



# IMEC UPW System Utilizes 3M™ Liqui-Cel™ Membrane Contactors for Oxygen Removal

IMEC (Interuniversity Micro-Electronics Center) in Belgium is Europe's largest independent research center. It focuses on microelectronics, nanotechnology, and enabling design methods and technologies for ICT (Integrated Circuit Technology) systems. IMEC's research runs 3 to 10 years ahead of industrial needs.

IMEC's technology choices for process manufacturing steps used for project and process development reflect their commitment to using the best solutions available to them.

Projects are currently underway at IMEC to address major technological challenges for CMOS chips of the 100 and 65 nanometer generation. The center has three full-scale pilot manufacturing lines and 4800 m<sup>2</sup> (51,666 ft<sup>2</sup>) of clean room facilities.

IMEC High Purity Water (HPW) Specifications and Outlets	
Flow Rate (Make-up loop)	15 m <sup>3</sup> /hr (55 gpm)
Flow Rate (Polishing loop)	35 m <sup>3</sup> /hr (128 gpm)
Temperature	19.5°C (67°F)
Vacuum	50 torr
Total N <sub>2</sub> required	3 m <sup>3</sup> /hr (1.8 scfm)
Inlet Dissolved O <sub>2</sub>	Saturated 9.14 ppm
Outlet Dissolved O <sub>2</sub> , estimated	<5 ppb
Outlet Dissolved O <sub>2</sub> , actual	3-4 ppb
Outlet TOC	<0.05-0.1 ppb
Outlet Particles	<0.05 µm
Number Particles/liter	300-500
Resistivity	18.2 Mohm cm

As future devices become smaller and as line widths become more critical, so too do the technologies required to produce high purity water for the process manufacturing steps in various microelectronics industries. Oxygen levels in the high purity water directly impact the product yields. New roadmaps for 300 mm wafers and other small devices point to requirements of <1 ppb of dissolved oxygen.

## Use of 3M™ Liqui-Cel™ Membrane Contactors at IMEC

3M™ Liqui-Cel™ Membrane Contactors were installed in the make-up and polishing loops of the High Purity Water (HPW) loop feeding the pilot lines at IMEC. Start-up occurred in September 1999, and no operating problems or out-of-specification conditions had been reported as of August 2002.

The make-up system runs at 15 m<sup>3</sup>/hr (55 gpm). Three 3M™ Liqui-Cel™ EXF-10×28 Series Membrane Contactors running in series remove the majority of the dissolved oxygen in the water. The O<sub>2</sub> outlet at this point in the system is 5.4 ppb.

The polishing system runs at 35 m<sup>3</sup>/hr (128 gpm) and requires only one Liqui-Cel EXF-10×28 Series membrane contactor for final polishing to <3.5 ppb of dissolved oxygen.



Both systems operate in the the combination mode with 50 torr of vacuum.

