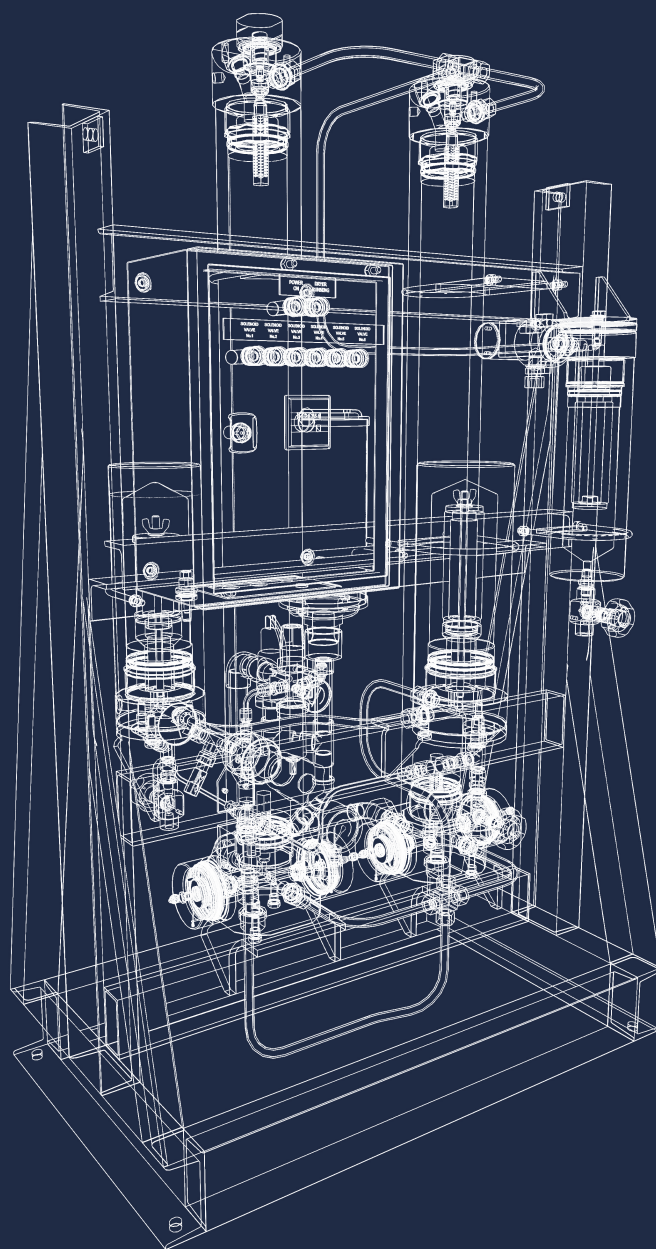


## Filters & Dryers

Creative engineered solutions for high pressure compressed air / gas equipment



# Contents

Innovation	01
Filters	02
Dryers	03
High & medium pressure dryer features & flow rates	05
Standard dryer dimensions & weights	06
Pilot valves	07
Manual valves & couplings	08
Demisters	09



## Innovation

Established in 1972, LB Bentley has a wealth of experience in the design and manufacture of medium and high pressure filters and desiccant dryers for use in extreme and severe environments.

With a comprehensive range of products designed to exceed your systems demands, we are confident that you will find our equipment both innovative and at the forefront of quality, reliability and cost effectiveness.

Having outgrown its original factory, Bentley moved to a 59,000ft<sup>2</sup> (5,481m<sup>2</sup>) single-site manufacturing facility in Stroud. This has produced significant improvements in customer service and delivery. Bentley is committed to on-time delivery and technical excellence of products through the creation of pro-active and integrated planning procedures, streamlined process systems based upon a 'lean manufacturing' ethos and supply chain development. Bentley is proud to have a highly skilled and experienced workforce.

The capabilities at the Stroud facility include CNC, CMM a 3D solid modelling CAD system with a CAM implementation, high pressure test cells, a cleanroom and an R&D department with hyperbaric and environmental chambers. The facility also holds ISO 9001 and 14001 accreditation along with PED certification.

In addition, Bentley has a dedicated team of service technicians to provide aftermarket support. Bentley remains committed to the development of new products in order to maintain its position as a leading independent supplier in the sector and also to safeguard the continuity of supply to its customers.

