Introduction to Filters

Master Pneumatic
General Purpose Filters
Coalescing Filters

© Master Pneumatic 2012
Several Types of Filters
Remove Contaminants from Compressed Air

• General Purpose --- Remove water and particulate matter
• Coalescing --- Remove oil and solids of a given size
• Adsorbing --- Remove oil vapor that cannot be removed by Coalescing filter
• Dryer/Filter --- Filenco using filtration and desiccant materials

• Note: This presentation will cover general purpose and coalescing filters

© Master Pneumatic 2012
Why Do You Need a Filter?

Dirt, moisture, and oil are everywhere. Several types of contaminants are:

- Particulates such as dust, dirt, pollen, smoke, & exhaust emissions
- Moisture in the form of water droplets
- Oil from the ambient air & compressor oil carryover
- Caustic gases such as sulfur oxides, nitrogen oxides, and chlorine compounds

Please note general purpose filters are not designed to remove oil. Instead, use a coalescing filter to remove oil.
Why Do You Need a Filter?

Did you know that when you compress air up to 125 psig (8.6 Bar), you increase the concentration of contaminants 8 times?

The results of contaminated compressed air are:

- Premature wearing and scoring of surfaces.
- Rust and corrosion of tools, piping, and equipment
- Damaged instruments
- Spoiled paint surfaces
- Increased scrap rate
- Unsafe and unpleasant work environment
Particulates-

Micron $\mu$ Comparison

- 50 Micron: Diameter of Human Hair (0.0020”)
- 40 Micron: Visibility Limit (0.0015”)
- 25 Micron: White Blood Cell (0.0010”)
- 8 Micron: Diameter of Red Blood Cell (0.0003”)
- 2 Micron: Diameter of Bacteria (0.00008”)
- 0.1 Micron: Diameter of G-Force Capability (0.000004”)

© Master Pneumatic 2012
General Purpose Filter

- Used in a Compressed Air system to stop dirt, pipe scale, water, and contaminants from passing downstream causing damage.
- Removes contaminating water emulsions and particle removal down to 5 microns.
- Install as close as possible to the component it protects.
- Replace elements frequently for optimal filter performance.
- 5 Micron Polyethylene standard (Some of the larger size products, 40 micron bronze is standard)
- Bronze options E3 (40 micron), E4 (20 micron) E5 (5 micron)
MP General Purpose Filters have the following ranges

- Product port size range from 1/8” to 2”
- Flow Rate from 10 scfm (4.7 l/s) to 1000 scfm (47 l/s)
- Element sizes from 5 um to 40 um
- Auto drains are standard on all filters.
- Float and Manual drains are optional.
- Other options can be accommodated

Consult factory
MP General Purpose Filters

...Several families are offered

- **Sentry and Miniature** Series – Polycarbonate bowl is standard. Metal bowl is optional.
  - **Guardsman Series** – Polycarbonate bowl with metal shatterguard is standard. Metal bowl optional.
  - **Guardsman 2 Series** – Metal bowl with sight gauge is standard.
  - **Vanguard and Vanguard High Capacity** – Polycarbonate bowl with metal shatterguard is standard. Metal bowl optional with sight gauge. Metal bowl only 1 ¼”-2”
  - **380 Series** – Polycarbonate bowl is standard. Metal bowl is optional.
Why Master Pneumatic Filters?

• Vast technical knowledge – since 1950
• Product has been proven over many years of service
• Designed for safety and performance
• M/P stands behind the product with a 7 YEAR warranty
• Made in USA
Filter Maintenance - Elements

- Pressure Drop – Replace contaminated filter elements to avoid excess pressure drop.
  - NOTE: A 10 psi (0.7 bar) pressure drop is excessive.
  - Each compressed air circuit contains different levels of moisture and contaminants.
  - Elements should be inspected soon after a new filter is first installed to determine the level of contamination.

Please note that a pressure drop can be critical to the products being operated.

Pressure drop occurs in pipe lines and bends in the piping.
MP offers Several Drains for General Purpose Filters

- **Internal**
  - Automatic
    - *Differential Pressure*
    - *Float Design (new in 2008)*
  - Manual (Optional)

- **External**
  - Hydro-Jector (Float Design)
  - BD-130 (Float Type)
  - Warrior Electronic Control
MP General Purpose Filters

Internal Drains

• In many industrial compressed air systems, the “standard” drain is a **manual** type. Maintenance has to visit the location on a regular basis to ensure that free water and the “soup” of contamination that the filter strips from the air is drained before it can re-entrain into the downstream air.

