

WILKERSON®

First incorporated in August of 1948, Wilkerson manufactures a complete line of compressed air treatment and control products to meet a wide variety of industrial, process, consumer and health care applications. Today, Wilkerson serves over 500 different industries throughout the world.

Over the years, Wilkerson facilities, manufacturing and engineering technology have kept pace with increased sales volume, the growing need to satisfy customers' specific requirements and the demands placed on production.

Wilkerson's growing leadership in the industry is due to our determined commitment to quality; quality

of products, services and people. Our dedication to the total quality management process assures our customers that we can consistently provide the highest levels of product quality and customer service required to meet their needs.

From the very beginning, Wilkerson has sold its products through a world-wide, independent distributor network. We currently have 200 distributors throughout North America, plus an expanding network of international distributors in over 40 countries. Our distributors, who have many years of experience in compressed air treatment and control, offer excellent product knowledge, technical

assistance and local inventory. As a result of representing other complimentary products, they are able to satisfy their customers' total requirements.

Today's broad line of Wilkerson products is the result of continuing product innovations and technology advancements which frequently become industry standards. Wilkerson is dedicated to designing and manufacturing innovative products with features and operating characteristics that meet customer requirements for quality, performance, reliability, serviceability, safety and value.

WARNING

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

This document and other information from The Company, its subsidiaries and authorized distributors provide product and/or system options for further investigation by users having technical expertise. It is important that you analyze all aspects of your application including consequences of any failure, and review the information concerning the product or system in the current product catalog. Due to the variety of operating conditions and applications for these products or systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems and assuring that all performance, safety and warning requirements of the application are met.

The products described herein, including without limitation, product features, specifications, designs, availability and pricing, are subject to change by The Company and its subsidiaries at any time without notice.

Offer of Sale

The items described in this document are hereby offered for sale by The Company, its subsidiaries or its authorized distributors. This offer and its acceptance are governed by the provisions stated on the separate page of this document "Offer of Sale".

Product Selection Chart

A

Compressed Air Systems

Basic Unit	Series	Port Size										Flange Size		Bowls			Elements (Micron)			Page		
		1/8	1/4	3/8	1/2	3/4	1	1-1/4	1-1/2	2	3	4	6	Poly	Metal	Metal SG	5	20	40		Adsorber	
F I L T E R S	F01		X												Aluminum Body			Std.	—	—	—	B4
	F03	X	X												X	X	—	Std.	—	—	—	B6
	F08	X	X												X	X	—	Std.	—	—	—	B8
	SF1		X												316 Stainless Steel			Opt.	Std.	—	—	E4
	F18		X	X	X										X	X	—	Opt.	—	Std.	—	B10
	F16		X	X	X										X	X	—	Std.	—	—	—	B12
	SF2				X										316 Stainless Steel			Opt.	—	Std.	—	E6
	F28			X	X	X									X	X	—	Std.	—	—	—	B14
	F26		X	X	X										X	X	—	Std.	—	—	—	B16
	F90					X	X								—	—	X	Opt.	—	Std.	—	B18
	F30					X	X								X	X	—	Std.	—	—	—	B20
	F34				X	X	X								X	X	—	Std.	—	—	—	B22
	F35							X	X	X					—	Metal w/ DPI		Std.	—	—	—	B24
	F43								X	X					—	Metal w/ DPI		Std.	—	—	—	B26
C O A L E S C I N G	M03	X	X												X	X	—	Type "B" 1.0	Type "C" 0.01	Type "D" 0.003	B30	
	M08	X	X												X	X	—	Type "B" 1.0	Type "C" 0.01	Type "D" 0.003	B32	
	SM1		X												316 Stainless Steel			Type "B" 1.0	Type "C" 0.01	Type "D" 0.003	E10	
	M18		X	X	X										X	X	X	Type "B" 1.0	Type "C" 0.01	Type "D" 0.003	B34	
	M16		X	X	X										X	X	—	Type "B" 1.0	Type "C" 0.01	Type "D" 0.003	B36	
	SM2				X										316 Stainless Steel			Type "B" 1.0	Type "C" 0.01	Type "D" 0.003	E12	
	M28			X	X	X									X	X	X	Type "B" 1.0	Type "C" 0.01	Type "D" 0.003	B38	
	M26		X	X	X										X	X	X	Type "B" 1.0	Type "C" 0.01	Type "D" 0.003	B40	
	M21			X											X	—	—	Type "B" 1.0	Type "C" 0.01	Type "D" 0.003	B42	
	F I L T E R S	M90				X	X									—	—	X	Type "B" 1.0	Type "C" 0.01	—	B44
		M30				X	X	X								X	X	—	Type "B" 1.0	Type "C" 0.01	Type "D" 0.003	B46
		M31				X	X									X	X	—	Type "B" 1.0	Type "C" 0.01	Type "D" 0.003	B48
		M32					X	X								—	—	X	Type "B" 1.0	Type "C" 0.01	Type "D" 0.003	B50
		M35							X	X						X	X	—	Type "B" 1.0	Type "C" 0.01	Type "D" 0.003	B52
		M43										X				—	X	—	Type "B" 1.0	Type "C" 0.01	Type "D" 0.003	B54
		M45										X				—	X	—	Type "B" 1.0	Type "C" 0.01	Type "D" 0.003	B56
M55											X	X		—	X	—	1.0 Micron	0.01 Micron	—	B58		

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Compressed Air Systems

Basic Unit	Series	Port Size				Bowls			Desiccant	Page
		1/4	3/8	1/2	3/4	Poly	Metal	Metal SG		
AFTERFILTERS	A18	X	X	X		X	X	X	Type "B" 5 Micron Element	B60
	A28		X	X	X	X	X	X	Type "B" 5 Micron Element	B62

Basic Unit	Series	Port Size									Spring Range									Page	
		1/8	1/4	3/8	1/2	3/4	1	1-1/4	1-1/2	2	15	25	30	40	60	125	160	180	200		250
STANDARD REGULATORS	R03	X	X								Opt.	—	Opt.	—	Std.	Std.	—	—	—	—	B80
	RB3		X								—	Std.	—	—	Std.	Std.	—	—	—	—	B82
	RA3		X								—	Std.	—	—	Std.	Std.	—	—	—	—	B82
	RA4	X	X								—	—	Std.	—	Std.	Std.	—	—	—	—	B84
	R24, R25	X	X								—	Std.	—	—	Std.	Std.	—	—	—	—	B86
	R45, R46		X	X							—	Std.	—	—	Std.	Std.	—	—	—	—	B88
	R08	X	X								—	—	Opt.	—	Opt.	Std.	—	—	—	—	B90
	R120		X	X	X	X	X				—	—	—	—	Opt.	Std.	—	—	—	Opt.	B92
	SR1		X								—	Opt.	—	—	Opt.	Std.	—	—	Opt.	—	E16
	R18		X	X	X						—	—	Opt.	—	Opt.	Std.	—	—	—	Opt.	B96
	R16		X	X	X						—	—	—	—	Opt.	Std.	—	—	—	Opt.	B98
	SR2				X						—	—	—	—	Opt.	Std.	—	—	—	Opt.	E18
	R28			X	X	X					—	—	—	—	Opt.	Std.	—	—	—	Opt.	B100
	R26			X	X	X					—	—	—	—	Opt.	Std.	—	—	—	Opt.	B102
	R90					X	X				—	—	—	—	Opt.	Std.	—	—	—	Opt.	B104
	R30					X	X	X			—	—	—	—	—	Std.	—	Opt.	—	—	B106
	R40								X	X	—	—	—	—	—	Std.	—	Opt.	—	—	B108
	R09	X	X								—	—	Opt.	—	Opt.	Std.	—	—	—	—	B114
R19			X							—	—	Opt.	—	Opt.	Std.	—	—	—	Opt.	B116	
DAIRL	R11		X							—	—	—	—	Opt.	—	Std.	—	—	—	B120	
	R21		X	X	X	X				—	—	—	Opt.	—	—	Std.	—	—	—	B122	
	R31				X	X	X			—	—	—	—	—	—	Std.	—	—	—	B124	
	R41							X	X	—	—	—	Opt.	—	—	Std.	—	—	—	B126	

Basic Unit	Series	Port Size				Spring Range										Page
		1/4	3/8	1/2	2	15	25	30	40	50	60	100	120	125	150	
PRECISION REGULATORS	P16	X	X	X	—	Opt.	—	Opt.	—	Opt.	—	—	—	Std.	—	B130
	P17	X			—	—	—	—	Opt.	—	—	—	Opt.	—	—	B132
	WRA302	X			—	—	—	X	—	—	X	X	—	—	—	B134
	WRA102	X			—	—	—	X	—	—	X	—	—	—	X	B136
	WRA102BP	X			—	—	—	X	—	—	X	—	—	—	X	B138
	WRA171	X			—	—	—	X	—	—	—	—	—	—	—	B140
	WEA632	X			—	—	—	—	—	—	—	X	—	X	—	B142
	WBA208	X			—	—	—	—	—	—	—	—	—	—	—	B144
	WBA45	X			—	—	—	—	—	—	—	—	—	—	—	B146

Product Selection Chart

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Compressed Air Systems

Basic Unit	Series	Type	Port Size									Bowls			Filling	Page		
			1/8	1/4	3/8	1/2	3/4	1	1-1/4	1-1/2	2	Poly	Metal	Metal SG				
LUBRICATORS	L01	Miniature Standard		X	X									Aluminum Body			Cannot be filled under pressure	B150
	L03	Miniature EconOmist™	X	X										X	X	—	Cannot be filled under pressure	B152
	L08	Miniature EconOmist™	X	X										X	X	—	Can be filled under pressure	B154
	L18	Compact EconOmist™		X	X	X								X	X	X	Can be filled under pressure	B156
	L16	Compact EconOmist™		X	X	X								X	X	X	Can be filled under pressure	B158
	L17	Compact AtoMist		X	X	X								X	X	X	Cannot be filled under pressure	B158
	L28	Standard EconOmist™			X	X	X							X	X	X	Can be filled under pressure	B160
	L26	Standard EconOmist™		X	X	X								X	X	X	Can be filled under pressure	B162
	L27	Standard AtoMist		X	X	X								X	X	X	Cannot be filled under pressure	B162
	SL2	Standard AtoMist				X								316 Stainless Steel			Can be filled under pressure	E28
	L90	Large EconOmist™					X	X						—	—	X	Can be filled under pressure	B164
	L30	Large EconOmist™					X	X						X	X	X	Can be filled under pressure	B166
	L31	Large EconOmist™						X						X	X	X	Can be filled under pressure	B168
	L32	Large EconOmist™						X						X	X	X	Can be filled under pressure	B170
	L40	Extra Large EconOmist™								X	X			X	X	X	Can be filled under pressure	B172
	L41	Extra Large EconOmist™								X	X			X	X	X	Can be filled under pressure	B174
L42	Extra Large EconOmist™								X	X			X	X	X	Can be filled under pressure	B176	
L50	Jumbo EconOmist™										X		X	X	X	Can be filled under pressure	B178	

Basic Unit	Series	Port Size						Bowls			Elements (Micron)			Spring Range							Page	
		1/8	1/4	3/8	1/2	3/4	1	Poly	Metal	Metal SG	5	20	40	15	25	30	50	60	125	200		250
FILTER / REGULATORS	B03	X	X					X	X	—	Std.	—	—	Opt.	—	Opt.	—	Opt.	Std.	—	—	B184
	BB3		X					X	—	—	Std.	—	—	—	Opt.	—	—	Opt.	Std.	—	—	B186
	BA3		X					X	—	—	Std.	—	—	—	Opt.	—	—	Opt.	Std.	—	—	B188
	B08	X	X					X	X	—	Std.	—	—	—	—	Opt.	—	Opt.	Std.	—	—	B190
	SB1		X					316 Stainless Steel			Std.	—	—	—	Opt.	—	—	Opt.	Std.	—	—	E22
	B18		X	X	X			X	X	X	Std.	—	—	—	—	Opt.	—	Opt.	Std.	—	Opt.	B190
	SB2				X			316 Stainless Steel			Std.	—	Opt.	—	—	—	—	Opt.	Std.	—	Opt.	E24
	CB6		X	X	X			X	X	X	Std.	—	—	—	—	—	Opt.	—	Std.	—	—	B192
	PC6		X	X	X			X	X	X	Opt.	—	Std.	Opt.	—	Opt.	Opt.	—	Std.	Opt.	—	B194
	B28				X	X	X	X	X	X	Std.	—	—	—	—	Opt.	—	Opt.	Std.	—	Opt.	B196
B90					X	X	—	X	X	Std.	—	Opt.	—	—	—	—	Opt.	Std.	—	Opt.	B198	

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Compressed Air Systems

Basic Unit	Series	Port Size						Bowls			Elements (Micron)			Spring Range						Page		
		1/8	1/4	3/8	1/2	3/4	1	Poly	Metal	Metal SG	5	20	40	15	25	30	50	60	125		200	250
COMBINATION THREE UNIT	D03	X	X					X	X	—	Std.	—	—	Opt.	—	Opt.	—	Opt.	Std.	—	—	B202
	D08	X	X					X	X	—	Std.	—	—	—	—	Opt.	—	Opt.	Std.	—	—	B204
	C87		X	X	X			X	X	X	Std.	—	—	—	—	—	Opt.	—	Std.	—	—	B206
	D18		X	X	X			X	X	X	Std.	—	—	—	—	Opt.	—	Opt.	Std.	—	Opt.	B208
	D28			X	X	X		X	X	X	Std.	—	—	—	—	Opt.	—	Opt.	Std.	—	Opt.	B210
	D90						X	—	—	X	Std.	—	Opt.	—	—	—	—	Opt.	Std.	—	Opt.	B212
	C03	X	X					X	—	—	Std.	—	—	Opt.	—	Opt.	—	Opt.	Std.	—	—	B216
	C08	X	X					X	X	X	Std.	—	—	—	—	Opt.	—	Opt.	Std.	—	—	B218
	C18		X	X	X			X	X	X	Std.	—	—	—	—	Opt.	—	Opt.	Std.	—	Opt.	B220
	C16		X	X	X			X	X	X	Std.	—	—	—	—	—	Opt.	—	Std.	—	—	B222
	C28			X	X	X		X	X	X	Std.	—	—	—	—	Opt.	—	Opt.	Std.	—	Opt.	B224
	C26		X	X	X			X	X	—	Std.	—	—	—	—	—	—	Opt.	Std.	—	Opt.	B226
	C31					X	X	X	X	—	Std.	—	—	—	—	—	—	Opt.	Std.	—	—	B228
	C90						X	—	—	X	Std.	—	Opt.	—	—	—	—	Opt.	Std.	—	Opt.	B230

Basic Unit	Series	Port Size				Bowls			Desiccant			Page
		1/4	3/8	1/2	3/4	Poly	Metal	Metal SG				
DESICCANT	DD10	X				Disposable Polycarbonate			—	—	Non-Toxic	F13
	X06	X				X	—	—	Silica Gel	4A Molecular Sieve	Non-Toxic	F16
	X03	X				X	X	—	Silica Gel	4A Molecular Sieve	Non-Toxic	F18
	X04	X		X		X	X	—	Silica Gel	4A Molecular Sieve	Non-Toxic	F18
	X25			X		—	X	—	Silica Gel	4A Molecular Sieve	Non-Toxic	F20
	X08	X				X	—	—	Silica Gel	—	—	F21
	WDAS					—	—	—	DRYFIL [®] MS desiccant and a 1µm particulate filter			F22
	WTW					—	—	—				F27
MEDRYER TRANS	MSD		X	X		—	X	—	Modular Membrane			F31

Compressed Air Systems

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Compressed Air Systems

Air Treatment and Control Components

Compressed air is an essential power source for most industries today. It is a safe operation, relatively inexpensive to operate and very reliable. However, compressed air is susceptible to various types of contamination which not only reduces its value as a power source, but can seriously affect the performance of other pneumatic equipment and, therefore, productivity.