# FILTERS & DRYERS

# Filters

## High-pressure air filters

They are constructed of carbon steel or stainless steel. The filter head can be unscrewed by hand and all filter parts can be renewed in minutes without the use of tools. All units can also be provided with manual drain valves.

They will remove moisture, oil, vapours, odours, carbon monoxide and solid particulates commonly present in ordinary compressed air. The result is high quality, clean air suitable for breathing applications that conform to BS EN 12011 standards.

## Pre-filters

Our pre-filters feature a mechanical 1 micron separator element to remove heavy condensates. The filter also has the ability to retain large quantities of solid particles without clogging.

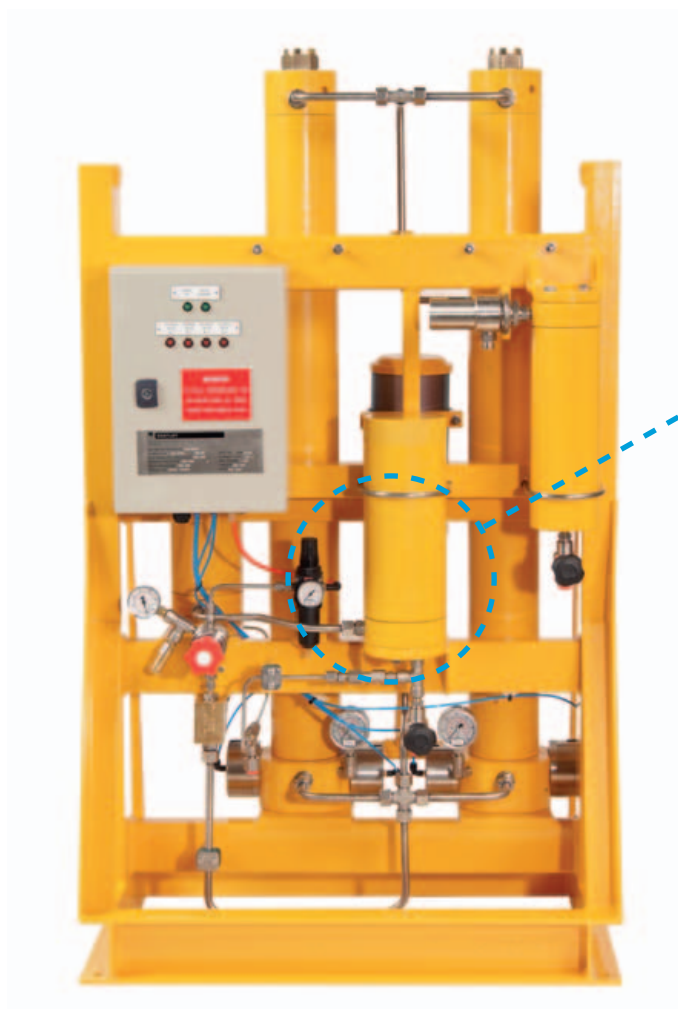
## Adsorption filters

Depending on the application, Bentley adsorption filters can be supplied as a three, four or five stage system. These stages can consist of coalescer element, activated carbon, soda lime, desiccant and catalyst media, with a final in-line filter for the removal of dust particulate.

## Particulate filters

Bentley's particulate (dust) filters are fitted with elements of various grades to remove and prevent the carry over of dust or other particles to 0.01 micron and above. This makes them ideal as an after-filter for desiccant dryers or for applications where a high standard of filtration is required.

The filter element is constructed of pleated layers of borosilicate fibres in an in-depth arrangement, which has the ability to accumulate large amounts of solid particles and resist clogging. This allows a gradual increase in pressure drop across the filter resulting in a long operational life.



High-pressure  
filtration

# Dryers

## Regenerative desiccant dryers

The market for high pressure regenerative desiccant dryers is small and specialised, requiring a high level of customised engineering combined with high skilled small batch manufacture. Bentley has spent forty years developing these qualities to meet the customers' needs.

