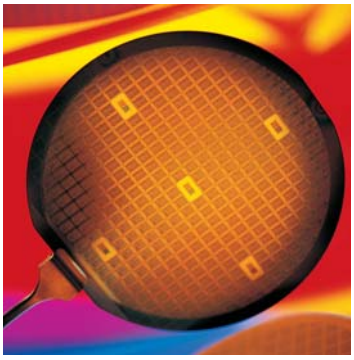
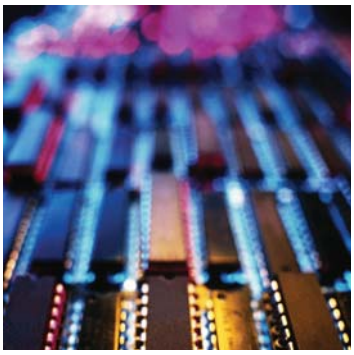
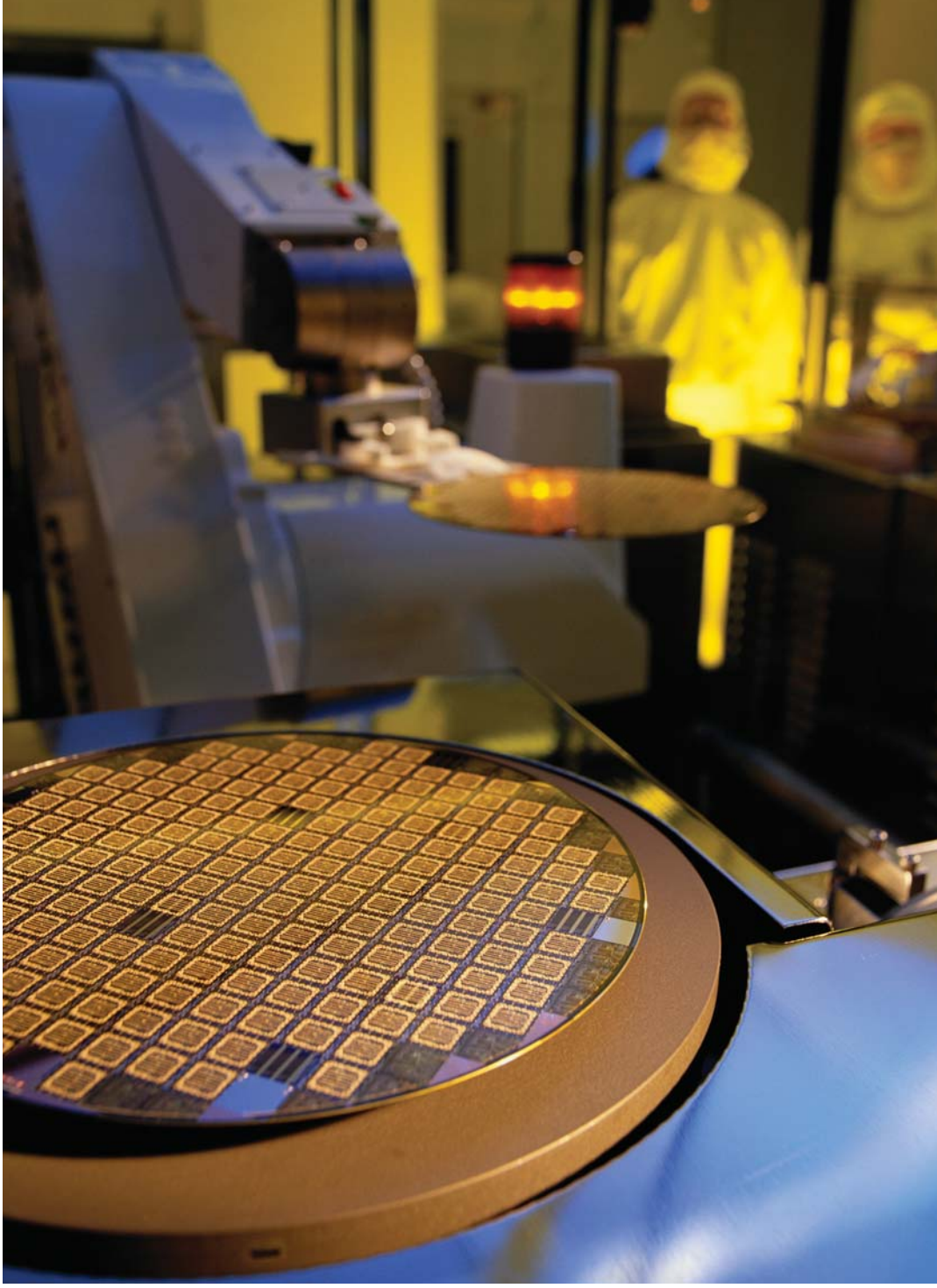


