bulk chemical management

bulk chemical

process control « » safety

high purity « » high flow rate « »

Entegris
bulk chemical management

The backbone to the high tech fabrication environment is the steady supply of process materials. Safe, accurate and timely delivery of process chemistries throughout the facility enables the efficient and economically stable operation of each process step. The diversity of the chemistries flowing through the lines at any one time covers a wide range of materials ranging from aggressive acids to DI water to concentrated substances. In addition, these chemistries must be controlled to levels general industries cannot achieve in terms of repeatability and consistency. Entegris provides the solutions to succeed under these extreme conditions.

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* Electronic grade
Entegris provides products and services for applications across key semiconductor processes to help chip makers solve manufacturing challenges, enhance yield and gain sustainable competitive advantage.

**purify, protect and transport**

As wafer sizes continue to increase and line widths shrink, purity requirements become more stringent and precise chemical blending becomes more critical. Whether it’s transport or storage, mixing or dispense, Entegris has solutions to meet bulk chemical handling needs.

**bulk chemical**

Wafer handling

Entegris provides wafer handling products to protect and transport prime wafers, wafers being processed, finished wafers, bare die and packaged devices. Products include wafer carriers, wafer shippers, mask and reticle carriers, bare die trays, horizontal wafer shippers, chip trays and film frame shippers.

**wafer handling**

Chemical mechanical planarization

From filtration, liquid and slurry handling, Entegris products enable the CMP process.

**chemical mechanical planarization**

Wet etch and clean

Ultrapure liquids and gases are purified, protected and transported with Entegris filters, purifiers, valves, fittings and sensing and control products.

**wet etch and clean**

Photolithography

Entegris’ broad product line enables lithography processing with gas filters and diffusers, wafer and reticle handling, liquid filtration, purification and control.

**photolithography**

With 2,200 employees worldwide, Entegris thrives on the challenge to meet our customers’ expectations through a global network of service, technology, manufacturing and applications support teams, all built upon a tradition of product and process innovation.

**global presence**

Entegris’ broad product line enables lithography processing with gas filters and diffusers, wafer and reticle handling, liquid filtration, purification and control.

**lab capabilities**

Analytical Services

- Airborne molecular contamination
- Surface contamination
- Applications support
- Root-cause analysis

Product Testing

- Performance testing
- Particle testing
- Electrostatic charge
- Vibration
- Flow rate optimization
- Applied statistics
- Safety and industry standardization
- DOT and UN regulations
- CE marking

Materials Science

- New material development
- Material characterization
- Material selection
- Material incoming inspection
- Applications support
The technology roadmaps to produce the next generation of semiconductor devices and microelectronics are presenting unprecedented technological challenges, as well as ever increasing pressure to improve yields and productivity. As the leading provider of contamination control products and services to the global semiconductor and microelectronics industry, Entegris is using a wide array of analytical and materials science expertise to develop comprehensive solutions to contamination issues in the fab.

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>DRAM 1/2 Pitch (nm)</td>
<td>70</td>
<td>59</td>
<td>45</td>
<td>36</td>
</tr>
<tr>
<td>Logic (Flash) 1/2 Pitch (nm)</td>
<td>78 (64)</td>
<td>59 (45)</td>
<td>45 (36)</td>
<td>36 (28)</td>
</tr>
<tr>
<td>Critical Defect (nm)</td>
<td>29</td>
<td>30</td>
<td>23</td>
<td>18</td>
</tr>
<tr>
<td>DRAM Wafer Handling PWP</td>
<td>30</td>
<td>20</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>Molecular Contaminants Wafer level</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
</tr>
<tr>
<td>Critical Metal Ions (PPT)</td>
<td></td>
<td></td>
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</tbody>
</table>

Electronics that are smaller, faster, cheaper and more functional

Industry

<table>
<thead>
<tr>
<th>Technology</th>
<th>193 nm Immersion Lithography</th>
<th>Double Patterning</th>
<th>EUV</th>
</tr>
</thead>
<tbody>
<tr>
<td>300 mm Wafer Processing</td>
<td>300 mm Prime</td>
<td>450 mm?</td>
<td></td>
</tr>
</tbody>
</table>

Entegris Technologies

- Liquid and Gas Filtration and Purification
  - Continuous Improvement
    - Filtration products: smaller pore size, higher flow, higher retention
    - Purification products: volatile organics, AMC, moisture, degasification

- Wafer Handling
  - 300 mm Prime product platforms
  - 450 mm prototypes

- Mask Handling
  - Carriers to prevent reticle haze
  - EUV mask carriers

- Liquid Systems
  - Liquid Lens™
  - Multi scanner systems
  - Subsystems
  - Process monitoring

Leveraging our core competencies of materials science

Close to our customers

Direct sales and local support gives us the opportunity to achieve customer intimacy.

Customer intimacy helps us better understand our customers’ needs through direct feedback and roadmap sharing.

By aligning our materials science, engineering and R&D initiatives, we can develop indispensable contamination control solutions to solve our customers’ roadmap challenges.

Entegris Patents

- 2005: 39 new U.S. patents
- 2006: 44 new U.S. patents
- 2007: 25 new U.S. patents
- 2008: 35 new U.S. patents
- 2009: 16 new U.S. patents
Our expertise in materials science and contamination control enables our customers to meet the demands of the market by reducing costs, enhancing yields, increasing productivity and improving process control.

The following pages highlight products designed to solve your fab challenges by providing best-in-class purification, materials management and process control solutions.>><>
Pleated depth filters with high flow and excellent broad range retention efficiency, ideal prefiltration applications or electronics parts plating processes.

Depth pleated structure providing longer lifetime.