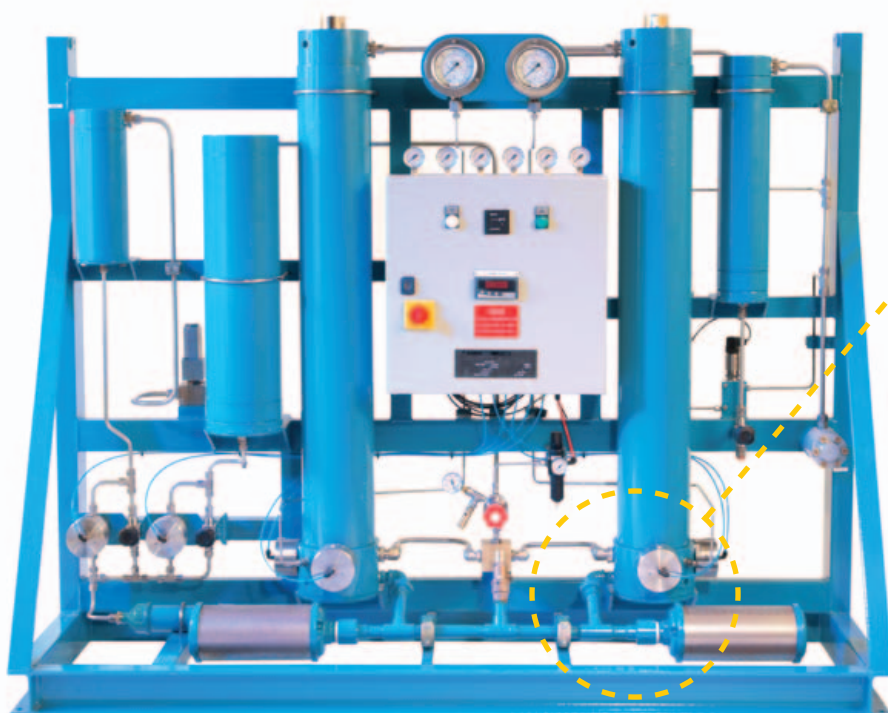
Bentley dryers are frequently packaged together with up to six stages of pre and after filtration (of our own manufacture) to meet the highest standards for air/gas quality. They are built to give many years of reliable and safe operation under the most demanding working conditions.

Bentley dryers are used extensively for numerous applications including Defence Standard 'Pure Air' for thermal imaging, medical and special gases, air blast circuit breakers, ships systems, waveguide dryers, dockside services and many other applications.

## Principle of operation

Fully automatic regenerative desiccant dryers working on the 'Pressure Swing' (heatless) method of regeneration are a highly reliable and economical way to dry compressed air and other gases to dewpoints below  $-70^{\circ}\text{C}$  measured at the atmospheric pressure. The dryers continuously dry compressed air by using two identical adsorption vessels each filled with a desiccant to adsorb water vapour. While one vessel is on-stream drying the compressed air, the other is off-stream being regenerated. The vessels are alternated on and off-stream resulting in a continuous supply of dry air.

The method of regeneration is by swinging the pressure in the adsorption vessel from the high system pressure to a low pressure just above atmospheric pressure. The desiccant is unable to retain the water at the lower pressure and gives it up to purge air which passes through the bed at low pressure in the opposite direction to the on-stream flow. The purge air, which is a small percentage of the systems air, has already been dried at high pressure. Expansion of this to the low pressure side through a factory set orifice causes it to become very dry. The very dry purge air regenerates the desiccant as it takes moisture away and carries it out of the dryer via the silencer.



