



5X MORE  
PRECISE  
than standard  
regulators



# SD Series

Single Use Back Pressure Regulators  
FOR BIOPHARMACEUTICAL INDUSTRIES

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PRECISE  
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# The Equilibar Difference

## Our performance.

Equilibar back pressure regulators outperform the competition, particularly in applications with low flow rates, mixed phase fluids, corrosive media, or extreme temperatures.

## Our people.

Every inquiry gets focused attention from our engineering team to determine the best possible product for your needs. Every back pressure regulator is hand assembled and tested to meet our stringent quality standards.

## Our priorities.

Our goal is to exceed your expectations. In an industry where delivery times frequently exceed months, we offer many of our standard products with delivery in weeks.

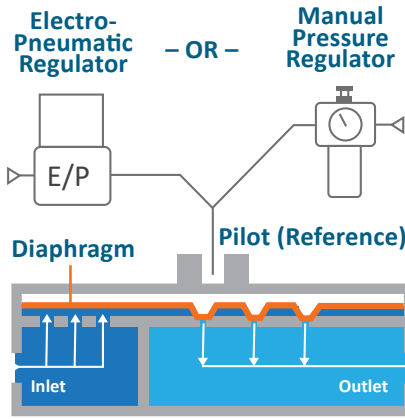
Traditional pressure regulators in the single use market use a tube pinching action or on/off control. These designs deliver choppy, crude control which introduces fluctuations in a system. The Equilibar back pressure regulator uses a thin, supple diaphragm as the only moving part. This allows frictionless operation without cracking pressure or hysteresis. The accuracy of the Equilibar back pressure regulator is determined by the accuracy of the pilot setpoint.



# How It Works

Simply load the Equibar back pressure regulator with a pilot pressure equal to the desired back pressure and the Equibar SDO does the rest. This pilot pressure forces the flexible diaphragm down onto a plate of orifices. A rise in inlet pressure lifts the diaphragm up to allow excess pressure to be relieved through the outlet orifices. Similarly, a loss of pressure at the inlet causes the diaphragm to be pushed closer to the orifices, restricting flow and rebuilding pressure upstream.

For **flow control**, connect an electronic pilot regulator and flow meter in an **inverse** PID loop with an Equibar valve and it will adjust to control flow.

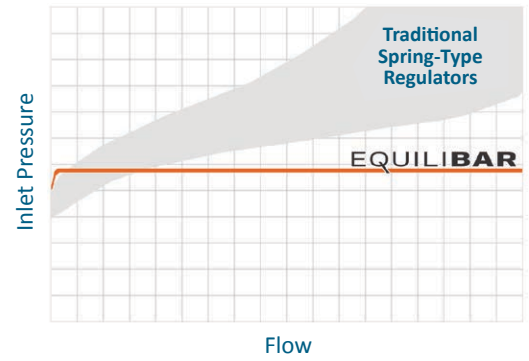


Pilot operate the Equibar SDO back pressure regulator with an electronic pressure regulator for precision automated control.



Or set the pilot pressure with a precision pressure reducing regulator for manual control.

## Performance Comparison



## BACK PRESSURE REGULATORS VS PRESSURE REDUCING REGULATORS

Pressure reducing regulators reduce a higher supply pressure at the inlet down to a regulated lower pressure at the outlet (downstream). Back pressure regulators work the opposite way. They regulate the inlet (upstream) pressure by opening up only as much as necessary to hold back the desired pressure at the inlet (upstream).

TYPE	PRESSURE REDUCING REGULATOR	BACK PRESSURE REGULATOR
SCHEMATIC		
CONTROLS PRESSURE	Downstream	Upstream
OPENS TO	Increase downstream pressure	Decrease upstream pressure
CLOSES TO	Decrease downstream pressure	Increase upstream pressure

# FOR SINGLE USE AND HYBRID BIOPROCESSING SYSTEMS

The patent pending Equilibar® SD series valve is manufactured using USP Class VI polymers and 316 stainless steel. The polymer body and diaphragms are disposable and are housed in a reusable 316 stainless steel cradle with wing nut closure for quick and easy assembly.