aerospace
climate control
electromechanical
filtration
fluid & gas handling
hydraulics
pneumatics
process control
sealing & shielding





Process Filtration

A guide to microelectronics applications

Parker domnick hunter

ENGINEERING YOUR SUCCESS.

Filtration solutions for microelectronics.

Parker domnick hunter Process Filtration

Reliable choice for your microelectronics applications

Microelectronics is a fast-changing industry with technological advances constantly leading to new processes and calling for new solutions. Working with Parker domnick hunter Process Filtration, you benefit from years of filtration experience and expertise in:

- Bulk chemical delivery
- Data storage
- High purity water
- Integrated circuit manufacturing
- Flat panel display
- Semiconductor | Wafer
- Solar | Photovoltaic

Parker domnick hunter understands that filtration systems are crucial to the success of your operations today and in the future. Operating with aggressive chemicals, at high temperature or under any other difficult processing conditions demands constant monitoring and close change control.

With Parker domnick hunter, you can be confident that your filtration is compatible with your overall process and that it performs consistently under stringent conditions and holds up to constant use.

Committed to offering comprehensive solutions

- Products
- Onsite technical support
- Laboratory services
- Proven experience
- Global presence
- Responsiveness

A leading manufacturer of liquid filtration products and systems **since 1936**.

Working with Parker domnick hunter, you can be assured your filtration is not only safe and reliable, but its efficiency and productivity are optimized.

PH LISTED NYSE

With annual sales exceeding $10 billion, Parker Hannifin is the world's leading diversified manufacturer of motion and control technologies and systems. Traded on the New York Stock Exchange under the symbol "PH," Parker is strategically diversified, value-driven and well positioned for global growth as the industry consolidator and supplier of choice.

Ask for our technical services available on-site and supported by dedicated test equipment in Parker laboratories.

Comprehensive business solutions

Local products & services

With sales offices on all continents, distribution channels active in 63 countries, and manufacturing operations worldwide, Parker is where you are with the products and services you need. We know fast and prompt support is key in microelectronics.

Worldwide on-site technical support

Our Technical Services team is dedicated to the needs of the microelectronics industry. With our extensive range of analytical instrumentation, highly-qualified technical engineers are available to optimize your processes and to relay your need for innovative solutions to our cross-functional microelectronics team. Our technical support includes:

- Process failure analyses
- Contamination analyses
- Process & cost improvement audits
- On-site testing services

Innovation

Our Research & Development teams are constantly working to innovate new products and discover technologies that will enhance the performance of process filtration, and thus keep us at the forefront of filtration technology in microelectronics.

Manufacturing excellence

Parker-Hannifin Corporation is committed to manufacturing excellence. Our manufacturing facilities feature:

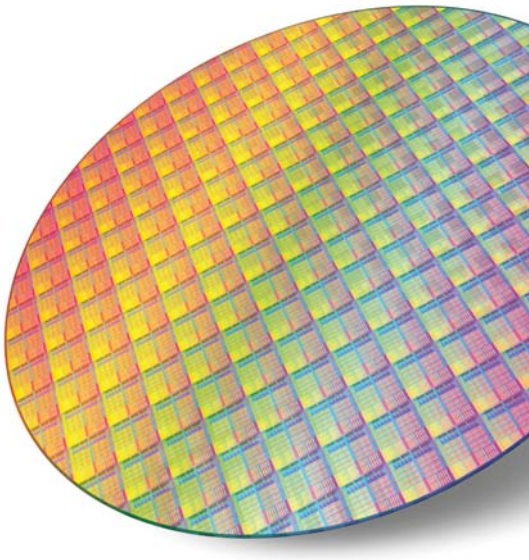
- Fully-equipped laboratory
- Test centers
- Certified-controlled cleanroom environments

Quality Management

Quality is of paramount importance to you and therefore to us. All products are manufactured under controlled environmental conditions and are subjected to demanding programs of quality assurance. Parker domnick hunter is ISO 9001 certified.