**Integral Bentley  
pilot operated valves**



## Dryers (continued)

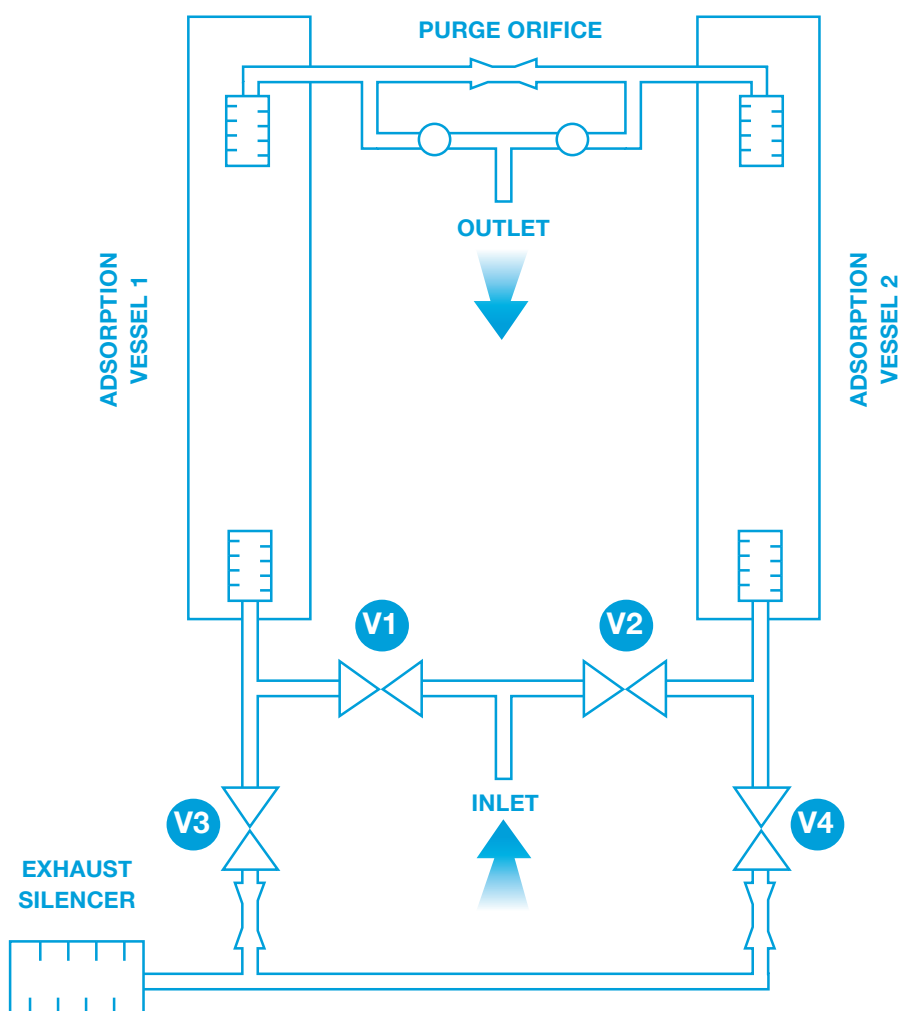
### Detailed sequence of operation

A typical dryer cycle time takes approximately 20 minutes (12 minutes for medium pressure) with the two adsorption vessels on drying duty for ten minutes each.

At the start of the cycle, both inlet Valves **V1** and **V2** are open with exhaust valves **V3** and **V4** closed. After 20 seconds **V2** will close, putting **Adsorption Vessel 1** on drying duty. Twenty seconds later **V4** will open, allowing the air in **Adsorption Vessel 2** to vent to atmosphere via the silencer thereby starting the regeneration of **Adsorption Vessel 2**. Purge air now flows from the purge orifice down through the purge valve **V4** to the silencer.

At the end of the purge period purge valve **V4** will close. Air continues to pass through the purge orifice into **Adsorption Vessel 2** until it has returned to the system working pressure. Inlet valve **V2** can now open, shortly followed by inlet valve **V1** closing to bring **Adsorption Vessel 2** on to drying duty.

Exhaust Valve **V3** will now open to start the regeneration of **Adsorption Vessel 1**. After the purge period is complete, purge valve **V3** will close and the pressure will equalise between the Adsorption Vessels so that inlet valve **V1** can again open to start the next cycle.



Regenerative dryer process

## High & medium pressure dryer features & flow rates

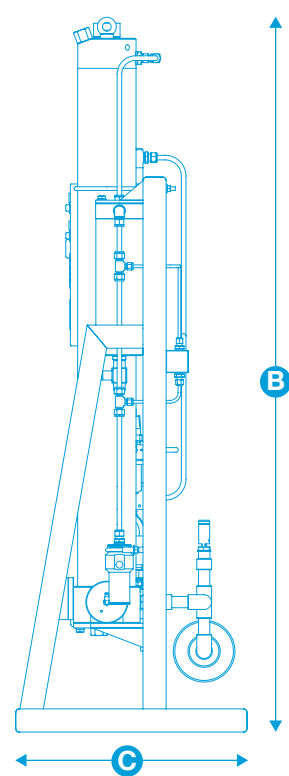
Description	High pressure 180 – 450 bar g	Medium pressure 20 – 45 bar g
Standard Model	✓	✓
Non-welded adsorption vessels made from solid bar stock	✓	X
Welded adsorption vessels comply with BS5500 & ASME VIII	X	✓
Fully-automatic operation	✓	✓
Electronic step timer giving reliable cycle control	✓	✓
Non-Ferrous high-pressure pipework connected with coaxial breakaway fittings ensures easy maintenance	✓	X
System pressure gauges on each adsorption vessel clearly indicate when they are drying or regenerating	✓	✓
Pilot air pressure gauges mounted on the control box clearly indicates which valve is open	✓	X
Indicator lights on the valve solenoids show valve status	X	✓
Robust floor-mounted steel frame	✓	✓
Fitted with high-efficiency silencers for quiet running	✓	✓
Separate fill and drain plugs for ease of desiccant replacement	✓	X
Visual mimic display showing function of dryer and valves	OPT	OPT
Pressure capacities from 180 – 450 bar g	✓	X
Pressure capacities from 20 – 45 bar g	X	✓
Auto drain system	OPT	OPT
Fitted with digital dewpoint analyser	OPT	OPT