The Equilibar SD back pressure regulator is a revolutionary design in single use pressure control. It features Equilibar’s unique dome-loaded multiple orifice technology delivering instantaneous control, frictionless operation and superior precision across exceptionally wide flow rate ranges. The stainless steel housing is designed as a permanent part of the process and connects to a dome pilot pressure supply. Universal mounting pattern allows for the housing to be interchanged in the system to accommodate different sizes. The disposable body is sold as non-sterile, is prepared in an ISO Class 7 clean room and comes ready for sterilization up to 50 kGy.

## Key Features

### EASE OF USE

The Equilibar SD is a dome-loaded pressure regulator with pilot operation. Once assembled, inert gas or air is fed into the pilot port on the dome of the regulator housing to provide the pressure setpoint in a 1:1 ratio for the process. The pressure of the gas in the dome is set by a secondary standard regulator called a pilot regulator. The pilot regulator can be manual or electronic depending on the application’s requirements.

### PRECISE CONTROL, WIDE FLOW RANGE

Equilibar regulators feature ultra sensitive diaphragm-operated back pressure technology capable of controlling pressure with high precision over a wide range of flows. The SD valve has negligible hysteresis and provides excellent stability. The graph at the right shows the SDO6 precision control across a range of Cv 1000:1.

### SMOOTH COMPUTER AUTOMATION

Equilibar regulators respond instantaneously to variations in flow or changes in setpoint to maintain the desired inlet pressure. Because of this millisecond control capability, the SD Series is a perfect match for computer automated control. Paired with an electronic pilot regulator, the SD valve can be connected to the process control system making it ready for automation.

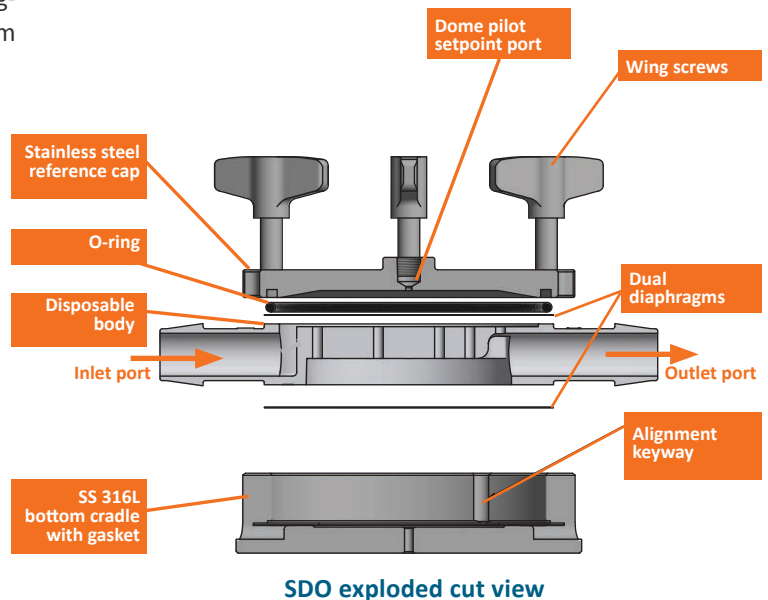
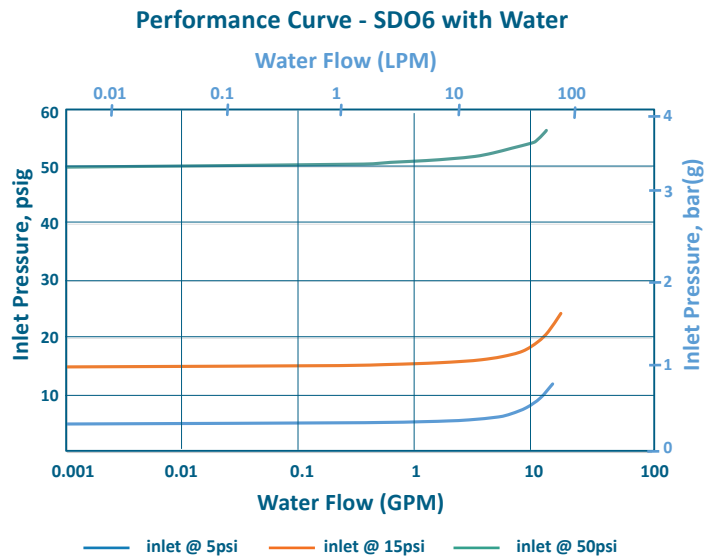
### VERSATILITY

The Equilibar SDO can be set up in closed loop flow control in addition to back pressure control.

