



Humphrey's twin custom valve assemblies control the operation of an implantable heart pump known as a Ventricular Assist Device (VAD). The customer's mobile VAD provides a long-term solution for patients awaiting a heart transplant, and to speed their recovery.

- ❶ Custom valve assembly controls pressure cycle to implanted heart pump.
- ❷ Custom valve assembly controls vacuum cycle to implanted heart pump.
- ❸ Highly reliable Humphrey 320 valve exceeded 175 million cycles.
- ❹ Unique shape designed to be easily retrofitted into existing equipment package.



Highly Reliable Custom Valve Manifold System

For Critical Medical Device



MEDICAL
SIC:3841

THE CUSTOMER'S PRODUCT

- The customer designs and manufactures a range of Ventricular Assist Devices used to supply additional pumping action to either the left ventricle or both left and right ventricles of the heart.
- The particular VAD model was a portable device that gives patients a high degree of personal mobility.
- The customer was experiencing a serious reliability problem with its previous supplier's valves, necessitating excessive replacement costs.

THE REQUIREMENTS

- Provide a custom valve manifold system with a minimum 30 million cycle MTBF rate.
- Meet critical performance specifications, including pressure range from -6 PSIG to + 6 PSIG and a maximum leak rate of 4CCM @ 100 PSIG.
- The valve manifold body must fit inside existing equipment housing and be easily installed.
- Design time was critical.

THE HUMPHREY ENGINEERED SOLUTION

- Humphrey utilized the 320 valve as the basis for both valve modules.
- In customer tests the 320 valve was determined capable of reaching 175 million cycles without failure.
- Valve module was designed with a unique configuration to allow it to fit easily into the customer's unit.

THE SOLUTION

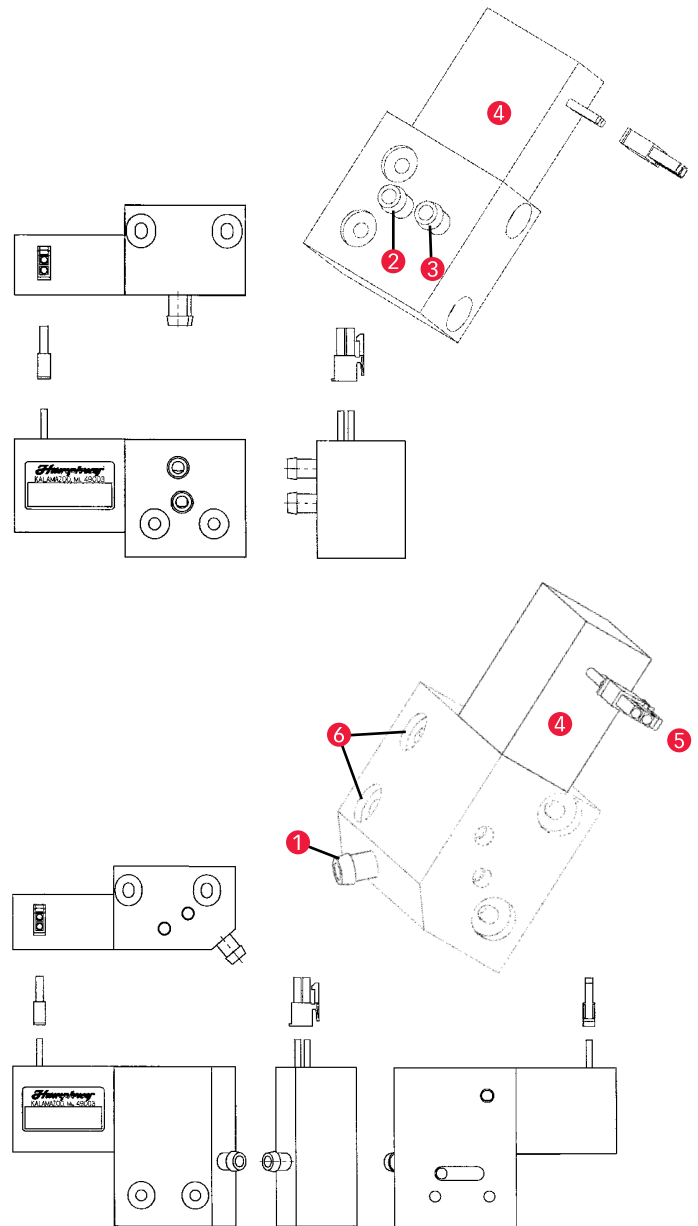
Having been aware of Humphrey's work in other medical applications, the customer immediately saw the benefits of the Engineered Solutions approach. A Humphrey engineering team was assigned to work directly with the customer's engineering department, and together they identified the opportunities to improve product reliability and reduce the costs associated with retrofitting the new valve modules.

Humphrey exceeded the customer's specifications for reliability with a MTBF cycle rate over 2-1/2 times the customer's requirements. The physical design was completely compatible with its existing equipment, and the low current consumption of the valve module would prove to conserve battery life.

THE PROCESS

The Humphrey Engineered Solutions team began with the customer's request to provide a complete assembly that would provide greatly improved reliability. Humphrey supplied a prototype with the 320 valve for life cycle testing. At 175 million cycles without failure, the customer approved the design.

Next, Humphrey designed a custom manifold for both the pressure and vacuum control valves, each having a unique shape dictated by the original layout inside the customer's instrument, which also contained the controller, compressor and the vacuum pump. Due to the critical nature of the customer's equipment, Humphrey accelerated the development process, delivering functioning products in an exceptionally short period of time.



- ① Supply (1/4" I.D. barb connection)
- ② Pressure (out to heart pump)
- ③ Vacuum (out to heart pump)
- ④ Solenoid
- ⑤ Electrical connections
- ⑥ Mounting holes

Humphrey