Test Methodologies

- ASTM
- OSU-F2
- ISO procedures
- Parker internal test protocols
- Parker external test protocols
- Repeatability & reproducibility



Microelectronics product history	
1984	All-fluoropolymer filter cartridges
1987	All-polypropylene depth cartridges for economical prefiltration
1994	Hydrophilic polyethersulfone (PES) membrane for liquid filtration applications
1994	Hydrophobic PTFE membrane filters for general purpose gas and solvent purification
1997	PTFE membrane filters with HDPE structure to maintain chemical purity
1998	Encapsulated all-fluoropolymer cartridge for aggressive chemical filtration
2003	SELECT pleat technology: optimizing effective filtration area to double lifetime
2005	Ultraclean technology: industry leader in cleanliness offering <5ppb metals extractables level
2006	XF technology: provides superior flow rates
2007	XL technology: new standard for flow and lifetime
2010	Hydrophilic PTFE filter (Proflow-HE) for aqueous solutions

NEW!

Proflow™-HE

Pleated hydrophilic PTFE membrane & polypropylene supported cartridges for microelectronic liquid

The Proflow™-HE cartridge is designed for filtration of microelectronic (MiE) fluids. High-purity polypropylene and hydrophilic PTFE provide an economical alternative for the filtration of various MiE chemicals. The hydrophilic nature of the PTFE membrane does not require pre-wetting for aqueous-based liquids typically necessitated with standard PTFE membranes. This can reduce total operating cost and improve process up-times.

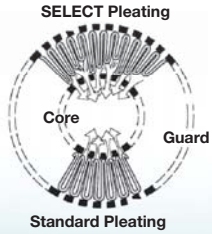
Filtration products for microelectronics

Product line	Available Configurations	Filter Ratings (microns)	Optional Features	Typical Applications
FLUOROFLOW® 100% Fluoropolymer construction	Cartridge	0.03, 0.05, 0.1, 0.2, 0.45, 1.0	S U XL XF	• Critical filtration of aggressive acids, bases, strippers, and solvents • Available for high temperature applications
FLUOROCAP® 100% Fluoropolymer construction capsules	Capsule	0.03, 0.05, 0.1, 0.2	S U XL XF	• Encapsulated filter for critical filtration of aggressive chemicals and process fluids under harsh conditions where potential contamination during cartridge change out is a concern • Available for high temperature applications
CHEMFLOW® PE & XF PTFE membrane | High density polyethylene structure	Cartridge	0.05, 0.1, 0.2, 1.0	S XF	• Purification of photoresists, chemicals & etch baths • Filtration of solvents, cleaning solutions
CLARIFLOW® Polyethersulfone (PES) membrane | mini-polypropylene structure	Cartridge Mini-Capsule Mini-Cartridge	0.02, 0.04, 0.1, 0.2, 0.45, 0.65, 0.8	S	• Aqueous based chemicals; recirculating etch baths; UPW systems
PROFLOW™ II PTFE membrane | Polypropylene mini-structure	Cartridge Mini-Capsule Mini-Cartridge	0.03, 0.05, 0.1, 0.2, 0.45, 1.0	S	• Ultrapure chemicals and gas processing; photochemical processing • Bulk chemical distribution
PROFLOW™-HE Pleated hydrophilic PTFE membrane | Polypropylene structure	Cartridge	0.05, 0.1, 0.2, 0.5, 1.0, 3.0, 10.0	S	• Acids & bases • Extraction/crystallization solvents • Hot ultra-high purity deionized water • Solvent filtration
POLYFLOW® MEMBRANE Polypropylene nominal rated membrane | Polypropylene structure	Cartridge	0.04, 0.07, 0.1, 0.2	S	• Filtration of photochemicals & ultrapure chemicals • Gas filtration
POLYFLOW® Polypropylene absolute rated depth media | Polypropylene structure	Cartridge Mini-Capsule Mini-Cartridge	0.6, 1.2, 2.5, 5.0, 10.0, 20.0, 40.0		• DI water prefiltration • Solvent and gas prefiltration • General filtration

Parker domnick hunter filtration technologies for Microelectronics

S SELECT Pleating

The revolutionary SELECT technology can improve and lower the costs of wafer processing. Imagine: up to 80% more effective filtration area – with twice the throughput. All of this with particle retention of >99.99% from a cleanroom manufactured and tested product.