- Pleated depth membrane
- Available in cartridge or disposable configuration
- Wide range of retention ratings from 0.5 μm to 40 μm
- Excellent chemical and heat resistance

Optimized for electronic chemical manufacturers

Consumer electronic market: TFT-LCD, TN/STN, color filter, wet etching, stripping, developer, cleaning

Chemical mechanical planarization (CMP) slurry

### FEATURE
- Higher particle and gel holding capability
- Reducing filter changing due to longer lifetime
- Increase tool uptime
- Providing clean and durable performance
- Low extractable levels ensure superior downstream cleanliness
- Improving tool uptime due to long-term chemical compatibility
- Improving quality and overall yield
- Superior retention of colloids and particles ensuring low particle counts
- Wide range of contaminants captured in a single filter unit
- Increasing overall chemical purity
- Lower filtration costs

### BENEFIT
- Fits most available housings
- Saves time due to easy installations in the equipment
- No retrofit costs

#### ProcessGard® NP Cartridge Filters

Pleated depth filters with high flow and excellent broad range retention efficiency, ideal prefiltration applications or electronics parts plating processes.

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Depth pleated structure providing longer lifetime.

- Pleated depth membrane
- Available in cartridge or disposabl
Fluorogard® FP and FP-HP Cartridge Filters

Fluorogard FP and FP-HP are constructed of hydrophobic or hydrophilic PTFE pleated membranes with polypropylene supports to enhance durability and cleanliness.

- Wide range of retention ratings from 0.05 µm to 10 µm
- Available in three different cartridge sizes (10", 20" and 30")
- Available in code 0, F, 7 and 5 (2-226 and 2-222 o-rings)
- Operating temperature up to 90°C
- Optimized for filtration of process chemicals, e.g., water-based chemicals and organic solvents
- Usable in bulk or point-of-use applications

### Performance

Chemical compatibility is mainly driven by the surface area exposed to chemicals. With its 7000 cm² PTFE membrane in a PP structure, the Fluorogard FP exhibits very good chemical resistance in most applications. It is an economical choice where PTFE material is required.

Ideal solution for electronic-grade chemical manufacturing and wet cleaning applications in many industries.

The hydrophilic version exhibits very good wettability even after drain and dry modes, without flow loss.

### Frequently asked questions

**What is my flow capability for a Fluorogard FP 10" cartridge?**

**How do I create the right part number for ordering the FP filter?**

---

<table>
<thead>
<tr>
<th>Feature</th>
<th>Advantage</th>
<th>Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Available in two different PTFE membranes:</td>
<td>Optimized chemical compatibility</td>
<td>• More consistent, reliable process</td>
</tr>
<tr>
<td>– Hydrophobic (FP)</td>
<td>• Spontaneous wetting</td>
<td>• Increased tool uptime due to no prewetting needed in aqueous chemicals</td>
</tr>
<tr>
<td>– Hydrophilic (FP-HP)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Available in different retention ratings (0.05 µm to 10 µm), lengths (10&quot;, 20&quot; and 30&quot;) and codes (0 and 7)</td>
<td>Fits most available housings, and addresses all filtration requirements</td>
<td>• Saves time due to easy installations in the equipment</td>
</tr>
<tr>
<td>PTFE membrane and polypropylene construction</td>
<td>Providing clean and durable performance</td>
<td>• Streamlined offering that covers all filtration needs</td>
</tr>
<tr>
<td></td>
<td>Low extractable levels ensure superior downstream cleanliness</td>
<td></td>
</tr>
</tbody>
</table>
Microgard™ Plus Cartridge Filters

Microgard Plus patented UPE membrane shows the highest retention efficiency of any membrane. It offers low surfactant binding and spontaneous wettability in solvents.

- High retention efficiency of up to 99.999% at rated particle size
- Removal of microbubbles and gels
- Low pressure drop
- Low leaching of ionic/metallic contamination from filter

Optimized for bulk chemical distribution systems, filtration of stripping photochemicals, photoresist stripping at temperatures below 70°C.

<table>
<thead>
<tr>
<th>FEATURE</th>
<th>ADVANTAGE</th>
<th>BENEFIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrophobic UPE membrane wets spontaneously in solvents</td>
<td>No prewetting or flush-up required for rapid start-up</td>
<td>Lower operational cost and increased tool uptime through fast filter installation and qualification</td>
</tr>
<tr>
<td>High retention efficiency and superior downstream cleanliness</td>
<td>Low particle counts and metal contamination in bulk chemical production and chemical delivery systems</td>
<td>Cleaner chemicals protect processes and end-user products. Reduced need for exchange of downstream filters.</td>
</tr>
<tr>
<td>Sponge-like structure of patented UPE membrane</td>
<td>Excellent retention of microbubbles and gels</td>
<td>Reduction of defects, yield improvement</td>
</tr>
<tr>
<td>Large filtration area</td>
<td>Long filter lifetime and low pressure drop</td>
<td>Improved COO due to reduced need for maintenance</td>
</tr>
</tbody>
</table>

**UPE vs. PTFE Membrane Particle Count Comparison**

<table>
<thead>
<tr>
<th>Dispense Number</th>
<th>Particle Number &gt; 0.15 µm</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 nm</td>
<td>Phased 0.05 µm PTFE filter</td>
</tr>
<tr>
<td>10 nm</td>
<td>UPE 0.1 µm filter</td>
</tr>
</tbody>
</table>

**frequently asked questions**

**Why does Microgard Plus have better flow characteristics than other filters?**

Entegris’ surface modification technology enhances the membrane to create less pressure drop and greater surface area.