### OTHER FEATURES

- Injection molded
- Thermally welded diaphragms
- ISO Class 7 clean room assembly
- Ready for sterilization up to 50 kGy<sup>1</sup>
- Gamma indicator on product label<sup>2</sup>
- All product 100% leak tested
- Simple compact design
- Wing screw closure for easy assembly
- keyway / key system for disposable insert alignment
- Multi-day use
- Documentation & traceability

<sup>1</sup>SDO not sold as sterile device    <sup>2</sup>10 KGy Min



PATENTS [equilibar.com/support/patents/](http://equilibar.com/support/patents/)

# Tangential Flow Filtration

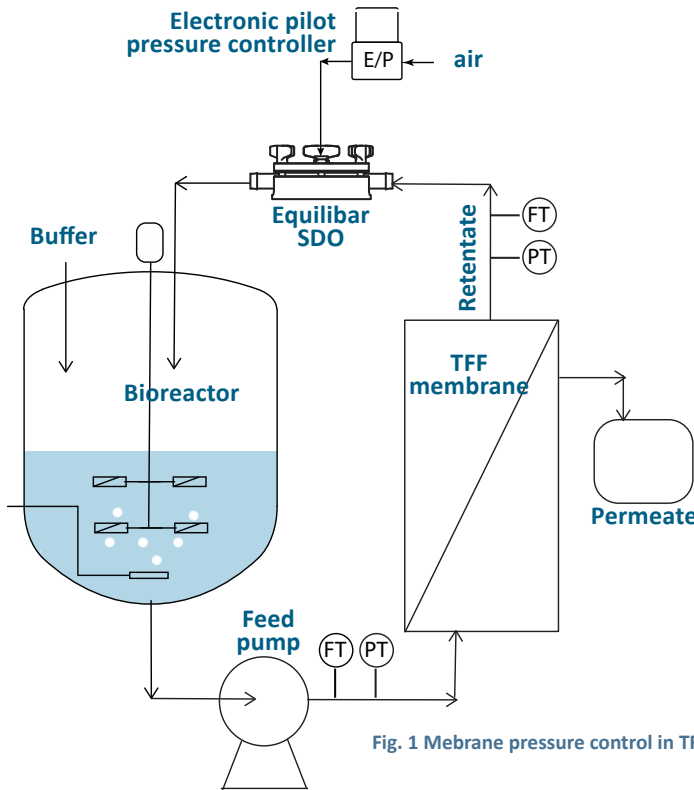


Fig. 1 Membrane pressure control in TFF process

Tangential flow filtration, or TFF, is used in the BioPharmaceutical industry as an efficient ultrafiltration method for purifying biomolecules. During the process, the differential pressure across the TFF membrane must be maintained within a narrow range, in some cases as low as 1 psi. The Equilibr SDO delivers superior precision and can accurately control transmembrane pressure in a wide range of flow rates and viscosities.

In the Figure at left, an Equilibr SDO valve is installed in the retentate line returning to the bioreactor. Using an electronic pilot controller, a setpoint is established on the dome of the SDO valve to deliver the desired TFF transmembrane pressure. The SDO valve adjusts quickly to changes in upstream pressure or flow in order to maintain stable target pressure for effective TFF process control.

The SDO regulator may also be used in other upstream perfusion or downstream ultrafiltration processes where precise pressure regulation improves process performance.

# Bioreactor Headspace Pressure

The bioreactor environment is complex. As sparging gases are introduced during the process, they create fluctuations in temperature, pressure or level. In order to maintain healthy cells, the pressure balance in the system must be maintained.

In this example, sparging gases are introduced to the broth from below and an Equilibr SDO back pressure regulator (BPR) is maintaining the headspace pressure in the bioreactor. As fluctuations in temperature and level change the pressure balance in the system, the Equilibr BPR reacts instantaneously without hysteresis to maintain accurate pressure. The unique Equilibr design allows the BPR to respond quickly even at the very low setpoint requirements for this application.

In single use bioreactors, solenoid valves typically control pressure by pulsing open and closed causing periodic pressure fluctuation. An Equilibr SDO back pressure regulator precisely regulates head space pressure without any fluctuation.