U Ultraclean

Ultraclean technology leads the microelectronics industry in cleanliness. Ultraclean is a proprietary process applied to electronics grade products. It provides a total metals extractables level of <5ppb. Ultraclean's low level of metals extractables provides users with a highly consistent manufacturing process and very low product reject rates.

XL XL

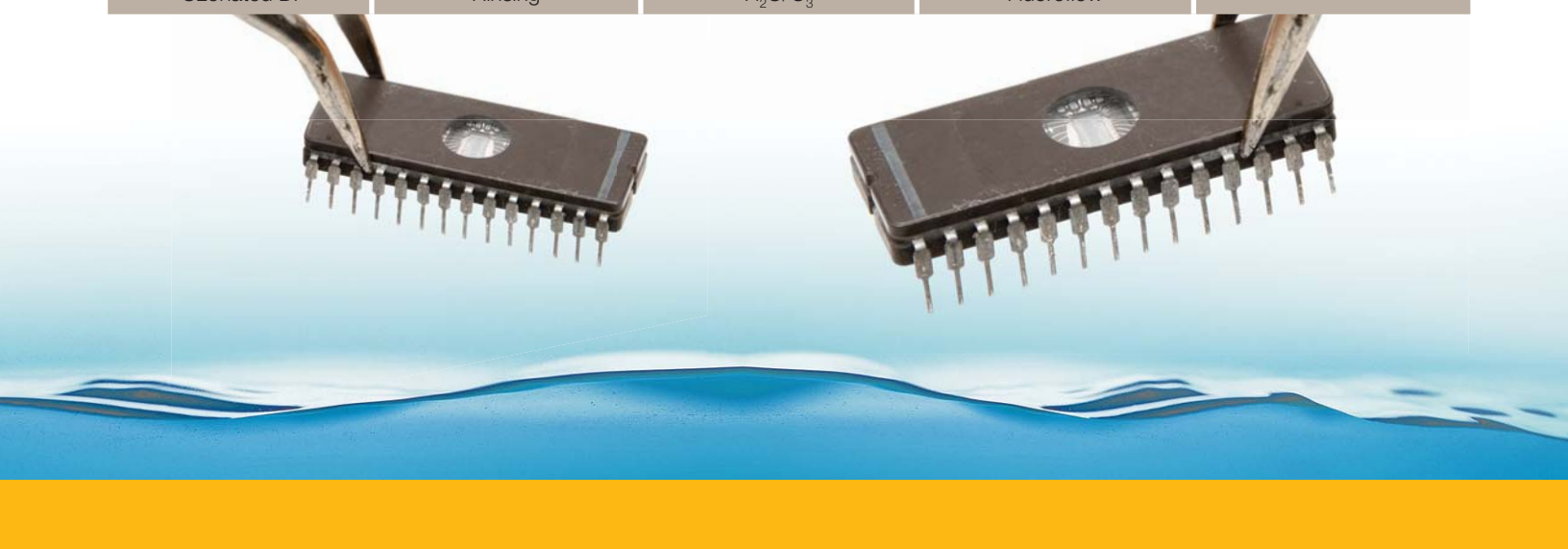
XL technology provides maximum flow rate and lifetime. It combines SELECT technology with a larger diameter cartridge (3.25") for the highest flows in the industry.

XF XF

XF is a revolutionary membrane technology. It provides superior flow over traditional cartridges by utilizing an asymmetric PTFE membrane. XF cartridges offer up to three times the flow rate and throughput at lower differential pressure.

