Injection Lubricators

Catalog 0302-2
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Why Injection Lubrication?

In many cases, conventional air line lubricators cannot supply adequate lubrication to tools, cylinders, etc. This is due to many factors such as long distances between tool and lubricator, intermittent flow, and complex piping. Parker/Watts Injection Lubricators are designed to deliver precise amounts of oil directly to the point of lubrication as required. To ensure proper lubrication, our injection lubrication products and accessories are available to cover a wide range of applications.

How It Works...

Oil Injection Module

When the pneumatic circuit is energized:
1.) Air pressure is routed to the air piston
2.) The air piston pushes on the oil piston
3.) The oil piston enters the oil cylinder bore and forces an exact amount of oil past the check valve to the outlet.
4.) The adjusting knob/screw is used to control the oil piston travel, effectively controlling the amount of oil delivered per actuation.

Oil Delivery

**Single Point – L50**

**Single/Multi Point – PL50**
Which Kind of Injection Lubricator Do I Need?

Selecting a Lubricator

<table>
<thead>
<tr>
<th>Common Applications</th>
<th>Lubricator Type</th>
<th>Number of Lubrication Points</th>
<th>Air Consumption</th>
<th>Cycle Operating Time</th>
<th>Cycle Counter</th>
<th>Pulse Generator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Tool - Hand Held</td>
<td>L50</td>
<td>One</td>
<td>1 - 40 SCFM</td>
<td>1-30 Seconds</td>
<td>Recommended</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>L50</td>
<td>One</td>
<td>20 - 40 SCFM</td>
<td>1-30 Seconds</td>
<td>Not Necessary</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>L50</td>
<td>One</td>
<td>10 - 50 SCFM</td>
<td>30 Seconds +</td>
<td>No</td>
<td>Recommended</td>
</tr>
<tr>
<td>Air Motor - Fixed Mount</td>
<td>PL50</td>
<td>One or Many</td>
<td>1 - 40 SCFM</td>
<td>1-30 Seconds</td>
<td>Recommended</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>PL50</td>
<td>One or Many</td>
<td>20 - 40 SCFM</td>
<td>1-30 Seconds</td>
<td>Not Necessary</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>PL50</td>
<td>One or Many</td>
<td>10 - 50 SCFM</td>
<td>30 Seconds +</td>
<td>No</td>
<td>Recommended</td>
</tr>
<tr>
<td>Cylinder/Actuator</td>
<td>PL50</td>
<td>One or Many</td>
<td>1 - 40 SCFM</td>
<td>1-30 Seconds</td>
<td>Recommended</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>PL50</td>
<td>One or Many</td>
<td>20 - 40 SCFM</td>
<td>1-30 Seconds</td>
<td>Not Necessary</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>PL50</td>
<td>One or Many</td>
<td>10 - 50 SCFM</td>
<td>30 Seconds +</td>
<td>No</td>
<td>Recommended</td>
</tr>
</tbody>
</table>

Note: If multiple points are to be lubricated in unison, use a Single Lubricator - Multiple Modules. If multiple points are to be lubricated at different times, use Multiple Lubricators - Single or Multiple Modules.

Options – Oil Delivery

**Cycle Counter Option**
For both L50 & PL50

All pneumatic device designed for applications where the **minimum** amount of oil injected every cycle is **too much**. The cycle counter controls oil delivery by reducing oil injection from every air cycle, to every 5th or 10th air cycle. The cycle counter also has settings allowing the module to operate with every air cycle, or turn off to stop injector module operation. (Maximum of 3 modules above counter on PL50)

Common Applications:
- Minimal oil demands
- Short cycle times
- Small tools
- Small cylinders

**Pulse Generator Option**
For both L50 & PL50

All pneumatic device designed for applications where the **maximum** amount of oil injected every cycle is **not enough**. The pulse generator increases oil delivery by generating oil injector cycles, effectively increasing oil delivery for long tool/application cycles. (Maximum of 10 modules above generator on PL50)

