A medical ventilator (see Figure 1) is designed to move a mixture of air and oxygen from separate sources into and out of a patient’s lungs to either assist in breathing, or, in some cases, mechanically breathe for a patient who is breathing insufficiently or is physically unable to breathe.

Each ventilator has an exhalation valve which allows exhaled gases to escape into the atmosphere and prevents them from being rebreathed by the patient. If condensation pools at the exhalation valve, the airflow measurement at this location may be skewed, resulting in the ventilator delivering an incorrect amount of air to the patient.

Airflow in medical ventilator exhalation valves is usually sensed by a hot wire anemometer rather than by a mass airflow sensor because a hot wire anemometer can tolerate fluids in the airstream.

A hot wire anemometer uses a very fine metal wire that is electrically heated up to a temperature above the ambient. Air flowing past the wire cools the wire. Because the electrical resistance of most metals is dependent upon the temperature of the metal, a relationship is obtained between the resistance of the wire and the airflow speed. The ventilator uses the resulting measurement to adjust the ingoing airflow to the patient. Condensation may cause the hot wire anemometer to become less accurate, changing the ventilator airflow to the patient.

**SOLUTION**

A Honeywell flexible heater was customized to fit inside the ventilator exhalation valve cover (see Figure 2). The flexible heater is on continuously when the ventilator is powered up, keeping the exhalation cover and valve warm. This dries the condensation that pools at the exhalation valve, eliminating the undesired results of skewed airflow sensing.

**Benefits to the patient/hospital:**
- Accurate airflow measurement at the exhalation valve helps ensure that the correct airflow is being delivered to the patient, promoting improved patient care.
- Removable exhalation valve cover allows exhalation valve to be sterilized and reused.

**Figure 2. Exhalation Valve Cover (Inside) and Benefits to the Exhalation Valve Cover/Ventilator Manufacturer**

- **Custom color:** The silicon color of the flexible heater was matched to the exhalation valve color so that it matched the rest of the ventilator. This example uses silicone, but could also use Kapton®.
- **Custom connector:** The connector was customized to interface with the mating connector on the customer’s ventilator.
- **Custom lead wire exit location:** The power harness was customized to specific customer requirements. This example has a round cable that terminates with a custom connector.
- **Custom geometry:** Honeywell cut a flexible heater pattern to fit precisely within the exhalation valve cover. This can be done on any kind of assembly.
- **Custom technical specifications:** Met application customer electrical and environmental characteristics.
- **Custom multiple wattage zones:** Provide uniform heat around multiple exhalation valve cover components.
- **Custom manufacturing:** Honeywell vulcanized the flexible heater to the exhalation valve cover in its factory and shipped the whole assembly to the customer.
- **Flexible heater is easy to field retrofit as well as to integrate on new ventilators.**
Total Thermal Management Solution for Ventilator Condensation Applications

**WARNING**

**PERSONAL INJURY**

DO NOT USE these products as safety or emergency stop devices or in any other application where failure of the product could result in personal injury. **Failure to comply with these instructions could result in death or serious injury.**

**WARNING**

**MISUSE OF DOCUMENTATION**

- The information presented in this technical note is for reference only. DO NOT USE this document as a product installation guide.
- Complete installation, operation, and maintenance information is provided in the instructions supplied with each product. **Failure to comply with these instructions could result in death or serious injury.**

**WARRANTY/REMEDY**

Honeywell warrants goods of its manufacture as being free of defective materials and faulty workmanship. Honeywell’s standard product warranty applies unless agreed to otherwise by Honeywell in writing; please refer to your order acknowledgment or consult your local sales office for specific warranty details. If warranted goods are returned to Honeywell during the period of coverage, Honeywell will repair or replace, at its option, without charge those items it finds defective. **The foregoing is buyer’s sole remedy and is in lieu of all other warranties, expressed or implied, including those of merchantability and fitness for a particular purpose. In no event shall Honeywell be liable for consequential, special, or indirect damages.**

While we provide application assistance personally, through our literature and the Honeywell web site, it is up to the customer to determine the suitability of the product in the application.

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Honeywell serves its customers through a worldwide network of sales offices, representatives and distributors. For application assistance, current specifications, pricing or name of the nearest Authorized Distributor, contact your local sales office or:

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