Filter recommendation by application

Application	Chemicals		Filter Family	
			Primary Choice	Secondary Choice
Etching	Si etch	HF HNO_3 Acetic acid	Chemflow	Proflow
	SiO2 etch	BOE BHF-HF NH_4F	Clariflow	Fluoroflow
	Si3N4 etch	H_3PO_4	Fluorocap	Fluoroflow-XF
	Al etch	H_3PO_4 HNO_3 Acetic acid	Fluoroflow	-
Residue Removal	Hydroxy/amine based	NMP Glycol amine, etc.	Chemflow (<60 °C), Fluoroflow (>60 °C)	Proflow-E (<60 °C) Fluoroflow (>60 °C)
	Glycol/NH4F based	Glycol NH_4F	Chemflow (<60 °C), Fluoroflow (>60 °C)	Proflow-E (<60 °C) Fluoroflow (>60 °C)
	DMSO/amine based	DMSO Amine EL 2 pentamone	Proflow (<60 °C), Fluoroflow (>60 °C)	Chemflow-E (<60 °C) Fluoroflow (>60 °C)
Cleaning	Piranha	H_2SO_4 H_2O_2	Fluorocap	Fluoroflow-XF
	SC1	NH_4OH H_2O_2 H_2O	Fluoroflow	-
	SC2	HCl H_2O_2 H_2O	Fluoroflow	-
	Cu, Ni, Au, etc.	Metal compound/acid or base/buffer	Clariflow (<60 °C), Fluoroflow (>60 °C)	Polyflow M (<60 °C) Fluoroflow (>60 °C)
Photochemical Filtration	Photoresist	Photo sensitive agent Polymer resin	Polyflow M Proflow-HE	Chemflow
	Developing	-	Chemflow PE	-
		-	Fluoroflow	-
		-	Proflow-HE	-
DI	Rinsing	H_2O	Clariflow (<60 °C) Fluoroflow (>60 °C)	
Ozonated DI	Rinsing	H_2O/O_3	Fluoroflow	-



Chemical Filtration

Wet Etch & Clean

Chemical resistance & cleanliness

In wet etch and clean, cleanliness is key while chemical resistance and high flow are also crucial considerations. Parker domnick hunter consistently meets your performance and compatibility needs – even when processing aggressive chemicals.

Developed with extreme care for cleanliness and with stringent control procedures, Parker domnick hunter's broad portfolio of liquid filters is well-adapted for highly sensitive chemistry changes and contamination control from high metallic loadings. High and low temperature versions are available as well as wet-pack options for quick installation. 100% integrity-tested in a clean room environment for reliability.

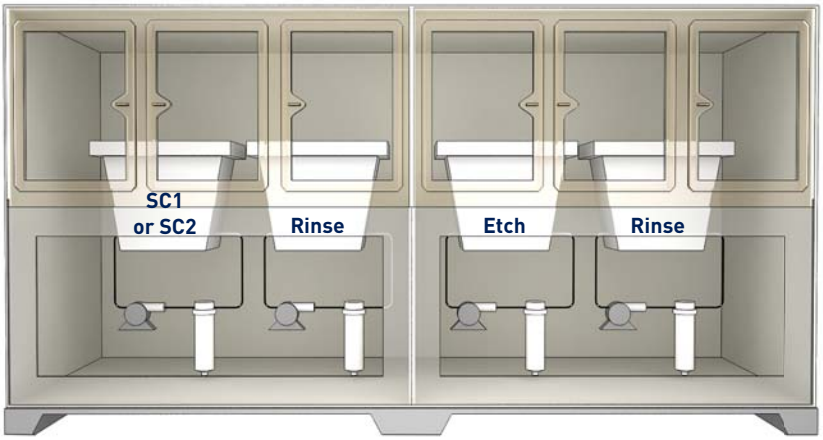
Fluoroflow® & Fluoroflow® Select cartridges
All-fluoropolymer pleated cartridges for effective filtration of aggressive chemicals at elevated temperatures. Provide the highest chemical resistance when filtering acids, bases and solvents.

Fluorocap® & Fluorocap® Select capsules
Encapsulated all-fluoropolymer filters for critical application of aggressive chemicals under harsh conditions. Provide high level of protection during change-outs.

Clariflow® & Clariflow® Select cartridges and mini-cartridges
Polyethersulfone membrane filters provide extremely high bath recovery rates in the cleaning process.

