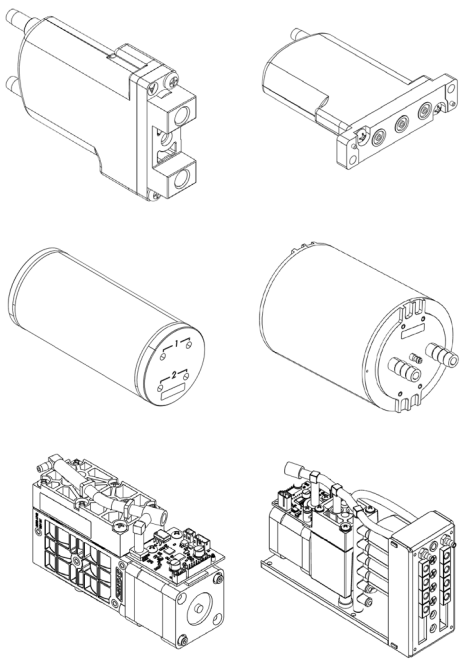
IN-LINE DEGASSING

Product Guide

Improve Instrument Performance with In-line Degassers

Reduce dissolved gas and air bubble interference in your fluidic system and improve the analysis result quality with IDEX Health & Science



Dissolved gases in reagent lines lead to bubble formation, disrupting analysis results and causing errors in fluidic and optical detection systems. IDEX Health & Science in-line degassing modules efficiently remove dissolved gases from a variety of fluids, ensuring optimal fluidic performance for your instrument. The fully swept flow path design of our degassers ensures minimal hydrodynamic impact; dissolved gas levels can be conveniently controlled through our adjustable vacuum pumps.

SUPERIOR CHEMICAL RESISTANCE

LONG LIFETIME

FULLY SWEPT IN-LINE FLUID PATH

Features:

- Highly efficient removal of dissolved gases
- Fully swept in-line fluid path
- Degassing across a wide range of flow rates (up to 1000 mL/min)
- Chemical resistance
- Long life, reliable vacuum sources

Applications:

- Diagnostic applications: clinical chemistry, immunoassay, hematology, and other similar applications
- Modern molecular platforms: next generation sequencing, proteomics, molecular interactions, etc.
- Cytometric and histological platforms: flow cytometry, cell sorting, spatial profiling, and other cell based systems
- Chemical analytics: chromatography, mass spectrometry, etc.

IDEX HEALTH & SCIENCE

Intelligent Solutions for Life®

Fluidics | Optics | Consumables | Assemblies

Revision A: 5/12/23

Importance of Degassing

Modern fluidic systems enable sophisticated molecular processes and diagnostic assays. Nevertheless, many mixing reactions and instrument connection points can lead to bubble formation. Unmitigated, bubbles can grow to considerable sizes and cause system errors.

Dissolved Gas Leads to Bubble Formation

In many cases, the source of bubbles can be traced to the presence of dissolved gas in system fluids, reagents, and samples. The dissolved gases start forming bubbles as soon as the physical and chemical conditions begin to change (see Figure 1).

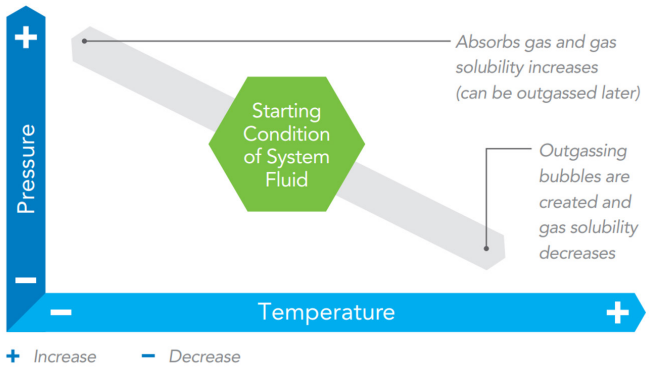


Figure 1: Anytime system conditions shift in a way that reduces the gas solubility of a fluid, outgassing occurs and bubbles form. If conditions change towards the lower right at any point in the fluid path, bubbles will be generated.