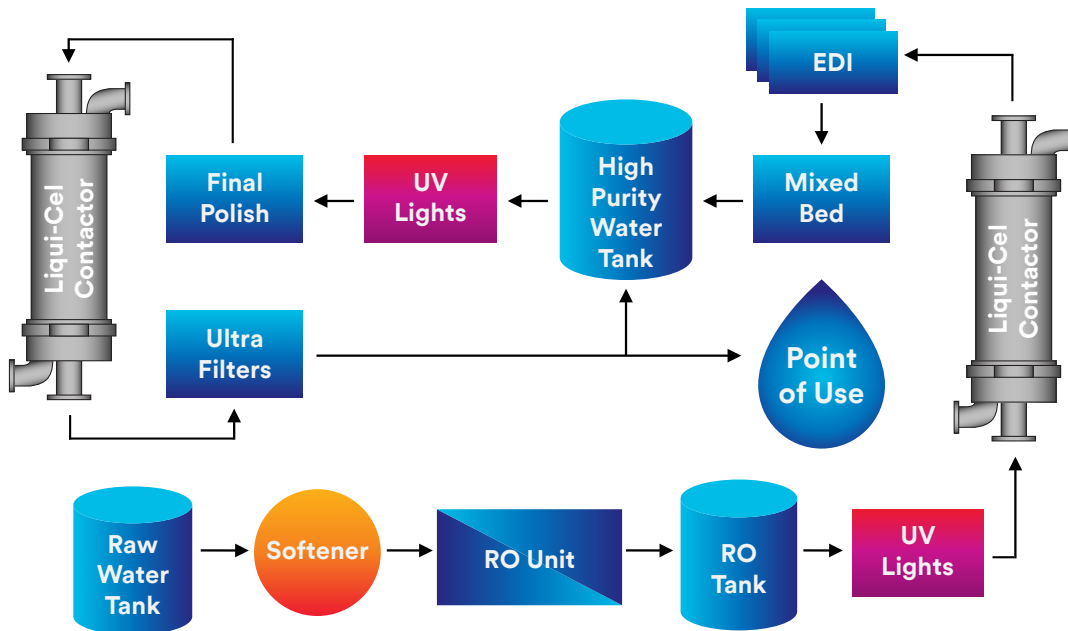
The total N<sub>2</sub> usage is 3 m<sup>3</sup>/hr (1.8 scfm). Because of minimal pressure drop in the membrane contactors, repressurization pumps are not required after the degassing step.

One of the benefits of Liqui-Cel membrane contactors is modularity. They can be placed in two separate locations to better meet the outlet oxygen requirements of the application. By breaking up the degassing system into two parts, the contactors can be located in the final polish step where any oxygen or other gasses picked up in piping or other system components can be removed.

## The HPW loop

A P&ID of the overall HPW water loop is shown on the following page. Philip Müller Hager+Elssäer in Germany was selected as the OEM to build and install the HPW process equipment loop.

## The High Purity Water Loop at IMEC



For additional information, please contact your 3M representative or visit [3M.com/Liqui-Cel](http://3M.com/Liqui-Cel).

**Technical Information:** The technical information, recommendations and other statements contained in this document are based upon tests or experience that 3M believes are reliable, but the accuracy or completeness of such information is not guaranteed.

**Product Use:** Many factors beyond 3M's control and uniquely within user's knowledge and control can affect the use and performance of a 3M product in a particular application. Given the variety of factors that can affect the use and performance of a 3M product, user is solely responsible for evaluating the 3M product and determining whether it is fit for a particular purpose and suitable for user's method of application.

**Warranty, Limited Remedy, and Disclaimer:** Unless an additional warranty is specifically stated on the applicable 3M product packaging or product literature, 3M warrants that each 3M product meets the applicable 3M product specification at the time 3M ships the product. 3M MAKES NO OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OR CONDITION OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY IMPLIED WARRANTY OR CONDITION ARISING OUT OF A COURSE OF DEALING, CUSTOM OR USAGE OF TRADE. If the 3M product does not conform to this warranty, then the sole and exclusive remedy is, at 3M's option, replacement of the 3M product or refund of the purchase price.

**Limitation of Liability:** Except where prohibited by law, 3M will not be liable for any loss or damage arising from the 3M product, whether direct, indirect, special, incidental or consequential, regardless of the legal theory asserted, including warranty, contract, negligence or strict liability.

3M and Liqui-Cel are trademarks of 3M Company. All other trademarks are the property of their respective owners. © 2017 3M Company. All rights reserved.



ISO 9001



**Separation and Purification Sciences Division**  
13840 South Lakes Drive  
Charlotte, North Carolina  
28273 USA  
Phone: +1 980 859 5400

**3M Deutschland GmbH**  
**Separation and Purification Sciences Division**  
Öhder Straße 28  
42289 Wuppertal Germany  
Phone: +49 202 6099 - 0  
Fax: +49 202 6099 - 241

LC-1068  
Rev. 03/2017

[3M.com/Liqui-Cel](http://3M.com/Liqui-Cel)