Common Applications:
- Long cycle times
  (L50: air motor/tool)
- Consistent lubrication intervals
  (PL50: chain/slide lubrication)
In-Line Injection Lubricators

L50 Single Point Injection Lubricator
The L50 Injection Lubricator is an in-line unit for use with tools and other pneumatic equipment which require consistent lubrication for longer life and maximum torque control. These units, available in 1/2" and 3/4" NPT, deliver an adjustable amount of oil through a capillary tube inside the main airline, directly to the tool. The amount of oil is adjustable up to .03cc. These units are designed for intermittent operation. Each time the tool is cycled, the unit injects the oil through the capillary tube to the lubrication point. If the minimum amount of oil is injected per cycle is too much, then the cycle counter may be added. Or, conversely, if the amount of oil injected per cycle is not enough due to long cycle times, a pulse generator is available.

Operation:
Every time air flow starts, the sensor piston (1) is pushed down and allows a pilot pressure to flow through port (2) which drives module piston (3) and metering plunger (4) to the right. As plunger passes by oil supply port (5), it forces oil into metering tube (6) which in turn lifts check valve (7) and forces the same quantity of oil into inner sight glass, it drives flow indicator (8) to the right (a positive indication of oil flow) and then flows up through annular area between inner and outer sight glass (9). It next flows down through out port (10) and capillary adapter (11) to capillary (12) adapted for internal feed. When air flow stops, the sensor piston is returned by its spring to the initial no-flow position and the pilot pressure behind metering piston is exhausted to atmosphere through exhaust valve (13) and exhaust port. When air is exhausted metering piston spring returns piston and plunger to initial position. As can be seen by referring to Figure A, the amount of oil injected into the system is determined by the distance the metering plunger (4) travels into the metering tube (6). The distance it travels to the right (into the tube) determines the quantity of oil that is forced out through the check valve (7) and into the system. Since the module piston always travels a set distance from point (A) to (B), oil feed rate is adjusted by varying the protruded length of the metering plunger. The longer the plunger, the greater the travel and the greater the oil feed per cycle. An adjusting knob (14) is provided to adjust the plunger length.

To operate, the knob must first be pulled into the unlocked position. Then as the knob is turned in a clockwise direction the adjusting screw (15) moves to the right and extends the metering plunger (4). Since the module/air piston (3) remains stationary, the extended length of the metering plunger is increased. Therefore, the next time the module is fired (pressurized), the metering plunger will travel a longer distance into the metering tube (6) so more oil will be forced through check valve and into system. Conversely, counter-clockwise rotation of the adjustment knob (14) will shorten the extended length of the plunger and decrease the amount of oil feed.
PL50 Multi-Point Injection Lubricator

The PL50 Injection Lubricator is designed to lubricate from one to ten points when sensing a single remote pilot signal. Like the L50, precise amounts of oil are injected directly at each of the lubrication points. Unlike the L50, a single air pilot signal fires the injector modules in the stack, and the oil is delivered by an external capillary tube directly to the air inlet of the point to be lubricated. The PL50 is ideal for multi-spindle air tools, automation equipment, air cylinders, and other components with intermittent operation which are difficult to lubricate.

If the minimum amount of oil is injected per cycle is too much, than the cycle counter may be added. Or, conversely, if the amount of oil injected per cycle is not enough due to long cycle times, a pulse generator is available.

A note about lubricating multiple points:

- How many points do you need to lubricate?
- How many lubricators do you need?

The PL50 Injection Lubricator will lubricate from 1 to 10 points all at one time. If your application has 6 cylinders to lubricate, and all 6 cylinders cycle at the same time, then the application requires one lubricator with 6 modules. If your application has 6 cylinders to lubricate, and 3 cylinders operate in one cycle, and the remaining 3 operate on a different cycle, then the application will require two 3 module lubricators.
L50 In-Line Injection Lubricators

Dependable Oil Delivery
L50 In-Line Injection Lubricators provide positive oil displacement lubrication ensuring the predetermined amount of oil is delivered to the tool each and every cycle regardless of pressure or flow.