<b>Bentley standard high pressure 180 – 450 bar g compressed air dryers</b>	Model	Capacity (m³/h) @pressure range 180 – 250 bar g	Capacity (m³/h) @pressure range 250 – 350 bar g	Capacity (m³/h) @pressure range 350 – 450 bar g
	BD 38	20	25	30
	BD 50	40	50	60
	BD 63	65	80	90
	BD 76	100	120	140
	BD 90	145	170	200
	BD 100	200	250	300
	BD 127	300	350	420
	BD 150	420	500	580

<b>Bentley standard medium pressure 20 – 45 bar g compressed air dryers</b>	Model	Capacity (m³/h) @pressure range 20 – 30 bar g	Capacity (m³/h) @pressure range 30 – 45 bar g
	BD 38	20	25
	BD 50	30	40
	BD 76	65	80
	BD 100	115	140
	BD 127	160	200
	BD 150	240	300
	BD 200	400	520

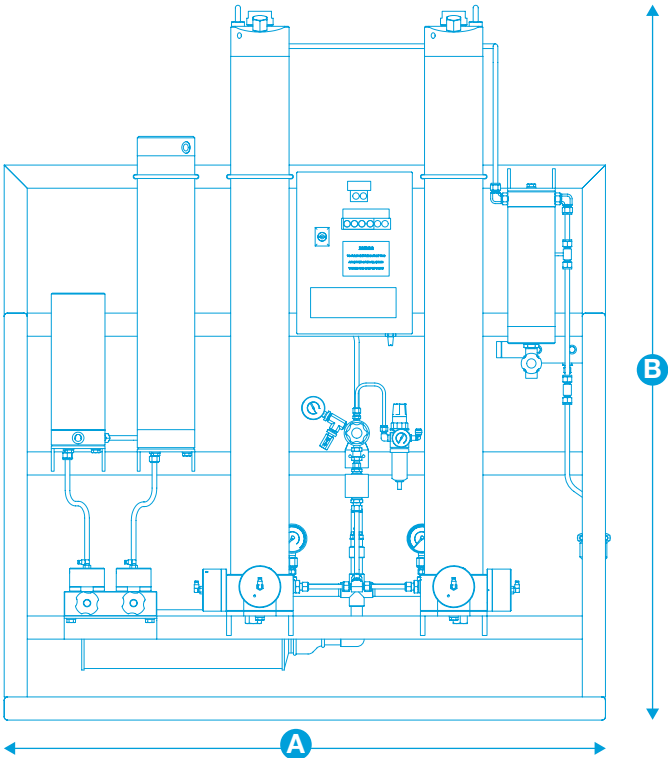
Non standard dryers for other pressures, capacities and gases are also available. Please contact us for further information.

# Standard dryer dimensions & weights



High Pressure 180 – 450 bar g	Model	A (mm)	B (mm)	C (mm)	Weight (kg)
	BD 38	750	900	210	150
	BD 50	1150	1400	450	222
	BD 63	1250	1550	450	300
	BD 76	1450	1620	550	410
	BD 90	1550	1620	550	450
	BD 100	1550	1825	550	500
	BD 127	1550	1950	610	650
Medium Pressure 20 – 45 bar g	Model	A (mm)	B (mm)	C (mm)	Weight (kg)
	BD 38	600	1000	200	90
	BD 50	650	1000	300	110
	BD 76	800	1300	400	160
	BD 100	1080	1650	560	195
	BD 127	1080	1525	560	240
	BD 150	1200	1800	700	290
	BD 200	1300	1860	700	350

We reserve the right to alter or amend specifications in this publication





# Pilot valves

## High-pressure pilot-operated stop valves

Bentley's pilot-operated stop valve was developed for use on high pressure desiccant dryers, to initially fulfil a specific MOD requirement. The compact cartridge design is ideal for manifold applications and enabled the company to supply an extremely compact, automatic dryer design for ship use.

