Air Preparation Units
General Line FRL, Hi-Flow FRL and Desiccant Dryers

Catalog 0730
CAUTION:
Polycarbonate bowls, being transparent and tough, are ideal for use with Filters and Lubricators. They are suitable for use in normal industrial environments, but should not be located in areas where they could be subjected to direct sunlight, an impact blow, nor temperatures outside of the rated range. As with most plastics, some chemicals can cause damage. Polycarbonate bowls should not be exposed to chlorinated hydro-carbons, ketones, esters and certain alcohols. They should not be used in air systems where compressors are lubricated with fire-resistant fluids such as phosphate ester and di-ester types.
Metal bowls are recommended where ambient and/or media conditions are not compatible with polycarbonate bowls. Metal bowls resist the action of most such solvents, but should not be used where strong acids or bases are present or in salt laden atmospheres. Consult the factory for specific recommendations where these conditions exist.

TO CLEAN POLYCARBONATE BOWLS USE MILD SOAP AND WATER ONLY! DO NOT use cleansing agents such as acetone, benzene, carbon tetrachloride, gasoline, toluene, etc., which are damaging to this plastic.

Metal bowl guards are recommended for all applications.

CAUTION:
REGULATOR PRESSURE ADJUSTMENT – The working range of knob adjustment is designed to permit outlet pressures within their full range. Pressure adjustment beyond this range is also possible because the knob is not a limiting device. This is a common characteristic of most industrial regulators, and limiting devices may be obtained only by special design.

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.
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Particulate and Coalescing Filters

Filtration

The average 10-hp compressor handles four million cubic inches of air per hour. This air can contain billions of contaminating particles.

At high concentration and high speed, these particles can be extremely harmful. They block orifices, erode components, and clog clearances between moving parts.

In addition, when ambient air is drawn into a compressor, it can, depending on weather conditions, have relative humidity up to 100 percent. As air is compressed and cooled, some water vapor\(^1\) condenses out as free water, and even with a compressor aftercooler, some moisture is swept downstream into the air system. This may result in rusted pneumatic tools and components, contaminated lubricants, and frozen air lines during low temperature periods.

Other types of foreign matter in air lines include: impurities generated within the air line, such as wear particles, pipe scale and rust; construction and assembly debris; and contaminants introduced into the air system during maintenance or through leakage passages.

All these contaminants, which are of a size to cause air stream problems, should be removed by the filter.

\(^1\) Water vapor, which is a gas, is not a contaminant in pneumatic systems until it condenses.

How to Select the Proper Filter

Filter element rating is the prime selection criterion. This rating must match the requirements of all downstream components. Next, the flow capacity and pressure rating of the filter should be considered. Finally, port size should match system piping to avoid unnecessary pressure drops through restricting adapters.

Bowl material and the type of drain for the application are other choices to be made.

The first step in choosing a filter is to determine the filtration requirements of the most critical components used in that system.

Contamination particle size is measured in micrometers. A micrometer is one millionth of a meter or \(0.000039\) inches. Frequently, micrometer is abbreviated as micron or symbolized by the Greek letter \(\mu\). Particle-removing filter elements are rated\(^2\) according to the particle size they will trap. For most industrial applications, filter elements rated at 40 microns are adequate. When necessary, filtration as low as 5 microns or finer can be provided. Remember, however, that finer filtration increases the pressure drop through the element. As micron size rating varies, so does the size and type of filter.

Most oils entrained in a compressed air stream are in the form of tiny mist or aerosol droplets which can pass through a standard industrial filter element. If it is necessary to remove these aerosols, an oil-removal type coalescing filter can be used. The sub-micron oil particles which escape an oil-removal filter should have no detrimental effect on industrial pneumatic components. But if these particles must be removed for applications such as spray painting, a coalescing type element should be used.

\(^2\) The inexact nominal filter element rating indicates that most particles that size or larger will be trapped. The absolute rating indicates that all particles that size or larger will be trapped.

Filter Construction

Most pneumatic filters consist of two basic elements: a die-cast body, into which the inlet and outlet piping is connected, and a sealed removable bowl which contains collected contaminants.

The bowl is fitted with a drain mechanism to remove liquids before they rise to the baffle level. The drain system usually operates while the filter is under pressure, but the unit must be exhausted to remove the bowl for cleaning and element service. The piping need not be disturbed.

Generally a transparent bowl is the most convenient because it provides easy visual inspection of the sump level. However, hostile environment, higher pressure, or higher temperature may require a metal bowl for safety.

The most common plastic used for bowls is polycarbonate. This material performs satisfactorily for air pressures below 150 PSIG and temperatures between 40° and 120° F. Parker offers polyethylene bowl guards for added safety.

As the pressure or temperature requirement increases, you may have to specify a metal bowl with sight gauge. For extreme conditions, it is recommended that the sight gauge be eliminated. (Please refer to the individual model descriptions for specifications on bowls.)

Thus, the environment determines the choice of bowl. Polycarbonates offer great strength and visibility, but can be attacked by certain chemicals. Metal bowls offer the highest pressure and temperature rating, and provide superior protection when installed in an environment containing chemicals that are incompatible with polycarbonate.

Filter Operation

When pressurized air enters a typical filter body. The curved inlet and deflector direct the incoming air in a downward whirling pattern. Centrifugal force hurls the larger solid and liquid water particles outward where they collect on the inner surface of the filter bowl. The particles spiral down past a baffle into a quiet chamber. The baffle prevents turbulent air in the upper bowl from re-entraining liquid contaminants and carrying them downstream.

Then the dry, cleaner air follows a convoluted path through the filter element, where finer solid particles are filtered out. Finally, filtered air passes up the center of the element and out the discharge port.
Warning

The plastic material used to manufacture the plastic bowls, and the sight gauge on metal bowls, may be attacked by certain chemicals. Do not use this filter on systems with air supplied by a compressor lubricated with synthetic oils or oils containing phosphate esters or chlorinated hydrocarbons. These oils can carry over into the air lines and chemically attack and possibly rupture the bowl or sight gauge. Also, do not expose the bowl or sight gauge to materials such as carbon tetrachloride, trichlorethylene, acetone, paint thinner, cleaning fluids, or other harmful materials, for they too will cause the plastic to craze and/or rupture. For use in environments where these, or any, chemicals may be present, consult the factory for approval.

Coalescing Filters

These high-efficiency filters operate on a somewhat different principle than particulate air filters. The key difference is in the element, where a fiber network is narrowly spaced to trap smaller contaminants. The special fibers hold any liquid particle which contacts them.

Pre-filtered (A particulate filter must be used prior to a coalescing filter) air enters the cylindrical element at the center. As it flows through the element, particles are captured by three different mechanisms: direct interception as particles impinge on the fibers; inertial impaction as particles are thrown against fibers by the turbulent air stream; and diffusion as smaller particles vibrate with Brownian movement to collide with fibers and other particles. As a result, coalescing elements can capture particles smaller than the nominal size of the flow passages through the element.

Collected liquid migrates to the crossing points of the fibers where larger drops form or coalesce. Pressure differential through the element then forces these drops to the downstream surface of the element where they gravitate downward to the sump.

The filtered air then exits through the outlet port.

It is very important that the air be pre-filtered, as larger contaminants tend to block the passages between fibers, reducing the efficiency of the coalescing element.
F602 Standard Filters

Features
- Excellent Water Removal Efficiency
- For Heavy Duty Applications with Minimum Pressure Drop Requirement
- Unique Deflector Plate that Creates Swirling of the Air Stream Ensuring Maximum Water and Dirt Separation
- Large Filter Element Surface Guarantees Low Pressure Drop and Increased Element Life
- 40 Micron Filter Element Standard, 5 Micron Available
- Metal Bowl with Sight Gauge Standard
- Twist Drain as Standard, Optional Auto Drain
- Large Bowl Capacity
- Optional High Capacity Bowl(s) Available
- High Flow: 3/4" .................... 220 SCFM§
  1" ....................... 240 SCFM§

§ SCFM = Standard Cubic Feet Per Minute at 100 PSI Inlet, and 5 PSI Pressure Drop with 40 Micron Element.

<table>
<thead>
<tr>
<th>Port Size</th>
<th>Manual Twist Drain</th>
<th>Internal Auto Drain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal Bowl / Sight Gauge - 16 oz.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3/4&quot;</td>
<td>F602-06WJ</td>
<td>F602-06WJR</td>
</tr>
<tr>
<td>1&quot;</td>
<td>F602-08WJ</td>
<td>F602-08WJR</td>
</tr>
<tr>
<td>Metal Bowl without Sight Gauge - 32 oz.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3/4&quot;</td>
<td>F602-06EJ</td>
<td>F602-06EJR</td>
</tr>
<tr>
<td>1&quot;</td>
<td>F602-08EJ</td>
<td>F602-08EJR</td>
</tr>
</tbody>
</table>

F602 Filter Dimensions

<table>
<thead>
<tr>
<th>A (inches)</th>
<th>B (inches)</th>
<th>C (inches)</th>
<th>D (inches)</th>
<th>E (inches)</th>
<th>F (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>F602-06W, F602-08W</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.90</td>
<td>7.88</td>
<td>8.72</td>
<td>4.06</td>
<td>0.84</td>
<td>2.45</td>
</tr>
<tr>
<td>(124)</td>
<td>(200)</td>
<td>(221)</td>
<td>(103)</td>
<td>(21)</td>
<td>(62)</td>
</tr>
<tr>
<td>F602-06E, F602-08E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.90</td>
<td>11.10</td>
<td>11.94</td>
<td>4.06</td>
<td>0.84</td>
<td>2.45</td>
</tr>
<tr>
<td>(124)</td>
<td>(282)</td>
<td>(303)</td>
<td>(103)</td>
<td>(21)</td>
<td>(62)</td>
</tr>
</tbody>
</table>

Ordering Information

F 602 — 06 W J /**

Port Threads
- NPT
- G BSPP

Port Size
- 06 3/4 Inch
- 08 1 Inch

Bowl
- E 32 oz. Large Capacity Metal without Sight Gauge
- W 16 oz. Metal with Sight Gauge

Element
- G 5 Micron
- J 40 Micron

Drains and Options
- Blank
- Manual Twist Drain
- Q External Heavy Duty Auto Drain
- R Internal Auto Drain

Engineering Change Designator
Will be entered at factory.

NOTE: BOLD OPTIONS ARE STANDARD.
**Technical Information**

F602 Filter Kits & Accessories

Bowl Kits –
- Aluminum (E) ....................................................... BK603B
- Zinc with Sight Gauge (W) .................................... BK605WB

Drain Kits –
- External Auto (E) ................................................. SA602D
- External Auto (W) ............................................... SA602MD
- Internal Auto (All) ............................................... SA602AM
- Manual (All) ....................................................... SA600Y7-1
- Semi-Automatic “Overnight” Drain ..................... SA602A7

Filter Element Kits –
- 40 Micron (All) .................................................. EK602B
- 5 Micron (All) ..................................................... EK602VB

Mounting Bracket Kit
(Pair or 2 Kits Pipe Mounted Brackets needed) –
- (3/4” Unit) ......................................................... SA200AW57
- (1” Unit) .......................................................... SA200CW57

Repair Kits –
- Deflector, Baffle Assembly, and Retaining Rod (E,W) ...... RK602B
- External Auto Drain (All) ....................................... RK602D
- Internal Auto Drain (All) ........................................ RK602MD
- Metal Bowl with Sight Gauge (W) .......................... RKB605WB

Specifications

Bowl Capacity –
- Aluminum Bowl (E) ........................................... 32 Ounces
- Zinc Bowl (W) .................................................. 16 Ounces

( ) = Bowl Type

**Port Threads** ................................................. 3/4, 1 Inch

**Pressure & Temperature Ratings** –
- Aluminum Bowl (E) ........................................... 0 to 300 PSIG (0 to 20.4 bar)
- 40°F to 150°F (4.4°C to 65.6°C)
- Zinc (W) ........................................................... 0 to 250 PSIG (0 to 17.2 bar)
- 40°F to 150°F (4.4°C to 65.6°C)
- With Internal Auto Drain (R) ............................... 20 to 175 PSIG (1.4 to 11.9 bar)
- 40°F to 125°F (4.4°C to 52°C)
- With External Auto Drain (Q) .............................. 0 to 250 PSIG (0 to 17.2 bar)
- 40°F to 150°F (4.4°C to 65.6°C)

**Weight** –
- Aluminum Bowl (E) ........................................... 7 lb. (3.18 kg) / Unit
- Zinc Bowl (W) ................................................... 6 lb. (2.72 kg) / Unit
- 20 lb. (9.07 kg) / 4-Unit Master Pack
- Zinc Bowl (W) ................................................... 6.3 lb. (2.86 kg) / Unit
- 25 lb. (11.34 kg) / 4-Unit Master Pack

**Materials of Construction**

Body ............................................................... Zinc

Bowls –
- (E) ................................................................. Aluminum without Sight Gauge
- (W) ................................................................. Zinc with Sight Gauge

Drain –
- Manual Twist & Overnight ................................... Brass
- Housing “R” ....................................................... Acetal
- Housing “Q” ..................................................... Bronze

Filter Elements –
- 40 Micron (Standard) ......................................... Polypropylene
- 5 Micron (Optional) ........................................... Polypropylene

Seals ............................................................... Nitrile

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“Q” Option External Heavy Duty Auto Drain
SA602D / SA603D
For heavy duty applications where the filter is being used to remove large volumes of liquid and/or particulate matter from the airstream, the external automatic drain (**“Q” option** should be used.)