For best results unit must be used with capillary line inside air outlet or with coaxial tool hoses (see accessories).

Features:

- **Air Flow Sensor**
  Single point injection lubricators are installed between a filtered, regulated air source and an air supply hose going to a pneumatic tool. The body of the unit is designed to sense air flow when the tool is being used and signal the oil injector module to lubricate.

- **Oil Injector Module**
  The oil injector module provides adjustable oil delivery in amounts up to 1 drop per cycle. Oil delivery adjustment is made by turning the adjusting knob increasing or decreasing the oil piston travel in the module. Unit comes standard with oil delivery indicator.

- **Cycle Counter - 4 Position - Optional**
  With the adjustable cycle counter, the lubricator can be set to dispense oil in the following manner:
  - Setting: Off No oil dispensed
  - 1 Every cycle of the application
  - 5 Every fifth cycle of the application
  - 10 Every tenth cycle of the application

- **Pulse Generator - Optional**
  For long cycle time applications the pulse generator makes the lubricator dispense a pre-determined amount of oil multiple times during a single tool cycle.

**Ordering Information**

<table>
<thead>
<tr>
<th>Threads</th>
<th>Port Size</th>
<th>Reservoir</th>
<th>Options</th>
<th>Counter / Generator Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>— NPT</td>
<td>04 1/2&quot;</td>
<td>Blank No Reservoir</td>
<td>Blank No Options</td>
<td>Blank No Cycle Counter or Pulse Generator</td>
</tr>
<tr>
<td>G BSP</td>
<td>06 3/4&quot;</td>
<td>R 10 oz. Integral Reservoir</td>
<td>Q Button Head Fill Fitting</td>
<td>NO 4 Position Adjustable Counter</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>X64 Fluorocarbon Elastomers in Injector Module</td>
<td>G Adjustable Pulse Generator</td>
</tr>
</tbody>
</table>
Injection Lubricators
In-Line Injection Lubricators

Technical Specifications

Dimensions

Amount Of Oil Injected Per Machine (Tool) Cycle With Cycle Counter

<table>
<thead>
<tr>
<th>Clicks Counter-clockwise</th>
<th>Turns Counter-clockwise</th>
<th>Cycle Counter Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>Prime</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>0.024 cc</td>
</tr>
<tr>
<td>16</td>
<td>2</td>
<td>0.024 cc 0.005 cc</td>
</tr>
<tr>
<td>24</td>
<td>3</td>
<td>0.018 cc 0.003 cc</td>
</tr>
<tr>
<td>32</td>
<td>4</td>
<td>0.012 cc 0.002 cc</td>
</tr>
<tr>
<td>40</td>
<td>5</td>
<td>0.006 cc 0.001 cc</td>
</tr>
<tr>
<td>48</td>
<td>6</td>
<td>—</td>
</tr>
</tbody>
</table>

Repair Kits & Accessories

Injector Module
- Sight Dome End Repair Kit: RKL50SD
- Adjustment End Only: RKL50MA
- Module Kit: KL50M

Sensor Body
- Sensor Piston: SAL50-0472

Button Head Fill Fitting: SA606Y107

Integral 10 oz. Reservoir: BKL50R

Cycle Counter Kit: RKL50NO

Pulse Generator Kit: RKL50G

Specifications

- Maximum Air Supply Pressure: 150 PSIG
- Oil Supply Pressure Range: Gravity Feed to 20 PSIG Max.
- Oil Viscosity Range: 150-1200 S.S.U.
- Minimum Airflow for Operation: 5 SCFM
- Oil Delivery Range: 0-1 Drop per Cycle of Injector
- Pressure Drop: Less than 5 PSIG @ 100 SCFM
- Oil Fill Port: 1/8" NPT