**Why does Microgard Plus hold back gels more effectively than PTFE filters?**

The string and node structure of PTFE allows gels to pass through easily. Furthermore, pressure pushes gels through PTFE membranes. The sponge-like structure of UPE prevents gels from passing through the membrane and additionally has more loading capacity.
FluoroPure® 1000 Liter Intermediate Bulk Container (IBC)

For applications where a package greater than 200 liters is required. The inner wetted material is identical to the 200 Liter HDPE Trilayer drum.

- UN tested and approved, and in compliance with DOT for packaging Group II and III chemicals (100 kPa rated)
- Accommodates Sentry QCII and QCIII quick connect systems
- Package includes three ports
- High-purity package
- Fork pocket opening on all four sides

Optimized for:
- wet etch and clean
  - HF, H₂O₂, H₂SO₄, H₃PO₄,
  - CMP
  - Colloidal silica, KOH-based slurry

**performance**

- Expected cleanliness levels
  - Trilayer particles
    - (counted in DI water)
    - 15 particles/mL @ 0.2
    - 6 particles/mL @ 0.3
    - 1 particle/mL @ 0.5
  - Typical metals:
    - Less than 170 ppt total metals
- Package is approved for safe operation at 100 kPa (not approved for pressure dispense)
- The burst disk ensures operator safety
  - Gauge pressure up to 100 kPa

**frequently asked questions**

What makes our solution unique?
The clean Entegris Trilayer inner materials.

Will the FluoroPure 1000 liter IBC also have the same inner liner as the 200 liter version?
Yes, the 1000 and 200 liter packages both utilize the inner liner material.

Can I connect the Sentry QCII and QCIII quick connect systems?
Yes, both systems are connectable.
FluoroPure® 55 Gallon (200 Liter) Advantage Trilayer and Trilayer HDPE Drum

UN tested and approved for all Entegris Sentry quick connect systems. High purity option for transporting and distributing chemicals.

- UN tested and approved, and in compliance with DOT for packaging Group II and III chemicals
- Tall chime protects drum insert during transportation
- Corrosion-free performance
- Compatible with our Sentry QCII and QCIII quick connect system

Optimized for wet etch and clean application and chemical mechanical planarization.

###FEATURE### ADVANTAGE### BENEFIT###

| Wetted inner liner of the purest virgin HDPE | Ensures chemical integrity and cleanliness | Minimize metallic, organic and particle contamination |
| UN tested and approved, and in compliance with DOT for packaging Group II and III chemicals (100 kPa rated) | Legal permission for worldwide use | No extra testing; Suitable for worldwide applications and transportation |
| UN tested and approved with Sentry QCII and QCIII quick connect systems | Single source supplier for chemical bulk delivery system | Complete package; No additional testing; ready for use |
| Molded-in chime | Protection for drum insert and closure during transportation | No spending for new DIP tube (compared to competition) |
| Reusable package | Reduced disposal costs | Package cost is rapidly amortized over several round-trips |
| Unique sump design | Maximum retrievability | Minimizes residual chemical |

###performance###

Drop test results for HDPE Trilayer Drum:

<table>
<thead>
<tr>
<th>Drum Type</th>
<th>Drop Height</th>
<th>Failure Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entegris drum</td>
<td>2.0 meters</td>
<td>0% (0 of 6)</td>
</tr>
<tr>
<td>Competitor Japanese drum</td>
<td>1.9 meters</td>
<td>50% (3 of 6)</td>
</tr>
<tr>
<td>Competitor US drum</td>
<td>1.9 meters</td>
<td>67% (4 of 6)</td>
</tr>
</tbody>
</table>

###frequently asked questions###

Can I connect the Sentry QCII and QCIII quick connect systems?

Yes, both systems are connectable.

What design features improve the strength and closure protection?

The single-piece design with molded-in chimes increases strength and closure protection. See the performance test results provided above.

When do I use Trilayer or Advantage Trilayer drum?

Please contact the factory with your media to discuss which drum would perform better for your specific application.
Sentry™ QCIII Quick Connect System

Key-coded Sentry QCIII Quick Connect System with recirculation option is the safest method of connecting FluoroPure chemical containers into your distribution equipment.

- Recirculation option (¼” connection)
- Key-coded connection system to prevent misconnects
- 2 check valves (in fill and dispense port)
- Dispense head: wetted parts include PFA, FEP and Kalrez® 4001 materials
- Drum insert: wetted parts are PFA or polyethylene with FEP encapsulated o-rings

Optimized for wet etch and clean applications: HF, H₂O₂, H₂SO₄, H₃PO₄, HNO₃, MAE and chemical mechanical planarization.

**FEATURE**  
Key-coded system (same key code system as for QCII)  
4-port option: Recirculation and dispense in one connection  
C₉ 5.0 vs. 3.3 for Sentry QCII system  
O-ring free main dispense seal at drum insert

**ADVANTAGE**  
Safety for maintenance personnel  
Minimization of operator errors  
Higher flow rate  
No maintenance/replacement necessary

**BENEFIT**  
Cost-savings due to fewer changing operations for inserts (reduced maintenance)  
Lower labor costs with fewer connections and easier handling (self-alignment)  
Avoid damaging slurry performance  
No maintenance/replacement necessary

**Performance**
- 4-port includes recirculation diffuser
- Drum insert has no o-ring vs. three o-rings on Sentry QCII and one o-ring on shipping cap
- Improved assembly features
  - Dual engagement thread creates easy assembly by operators in chemical room
  - Requires less "push down" force by operator
  - Connection can be made without any visual alignment

**Frequently Asked Questions**

Are the connections exclusive to Flaretek® fittings? 
Yes, all three connections are Flaretek connections.