Air valves, air cylinders, logic control systems and air tools can malfunction due to air-borne contamination. Air intended for air-gauging, air conveyors, spray painting, instrumentation, automation and food processing can be rendered unusable. Poor product quality and system shutdown due to compressed air contamination can occur frequently. There are many other problem areas associated with compressed air contamination, as numerous companies in differing industries can attest to.

With today's technology, an efficient, cost-effective compressed air system can be designed to provide years of reliable service if the proper air treatment and control equipment is installed. Operating and maintenance costs can be

significantly lowered by removal of most contaminants (dirt, rust, pipe scale, oil aerosols, liquid water and water vapor, microscopic particles and oil vapor). With a well-designed air system and the use of quality air treatment and control products, you can realize extended service life of components, increased flow capacity with minimum pressure loss and improved production efficiencies in your manufacturing processes.

Air Treatment and Control

To take the fullest advantage of the benefits that can be derived from using compressed air, it must be correctly and adequately prepared. Clean, dry, regulated air is the corner-stone of an efficient air system. Where necessary, lubricated air may be required to provide dependable operation and satisfactory service life of certain air tools and components.

Dryers

All atmospheric air contains some water vapor. When the air is compressed, the water content for a given volume of air increases. Because of the effects of compression, most of this water

vapor turns into damaging liquid water in your air system. Additionally, as air flows through the compressed air line system, the water vapor condenses in the pipeline. This moisture in the pipeline results in rust, scale, clogged orifices, malfunctioning of pneumatic controls, and increased wear of moving parts as it washes away the lubricant.

Compressed air dryers reduce the water vapor concentration and can prevent further liquid water formation in air lines. Liquid water and water vapor removal increases the efficiency of air operated equipment, prevents corrosion and clogging, extends the service life of pneumatic components, prevents air line freeze-ups and reduces product rejects.

For more detailed information on Dryers, refer to Section F.

Filters

Air-borne contamination from the atmosphere, such as dust, water vapor and hydrocarbons enter the air system through the compressor intake. The contaminants, usually 4 million particles per cubic foot, can easily pass through a typical compressor intake filter since over 80% of these particles are less than 2 microns in size. The compressor

also contributes to the problem with wear particles, oil vapor and fine aerosols that leak past glands and seals from the oil sump into the compression chamber.

Such contamination in the air system can effect the efficient operation of various pneumatic devices and, over time, damage them. Compressed air filters that are installed upstream of the air devices will remove most of these contaminants. In addition, by design these filters will also remove most liquid water from the air line.

The need for higher quality air is more evident today than in the past. To gain improved production efficiencies through automation, more sophisticated, technically advanced pneumatic equipment and instrumentation is being used throughout industry. Due to the critical nature of these applications, the need for extremely clean, virtually oil free air is required. Coalescing (oil removal) and oil vapor removal filters should be used for applications requiring high quality air.

Regulators

All pneumatic devices are designed to provide optimum performance and service life at a specific air

pressure. While it is feasible to operate these devices at pressures in excess of the manufacturer's recommended operating conditions, it is not advisable to do so.

Operating at higher pressures can cause excessive wear and damage to the device. Further, operating your compressed air system at a higher-than-required pressure wastes energy and is not cost-effective.

To obtain the best operation and service life of your pneumatic equipment use the proper pressure level recommended by the manufacturer. A regulator (pressure control valve) is normally used to reduce and maintain a downstream pressure while the amount of air required to the device may vary with the demand.

Filter / Regulators

The integral Filter / Regulator units combine all the functions and features of a filter and a regulator, as discussed above, into one compact, high performance, space-saving unit.

Lubricators

Getting the proper lubrication to the proper device at the proper time is

fundamental to preventative maintenance, longer service life and increased productivity. The efficiency of air motors, control valves, cylinders and other air actuators can be greatly enhanced when the proper amount of lubrication is supplied.

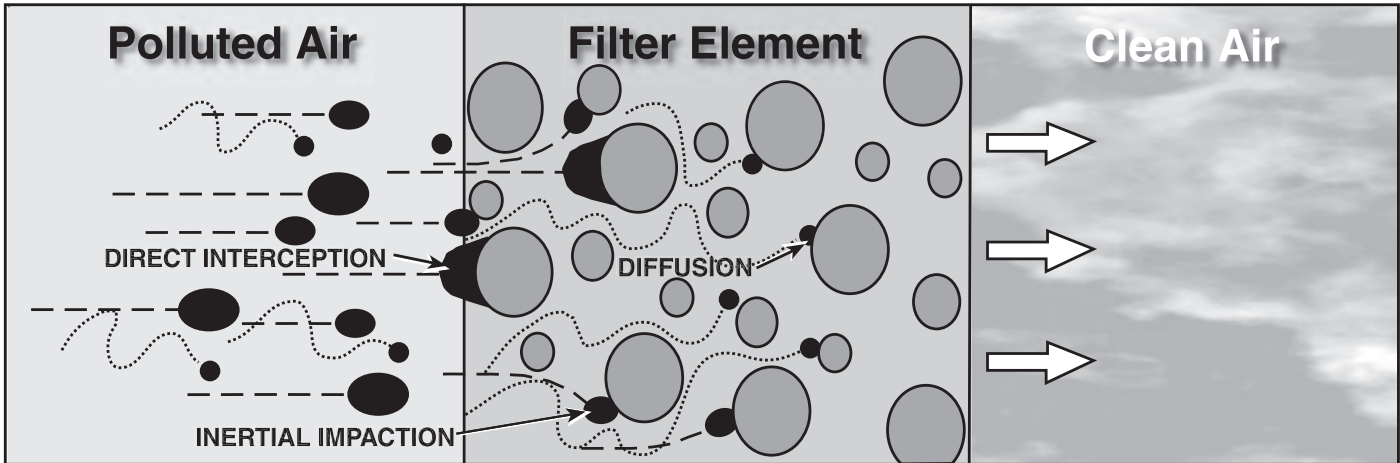
Air line lubricators are specifically designed to generate and introduce an oil aerosol (mist) into the compressed air flow. The air flow then carries the oil to the pneumatic devices where the lubricant mist coats the moving and sliding surfaces thus reducing friction and wear.

To provide satisfactory lubrication to your air devices most lubricators have a proportional delivery system. This feature automatically provides a nearly constant oil-to-air ratio over a wide range of air flows.

Filter Technology – Mechanisms of Filtration

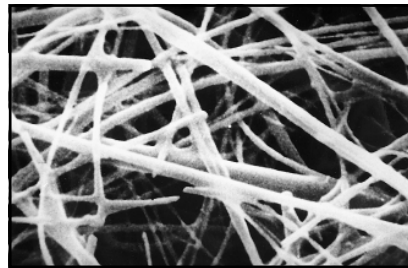
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Compressed Air Systems



Coalescing Filters

Essentially, coalescing filters (Type B, B1 and C) rely on what is known as mechanical filtration for their effectiveness. The main mechanisms of mechanical filtration are direct interception, inertial impaction and diffusion. Electrostatic attraction can have some bearing although the efficiency of Wilkerson coalescing filters is not dependent on this mechanism.



Above: Clean borosilicate microfiber seen at a magnification factor of 3900. Right: The same filter material in a contaminated state at the same degree of magnification.



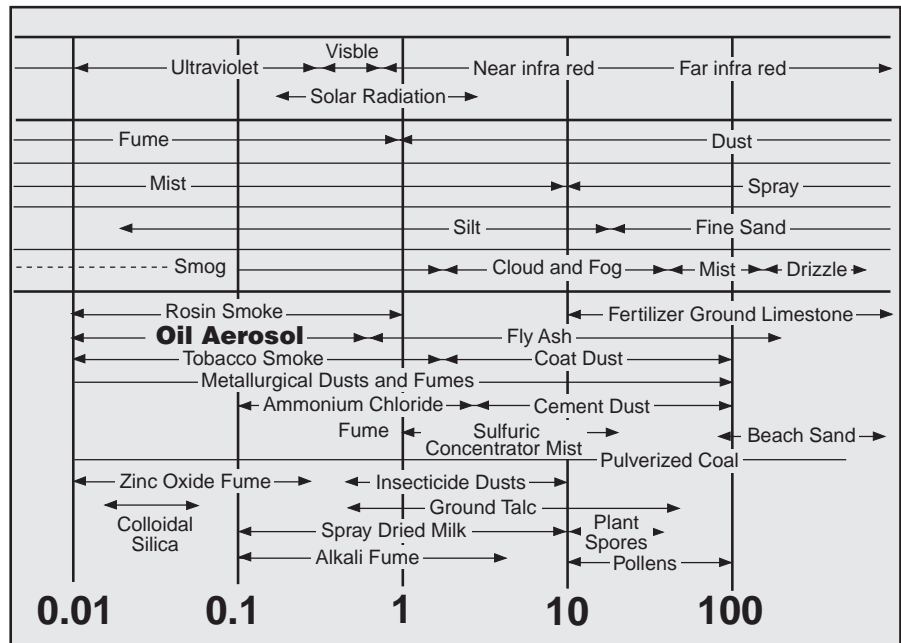
When all mechanisms are combined and utilized by a deep bed of the correct type of filter material, removal of virtually all particles whether liquid or solid, is achieved.

Direct Interception occurs when a particle collides with and adheres to a fiber of the filter material without deviating out of the streamline flow. This mechanism tends to take place on the surface of the filter material and affects mainly larger particles over 1 micron in size.

Inertial Impaction occurs when a particle is unable to follow the tortuous path around the filter fibers and eventually collides with and adheres to one of the fibers. Typically affecting particles in the 0.3 micron -1 micron size range.

Diffusion or Brownian Movement, as it is sometimes called, occurs with extremely small particles which tend to wander within the gas stream, increasing their chances of colliding with and adhering to a fiber. This usually affects particles below 0.3 micron in size. A degree of overlap takes place with the mechanisms, the extent varying on the conditions.

Pollution Size Chart



To assist in understanding the parameters of filtration, refer to this pollution size comparison chart. Look at the size of a major contaminant, **oil aerosol!** It is in the region of 0.01 - 0.8 micron. Tobacco smoke is also

a liquid aerosol in a similar size band 0.01 -1.2 micron. Observe the smoke test yourself, appreciate the size of the problem! The smallest particle the human eye can see is in the order of 40 microns.

Particulate Filters

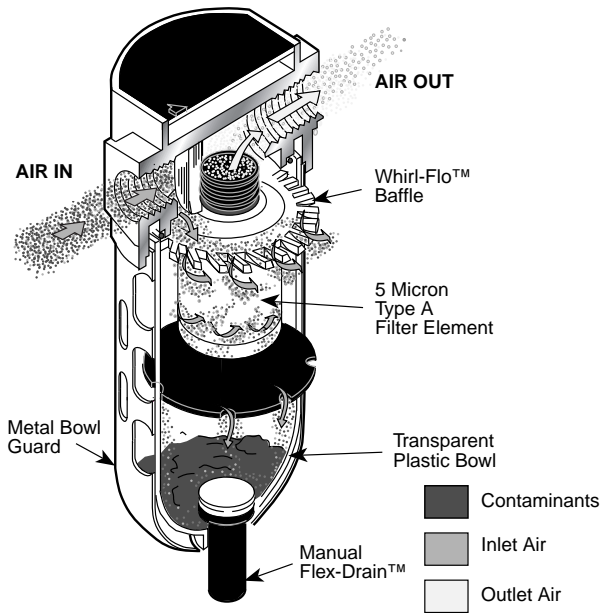
For the removal of solid particle contaminants down to 5 microns and the separation of bulk liquids.

This type of filter is generally used in industrial applications where liquid water and oil, and harmful dirt particles must be removed from the compressed air system. This type of filter should also be used as a prefilter for the Coalescing (oil removal) filter.

Operation

Wet and dirty inlet air is directed downward and outward in a circular pattern by the turbine-shaped upper baffle. This action mechanically separates a large amount of the liquid and gross particles, which then flow down the inside of the bowl, past the lower baffle, into the quiet zone to be drained away. The quiet zone baffle prevents the contaminants from re-entering the air flow stream.

The partially cleansed air then passes through the filter element. By utilizing depth filtration, the 5 micron filter media provides superior filtration, exceptional service life and minimum pressure drop.



Coalescing Filters (Oil Removal)

Specifically designed for the removal of solid particles, water and oil aerosols down to 0.01 micron. Maximum remaining oil content of air leaving the filter down to 0.01ppm at 70°F (21°C) at a pressure of 100 PSIG (6,9 bar g) using a typical compressor lubricant. Two filter element grades are offered to better meet your air quality requirements.

Grade B and B1 filter elements are used for most air coalescing applications where the removal of liquid aerosols and submicronic particles for general air quality is required.

Protection of components such as air valves, cylinders, as well as air conveyors, air gaging, air bearings, air control circuits and paint spraying equipment are examples of specific end-use applications. This grade of filter element should be used as a *prefilter* for the *Grade C* coalescing filter.

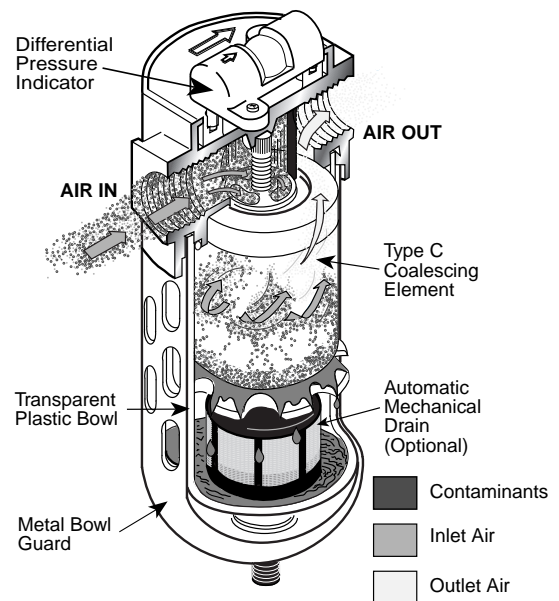
Grade C high-efficiency filter elements are used where the removal of extremely fine particulate and virtually “oil-free” or high quality air is necessary. Specific end-use applications are protection of critical air control circuits, air logic systems, flow and temperature controllers, food processing, electronics, health care and film processing. This grade of filter element should be used as a *prefilter* for the *Grade D* oil vapor removal filter.

Operation

The filter element design utilizes a borosilicate micro fiber that provides superior filtration efficiency, quick draining and minimum pressure drop. Unlike standard particle filters, air flow is inside to out. The compressed air / gas passes through the inner layer of the filter element which acts as an integral pre-filter to remove large contaminants. This gives protection to the layer of high efficiency filter material which substantially removes submicronic aerosols and solids from the air flow stream. Solid particles are permanently trapped within the filter media.

The fine liquid particles, including aerosols, after initially being trapped by the fibers of the filter media, begin to collect or coalesce forming larger droplets. These droplets, along with other large droplets present, are pushed to the outer surface. Here, the anti-re-entrainment barrier collects the droplets as they break free from the micro fiber and allow them to gravitate within its cellular structure forming a “wet band” around the bottom of the element.

Clean filtered air / gas passes through the anti-re-entrainment barrier above the “wet-band” where the resistance to flow is less, leaving a quiet zone of no air / gas movement in the bottom of the filter housing. The separated liquid drops from the bottom of the filter element and falls through the, without being re-entrained, to the bottom of the filter housing where it collects to be removed by a drain.