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**F602 Series Standard Filters**
F602 Standard Filters

Features
- Excellent Water Removal Efficiency
- For Heavy Duty Applications with Minimum Pressure Drop Requirement
- Unique Deflector Plate that Creates Swirling of the Air Stream Ensuring Maximum Water and Dirt Separation
- Large Filter Element Surface Guarantees Low Pressure Drop and Increased Element Life
- 40 Micron Filter Element Standard, 5 Micron Available
- Metal Bowl with Sight Gauge Standard
- Twist Drain as Standard, Optional Auto Drain
- Large Bowl Capacity
- Optional High Capacity Bowl(s) Available
- High Flow: 1-1/4" ................. 390 SCFM§
1-1/2" .................. 450 SCFM§

§ SCFM = Standard Cubic Feet Per Minute at 100 PSI Inlet, and 5 PSI Pressure Drop with 40 Micron Element.

Ordering Information

F 602 — 10 W J /**

Port Threads
— NPT
G BSPP
Port Size
10 1-1/4 Inch
12 1-1/2 Inch
Bowl
E 32 oz. Large Capacity Metal without Sight Gauge
W 16 oz. Metal with Sight Gauge
Element
G 5 Micron
J 40 Micron
Drains and Options
Blank Manual Twist Drain
Q External Heavy Duty Auto Drain
R Internal Auto Drain
Engineering Change Designator
Will be entered at factory.

NOTE: BOLD OPTIONS ARE STANDARD.
Technical Information

**Pressure & Temperature Ratings**
- **Aluminum Bowl (E)**: 0 to 300 PSIG (0 to 20.4 bar) at 40°F to 150°F (4.4°C to 65.6°C)
- **Zinc (W)**: 0 to 250 PSIG (0 to 17.2 bar) at 40°F to 150°F (4.4°C to 65.6°C)
- **With Internal Auto Drain (R)**: 20 to 175 PSIG (1.4 to 11.9 bar) at 40°F to 125°F (4.4°C to 52°C)
- **With External Auto Drain (Q)**: 0 to 250 PSIG (0 to 17.2 bar) at 40°F to 150°F (4.4°C to 65.6°C)

**Weight**
- **Aluminum Bowl (E)**: 7.7 lb. (3.49 kg) / Unit, 31 lb. (14.06 kg) / 4-Unit Master Pack
- **Zinc Bowl (W)**: 7 lb. (3.18 kg) / Unit, 28 lb. (12.70 kg) / 4-Unit Master Pack

**Materials of Construction**
- **Body**: Aluminum (E) / Zinc (W)
- **Bowl**: Aluminum without Sight Gauge (E) / Zinc with Sight Gauge (W)
- **Drain**: Manual Twist & Overnight (R) / Brass, Housing “R” (Q) / Acetal, Housing “Q” / Bronze
- **Filter Elements**: 40 Micron (Standard) / Polypropylene, 5 Micron (Optional) / Polypropylene
- **Seals**: Nitrile
- **Sight Gauge**: Nylon

**Specifications**
- **Bowl Capacity –**
  - **Aluminum (E)**: 32 Ounces
  - **Zinc (W)**: 16 Ounces
- **Port Threads**: 1-1/4, 1-1/2 Inch

( ) = Bowl Type

---

“Q” Option External Heavy Duty Auto Drain
SA602D / SA603D
For heavy duty applications where the filter is being used to remove large volumes of liquid and/or particulate matter from the airstream, the external automatic drain (“Q” option) should be used.

**F602 Filter Kits & Accessories**

**Bowl Kits –**
- **Aluminum (E)**: BK603B
- **Zinc with Sight Gauge (W)**: BK605WB

**Drain Kits –**
- **External Auto (E)**: SA602D
- **Internal Auto (All)**: SA602MD
- **Manual (All)**: SA600Y7-1
- **Semi-Automatic “Overnight” Drain**: SA602A7
  (Drains automatically under zero pressure)

**Filter Element Kits –**
- **40 Micron (All)**: EK602B
- **5 Micron (All)**: EK602VB

**Repair Kits –**
- **Deflector, Baffle Assembly, and Retaining Rod (All)**: RK602C
- **External Auto Drain (All)**: RK602D
- **Internal Auto Drain (All)**: RK602MD
- **Metal Bowl with Sight Gauge (W)**: RKB605WB

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**F602 Series Standard Filters**

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F602 Standard Filters

**Features**

- Excellent Water Removal Efficiency
- For Heavy Duty Applications with Minimum Pressure Drop Requirement
- Unique Deflector Plate that Creates Swirling of the Air Stream Ensuring Maximum Water and Dirt Separation
- Large Filter Element Surface Guarantees Low Pressure Drop and Increased Element Life
- 40 Micron Filter Element Standard
- Metal Bowl with Sight Gauge Standard
- Twist Drain as Standard, Optional Auto Drain
- Large Bowl Capacity
- Optional High Capacity Bowl(s) Available
- High Flow: 2” & 2-1/2” .......... 1500 SCFM

$ SCFM = Standard Cubic Feet Per Minute at 100 PSIG Inlet, and 5 PSIG Pressure Drop with 40 Micron Element.

<table>
<thead>
<tr>
<th>Port Size</th>
<th>Manual Twist Drain</th>
<th>Internal Auto Drain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal Bowl / Sight Gauge - 16 oz.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2”</td>
<td>F602-16WJ</td>
<td>F602-16WJR</td>
</tr>
<tr>
<td>2-1/2”</td>
<td>F602-20WJ</td>
<td>F602-20WJR</td>
</tr>
<tr>
<td>Metal Bowl without Sight Gauge - 32 oz.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2”</td>
<td>F602-16EJ</td>
<td>F602-16EJR</td>
</tr>
<tr>
<td>2-1/2”</td>
<td>F602-20EJ</td>
<td>F602-20EJR</td>
</tr>
</tbody>
</table>

Standard part numbers shown bold.
For other models refer to ordering information below.

**Ordering Information**

<table>
<thead>
<tr>
<th>F</th>
<th>602</th>
<th>16</th>
<th>W</th>
<th>J</th>
<th>/**</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Port Threads</th>
<th>Port Size</th>
<th>Bowl</th>
<th>Element</th>
<th>Drains and Options</th>
<th>Engineering Change Designator</th>
</tr>
</thead>
<tbody>
<tr>
<td>— NPT</td>
<td>16 2 Inch</td>
<td>E 32 oz. Large Capacity Metal without Sight Gauge</td>
<td>J 40 Micron</td>
<td>Blank Manual Twist Drain</td>
<td>Will be entered at factory.</td>
</tr>
<tr>
<td>G BSPP</td>
<td>20 2-1/2 Inch</td>
<td>W 16 oz. Metal with Sight Gauge</td>
<td></td>
<td>Q External Heavy Duty Auto Drain</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: BOLD OPTIONS ARE STANDARD.
Technical Information

F602 Filter Kits & Accessories

Bowl Kits –
Aluminum (E) .................................................. BK603B
Zinc with Sight Gauge (W) .......................... BK605WB

Drain Kits –
External Auto (E) ....................... SA603D
External Auto (W) .................. SA602D
Internal Auto (All) ............................. SA602MD
Manual (All) .................................. SA600Y7-1
Semi-Automatic “Overnight” Drain ............. SA602A7
(Drains automatically under zero pressure)

Filter Element Kits –
40 Micron (All) .................................. EK602B

Repair Kits –
Deflector, Baffle Assembly, and Retaining Rod (All) ...... RK602C
External Auto Drain (All) .................... RK602D
Internal Auto Drain (All) .................... RK602MD
Metal Bowl with Sight Gauge (W) ............. RKB605WB

Specifications

Bowl Capacity –
Aluminum (E) .............................................. 32 Ounces
Zinc (W) .................................................. 16 Ounces

Port Threads ........................................... 2, 2-1/2 Inch

( ) = Bowl Type

Pressure & Temperature Ratings –
Aluminum Bowl (E) .................. 0 to 300 PSIG (0 to 20.4 bar)
40°F to 150°F (4.4°C to 65.6°C)
Zinc (W) ............................................... 0 to 250 PSIG (0 to 17.2 bar)
40°F to 150°F (4.4°C to 65.6°C)
With Internal Auto Drain (R) ........ 20 to 175 PSIG (1.4 to 11.9 bar)
40°F to 125°F (4.4°C to 52°C)
With External Auto Drain (Q) ........ 0 to 250 PSIG (0 to 17.2 bar)
40°F to 150°F (4.4°C to 65.6°C)

Weight –
Aluminum Bowl (E) .................. 10.3 lb. (4.67 kg) / Unit
11 lb. (4.99 kg) / 1-Unit Master Pack
Zinc Bowl (W) ................................. 9.8 lb. (4.45 kg) / Unit
39 lb. (17.69 kg) / 4-Unit Master Pack

Materials of Construction

Body .............................................................. Aluminum
Bowls –
(E) .............................................................. Aluminum without Sight Gauge
(W) ............................................................. Zinc with Sight Gauge

Drain –
Manual Twist & Overnight ...................... Brass
Housing “R” ................................................. Acetal
Housing “Q” .............................................. Bronze

Filter Elements –
40 Micron (Standard) .............................. Polypropylene

Seals ................................................................. Buna N

Sight Gauge .................................................. Nylon

“Q” Option External Heavy Duty Auto Drain
SA602D / SA603D
For heavy duty applications where the filter is being used to remove large volumes of liquid and/or particulate matter from the airstream, the external automatic drain (“Q” option) should be used.
09F Filters – Hi-Flow

Features

- Metal Bowl Standard
- 5 Micron Element
- Large Capacity Bowl
- Standard Differential Pressure Indicator
- High Flow: 2" ................... 1000 SCFM

$\text{SCFM} = \text{Standard Cubic Feet Per Minute at 90 PSIG Inlet and 5 PSIG Pressure Drop.}$

<table>
<thead>
<tr>
<th>Port Size</th>
<th>NPT</th>
<th>Twist Drain</th>
<th>Automatic Float Drain</th>
</tr>
</thead>
<tbody>
<tr>
<td>2&quot;</td>
<td>09F83BB</td>
<td>09F87BB</td>
<td></td>
</tr>
</tbody>
</table>

Distance Required To Remove All Bowls Regardless Of Drain Option

NOTE: BOLD OPTIONS ARE STANDARD.

For other models refer to ordering information below.