• **How often do you think this happens??**

• **Float drains** work on the float principal. As water and contamination accumulates in the bottom of the bowl, it will ultimately lift a float, and the air pressure in the bowl will vent to atmosphere through the opening, “blowing” the water from the bowl as it does. When the accumulated water is gone, there’s nothing left to “float” the valve operator, and it drops back into the orifice, sealing off the exit from the bowl.

[ISO symbol for Manual drain]

[ISO symbol for Automatic drain]
MP General Purpose Filter Design
Internal Drain (Differential Type)

- **Flow**
- **Primary Baffle** – Creates Cyclonic action
- **Double Baffle** Unique to MP
- **Non-turbulent (Quiet Zone)**
- **Automatic Drain**
- **Accumulated Liquid Contaminants**

© Master Pneumatic 2012
Internal Automatic Drain Operation

- **Differential Pressure Design**

- **Note:** There must be a pressure drop across the filter having this type of automatic drain. If the application is continuous flow, a float drain must be used.

- An air filter auto-drain will ensure that the filter bowl is drained as necessary, without operator intervention.
MP General Purpose Filters
External Drain Application

- Use where severe condensation problems exist
- Liquid will drain regardless of air flow and with no loss of air
- Maximum discharge rate approximately 5 gallons (18.9 L) per minute at 100 psig (6.9 Bar).
- Self Flushing action removes contaminated water
Tube Away

In applications where the fluid in the bowl should not be vented into the atmosphere, tube away kits are available to divert the fluid into the proper receptacle.

New for Sentry and Miniature Filters in July 2012
MP General Purpose Filters
M/P Offers 3 External Drains

Hydro-Jector Float Drain
BD130 Auto Float Drain
Electronic (Warrior) Controlled Drain
Automatic External Drain/Filter Installation

M/P™ Full or High Capacity Filter

Connecting Nipple with rubber spacer

Filter Element

Sump Area (true “quiet” zone)

M/P™ Automatic External Drain Hydro-Jector

Bleed Port

Manual Override

© Master Pneumatic 2012
Hydro-Jector

Section View

New design provides the following benefits:

- Better reliability
- Shorter profile
- Less weight
- Replaced flat bowl seal with “O” ring to improve sealing capacity with filter

Not recommended where heavy oil or foam is present as can be the case in separators or large aftercoolers.
Hydro-Jector Installation

Master Pneumatic heavy duty filters and hydro-jectors dramatically reduce water content of compressed air systems. More expensive refrigerant dryers with M/P filters installed ahead of them are also good added investments to remove moisture content.

COMPRESSOR CIRCUIT

There is a rainstorm inside the compressed air line every time the temperature drops one degree. This is often referred to as "reaching dew point".

* Temperatures indicated are typical according to compressor trade.

Compressing air creates a great deal of moisture, little water.

* 175 deg F to 250 deg F
* 115 deg F

Compressed air moisture and condensing water
Compressed air cooling through expansion.

Collected air with condensed water due to expansion and cooling.

Clean air in front of first application.

Vanguard models FE or BFE filters

* 100 deg F

Copper tube to direct condensate to drain or against wall
Distance should be as far as possible to allow maximum condensation of moisture.

E100-2 Hydro-Jector automatic drain
1/8" tube to drain (provided by customer)

© Master Pneumatic 2012
How to Select MP Filters

- **Flow requirement SCFM (l/s)**
  - Pipe size and thread type
  - Inlet & Outlet pressure(s)
  - Metal or Polycarbonate Bowl
  - Drain Type
  - Temperature Range
  - \(1 \ C_v = 25 \text{ SCFM (11.8 l/s) @100 psig (6.9 bar)}\) (ballpark)
  - Compressor Horse Power X 4 or 4.5 = SCFM (ballpark)

*SCFM*

Standard Cubic Feet per Minute (SCFM) is a volumetric flow-rate corrected to a set of "standardized" conditions of pressure and temperature. The standard conditions are often defined as some pressure (e.g., 14.7 psia) and some temperature (e.g., 68°F), depending on the "standard" used.
How to Select MP Filters

- **Flow requirement** - This is critical to using the correct Filter in the application. MP may have several different Filters with a particular port size, but all will have different flow capabilities.