Materials of Construction

Injector Module
- Body: Aluminum
- Oil Piston: Steel
- Air Piston: Ultem
- Sight Dome: Polyurethane
- Springs: Steel
- End Plug: Brass
- Seals: Buna-N (Fluorocarbon Optional)

Flow Sensor Body
- Body: Zinc
- Bottom Plate: Steel
- Sensor Piston: Aluminum / Brass
- Spring: Steel
- Top Plate: Zinc

Reservoir
- Top & Bottom Plate: Zinc
- Reservoir Cylinder: Polycarbonate
- Seals: Buna-N

Cycle Counter
- Body: Nylon
- Seals: Buna-N

Pulse Generator
- Body: Aluminum
- Timer: Acetal / Steel / Buna-N

L50 Dimensions

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.13</td>
<td>3.48</td>
<td>1.38</td>
<td>5.09</td>
<td>2.44</td>
</tr>
<tr>
<td>(104.8)</td>
<td>(88.4)</td>
<td>(35)</td>
<td>(129.3)</td>
<td>(61.9)</td>
</tr>
</tbody>
</table>

For Integral Reservoir Add: 3.0 (76.2) — 2.01 (51)

For Cycle Counter Add: 0.88 (22.4) — —

For Pulse Generator Add: 1.75 (44.5) 2.06 (52.3) —
Individual Points of Lubrication
PL50 Multi-Point Injection Lubricators use an air pilot signal to provide positive displacement lubrication to either single or multiple points ensuring the predetermined amount of oil is delivered to each point per cycle regardless of pressure or flow.
The PL50 delivers oil externally to the air inlet to a pneumatic device where it is “tee’d” into the air line.

Features:
- **Oil Injector Module**
The oil injector module provides adjustable oil delivery in amounts up to 1 drop per cycle. Oil delivery adjustment is made by turning the adjusting knob increasing or decreasing the oil piston travel in the module. Optional visible oil delivery indicator(s) are available - and recommended - ensure visual proof of lubrication at each point.
- **Cycle Counter - 4 Position - Optional**
With the adjustable cycle counter, the lubricator can be set to dispense oil in the following manner:
Setting: Off No oil dispensed
1 Every cycle of the application
5 Every fifth cycle of the application
10 Every tenth cycle of the application
- **Pulse Generator - Optional**
For long cycle time applications the pulse generator makes the lubricator dispense a pre-determined amount of oil multiple times during a single tool cycle.
(Maximum of 10 modules above pulse generator)

Ordering Information

<table>
<thead>
<tr>
<th>PL50M</th>
<th>2</th>
<th>V</th>
<th>R</th>
<th>NO</th>
<th>Q</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Number of Modules</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  1 Module</td>
</tr>
<tr>
<td>2  2 Modules</td>
</tr>
<tr>
<td>10 Modules Maximum</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reservoir</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blank No Reservoir</td>
</tr>
<tr>
<td>R  10 oz. Integral Reservoir</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Counter / Generator Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blank No Cycle Counter or Pulse Generator</td>
</tr>
<tr>
<td>NO 4 Position Adjustable Counter (Maximum of 3 modules above cycle counter)</td>
</tr>
<tr>
<td>G Adjustable Pulse Generator</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Position of Cycle Counter or Pulse Generator</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Indicates if modules below counter or generator)</td>
</tr>
<tr>
<td>Blank Standard Configuration (Counter or Generator operates all modules)</td>
</tr>
<tr>
<td>1 1 module below counter</td>
</tr>
<tr>
<td>2 2 modules below counter</td>
</tr>
<tr>
<td>...etc. ...etc.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blank No Options</td>
</tr>
<tr>
<td>Q Button Head Fill Fitting</td>
</tr>
<tr>
<td>X64 Fluorocarbon Elastomers in Injector Module</td>
</tr>
</tbody>
</table>
Technical Specifications