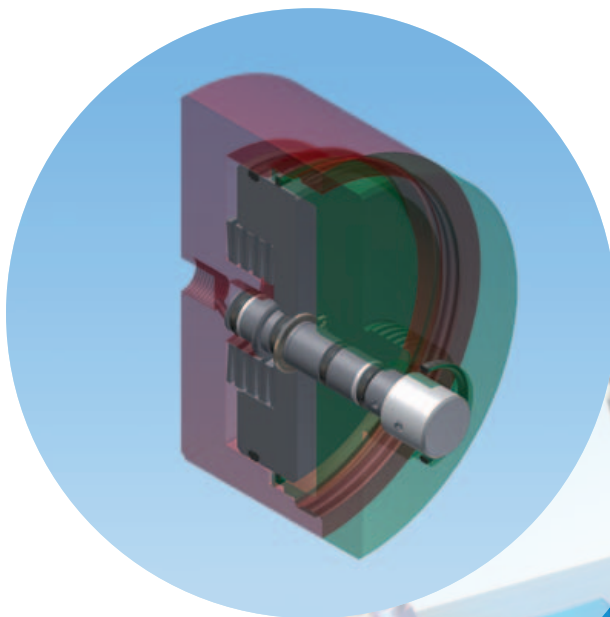
We have now standardised on this valve throughout our industrial dryer range as it offers exceptional reliability and is quick and easy to service.

This unique patented design is ideal for high pressure compressed air or gas applications and is available as a standalone valve or as a cartridge designed for manifold use.