Fluoroflow® XF cartridges
All-fluoropolymer construction with the highest degree of chemical compatibility & thermal resistance. Ideal for highly viscous liquids used in critical processes.

Wet Etch & Clean Sequence



Bulk Chemical Delivery

Low extractables, high retention

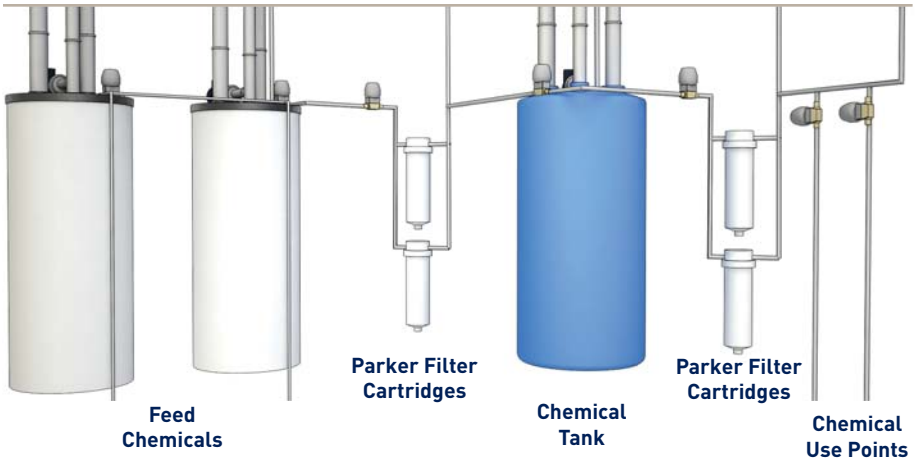
As the microelectronics industry moves into ever-increasing miniaturization, the requirements for the amount and purity levels of chemicals supporting these technology changes are dramatic.

Fluoroflow® & Select filter cartridges
All-fluoropolymer pleated cartridges for effective filtration of aggressive chemicals. Provide the highest chemical resistance when filtering in a wide variety of microelectronic applications.

Chemflow® PE filter cartridges
PTFE membrane with HDPE support for chemical resistance, high retention and cleanliness at low temperature.

Proflow™ filter cartridges
PTFE membrane with polypropylene support thermally-bonded for integrity and low extractable.