Injection Lubricators
Multi-Point Injection Lubricators

Dimensions

Amount Of Oil Injected Per Machine (Tool)
Cycle With Cycle Counter

<table>
<thead>
<tr>
<th>Injector Module Setting</th>
<th>Clicks Counter-clockwise</th>
<th>Turns Counter-clockwise</th>
<th>Cycle Counter Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Off ( \text{or w/o Counter} )</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Prime</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>0</td>
<td>0.024 cc 0.005 cc 0.002 cc</td>
</tr>
<tr>
<td>16</td>
<td>2</td>
<td>0</td>
<td>0.0018 cc 0.0003 cc 0.0002 cc</td>
</tr>
<tr>
<td>32</td>
<td>4</td>
<td>0</td>
<td>0.0012 cc 0.0002 cc 0.0001 cc</td>
</tr>
<tr>
<td>40</td>
<td>5</td>
<td>0</td>
<td>— — —</td>
</tr>
<tr>
<td>48</td>
<td>6</td>
<td>0</td>
<td>— — —</td>
</tr>
</tbody>
</table>

Repair Kits & Accessories

Injector Module
Visible Indicator End Repair Kit ........................... RKL50MD
Adjustment End Only .................................................. RKL50MA
Module Kit - Visible Indicator .............................KPL50MV
Module Kit - Non-Visible Indicator ......................... KPL50M

Button Head Fill Fitting ........................................ SA606Y107
Integral 10 oz. Reservoir ........................................ BKL50R
Cycle Counter Kit .................................................. RKL50NO
Pulse Generator Kit ............................................... RKL50G

Specifications

Maximum Air Supply Pressure .................................. 150 PSIG
Oil Supply Pressure Range .................................Gravity Feed to 20 PSIG Max.
Oil Viscosity Range ........................................ 150-1200 S.S.U.
Minimum Airflow for Operation ................................... 5 SCFM
Oil Delivery Range .............................................. 0-1 Drop per Cycle of Injector
Pressure Drop ...................................................... Less than 5 PSIG @ 100 SCFM
Oil Fill Port .......................................................... 1/8" NPT
Air Signal Pilot Port .................................................. 1/8" NPT

Material of Construction

Injectors Module
Body .......................................................... Aluminum
Oil Piston .......................................................... Steel
Air Piston .......................................................... Ultem
Sight Dome .......................................................... Polyurethane
Springs .......................................................... Steel
End Plug .......................................................... Brass
Seals .......................................................... Buna-N (Fluorocarbon Optional)

Bottom Plate .................................................. Aluminum
Top Plate .................................................. Zinc
Reservoir
Top & Bottom Plate .................................................. Zinc
Reservoir Cylinder .................................................. Polycarbonate
Seals .......................................................... Buna-N

Cycle Counter

Body .......................................................... Nylon
Seals .......................................................... Buna-N

Pulse Generator

Body .......................................................... Aluminum
Timer .......................................................... Acetal / Steel / Buna-N

# PL50 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>Standard 1 Module Unit w/o Visible Indicator</td>
<td>2.50 (63.5)</td>
<td>2.48 (63)</td>
<td>5.27 (133.9)</td>
<td>2.00 (51)</td>
<td>1.27 (32.3)</td>
</tr>
<tr>
<td>For Each Additional Module Add:</td>
<td>—</td>
<td>1 (25.4)</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>For Visible Indicators Add:</td>
<td>—</td>
<td>—</td>
<td>0.85 (21.6)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>For Integral Reservoir Add:</td>
<td>—</td>
<td>3.0 (76.2)</td>
<td>—</td>
<td>2.46 (62.5)</td>
<td>—</td>
</tr>
<tr>
<td>For Cycle Counter Add:</td>
<td>—</td>
<td>0.88 (22.4)</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>For Pulse Generator Add:</td>
<td>—</td>
<td>1.75 (44.5)</td>
<td>—</td>
<td>2.06 (52.3)</td>
<td>—</td>
</tr>
</tbody>
</table>

inches (mm)
Accessories
Injection Lubricators

 Typical Air Drop Application

- Injection Lubricator
- Filter
- Regulator
- Male Plug
- Coaxial Fitting
- Coaxial Hose Assembly
- Air / Oil Supply Hose
### Oil Reservoirs
(All units come with mounting bracket)