- Typically, you want to specify the product with the lowest pressure drop at your desired flow rate.

![Graph showing pressure drop vs flow rate for different port sizes](graph.png)
How to Select MP Filters

- The graph below shows (3) different inlet pressures per the ISO standards. (NOTE: The flow v. pressure drop curves are based on a dry element. A wet element will have lower flow/higher pressure drop ratings).

As shown above, if desired flow is 60 scfm (28 l/s), pressure drop will be higher with lower inlet pressure.

- 36 psig (2.5 bar) inlet-4 psig (0.28 bar) drop at 60 scfm (28 l/s)
- 92 psig (6.3 bar) inlet-1.75 (0.12 bar)psig drop at 60 scfm (28 l/s)
- 150 psig (10 bar) inlet-1.25 psig (0.08 bar) drop at 60 scfm (28 l/s)
Sizing (cont’d)

In this example, if your inlet pressure is low, you should consider another MP filter that has a lower pressure drop at the desired flow rate. Starting out with a new filter that has a 4 psig (0.28 bar) drop is not a good practice.

More course elements (20µ or 40µ) will decrease pressure drop but will also allow larger particles to pass downstream.
Sizing (cont’d)

- If your inlet pressure is between the inlet pressures shown, you can *approximate* where the pressure drop would intersect the flow curve for your inlet pressure. The red line below would show the approximate pressure drop at 60 scfm (28 l/s) with an inlet pressure of 55 psig (3.8 bar).

- **Contact MP if more exact information is required. Calculations can be done for other inlet pressures.**
General Purpose Air Filters & Port Sizes.
(Approximate size relationship as shown)

FD60 Guardsman
NPT & BSPP Port sizes: 1/4, 3/8 & 1/2
SAE sizes: 9/16-18

BFD70 Guardsman II
NPT & BSPP Port sizes: 1/4, 3/8 & 1/2
SAE sizes: 9/16-18

FD10 Sentry Modular
NPT & BSPP Port sizes: 1/8, 1/4
Tubing sizes: 1/4, 3/8, 4mm, 6mm, 8mm & 10mm

FD50 Miniature
NPT & BSPP Port sizes: 1/8, 1/4

FD100 Vanguard Modular
NPT & BSPP Port sizes: 1/4, 3/8, 1/2 & 3/4
SAE sizes: 9/16-18, 5/16-18 & 7/8-14

FD100 High Flow
NPT & BSPP Port sizes: 3/4 & 1
SAE sizes: 1-1/16-12 & 1-1/8-12

BFD200 High Flow
NPT & BSPP Port sizes: 3/4, 1, 1-1/4 & 1-1/2
SAE sizes: 1-1/16-12, 1-1/8-12 & 1-7/8-12

BF6A400 High Flow
NPT & BSPP Port sizes: 1-1/4, 1-1/2 & 2
SAE sizes: 1-5/8-12, 1-7/8-12 & 1-13/16-12

Master Pneumatic
6301-10 Mile Rd | Sterling Heights, MI 48314
Phone: (586) 254-1000 | Fax: (586) 254-6055
Website: www.masterpneumatic.com
Email: mp@masterpneumatic.com

© Master Pneumatic 2012
### General Purpose Air Filters & Port Sizes

Boxes that are marked with a yellow are available options for the product listed. Numbers and letters inside each yellow box reflects the proper suffix / prefix needed. See Master Pneumatics catalog for a complete product breakdown chart.