A
Compressed Air Systems

Oil Vapor Filters

A

Compressed Air Systems

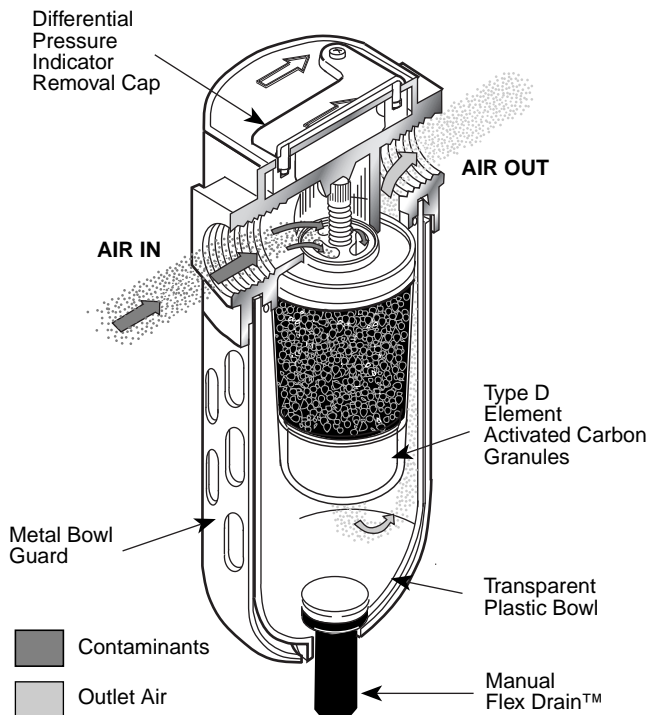
Activated carbon element for the removal of oil vapor and oil associated odors. Maximum remaining oil content of air leaving the filter is 0.003 ppm at 70°F (21°C) at a pressure of 100 PSIG (6,9 bar g). For the *Grade D* filter element, two types of designs are used depending on the size and flow capacity of the filter housing.

An oil vapor filter is used, in conjunction with a *Grade C* filter element, where the application requires very high air quality. Typical applications are food processing and packaging, pharmaceutical, fermentation, electronics and semi-conductor, and critical air control.

Operation

While the *Grade B, B1 and C* filter elements can remove extremely fine liquid and solid particles, they cannot remove gaseous contaminants such as oil vapor or odors. To do this you must employ the physical phenomena of adsorption. Activated carbon, having an affinity for oil vapor molecules and with an extremely high surface area, created by its capillary structure, is used.

Our activated carbon *Grade D* filter elements are designed to maximize the adsorption properties of the carbon. This is achieved by first passing the air through carbon granules located either in an annular space or tubular section. The granules provide a very high ratio of surface area to volume, and when arranged in a deep bed, increases the dwell time of the air flow. This type of design provides the benefit of both high efficiency and longer service life of the activated carbon.



Differential Pressure Indicator (DP2, DP8)

The Wilkerson direct mounting Differential Pressure Indicator is equipped standard on most Coalescing Filter models. It provides a maintenance free means of determining the service life of the filter element. With a new filter the indicator shows all green, and progresses to a full red indication a 7-8 PSID, indicating the element should be changed. The magnified indicator can be easily seen from the top or either side of the filter, and with only one moving part will provide reliability and long life.

The Differential Pressure Indicator cannot be retrofitted to Wilkerson filters ordered without it. It is available as a replacement accessory kit.

Note: The maximum operating pressure for metal or plastic bowls with this Indicator is 150 PSIG. The maximum operating temperature is 150°F for metal bowls and 125°F for plastic bowls.

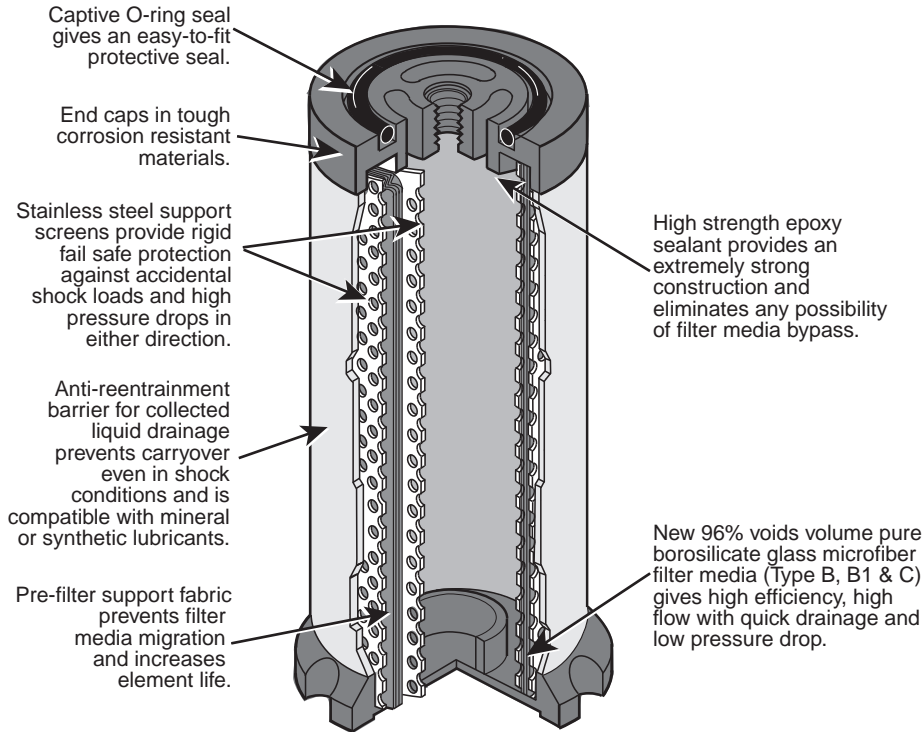
DP3 Differential Pressure Gauge

The Wilkerson direct mounting Differential Pressure Gauge (non-pressurized face) is standard on all mainline filters and it is available as an accessory in kit form. With a scale reading to 20 PSID (1370 m bar dp) the gauge gives a quick indication of the status of the filter element in the filter. The gauge provides a reliable method to help ensure that the filter element is changed at the most economical and convenient time.

Coalescing Elements Features and Benefits

Type B, B1 & C

A
Compressed Air Systems

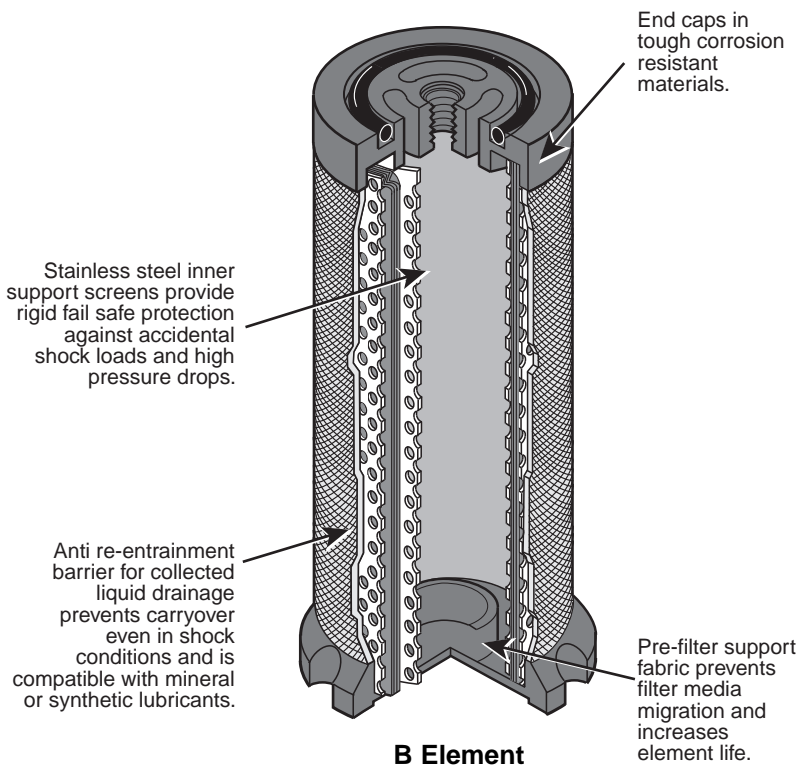


B1 and C Element

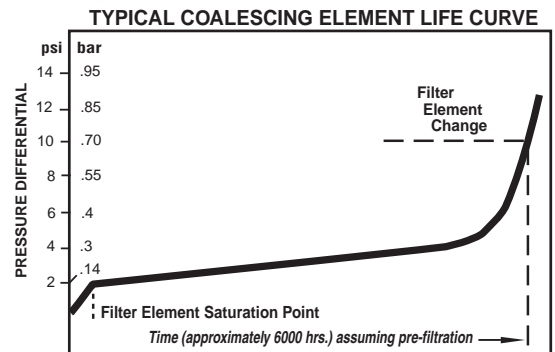
How The Elements Work

Using the principles of mechanical filtration, the filter media removes the solid particles first in the pre-filter support layers and then in the actual filter media. These particles remain permanently trapped and gradually cause an increase in pressure drop. The liquid particles similarly collected coalesce together forming larger droplets and as the flow is inside to out, are pushed to the outer surface. Here, the anti-reentrainment barrier prevents them from being introduced back into the airstream and instead drains them through its cellular structure to the bottom of the element. The resultant "wet-band" on the bottom of the element, in presenting a high pressure drop area, ensures that the filtered air passes through the upper portion of the element. This creates a "quiet zone" in the bottom of the filter through which the liquid falls to the bottom of the filter bowl and is drained away via the automatic drain.

As mentioned earlier, solid particles cause the pressure drop to slowly increase throughout the working life. Initially, during the period to reach an equilibrium saturation, as determined by the upstream liquid contamination concentration, the pressure drop rises sharply as shown below. This is a typical pressure drop versus time characteristic for a coalescing filter. The end of useful and economic service life is indicated by an accelerating increase in pressure drop. The element should be replaced every 12 months or 6000 working hours under normal working conditions.



B Element



Adsorption Elements Features and Benefits

Type D

A

How The Elements Work

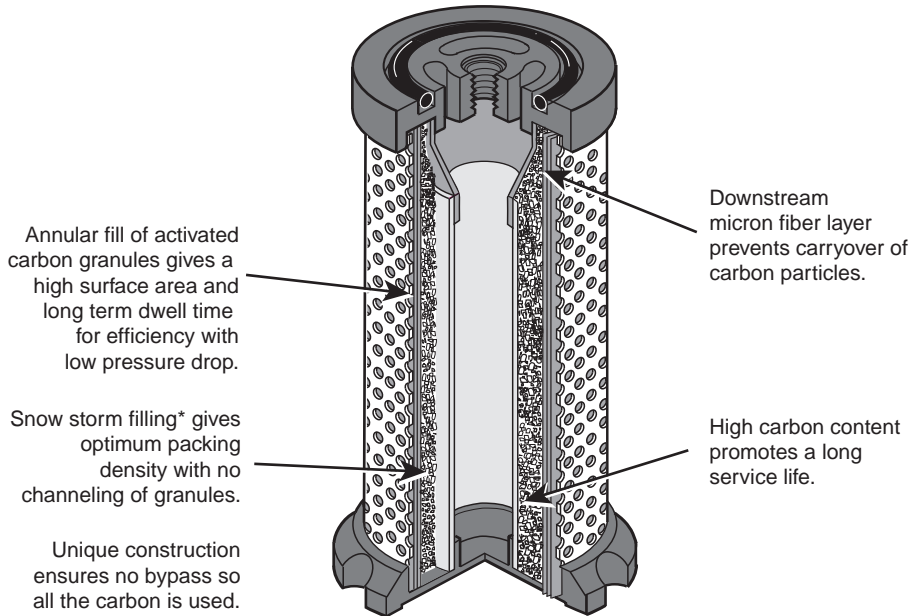
While mechanical filtration employing the Type C element is capable of removing extremely fine liquid or solid particles even as small as 0.01 micron it cannot remove gaseous contaminants such as oil vapor or odors. To do this we must employ the physical phenomena of adsorption. Activated carbon, having an affinity for oil vapor molecules and with an extremely high surface area, created by its capillary structure, is used for this.

Wilkerson activated carbon elements are designed to maximize the adsorption properties of the carbon. This is achieved by first passing the air through carbon granules, snow storm filled* into either an annular space or tubular section. The granules provide an extremely high surface area to volume and when arranged in a deep bed that increases dwell time gives the benefit of both efficiency and service life. After being passed through the carbon, the air goes through a layer of microfiber to prevent migration of fine carbon particles downstream.

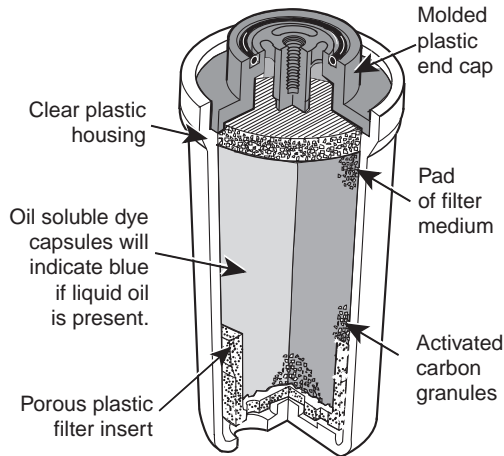
Adsorption elements have a limited life and this is affected by many factors but principally temperature. Obviously, the higher the inlet temperature, the more oil vapor there is present, for example at 104°F (40°C) there is more than ten times the oil vapor than at 70°F (21°C). For this reason, activated carbon filters are best installed at the lowest possible system temperature. The type C filter should always precede a Type D filter.

The typical life of an adsorption element is in the region of 1000-2000 hours at 70°F (21°C). Filtration temperature is based on tests carried out on a Chlorobenzene test rig, however, this is best determined in practice by a routine "odor" check.

Oil vapor has a distinct odor. The least expensive and very effective way to check for oil vapor getting through the filter is to install a small bleed valve downstream. Periodically crack this valve and smell the air. The human nose is extremely sensitive to oil vapor and at the first hint of this odor, change the element.

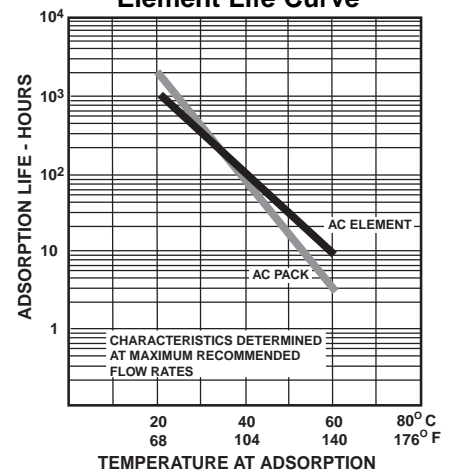


D Element (AC Element)



D Element (AC Pack)

Typical Adsorption Element Life Curve



Type B Filter Element Specifications

Efficiency

99.97% when tested with 0.3 micron aerosol DOP test Federal Standard 209B. Compatible with mineral and synthetic oils.

Residual Oil

0.5 ppm / wt (inlet temperature / pressure 70°F / 100 PSIG) when analyzed using infra red spectrophotometry based on the Pneurop 6611 procedure.

Air Quality Class *

Conforms to ISO 8573 Class 3 or better

Flow

Inside to outside

Filter Media

Resin impregnated borosilicate glass microfiber

Support Structure

Inner 304 Stainless Steel support cylinder with outer polymeric sleeve.

End Caps

Glass filled polyamide material

Initial Differential

Pressure Dry — 1.5 PSID

Initial Differential

Pressure Wet — 2.5 PSID

Flow Range — 5 to 4800 SCFM @ 100 PSIG

Application

Installations as a coalescing prefilter for general purpose protection or as a prefilter to a high efficiency coalescer.

Appearance

White polymeric outer sleeve with black end caps.

* "M" Series Coalescing Filters, with **Type "B" 0.5 micron elements:** All Wilkerson Type "M" Oil Removal (Coalescing) Filters with Type "B" 0.5 micron elements **exceed ISO Class 2** for maximum particle size and concentration of solid contaminants, and **exceed Class 3** on maximum oil content (ppm / wt).⁵

Type C Filter Element Specifications

Efficiency

99.99998% when testing with 0.3 micron aerosol on dioctyl phylate (DOP) test according to Federal Standard 209B. Compatible with mineral and synthetic oils.

Residual Oil

0.01 ppm / wt (inlet temperature / pressure 70°F / 100 PSIG) when analyzed using infra red spectrophotometry based on the Pneurop 6611 procedure.