Common conditions leading to bubble formation include:

- Gas oversaturation in pressurized system fluids and reagents
- Under-pressurized liquids when aspirating over long lines or overcoming a height difference
- Temperature changes when routing liquids close to or through heat sources, such as solenoid valves
- Change in fluid chemistry

Beyond these slow processes, a significant ingress of air can occur when exchanging reagents, through faulty connections, or via shock and agitation.

Bubble Interference

Slow-moving or trapped gas bubbles interfere with system operation in many ways, negatively affecting instrument throughput, precision, and results:

- Disruption of optical detection, laser-based excitation and scattering, and imaging
- Disruption of fluid contact detectors like ISFET, LED, or any miniature electrodes or fluorescence detectors
- Interference with fluid contact feedback like pressure and level sensors
- Prevention of wetting small channels, micro patterns, and micro structures
- Interference with any precision fluid motion required for sampling and aspiration-dispensing cycles

Degassers eliminate dissolved gases before they start forming bubbles. They actively remove ingressed bubbles of significant size while flushing their surroundings with degassed liquid to prevent any disruption to your analytical system.

How it Works

IDEX Health & Science manufactures high efficiency active degassing systems, in-line degassing chambers, and long-life vacuum pumps. Our unique permeable membrane materials and flow path designs enable you to improve the automated processes and assays carried out by your fluidic system.

Active Gas Removal

Our in-line fluidic degassers remove dissolved gases from reagents, buffers, and solutions as they pass through a membrane-filled fluid chamber (see Figure 2).

The housing of our chambers acts as a vacuum container when connected to our long-life vacuum pumps. The partial pressure difference between reagents and the vacuum space efficiently removes dissolved gases. The complete enclosed systems require no user maintenance, are easy to integrate into your instrumentation, and offer a fully swept in-line flow path, mitigating carryover concerns when switching between analytical reagents and wash solutions.

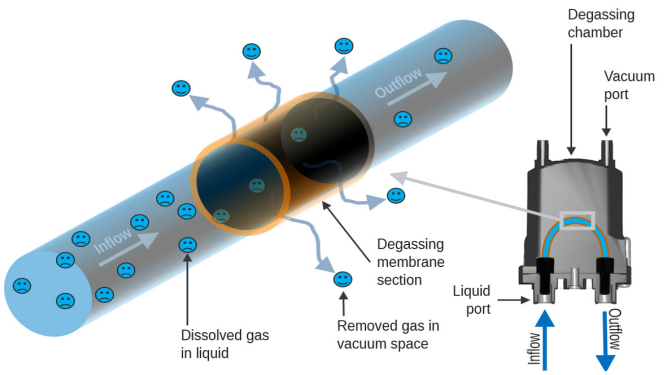


Figure 2: Active in-line degassing process as used in IDEX Health & Science degassing products. Gas-containing liquids enter the degassing chamber and are routed through a gas-permeable membrane located in a vacuum space. The partial pressure difference of a gas between liquid and vacuum drives gases out of the liquid.

Permeation Membranes

We achieve high-efficiency degassing through the use of precision-manufactured membranes. Specifically designed for in-line liquid-gas permeation, our Teflon AF membranes ensure performant degassing for slower flowing liquids and are compatible with a wide range of liquids. High flow aqueous applications use a special silicone polymer with permeation rates similar to Teflon AF with a high liquid contact area.

Degassing Performance & Reliability

For optimal degassing performance, in-line degassing chambers operate in combination with our long-life vacuum pumps (see Figure 3). Vacuum levels are actively maintained by a PID-based control system, reducing unnecessary wear and improving overall lifetime. Pumps are available with different factory-set vacuum levels or can be programmed with custom values.

The choice of materials and further design considerations (e.g. provisions to remove pervaporated solvents) provide a significant chemical inertness and resistance.