Ordering Information

NOTE: BOLD OPTIONS ARE STANDARD.
Technical Information

![Graph showing Pressure Drop vs Flow for 09F83BB 2 Inch Ports]

### Technical Specifications

- **Primary Pressure - bar**: 1.0, 2.4, 4.1, 6.2, 7.0, 8.2, 10.3, 15, 35, 60, 90, 100, 120, 150
- **Primary Pressure - PSIG**: 15, 35, 60, 90, 100, 120, 150, 200, 400, 600, 800, 1000, 1200, 1400
- **Flow - SCFM**: 0, 100, 200, 300, 400, 500, 600, 1
- **Flow - dm³/s**: 0, 100, 200, 300, 400, 500, 600

#### 09F Filter Kits & Accessories
- **Differential Pressure Indicator**: PS619P
- **Drain Kits** –
  - Automatic Float Drain: PS620P
  - Twist Drain: PS625P
- **Filter Element Kit** – 5 Micron Element: PS618P

#### Specifications
- **Bowl Capacity**: 117 Ounces
- **Sump Capacity**: 12.5 Ounces
- **Port Threads**: 2 Inch
- **Pressure & Temperature Ratings**: 150 PSIG at 150°F (10.3 bar at 66°C)
- **Weight**: 19.3 lb. (8.7 kg)

#### Materials of Construction
- **Body**: Aluminum
- **Bowls**: Metal
- **Deflector**: Steel
- **Drains** –
  - Twist Drain: Brass Petcock
  - Automatic Float Drain –
    - Housing, Float: Plastic
    - Seals: Buna N
    - Springs, Push Rod: Stainless Steel
- **Filter Element**: Plastic
- **Seals**: Fluorocarbon
F701 Coalescing Filters

Features

• Removes Liquid Aerosols and Sub-micron Particles
• Protects Pneumatic Systems from Contamination that Standard Particulate Filters Will Not Catch.
• Two Different Grade Elements Available
• Differential Pressure Pop-up Indicator Standard
• Differential Pressure Gauge Optional
• High Flow Design

Note: All coalescing filters should be protected by a particulate filter (i.e., F602, or other) installed upstream.

### Ordering Information

<table>
<thead>
<tr>
<th>Part Threads</th>
<th>Port Size</th>
<th>Bowl</th>
<th>Element</th>
<th>Element Service Indicator</th>
<th>Bowl Drains</th>
<th>Engineering Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPT</td>
<td>3/4 Inch</td>
<td>Metal without Sight Gauge</td>
<td>3 Grade 6</td>
<td>Blank</td>
<td>Blank</td>
<td>* Will be Entered at Factory</td>
</tr>
<tr>
<td>G BSPP</td>
<td>1 Inch</td>
<td>Metal without Sight Gauge</td>
<td>7 Grade 10</td>
<td>None</td>
<td>Manual</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: BOLD OPTIONS ARE STANDARD.
Element Selection

<table>
<thead>
<tr>
<th>Element Grade</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>General air coalescing applications when total removal of liquid aerosols and suspended fines is required in all pressure ranges. Protection of air dryers, air gauging, air logic, modulating systems, critical air conveying, most breathing air systems, etc.</td>
</tr>
<tr>
<td>10</td>
<td>Precoalescer or prefilter for Grade 6 to remove gross amounts of water and oil, or tenacious aerosols which are difficult to remove. Upgrading existing particulate equipment to coalescing without increase in pressure drop.</td>
</tr>
</tbody>
</table>

Element Specifications

<table>
<thead>
<tr>
<th>Grade</th>
<th>D.O.P. Coalescing Efficiency 0.3 to 0.6 Micron Particles</th>
<th>Maximum Oil Carryover (^1) PPM w/w</th>
<th>Pressure Drop (PSID) (^2) @ Rated Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>99.97%</td>
<td>0.008</td>
<td>0.01</td>
</tr>
<tr>
<td>10</td>
<td>95%</td>
<td>0.85</td>
<td>0.7</td>
</tr>
</tbody>
</table>

\(^1\) Tested per BCAS 86900 at 40 ppm inlet.
\(^2\) Add dry + wet for total pressure drop.

F701 Filter Kits & Accessories

Mounting Bracket –

<table>
<thead>
<tr>
<th>Port Size</th>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4 (Pair of Pipe Mounted Brackets)</td>
<td>SA200AW57</td>
<td></td>
</tr>
<tr>
<td>1 (Pair of Pipe Mounted Brackets)</td>
<td>SA200CW57</td>
<td></td>
</tr>
</tbody>
</table>

Bowl Kit –

<table>
<thead>
<tr>
<th>Port Size</th>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4, 1 Inch (E)</td>
<td>BK603B</td>
<td></td>
</tr>
<tr>
<td>3/4, 1 Inch (L)</td>
<td>BK603C</td>
<td></td>
</tr>
</tbody>
</table>

Differential Pressure Pop Up Indicator Repair Kit –

<table>
<thead>
<tr>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>(only works with originally equipped units)</td>
<td>RK701P</td>
</tr>
</tbody>
</table>

Differential Pressure Gauge –

<table>
<thead>
<tr>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>(only works on units without pop-up indicator)</td>
<td>DP276-P</td>
</tr>
</tbody>
</table>

Drain Kits –

<table>
<thead>
<tr>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal Automatic Drain - High Pressure (T)</td>
<td>SA702MD</td>
</tr>
<tr>
<td>Manual Twist Drain</td>
<td>SA600Y7-1</td>
</tr>
</tbody>
</table>

Filter Element Kits –

<table>
<thead>
<tr>
<th>Port Size</th>
<th>Grade 6</th>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4, 1 Inch (E)</td>
<td>F701-C3-0773</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3/4, 1 Inch (L)</td>
<td>F701-C3-0774</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Port Size</th>
<th>Grade 10</th>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4, 1 Inch (E)</td>
<td>F701-C7-0773</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3/4, 1 Inch (L)</td>
<td>F701-C7-0774</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Specifications

Operation –

<table>
<thead>
<tr>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Recommended Pressure Drop</td>
<td>10 PSIG</td>
</tr>
<tr>
<td>(element should be replaced)</td>
<td></td>
</tr>
<tr>
<td>Normal Operating Pressure Drop (Dry)</td>
<td>2 PSIG</td>
</tr>
<tr>
<td>Normal Operating Pressure Drop (Wet)</td>
<td>5 PSIG</td>
</tr>
</tbody>
</table>

Minimum Recommended Flow – 20% of Rated Flow

Maximum Pressure (Manual Drains) –

<table>
<thead>
<tr>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;R&quot; Drain</td>
<td>175 PSIG (12 bar)</td>
</tr>
<tr>
<td>&quot;T&quot; Drain</td>
<td>250 PSIG (17 bar)</td>
</tr>
<tr>
<td>&quot;Q&quot; Drain</td>
<td>250 PSIG (17 bar)</td>
</tr>
</tbody>
</table>

Maximum Pressure Automatic Drains –

<table>
<thead>
<tr>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;R&quot; Drain</td>
<td>195 PSIG (12 bar)</td>
</tr>
<tr>
<td>&quot;T&quot; Drain</td>
<td>275 PSIG (17 bar)</td>
</tr>
<tr>
<td>&quot;Q&quot; Drain</td>
<td>275 PSIG (17 bar)</td>
</tr>
</tbody>
</table>

Maximum Temperature – 120°F (49°C)

Weight –

<table>
<thead>
<tr>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4 &amp; 1 Inch (E)</td>
<td>32 oz.</td>
</tr>
<tr>
<td>3/4 &amp; 1 Inch (L)</td>
<td>100 oz.</td>
</tr>
</tbody>
</table>

Materials of Construction

Body & Flange Ring –

<table>
<thead>
<tr>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zinc</td>
<td></td>
</tr>
</tbody>
</table>

Bowl –

<table>
<thead>
<tr>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal Bowl (E)</td>
<td>Aluminum</td>
</tr>
</tbody>
</table>

Drains –

<table>
<thead>
<tr>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automatic Float Drain</td>
<td>Acetal</td>
</tr>
<tr>
<td>Housing &quot;R&quot;, &quot;T&quot;</td>
<td>Bronze</td>
</tr>
<tr>
<td>Housing &quot;Q&quot;</td>
<td>Brass</td>
</tr>
</tbody>
</table>

Seals & Float –

<table>
<thead>
<tr>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buna N</td>
<td></td>
</tr>
</tbody>
</table>

Springs –

<table>
<thead>
<tr>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stainless Steel</td>
<td></td>
</tr>
</tbody>
</table>

Elements (Media) –

<table>
<thead>
<tr>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Borosilicate Fibers &amp; Felt</td>
<td></td>
</tr>
</tbody>
</table>

Element End Caps –

<table>
<thead>
<tr>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urethane</td>
<td></td>
</tr>
</tbody>
</table>

Seals –

<table>
<thead>
<tr>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buna N</td>
<td></td>
</tr>
</tbody>
</table>
### Features
- Removes liquid aerosols and sub-micron particles.
- Liquids gravitate to the bottom of the element and will not re-enter the airstream.
- Oil free air for critical applications, such as air gauging and pneumatic instrumentation and controls.
- Differential pressure indicator standard.
- High Flow:

<table>
<thead>
<tr>
<th>Port Size</th>
<th>Model</th>
<th>Sump Capacity</th>
<th>SCFM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1/2&quot;</td>
<td>30F</td>
<td>14.8 Oz.</td>
<td>350</td>
</tr>
<tr>
<td>2&quot;</td>
<td>31F83</td>
<td>17.9 Oz.</td>
<td>450</td>
</tr>
<tr>
<td>2&quot;</td>
<td>31F8L</td>
<td>20.9 Oz.</td>
<td>625</td>
</tr>
<tr>
<td>2-1/2&quot;</td>
<td>32F9</td>
<td>29.7 Oz.</td>
<td>800</td>
</tr>
<tr>
<td>3&quot;</td>
<td>32FN</td>
<td>29.7 Oz.</td>
<td>1000</td>
</tr>
</tbody>
</table>

### Ordering Information
```
Port Size | Bowl Options | Element | Engineering Level | Options
---|--------------|--------|-----------------|-------
30F | Twist Drain  | E Grade 6 | * Will be Entered at Factory | P Pressure Differential Indicator
7 1-1/2 Inch | 3 Short Bowl (30F, 31F) | |
8 2 Inch | L Long Bowl (31F, 32F) | |
9 2-1/2 Inch | N Long Bowl (31F, 32F) | |
```

**NOTE:** BOLD OPTIONS ARE STANDARD.
Technical Information

30F, 31F, 32F Coalescing Filter Kits & Accessories

Bowl Kit – Metal / Twist Drain –
- 30F ................................................................. 41618P
- 31F83 ......................................................... 41619P
- 31F8L ....................................................... 41620P
- 32F ............................................................. 41621P

DPI Replacement Kit –
- 30F, 31F83, 31F8L, 32F .................................. 2003P

Differential Pressure Indicating Gauge –
- 30F, 31F83, 31F8L, 32F .................................. 2111P

Drain Kits – Automatic Float Drain –
- 30F, 31F83, 31F8L, 32F .................................. PS506P

Filter Element Kits – Grade 6 (Standard) –
- 30F ................................................................. 9920-011x1P
- 31F83 ........................................................... 9920-012x1P
- 31F8L ........................................................... 9920-013x1P
- 32F ............................................................. 9920-014x1P

- Grade 10 (Optional) –
- 30F ................................................................. 9920-015x1P
- 31F83 ........................................................... 9920-016x1P
- 31F8L ........................................................... 9920-017x1P
- 32F ............................................................. 9920-018x1P

Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>Sump Capacity</th>
<th>Port Threads</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>30F</td>
<td>14.8 Oz</td>
<td>1-1/2&quot;</td>
<td>11.9 lb. (5.4 kg)</td>
</tr>
<tr>
<td>31F83</td>
<td>17.9 Oz</td>
<td>2&quot;</td>
<td>14.0 lb. (6.4 kg)</td>
</tr>
<tr>
<td>31F8L</td>
<td>20.9 Oz</td>
<td>2&quot;</td>
<td>15.9 lb. (7.2 kg)</td>
</tr>
<tr>
<td>32F9</td>
<td>29.7 Oz</td>
<td>2-1/2&quot;</td>
<td>35.0 lb. (15.9 kg)</td>
</tr>
<tr>
<td>32FN</td>
<td>29.7 Oz</td>
<td>3&quot;</td>
<td>34.2 lb. (15.5 kg)</td>
</tr>
</tbody>
</table>

Operation –
- Normal Operating Pressure Drop ...................... 2 PSIG
- Maximum Recommended Pressure Drop ................. 10 PSIG
(Element should be replaced)
- Minimum Recommended Flow ................................ 20%

