

Humphrey's custom valve assembly enabled customer to provide critical pressure monitoring when delivering CO₂ - O₂ mixture to patients suffering from toxic gas or smoke inhalation.

- ❶ CO₂ and O₂ out to blender valve
- ❷ Humphrey 2-way N.C. 310 Pilot Operated valve provided optimal hysteresis control to ensure fast action
- ❸ Spring Loaded pneumatic actuator with adjustable spring
- ❹ CO₂ and O₂ Inputs

Custom Valve Assembly Solved Critical Problem

Allowing Customer to Offer New Product to Emergency Medical Technology Market



MEDICAL
SIC:3841

THE CUSTOMER'S PRODUCT

- The customer, a major manufacturer of respiratory care and critical care products, wanted to introduce a portable rebreather for emergency medical treatment of victims of toxic gas or smoke inhalation.
- The device utilized a control assembly to supply CO₂ and O₂ to a separate mixture valve, and then delivered to the patient.
- Utilizing proprietary technology, this equipment would open up a new market potential if it could meet critical design requirements beyond the company's core competency.

THE REQUIREMENTS

- Design a valve assembly that would operate at 30-40 psi, with ON/OFF capability no greater than ± 3 psi.
- Leakage to be no greater than 1.9 cm³/hour.
- Create an assembly that would meet specific size and weight requirements for portability.

THE HUMPHREY ENGINEERED SOLUTION

- Humphrey pilot-operated 310 Valves with short stroke solved the hysteresis challenge, enabling the device to precisely meter gas flow and respond quickly to any variations in pressure.
- The valves in normal operation allowed delivery of the two supply gases to the mixing valve. If oxygen pressure dropped below a present level, the two valves switched, causing delivery of pure oxygen to the patient while sounding a horn to warn of the low oxygen level.
- Adjustable, spring-loaded, single-action pneumatic actuators controlled activation of the two 310 valves.
- The manifold assembly was supplied with all pressure gauges, control switches, filters, regulators and check valves.
- Entire unit was assembled and 100% tested at Humphrey.

THE SOLUTION

The Engineered Solutions team approach began with a Humphrey engineer working directly with the customer's engineering department to identify all the requirements and opportunities to improve the product. In this case, the customer had developed a design for a new emergency respiratory device, but identified both size and valve response time as critical.

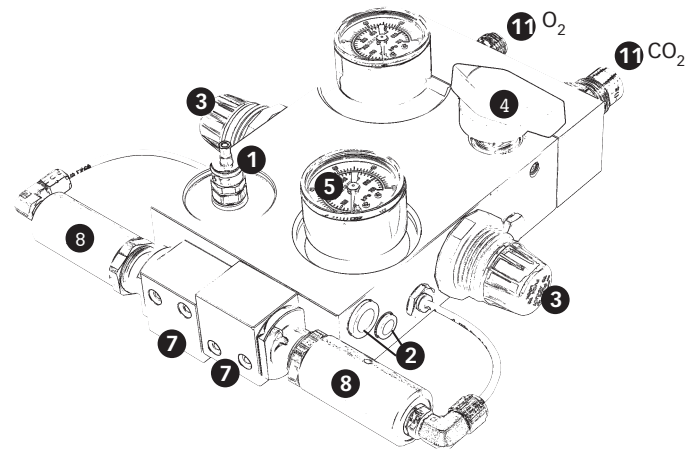
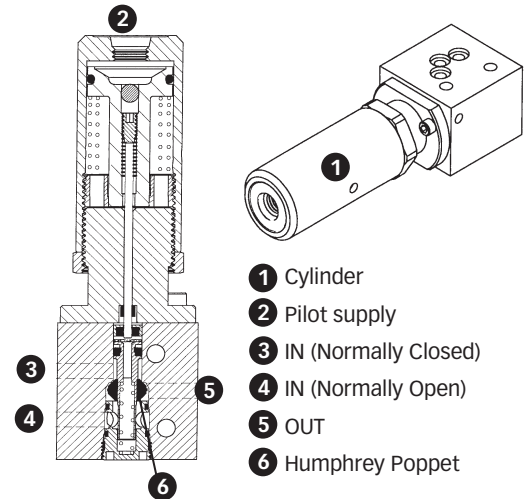
Utilizing Humphrey 310 valves that were activated by a spring-loaded cylinder, Humphrey was able to provide the customer with a fast-acting valve that met the requirements for an exceptionally low leak rate and responsiveness down to ± 3 psi. Humphrey then designed a highly compact manifold that incorporated all the necessary components, including flow control valves and regulators, filters and check valves. A key aspect of this new device was the redundant low pressure warning system. Utilizing both a check valve and an actuated 310 valve, any out-of-spec pressure variation would automatically sound an audible warning to alert medical personnel.

THE PROCESS

The customer was a world leader in respiratory technology and had established its core competency as a designer of innovative equipment. While they had designed the new system, its functionality and size presented a barrier to further development. This is when they contacted Humphrey for help in developing a finished product that would meet the critical requirements and specifications.

Addressing functionality, the Engineered Solutions team identified valve hysteresis as the key to improved response time and, consequently, critical pressure maintenance. Humphrey presented a solution utilizing its 310 short stroke valve, piloted by an pneumatic actuator. Used in pairs, one cylinder would isolate the CO₂ supply, while the other would provide pure O₂ to the patient along with a critical warning signal to an air horn in the event the gas supply dropped below the required pressure.

To enable the customer to meet the device's target size, Humphrey developed a custom manifold that incorporated a manual needle valve flow control, regulators, gauges, shutoff valves, filters and check valves. One of the check valves was designed as a redundant low-pressure warning device, sending a signal to an air horn with a fixed orifice. The Humphrey manifold, together with the company's mixer valve, met the desired size requirements for portability.



- 1 Manual Needle Valve controls CO₂ flow to blender (knob not shown)
- 2 CO₂ and O₂ out to blender valve
- 3 Blender valve regulator
- 4 Manual On/Off
- 5 Pressure Gauges
- 6 Air Horn with fixed orifice (signals low pressure condition) (not shown)
- 7 Humphrey 2-way N.C. 310 Pilot Operated valve provided optimal hysteresis control to ensure fast action.
- 8 Spring Loaded pneumatic actuator with adjustable spring
- 9 Internal filters (not shown)
- 10 Internal Check Valves provide redundant low pressure warning for either CO₂ or O₂ (not shown)
- 11 CO₂ and O₂ Inputs

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Humphrey Products Company • P.O. Box 2008 • Kalamazoo, MI 49003 USA • T.269.381.5500 • F.269.381.4113 • www.humphrey-products.com