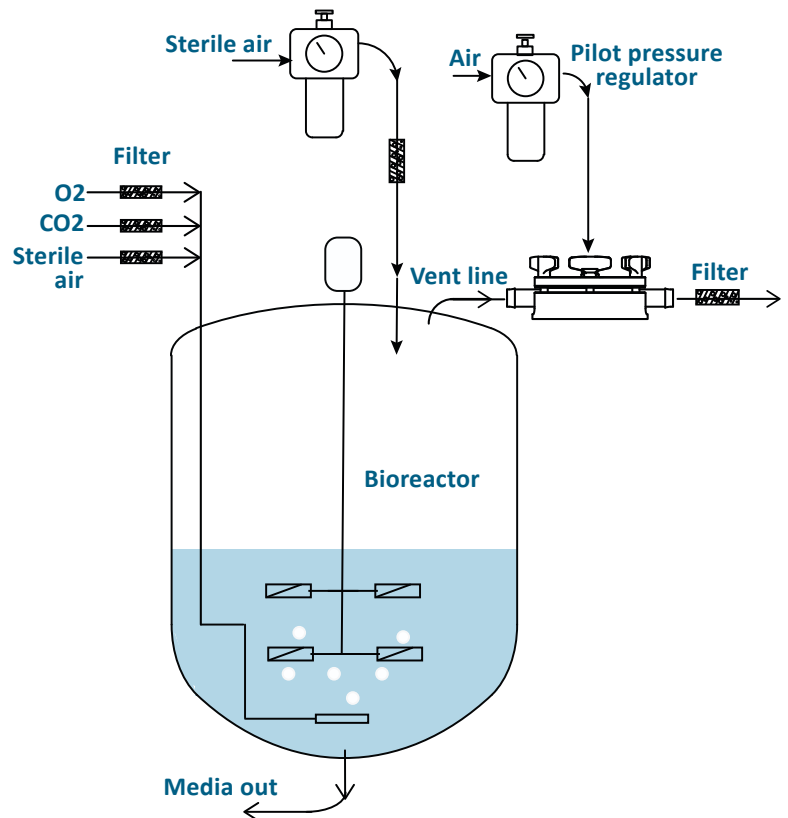


Fig. 2 Bioreactor headspace pressure is controlled with an Equilibr SDO

## APPLICATION HIGHLIGHTS

# Pressure Control in Chromatography

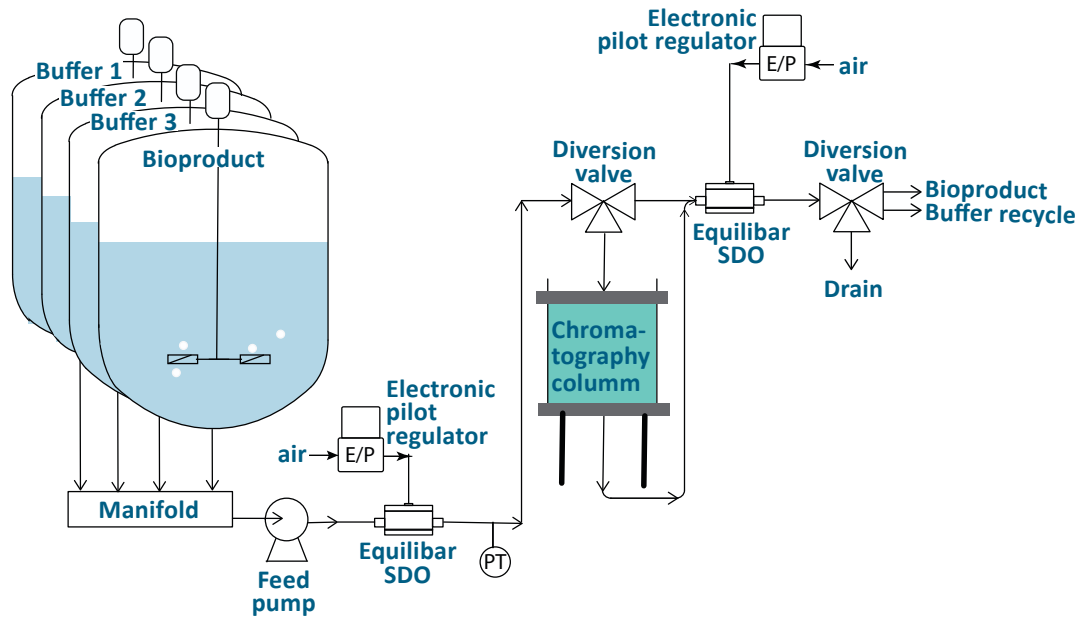


Fig. 3 Equilibrar SDO valves shown in chromatography column application

Equilibrar SDO back pressure regulators (BPR) can help stabilize pressure in chromatography feed lines. When using positive displacement pumps, such as peristaltic, lobe or diaphragm pumps, pressure pulses can be introduced into the process. Chromatography is vulnerable to pulsations because it may cause channelling in the packed bed, reducing process efficiency and damaging sensitive cells.