**BKL50A**
- 9 oz. polycarbonate bowl
  - Diameter: 2.87 (73)
  - Overall Height: 5.5 (140)
  - Mount to Top: 4.87 (124)
  - Mount to Bottom: 0.63 (16)

**BKL50B**
- 1 qt. polycarbonate bowl
  - Diameter: 4.25 (108)
  - Overall Height: 7.44 (189)
  - Mount to Top: 6.81 (167)
  - Mount to Bottom: 0.63 (16)

**BKL50C**
- 2 qt. polycarbonate bowl
  - Diameter: 5.5 (140)
  - Overall Height: 9.44 (247)
  - Mount to Top: 8.81 (224)
  - Mount to Bottom: 0.63 (16)

### Accessories

**Injection Lubricators**

**Button Head Fill Fitting**
- SA606Y107
  - 1/8" NPT Male

**Oil filled Capillary Line**
- SA606X71-1
  - 25 Feet
- SA606Y71-1
  - 50 Feet

**Capillary Line Connectors**
- SAL50Y139
  - 1/8" OD compression X
  - 1/8" NPT male connector

- SA606Z26
  - 1/8" OD compression X
  - 1/8" NPT male check valve

### Supply and Tool Hoses & Fittings

**A Air / Oil Supply Hose**
- **ASH-25**
  - Air Supply Hose - 25 Feet
  - 3/4" male NPT swivel fittings

- **AOSH-25**
  - Air & Oil Supply Hose - 25 Feet
  - 3/4" male NPT swivel fittings

**B Coaxial Fittings**
- **CES-06**
  - Coaxial Elbow & Socket
    - Inlet: 3/4" male NPT
    - Outlet: 3/4" female coax socket

- **CDS-06**
  - Coaxial Direct Socket
    - Inlet: 3/4" male NPT
    - Outlet: 3/4" female coax socket

**C Coaxial Hose Assemblies**
- **THC-20**
  - Coiled Tool Hose - 20 Feet
  - Tube Dia: 3/8"
  - Inlet: 3/4" male coax plug
  - Outlet: 3/8" male NPT

- **THS-20**
  - Straight Tool Hose - 20 Feet
  - Tube Dia: 3/8"
  - Inlet: 3/4" male coax plug
  - Outlet: 3/8" male NPT

- **DW-06-2**
  - Drop-Whip Hose - 2 Feet
  - Inlet: 3/4" male NPT
  - Outlet: 3/4" female coax socket
1. GENERAL INSTRUCTIONS

1.1. Scope: This safety guide is designed to cover general guidelines on the installation, use, and maintenance of Pneumatic Division Valves, FRLs (Filters pressure Regulators and Lubricators), Vacuum products and related accessory components.

1.2. Fail-Safe: Valves in a fail-safe mode, so that failure of associated valves, FRLs or Vacuum products will not endanger persons or property.


1.4. Distribution: Provide a copy of this safety guide to each person that is responsible for selection, installation, or use of Valves, FRLs or Vacuum products. Do not select, or use Watts valves, FRLs or vacuum products without thoroughly reading and understanding this safety guide as well as the specific Watts publications for the products considered or selected.

1.5. User Responsibility: Due to the wide variety of operating conditions and applications for valves, FRLs, and vacuum products Watts and its distributors do not represent or warrant that any particular valve, FRL or vacuum product is suitable for any specific end use system. This safety guide does not analyze all technical parameters that must be considered in selecting a product. The user, through its own analysis and testing, is solely responsible for:
   • Making the final selection of the appropriate valve, FRL, Vacuum component, or accessory.
   • Assuring that all user’s performance, endurance, maintenance, safety, and warning requirements are met and that the application presents no health or safety hazards.
   • Complying with all existing warning labels and/or providing all appropriate health and safety warnings on the equipment on which the valves, FRLs or Vacuum products are used; and,
   • Assuring compliance with all applicable government and industry standards.