Air Quality Class *

Conforms to ISO 8573, better than Class 1

Flow

Inside to outside

Filter Media

Pure borosilicate glass microfiber with a mean strand diameter of 0.5 micron and a voids volume of 96%. Contains no glues or resins.

Support Structure

Inner and outer 304 Stainless Steel support cylinders.

End Caps

Glass filled polyamide material

Initial Differential

Pressure Dry — 1.25 PSID

Initial Differential

Pressure Wet — 2.25 PSID

Flow Range — 5 to 4800 SCFM

Application

Install where highest quality air is required; typically instrumentation, process air, pneumatic gauging, paint spraying, etc.

* "M" Series Coalescing Filters, with **Type "C" 0.01 micron elements:** All Wilkerson Type "M" Oil Removal (Coalescing) Filters with Type "C" 0.01 micron elements **exceed ISO Class 1** for maximum particle size and concentration of solid contaminants, and **exceed Class 1** on maximum oil content (ppm / wt).⁵

Type D Filter Element Specifications

Efficiency

Less than 0.003 ppm / wt maximum remaining oil content (inlet temperature / pressure of 70°F / 100 PSIG) when analyzed using infra red spectrophotometry based on the Pneurop 6611 procedure; removal of hydrocarbon vapors and odors.

Air Quality Class *

Conforms to ISO 8573, better than Class 1

Flow

Inside to outside

Filter Media

Snow storm filled activated carbon for optimum packing density and life.

Support Structure

Model M03 - M28: Clear plastic housing with molded plastic end cap. Integral outlet filter.

Model M30 - M45: Inner and outer 304 Stainless Steel support sleeve cylinders

End Caps

Glass filled polyamide material

Initial Differential

Pressure Dry — M30 - M31: 3 PSID
M32 - M45: 1 PSID

Flow Range — 5 to 4800 SCFM

Application

Installation after high efficiency coalescer for process air purification, odor removal, removal of trace vapors and for critical applications.

* "M" Series Absorption Filters, with **Type "D" activated carbon elements:** All Wilkerson Type "M" Absorption Filters with Type "D" activated carbon elements **exceed ISO Class 1** on maximum oil content (ppm / wt).⁵

Afterfilters

A

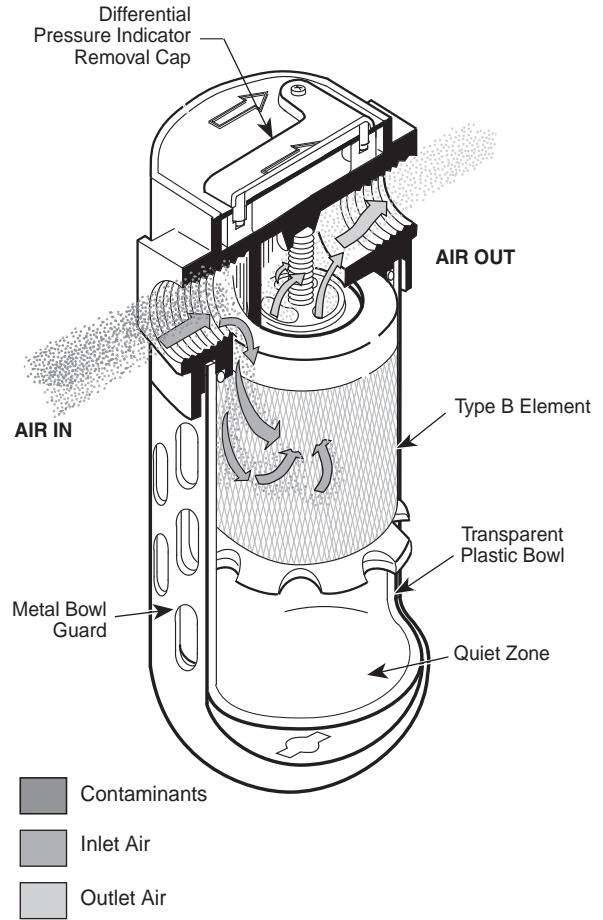
Compressed Air Systems

For the removal of solid particles down to 0.5 micron.

The Afterfilter is designed for use in “dry” systems where it provides efficient removal of desiccant dust and other solid contaminants downstream of various types of desiccant air dryers. These solid contaminants, if not removed, can damage sensitive downstream instruments and critical air controls.

Operation

The inlet air is directed downward and outward in a circular pattern. This action mechanically separates a large amount of gross particles which fall to the bottom of the housing. The air then passes through the filter media bed where a significant number of smaller solid particles and other contaminants are trapped within the filter media.



ISO 8573.1 System Ratings

ISO 8573.1

System Quality Class Rating Applications

1.	3.7.4	Air Tools, Air Motors
2.	1.4.1	Automated Equipment, Robotics, Rough Paintings
3.	1.4.1	Injection Molding, CNC, Electronics
4.	1.2.1 or 1.1.1	Semi-Conductors, Instrumentation
5.	1.2.1 or 1.1.1	Food Processing, Hospital Grade, Breathing Air

Applying condensate management systems, dry air storage and flow controllers.

ISO 8573.1 Quality Class

Quality Class	Solid Contaminants (max. particle size in microns)	Max. Pressure Dew Point °F	Max. Oil Content (droplets, aerosols & vapor) ppm
1	0.1	-94	0.01
2	1	-40	0.1
3	5	-4	1
4	15	37.4	5
5	40	44.6	25
6	—	50	—
7	—	not specified	—

AF Series Afterfilters, with Type “B” 0.5 micron elements: All Wilkerson Type “AF” Afterfilters with 0.5 micron elements **exceed** ISO Class 2 for maximum particle size and concentration of solid contaminants, and **exceed** Class 3 on maximum oil

Filter Types

All filters and filter elements are suitable for use in either compressed air or nitrogen applications.

Wilkerson Types B, B1, and C filters are made of materials acceptable in processing of compressed air as defined by regulations of both the United States and Canadian Departments of Agriculture.

Type A General Purpose Filter

Specifications

Particle removal down to 5.0 microns. Separation of liquid water and aerosols > 95% at rated flows. Separation of bulk liquid only.

Purpose

For removal of solid contaminants and bulk liquids. The Type A can be used alone as a general purpose filter or as a pre-filter for Types B, B1 and C elements to extend their service life.

"F" Series Filters, Type "A" 5 micron elements: All Wilkerson Type "A" 5 micron elements meet or exceed ISO Class 3 for maximum particle size and concentration of solid contaminants.⁵

Type AF Prime Efficiency Filter

Specifications

Solid particle removal down to 0.5 micron. Retention on DOP test > 99.97%.^{*2} Designed for use in "dry" systems.

Purpose

For removal of desiccant dust and other solid contaminants downstream of Twin Tower or other desiccant air dryers.

"AF" Series Afterfilters, with Type "B" 0.5 micron elements: All Wilkerson Type "AF" Afterfilters with 0.5 micron elements exceed ISO Class 2 for maximum particle size and concentration of solid contaminants, and exceed Class 3 on maximum oil content (ppm / wt).⁵

Type B1 Prime Efficiency Coalescer

Specifications

Particle removal down to 1.0 micron. Maximum downstream remaining oil content 0.5 ppm / wt^{*1}. Retention on DOP test > 99.97%.^{*2} "B1" Prime Efficiency Coalescing Filters meet ISO Class 2 for maximum particle size and exceeds Class 3 for maximum oil content (ppm / wt).⁵

Purpose

For removal of aerosols and solid particles. Is used in coalescing filter models M32 through M55. Can be used alone as a coalescing filter or as a pre-filter to the Type C elements to extend their service life. Usage proves most economical when preceded by a Type A filter.

Type B Prime Efficiency Coalescer

Specifications

Particle removal down to 0.5 micron. Maximum downstream remaining oil content 0.5 ppm / wt^{*1}. Retention on DOP test > 99.97%.^{*2}

Purpose

For removal of aerosols and solid particles. Can be used alone as a coalescing filter or as a pre-filter for the Type C elements to extend their service life. Usage proves most economical when preceded by a Type A filter.

"M" Series Coalescing Filters, with Type "B" 0.5 micron elements: All Wilkerson Type "M" Oil Removal (Coalescing) Filters with Type "B" 0.5 micron elements exceed ISO Class 2 for maximum particle size and concentration of solid contaminants, and exceed Class 3 on maximum oil content (ppm / wt).⁵

Type C Extremely High Efficiency Coalescer

Specifications

Particle removal down to 0.01 micron. Maximum downstream remaining oil content 0.01 ppm / wt^{*1}. Retention on DOP^{*2} and Sodium Flame Test ₃ > 99.9999% (limit of measurability).

Purpose

For removal of extremely fine oil mists, oil aerosols and microscopic particles. The Type C is extremely efficient in the coalescing of remaining oil mists and oil aerosols as well as the retention of solid particles. It is recommended the Type C filter be installed downstream of a Type A and / or Type B or B1. This is very cost effective as it prevents build up of solid contaminants on the Type C element and extends service life.

"M" Series Coalescing Filters, with Type "C" 0.01 micron elements: All Wilkerson Type "M" Oil Removal (Coalescing) Filters with Type "C" 0.01 micron elements exceed ISO Class 1 for maximum particle size and concentration of solid contaminants, and exceed Class 1 on maximum oil content (ppm / wt).⁵

Type D Critical Application Adsorption Filter

Specifications

Activated carbon element for removal of oil vapor and associated odors whether petroleum or synthetic base. Maximum downstream remaining oil content 0.003 ppm / wt.⁵

Purpose

For elimination of oil vapor, oil associated odors whether petroleum or synthetic base. Type D elements utilize selected grades of activated carbon and rely on adsorption to remove oil associated vapor and odors. The Type D Filter should be used as the final filter for critical applications. It should always have a Type C Filter element installed upstream to remove oil aerosols and solids particles.

Note: The Type D element will not remove carbon dioxide, carbon monoxide, ethane, methane or other toxic gases.

"M" Series Adsorption Filters, with Type "D" activated carbon elements: All Wilkerson Type "M" adsorption filters with Type "D" activated carbon elements exceed ISO Class 1 on maximum oil content (ppm / wt).⁵

Applications Notes

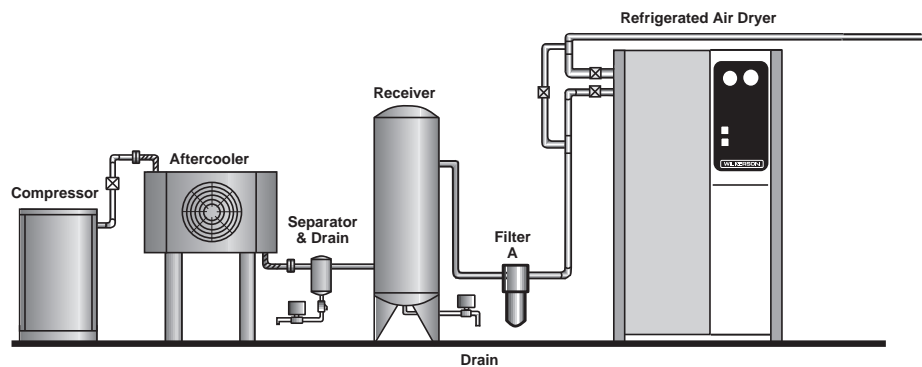
- 1) Based on a compressed air temperature of 7°F (21°C) at 100 PSIG (6.9 bar g) with a typical compressor lubricant using the Pneurop1 Recommended Test Method No. 6611 / 1984 PART 2. For further information contact Wilkerson. 1 mg/m³ is approximately 0.83 ppm / wt. (parts per million by weight).
- 2) Dioctyl phthalate test generates particles with mean diameter of between 0.1 and 0.3 micron (most difficult size to remove) based on USA Federal Standard 209B.
- 3) Sodium Flame Test using particles with a mean diameter of 0.65 micron based on British Standards Institute BS3928.
- 4) Filtration at a high temperature, although possible, increases the risk of gaseous contaminants condensing downstream. At temperatures above 122°F (50°C), the amount of water and oil vapor increases significantly and is more difficult and costly to remove.
- 5) All classes above refer to international standards organization (ISO) standard 8573-1, pertaining to maximum particle size and concentration of solid contaminants, and maximum oil content.

When Making Your Selection

- 1) Generally, install filters downstream of aftercoolers / separators and air receivers at the lowest temperature point and as close to the point of application as possible. This reduces the chance of additional water and oil vapor condensing after the filter.
- 2) Filters should not be installed downstream of quick opening valves and should be protected from possible reverse flow or other shock conditions.
- 3) It may be necessary to install a combination of mainline filtration near the compressor installation before entry to the main air distribution system as well as installing terminal filtration at the critical application points. Remember, especially in existing installations, the contamination already in the pipe system downstream of the filters will take a long time to disappear and probably never will completely.
- 4) Purge all lines leading from the filters to the final application to be protected.
- 5) Install filters in a vertical position ensuring that there is sufficient room below the filters to facilitate element change.
- 6) Provide a facility to drain away collected liquids from the filter drains via properly sized tubing, taking care there are no restrictions in the drain line.
- 7) Install Wilkerson differential pressure gauge or pop-up indicator to monitor the pressure drop across the filters. This will provide an easy way of visually monitoring the filter element condition, indicating when to replace the element.
If you have a problem on filter selection or installation, please contact your local Wilkerson stocking distributor. Wilkerson and their representatives will be pleased to help you in selecting the proper installation for your application requirements.
- 8) For piping convenience and to minimize air system disruptions, we recommend piping the system with by-pass circuits and isolation valves.

General Purpose Protection

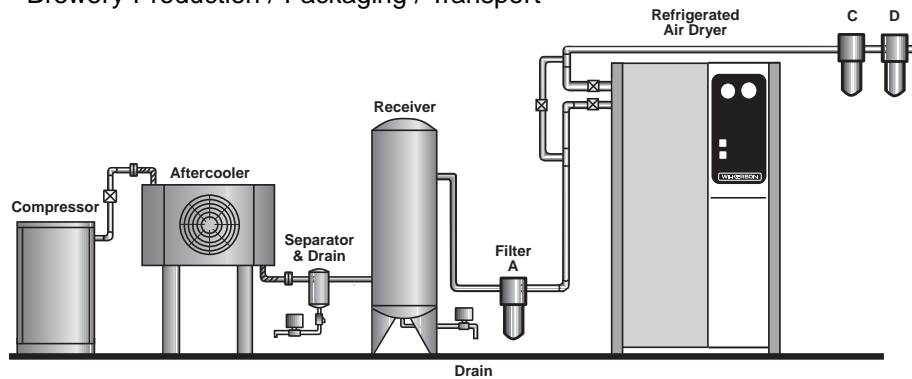
- General Compressed Air System Protection
- Liquid and Solid - Bulk Contamination Removal
- Particle Removal in "Dry" Systems
- Large Pneumatic Tools
- Shot-blasting Air
- Low Cost Automation—cylinders and valves
- Pre-Filtration for Refrigeration Air Dryers
- Pre-Filtration to High Efficiency Dryers
- Pre-Filtration to Adsorption Air Dryers in "Oil-Free" Systems
- Pre-Filtration to Air Sterilization Filters in "Oil-Free" Systems
- High Speed and / or Miniature Pneumatic Tools
- Air Gauging
- Air Conveying
- Air Motors
- Pipeline Purging
- Pre-Filtration to Adsorption Air Dryers in Oil Contaminated Systems
- Pre-Filtration to Air Sterilization Filters in Oil Contaminated Systems



Critical Applications — Clean and “Oil-Free”

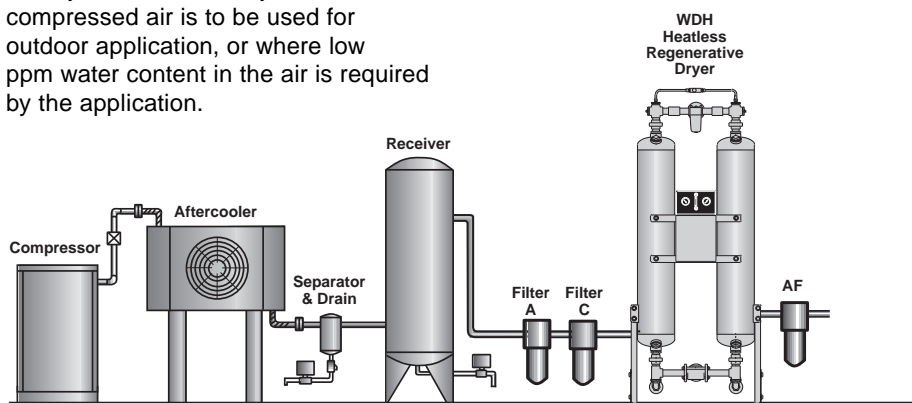
Where dew point is not required to be less than 36-40°F (2.2-4.4°C). Ambient temperature should not be below 45°F (7.2°C). For example, interior of factories.