Bulk Chemical Delivery System



High Purity Water

Cleanliness and purity

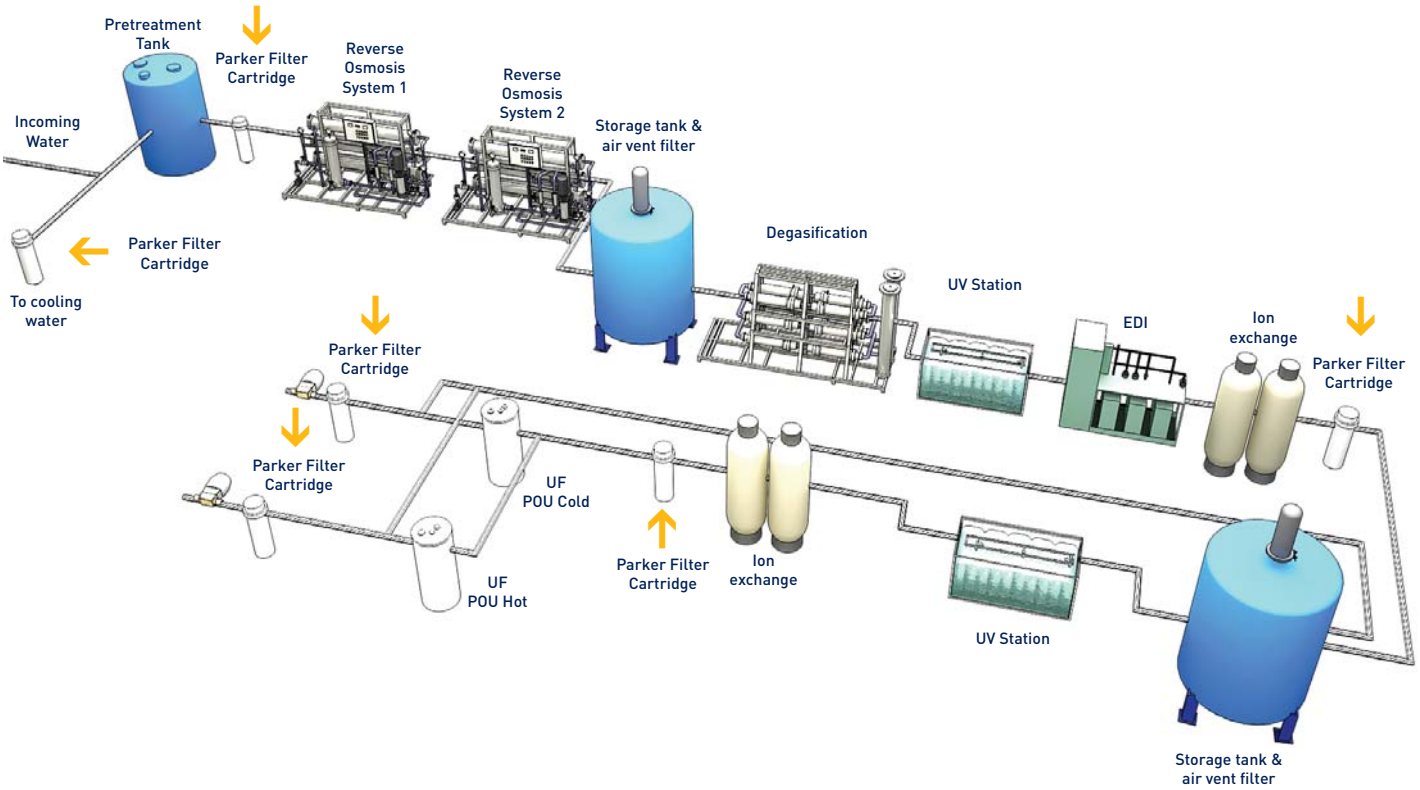
The processes involved with semiconductor manufacturing demand optimum filtration performance. As line widths shrink, the need for high purity is more crucial and purity requirements more stringent.

Parker domnick hunter provides solutions that enhance these processes to meet the high purity requirements of this critical industry.

Polyflow® filter cartridges
Polypropylene depth media for high-retention and high flow rate. Available in cartridge, mini-capsule and mini-cartridge formats.

Clariflow® filter cartridges
PES membrane with polypropylene support for chemical resistance, high retention and cleanliness.

DI Water Flow



Redefining Particle Cleanliness

Parker offers a wide range of microfiltration products for critical liquid applications, with stringent particle removal ratings as low as 0.02 micron.

Our products have consistently met semiconductor industry performance and compatibility requirements – even in processes using aggressive chemicals.

Microelectronics Laboratory Expertise

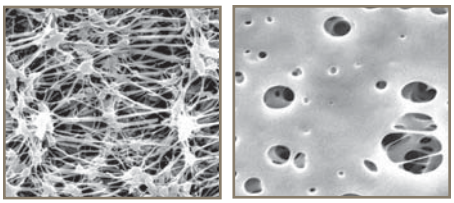
Technical Support

Our Technical Services team is dedicated to the needs of the microelectronics industry. We have an extensive range of analytical instrumentation and a highly qualified team of scientists and engineers generating innovative solutions to a wide variety of filtration needs. We strive to optimize our customers' filtration applications by offering full technical support that includes:

- Process failure analyses
- Contamination analyses
- Process & cost improvement audits
- On-site testing services
  - Calibration
  - Certification
  - Training
  - Filterability study
  - Problem solving

Typical instruments for filter analysis:

- SEM
- EDX
- FTIR
- ICP-MS
- HPLC
- GMCS
- Particle counter



PTFE @ 20,000X SEM Samples PES @ 5,000X

Research & Development

Our R&D teams are constantly working to innovate new products and discover technologies that will enhance the performance of process filtration, and thus keep us at the forefront of process filtration technology.

Customer Service

An experienced team of dedicated professionals are available to respond quickly and comprehensively to orders - both for standard and customized products – ensuring their on-time delivery worldwide.

Regional Laboratories

Parker domnick hunter believes in providing fast and prompt technical support to our Microelectronics customers which can be provided by our regional labs.