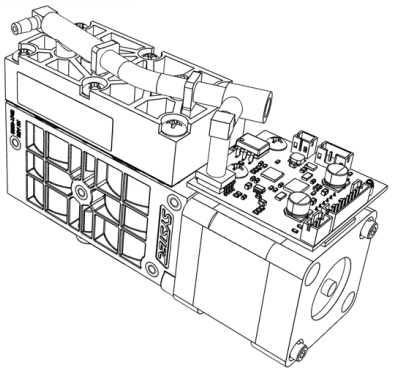
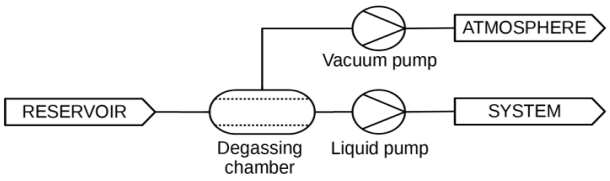


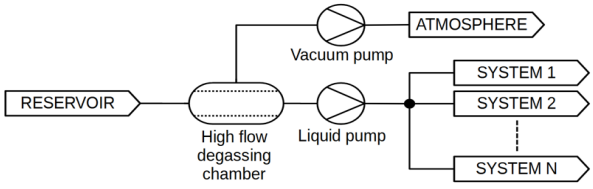
Figure 3: Example of a dual-stage IDEX Health & Science vacuum pump with integrated pressure sensor, stepper motor, and controller. The pump is available with various vacuum set points and a high-level serial communication command set allowing for fine vacuum adjustments.

Fluid Integration

In fluidic applications, many different pump types can be used to distribute reagents throughout the system. Since degassers facilitate permeation of gases, their membranes need to be thin. To avoid excessive hydrostatic pressure, the degassing chamber is typically placed in the pump suction line, not in the discharge line (shown below).



High flow degassing chambers can be used as a central degassing unit serving multiple lines. This can be achieved by using a single pump with a distribution valve (shown below) or individual pumps per line for asynchronous operation.



Development & Testing

IDEX Health & Science employs a robust, data-driven development process to deliver products tailored for your application. Our careful engineering approach pays attention to more than just the degassing materials, vacuum controller, and electromechanical design. We complement our products with extensive testing to ensure reliability and performance characterizing degassing efficiency with respect to flow rate, and making sure all other design elements satisfy your requirements. Our life-test methods use commercially available reagent preparations, or your unique reagent blend to provided confidence in your product performance.

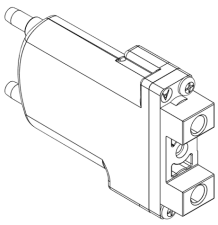
Operational Excellence

Our Manufacturing Operations, Quality, Purchasing, and Planning groups are a part of our development teams and work together to transfer degassing specifications into the production environment. We use documented and controlled work processes, automated test equipment, verify the product's value stream to ensure consistent and high-quality products.

Figure 4: Our highly skilled production teams assemble and test degassing chambers and vacuum pumps in production. Our focus is ensuring that you get a high-quality product, manufactured to the highest workmanship standards.

Standard Degassing Products

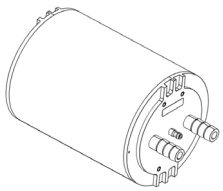
Our standard degassing offering provides you a with wide range of flexibility to build your instrument. A team of dedicated applications scientists and engineers can help you select the right components to meet the specific needs of your application. For whichever design configuration you select, IDEX Health & Science offers you confidence in degassing efficiency, lifetime, quality, and consistency for your fluidic application.