- Highest Quality - Clean, Oil and Odor Free Air
- Blow Molding of Plastic e.g. P.E.T. Bottles
- Film Processing
- Critical Instrumentation
- Advanced Pneumatics
- Air-Blast Circuit Breakers
- Decompression Chambers
- Cosmetic Production
- Foodstuffs Production / Packaging
- Pharmaceutical Production
- Dairy Production / Packaging / Transport
- Brewery Production / Packaging / Transport
- Robotics
- Air Logic
- Instrumentation
- Air Bearings
- Spray Painting
- Temperature Control Systems



Extremely Low Dew Point System

Where dew point must be below 32°F (0°C). For example, indoor factory installation of dryer, but where compressed air is to be used for outdoor application, or where low ppm water content in the air is required by the application.



When Making Your Selection

Always try to obtain as much information as possible including flow rates, inlet pressure, temperature and pipe size.

Select filtration air quality required to the application to be protected. Remember, it is better to over-specify than not provide enough protection.

Select size of filters by flow rate and inlet pressure at the point of filtration. Also keep in mind pressure drop, if this is critical it may be advisable to oversize the filters. Generally, for operating costs, it is best never to undersize filters. The higher pressure drop caused by undersizing actually increases system operating cost.

Be careful to consider working pressure drops. Although all filters start dry, in time they become wetted with liquid (a normal condition) and this increases pressure drop. Select filters for the highest flow rate and lowest working pressure they will operate under.

Check the pipe size of the installation. If possible, match pipe sizes. This may involve increasing the size of the filter. Never reduce the pipe size of the installation to match the filter. The restriction caused by this is expensive in terms of pressure drop and operating costs and is ongoing. Increasing the size of the filter on the other hand reduces pressure drop and increases the time between element changes. This more than offsets the initial higher costs.

How You Read Flow Charts

A

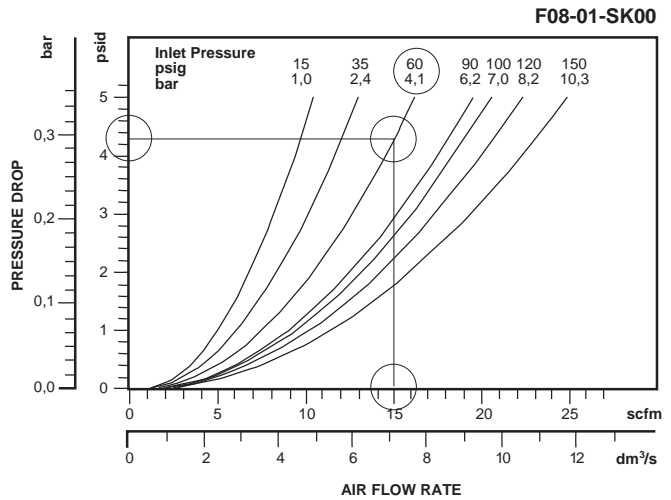
Compressed Air Systems

Using Filter Graphs

- 1) From the graph select one of the inlet pressure curves to be used. 35 PSIG, 60 PSIG, etc.
- 2) Decide upon the air flow rate requirement for this application. (Refer to the horizontal air flow rate scale located at the bottom of the graph.)
- 3) To find the initial pressure drop draw a vertical line from the flow rate selected to a point where it crosses the inlet pressure curve. From this intersection draw a horizontal line to where it intersects the vertical pressure drop scale.

EXAMPLE:

At 15 SCFM flow rate and 60 PSIG inlet pressure, pressure drop is about 4.3 PSID.



Using Regulator Graphs

NOTE: Regulator graphs are based upon an inlet pressure of 100 PSIG.

Maximum flow capacity is measured at a point that is 75% of the initial secondary pressure setting. * (NFPA)

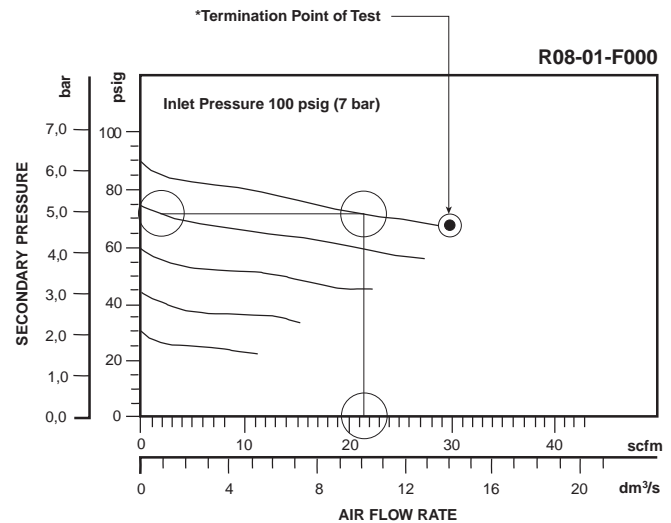
EXAMPLE:

Inlet Pressure = 100 PSIG,

Secondary Pressure @ 0 SCFM = 90 PSIG,
 Secondary Pressure @ 21.5 SCFM = 75 PSIG,
 Pressure Drop @ 21.5 SCFM = 15 PSID.

- 1) Using a graph selected by product family and pipe size pick the secondary pressure curve that fits
- 2) Determine the air flow rate required from the air flow rate scale located at the bottom of the graph.
- 3) To find the pressure drop for this regulator draw a vertical line from the air flow rate selected to a point where it crosses the secondary pressure curve. From this intersection draw a horizontal line to where it intersects the vertical secondary pressure line. This is the secondary pressure at the flow rate selected to determine full pressure drop. Subtract this pressure from the original secondary pressure used.

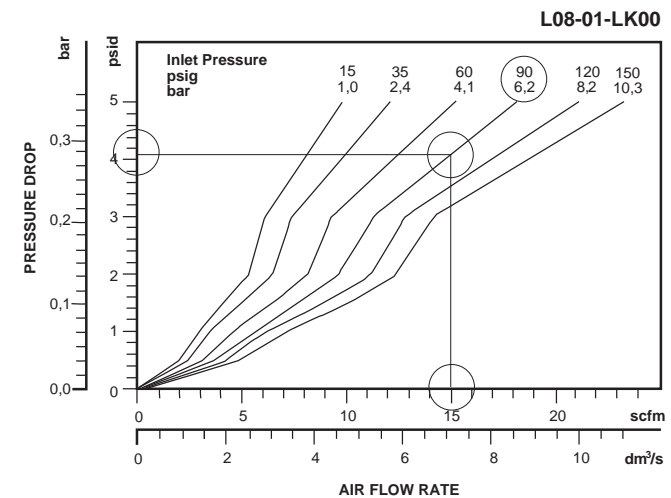
The Difference = Pressure Drop



Using Lubricator Graphs

- 1) From the graph select one of the inlet pressure curves to be used. 35 PSIG, 60 PSIG, etc.
- 2) Decide the air flow rate requirement for this application. (Refer to horizontal air flow rate scale located at the bottom of the graph.)
- 3) To determine pressure drop draw a vertical line from the flow rate selected to the point where it crosses the inlet pressure curve used. From this intersection draw a horizontal line to where it intersects the vertical pressure drop scale.

NOTE: Pressure drop value should not be less than 0.8 PSID.



Regulators

General Purpose

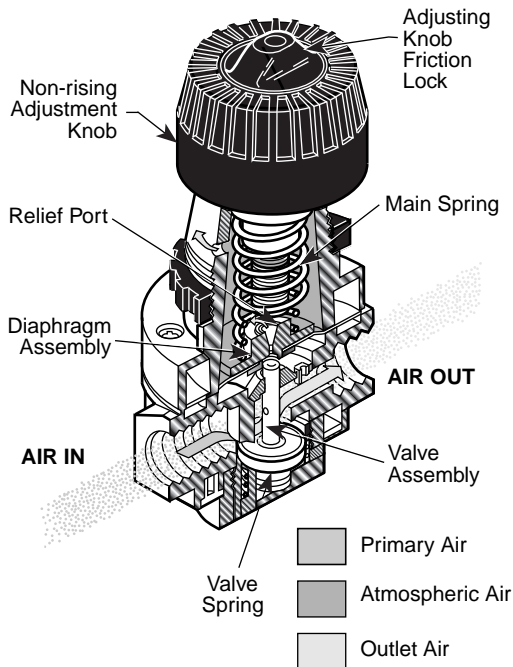
Used to provide a convenient and low cost method to reduce a supplied air pressure to a desired outlet pressure and transform a fluctuating air supply to a relatively constant reduced air pressure within the operating range of the regulator.

This type of regulator is generally used in a wide variety of applications where reduced pressure is highly desirable for energy conservation, safety requirements, air circuit control and air instrumentation.

Operation

Turning the adjusting knob clockwise forces the main spring downward onto the flexible diaphragm which presses down onto the valve stem. The diaphragm and valve stem move downward forcing the balanced valve off its seat, which allows air to flow past the valve to the outlet side of the regulator and downstream to the air system. A precisely positioned aspirator tube communicates secondary pressure to the diaphragm resulting in instant compensation in order to maintain the desired secondary set pressure.

The diaphragm, valve stem and valve move upward, compressing the regulating main spring. Upward movement stops when the spring force acting on the diaphragm balances the pressure force acting below the diaphragm. For best performance, regulated pressure should always be set by increasing the pressure up to the desired setting.



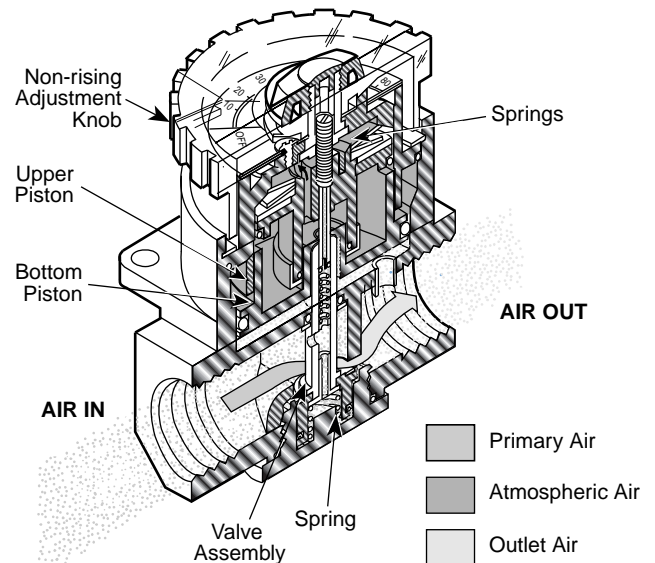
Dial-Air™ Pilot

The Dial-Air™ Pilot is a constant bleed, piston operated regulator. The pilot controlled pressure reducing valve provides exceptionally high air flow with steady pressure control and minimal secondary pressure drop. The non-rising adjustment knob provides quick selection of the desired secondary pressure in less than one full turn. The adjustment knob also can serve as the pressure indicator thereby eliminating the need for a pressure gauge.

This regulator is specifically designed for applications requiring more accurate air circuit control, high air flow capacity with flat performance curves and quick regulator adjustment. The regulator can be used as a conventional regulator for standard air circuits or as a pilot regulator to provide pressure to the control chamber of a pilot operated (slave) regulator.

Operation

To set the regulator, turn the large dial adjustment knob to the desired secondary set pressure. This opens the pilot valve seat allowing air flow into the control chamber which forces the lower piston downward against the relief seat and opens the main valve. At the same time, the air in the control chamber forces the upper piston upward against Belleville springs which closes the pilot valve seat when the set pressure is attained. Secondary pressure in the chamber is now balanced against the control pressure through the lower piston. If demand flow increases, the constant control pressure will force the lower piston and the main valve further downward, and allow more flow downstream. A higher than desired secondary pressure will force the lower piston upward, closing the main valve seat and opening the main relief valve seat thereby allowing air to relieve to the atmosphere. For best performance, regulated pressure should always be set by increasing the pressure up to the desired setting.



A
Compressed Air Systems

Regulators

A

Compressed Air Systems

Precision Regulator

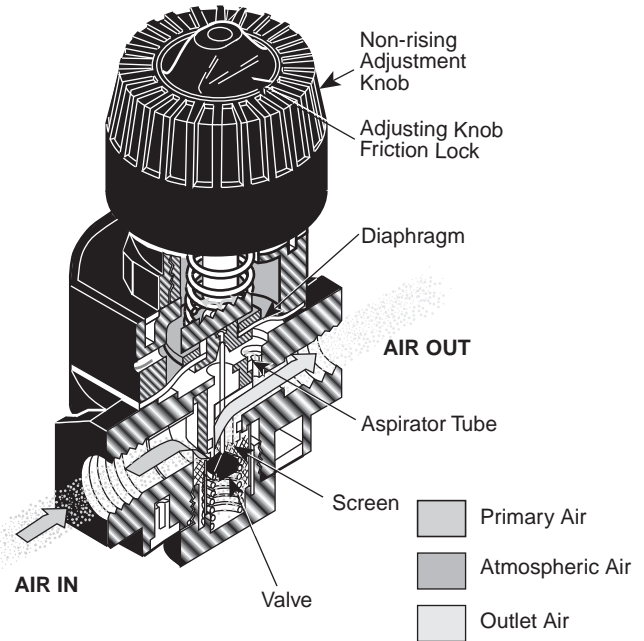
For use in applications that require reliable performance and accurate pressure control. This type of regulator is generally used for material handling systems, flow and temperature controllers, critical air control circuits, medical and scientific test equipment, and valve positioners.

Operation

Set the desired secondary pressure by turning the adjustment knob clockwise. This action increases the regulating spring force against the top of the diaphragm disc. When the spring force above exceeds the air pressure beneath the diaphragm, it is transmitted by the valve stem and opens the valve. Airflow through the regulator now occurs.

A precisely designed and positioned aspirator tube constantly transmits the secondary pressure to the under side of the diaphragm so that during flow conditions any pressure loss can be quickly compensated for. When flow is no longer required, the outlet pressure increases slightly, allowing the diaphragm to rise, the valve to close, and set pressure to be maintained.

On self-relieving models, if outlet pressure should increase above the set pressure, the diaphragm will rise therefore opening the relief seal between the diaphragm and the valve. The excess outlet pressure is then vented through the diaphragm orifice into the bonnet and subsequently to the atmosphere through an orifice in the bonnet. For best performance, regulated pressure should always be set by increasing the pressure to the desired setting.



Lubricators

EconOmist™

The EconOmist™ lubricators inject an oil aerosol into the flowing air stream to automatically provide the proper amount of internal lubrication to air operated tools or other pneumatic devices.