Using an Equilibrar SDO valve after the feed pump can help. The upper diaphragm of the SDO valve responds to slugs of fluid moving through the valve, keeping upstream pressure constant. The ultra-wide Cv range of the SDO valve allows it

to keep up with positive displacement pumps to maintain consistent pressure.

Downstream pulsation is mitigated through the lower diaphragm, which can act to dampen pulsations and absorb downstream pulsations.

An SDO back pressure regulator can also help maintain the pressure of the column by placing it at the outlet of the column or the outlet of a diversion valve. In this position, the SDO maintains pressure in the process line when switching to or diverting from the chromatography column.

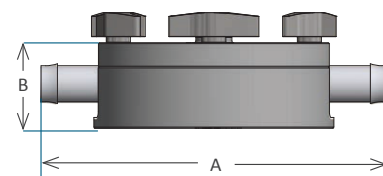
## OTHER APPLICATIONS

Read about other applications such as [disk stack centrifuge pressure control](#) on our website [equilibrar.com](#)

## Specifications

MODEL	INLET / OUTLET PORT	CV RANGE (PRECISION)		DIMENSION IN (MM)		INTERNAL VOLUME ML / IN <sup>3</sup>
		MIN	MAX	A	B	
SDO1	1/8" (3.2mm)	1E-04	0.06	2.3 (58)	1.0 (25)	1.8 / 0.1
SDO2	1/4" (6.4mm)	1E-04	0.4	3.6 (91)	1.2 (30)	7.0 / 0.4
SDO3	3/8" (9.5mm)	1E-04	0.9	4.2 (107)	1.4 (36)	13.8 / 0.8
SDO4	1/2" (12.5mm)	1E-03	1.6	5.5 (140)	1.6 (41)	38 / 2.3
SDO6	3/4" (19mm)	1E-03	4.0	7.2 (183)	1.8 (46)	109 / 6.6
SDO8	1" (25.4mm)	1E-03	7.0	9.6 (244)	2.6 (66)	245 / 14.9

- Pilot reference port size 1/8" NPT
- Max pressure 60 psig / 4 bar(g)
- Single use body & diaphragm material is USP Class VI HDPE - BPE and TSE free
- Cradle material is 316L stainless steel
- Wing nuts standard/ Hex head bolts optional





SDO Dimensions

# Pilot Control Options


## ELECTRONIC PILOT OPERATION

For precise electronic control, using an Equilibar EPC or QPV Series electronic pilot regulator is recommended. The pilot regulator can be mounted near the process control system for easy process integration or mounted closer to the dome of the SD regulator<sup>1</sup>.

REGULATOR	DESCRIPTION	KEY FEATURES
EPC	 <p>Precision Electronic Pressure Controller Controls up to 150 psig (10 bar)</p> <p>0-10V or 4-20mA Analog 3.3V Serial Digital</p>	<ul style="list-style-type: none"> <li>• Dual proportional valve control with integrated digital microcontroller</li> <li>• Closed loop control</li> <li>• 4-20mA, 0-10V or 3.3V serial command</li> <li>• Gauge, vacuum, and absolute pressure models</li> <li>• No integral bleed required</li> <li>• IP65 enclosure</li> <li>• CE models available</li> </ul>
EPR-150	 <p>Precision Electronic Pressure Controller Controls up to 150 psig (10 bar)</p> <p>4-20 mA or 0-5 VDC Analog RS-232 and RS-485 Serial Digital</p>	<ul style="list-style-type: none"> <li>• Dual proportional valve control with electronic control circuit</li> <li>• Closed loop control</li> <li>• 4-20mA or 0-5V command</li> <li>• Gauge, vacuum, and absolute pressure models</li> <li>• No gas wasted at steady state</li> <li>• Direct control from keypad</li> <li>• IP40 enclosure</li> <li>• CE models available</li> </ul>

<sup>1</sup> For best stability, the tubing between the outlet of the electronic regulator and the dome of the SDO requires a minimum volume of 2 cubic inches / 35cc.