1.6. Safety Devices: Safety devices should not be removed, or defeated.

1.7. Warning Labels: Warning labels should not be removed, painted over or otherwise obscured.

1.8. Additional Questions: Call the appropriate Watts technical service department if you have any questions or require any additional information. See the Watts publication for the product being considered or used, or call 269-629-5000, or go to www.wattsfluidair.com, for telephone numbers of the appropriate technical service department.

2. PRODUCT SELECTION INSTRUCTIONS

2.1. Flow Rate: The flow rate requirements of a system are frequently the primary consideration when designing any pneumatic system. System components need to be able to provide adequate flow and pressure for the desired application.

2.2. Pressure Rating: Never exceed the rated pressure of a product. Consult product labeling, Pneumatic Division catalogs or the instruction sheets supplied for maximum pressure ratings.

2.3. Temperature Rating: Never exceed the temperature rating of a product. Excessive heat can shorten the life expectancy of a product and result in complete product failure.

2.4. Environment: Many environmental conditions can affect the integrity and suitability of a product for a given application. Pneumatic Division products are designed for use in general purpose industrial applications. If these products are to be used in unusual circumstances such as direct sunlight and/or corrosive or caustic environments, such use can shorten the useful life and lead to premature failure of a product.

2.5. Lubrication and Compressor Carryover: Some modern synthetic oils can and will attack nitrile seals. If there is any possibility of synthetic oils or greases migrating into the pneumatic components check for compatibility with the seal materials used. Consult the factory or product literature for materials of construction.

2.6. Polycarbonate Bowls and Sight Glasses: To avoid potential polycarbonate bowl failures:
   • Do not locate polycarbonate bowls or sight glasses in areas where they could be subject to direct sunlight, impact blow, or temperatures outside of the rated range.
   • Do not expose or clean polycarbonate bowls with detergents, chlorinated hydro-carbons, keytones, esters or certain alcohols.
   • Do not use polycarbonate bowls or sight glasses in air systems where compressors are lubricated with fire resistant fluids such as phosphate ester and di-ester lubricants.

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

Before selecting or using any of these Products, it is important that you read and follow the instructions below.
2.8. Product Rupture: Product rupture can cause death, serious personal injury, and property damage.
- Do not connect pressure regulators or other Pneumatic Division products to bottled gas cylinders.
- Do not exceed the maximum primary pressure rating of any pressure regulator or any system component.
- Consult product labeling or product literature for pressure rating limitations.

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

3.2. Installation Instructions: Watts published Installation Instructions must be followed for installation of Watts valves, FRLs and vacuum components. These instructions are provided with every Watts valve or FRL sold, or by calling 269-629-5000, or at www.wattsfluidair.com.

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

4. VALVE AND FRL MAINTENANCE AND REPLACEMENT INSTRUCTIONS
4.1. Maintenance: Even with proper selection and installation, valve, FRL and vacuum products service life may be significantly reduced without a continuing maintenance program. The severity of the application, risk potential from a component failure, and experience with any known failures in the application or in similar applications should determine the frequency of inspections and the servicing or replacement of Pneumatic Division products so that products are replaced before any failure occurs. A maintenance program must be established and followed by the user and, at minimum, must include instructions 4.2 through 4.10.

4.2. Installation and Service Instructions: Before attempting to service or replace any worn or damaged parts consult the appropriate Service Bulletin for the valve or FRL in question for the appropriate practices to service the unit in question. These Service and Installation Instructions are provided with every Watts valve and FRL sold, or are available by calling 269-629-5000, or by accessing the Watts web site at www.wattsfluidair.com.