Global Laboratories

- Europe
- Latin America
- Asia
- China
- Korea
- Singapore
- Taiwan

Winovation

The WIN Process

From concept to launch Parker utilizes a new product development system called Winovation, which creates value by determining customer needs and developing products that meet their filtration demands.

Laboratory Equipment

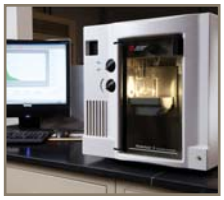

FTIR Spectrometer


Inductively Coupled Plasma (ICP)


High Performance Liquid Chromatograph (HPLC)


Limulus Amebocyte Lysate Analyzer (LAL)


Laser Particle Counter (LS230)


Coulter Multisizer

Equipment Type	Description	Function
Accusizer	*An automatic laser particle counter for liquid samples*	Quantifies particles in diluted and non-diluted liquid samples from 0.5µ to 400µ; also used for efficiency testing. It is capable of handling acids, bases, and solvents.
Coulter Multisizer	*A particle counter utilizing Coulter principle*	Sizes and counts particles from 1.5µ to 80µ using different aperture tubes; also used for efficiency testing
LS230 | Laser Particle Counter	*The traditional particle counter using light scattering principles*	Provides Particle Size Distribution in liquid samples from 0.04µ to 2,000µ
FTIR Spectrometer | Fourier Transform Infrared Spectrometer	*A technique used to obtain an infrared spectrum of absorption, emission, photoconductivity or Roman scattering of a solid, liquid or gas*	Primarily used for organic chemical analysis. Used for verification of materials, such as O-ring seals, polymers and organic contamination
ICP | Inductively Coupled Plasma – Mass Spectrometer	*A type of mass spectrometry highly sensitive and capable of the determination of a range of metals and several non-metals at concentrations below part per trillion*	Analyzes many metals and non-metals at parts per trillion level. Used to verify low metal extractables in semiconductor applications
Diffusive Flow Test Stand	*Measures diffusion of pressurized air through prewetted filter membranes and cartridges*	Tests up to four specimens in series with flow from less than 5cc/minute up to 500cc/minute and pressure up to 80 PSIG in order to characterize diffusive air flow and to test for integrity
HPLC | High Performance Liquid Chromatograph	*A chromatographic technique that can separate a mixture of compounds and is used in biochemistry and analytical chemistry to identify, quantify, and purify the individual components of the mixture*	Primarily used to identify soluble organic compounds of moderate molecular weight
LAL Station | Limulus Amebocyte Lysate Analyzer	*A quantitative test for endotoxin analysis*	Analyzes endotoxin levels in water samples. Verifies acceptable endotoxin levels in filter wet pack water (<0.25 EU/ml)
Latex Bead Challenge | Laser Particle Counter	*An injection of latex microsphere slurry through filter cartridges and membranes; utilizes Laser Particle Counter to determine Logarithmic Reduction Value (LRV) performance*	Has a range of 0.05µ to 0.2µ and counts up to 250,000 particles per sample
Porometer	*The study of the pore structure of materials used in filtration.*	Determines pore size, distribution and permeability of membranes and media. Measurement range from 0.01µ to 100µ
SEM | Scanning Electron Microscope	*A type of electron microscope that images a sample by scanning it with a high beam of electrons in raster scan pattern*	A highly magnified analysis of samples, up to 100,000 times. Used to analyze material morphology such as membrane and contamination issues
Tensile Tester	*A measure of the tensile strength of a material in terms of the amount of force needed to pull specimen apart*	Measures a range from 0.5 to 224 lbs/force
TOC Analyzer	*An analysis of DI water for Total Organic Carbons (TOC) and conductivity*	Measures a range from 0.03-2500 ppb TOC and 0.01-35µS conductivity
UV/VIS Spectrophotometer	*A measure of light frequencies in visible and Ultraviolet (UV) ranges through liquid specimens*	Used for performance testing of various membranes and media
Water Flow Rate	*A measurement of DI water flow through and differential pressure (PSID) across filter cartridges, membranes and media*	Measures from 0.5 to 6 gallons per minute (GPM) and to 100 PSID differential pressure (Delta-P)

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