Pressure & Temperature Ratings –
- 0 to 250 PSIG (0 to 17.2 bar) 32°F to 175°F (0°C to 80°C)

Materials of Construction

Body ......................................................... Aluminum
Bowl ...................................................... Aluminum without Sight Gauge
Drains – Twist Drain .................................. Brass Petcock
- Automatic Float Drain –
- Housing, Float ............................................ Plastic
- Seals ......................................................... Buna N
- Springs, Push Rod ..................................... Stainless Steel

Filter Element –
- Borosilicate & felt glass fibers 99.97% DOP efficiency
- Largest Aerosol Particle Passed (Grade 6) .......... 0.75 Microns
- Largest Solid Particle Passed (Grade 6) ............ 0.30 Microns
- Seals ..................................................... Nitrile
DD Desiccant Dryers

Features
- These Desiccant Dryers are a Convenient and Cost Effective Means of Ensuring Your Sensitive Pneumatic Applications are Never Exposed to Damaging Moisture
- Compact Size for Point-of-Use Applications
- Drying Efficiency Down to -40°F Pressure Dew Point
- Easily and Quickly Serviced
- Sightglass in Bowl to Monitor Desiccant
- Built-in Particulate after Filter Prevents Downstream Dust
- No Electricity Needed
- Low Pressure Drop
- No Purge Air Lost as with Other Dryer Types

Applications
- Paint Spraying
- Instrument Air
- Laboratory Instruments
- Control Air Systems
- Air Blanketing

<table>
<thead>
<tr>
<th>Port Size</th>
<th>Desiccant Capacity¹</th>
<th>15 SCFM</th>
<th>30 SCFM</th>
<th>60 SCFM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4”</td>
<td>2.5 lb¹</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DD15-02</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3/8”</td>
<td>5 lb.¹</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DD15-03</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/2”</td>
<td>10 lb.¹</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DD15-04</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3/4”</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DD15-06</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1”</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DD30-08</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DD60-08</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Desiccant Capacity¹
1. Desiccant must be ordered separately
2. These units supplied with reducer bushings

Performance
The rated flow capacities are nominal ratings provided for reference. These capacities are recommended for minimal pressure drop and average desiccant life. A supply of low flow / low humidity air will provide longer desiccant life; whereas, high flow / high humidity air will require more frequent desiccant changes. Installed in an application with intermittent flow, these desiccant dryers will typically dry air for weeks before the silica gel desiccant requires replacement or regeneration.
As the wet compressed air enters through the inlet, the air travels down through the bed of desiccant which adsorb the water vapor and aerosols. The silica gel desiccant beads will reduce the humidity down to a -40°F pressure dew point. After the moisture has been removed, the dry air passes through a sintered bronze filter element (eliminating dust downstream), up the tube and out the outlet port.

As the desiccant becomes saturated with moisture, the dew point will begin to rise. This is evident when the blue silica gel desiccant beads in the sight glass change to pink, indicating the need for desiccant replacement. Simply remove the flange and bowl and replace with new desiccant or regenerate saturated desiccant by heating to 275°F.

**Installation Tips**
- Always place a moisture separator/particulate filter (i.e., F602) to remove bulk moisture and a coalescing filter (i.e., F701) to remove oil upstream of desiccant dryer. Desiccant coated with oil will not adsorb oil.
- Automatic drains should be used in prefilters
- A spring ball check valve should be installed at the dryer inlet to maximize the life of the desiccant.

**Air Preparation Stages**

<table>
<thead>
<tr>
<th>Stage</th>
<th>Type of Filter</th>
<th>Example</th>
<th>Function Served in Compressed Air System</th>
</tr>
</thead>
</table>
| 1     | Particulate / Moisture Removal Filters | F602    | Removes bulk moisture & particulate matter
| 2     | Coalescing Filters               | F701, 30F, 31F | Removes fine particulate matter, moisture droplets and aerosols, but NOT vapor² |
| 3     | Desiccant Dryer                  | DD15, DD30, DD60 | Removes moisture vapor³ |

**Notes:**
1. Removes approx 75% of moisture
2. Removes approx 99.97% efficient in removing oil & water aerosols >.01 micron
3. Provides pressure dew point of -40° F with unsaturated desiccant

**Desiccant Dryers Kits & Accessories**

- **Desiccant - Silica Gel 100% Indicating** – 5 lb. Can SGM100-1, Four - 5 lb. Cans SGM100-4
- **Flow Tube Repair Kit (Tube, Filter Element(s), Adaptor)**
  - DD15 RKDD15-02-06, DD30 RKDD30-03-08, DD60 RKDD60-03-08
- **Mounting Brackets (Recommended for DD15 & DD30 only)** – 1/4 Inch Pipe Size (Pair of Pipe Mounted Brackets) SA200YW57, 1 Inch Pipe Size (Pair of Pipe Mounted Brackets) SA200CWS7
- **Spring Check Valve for Inlet (250 PSIG max.)** – (Maximizes Life of Desiccant)
  - 1/4 Inch NPT 00339S001
  - 3/8 Inch NPT 00339S002
  - 1/2 Inch NPT 00339S003
  - 3/4 Inch NPT 00339S004

**Specifications**

- **Desiccant Capacity (Desiccant must be ordered separately)** –
  - DD15 2.5 lb.
  - DD30 5 lb.
  - DD60 10 lb.

**Filter Element Rating**
- DD15, DD30 .................................................. 90 micron
- DD60 ............................................................. 40 micron

**Pressure & Temperature Ratings**
- Optimum working temperature .......................... Below 100° F
- Pressure Range ............................................... 0 to 300 PSIG
- Temperature Range ........................................ 32°F to 180°F

**Weight (Housing Only)**
- DD15 (add 2.5 lb for weight full) ....................... 8 lb.
- DD30 (add 5 lb for weight full) ......................... 13 lb.
- DD60 (add 10 lb for weight full) ....................... 20 lb.

**Materials of Construction**

- **Bowl** – DD15, DD30 .................................. Aluminum
- DD60 ................................................................. Steel
- **Flow Tube** ................................................ CPVC
- **Filter Elements** ......................................... Sintered Bronze
- **Head & Flange Ring** .................................. Zinc
- **Other Hardware** ......................................... Brass
- **Seals** ......................................................... Buna-N
- **Sight Glass** ............................................... Glass & Steel

**Catalog 0730**

Technical Specifications – DD Series

Desiccant Dryers

Parker Hannifin Corporation
Pneumatic Division North America
Richland, Michigan
www.parker.com/pneumatic
Regulators

Regulation
An air regulator is a specialized control valve. It reduces upstream supply pressure level to a specified constant downstream pressure.

Pneumatic equipment that is operated at higher-than-recommended pressure wastes the energy to generate that pressure. It creates a potential safety hazard, and probably will wear out prematurely. Overloading below specified pressure can cause the machine to fail to meet design performance specifications. Therefore, precise air pressure control is essential to efficient operation of air-powered equipment.

How to Select the Proper Regulator
While regulator bodies are generally constructed of die-cast metal, other external parts may be either metal or plastic. Remember that all-metal construction is best for tough applications, where abuse is likely to occur, but plastic construction is generally lower in cost. For normal industrial applications, either construction is suitable.

Inlet pressure rating and downstream controlled range, as well as flow capacity, must be determined before selecting a regulator. Port size should match piping size.

Required response time, relieving capability, and type of adjustment are other considerations. Highly sensitive, lightweight diaphragm sensors vs. the slower, but often more durable, piston sensors. Self-relieving vs. non-relieving regulators. T-Handles or knobs as the adjustment mechanism, or air pilot operated regulator which offer remote adjustment. Other choices to be made include gauge, panel mount and other special options.

Regulator Construction
Regulators are generally constructed using a die-cast metal body. Other external parts, such as the spring cage and bottom plug, may be either metal or plastic. All-metal construction offers more durability in tough applications where abuse is likely to occur, while the plastic construction offers lower cost. For normal industrial applications (temperature range of 40° to 120° F and supply pressure to 300 PSIG), either construction will serve well.

Lightweight diaphragm sensors offer quick response and high sensitivity to air pressure changes. Piston sensors are somewhat slower but may be more durable. Where downstream pressure requirements change rapidly enough to cause regular chatter, slower response may be an advantage.

If the self-relieving feature is not needed for an application, simpler non-relieving regulators are available.

For regulators with an adjustment spring, a -T-Handle or knob provides the external link to the spring on various models.

Pilot-operated regulators substitute air pressure in the chamber above the sensor to provide the reference force.

Remote adjustment through a separate pilot regulator thus becomes possible, or the pilot signal can be fed back from a downstream location for precise control.

The balanced inner valve design exposes both sides of the inner valve to essentially the same pressure. This eliminates much of the effect that changes in inlet pressure might have on inner valve position and orifice opening.

Regulator Operation
In a typical regulator, an inner valve sets the size of an orifice which connects inlet port to outlet port. The sensing element, often a diaphragm or piston mechanically linked to the inner valve, reacts to downstream pressure and a reference force to position the inner valve. The reference force can be a spring, or an air pilot chamber.

The valve is normally open. High pressure air enters and flows through the orifice toward the outlet. Downstream pressure is connected through an aspirator tube to the bottom of the diaphragm. As downstream pressure increases, the diaphragm is forced upward, compressing the adjustment spring. When the diaphragm moves, the inner valve spring pushes the inner valve disc upward to throttle the orifice. If downstream pressure exhausts, the mechanical sequence reverses and the inner valve disc opens the orifice until the set pressure is reached again.

The arrangement of separate diaphragm chamber and aspirator tube accomplishes two purposes. First, the diaphragm is moved out of the potentially abrasive air stream. Second, and more important, if the downstream system calls for high flow, this flow generates a low pressure venturi effect at the end of the aspirator tube and into the diaphragm chamber. The diaphragm therefore reacts more quickly to open the orifice via the inner valve, thereby improving response time to high flow demands.

Some circuits may be subject to downstream-generated high pressure (from high temperatures or heavy vertical loads on cylinders, for example). This high pressure is reduced by a self-relieving feature built into the regulator. The inner valve stem normally blocks a relieving orifice in the center of the diaphragm. If excessive pressure lifts the diaphragm off the stem, air bleeds through the orifice and out the spring cage vent until the system returns to the set pressure.
### Regulator Comparison Chart

<table>
<thead>
<tr>
<th></th>
<th>High Precision Regulators</th>
<th>Precision Regulator</th>
<th>Standard Regulator</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R210</td>
<td>R220</td>
<td>R230</td>
</tr>
<tr>
<td><strong>Repeatability / Sensitivity</strong></td>
<td>0.005 PSIG 1/8&quot; Water Column</td>
<td>0.005 PSIG 1/8&quot; Water Column</td>
<td>0.010 PSIG 1/4&quot; Water Column</td>
</tr>
<tr>
<td></td>
<td>Best</td>
<td>Best</td>
<td>Better</td>
</tr>
<tr>
<td><strong>Reduced Pressure Variation</strong></td>
<td>This refers to the regulator's ability to maintain a consistent output pressure when faced with variables such as time, cycling, temperature, supply pressure, flow, etc.</td>
<td>Best</td>
<td>Best</td>
</tr>
<tr>
<td><strong>Input Pressure</strong></td>
<td>Unregulated air pressure going into the regulator</td>
<td>150 PSIG Max.</td>
<td>150 PSIG Max.</td>
</tr>
<tr>
<td><strong>Effect of Supply Pressure Variation on Regulated Pressure</strong></td>
<td>Reduced / set pressure variation when input pressure changes by 100 PSIG</td>
<td>0.020 PSIG</td>
<td>0.020 PSIG</td>
</tr>
<tr>
<td><strong>Reduced Pressure Range</strong></td>
<td>Reduced pressure ranges available</td>
<td>2-40 PSIG 2-120 PSIG</td>
<td>2-120 PSIG</td>
</tr>
<tr>
<td><strong>Flow Capacity</strong></td>
<td>Regulator's flow capacity</td>
<td>14 SCFM</td>
<td>14 SCFM</td>
</tr>
<tr>
<td><strong>Exhaust (Relief) Capacity</strong></td>
<td>Regulator's exhaust/relief flow rating when backpressure is introduced from downstream</td>
<td>3 SCFM</td>
<td>11 SCFM</td>
</tr>
<tr>
<td><strong>Overpressure to Relieve</strong></td>
<td>Regulator's sensitivity to relieve excess downstream pressure over the set pressure.</td>
<td>Best (0.005 PSIG)</td>
<td>Best (0.005 PSIG)</td>
</tr>
<tr>
<td><strong>Constant Bleed</strong></td>
<td>Does the regulator constantly bleed air to the atmosphere to maintain accuracy?</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Size Constraints</strong></td>
<td>Overall size of regulator</td>
<td>4.5&quot; H x 2.06&quot; W</td>
<td>4.5&quot; H x 2.06&quot; W</td>
</tr>
<tr>
<td><strong>Mounting Constraints</strong></td>
<td>Mounting options</td>
<td>Panel, Pipe, or Bracket</td>
<td>Panel, Pipe, or Bracket</td>
</tr>
<tr>
<td><strong>Port Size</strong></td>
<td>Inlet / Outlet port size</td>
<td>1/4&quot;</td>
<td>1/4&quot;</td>
</tr>
</tbody>
</table>