#### PIPE SIZE CHART

<table>
<thead>
<tr>
<th>TUBING</th>
<th>NPT AND BSP PIPE THREADS</th>
<th>SAE PIPE THREADS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4</td>
<td>1/8</td>
<td>1/4</td>
</tr>
<tr>
<td>1/8</td>
<td>1/8</td>
<td>1/8</td>
</tr>
<tr>
<td>1/4</td>
<td>1/8</td>
<td>1/4</td>
</tr>
<tr>
<td>1/8</td>
<td>1/8</td>
<td>1/8</td>
</tr>
</tbody>
</table>

#### OPTIONS CHART

<table>
<thead>
<tr>
<th>Bensely</th>
<th>Drain (prefix)</th>
<th>Elements (suffix)</th>
<th>Bowl Length (prefix)</th>
<th>Differential Pressure Gauge (prefix)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal</td>
<td>Plastic</td>
<td>Automatic</td>
<td>Manual</td>
<td>No Drain</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Hydro-Jector</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5-μm 5-μm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5-μm 10-μm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10-μm 20-μm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20-μm 40-μm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>40-μm 80-μm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>80-μm 160-μm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Standard</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Extended</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No Gauge</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Small Gauge</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Large Gauge</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>S20</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>S52</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>S52</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>S52</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>S52</td>
</tr>
</tbody>
</table>

* = Note: FSA option applies to metal bowl configuration. If plastic bowl is chosen, use FSA for plastic stem on float drain. If brass stem is needed on plastic bowl then consult factory.

#### FLOW RATE & OPERATING RANGES

**FLOW RATE**

<table>
<thead>
<tr>
<th>Part Size</th>
<th>Flow Rate (PSIG x INLET x SCFM x @ Pressure Only)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L/4</td>
<td>15-150</td>
</tr>
<tr>
<td>L/8</td>
<td>15-150</td>
</tr>
<tr>
<td>L/16</td>
<td>15-150</td>
</tr>
<tr>
<td>L/32</td>
<td>15-150</td>
</tr>
</tbody>
</table>

**INLET OPERATING PSI**

<table>
<thead>
<tr>
<th>Part Size</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>L/4</td>
<td>15-150</td>
</tr>
<tr>
<td>L/8</td>
<td>15-150</td>
</tr>
<tr>
<td>L/16</td>
<td>15-150</td>
</tr>
<tr>
<td>L/32</td>
<td>15-150</td>
</tr>
</tbody>
</table>

**FLOW RATE & OPERATING RANGES**

<table>
<thead>
<tr>
<th>Part Size</th>
<th>Flow Rate (PSIG x INLET x SCFM x @ Pressure Only)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L/4</td>
<td>15-150</td>
</tr>
<tr>
<td>L/8</td>
<td>15-150</td>
</tr>
<tr>
<td>L/16</td>
<td>15-150</td>
</tr>
<tr>
<td>L/32</td>
<td>15-150</td>
</tr>
</tbody>
</table>

**INLET OPERATING PSI**

<table>
<thead>
<tr>
<th>Part Size</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>L/4</td>
<td>15-150</td>
</tr>
<tr>
<td>L/8</td>
<td>15-150</td>
</tr>
<tr>
<td>L/16</td>
<td>15-150</td>
</tr>
<tr>
<td>L/32</td>
<td>15-150</td>
</tr>
</tbody>
</table>

---

Master Pneumatic

7101 Idle Rd. | Shantung Heights, MI 48314

Phone: (586) 256-0000 | Fax: (586) 254-6055

Website: www.masterpneumatic.com

Email: mp@masterpneumatic.com

© Master Pneumatic 2012
What is the purpose of a Coalescing Filter?

- Used in a compressed air system, often to remove oil created by an oil-lubricated compressor
- Why remove the oil?
  - Can affect product quality
  - Surface blemishes in paint applications
  - Oil can cause seals in pneumatic valves and cylinders to swell causing sluggish operation or, in severe cases, complete seizure.
- Application
  - Use as close as possible before the component it protects
  - Removes contaminating water emulsions and particle removal down to 0.01 microns.
  - Replace elements when gauge indicates to improve effectiveness

Coalescing filters operate the opposite of General Purpose Filters. Air flows from the inside out of the Coalescing Filter element. The Coalescing element, by having extremely fine mesh size 'holes', brings an additional function not available from general purpose elements, that of removing oil from the compressed air stream.
Coalescing Filter Elements

• The elements are epoxy-resin-coated, borosilicate, glass-fiber

• How They Work
  – Inertial impaction - Impact on fibers
  – Direct Interception – Molecular attraction to fiber
  – Diffusion – Random Brownian motion

Note: A 0.3 µ coalescing element is standard and removes 99.99% of oil and solid contaminants larger than 0.3 µ. 0.01 µ element is optional.
MP Coalescing Filters

