential ignition sources becoming effective
Pressurization	р	1, 2	2	Excludes the hazardous atmospheres by 50Pa positive pressure of inert gas
Flameproof	d	1, 2	2	Explosion containment, will not allow transmission of an internal explosion to the surrounding environment
Liquid Immersion	k	1, 2	2	A type of protection in which potential ignition sources are made ineffective
Flow Restriction	fr	2	3	Flow restricting enclosures are simple enclosures, which will pre- vent, with adequate probability, the atmosphere inside the enclo- sures becoming explosive

#### **Explosion Groups**

 	•	-	-	•	
Group	I	IIA	IIB	IIC	Temperatur Class
Fuels	methane	propane	ethylene	hydrogen	T1
		cyclohexane	vinyl acetate	acetylene	T2
		carbon monoxide			Т3
		ethl cloride ammonia aniline			T4
			ammonia aniline		
					Т6

**BSG Kuhnke Solutions products with ATEX certification** We supply part of our standard range of valves and cylinders with ATEX certification. Please ask us for more details.

All our ATEX devices are supplied with:

- Identification labels showing part number and category
- Operating instructions
- Declaration (or certificate) of compliance

#### Classification of maximum surface temperatures - Group IIG

	•
Temperature Class	Max. surface temperature (°C)
T1	450
T2	300
T3	200
T4	135
Т5	100
T6	85



# **Pneumatics Checklist for Valves**

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J	U
Solutio	115

Project no.:			
Customer details		Internal details	
Company:		Representative:	
Address:		Sales manager:	
		Application engineer:	
Contact person:		Customer visits / date :	Branch key
Dept.: Phone: Fax:		Competitor:	
E-mail:		Standard product:	
Competitor offer:	🗌 Yes 🗌 No		
Technical requirements		General features	
Valve function:		Size of fitting M5	□G1/8″ □G1/4″
Actuation:		□G 1,	/2′′ □ Flange base □ Other
Orifice base:	mm	Pressure [bar]:	
Orifice stem:	mm	P <sub>N</sub> = P <sub>min</sub> =	P <sub>max</sub> =
Type of base:		Control pressure [bar]:	
Material of base:		P <sub>N</sub> = P <sub>min</sub> =	P <sub>max</sub> =
Nominal flow rate:	l/min	Vacuum:	_ mbar
Nominal voltage: DC	AC Mains Accu/Batt.	Medium:	_ %
Voltage tolerance:	Standard	Medium state: 🗌 dry	🗌 oiled 🛛 🗍 filtered
Voltage tolerance: Umin	Umax	Max. acceleration during of	peration: x-direction m/sec <sup>2</sup>
P <sub>E</sub> :	W/VA		y-direction m/sec <sup>2</sup>
Duty cycle:	% ED	Mounting: 🗌 x-dir	ection 🗌 y-direction
Switching frequency:		Permiss. leakage: 🗌 Stan	dard 🗌 l/min
Switching time (to VDI 3290): msec.		Ambient temperature T <sub>min.</sub> : C° T <sub>max.</sub> : C°	
Service life: Cycle	əs:	Medium temperature T <sub>min.</sub> :C° T <sub>max.</sub> :C°	
Protection class: Sealing material: DBR Viton			
□ Plug-in socket □ Flying lead □ with: mm <sup>2</sup>			
Colour: Basic lubrication: 🗌 Yes 🗌 No			
Length of leads: mm	Tolerance: +/ mm	Misc.:	
Protection diode:  Ves No			
Statutory demands and environmental aspects:			
Demands to standards:			
(e.g. VDI, VDE, VDS, VDA, DIN, ISO etc.), which:			
Activities	] Dimension sketch 🗌 Sample	☐ Offer	□ Information □ Target price
	Qty	Date	Chance of realisation:%
Sample			<b>.</b>
Pilot series			Priority
Qty per year			
Qty per order			
Total quantity			🗌 high
Customer's price idea:			
Customer keep:			
Project statement (to be filled in by project division)			
Date of receipt: Project no.:			
To be handled as a project: Ves Vo			
Handled by name: Phone:			
Suggested date Comments:			
		Comments:	
Dimension sl			
Otter			
Sample			
	ł		

Signature: \_

\_\_\_\_\_

Date: \_







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