Can you use QCIII dispense head with QCII drum insert? 
No.
Key-coded Sentry QCII Quick Connect System is the safest method of connecting FluoroPure chemical containers.

- Key-coded connection system prevents misconnects
- One connection provides dispensing, venting and level detection
- Check valve designed to seal off backflow when disconnecting the Sentry QCII system (safety)
- Dispense head: wetted parts include PFA, FEP and Kalrez 4079 materials
- Drum insert: wetted parts are PFA or polyethylene with FEP encapsulated o-rings
- Optional high-flow dispense head is available (includes 1⁄4 turn plug valve)

Optimized for wet etch and clean applications: HF, H₂O₂, H₂SO₄, H₃PO₄, HNO₃, MAE and chemical mechanical planarization.

**performance**
- Approximately 700 different key codes for different chemicals available
  - We can create a new key code for every chemical/blending/mixture
- Flow performance:
  - DHT has a Cv of 3.3
  - Increased flow DH has a Cv of 5.3
- A wide range of accessories are available for QCII (e.g. covers, code checker, shipping plugs)

**frequently asked questions**

*Are the connections exclusive to Flaretek fittings?*
Yes, all three connections are Flaretek connections.

*Do I have to use other key codes for the increased flow DH?*
No, it is the same key code system as for DHT.

**Increased flow DH has no check valve in – is it safe?**
By incorporating a PTFE plug valve, Entegris has successfully eliminated the chemical restriction while maintaining operator safety and increasing flow capacity.

---

**FEATURE** | **ADVANTAGE** | **BENEFIT**
--- | --- | ---
Key-coded system (same key code system as for QCIII) | • Improved operator safety | • Cost-savings due to fewer changing operations for inserts (reduced maintenance)
Increased flow dispense head with Cv 5.3 available | • High flow rate | • Longer pump life due to less pump stress
Dispense head key code ring replacement available | • Replace only key code ring instead of complete dispense head | • Lower replacement costs
Different o-ring material options (FEP encapsulated silicone, FEP encapsulated Viton and FEP encapsulated EPDM) | • Compatibility for all chemicals | • O-ring core material can be selected to match media compatibility for longer service
Chemlock® Housing PFA/PP

The Chemlock housing offers a space- and time-saving solution like no other cartridge filter housing available today. It is available in different sizes and a large variety of fitting configurations.

- Small footprint
- Easy and fast filter changeout
- Improved safety and handling
- Lower cost of ownership
- Available in PFA and PP

Optimized for bulk chemical distribution systems, wet etch and clean applications: HFF, H₂O₂, H₂SO₄, H₃PO₄, HNO₃ etc., chemical mechanical planarization and electronic grade chemical manufacturing.

### Installation*

1. Insert cartridge into bowl.
2. Twist filter 1/4-turn to lock.
3. Attach head to bowl.
4. Tighten locking ring to easily seat double o-rings. Use a Chemlock/Chemgard™ integrated housing wrench to ensure proper tightening.

**Chemlock housing saves more than 210 mm (8.3”) for 10” cartridge; 457.2 mm (18”) for 20” cartridge**

**IMPORTANT:** To ensure a leak-free seal, it is indispensable to follow the instructions from the Chemlock installation manual. To view an electronic file of this manual, go to www.entegris.com

### Frequently Asked Questions

**Can I use any standard 10” filter in this housing?**

Yes, standard filters without Chemlock-key will fit, but they have to be inserted the traditional way in the housing head.

**Why does Entegris recommend using a housing wrench and torque wrench?**

This ensures proper installation of the filter and avoids leakages.

**Can I upgrade the Chemgard bowl to Chemlock?**

Yes, the Chemlock bowl is compatible with full benefits.
QuickChange® ATM and ATE Filters

QuickChange ATM and ATE filters are prewet and nondewetting ultraclean filters that enable rapid nanoparticle removal at low pressure drop and high flow rates.

- Enables rapid filter changeout due to prewet membrane.
- No loss of membrane surface in outgassing chemicals due to patented nondewetting technology.
- Retention of nanoparticles while maintaining high flow.
- Low metal extractables ensure cleanliness of chemicals.
- High membrane-surface area enables low pressure drop and long lifetime.

Optimized for aqueous aggressive acids and bases, outgassing chemicals like SC1, SC2, SPM and piranha and high-temperature applications.

**FEATURE**

<table>
<thead>
<tr>
<th>ADVANTAGE</th>
<th>BENEFIT</th>
</tr>
</thead>
</table>
| Prewet and nondewetting PTFE membrane | • Eliminates prewetting and flushing cycles  
• High-purity, ultraclean, ready-to-use filter  
• Consistent flow performance in outgassing chemistries  
• Higher yields and longer life through consistent filter performance  
• Increased tool time and decreased COO through longer filter life  
• Decreased COO through reduced work/chemical consumption |

| High membrane surface area | • ATM and ATE designs add 100% and 145% of surface area respectively to standard 10” elements  
• Lower flow resistance and higher flow  
• Extended lifetime  
• Reduced overall maintenance  
• Lower COO and increased OEE through extended filter lifetime |

| High retention | • Smaller particle removal, 30 nm  
• Cleaner device, higher yield needed for advanced technology nodes |

| Low metal extractables | • Reduction in qualification time, ensures ultraclean processing, low risk of metallic contamination of wafers  
• Higher yield and wafer throughput |

**performance**

- QuickChange nondewetting filters do not dewet.
- Entegris’ nondewetting filter membrane delivers yield enabling performance by providing consistent retention and flow properties.