---

**Standard Regulator**

- T-handle Adjusting Screw
- Lock Nut
- Spring Button
- Control Spring
- Spring Cage
- Diaphragm Assembly
- Innervalve Assembly
- Body
- Spring, Bottom
- Bottom Plug

**Pilot Regulator Application**

- Use This Gauge For Setting Reduced Pressure

**Pilot Operated Regulator**

- Diaphragm Assembly
- Innervalve Assembly
- Body
- Spring, Bottom
- Bottom Plug
R119 Standard Regulators

Features
- High Flow Performance Featuring Rugged Design for the Most Demanding Applications
- Ideal for Those Installations Calling for Constant Pressure with Wide Variation in Flow
- Diaphragm Operated Design with Balanced Poppet Design for Quick and Accurate Regulation
- Secondary Aspiration Plus Balanced Poppet Provides Quick Response and Accurate Pressure Regulation
- Heavy Duty Tee Handle Adjustment
- Reverse Flow Version Available
- High Flow: 3/4" ................. 300 SCFM
1" .................................. 400 SCFM
1-1/4" & 1-1/2" ... 500 SCFM

CAUTION
REGULATOR PRESSURE ADJUSTMENT – The working range of knob adjustment is designed to permit outlet pressures within their full range. Pressure adjustment beyond this range is also possible because the knob is not a limiting device. This is a common characteristic of most industrial regulators, and limiting devices may be obtained only by special design.

NOTE: BOLD OPTIONS ARE STANDARD.
**Technical Information**

**Flow Characteristics**

- **R119-06C**
  - 3/4 Inch Ports
  - 100 PSIG (6.9 bar) Primary Pressure

- **R119-08C**
  - 1 Inch Ports
  - 100 PSIG (6.9 bar) Primary Pressure

- **R119-10C**
  - 1-1/4 Inch Ports
  - 100 PSIG (6.9 bar) Primary Pressure

- **R119-12C**
  - 1-1/2 Inch Ports
  - 100 PSIG (6.9 bar) Primary Pressure

**R119 Regulator Kits & Accessories**

**Gauges**
- 2" Dial Size, 1/4" Back Connection
  - 0 to 60 PSIG (0 to 400 kPa) ............................................... 275Y60S
- 2" Dial Size, 1/4" Back Connection
  - 0 to 160 PSIG (0 to 1100 kPa) ......................................... 275Y160S
- 2" Dial Size, 1/4" Back Connection
  - 0 to 300 PSIG (0 to 2068 kPa) ......................................... 275Y300S

**Mounting Bracket Kit** ............................................................... 18B57

**Repair Kits**
- Non-Relieving Diaphragm,
  - Valve Assembly (3/4", 1") ............................................... RK118B
- Non-Relieving Diaphragm,
  - Valve Assembly (1-1/4", 1-1/2") ......................................... RK118D
- Relieving Diaphragm,
  - Valve Assembly (3/4", 1") ............................................... RK119B
- Relieving Diaphragm,
  - Valve Assembly (1-1/4", 1-1/2") ......................................... RK119D

For Fluorocarbon Repair Kits, add X64 to Kit Number suffix.

**Specifications**

- **Gauge Ports (2)** ................................................................. 1/4 Inch
- **Port Threads** ................................................................. 3/4, 1, 1-1/4, 1-1/2 Inch
- **Reduced Pressure Range** ..................................................... 2 to 125 PSIG (0.15 to 8.5 bar)
- **Supply Pressure** ............................................................... 300 PSIG Maximum (20.4 bar)
- **Temperature Rating** .......................................................... 40°F to 120°F (4.4°C to 48.9°C)
- **Weight**
  - R119-06, R119-08 ......................................................... 6.2 lb. (2.81 kg) / Unit
  - 25 lb. (11.34 kg) / 4-Unit Master Pack
  - R119-10, R119-12 ......................................................... 7.2 lb. (3.27 kg) / Unit
  - 29 lb. (13.15 kg) / 4-Unit Master Pack

**Materials of Construction**

- **Adjusting Screw, Springs** ................................................... Steel
- **Body, Spring Cage** ............................................................. Zinc
- **Bottom Plug, Innervalve** .................................................... Brass
- **Seals** .................................................................................. Buna N
09R Regulators – Hi-Flow

Features

- Piston Design for Reduced Downtime
- High Flow
- Balanced Poppet for Quick and Accurate Regulation
- Two Full Flow 1/4" Gauge Ports which can be Used as Additional Outlets
- Self Relieving Piston Standard
- High Flow: 2" ................ 1000 SCFM

\[ \text{SCFM} = \text{Standard Cubic Feet Per Minute at 100 PSIG Inlet, 90 PSIG No Flow Secondary Setting and 10 PSIG Pressure Drop.} \]

<table>
<thead>
<tr>
<th>Port Size</th>
<th>NPT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without Gauge</td>
<td>2&quot; 09R813BA</td>
</tr>
</tbody>
</table>

Standard part numbers shown bold. For other models refer to ordering information below.

<table>
<thead>
<tr>
<th>Port Size</th>
<th>NPT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without Gauge</td>
<td>2&quot; 09R813BA</td>
</tr>
</tbody>
</table>

09R Regulator Dimensions

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.30</td>
<td>3.60</td>
<td>9.10</td>
</tr>
<tr>
<td>(135)</td>
<td>(91)</td>
<td>(231)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.80</td>
<td>11.90</td>
</tr>
<tr>
<td>(71)</td>
<td>(302)</td>
</tr>
</tbody>
</table>

WARNING

Product rupture can cause serious injury.
Do not connect regulator to bottled gas.
Do not exceed maximum primary pressure rating.

Ordering Information

09R 8 13 B —

Port Size: 8. 2 Inch
Pressure Range: 13. 125 PSIG
Relief: B. Relieving
M. Non-Relieving
Engineering Level: A. Current

NOTE: BOLD OPTIONS ARE STANDARD.
Technical Information

09R Regulator Kits & Accessories

<table>
<thead>
<tr>
<th>Component</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body Service Kit</td>
<td>PS603P</td>
</tr>
<tr>
<td>Gauges – 160 PSIG (0 to 11.0 bar)</td>
<td>P781642</td>
</tr>
<tr>
<td>Pressure Sensor – 0 to 145 PSI</td>
<td>MPS-P31N-PC</td>
</tr>
<tr>
<td>Mounting Bracket Kit</td>
<td>PS605P</td>
</tr>
<tr>
<td>Service Kit – Non-Relieving</td>
<td>PS604P</td>
</tr>
<tr>
<td>Relieving</td>
<td>PS626P</td>
</tr>
<tr>
<td>Springs – 2-125 PSIG Range</td>
<td>PS602P</td>
</tr>
</tbody>
</table>

Specifications

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gauge Ports</td>
<td>(Can be used as additional Full Flow 1/4 Inch Outlet Ports)</td>
</tr>
<tr>
<td>Port Threads</td>
<td>2 Inch Ports</td>
</tr>
<tr>
<td>Maximum Primary Pressure</td>
<td>250 PSIG (17.2 bar)</td>
</tr>
<tr>
<td>Secondary Pressure Range</td>
<td>10 to 125 PSIG (0.7 to 8.6 bar)</td>
</tr>
<tr>
<td>Temperature Rating</td>
<td>32°F to 150°F (0°C to 66°C)</td>
</tr>
<tr>
<td>Weight</td>
<td>10.82 lb (53 kg)</td>
</tr>
</tbody>
</table>

Materials of Construction

<table>
<thead>
<tr>
<th>Component</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjusting Stem &amp; Springs</td>
<td>Steel</td>
</tr>
<tr>
<td>Body</td>
<td>Zinc Alloy, Die Cast</td>
</tr>
<tr>
<td>Bonnet, Piston Stem, Valve Poppet &amp; Cap</td>
<td>Aluminum</td>
</tr>
<tr>
<td>Piston, Cap</td>
<td>Plastic</td>
</tr>
<tr>
<td>Seals</td>
<td>Nitrile</td>
</tr>
</tbody>
</table>
R119 Pilot Operated Regulators

Features
- Adapted for Control by a Remote or Distant Small Pilot Regulator. Ideal for Maximum Capacity Requirements in Applications where Units are Not Readily Accessible
- High Flow Performance Featuring Rugged Design for the Most Demanding Applications
- Ideal for Those Installations Calling for Constant Pressure with Wide Variation in Flow
- Diaphragm Operated Design with Balanced Poppet and Constant Bleed Pilot for Quick and Accurate Regulation
- Secondary Aspiration Plus Balanced Poppet Provides Quick Response and Accurate Pressure Regulation
- Reverse Flow Version Available
- High Flow: 3/4” & 1” .............. 300 SCFM
  1-1/4” & 1-1/2” .... 500 SCFM

$ SCFM = Standard Cubic Feet Per Minute at 100 PSIG Inlet, 75 PSIG No Flow Secondary Setting, and 20 PSIG Pressure Drop.

<table>
<thead>
<tr>
<th>Port Size</th>
<th>NPT Relieving</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4&quot;</td>
<td>R119-06J</td>
</tr>
<tr>
<td>1&quot;</td>
<td>R119-08J</td>
</tr>
<tr>
<td>1-1/4&quot;</td>
<td>R119-10J</td>
</tr>
<tr>
<td>1-1/2&quot;</td>
<td>R119-12J</td>
</tr>
</tbody>
</table>

Standard part numbers shown bold. For other models refer to ordering information below.

R119 Regulator Dimensions

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>R119-06J, R119-08J</td>
<td>4.72 (120)</td>
<td>1.87 (47)</td>
<td>2.94 (75)</td>
<td>4.38 (111)</td>
<td>4.81 (122)</td>
<td>2.47 (63)</td>
</tr>
<tr>
<td>R119-10J, R119-12J</td>
<td>4.94 (125)</td>
<td>1.81 (46)</td>
<td>3.32 (84)</td>
<td>4.94 (125)</td>
<td>5.13 (130)</td>
<td>2.88 (73)</td>
</tr>
</tbody>
</table>

Inches (mm)

WARNING
Do not connect regulator to bottled gas. Do not exceed maximum primary pressure rating. Product rupture can cause serious injury.

Ordering Information

R 119 — 06 J /**

Port Threads
- NPT
- G BSPP

Port Size
06 3/4 Inch
08 1 Inch
10 1-1/4 Inch
12 1-1/2 Inch

Reduced Pressure Range
J Air Pilot Operated

Options
K Non-Relieving
X64 Fluorocarbon O-Rings and Diaphragm
X71 Non-Bleed Pilot (For use with Electronic Controllers)

Engineering Change Designator
Will be entered at factory.