Operation

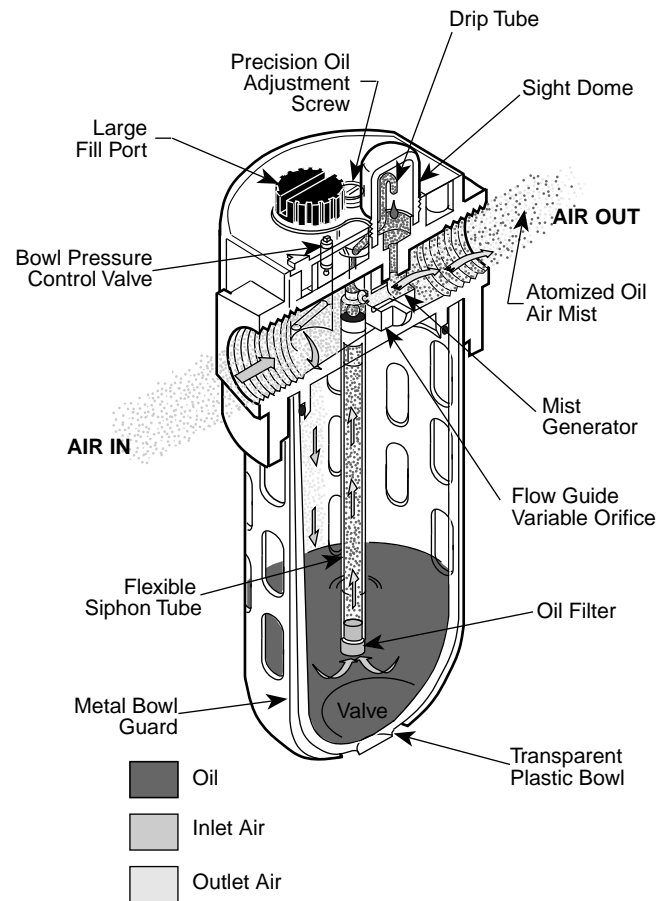
For proper operation there must be line pressure in the reservoir bowl. As the air flows through the lubricator, some of the incoming air passes through the bowl pressure control valve that then pressurizes the bowl pushing oil upward through the siphon tube. Most of the air flow passes through the self-adjusting Flow-Guide® flow sensor in the lubricator throat creating a slight pressure drop that is proportional to the rate of air flow. The pressure drop is sensed by the sight dome and across the adjustment needle valve allowing oil to flow upward through the siphon tube into the sight dome where it drips into a nozzle passage and then into the lubricator throat.

The precise amount of oil to be delivered to the air stream is determined by the oil adjusting needle valve that sets the exact drip rate.

The oil drops are atomized by the high velocity air flowing through the lubricator. All of the drops visible in the sight dome are delivered downstream to the air devices.

The self-adjusting flow sensor automatically maintains a constant oil-to-air ratio by opening and closing in response to a wide range of changing air flows. A check valve keeps the siphon tube full of oil during periods of no flow and prevents oil carry-over due to the possibility of reverse flow.

The pressurizing valve controls the rate of bowl pressurization and allows depressurization for refilling the unit without shutting off the supply air. When the oil fill plug is loosened, a spring loaded, normally closed 2-way valve closes, allowing the air pressure in the bowl to be gradually reduced. When the fill plug is replaced, the bowl repressurizes through the pressure control valve. Upon initial use, or if unit has been run dry, open oil adjustment wide open until no air bubbles are visible in sight dome. Then, reset oil feed adjustment to desired setting.



A

Compressed Air Systems

Lubricators

AtoMist™

A

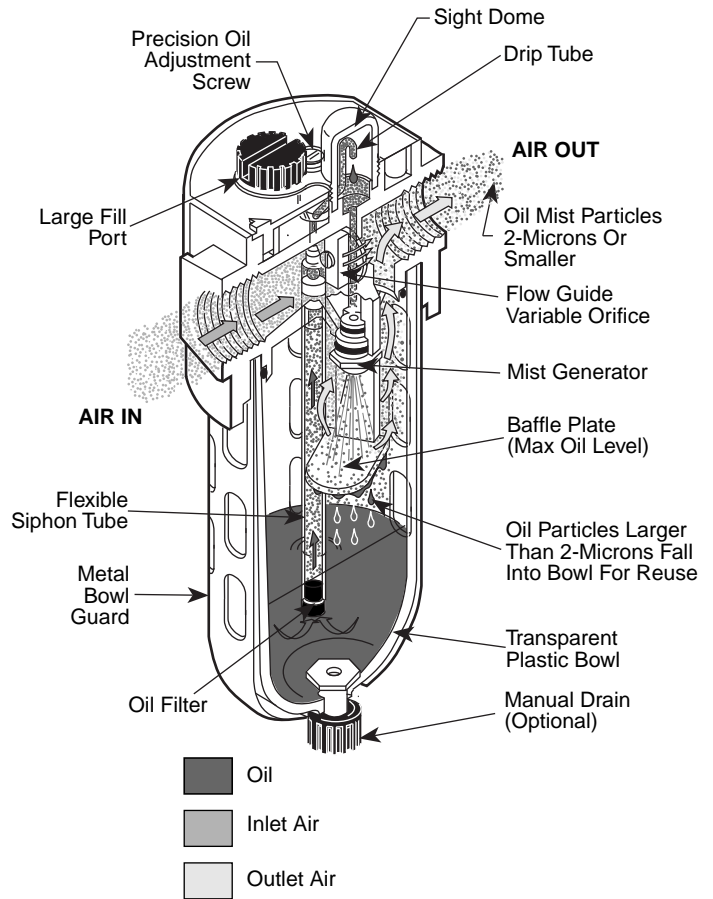
Compressed Air Systems

The AtoMist™ lubricators inject a micro-mist of oil into the flowing air stream to automatically provide the correct amount of internal lubrication for air tools and other pneumatic devices. This type of lubricator can be precisely adjusted to a very low oil flow rate because only a portion of the oil drops seen in the sight dome goes downstream. The lubricator should be used where only a very minute amount of lubricant is desirable or where it is necessary for the oil to remain in suspension in the air stream for long distances.

Lubricating oil is injected into the mist generator by allowing a portion of the incoming air to bypass the mist generator and enter the bowl, where it forces the oil up the siphon tube. The oil then passes the adjustment screw, which meters the amount of oil that can flow to the drip tube and down into the mist generator. The oil droplets and air are then sprayed onto the generator baffle where the oil drops are atomized. The larger oil particles are baffled out and fall into the bowl to be reused.

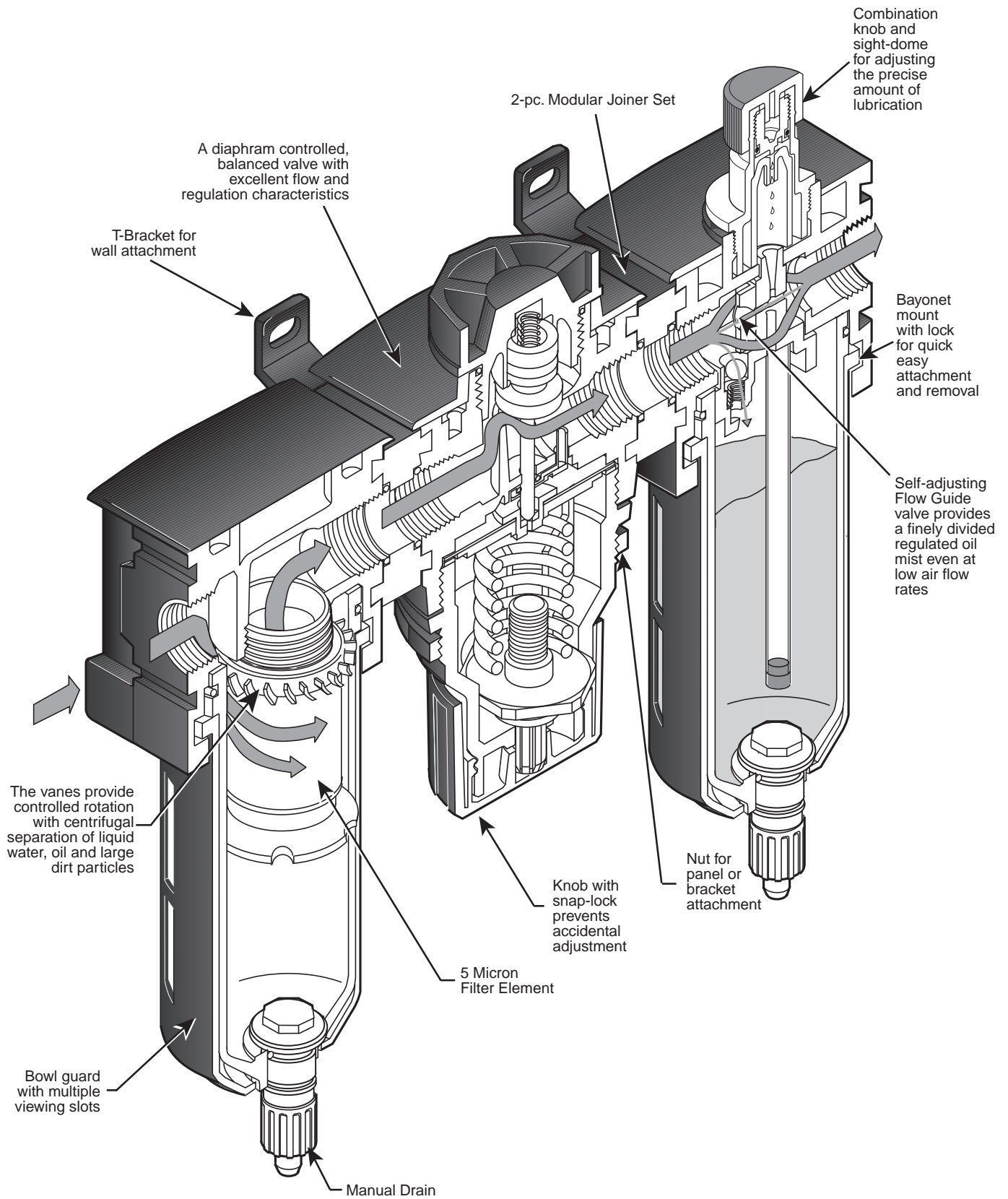
The very fine oil aerosol particles remain airborne and are swept into the lubricator outlet by the airflow, where they are carried downstream. Only a small amount of the oil drops visible in the sight dome are delivered downstream. Generally, micro-mist lubricators convert about 3% of the liquid oil “atomized” particles 2 microns or smaller in size.

Once the oil-to-air density ratio has been established and the drip rate adjustment set, the proportional control of the patented Flow-Guide® variable orifice permits varying volumes of air to pass through the lubricator while maintaining the oil-to-air ratio balance. AtoMist™ lubricators cannot be filled manually without turning off and venting the air pressure from the bowl. The height of the oil level in the bowl is critical and cannot be allowed higher than the baffle plate.



18 / 28 Series FRL Modular Combination

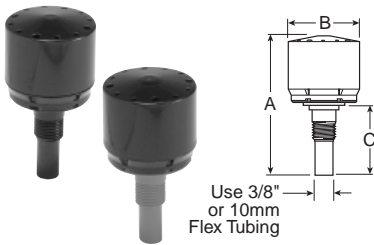
A
Compressed Air Systems



Automatic Mechanical Drains

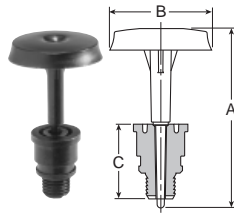
A

Compressed Air Systems



Automatic Drain

(Nitrile and Fluorocarbon Versions)
Operating Range
15 to 250 PSIG (1 to 17 bar)



Automatic Piston Drain

(08 Series as shown)
Works with cyclical operation of air system.



Automatic Piston Drains (used in F03, F08, M03, M08, B03 and B08 filter units)

Air enters bowl, and pressure equalizes above and below piston. The piston has differential areas above and below, with the top area being larger. This gives a slight downward force, holding the drain orifice closed, as long as air pressure is constant. System fluctuations, such as an increased demand for air downstream, causes the pressure above the piston to drop slightly. Now the trapped air below the piston is a higher pressure, and thus pushes the piston up, opening the orifice, and causing the system pressure to expel to atmosphere any accumulated liquids. The sudden drop of pressure below the piston now causes the system pressure to quickly push the piston down, closing the drain, and resetting the piston for the next cycle. It is important to note that this type of drain requires periodic fluctuations in system pressure in order to operate; in a system where the pressure is constant, the drain piston will never cycle.

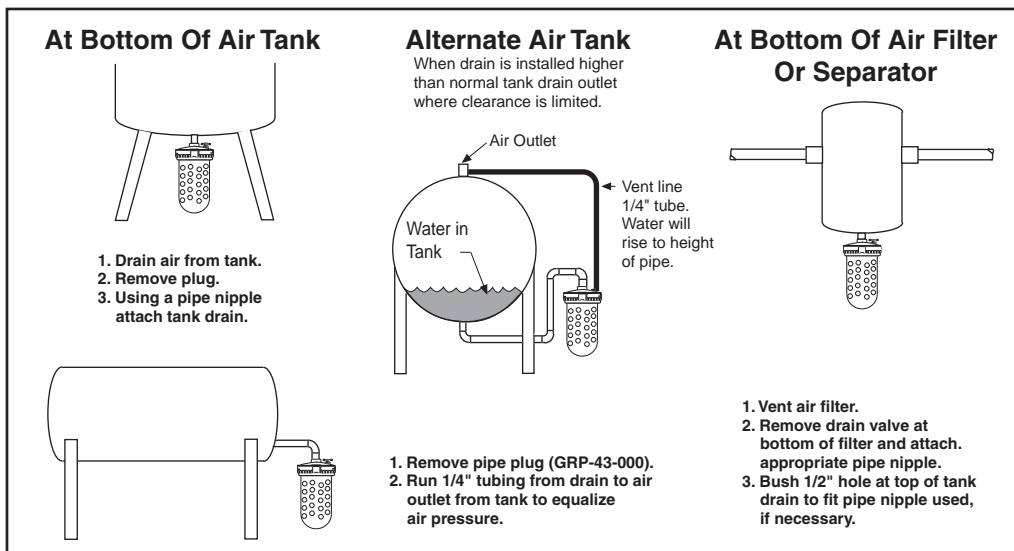
Wilkerson automatic mechanical drains are designed to remove liquid oil and water contaminants from compressed air systems automatically. They eliminate the necessity of someone having to drain accumulated liquids from filters, separators, receivers, etc. on a daily basis. Instead, only regular, periodic maintenance and cleaning is needed. Typically, once a month the drain should be removed from the housing and cleaned in warm, soapy water (no solvents).

Operation

Automatic Mechanical Drains

Liquid contaminants collected in the bowl cause the float mechanism to rise. When the liquid reaches a specific level, the float triggers a mechanism which pilots system pressure against a large-area piston, driving the piston down. The piston opens the drain orifice, causing the system pressure to evacuate the liquid contaminants. As the liquid level falls, the pilot valve closes, system pressure against the piston exhausts to atmosphere, and the drain valve snaps closed, ready to repeat the cycle. At least once a month, the drain should be removed from service, and cleaned with warm, soapy water to ensure continued reliable operation.