**frequently asked questions**

**What is the shelf life of a QuickChange filter?**

QuickChange filters are autoclaved to prevent microbiological contamination. Entegris warranties unlimited shelf life for QuickChange.

**Why are QuickChange filters higher in price than other Teflon filters?**

QuickChange is an extremely clean filter, and its prewetting and nondewetting technology requires high manufacturing input. All advantages as shown above easily pay off over time and help our customers save money in the long run.
Intercept® Filters

Hydrophilic dual-capture membrane for superior particle removal. Intercept is one of the most advanced UPE liquid microcontamination platforms available.

- Hydrophilic membrane eliminates need for prewetting and minimizes formation of microbubbles
- Even with a 0.2 μm membrane, particle retention down to 0.03 μm (pH <2.5 and no surfactant) is enhanced, while maintaining high flow rate
- Long filter lifetime
- Extremely clean filter, low metal extractables

- Optimized for DHF, HF, BOE solutions in chemical delivery systems, batch baths and single wafer tools.

**Performance**

- Intercept removes particles in typical DHF applications by an additional mechanism to sieving: physisorption
- Particle retention below rated pore size is achieved, enhancing process capability

**Frequently Asked Questions**

How does this dual-capture mechanism work?

Sieving (i.e., size exclusion) is the most common capture mechanism. Utilizing patented surface modification technology (pH <2.5), the Intercept UPE membrane’s physisorption (so-called “van der Waals forces”) become active with small particles adhering the membrane surface. This is how a 0.2 μm retention rating filter achieves a 0.03 μm retention rating performance.

**Extractables Sample Data**

<table>
<thead>
<tr>
<th>Metal</th>
<th>µg/unit (ppb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Na</td>
<td>4.9</td>
</tr>
<tr>
<td>Mg</td>
<td>1.5</td>
</tr>
<tr>
<td>Al</td>
<td>7.7</td>
</tr>
<tr>
<td>K</td>
<td>2.9</td>
</tr>
<tr>
<td>Ca</td>
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<tr>
<td>Ti</td>
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<tr>
<td>Cr</td>
<td>0.5</td>
</tr>
<tr>
<td>Mn</td>
<td>0.0</td>
</tr>
<tr>
<td>Fe</td>
<td>5.7</td>
</tr>
<tr>
<td>Ni</td>
<td>0.2</td>
</tr>
<tr>
<td>Cu</td>
<td>0.1</td>
</tr>
<tr>
<td>Zn</td>
<td>1.8</td>
</tr>
<tr>
<td>Pb</td>
<td>0.1</td>
</tr>
<tr>
<td>Total</td>
<td>33.8</td>
</tr>
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</table>
Tubing and Pipe

Broad range of tubing and pipe made from 100% virgin high-purity PFA material for highly corrosive, ultrapure applications.

- Tube flaring process provides leak-free connections and offers design flexibility
- PureBond weld process is ideal when permanent connections are required
- Non-intrusive, non-contaminating and permanent serialized laser-marking allows immediate material identification
- Standard wall tubing is available in 1/4", 3/8", 1/2", 3/4", 1", 1 1/4", 1 1/2" sizes
- Pipe is available in 1/4", 1/2", 3/4", 1", 2" sizes
- Pipe and tubing are available in different PFA grades

► Optimized for bulk distribution, valve manifold boxes mainline, wet etch and clean applications: HF, H₂O₂, H₂SO₄, H₃PO₄, HNO₃, MAE and chemical mechanical planarization.

**Performance**

<table>
<thead>
<tr>
<th>Pressure vs. Temperature</th>
<th>Fluid Temperature (°C)</th>
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<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>

**Frequently asked questions**

Can I use the standard 4200 material with surfactant?
4200 should not be used with fluorinated surfactants.

Are all tubings available as coiled tubing?
Yes, the standard straight wall tubing can be coiled customized.

Is a convoluted tubing available?
Yes, available in 1/4", 3/4" and 1" sizes.

How can I identify my installed tubing?
Laser marking identifies the size, and traceability to a material lot number and production inspection record (except 0.030" wall).
Entegris has the broadest range of PFA fitting configurations and sizes available for Flaretek, FlareLock®II and PureBond.®

- Most complete line of flare and pipe fitting connection applications
- Flare fittings provide leak-free performance in demanding applications
- PureBond weldable pipe fittings provide a rigid, permanent, leak-free piping system
- Broad range of sizes and configurations: flare 1⁄4" – 1 1⁄4"; PureBond 1⁄8" – 2" elbows, unions, reducers, caps, tees, crosses and adapters

Optimized for bulk distribution, valve manifold boxes mainline, wet etch and clean applications: HF, H₂O₂, H₂SO₄, H₃PO₄, HNO₃, MAE and chemical mechanical planarization.

---

**FEATURE**

<table>
<thead>
<tr>
<th>ADVANTAGE</th>
<th>BENEFIT</th>
</tr>
</thead>
</table>
| PFA wetted surfaces | • Provides high purity and chemical resistance  
• Lower cost of ownership through increased productivity and throughput |
| Largest installed customer base of PFA fittings | • Global manufacturing and support  
• Assured reliability and performance  
• High service levels in all regions  
• Lower cost of ownership through increased manufacturing uptime |
| Available in a broad range of sizes and configurations | • Single source supplier for all high-purity, corrosive chemical connection needs  
• Suitable for a wide variety of FPD applications  
• Reduces number of suppliers  
• Lower design cost |