NOTE: BOLD OPTIONS ARE STANDARD.
Technical Information

**Flow Characteristics**

**R119-06J**

<table>
<thead>
<tr>
<th>Flow SCFM</th>
<th>Flow dm/s</th>
<th>Secondary Pressure - bar</th>
<th>Secondary Pressure - PSIG</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>100</td>
<td>100</td>
<td>25</td>
<td>18</td>
</tr>
<tr>
<td>200</td>
<td>200</td>
<td>50</td>
<td>34</td>
</tr>
<tr>
<td>300</td>
<td>300</td>
<td>75</td>
<td>52</td>
</tr>
<tr>
<td>400</td>
<td>400</td>
<td>100</td>
<td>70</td>
</tr>
</tbody>
</table>

**R119-08J**

<table>
<thead>
<tr>
<th>Flow SCFM</th>
<th>Flow dm/s</th>
<th>Secondary Pressure - bar</th>
<th>Secondary Pressure - PSIG</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>50</td>
<td>50</td>
<td>25</td>
<td>18</td>
</tr>
<tr>
<td>100</td>
<td>100</td>
<td>50</td>
<td>34</td>
</tr>
<tr>
<td>200</td>
<td>200</td>
<td>75</td>
<td>52</td>
</tr>
<tr>
<td>300</td>
<td>300</td>
<td>100</td>
<td>70</td>
</tr>
</tbody>
</table>

**R119-10J**

<table>
<thead>
<tr>
<th>Flow SCFM</th>
<th>Flow dm/s</th>
<th>Secondary Pressure - bar</th>
<th>Secondary Pressure - PSIG</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>100</td>
<td>100</td>
<td>25</td>
<td>18</td>
</tr>
<tr>
<td>200</td>
<td>200</td>
<td>50</td>
<td>34</td>
</tr>
<tr>
<td>300</td>
<td>300</td>
<td>75</td>
<td>52</td>
</tr>
<tr>
<td>400</td>
<td>400</td>
<td>100</td>
<td>70</td>
</tr>
</tbody>
</table>

**R119-12J**

<table>
<thead>
<tr>
<th>Flow SCFM</th>
<th>Flow dm/s</th>
<th>Secondary Pressure - bar</th>
<th>Secondary Pressure - PSIG</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>100</td>
<td>100</td>
<td>25</td>
<td>18</td>
</tr>
<tr>
<td>200</td>
<td>200</td>
<td>50</td>
<td>34</td>
</tr>
<tr>
<td>300</td>
<td>300</td>
<td>75</td>
<td>52</td>
</tr>
<tr>
<td>400</td>
<td>400</td>
<td>100</td>
<td>70</td>
</tr>
</tbody>
</table>

**R119 Regulator Kits & Accessories**

- **Gauges** –
  - 2" Dial Size, 1/4" Back Connection
    - 0 to 60 PSIG (0 to 400 kPa) ............................................... 275Y60S
  - 2" Dial Size, 1/4" Back Connection
    - 0 to 160 PSIG (0 to 1100 kPa) ......................................... 275Y160S
  - 2" Dial Size, 1/4" Back Connection
    - 0 to 300 PSIG (0 to 2068 kPa) ......................................... 275Y300S

- **Repair Kits** –
  - Non-Relieving Diaphragm,
    - Valve Assembly (3/4", 1") .............................................. RK118X20B
  - Non-Relieving Diaphragm,
    - Valve Assembly (1-1/4", 1-1/2") .................................... RK118X20D
  - Relieving Diaphragm,
    - Valve Assembly (3/4", 1") .............................................. RK119X20B
  - Relieving Diaphragm,
    - Valve Assembly (1-1/4", 1-1/2") .................................... RK119X20D

For Fluorocarbon Repair Kits, add X64 to Kit Number suffix.

**Specifications**

- **Gauge Ports (2)** ................................................................. 1/4 Inch
- **Port Threads** ................................................................. 3/4, 1, 1-1/4, 1-1/2 Inch
- **Reduced Pressure Range** –
  - Adjustable to Within 5 to 7 PSIG of Supply Pressure
- **Supply Pressure** ................................................................. 300 PSIG Maximum (20.4 bar)
- **Air Consumption** –
  - Constant Bleed from Air Pilot Chamber:
    - Approximately 0.17 SCFM (10 SCFH)
- **Temperature Rating** .......................................................... 40°F to 120°F (4.4°C to 48.9°C)
- **Weight** –
  - R119-06J, R119-08J ......................................................... 5.2 lb. (2.36 kg) / Unit
  - 42 lb. (19.05 kg) / 8-Unit Master Pack
  - R119-10J, R119-12J ........................................................... 5.6 lb. (2.54 kg) / Unit
  - 46 lb. (20.87 kg) / 8-Unit Master Pack

**Materials of Construction**

- **Body, Ring, Top Plate** ....................................................... Zinc
- **Bottom Plug, Innervalve** ................................................... Brass
- **Seals** ............................................................................. Buna N
### R119 Pilot Operated Regulators

**Features**
- Adapted for Control by a Remote or Distant Small Pilot Regulator. Ideal for Maximum Capacity Requirements in Applications where Units are Not Readily Accessible
- High Flow Performance Featuring Rugged Design for the Most Demanding Applications
- Ideal for Those Installations Calling for Constant Pressure with Wide Variation in Flow
- Piston Operated Design with Balanced Poppet and Dual Constant Bleed for Quick and Accurate Regulation
- High Flow: 2” & 2-1/2” ....... 1800 SCFM

<table>
<thead>
<tr>
<th>Port Size</th>
<th>NPT Relieving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without Gauge 0-125 PSIG Reduced Pressure</td>
<td></td>
</tr>
<tr>
<td>2”</td>
<td>R119-16J</td>
</tr>
<tr>
<td>2-1/2”</td>
<td>R119-20J</td>
</tr>
</tbody>
</table>

Standard part numbers shown bold. For other models refer to ordering information below.

**Ordering Information**

<table>
<thead>
<tr>
<th>Port Threads</th>
<th>Port Size</th>
<th>Reduced Pressure Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>— NPT</td>
<td>16 2 Inch</td>
<td>J Air Pilot Operated</td>
</tr>
<tr>
<td>G BSPP</td>
<td>20 2-1/2 Inch</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: Non-Relieving Not Available.

**WARNING**
- Do not connect regulator to bottled gas.
- Do not exceed maximum primary pressure rating. Product rupture can cause serious injury.

**R119 Regulator Dimensions**

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>R119-16J, R119-20J</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>inches</td>
<td>6.63 (168)</td>
<td>3.09 (79)</td>
<td>7.78 (147)</td>
<td>7.31 (185)</td>
<td>1.087 (276)</td>
</tr>
<tr>
<td>mm</td>
<td>168</td>
<td>79</td>
<td>147</td>
<td>185</td>
<td>276</td>
</tr>
</tbody>
</table>
Technical Information

R119 Regulator Kits & Accessories

Gauges –
- 2" Dial Size, 1/4" Back Connection
  0 to 60 PSIG (0 to 400 kPa) ............................................... 275Y60S
- 2" Dial Size, 1/4" Back Connection
  0 to 160 PSIG (0 to 1100 kPa) ........................................... 275Y160S
- 2" Dial Size, 1/4" Back Connection
  0 to 300 PSIG (0 to 2068 kPa) ......................................... 275Y300S

Repair Kits –
- Piston Type Regulation (2", 2-1/2") ......................... RK119G

Specifications

Gauge Ports (2) ............................................................... 1/4 Inch
  (Can be used for Full Flow)
  High Pressure Outlet for Pilot (Not seen in photo) ............ 1/4 Inch

Port Threads ................................................................. 2, 2-1/2 Inch

Reduced Pressure Range –
  Adjutable to Within 5 to 7 PSIG of Supply Pressure

Supply Pressure .......................................................... 300 PSIG Maximum (20.4 bar)

Air Consumption –
- Constant Bleed from Air Pilot Chamber:
  Approximately 0.17 SCFM (10 SCFH)
- Constant Bleed from Reduced Pressure:
  Approximately 0.17 SCFM (10 SCFH)

Temperature Rating ............................ 40°F to 120°F (4.4°C to 48.9°C)

Weight –
- R119-16J, R119-20J ................................. 15 lb. (6.80 kg) / Unit
  15 lb. (6.80 kg) / 1-Unit Master Pack

Materials of Construction

- Body, Piston .............................................................. Aluminum
- Seals ........................................................................... Buna N
- Innervalve ................................................................. Brass & Stainless
Lubricators

Lubrication

Many pneumatic system components and most pneumatic tools require oil lubrication for proper operation and long service life. This lubricant is typically carried by the air stream. Too little oil can cause excessive wear and premature failure. Too much oil is wasteful and can become a contaminant, particularly when carried over with the air exhaust. Intermittent lubrication may be the worst situation because the oil film can dry out to form sludges and varnishes on internal surfaces.

Air line lubricators meter oil from a reservoir into the moving air stream. In general terminology, the oil droplets are usually termed a fog. For best results, the lubricator should be located as close as possible to the point where lubrication is required.

How to Select the Proper Lubricator

Use of proper lubricator can greatly extend the life of expensive downstream pneumatic equipment. Lubricators often are selected according to pipe size. Other selection factors are type of bowl material, bowl size, and refilling system capability. Bowls are available in both polycarbonate and metal. Polycarbonate offers the advantage or transparency, for simplified inspection of oil level and condition. However, caution must be exercised when using polycarbonate bowls in any area where certain chemicals are used. (Please read the warning carefully.)

In addition to choice of bowls, minimum and maximum flow rates and pressure requirements should also be considered. Be sure to check the pressure drop curves, to make certain the selected model will not create a higher pressure drop than the system design can tolerate.

Lubricator Construction

Bowls are available in polycarbonate and metal, subject to the same constraints discussed in the Filter Section. Transparent polycarbonate simplifies inspection of the oil level and checking for dirt and liquid condensate in the oil. Note that the system must be exhausted before removing the bowl.

In some models, the system must also be exhausted before opening the fill plug to recharge the lubricator. Other designs automatically bypass the air during refilling.

⚠️ Warning

The plastic material used to manufacture the plastic bowls, and the sight gauge on metal bowls, may be attacked by certain chemicals. Do not use this lubricator on systems with air supplied by a compressor lubricated with synthetic oils or oils containing phosphate esters or chlorinated hydrocarbons. These oils can carry over into the air lines and chemically attack and possibly rupture the bowl or sight gauge. Also, do not expose the bowls or sight gauge to materials such as carbon tetrachloride, trichlorethylene, acetone, paint thinner, cleaning fluids, or other harmful materials, for they too will cause the plastic to craze and/or rupture. For use in environments where these, or any, chemicals may be present, consult the factory for approval.

Lubricator Installation

The lubricators listed in this catalog should be placed before any valving and stay pressurized before, during, and after machine tool cycles. These lubricators should be placed no farther away than 15 feet from the desired point of lubrication.
Lubricators

Lubrication Operation

Most lubricator designs include a high-velocity venturi section in the air flow path which creates a low-pressure area to draw oil from the reservoir through a capillary tube to the point of injection. There, the air stream breaks up the oil into droplets.

In a typical lubricator, filtered and regulated air enters the lubricator housing and is channeled in either of two directions depending on flow rate. At low flow rates, all the air passes through the venturi where it mixes with metered oil droplets. Under higher flow conditions, the spring-loaded bypass valve opens and the excess flow bypasses the venturi, then blends with the lubricated air at a downstream point. A manual adjustment (needle valve) in the housing sets the oil drip-rate into the air stream; a sight gauge allows that rate to be monitored. Fill plugs at the lubricator top provide access to refill the reservoir with oil. The bowl is removable for cleaning.

IN  OUT

- Body
- O-ring
- Collar
- Sight Gauge
- Dip Tube
- O-ring
- Sight Dome
- O-ring
- Valve Seat
- Needle Valve Assembly
- Adjusting Knob
- Bowl
- Fill plugs at the top provide access to refill the reservoir with oil. The bowl is removable for cleaning.
L606 Standard Lubricators

Features
- Metal Bowl with Sight Gauge - Standard
- Polycarbonate Sight Dome
- Bowl can be filled while Air Line is Under Pressure
- Proportional Oil Delivery Over a Wide Range of Air Flows
- Large Capacity Bowl
- Optional High Capacity Bowl(s) Available
- Precision Needle Valve Assures Repeatable Oil Delivery and Provides Simple Adjustment of Delivery Rate
- Automatic Fill Optional (Requires External Pressurized Oil Supply)
- High Flow: 3/4” .................... 260 SCFM§
  1” ....................... 350 SCFM§

Note: SCFM = Standard Cubic Feet Per Minute at 100 PSIG Inlet, and 5 PSIG Pressure Drop.