Typical Installations



AIR PREPARATION UNITS

Symbol	Description
	FILTER / SEPARATOR with manual drain
	FILTER / SEPARATOR with automatic drain
	OIL REMOVAL FILTER
	AUTOMATIC DRAIN
	LUBRICATOR less drain
	LUBRICATOR with manual drain
	LUBRICATOR with automatic filling
	AIR LINE PRESSURE REGULATOR adjustable, relieving
	AIR LINE PRESSURE REGULATOR pilot controlled, relieving
	FILTER / REGULATOR (piggyback) Manual Drain Relieving (With Gauge)
	FILTER / REGULATOR (piggyback) Auto Drain Relieving
	AIR LINE COMBO F-R-L simplified

PNEUMATIC VALVES

Symbol	Description
	CHECK
	FLOW CONTROL
	RELIEF VALVE

PNEUMATIC VALVES (Cont'd)

Symbol	Description
	2-POSITION 2-WAY
	2-POSITION 3-WAY
	2-POSITION 4-WAY
	2-POSITION, 4-WAY 5-PORTED
	3-POSITION, 4-WAY, APB ports closed, center pos.
	3-POSITION, 4-WAY, CE 5-PORTED cylinder ports open to exhaust in center position
	3-POSITION, 4-WAY, PC 5-PORTED pressure ports open to exhaust in center position
	QUICK EXHAUST
	SHUTTLE

VALVE ACTUATORS

Symbol	Description
	MANUAL general symbol
	PUSH BUTTON
	LEVER
	PEDAL OR TREADLE
	MECHANICAL cam, toggle, etc.
	SPRING
	DETENT line indicates which detent is in use
	PIEZO

VALVE ACTUATORS (Cont'd)

Symbol	Description
	SOLENOID
	INTERNAL PILOT SUPPLY
	REMOTE PILOT SUPPLY
	AND / OR COMPOSITE solenoid and pilot or manual override
	AND / OR COMPOSITE solenoid and manual override and pilot

LINES AND FUNCTIONS

Symbol	Description
	solid line – MAIN LINE
	dashed line – PILOT LINE
	dotted line – EXHAUST OR DRAIN LINE
	center line – ENCLOSURE OUTLINE
	LINES CROSSING (90° intersection not necessary)
	LINES JOINING (90° intersection not necessary)
	LINES JOINING
	FLOW DIRECTION hydraulic medium
	FLOW DIRECTION gaseous medium
	ENERGY SOURCE
	LINE WITH FIXED RESTRICTION
	LINE WITH ADJUSTABLE RESTRICTION
	FLEXIBLE LINE
	PLUGGED PORT, TEST STATION, POWER TAKE-OFF
	connected QUICK DISCONNECT WITHOUT CHECKS
	disconnected QUICK DISCONNECT WITHOUT CHECKS
	connected QUICK DISCONNECT WITH CHECKS
	disconnected QUICK DISCONNECT WITH CHECKS
	connected QUICK DISCONNECT WITH ONE CHECK
	disconnected QUICK DISCONNECT WITH ONE CHECK

A

Compressed Air Systems

Saving Money and Space by Sizing Your Valves Properly

You can “plug” your requirements into the following simple formula, and determine the Cv needed to do the job. By not oversizing, you’ll save space and money, and you’ll ensure the valve you select will do the job.

Converting the Job Requirements Into Cv (Capacity Co-efficient).

$$Cv = \frac{\text{Cylinder Area (Sq. In.)} \times \text{Stroke (In.)} \times \text{Compression Factor (Table 2)} \times \text{“A” (Table 2)}}{\text{Stroke Time (sec.)} \times 28.8}$$

Let’s work through an example:

We want to extend a 3-1/4" bore cylinder which has a 12" stroke in one second, and we have a supply pressure of 80 PSI to do the work. Here’s what we know:

- Cylinder Area for a 3-1/4" Bore, from Table 18.30 sq. in.
- Cylinder Stroke..... 12 in.
- Stroke Time Required in Seconds..... 1 sec.
- Compression Factor at 80 PSI, from Table 26.4
- “A” Constant for 80 PSI, from Table 2......048

Substituting in the formula, we have:

$$Cv = \frac{8.30 \times 12 \times 6.4 \times .048}{1 \times 28.8} = 1.06$$

Any valve, therefore, which has a Cv of *at least* 1.06, will extend our cylinder the specified distance in the required time.

Choosing the Valve “Series”

Your next step is to choose a basic valve design to do the job. For a quick guide to valve designs, see Table 3.

Having selected the basic valve design, consult the Capacity Co-efficient (Cv) tables which describe the individual valve capacities.

Selecting the Valve Model, Options and Accessories

Having determined Cv, series, port size, flow-path configuration (pre-determined by circuit design), and actuation method, you’re ready to choose the *exact* valve model number.

Table 1
Effective Square-Inch Areas for Standard-Bore-Size Cylinders

Bore Size	Cylinder Area (Sq. In.)	Bore Size	Cylinder Area (Sq. In.)
3/4"	.44	4"	12.57
1"	.79	4-1/2"	15.90
1-1/8"	.99	5"	19.64
1-1/4"	1.23	6"	28.27
1-1/2"	1.77	7"	38.48
1-3/4"	2.41	8"	50.27
2"	3.14	10"	78.54
2-1/2"	4.91	12"	113.10
3-1/4"	8.30	14"	153.94
3-5/8"	10.32	—	—

Table 2
Compression Factors and “A” Constants

Inlet Pressure (PSIG)	Compression Factor	“A” Constants for Various Pressure Drop*		
		2 PSI ΔP	5 PSI ΔP	10 PSI ΔP
10	1.6	.152	.103	—
20	2.3	.126	.084	.065
30	3.0	.111	.073	.055
40	3.7	.100	.065	.048
50	4.4	.091	.059	.044
60	5.1	.085	.055	.040
70	5.7	.079	.051	.037
80	6.4	.075	.048	.035
90	7.1	.071	.046	.033
100	7.8	.068	.044	.032
110	8.5	.065	.042	.030
120	9.2	.063	.040	.029
130	9.9	.061	.039	.028
140	10.6	.058	.037	.027
150	11.2	.057	.036	.026
160	11.9	.055	.035	.025
170	12.6	.053	.034	.024
180	13.3	.052	.033	.024
190	14.0	.051	.032	.023
200	14.7	.050	.032	.023

Note: Use “A” constant at 5 PSI rP for most applications. On very critical applications, use “A” at 2 PSI rP. You will find in many cases, a 10 PSI rP is not detrimental, and can save money and mounting space.

* Tabulated values are the solution of $\frac{1}{22.48} \sqrt{\frac{GT}{(P_1 - P_2) P_2}}$ where T is for 68°F and G =1 for Air.

Table 3
Characteristics of the Major Valve Designs

<p>A. Poppet 3-Way and 4-Way</p>	<ol style="list-style-type: none"> High flow capacities Minimum lubrication requirements Fast response Self-cleaning poppet seats Pressures of 15 to 150 PSIG (modifications for vacuum to 250 PSIG)
<p>B. Spool Valves (WCS) 3-Way and 4-Way</p>	<ol style="list-style-type: none"> Low friction Lower operating pressures Fast response Less wear Long Cycle Life - Under pressure, radial expansion of the seal occurs to maintain sealing contact with the valve bore Non-Lube Service - No lubrication required for continuous valve shifting Bi-Directional Spool Seals - Common spool used for any pressure, including vacuum
<p>C. Packed Bore 4-Way</p>	<ol style="list-style-type: none"> Wide range of flow capacities Wide range of flow-path configurations Pilot-operated models available Pressures of vacuum to 150 PSIG
<p>D. Rotary Or Reciprocating Disc 4-Way, manually operated</p>	<ol style="list-style-type: none"> Inexpensive Versatility in manual actuation

Cv – Capacity Co-efficients (sometimes called Flow Factors). Each flow path through the valve has its own Cv value. All Cv ratings for each valve cataloged on this page are listed on the front side of this sheet.

$$Cv = \frac{Q}{22.48} \sqrt{\frac{GT}{(P_1 - P_2) P_2}}$$

Q = Flow in Standard Cubic Feet per minute (14.7 PSIA at 60°F)
 P1 = Inlet Absolute Pressure (gauge pressure + 14.7)
 P2 = Outlet Absolute Pressure (gauge pressure + 14.7)
 Note: P2 must be greater than .53 x P1
 G = Specific Gravity of flowing medium (Air, G =1)
 T = Absolute Temperature of Air (460 + °F.)
 Cv = Q x “A” (Table 2)

Safety Guide For Selecting And Using Pneumatic Division Products And Related Accessories

WARNING:

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF PNEUMATIC DIVISION PRODUCTS, ASSEMBLIES OR RELATED ITEMS (“PRODUCTS”) CAN CAUSE DEATH, PERSONAL INJURY, AND PROPERTY DAMAGE. POSSIBLE CONSEQUENCES OF FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THESE PRODUCTS INCLUDE BUT ARE NOT LIMITED TO:

- Unintended or mistimed cycling or motion of machine members or failure to cycle
- Work pieces or component parts being thrown off at high speeds.
- Failure of a device to function properly for example, failure to clamp or unclamp an associated item or device.
- Explosion
- Suddenly moving or falling objects.
- Release of toxic or otherwise injurious liquids or gasses.

Before selecting or using any of these Products, it is important that you read and follow the instructions below.

1. GENERAL INSTRUCTIONS

- 1.1. Scope:** This safety guide is designed to cover general guidelines on the installation, use, and maintenance of Pneumatic Division Valves, FRLs (Filters pressure Regulators and Lubricators), Vacuum products and related accessory components.
- 1.2. Fail-Safe:** Valves, FRLs, Vacuum products and their related components can and do fail without warning for many reasons. Design all systems and equipment in a fail-safe mode, so that failure of associated valves, FRLs or Vacuum products will not endanger persons or property.
- 1.3 Relevant International Standards:** For a good guide to the application of a broad spectrum of pneumatic fluid power devices see: ISO 4414:1998, Pneumatic Fluid Power – General Rules Relating to Systems. See www.iso.org for ordering information.
- 1.4. Distribution:** Provide a copy of this safety guide to each person that is responsible for selection, installation, or use of Valves, FRLs or Vacuum products. Do not select, or use Wilkerson valves, FRLs or vacuum products without thoroughly reading and understanding this safety guide as well as the specific Wilkerson publications for the products considered or selected.
- 1.5. User Responsibility:** Due to the wide variety of operating conditions and applications for valves, FRLs, and vacuum products Wilkerson and its distributors do not represent or warrant that any particular valve, FRL or vacuum product is suitable for any specific end use system. This safety guide does not analyze all technical parameters that must be considered in selecting a product. The user, through its own analysis and testing, is solely responsible for:
 - Making the final selection of the appropriate valve, FRL, Vacuum component, or accessory.
 - Assuring that all user's performance, endurance, maintenance, safety, and warning requirements are met and that the application presents no health or safety hazards.
 - Complying with all existing warning labels and / or providing all appropriate health and safety warnings on the equipment on which the valves, FRLs or Vacuum products are used; and,
 - Assuring compliance with all applicable government and industry standards.
- 1.6. Safety Devices:** Safety devices should not be removed, or defeated.
- 1.7. Warning Labels:** Warning labels should not be removed, painted over or otherwise obscured.
- 1.8. Additional Questions:** Call the appropriate Wilkerson technical service department if you have any questions or require any additional information. See the Wilkerson publication for the product being considered or used, or call 269-629-2550, or go to www.wilkersoncorp.com, for telephone numbers of the appropriate technical service department.

2. PRODUCT SELECTION INSTRUCTIONS

- 2.1. Flow Rate:** The flow rate requirements of a system are frequently the primary consideration when designing any pneumatic system. System components need to be able to provide adequate flow and pressure for the desired application.
- 2.2. Pressure Rating:** Never exceed the rated pressure of a product. Consult product labeling, Pneumatic Division catalogs or the instruction sheets supplied for maximum pressure ratings.
- 2.3. Temperature Rating:** Never exceed the temperature rating of a product. Excessive heat can shorten the life expectancy of a product and result in complete product failure.
- 2.4. Environment:** Many environmental conditions can affect the integrity and suitability of a product for a given application. Pneumatic Division products are designed for use in general purpose industrial applications. If these products are to be used in unusual circumstances such as direct sunlight and/or corrosive or caustic environments, such use can shorten the useful life and lead to premature failure of a product.
- 2.5. Lubrication and Compressor Carryover:** Some modern synthetic oils can and will attack nitrile seals. If there is any possibility of synthetic oils or greases migrating into the pneumatic components check for compatibility with the seal materials used. Consult the factory or product literature for materials of construction.
- 2.6. Polycarbonate Bowls and Sight Glasses:** To avoid potential polycarbonate bowl failures:
 - Do not locate polycarbonate bowls or sight glasses in areas where they could be subject to direct sunlight, impact blow, or temperatures outside of the rated range.
 - Do not expose or clean polycarbonate bowls with detergents, chlorinated hydro-carbons, ketones, esters or certain alcohols.
 - Do not use polycarbonate bowls or sight glasses in air systems where compressors are lubricated with fire resistant fluids such as phosphate ester and di-ester lubricants.

2.7. Chemical Compatibility: For more information on plastic component chemical compatibility see Pneumatic Division technical bulletins Tec-3, Tec-4, and Tec-5

2.8. Product Rupture: Product rupture can cause death, serious personal injury, and property damage.

- Do not connect pressure regulators or other Pneumatic Division products to bottled gas cylinders.
- Do not exceed the maximum primary pressure rating of any pressure regulator or any system component.
- Consult product labeling or product literature for pressure rating limitations.

3. PRODUCT ASSEMBLY AND INSTALLATION INSTRUCTIONS

3.1. Component Inspection: Prior to assembly or installation a careful examination of the valves, FRLs or vacuum products must be performed. All components must be checked for correct style, size, and catalog number. DO NOT use any component that displays any signs of nonconformance.

3.2. Installation Instructions: Wilkerson published Installation Instructions must be followed for installation of Wilkerson valves, FRLs and vacuum components. These instructions are provided with every Wilkerson valve or FRL sold, or by calling 269-629-2550, or at www.wilkersoncorp.com.

3.3. Air Supply: The air supply or control medium supplied to Valves, FRLs and Vacuum components must be moisture-free if ambient temperature can drop below freezing

4. VALVE AND FRL MAINTENANCE AND REPLACEMENT INSTRUCTIONS

4.1. Maintenance: Even with proper selection and installation, valve, FRL and vacuum products service life may be significantly reduced without a continuing maintenance program. The severity of the application, risk potential from a component failure, and experience with any known failures in the application or in similar applications should determine the frequency of inspections and the servicing or replacement of Pneumatic Division products so that products are replaced before any failure occurs. A maintenance program must be established and followed by the user and, at minimum, must include instructions 4.2 through 4.9.

4.2. Installation and Service Instructions: Before attempting to service or replace any worn or damaged parts consult the appropriate Service Bulletin for the valve or FRL in question for the appropriate practices to service the unit in question. These Service and Installation Instructions are provided with every Wilkerson valve and FRL sold, or are available by calling 269-629-2550, or by accessing the Wilkerson web site at www.wilkersoncorp.com.

4.3. Lockout / Tagout Procedures: Be sure to follow all required lockout and tagout procedures when servicing equipment. For more information see: OSHA Standard – 29 CFR, Part 1910.147, Appendix A, The Control of Hazardous Energy – (Lockout / Tagout)

4.4. Visual Inspection: Any of the following conditions requires immediate system shut down and replacement of worn or damaged components:

- Air leakage: Look and listen to see if there are any signs of visual damage to any of the components in the system. Leakage is an indication of worn or damaged components.
- Damaged or degraded components: Look to see if there are any visible signs of wear or component degradation.
- Kinked, crushed, or damaged hoses. Kinked hoses can result in restricted air flow and lead to unpredictable system behavior.
- Any observed improper system or component function: Immediately shut down the system and correct malfunction.
- Excessive dirt build-up: Dirt and clutter can mask potentially hazardous situations.

Caution: Leak detection solutions should be rinsed off after use.

4.5. Routine Maintenance Issues:

- Remove excessive dirt, grime and clutter from work areas.
- Make sure all required guards and shields are in place.

4.6. Functional Test: Before initiating automatic operation, operate the system manually to make sure all required functions operate properly and safely.

4.7. Service or Replacement Intervals: It is the user's responsibility to establish appropriate service intervals. Valves, FRLs and vacuum products contain components that age, harden, wear, and otherwise deteriorate over time. Environmental conditions can significantly accelerate this process. Valves, FRLs and vacuum components need to be serviced or replaced on routine intervals. Service intervals need to be established based on:

- Previous performance experiences.
- Government and / or industrial standards.
- When failures could result in unacceptable down time, equipment damage or personal injury risk.

4.8. Servicing or Replacing of any Worn or Damaged Parts: To avoid unpredictable system behavior that can cause death, personal injury and property damage:

- Follow all government, state and local safety and servicing practices prior to service including but not limited to all OSHA Lockout Tagout procedures (OSHA Standard – 29 CFR, Part 1910.147, Appendix A, The Control of Hazardous Energy – Lockout / Tagout).
- Disconnect electrical supply (when necessary) before installation, servicing, or conversion.
- Disconnect air supply and depressurize all air lines connected to system and Pneumatic Division products before installation, service, or conversion.
- Installation, servicing, and / or conversion of these products must be performed by knowledgeable personnel who understand how pneumatic products are to be applied.
- After installation, servicing, or conversions air and electrical supplies (when necessary) should be connected and the product tested for proper function and leakage. If audible leakage is present, or if the product does not operate properly, do not put product or system into use.
- Warnings and specifications on the product should not be covered or painted over. If masking is not possible, contact your local representative for replacement labels.