---

**performance**

<table>
<thead>
<tr>
<th>Size</th>
<th>PVDF Nut</th>
<th>PFA Nut</th>
<th>CPFa Nut</th>
<th>FlareLock II PFA Nut</th>
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</thead>
<tbody>
<tr>
<td>1⁄4&quot;</td>
<td>225 (1551)</td>
<td>225 (1551)</td>
<td>225 (1551)</td>
<td>225 (1551)</td>
</tr>
<tr>
<td>3⁄8&quot;</td>
<td>225 (1551)</td>
<td>225 (1551)</td>
<td>225 (1551)</td>
<td>225 (1551)</td>
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<td>190 (1310)</td>
<td>190 (1310)</td>
<td>190 (1310)</td>
<td>190 (1310)</td>
</tr>
<tr>
<td>3⁄4&quot;</td>
<td>110 (758)</td>
<td>110 (758)</td>
<td>110 (758)</td>
<td>140 (965)</td>
</tr>
<tr>
<td>1&quot;</td>
<td>75 (514)</td>
<td>75 (514)</td>
<td>75 (514)</td>
<td>90 (620)</td>
</tr>
<tr>
<td>1 1⁄4&quot;</td>
<td>80 (552)</td>
<td>—</td>
<td>—</td>
<td>N/A</td>
</tr>
</tbody>
</table>

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**frequently asked questions**

**What is Flaretek?**
The flaring process provides a permanent expansion (flare) of the tubing end, allowing insertion of the Flaretek fitting body.

**What are the tools required to make a proper Flaretek connection?**
A heating source (air gun), mandrel and tube cutter.

**What are the requirements to make a PureBond connection?**
A 1" or 2" Entegris PureBond tool.

**What does a X at the end of a part number mean (e.g. EB-8F8N-1X)?**
X means fitting body is made of PFA HP Plus and it is recommended for chemicals containing fluorinated surfactants.

**When is FlareLock II recommended?**
For elevated temperatures >100°C or higher pressure (see chart) and before/after pumps (pulsation/vibration).
Integra® 1/2” Orifice Valve

Reliable field-repairable 1/2” orifice Integra valves with many configuration options (manual, multiturn, pneumatic, 2-way, 3-way, high-pressure).

- Available in options compliant to SEMI® standard
- No external metal parts
- All wetted parts are molded PFA
- Unique top loading design allows for field repair
- Piston shaft is encapsulated in PFA diaphragm
- Unique body design allows for 100% cavity drainage

Optimized for bulk distribution, valve manifold boxes mainline, wet etch and clean applications: HF, H₂O₂, H₂SO₄, H₃PO₄, HNO₃, MAE and chemical mechanical planarization.

**FEATURE** | **ADVANTAGE** | **BENEFIT**
--- | --- | ---
Piston shaft is encapsulated in the molded PFA diaphragm | No metal contact with media | No contamination – high purity
Available with electronic leak detection and position indication sensors | Capability to detect media and to monitor valve position (open or closed) | Advanced process control
Top loading design | Allows field repair | Lower cost of ownership
Available with ECTFE cap | More robust material for base applications | No discoloration when using ammonia

**performance**

- Pressure range of 29” Hg to 80 PSIG (5.5 bar)
- 0 to 120 PSIG (8.3 bar) for high pressure valve
- Ambient temperature rating from room temperature to 65°C (150°F)
- Media temperature ratings start at room temperature and vary depending on the style
- Most Cv ratings are 2 to 3

**frequently asked questions**

*Is the maximum inlet pressure same as the maximum outlet pressure?*
Outlet pressure is reduced due to valve and diaphragm design.

*Is valve repair possible? Do I need tools?*
Yes, repair is possible. A repair kit and repair tools are available.

*Is there a 1/2” orifice 3-way valve available?*
Yes, manually and pneumatically normally closed D8-3X-xx.

*Is the 3-way valve available with different inlet/outlet configurations?*
Yes - the D8 series is available with inlet/outlet ports opposite of a standard valve.

*Is there a 1/2” orifice sampling (T) valve available?*
Yes, manually and pneumatically normally closed MA8-3X-xx.
New ¾” design (manual and pneumatic designs) for higher flow and small footprint.

- Increasing flow capacity
- Reducing pressure drop
- No external metal parts
- Minimizing turbulence
- Saving valuable space
- High temperature version available (180°C/30 PSIG)

Optimized for bulk distribution, valve manifold boxes mainline, wet etch and clean applications: HF, H₂O₂, H₂SO₄, H₃PO₄, HNO₃, MAE and chemical mechanical planarization.

**performance**

- Pressure range of 29” Hg to 80 PSIG (5.5 bar)
- Media temperature rating
  - up to 165°C @ standard valve
  - up to 180°C @ high temp valve
- Ambient temperature rating from 23°–32°C (73°–90°F)
- Cv ratings from 7.0 to 8.5
- Manual valve safety lockout option

**frequently asked questions**

**Is there a higher-temperature version?**
Yes, in a 2-way and a sampling configuration.

**Is there a ¾” orifice sampling (T) valve available?**
Yes, in the DH high temperature configuration

What is meant by “internal radius”?
Technology used from the sweep elbow design to avoid sharp corners.

Is the valve recommended for slurry application?
Yes, due to the internal radius – it prevents shearing.

### Integra® 3/4" Orifice Valve

<table>
<thead>
<tr>
<th>FEATURE</th>
<th>ADVANTAGE</th>
<th>BENEFIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unique internal radius</td>
<td>High flow with small footprint</td>
<td>Lower cost of ownership due to space-savings</td>
</tr>
<tr>
<td>Top loading design</td>
<td>Allows field repair</td>
<td>Lower cost of ownership</td>
</tr>
<tr>
<td>Available with electronic leak detection and position indication sensors</td>
<td>Capability to detect media and to monitor valve position (open or closed)</td>
<td>Advanced process control</td>
</tr>
<tr>
<td>Manual valve safety lockout option</td>
<td>Helps protect users and equipment</td>
<td>Decreased risk of chemical exposure during equipment maintenance</td>
</tr>
</tbody>
</table>

Increases Flow Capacity, Decreases Pressure Drop, Reduces Shear
Integra® 1" Orifice Valve

1" for bulk chemical distribution where high flow is required (manual, pneumatic, sampling designs).