- Product port size range from 1/8” to 2”
- Flow Rate from 8 scfm (3.8 l/s) to 840 scfm (396 l/s)
- Element sizes from .3 µ (std) to .01 µ
- Differential pressure gauges are standard on every series except the 10 & 50 series.
- Other options can be accommodated
MP Coalescing Filters

• Differential Pressure Gauges
  – Used to indicate remaining element life
  – Standard on all but Series 10 & 50
  – Three versions available

Large Indicating-
Clean, Change, Dirty

Small
Go/No-Go

Large version available with reed switch

© Master Pneumatic 2012
Filter Maintenance - Elements

- Accumulation of solid contaminants will result in excessive pressure drop across element.
- Differential Pressure Gauge will indicate when an element change is required.
- Note a particulate filter should be installed up stream of coalescing filter to extend the life of the element.
A Coalescing Filter removes oil droplets. A General Purpose filter is required prior to this filter to extend the life of the coalescing element.
MP Coalescing Filter - Benefits

- Remove unwanted oil from compressed air system
- A few examples/applications:
  - Sensitive air gauging equipment
  - Assembly operations where oil film on parts is a problem
  - Food and Beverage
  - Packaging operations
  - Painting and other film applications where oil presence will cause stencil or adhesion problems

High Capacity Series

© Master Pneumatic 2012
M/P offers Several Drains for Coalescing Filters

- **Internal**
  - Automatic
    - *Differential Pressure*
    - *Float Design (New in 2008)*
  - Manual (Optional)

- **External**
  - Automatic
    - » Float Type
    - » Warrior Electronic Control
  - Manual (Optional)

- **Hydro-Jector** is not recommended for a coalescing filter.
MP Coalescing Filters
2 External Drains

Note: Hydro-Jector is not recommended for a coalescing filter.
How to Select a Coalescing Filter

- **Flow requirement SCFM (l/s)**
  - Pipe Size and thread type
  - Inlet & Outlet Pressure(s)
  - Bowl material and Drain Type
  - Temperature
  - Chemicals present environment
  - How fine of element required
  - $1 \ C_V = 25 \text{ SCFM (11.8 l/s) @100 psig (6.9 bar)}$ (ballpark)
  - Compressor Horse Power $\times$ 4 or 4.5 = SCFM (ballpark)
Coalescing Filters & Port Sizes.
(Approximate size relationship as shown)

- **BFCD201** High Flow
  - NPT & BSPP Port sizes: 3/4 & 3
  - SAE sizes: 1-1/16-12 & 1-5/16-12

- **BFCD201** High Flow
  - NPT & BSPP Port sizes: 3/4 & 3
  - SAE sizes: 1-1/16-12 & 1-5/16-12

- **BFCD600** Guardsman
  - NPT & BSPP Port sizes: 1/4, 1/8
  - SAE sizes: 9/64-18

- **BFCD100** Sentry Modular
  - NPT & BSPP Port sizes: 1/8, 1/4
  - Tubing sizes: 1/4, 3/8, 4mm, 6mm, 8mm & 10mm

- **BFCD50** Miniature
  - NPT & BSPP Port sizes: 1/8, 1/4

- **BFCD101** Vanguard Modular
  - NPT & BSPP Port sizes: 1/4, 3/8, 1/2
  - SAE sizes: 9/64-18 & 5/32-18

- **BFCD380** Modular
  - NPT & BSPP Port sizes: 3/8, 1/2, 3/4
  - SAE sizes: 3/8-16 & 7/16-14

- **BFCD380** High Flow
  - NPT & BSPP Port sizes: 3/4 & 1
  - SAE sizes: 1-1/16-12 & 1-1/16-12

© Master Pneumatic 2012
Coalescing Filters & Port Sizes.

Bowes that are marked with a yellow are available options for the product listed. Numbers and letters inside each yellow box reflects the proper suffix / prefix needed. See Master Pneumatics catalog for a complete product breakdown chart.