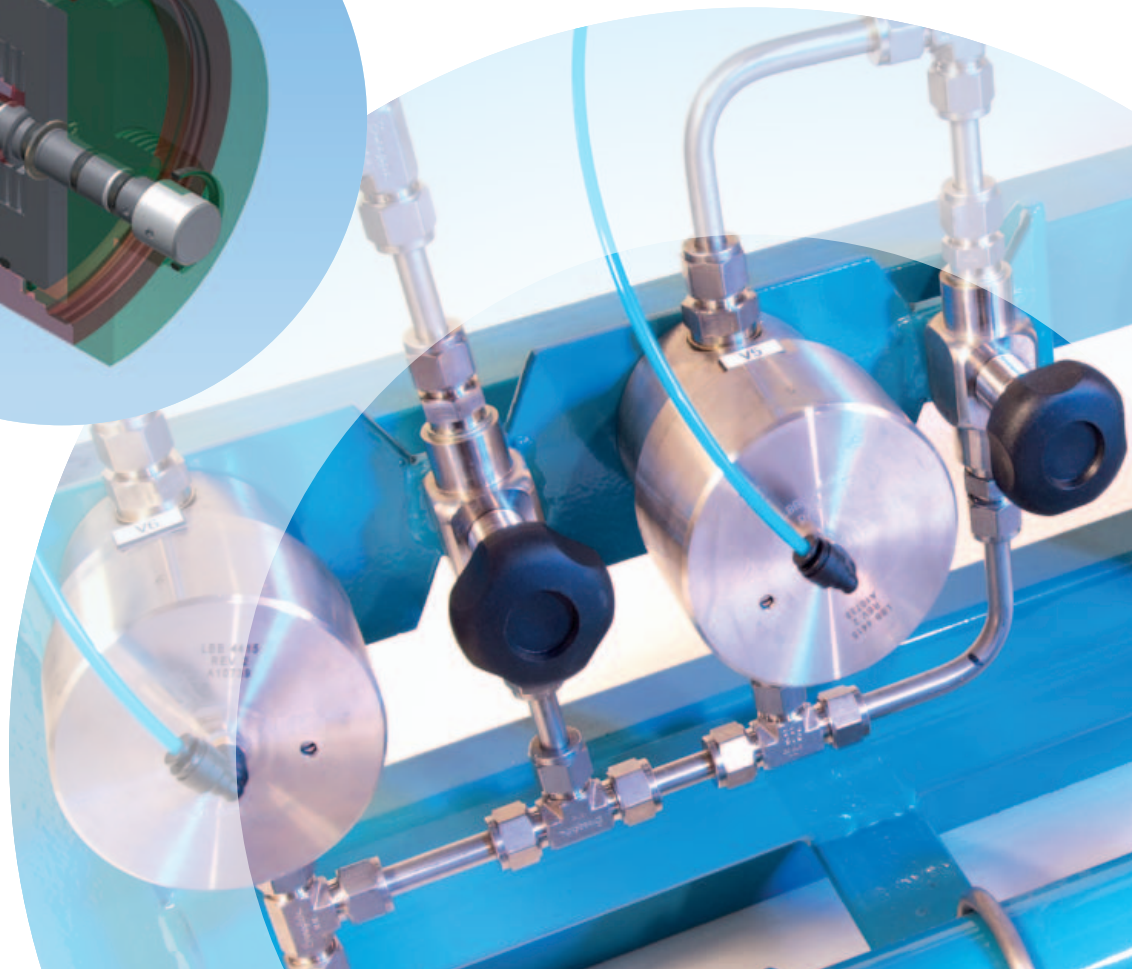
## Features

- ✓ Max. working pressure to 450 bar g
- ✓ Balanced stem design gives bubble tight shut off at all pressures
- ✓ Compact cartridge design
- ✓ Stainless steel construction
- ✓ Fail safe closed
- ✓ Visual Position Indication
- ✓ High reliability even on contaminated fluids

Cross section  
of a pilot valve actuator



Pilot valve



# Manual Valves

## Manual stop valves

Bentley's manual stop valves are manufactured in 316 stainless steel as standard. They are suitable for high-pressure compressed air and other inert gases to 414 bar g having 1/4" BSPP connections.

A simple manually-operated valve, with a seal that can be replaced without taking the body out of line.