- Ideal for high flow application
- No external metal parts
- Unique below design
- Available up to 1¼" Flaretek connection

- Optimized for bulk distribution, valve manifold boxes mainline, wet etch and clean applications: HF, H₂O₂, H₂SO₄, H₃PO₄, HNO₃, MAE and chemical mechanical planarization.

performance

- Pressure range of 29" Hg to 80 PSIG (5.5 bar) – 40 PSIG (2.8 bar) @ 93°C (200°F)
- Ambient temperature rating from 23°–38°C (73°–100°F)
- Media temperature rating from 23°–93°C (73°–200°F)
- CV ratings from 9 to 13.6

frequently asked questions

Is there a 1" orifice sampling (T) valve available?
Yes, in both manual and pneumatic designs.

Could slurry particles agglomerate in the bellows?
No, due to "no touch" pleat design.

Is there a 3-way valve available?
No.

Is valve repair possible? Do I need tools?
Yes, repair is possible. A repair kit and repair tools are available.

<table>
<thead>
<tr>
<th>FEATURE</th>
<th>ADVANTAGE</th>
<th>BENEFIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bellows design</td>
<td>Increased flow rates</td>
<td>Lower cost of ownership due to space-savings</td>
</tr>
<tr>
<td>Top loading design</td>
<td>Allows field repair</td>
<td>Lower cost of ownership</td>
</tr>
<tr>
<td>Actuator body/outer cap</td>
<td>More robust valve design</td>
<td>Longer lifetime in high-flow applications</td>
</tr>
</tbody>
</table>

- Unique bellows design
  - One piece
  - Optimum material
  - "No Touch" pleat design
  - Integral media seal
- Helps maintain media integrity
Provide accurate and reliable inert pressure measurements. Measure gas or liquid pressure, allowing you to monitor process conditions for increased safety and system performance.

- Accuracy of 1% of full scale
- Nonmetallic sensing technology
- All wetted parts are constructed of PFA, PTFE, CTFE and Kalrez
- No moving parts
- No fill fluids

Optimized for bulk distribution, valve manifold boxes mainline, wet etch and clean applications: HF, H₂O₂, H₂SO₄, H₃PO₄, HNO₃, MAE and chemical mechanical planarization.

### NT® Pressure Transducers

**FEATURE**

<table>
<thead>
<tr>
<th>ADVANTAGE</th>
<th>BENEFIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>All wetted parts are constructed of PTFE, sapphire and other high purity polymers for corrosion resistance</td>
<td>Compatible with all semiconductor process chemistries</td>
</tr>
<tr>
<td>Provides compatibility and easy integration with electronic displays and monitoring systems</td>
<td>Enables tool interaction with pressure transducer and offers increased accuracy in pressure measurements</td>
</tr>
<tr>
<td>Industry standard Flaretek flared port connections</td>
<td>Compact design enables easy installation</td>
</tr>
<tr>
<td>No moving parts or fill fluids</td>
<td>Reduces contamination potential</td>
</tr>
</tbody>
</table>

### Frequently asked questions

**What is the PFA vs CTFE sensor interface when not using sapphire technology?**
- CTFE is generally used for aqueous solutions, exceptions apply
- PFA is generally used for solvents, exceptions apply
- In temperatures above 50°C, PFA performs better

**Where can I use NT pressure transducers?**
- System diagnostics
- System pressure monitoring for tool queuing
- Pressure at distribution modules, valve manifold boxes and point-of-use
- Differential pressure in filtration systems

### Entegris chemical compatibility chart for Sensing and Control products*

<table>
<thead>
<tr>
<th>Chemical Type</th>
<th>Chemical</th>
<th>CTFE**</th>
<th>PFA**</th>
<th>PTFE</th>
<th>Kalrez® 4079</th>
<th>Kalrez® 1050</th>
<th>Kalrez® 6375UP</th>
<th>PVDF</th>
<th>PP</th>
<th>PE</th>
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</thead>
<tbody>
<tr>
<td>Acids</td>
<td>Acetic</td>
<td>A/B</td>
<td>B</td>
<td>A</td>
<td>A</td>
<td>C</td>
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<td></td>
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**A:** Preferred, suitable for all high-purity applications
**B:** Acceptable, suitable for nonwetted parts in most applications
**C:** Not recommended for wetted parts in high-purity applications
**D:** Information not available

* The compatibility chart is compiled from information published by: Entegris, DuPont Dow Elastomers, Welch Fluorocarbon, Little Giant Pump Company, the PDL Handbook and Compass Corrosion Guide.

**The suitability of CTFE and PFA is based on both chemical resistance and permeability.**

Entegris neither represents nor warrants the accuracy or sufficiency of the information set forth in this chart for specific end-user applications. Ultimate responsibility for material selection remains with the end user. Nothing in this chart constitutes a change to the terms and conditions under which Entegris product was sold.
FluoroPure® Day Tanks

Day tanks are a customized solution for non-transportable vessels from 50 L up to 1,900 L.