4.4. Visual Inspection: Any of the following conditions requires immediate system shut down and replacement of worn or damaged components:
- Air leakage: Look and listen to see if there are any signs of visual damage to any of the components in the system. Leakage is an indication of worn or damaged components.
- Damaged or degraded components: Look to see if there are any visible signs of wear or component degradation.
- Kinked, crushed, or damaged hoses. Kinked hoses can result in restricted air flow and lead to unpredictable system behavior.
- Any observed improper system or component function: Immediately shut down the system and correct malfunction.
- Excessive dirt build-up: Dirt and clutter can mask potentially hazardous situations.
Caution: Leak detection solutions should be rinsed off after use.

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

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

4.7. Service or Replacement Intervals: It is the user’s responsibility to establish appropriate service intervals. Valves, FRLs and vacuum products contain components that age, harden, wear, and otherwise deteriorate over time. Environmental conditions can significantly accelerate this process. Valves, FRLs and vacuum components need to be serviced or replaced on routine intervals. Service intervals need to be established based on:
- Previous performance experiences.
- Government and / or industrial standards.
- When failures could result in unacceptable down time, equipment damage or personal injury risk.

4.8. Servicing or Replacing of any Worn or Damaged Parts: To avoid unpredictable system behavior that can cause death, personal injury and property damage:
- Disconnect electrical supply (when necessary) before installation, servicing, or conversion.
- Disconnect air supply and depressurize all air lines connected to system and Pneumatic Division products before installation, service, or conversion.
- Installation, servicing, and / or conversion of these products must be performed by knowledgeable personnel who understand how pneumatic products are to be applied.
- After installation, servicing, or conversions air and electrical supplies (when necessary) should be connected and the product tested for proper function and leakage. If audible leakage is present, or if the product does not operate properly, do not put product or system into use.
- Warnings and specifications on the product should not be covered or painted over. If masking is not possible, contact your local representative for replacement labels.

4.9. Putting Serviced System Back into Operation: Follow the guidelines above and all relevant Installation and Maintenance Instructions supplied with the valve FRL or vacuum component to insure proper function of the system.
The items described in this document and other documents or descriptions provided by Parker Hannifin Corporation, its subsidiaries and its authorized distributors, are hereby offered for sale at prices to be established by Parker Hannifin Corporation, its subsidiaries and its authorized distributors. This offer and its acceptance by any customer (“Buyer”) shall be governed by all of the following 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.

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 these terms and conditions. Any terms or conditions in addition to, or inconsistent with those contained 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, in writing, together with any amendments, modifications and any additional terms or conditions expressly accepted by Seller in writing, shall constitute acceptance of this offer.

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 the Buyer is late in making payment. Any claims for damages for overcharges or shortages in a shipment shall be made within 10 days after Buyer’s receipt of the shipment.

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, however, risk of loss shall pass to Buyer upon Seller’s 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 12 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.

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 items found to be defective or refunded in the event the purchase price is 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 shall be 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 by Buyer. In no event will Buyer acquire any interest in the 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 Seller after two (2) consecutive years have elapsed without Buyer 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 required by law to charge 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 save Seller harmless from and against any such tax, together 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 dress, trade secrets or similar rights except as provided hereinafter. 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 to make it noninfringing, or offer to accept return of such item and return the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed to items delivered hereunder for which the designs are specified in whole or part by Buyer resulting from the modification or the use in a system of any item sold hereunder. The foregoing provisions of this Part 10 shall constitute Seller’s sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights.

If a claim is based on information provided by Buyer or if the design for an item delivered hereunder is specified in whole or in part by Buyer, Buyer shall defend and indemnify Seller for all costs, expenses or judgements resulting from any claim that such item infringes any patent, trademark, copyright, trade dress, trade secret or any similar right. 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 without limitation, accidents, acts of God, strikes or labor disputes, acts, laws, rules or regulations of any government or 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 which pertain thereto. This Agreement shall be governed in all respects by the law 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.