<table>
<thead>
<tr>
<th>Port Size</th>
<th>NPT</th>
<th>No Drain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal Bowl / Sight Gauge</td>
<td>L606-06W, L606-08W</td>
<td></td>
</tr>
<tr>
<td>3/4”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metal Bowl 32 oz. without Sight Gauge</td>
<td>L606-06E, L606-08E</td>
<td></td>
</tr>
<tr>
<td>3/4”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metal Bowl 64 oz. with Sight Gauge</td>
<td>L606-06G, L606-08G</td>
<td></td>
</tr>
<tr>
<td>3/4”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1”</td>
<td></td>
<td></td>
</tr>
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</table>

Standard part numbers shown bold.
For other models refer to ordering information below.

L606 Lubricator Dimensions

<table>
<thead>
<tr>
<th>L606-06W, L606-08W</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>4.97</td>
<td>7.25</td>
<td>2.63</td>
<td>4.06</td>
<td>9.88</td>
<td>2.48</td>
</tr>
<tr>
<td></td>
<td>(126)</td>
<td>(184)</td>
<td>(66.7)</td>
<td>(103)</td>
<td>(251)</td>
<td>(63.1)</td>
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<tr>
<td>L606-06E, L606-08E</td>
<td>4.97</td>
<td>10.75</td>
<td>2.63</td>
<td>4.06</td>
<td>13.38</td>
<td>2.48</td>
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<td>(126)</td>
<td>(273)</td>
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<td>(103)</td>
<td>(340)</td>
<td>(63.1)</td>
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<td>L606-06G, L606-08G</td>
<td>5.00</td>
<td>9.40</td>
<td>2.62</td>
<td>4.06</td>
<td>12.02</td>
<td>2.50</td>
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<td></td>
<td>(127)</td>
<td>(239)</td>
<td>(66)</td>
<td>(103)</td>
<td>(305)</td>
<td>(64)</td>
</tr>
</tbody>
</table>

Ordering Information

<table>
<thead>
<tr>
<th>L</th>
<th>606</th>
<th>—</th>
<th>06</th>
<th>W</th>
<th>/**</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Port Threads</th>
<th>Port Size</th>
<th>Bowl Capacity</th>
<th>Description</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>— NPT</td>
<td>06 3/4 Inch</td>
<td>E 32 oz.</td>
<td>Large Capacity</td>
<td>3/4” &amp; 1”</td>
</tr>
<tr>
<td>G BSPP</td>
<td>08 1 Inch</td>
<td>G 64 oz.</td>
<td>Large Capacity</td>
<td>3/4” &amp; 1” with Sight Gauge</td>
</tr>
<tr>
<td></td>
<td></td>
<td>W 16 oz.</td>
<td>Metal with Sight Gauge</td>
<td>3/4” &amp; 1”</td>
</tr>
</tbody>
</table>

Options
- H Button Head Fill Fitting
- J Automatic Fill Device
- X9 Manual Twist Drain (Increases Product Length by 9/16 Inch)

Engineering Change Designator
Will be entered at factory.

Note: Bold options are standard.
Catalog 0730
Technical Specifications – L606

L606 Series
Standard Lubricators

Technical Information

L606 Lubricator Kits & Accessories

Adjusting Knob ................................................................. 606Y72
Bowl Kits –
  Aluminum (E) .................................................. BK603B
  Aluminum with Sight Gauge (G) ....... BK606X30B
  Zinc with Sight Gauge (W) ............... BK609WB
Button Head Fill Fitting (9/16-24 male thread) ........ SAA606C109
Dip Tube Kit ................................................................. DTK606
Drip Spout Kit ............................................................... RK606SY
Mounting Bracket –
  3/4 Inch units (2 required per unit) ........ SA200AW57
  1 Inch units (2 required per unit) ........ SA200CW57
Oil –
  1 Gal. ................................................................. F442000
  12 Quart Case ................................................. F442002
  4 Gallon Case ...................................................... F442005
Repair Kits –
  Needle Valve Assembly (All) ................. RK606Y
  Sight Gauge Bowl Repair Kit (W) .............. RKB605WB
  Sight Gauge Bowl Repair Kit (G) .............. RKB606X30B

Specifications

Automatic Fill Option (J) (Only available factory installed)
  Requires remote oil supply @ 5 - 10 PSIG above air pressure in bowl.
Bowl Capacity –
  Aluminum (E) .................................................. 32 Ounces
  Aluminum with Polycarbonate Sight Gauge (G) .... 64 Ounces
  Zinc with Nylon Sight Gauge (W) ............... 16 Ounces
Port Threads ......................................................... 3/4, 1 Inch

Pressure & Temperature Ratings –
  Aluminum Bowl (E) .............................. 0 to 300 PSIG (0 to 20.4 bar)
  ......................................................... 40°F to 180°F (4.4°C to 82.2°C)
  Aluminum Bowl with
  Polycarbonate Sight Gauge (G) ............ 0 to 150 PSIG (0 to 10.2 bar)
  ......................................................... 40°F to 120°F (4.4°C to 48.9°C)
  Zinc Bowl with
  Nylon Sight Gauge (W) ........................ 0 to 250 PSIG (0 to 17.2 bar)
  ......................................................... 40°F to 150°F (4.4°C to 66.6°C)

Suggested Lubricant ...................................................... F442 Oil
  Petroleum based oil of 100 to 200 SSU viscosity at 100°F and an
  aniline point greater than 200°F.
  (DO NOT USE OILS WITH ADDITIVES, COMPOUNDED OILS
  CONTAINING SOLVENTS, GRAPHITE, DETERGENTS, OR
  SYNTHETIC OILS.)

Weight –
  Aluminum Bowl (E) .......................... 5.5 lb. (2.49 kg) / Unit
  ......................................................... 22.3 lb. (10.12 kg) / 4-Unit Master Pack
  Aluminum Bowl with
  Polycarbonate Sight Gauge (G) ............ 7.2 lb. (3.27 kg) / Unit
  ......................................................... 28.8 lb. (13.06 kg) / 4-Unit Master Pack
  Zinc Bowl with
  Nylon Sight Gauge (W) ........................ 4.2 lb. (1.91 kg) / Unit
  ......................................................... 16.6 lb. (7.53 kg) / 4-Unit Master Pack

Materials of Construction

Body .................................................................................. Zinc
Bowls –
  (E) ................................................................. Aluminum
  (G) ................................................................. Aluminum with Polycarbonate Sight Gauge
  (W) ................................................................. Zinc with Nylon Sight Gauge
Seals ................................................................................. Buna N
L606 Standard Lubricators

Features
- Metal Bowl with Sight Gauge - Standard
- Polycarbonate Sight Dome
- Bowl can be Filled while Air Line is Under Pressure
- Proportional Oil Delivery Over a Wide Range of Air Flows
- Large Capacity Bowl
- Optional High Capacity Bowl(s) Available
- Precision Needle Valve Assures Repeatable Oil Delivery and Provides Simple Adjustment of Delivery Rate
- Automatic Fill Optional (Requires External Pressurized Oil Supply)
- High Flow: 1-1/4" .............. 325 SCFM\(^\text{§}\)
- 1-1/2" .................. 400 SCFM\(^\text{§}\)

\[ \text{SCFM} = \text{Standard Cubic Feet Per Minute at 100 PSIG Inlet, and 5 PSIG Pressure Drop.} \]

<table>
<thead>
<tr>
<th>Port Size</th>
<th>NPT</th>
<th>L606-10W</th>
<th>L606-12W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal Bowl / Sight Gauge</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-1/4&quot;</td>
<td>L606-10W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-1/2&quot;</td>
<td>L606-12W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metal Bowl 32 oz. without Sight Gauge</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-1/4&quot;</td>
<td>L606-10E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-1/2&quot;</td>
<td>L606-12E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metal Bowl 64 oz. with Sight Gauge</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-1/4&quot;</td>
<td>L606-10G</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-1/2&quot;</td>
<td>L606-12G</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Standard part numbers shown bold. For other models refer to ordering information below.

Ordering Information

<table>
<thead>
<tr>
<th>L</th>
<th>606</th>
<th>—</th>
<th>10</th>
<th>W</th>
<th>/**</th>
</tr>
</thead>
</table>

Port Size
- NPT
- G BSPP

Options
- H Button Head Fill Fitting
- J Automatic Fill Device
- X9 Manual Twist Drain (Increases Product Length by 9/16 Inch)

Engineering Change Designator
Will be entered at factory.

NOTE: BOLD OPTIONS ARE STANDARD.
Technical Information

L606 Lubricator Kits & Accessories
Adjusting Knob ......................................................... 606Y72
Bowl Kits –
  Aluminum (E) ...................................................... BK603B
  Aluminum with Sight Gauge (G) ....................... BK606X30B
  Zinc with Sight Gauge (W) ...................... BK609WB
Button Head Fill Fitting (9/16-24 male thread) ...... SAA606C109
Dip Tube Kit ............................................................... DTK606
Drip Spout Kit ............................................................ RK606SY
Oil –
  1 Gal. ................................................................. F442002
  12 Quart Case .................................................... F442003
  4 Gallon Case ..................................................... F442005
Repair Kits –
  Needle Valve Assembly (All) .............................. RK606Y
  Sight Gauge Bowl Repair Kit (W) ......................... RKB605WB
  Sight Gauge Bowl Repair Kit (G) ...................... RKB606X30B

Specifications
Automatic Fill Option (J) (Only available factory installed)
  Requires remote oil supply @ 5 - 10 PSIG above air pressure in bowl.
Bowl Capacity –
  Aluminum (E) ...................................................... 32 Ounces
  Aluminum with Polycarbonate Sight Gauge (G) .... 64 Ounces
  Zinc with Nylon Sight Gauge (W) .................... 16 Ounces
Port Threads ............................................................. 1-1/4, 1-1/2 Inch

Pressure & Temperature Ratings –
  Aluminum Bowl (E) .............................................. 0 to 300 PSIG (0 to 20.4 bar)
  40°F to 180°F (4.4°C to 82.2°C)
  Aluminum Bowl with Polycarbonate Sight Gauge (G) .... 0 to 150 PSIG (0 to 10.2 bar)
  40°F to 120°F (4.4°C to 48.9°C)
  Zinc Bowl with Nylon Sight Gauge (W) .................. 0 to 250 PSIG (0 to 17.2 bar)
  40°F to 150°F (4.4°C to 65.6°C)

Suggested Lubricant .................................................. F442 Oil
  Petroleum based oil of 100 to 200 SSU viscosity at 100°F and an aniline point greater than 200°F.
  (DO NOT USE OILS WITH ADDITIVES, COMPOUNDED OILS CONTAINING SOLVENTS, GRAPHITE, DETERGENTS, OR SYNTHETIC OILS.)

Weight –
  Aluminum Bowl (E) ............................................. 8.3 lb. (3.76 kg) / Unit
  33.2 lb. (15.06 kg) / 4-Unit Master Pack
  Aluminum Bowl with Polycarbonate Sight Gauge (G) .... 10 lb. (4.54 kg) / Unit
  40 lb. (18.14 kg) / 4-Unit Master Pack
  Zinc Bowl with Nylon Sight Gauge (W) .................... 7.5 lb. (3.40 kg) / Unit
  28.2 lb. (12.79 kg) / 4-Unit Master Pack

Materials of Construction
Body ................................................................. Zinc
Bows –
  (E) ................................................................. Aluminum
  (G) ......................................................... Aluminum with Polycarbonate Sight Gauge
  (W) .......................................................... Zinc with Nylon Sight Gauge
Seals ................................................................. Buna N
Hi-Flow 09L Series

09L Mist Lubricators – Hi-Flow

Features

- Metal Bowl with Sight Gauge and Manual Drain – Standard
- Polycarbonate Sight Dome for 360° Visibility
- Bowl can be Filled while Air Line is Under Pressure
- Proportional Oil Delivery Over a Wide Range of Air Flows
- High Flow: ...................... 1000 SCFM

SCFM = Standard Cubic Feet Per Minute at 90 PSIG Inlet and 5 PSIG Pressure Drop.

Ordering Information

<table>
<thead>
<tr>
<th>Port Size</th>
<th>NPT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal Bowl / Sight Gauge – 1 Quart</td>
<td>2&quot;</td>
</tr>
<tr>
<td>Metal Bowl / Sight Gauge – 3 Quart</td>
<td>2&quot;</td>
</tr>
</tbody>
</table>

Standard part numbers shown bold. For other models refer to ordering information below.