# Couplings

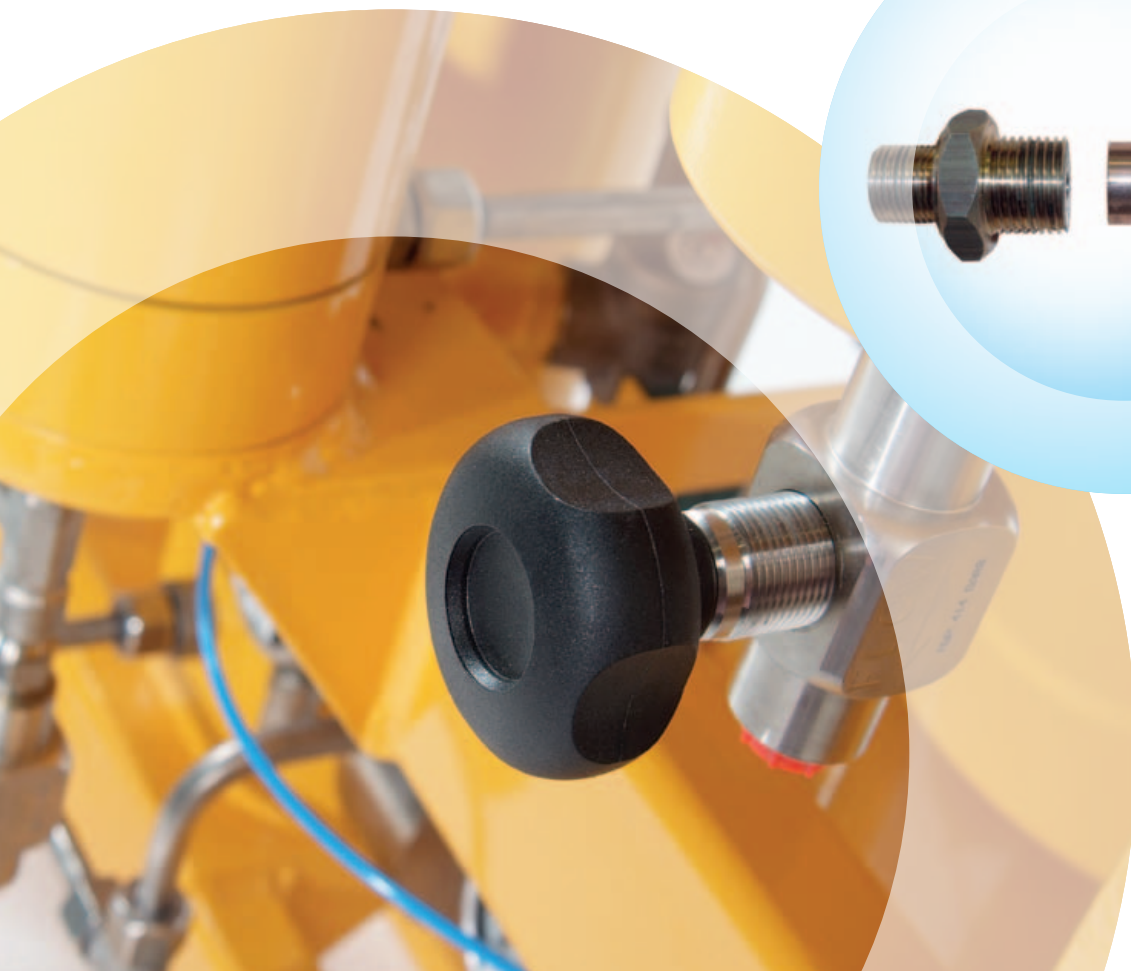
## Coaxial breakaway couplings

Bentley's coaxial breakaway couplings are suitable for high pressure compressed air and other inert gases to up to 450 bar g. Manufactured from CZ121 Brass and Phosphor Bronze, sealing of the couplings is achieved by o-rings.

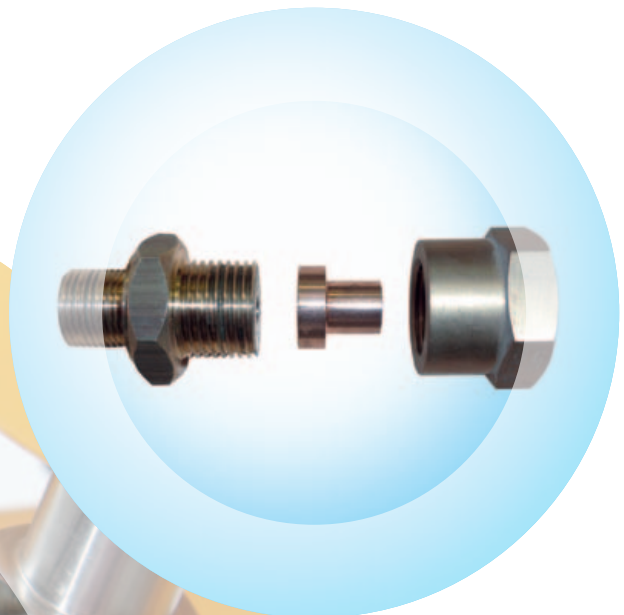
The breakaway couplings allow items, such as valves, to be removed without having to 'spring' the pipework apart making service work considerably easier.

The standard range includes nine BSP connections from 1/4" to 1" and four OD tubes from 6mm to 20mm, other connection and imperial tube sizes are also available.

Manual stop valve



Coaxial coupling



# Demisters

## Water / Oil demister filters

Bentley's water/oil demister filters incorporate unique cartridges for silencing and separating water/oil mist from low-pressure and high-pressure compressed air exhaust drainage points.

They remove virtually 100% of water/oil mist particles from air being exhausted at pressures up to 450 bar g to atmosphere. They also eliminate water/oil mist and smoke within buildings and ensure a clean working atmosphere.

The filters can be installed inside or outside buildings, allowing the use of compressed air drainage points where environmental regulations would not normally allow and provide suitable collection points for waste disposal.

They have been designed for compressed air systems where it is necessary to silence, separate and collect all condensate and sludge discharge from air compressor inter-cooler stages, after cooler, air dryers, air receivers, filters and automatic drain traps.

They are ideal for areas where cleanliness is important, where site water/oil condensates and where sludge cannot be sent direct to drains or wasted over floor area. Their special elements combine excellent liquid separation characteristics with fine filtration and a large capacity for containment of liquid condensates.

Bentley's oil demister filter vessels are constructed of Carbon Steel and are available with either a large removable top lid to allow air to be exhausted direct to atmosphere, or a flanged pipeline unit with bottom swing bolt closure for applications where the exhaust has to be piped to a suitable discharge point.