Low Flow In-line Degassing Chambers

Eliminate dissolved gases in precision low-flow applications or from chemically challenging fluids

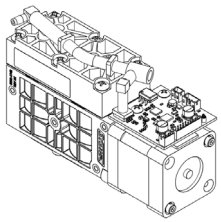
- High degassing efficiency at low flow rates
- Available as tube or as highly efficient film degasser chambers
- Provides outstanding chemical resistance to a wide variety of fluids
- Available standalone or manifold-mountable component
- For use in modern molecular detection or processing platforms including DNA sequencing, protein identification and interaction, flow cytometry, or chromatography



Medium and High Flow In-line Degassing Chambers

Improve throughput while maintaining performance

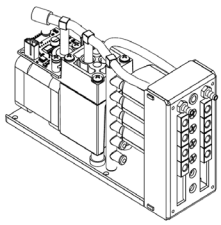
- Enables highest throughput of system fluids and reagents
- Ensures highly efficient degassing under heavy load
- Available as manifold-mountable component or as a standalone degasser option
- For use in high -throughput clinical chemistry and comparable assay systems



Long-life, Chemically Inert Vacuum Pumps

Add control and reliability to your degassing system

- Highly integrated, standalone, self-regulating system
- Improved chemical resistance using resistant materials and efficient prevention of pervaporated solvents
- Reduces wear by adapting speed to the vacuum level thereby improving reliability
- Can be used as a pneumatic fluid actuator provided liquid is prevented from entering the pump
- Designed for optimal performance with our degassing chambers



Complete Degassing Systems

For assembly and supply chain convenience

- Autonomous operation with minimal oversight from your instrument control system
- Improves throughput and performance using parallel degassing paths for each reagent line
- Provides reliability and reduces downtime in your instrument platform
- For use in higher throughput molecular or analytical platforms

Overview of In-line Degassing Chambers

Parameter	Low Flow Teflon AF Chambers	Medium Flow Teflon AF Chambers	Medium Flow Silicone Chambers	High Flow Silicone Chambers
Recommended continuous degassing flow rate range[1]	1 to 10 mL/min	1 to 40 mL/min	1 to 80 mL/min	100 to 1000 mL/min
Chemical compatibility	Organic solvents[2], pH 1 to 14, organic-aqueous mixtures, high salinity and detergent-containing fluids	Organic solvents[2], pH 1 to 14, organic-aqueous mixtures, high salinity and detergent-containing fluids	Deionized water, low salinity, moderate pH aqueous solutions, detergents	Deionized water, low salinity, moderate pH aqueous solutions, detergents
Degassing channel internal volume options (mL)	0.10, 0.48, 0.67, 0.73, 0.93	6.4, 8.5[3], 9.5[3], 13.8[3]	2, 9[3]	58, 60, 100, 217
Independent degassing channels	1	1 for the 6.4 mL options, 2 for the rest	1 for the 2 mL option, 2 for the 9 mL option	1
Maximum pressure tolerability[4]	70 PSI, 480 kPa	70 PSI, 480 kPa	14.5 PSI, 100 kPa	14.5 PSI, 100 kPa
Fluidic connections	¼-28 UNF-2B	¼-28 UNF-2B	¼-28 UNF-2B	Connection for elastomeric tubing
Vacuum connection	Connection for elastomeric tubing	Connection for elastomeric tubing	Connection for elastomeric tubing	Connection for elastomeric tubing
Fluid contact materials	FEP, PEEK, PTFE	PPS, PTFE, glass-filled PTFE, stainless steel	EPDM, PVC, Silicone	(EPDM, Epoxy, mPPE, NBR, PE, PMP, PP, PVC, Silicone)[5]

1: Depends on model; please check product or product family data sheets for further information; most chamber models show a ~50% degassing efficiency with respect to oxygen removal at the midpoint of their recommended flow rate range.

2: Note that a high vapor pressure can lead to a high pervaporation rate and potential condensation in the vacuum system.

3: The internal volume is given per channel in case of a multi-channel chamber.

4: Pressure difference across the membrane between liquid and vacuum space.

5: Depends on model; please check product data sheet for more information; most common materials are NBR, PP, PVC, and silicone material.

IDEX HEALTH & SCIENCE

For ordering, technical support, and contact information please visit www.idex-hs.com

Revision A: 5/12/23