- Expertise in the design, development and manufacture of process tanks, mixing or storage vessels and shipping containers
- Custom and semi-custom vessels rotationally molded out of a variety of materials, including PFA and polyethylene
- Size capabilities range from 20 L to 1,900 L with a wall thickness from \( \frac{1}{16}'' \) to \( \frac{1}{4}'' \)
- Low volume runs are economical due to lower tooling costs compared to blowmolded or injection molded products

Optimized for wet etch and clean applications: HF, H\(_2\)O\(_2\), H\(_2\)SO\(_4\), H\(_3\)PO\(_4\), HNO\(_3\), MAE and chemical mechanical planarization.

### FEATURE

- Overpack options for PE/PFA:
  - Ability of welding connections
  - Sight windows
  - Valve boxes
  - Connection supports
  - Stands (stainless steel, epoxy-coated carbon steel, PVC)

- Overpack options for PE/PE:
  - All connection NPT (no welding)
  - Sight windows
  - Valve boxes
  - Connection supports
  - Stands (stainless steel, epoxy-coated carbon steel, PVC)

### ADVANTAGE

- Customized day tank along with customer requirements
- Flaretek connection possible
- Level observation

### BENEFIT

- Reduces contamination risk

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### frequently asked questions

Could I have a drain in a PE/PFA day tank?
Yes, a drain port can be molded and connections bonded.

Could I have a drain in a PE/PE day tank?
No, a drain port is not available because of the non-bondable material.

What is the largest available volume?
The largest volume for the day tank is 500 gallons.

Are different vessel volumes available?
Yes, from 50 liters up to 500 gallons.
Dymension® Valve Manifold

Customized fluid control solution where a small footprint valve-function is needed with fewer potential leaking points – tailored to specific needs.

- Enables you to replace or change a single valve as needed
- FlareMount™ sealing technology provides a robust, leak-free seal
- Available with a dual FlareMount interface
- Manifold blocks are available in PFA or proprietary HyQ® PTFE
- Small footprint saves valuable equipment space

Optimized for wet etch and clean applications: HF, H₂O₂, H₂SO₄, H₃PO₄, HNO₃, MAE and chemical mechanical planarization.

**FEATURE** | **ADVANTAGE** | **BENEFIT**
---|---|---
Manifold block – simplifies design | • Less space needed | • Reduces overall fluid delivery system cost
- Single component | • Eliminates tubing and fitting connections | - Less space
- One part number | • Allows complex flow path and control | - Reduced maintenance

Unique FlareMount technology | • Eliminates gasket or o-rings | • Lower cost of ownership
- Replaceable valves | • Increases serviceability | - Interchangeable valves
- Interchangeable valves | • Enables simple field adjustments |

Manufacturing process via quick-turn capability | • Fast prototyping within 10 working days | • Short lead times
- Manufacturing process | • Reduces process start-up time |

**performance**

Mixing Manifold Solution

- Computational fluid dynamics:
  - Mixing analysis
  - Flow velocity
  - Flushing performance

- Optional integrated-mixing element:
  - Effective inline blending
  - Creates homogeneous chemical mix downstream of manifold
  - Mixer designs available for multiple flow requirements

**frequently asked questions**

What do I need for quoting?
You will need a sketch/drawing where the specific function is described.

What is the lead time on such customized products?
The lead time for a new prototype is 10 working days for up to 10 pieces.

Why does a manifold reduce overall fluid delivery system cost?
Manifolds require less space and have reduced maintenance. Manifolds also have fewer connections which eliminates tubing and fitting connection, and allows complex flow pass and control in a single component.

How can I manage the mixing analysis?
Entegris can perform computational analysis.

Are other types of manifolds available?
Yes, there are Dymension full rinse, ¼” and ½” stack valve, ½” custom Integra.
Entegris regional customer service centers

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<tr>
<th>REGION</th>
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<tr>
<td>Massachusetts</td>
<td>Entegris, Inc.</td>
<td>Corporate Headquarters</td>
</tr>
<tr>
<td></td>
<td>Tel.</td>
<td>+1 978-436-6500</td>
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<tr>
<td></td>
<td>Entegris, Inc.</td>
<td>101 Peavey Road</td>
</tr>
<tr>
<td></td>
<td>Tel.</td>
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<tr>
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</tr>
<tr>
<td></td>
<td>Israel</td>
<td>Entegris Israel Limited</td>
</tr>
<tr>
<td></td>
<td>Entegris, Israel Ltd.</td>
<td>1 Rishon Street 12</td>
</tr>
<tr>
<td></td>
<td>Tel.</td>
<td>+972 (0) 73 221 00 00</td>
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<tr>
<td></td>
<td>Japan</td>
<td>Nihon Entegris K.K.</td>
</tr>
<tr>
<td></td>
<td>Regional Headquarters</td>
<td>Mita-Kokusai Bldg.</td>
</tr>
<tr>
<td></td>
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<td>1-1-1, Nishinakajima</td>
</tr>
<tr>
<td></td>
<td>Tel.</td>
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</tr>
<tr>
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<td>Hakataekihigashi 113 Bldg.</td>
<td>13-3 Hakataekihigashi</td>
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<tr>
<td></td>
<td>Tel.</td>
<td>+81 92-471-8133</td>
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<tr>
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<td>Entegris (Shanghai) Microelectronics Trading Co., Ltd.</td>
<td>Unit 606-609, Tower I</td>
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<tr>
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<tr>
<td></td>
<td>Taiwan</td>
<td>Entegris Asia LLC, Taiwan Branch</td>
</tr>
<tr>
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<td>Nihon Entegris K.K.</td>
<td>14F, No. 120, Sec. 2, Gong Dao Wu Road</td>
</tr>
<tr>
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<td>14F-6, No. 126, Yung-Fu Road</td>
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<tr>
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<td>Room 1105, Zhaolin Mansion</td>
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