09L Lubricator Dimensions

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Qt.</td>
<td>5.50 (140)</td>
<td>10.40 (264)</td>
<td>2.64 (67)</td>
<td>—</td>
<td>13.04 (331)</td>
<td>—</td>
</tr>
<tr>
<td>3 Qt.</td>
<td>5.50 (140)</td>
<td>9.44 (240)</td>
<td>2.64 (67)</td>
<td>6.00 (152)</td>
<td>12.08 (307)</td>
<td>7.12 (181)</td>
</tr>
</tbody>
</table>

Inches (mm)

NOTE: BOLD OPTIONS ARE STANDARD.
Technical Information

09L Lubricator Kits & Accessories

Fill Cap Kit .................................................. PS610P
Lubricator Service Kit .................................. PS607P
Metal Bowl – Sight Gauge / Twist Drain .......... PS612P*
Oil –
  1 Gal. ......................................................... F442002
  12 Quart Case ............................................ F442003
  4 Gallon Case ............................................ F442005
Sight Dome Kit .......................................... PS613P
* 1 Quart Bowl

Specifications

Bowl Capacity .............................................. 1 Qt. (Standard)
                                            3 Qt. (Optional)
Bowl ..................................................... Metal with Sight Gauge
Drain .......................................................... Manual Twist Drain
Port Threads ............................................... 2 Inch
Pressure & Temperature Rating .............. 0 to 150 PSIG (0 to 10.3 bar)
                                            32°F to 150°F (0°C to 66°C)
Suggested Lubricant ................................ F442 Oil
Petroleum based oil of 100 to 200 SSU viscosity at 100°F and an aniline point greater than 200°F.
(Do not use oils with additives, compounded oils containing solvents, graphite, detergents, or synthetic oils.)

Weight –
  1 Qt ..................................................... 10.2 lb. (4.6 kg)
  3 Qt ..................................................... 13.7 lb. (6.2 kg)

Materials of Construction

Body .................................................... Zinc Alloy, Die Cast
Standard Combinations – C628 Series

- See individual component pages for details.
- Gauges included on combinations.

### Three-Unit Combo

![C628-04FRLWJCW Shown](image)

<table>
<thead>
<tr>
<th>Series</th>
<th>Port</th>
<th>Model Numbers</th>
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<tbody>
<tr>
<td>C628</td>
<td>3/4&quot;</td>
<td>C628-06FRLWJCW</td>
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<td>1&quot;</td>
<td>C628-08FRLWJCW</td>
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<td>1-1/4&quot;</td>
<td>C628-10FRLWJCW</td>
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<td>1-1/2&quot;</td>
<td>C628-12FRLWJCW</td>
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</table>

For other models, refer to ordering information below.

### Ordering Information

![Diagram](image)

**Filter Bowl Options**

<table>
<thead>
<tr>
<th>Port Size</th>
<th>Filter Bowl Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>06 3/4 Inch</td>
<td>E 32 oz. Large Capacity w/o Sight Gauge 3/4&quot; thru 1-1/2&quot;</td>
</tr>
<tr>
<td>08 1 Inch</td>
<td>W 16 oz. Metal w/Sight Gauge 3/4&quot; thru 1-1/2&quot;</td>
</tr>
<tr>
<td>10 1-1/4 Inch</td>
<td></td>
</tr>
<tr>
<td>12 1-1/2 Inch</td>
<td></td>
</tr>
</tbody>
</table>

**Elements**

- G 5 Micron
- J 40 Micron

**Regulator Reduced Pressure Range**

- C 0-125 PSIG
- D 0-250 PSIG

**Drains and Options**

- H Button Head Fill Fitting (Lubricator)
- K Non-Relieving Regulator
- Q External Heavy Duty Auto Drain (Filter)
- R Internal Auto Drain (Filter)
- X Manual Twist Drain on Lubricator (Increases Product Length by 9/16 Inch)

**Lubricator Bowl Options**

<table>
<thead>
<tr>
<th>Port Size</th>
<th>Lubricator Bowl Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>E 32 oz.</td>
<td>Large Capacity w/o Sight Gauge 3/4&quot; thru 1-1/2&quot;</td>
</tr>
<tr>
<td>W 16 oz.</td>
<td>Metal w/Sight Gauge 3/4&quot; thru 1-1/2&quot;</td>
</tr>
</tbody>
</table>

---

**CAUTION:**

**REGULATOR PRESSURE ADJUSTMENT** – The working range of knob adjustment is designed to permit outlet pressures within their full range. Pressure adjustment beyond this range is also possible because the knob is not a limiting device. This is a common characteristic of most industrial regulators, and limiting devices may be obtained only by special design.

**NOTE:** BOLD OPTIONS ARE STANDARD.
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1. Terms and Conditions of Sale: All descriptions, quotations, proposals, offers, acknowledgments, acceptances and sales of Seller’s products are subject to and shall be governed exclusively by the terms and conditions stated herein. Buyer’s acceptance of any offer to sell is limited to the terms and conditions stated herein, any terms or conditions in addition to, or inconsistent with those stated herein, proposed by Buyer in any acceptance of an offer by Seller, are hereby objected to. No such additional, different or inconsistent terms and conditions shall become part of the contract between Buyer and Seller unless expressly accepted in writing by Seller. Seller’s acceptance of any offer to purchase by Buyer is expressly conditional upon Buyer’s assent to all the terms and conditions stated herein, including any terms in addition to, or inconsistent with those contained in Buyer’s offer. Acceptance of Seller’s products shall in all events constitute such assent.

2. Payment: Payment shall be made by Buyer net 30 days from the date of delivery of the items purchased hereunder. Amounts not timely paid shall bear interest at the maximum rate permitted by law for each month or portion thereof that Buyer is late in making payment. Any claims by Buyer for deductions or set-offs in a shipment, purchase price paid by Buyer at Seller’s sole option. In no event shall Seller be liable for any incidental, consequential or special damages of any kind or nature whatsoever, including but not limited to lost profits arising from or in any way connected with this Agreement or items sold hereunder, whether alleged to arise from breach of contract, express or implied warranty, or in tort, including without limitation, negligence, failure to warn or strict liability.

3. Delivery: Unless otherwise provided on the face hereof, delivery shall be made F.O.B. Seller’s plant. Regardless of the method of delivery, risk of loss shall pass to Buyer upon delivery to a carrier. Any delivery dates shown are approximate only, and Seller shall have no liability for any delays in delivery.

4. Warranty: Seller warrants that the items sold hereunder shall be free from defects in material or workmanship for a period of 18 months from the date of shipment from Parker Hannifin Corporation. This WARRANTY COMPRISES THE SOLE AND ENTIRE WARRANTY PERTAINING TO ITEMS PROVIDED HEREUNDER. SELLER MAKES NO OTHER WARRANTY, GUARANTEE, OR REPRESENTATION OF ANY KIND WHATSOEVER. ALL OTHER WARRANTIES, INCLUDING BUT NOT LIMITED TO MERCHANTABILITY AND FITNESS FOR PURPOSE, WHETHER EXPRESS, IMPLIED, OR ARISING BY OPERATION OF LAW, TRADE USAGE, OR COURSE OF DEALING ARE HEREBY DISCLAIMED. NOTWITHSTANDING THE FOREGOING, THERE ARE NO WARRANTIES WHATSOEVER ON ITEMS BUILT OR ACQUIRED WHOLOLY OR PARTIALLY, TO BUYER’S DESIGN OR SPECIFICATIONS.

5. Limitation of Remedy: SELLER’S LIABILITY ARISING FROM OR IN ANY WAY CONNECTED WITH THE ITEMS SOLD OR THIS CONTRACT SHALL BE LIMITED EXCLUSIVELY TO REPAIR OR REPLACEMENT OF THE ITEMS SOLD OR THE RETURN OF THE PURCHASE PRICE PAID BY BUYER, AT SELLER’S SOLE OPTION. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES OF ANY KIND OR NATURE WHATSOEVER, INCLUDING BUT NOT LIMITED TO LOST PROFITS ARISING FROM OR IN ANY WAY CONNECTED WITH THIS AGREEMENT OR ITEMS SOLD HEREUNDER, WHETHER ALLEGED TO ARISE FROM BREACH OF CONTRACT, EXPRESS OR IMPLIED WARRANTY, OR IN TORT, INCLUDING WITHOUT LIMITATION, NEGLIGENCE, FAILURE TO WARN OR STRICT LIABILITY.

6. Changes, Reschedules and Cancellations: Buyer may request to modify the designs or specifications for the items sold hereunder as well as the quantities and delivery dates thereof, or may request to cancel all or part of this order, however, no such requested modification or cancellation shall become part of the contract between Buyer and Seller unless accepted by Seller in a written amendment to this Agreement. Acceptance of any such requested modification or cancellation is at Seller’s discretion and shall be upon such terms and conditions as Seller may require.

7. Special Tooling: A tooling charge may be imposed for any special tooling, including without limitations, dies, fixtures, molds and patterns, acquired to manufacture items sold pursuant to this contract. Such special tooling shall be and remain Seller’s property notwithstanding payment of all or any part of the purchase price by Buyer. In the event that Buyer liquidates its interest in apparatus belonging to Seller which is utilized in the manufacture of the items sold hereunder, even if such apparatus has been specially converted or adapted for such manufacture and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller shall have the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.

8. 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, may be considered obsolete and may be destroyed by Buyer upon expiration of the contract or within two (2) consecutive years after the cause of action accrues, without Seller placing an order for the items which are 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. Taxes: Unless otherwise indicated on the face hereof, all prices and charges are exclusive of excise, sales, use, property, occupational or like taxes which may be imposed by any taxing authority upon the manufacture, sale or delivery of the items sold hereunder. If any such taxes must be paid by Seller or if Seller is liable for the collection of such tax and the amount thereof shall be in addition to the amounts for the items sold. Buyer agrees to pay all such taxes or to reimburse Seller therefore upon receipt of its invoice. If Buyer claims exemption from any sales, use or other tax imposed by any taxing authority, Buyer shall indemnify and hold Seller harmless from and against any losses or costs with any interest or penalties thereon which may be assessed if the items are held to be taxable.

10. Indemnity For Infringement of Intellectual Property Rights: Seller shall have no liability for infringement of any patents, trademarks, copyrights, trade secrets, or similar rights except as provided in this Part 10. Seller will defend and indemnify Buyer against allegations of infringement of U.S. patents, U.S. trademarks, copyrights, trade dress and trade secrets (hereinafter “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 an item sold pursuant to this contract 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 an item sold hereunder 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 said item, replace or modify said item so as to make it noninfringing, or offer to accept return of said item and return to Buyer the purchase price paid by Buyer or if Seller is liable for the collection of such tax, the amount thereof shall be in addition to the amounts for the items sold. Buyer agrees to pay all such taxes or to reimburse Seller therefore upon receipt of its invoice. If Buyer claims exemption from any sales, use or other tax imposed by any taxing authority, Buyer shall indemnify Seller for all costs, expenses or judgments resulting from any claim that such item infringes any patent, trademark, copyright, trade dress and trade secret or any similar right.

11. Force Majeure: Seller does not assume the risk of and shall not be liable for delay or failure to perform any of Seller’s obligations by reason of circumstances beyond the reasonable control of Seller (hereinafter “Events of Force Majeure”). Events of Force Majeure shall include, but not be limited to, strikes, lockouts, work stoppages, riots, insurrections, acts of war, epidemics, diseases, earthquakes, floods, acts of God, riots, wars, government agency, fires, floods, delays or failures in delivery of carriers or suppliers, shortages of materials and any other cause beyond Seller’s control.

12. Entire Agreement/Governing Law: The terms and conditions set forth herein, together with any amendments, modifications and any different terms or conditions expressly accepted by Seller in writing, shall constitute the entire Agreement concerning the items sold, and there are no oral or other representations or agreements of any kind whatever, express or implied, made or given by Seller or by Seller’s representatives or agents with respect thereto. This Agreement shall be governed in all respects by the laws of the State of Ohio. No actions arising out of sale of the items sold hereunder or this Agreement may be brought by either party more than two (2) years after the cause of action accrues.