## MANUAL PILOT OPERATION

REGULATOR	DESCRIPTION	KEY FEATURES
MODEL 10	 <p>The Model 10 is a pressure reducing regulator designed for applications that require high capacity and accurate process control.</p>	<ul style="list-style-type: none"> <li>• More rugged construction than others in its class</li> <li>• Model output ranges from 0 – 2 psig / 0.1 bar(g) up to 5 – 400 psig / 0.35 – 27.5 bar(g)</li> <li>• Max supply pressure 500 psig / 35 bar(g)</li> <li>• Temperature range -40°F to +200°F (-40°C to 93.3°C)</li> <li>• Pipe size 1/4" NPT</li> <li>• Acceptable for use in Zones 1 and 2 for gas atmosphere; Groups IIA and IIB and Zones 21 and 22 for dust atmospheres</li> </ul>

Contact an Equilibar application engineer for assistance or visit [equilibar.com](http://equilibar.com) for additional details.

# Consumable Part Number Information

## EXAMPLE CONSUMABLE PART NUMBER: SDO3NZA2 - XXXXX

Equilibar SDO consumable part numbers have two components. The first component (SDO3NZA2) describes the size and model. The second part (XXXXX) is a unique number created for our customer's specific application to ensure traceability. When ordering parts or communicating with application engineers about any questions you may have, please refer to both components of the part number.

## CERTIFICATIONS only apply to the diaphragms and valve bodies (medium wetted parts), not the actuator.

- USP Bacterial Endotoxins Test, USP <85>
- USP Biological Reactivity Test in vitro, USP <87>
- USP Biological Reactivity Tests in vivo for Class VI, USP <88>
- USP Particulate Matter in Injections, USP <788>

Contact Equilibar if you have any questions

# About Equilibar

Equilibar provides innovative and robust pressure control technology for researchers and engineers worldwide. We are proud to design, manufacture and test our patented back pressure regulators in our factory overlooking the Blue Ridge Mountains near Asheville, NC, and we are equally proud to work with clients around the world each and every day.

## APPLICATION ENGINEERING – WHAT SETS US APART

Unlike mass-market regulator distributors, we focus on working with you, the scientist or engineer with a complex pressure control scenario.

Our application engineers work collaboratively with clients to identify the optimal model, trim, and diaphragm for each application's unique challenges. No matter where you are on the globe, you can stay in close contact with your engineer by email, telephone, videoconferencing or fax.

After installation, your application engineer will support you with start-up information and fine-tuning as needed.



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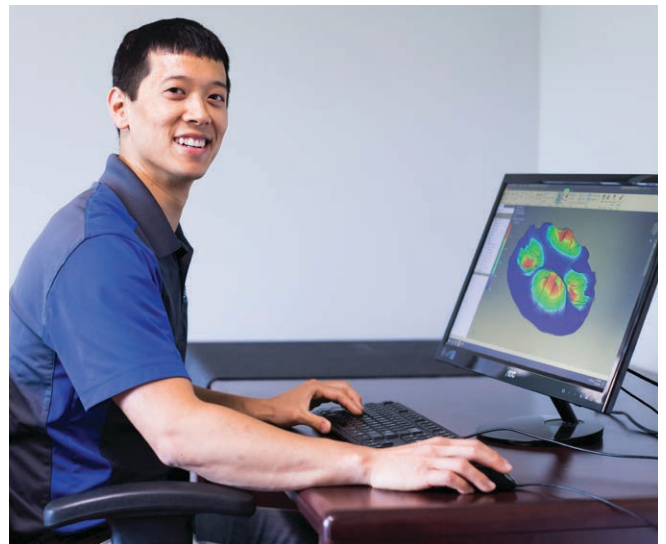


Made in the  
**USA**

Equilibar's quality system is  
**ISO 9001:2015** certified.



Each application is reviewed by our engineering team to ensure quality performance of our products.



Our engineers offer custom designed solutions for the most difficult pressure control challenges. Feel free to contact us to discuss your situation.