**PIPE SIZE CHART**

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>NPTF</th>
<th>Block</th>
<th>Round</th>
<th>Size</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4</td>
<td>3/8</td>
<td>1/8</td>
<td>1/8</td>
<td>3/16</td>
<td>1/16</td>
</tr>
<tr>
<td>1/2</td>
<td>3/4</td>
<td>1/2</td>
<td>1/2</td>
<td>7/16</td>
<td>5/16</td>
</tr>
<tr>
<td>3/4</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>9/16</td>
<td>7/16</td>
</tr>
<tr>
<td>1</td>
<td>1-1/4</td>
<td>1-1/4</td>
<td>1-1/4</td>
<td>11/16</td>
<td>9/16</td>
</tr>
<tr>
<td>1-1/4</td>
<td>1-1/2</td>
<td>1-1/2</td>
<td>1-1/2</td>
<td>13/16</td>
<td>11/16</td>
</tr>
<tr>
<td>1-1/2</td>
<td>1-1/2</td>
<td>1-1/2</td>
<td>1-1/2</td>
<td>15/16</td>
<td>13/16</td>
</tr>
<tr>
<td>1-1/2</td>
<td>1-1/2</td>
<td>1-1/2</td>
<td>1-1/2</td>
<td>15/16</td>
<td>13/16</td>
</tr>
<tr>
<td>1-1/2</td>
<td>1-1/2</td>
<td>1-1/2</td>
<td>1-1/2</td>
<td>15/16</td>
<td>13/16</td>
</tr>
<tr>
<td>1-1/2</td>
<td>1-1/2</td>
<td>1-1/2</td>
<td>1-1/2</td>
<td>15/16</td>
<td>13/16</td>
</tr>
</tbody>
</table>

**OPTIONS CHART**

<table>
<thead>
<tr>
<th>Bowel (NPTF)</th>
<th>Drain (NPTF / SAE)</th>
<th>Elements (SAE)</th>
<th>Bowel Length (Feet)</th>
<th>Differential Pressure (PSI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4</td>
<td>1/8</td>
<td>PC4A</td>
<td>3/16</td>
<td>1/16</td>
</tr>
<tr>
<td>3/8</td>
<td>3/8</td>
<td>PC4A</td>
<td>5/16</td>
<td>3/16</td>
</tr>
<tr>
<td>1/2</td>
<td>1/2</td>
<td>PC4A</td>
<td>7/16</td>
<td>5/16</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>PC4A</td>
<td>9/16</td>
<td>7/16</td>
</tr>
<tr>
<td>1-1/4</td>
<td>1-1/4</td>
<td>PC4A</td>
<td>11/16</td>
<td>9/16</td>
</tr>
<tr>
<td>1-1/2</td>
<td>1-1/2</td>
<td>PC4A</td>
<td>13/16</td>
<td>11/16</td>
</tr>
</tbody>
</table>

**FLOW RATE & OPERATING RANGE**

<table>
<thead>
<tr>
<th>Bowel Size</th>
<th>Flow Rate (3-3.5 um Element)</th>
<th>Flow Rate (1-2.5 um Element)</th>
<th>Inlet Operating PSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4</td>
<td>1/8</td>
<td>3/16</td>
<td>1/16</td>
</tr>
<tr>
<td>3/8</td>
<td>3/8</td>
<td>5/16</td>
<td>3/16</td>
</tr>
<tr>
<td>1/2</td>
<td>1/2</td>
<td>7/16</td>
<td>5/16</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>9/16</td>
<td>7/16</td>
</tr>
</tbody>
</table>

**FLOW RATE & OPERATING RANGE**

<table>
<thead>
<tr>
<th>Bowel Size</th>
<th>Flow Rate (3-3.5 um Element)</th>
<th>Flow Rate (1-2.5 um Element)</th>
<th>Inlet Operating PSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4</td>
<td>1/8</td>
<td>3/16</td>
<td>1/16</td>
</tr>
<tr>
<td>3/8</td>
<td>3/8</td>
<td>5/16</td>
<td>3/16</td>
</tr>
<tr>
<td>1/2</td>
<td>1/2</td>
<td>7/16</td>
<td>5/16</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>9/16</td>
<td>7/16</td>
</tr>
</tbody>
</table>

© Master Pneumatic 2012
Remember-

• **General Purpose Filters** remove WATER and PARTICULATES and should always be installed upstream of Coalescing Filters.

• **Coalescing Filters** remove 99.99% of oil & solids greater than 0.3 µ in size. An optional 0.01 µ element is available.

• Thank you!

© Master Pneumatic 2012