4.9. Putting Serviced System Back into Operation: Follow the guidelines above and all relevant Installation and Maintenance Instructions supplied with the valve FRL or vacuum component to insure proper function of the system.

Warning: Use Limitations

Wilkerson's warranties are void, and Wilkerson assumes no responsibility for any resulting cost, loss, injury or any other damages whatsoever, with respect to any plastic bowl unit for which a bowl guard is standard equipment if the unit is placed in service without the bowl guard and, except as otherwise specified in writing by Wilkerson, with respect to any Wilkerson products which are used in other than compressed air service. Specific warnings with respect to these and other use limitations appear elsewhere in this catalog.

Wilkerson maintains a policy of ongoing product development and improvement. We therefore reserve the right to change dimensions specification and design without notice.

Do not place plastic bowl unit in service without bowl guard installed.

Plastic bowl units are sold only with bowl guards with the exception to miniature units (C04, F00, L00, & M00). To minimize the danger of flying fragments in the event of plastic bowl failure, the bowl guards should not be removed. If the unit is in service without the bowl guard installed, manufacturer's warranties are void, and the manufacturer assumes no responsibility for any resulting loss.

If the unit has been in service and does not have a bowl guard, order one and install before placing back in service.

Caution

Certain compressor oils, chemicals, household cleaners, solvents, paints and fumes will attack plastic bowls and can cause bowl failure. Do not use near these materials. When bowl becomes dirty replace bowl or wipe only with a clean, dry cloth. Reinstall bowl guard or buy and install a bowl guard. Immediately replace any crazed, cracked, damaged or deteriorated plastic bowl with a bowl or a new plastic bowl and bowl guard.

Caution

Except as otherwise specified by the manufacturer, this product is specifically designed for compressed air service, and use with any other fluid (liquid or gas) is a misapplication. For example, use with or injection of certain hazardous liquids or gases in the system (such as alcohol or liquid petroleum gas) could be harmful to the unit or result in a combustible condition or hazardous external leakage. Before using with fluids other than air, or for non-industrial applications, or for life support systems, consult Wilkerson Operations for written approval.

Some of the Materials that will Attack Polycarbonate Plastic Bowls

Acetaldehyde	Chloroform	Milk of Lime (CaOH)
Acetic acid (conc.)	Cresol	Nitric Acid (conc.)
Acetone	Cyclohexanol	Nitrobenzene
Acrylonitrile	Cyclohexanone	Nitrocellulose Lacquer
Ammonia	Cyclohexene	Phenol
Ammonium Fluoride	Dimethyl Formamide	Phosphorous Hydroxy Chloride
Ammonium Hydroxide	Diozane	Perchloroethylene
Ammonium Sulfide	Ethgane tetrachloride	Phosphorous
Anaerobic adhesives	Ethyl Acetate	Propionic Acid
Trichloride and Sealants	Ethyl Ether	Pyridine
Antifreeze	Ethylamine	Sodium Hydroxide
Benzene	Ethylene Chlorohydrin	Sodium Sulfide
Benzoic Acid	Ethylene Dichloride	Styrene
Benzyl Alcohol	Ethylene Glycol	Sulfuric Acid (conc.)
Brake Fluids	Formic Acid (conc.)	Sulphural Chloride
Bromobenzene	Freon (Refrig. & Propell.)	Tetrahydronaphthalene
Butyric Acid	Gasoline (High Aromatic)	Tiophene
Carbolic Acid	Hydrazine	Toluene
Carbon Disulfide	Hydrochloric Acid (conc.)	Turpentine
Carbon Tetrachloride	Lacquer Thinner	Xylene & Others
Caustic Potash Solution	Methyl Alcohol	
Caustic Soda Solution	Methylene Chloride	
Chlorobenzene	Methylene Salicylate	

Trade Names of some Compressor Oils, Rubber Compounds and other Materials that will Attack Polycarbonate Plastic Bowls.

Atlas "Perma-Guard"	National Compound #N11
Buna N	"Nylock" VC-3
Cellulube #150 and #220	Parco #1306 Neoprene
Crylex #5 cement	*Permabond 910
*Eastman 910	Petron PD287
Garlock #98403 (polyurethane)	Prestone
Haskel #568-023	Pydraul AC
Hilgard Co.'s hil phene	Sears Regular Motor Oil
Houghton & Co. oil #1120, #1130 & #1055	Sinclair oil "Lily White"
Houtosafe 1000	Stauffer Chemical FYRQUEL #150
Kano Kroil	Stillman #SR 269-75 (polyurethane)
Keystone penetrating oil #2	Stillman #SR 513-70 (neoprene)
*Loctite 271	Tannergas
*Locite 290	Telar
*Loctite 601	Tenneco anderol #495 & #500 oils
*Loctite Teflon-Sealant	Titon
Marvel Mystery Oil	*Vibra-tite
Minn. Rubber 366Y	Zerex
*When in raw liquid form.	

We cannot possibly list all harmful substances, so check with Mobay or the General Electric office for further information on polycarbonate plastic.

The trade names "EconOmist" and "Flow-Guide" are registered at the United States Patent Office.

"Auto-Fill", "Dial-Air", "Flex-Drain", "Mainliner" and "Whirl-Flo" are tradenames of Wilkerson.

Claims and Shortages: Risk of loss passes to buyer when goods are delivered to the carrier. Inspect all shipments for damage at time of receipt. Claims should be filed by the consignee against the carrier.

Changes: Wilkerson maintains a policy of ongoing product development and improvement. We therefore reserve the right to change dimensions, specifications and design without notice.

Offer of Sale

The goods, services or work (referred to as the "Products") offered by **Parker-Hannifin Corporation**, its subsidiaries, groups, divisions, and authorized distributors ("Seller") are offered for sale at prices indicated in the offer, or as may be established by Seller. The offer to sell the Products and acceptance of Seller's offer by any customer ("Buyer") is contingent upon, and will be governed by all of the terms and conditions contained in this Offer of Sale. Buyer's order for any Products specified in Buyer's purchase document or Seller's offer, proposal or quote ("Quote") attached to the purchase order, when communicated to Seller verbally, or in writing, shall constitute acceptance of this offer.

1. Terms and Conditions. Seller's willingness to offer Products for sale or accept an order for Products is subject to the terms and conditions contained in this Offer of Sale or any newer version of the same, published by Seller electronically at www.parker.com/saleterms/. Seller objects to any contrary or additional terms or conditions of Buyer's order or any other document or other communication issued by Buyer.

2. Price; Payment. Prices stated on Seller's Quote are valid for thirty (30) days, except as explicitly otherwise stated therein, and do not include any sales, use, or other taxes or duties unless specifically stated. Seller reserves the right to modify prices to adjust for any raw material price fluctuations. Unless otherwise specified by Seller, all prices are F.C.A. Seller's facility (INCOTERMS 2010). Payment is subject to credit approval and payment for all purchases is due thirty (30) days from the date of invoice (or such date as may be specified by Seller's Credit Department). Unpaid invoices beyond the specified payment date incur interest at the rate of 1.5% per month or the maximum allowable rate under applicable law.

3. Shipment; Delivery; Title and Risk of Loss. All delivery dates are approximate. Seller is not responsible for damages resulting from any delay. Regardless of the manner of shipment, delivery occurs and title and risk of loss or damage pass to Buyer, upon placement of the Products with the shipment carrier at Seller's facility. Unless otherwise stated, Seller may exercise its judgment in choosing the carrier and means of delivery. No deferment of shipment at Buyers' request beyond the respective dates indicated will be made except on terms that will indemnify, defend and hold Seller harmless against all loss and additional expense. Buyer shall be responsible for any additional shipping charges incurred by Seller due to Buyer's acts or omissions.

4. Warranty. Seller warrants that the Products sold hereunder shall be free from defects in material or workmanship for a period of twelve (12) months from the date of delivery or 2,000 hours of normal use, whichever occurs first. All prices are based upon the exclusive limited warranty stated above, and upon the following disclaimer: **DISCLAIMER OF WARRANTY: THIS WARRANTY IS THE SOLE AND ENTIRE WARRANTY PERTAINING TO PRODUCTS PROVIDED. SELLER DISCLAIMS ALL OTHER WARRANTIES, EXPRESS AND IMPLIED, INCLUDING DESIGN, MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.**

5. Claims; Commencement of Actions. Buyer shall promptly inspect all Products upon receipt. No claims for shortages will be allowed unless reported to the Seller within ten (10) days of delivery. No other claims against Seller will be allowed unless asserted in writing within thirty (30) days after delivery. Buyer shall notify Seller of any alleged breach of warranty within thirty (30) days after the date the defect is or should have been discovered by Buyer. Any claim or action against Seller based upon breach of contract or any other theory, including tort, negligence, or otherwise must be commenced within twelve (12) months from the date of the alleged breach or other alleged event, without regard to the date of discovery.

6. LIMITATION OF LIABILITY. IN THE EVENT OF A BREACH OF WARRANTY, SELLER WILL, AT ITS OPTION, REPAIR OR REPLACE A DEFECTIVE PRODUCT, OR REFUND THE PURCHASE PRICE WITHIN A REASONABLE PERIOD OF TIME. **IN NO EVENT IS SELLER LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF, OR AS THE RESULT OF, THE SALE, DELIVERY, NON-DELIVERY, SERVICING, USE OR LOSS OF USE OF THE PRODUCTS OR ANY PART THEREOF, OR FOR ANY CHARGES OR EXPENSES OF ANY NATURE INCURRED WITHOUT SELLER'S WRITTEN CONSENT, WHETHER BASED IN CONTRACT, TORT OR OTHER LEGAL THEORY. IN NO EVENT SHALL SELLER'S LIABILITY UNDER ANY CLAIM MADE BY BUYER EXCEED THE PURCHASE PRICE OF THE PRODUCTS.**

7. User Responsibility. The user, through its own analysis and testing, is solely responsible for making the final selection of the system and Product and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application and follow applicable industry standards and Product information. If Seller provides Product or system options based upon data or specifications provided by the user, the user is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the Products or systems.

8. Loss to Buyer's Property. Any designs, tools, patterns, materials, drawings, confidential information or equipment furnished by Buyer or any other items which become Buyer's property, will be considered obsolete and may be destroyed by Seller after two (2) consecutive years have elapsed without Buyer ordering the items manufactured using such property. Seller shall not be responsible for any loss or damage to such property while it is in Seller's possession or control.

9. Special Tooling. A tooling charge may be imposed for any special tooling, including without limitation, dies, fixtures, molds and patterns, acquired to manufacture Products. Such special tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in apparatus belonging to Seller which is utilized in the manufacture of the Products, even if such apparatus has been specially converted or adapted for such manufacture and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller has the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.

10. Buyer's Obligation; Rights of Seller. To secure payment of all sums due or otherwise, Seller retains a security interest in all Products delivered to Buyer and this agreement is deemed to be a Security Agreement under the Uniform Commercial Code. Buyer authorizes Seller as its attorney to execute and file on Buyer's behalf all documents Seller deems necessary to perfect its security interest.

11. Improper Use and Indemnity. Buyer shall indemnify, defend, and hold Seller harmless from any losses, claims, liabilities, damages, lawsuits, judgments and costs (including attorney fees and defense costs), whether for personal injury, property damage, patent,

trademark or copyright infringement or any other claim, brought by or incurred by Buyer, Buyer's employees, or any other person, arising out of: (a) improper selection, application, design, specification or other misuse of Products purchased by Buyer from Seller; (b) any act or omission, negligent or otherwise, of Buyer; (c) Seller's use of patterns, plans, drawings, or specifications furnished by Buyer to manufacture Products; or (d) Buyer's failure to comply with these terms and conditions. Seller shall not indemnify Buyer under any circumstance except as otherwise provided.

12. Cancellations and Changes. Buyer may not cancel or modify or cancel any order for any reason, except with Seller's written consent and upon terms that will indemnify, defend and hold Seller harmless against all direct, incidental and consequential loss or damage. Seller may change Product features, specifications, designs and availability.

13. Limitation on Assignment. Buyer may not assign its rights or obligations under this agreement without the prior written consent of Seller.

14. Force Majeure. Seller does not assume the risk and is not liable for delay or failure to perform any of Seller's obligations by reason of events or circumstances beyond its reasonable control (hereinafter "Events of Force Majeure"). Events of Force Majeure shall include without limitation: accidents, strikes or labor disputes, acts of any government or government agency, acts of nature, delays or failures in delivery from carriers or suppliers, shortages of materials, or any other cause beyond Seller's reasonable control.

15. Waiver and Severability. Failure to enforce any provision of this agreement will not invalidate that provision; nor will any such failure prejudice Seller's right to enforce that provision in the future. Invalidation of any provision of this agreement by legislation or other rule of law shall not invalidate any other provision herein. The remaining provisions of this agreement will remain in full force and effect.

16. Termination. Seller may terminate this agreement for any reason and at any time by giving Buyer thirty (30) days prior written notice. Seller may immediately terminate this agreement, in writing, if Buyer: (a) breaches any provision of this agreement (b) appoints a trustee, receiver or custodian for all or any part of Buyer's property (c) files a petition for relief in bankruptcy on its own behalf, or one if filed by a third party (d) makes an assignment for the benefit of creditors; or (e) dissolves its business or liquidates all or a majority of its assets.

17. Governing Law. This agreement and the sale and delivery of all Products are deemed to have taken place in, and shall be governed and construed in accordance with, the laws of the State of Ohio, as applicable to contracts executed and wholly performed therein and without regard to conflicts of laws principles. Buyer irrevocably agrees and consents to the exclusive jurisdiction and venue of the courts of Cuyahoga County, Ohio with respect to any dispute, controversy or claim arising out of or relating to this agreement.

18. Indemnity for Infringement of Intellectual Property Rights. Seller is not liable for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Section. Seller will defend and indemnify Buyer against allegations of infringement of U.S. patents, U.S. trademarks, copyrights, trade dress and trade secrets ("Intellectual Property Rights"). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on an allegation that a Product sold pursuant to this agreement infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If a Product is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole expense and option, procure for Buyer the right to continue using the Product, replace or modify the Product so as to make it noninfringing, or offer to accept return of the Product and refund the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller is not liable for claims of infringement based on information provided by Buyer, or directed to Products delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any Product sold hereunder. The foregoing provisions of this Section constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights.

19. Entire Agreement. This agreement contains the entire agreement between the Buyer and Seller and constitutes the final, complete and exclusive expression of the terms of sale. All prior or contemporaneous written or oral agreements or negotiations with respect to the subject matter are herein merged. The terms contained herein may not be modified unless in writing and signed by an authorized representative of Seller.

20. Compliance with Laws. Buyer agrees to comply with all applicable laws, regulations, and industry and professional standards of care, including those of the United Kingdom, the United States of America, and the country or countries in which Buyer may operate, including without limitation the U. K. Bribery Act, the U.S. Foreign Corrupt Practices Act ("FCPA"), the U.S. Anti-Kickback Act ("Anti-Kickback Act") and the U.S. Food Drug and Cosmetic Act ("FDCA"), each as currently amended, and the rules and regulations promulgated by the U.S. Food and Drug Administration ("FDA"), and agrees to indemnify and hold harmless Seller from the consequences of any violation of such provisions by Buyer, its employees or agents. Buyer acknowledges that it is familiar with the provisions of the U. K. Bribery Act, the FCPA, the FDA, and the Anti-Kickback Act, and certifies that Buyer will adhere to the requirements thereof. In particular, Buyer represents and agrees that Buyer will not make any payment or give anything of value, directly or indirectly to any governmental official, any foreign political party or official thereof, any candidate for foreign political office, or any commercial entity or person, for the purpose of influencing such person to purchase Products or otherwise benefit the business of Seller.

05/14