Thermal Gas Mass Flow Meters and Controllers in Medical Gas Consumption and Allocation Applications

A Technical White Paper

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Flow meters and controllers are used in a wide variety of medical applications. Many of these applications have requirements that are dictated by the FDA. Others are purely based on medical facilities need to improve plant and process efficiencies to save money or lower costs. Of these two categories, the first requires you to "just do what the rules say" and the second is a proactive stance because "it just makes good economic sense". For those medical facilities in the latter category, there is probably no more compelling an economic case for installing a Vogtlin mass flow meter or controller than for monitoring medical gas systems.

Payback

A Vogtlin flow meter/controller can be installed to monitor for normal baseline usage, then spikes or increases in usage that are likely caused by leaks can be easily identified. The payback period for implementing such a medical gas monitoring system is usually measured in weeks - rather than years. In fact, most material management directors don't realize that it isn't always necessary to make a major capital investment to reap an almost immediate return. Identifying and repairing leaks in medical gas systems usually provides a very fast, and dramatic return. Incorrect manifold design for medical gases is another factor that drives up operational costs since systems run best when properly isolating gases and accurately blending percentages for the gas mix. Manifold's don't always solve gas control issues in operating rooms, research laboratories, pharmaceutical labs, individual hospital rooms and ancillary medical complexes. In the case of one Kentucky-based hospital, the estimated gas savings, plus the gains from lower systems maintenance, and monitoring gas usage by using thermal gas mass flowmeters and controllers resulted in a substantial savings annually. And this was just one hospital.

Medical Air Isn't Free

The problem is that many medical facility personnel don't quite understand that there is a cost associated with medical air usage. The term medical air, in fact comes from a specific compressed air system. In fact, it is an expensive utility in most cases. In 1995, the Department of Energy (DOE) instituted the "Compressed Air Challenge". The goal was to help industry reduce usage by 10% by 2010. The DOE pointed out that medical compressed air is one of the costliest plant utilities - and that 30% of all air produced in the US is lost to leaks. At the conclusion of the study, the DOE estimated the annual loss to be around $3.2 billion.

Q: Why are Medical gases so Costly?

It is both expensive to produce and inefficient to use. The annual operating costs of a cryogenic supplier of medical gases is tremendous. Cylinder filling, Dewar's, Micro-Bulk, Bulk filling and on site management from cryogenic operations through the vaporizer and into the gas systems

is very costly and time consuming. Many suppliers use just in time inventory management software and wireless communications to control delivery, but outdated measurement and control technologies within many medical institutions leave great room for improvement of medical gas consumption and allocation due to fluctuations between pressure & temperatures systemwide. **Just 1-psig fluctuation within a system is enough to start a chain of events in incorrect billing systemwide to incorrect supply to the end user, causing a hysteresis within a critical medical system.** Manual regulators typically operate with a needle valve and twist knob to increase or decrease the volume of gas necessary for the application. Improper control of these systems results in incorrect usage, and improper allocation of departmental billing. Furthermore, of the initial energy required to produce medical air, less than 20% will be left for performing useful work. Think about it: 80% of the total energy required is gone even before any medical air enters the distribution system.

Wasteful Habits

While medical system design and compressor efficiency are important factors to consider regarding system efficiencies, there are two other major factors: misuse and leaks. Many plant personnel, working under the assumption that "regulators are accurate", often waste and misuse it. Medical gas leaks are often ignored. It is not uncommon to walk through a medical facility where the telltale "hissing sound" associated with gas leaks is considered "background noise". Plant operators may misunderstand the inefficiency and cost associated with medical air. Common wasteful practices include medical air tools being left on while performing additional tasks.

Medical Gas Applications

Leaks can be found in virtually every plant's medical gas and compressed air system. Worn out piping and tubing, poor maintenance, wrong hoses/connections and incorrect settings on valves and controllers are just some of the major causes for costly leaks. The question is this: just how severe will the losses be? Many hospitals report annual losses to be significant. The chart below is an example of how costly these leaks can be. While these numbers relate to one leak, imagine the cost of multiple leaks in a given system. Since about 30% of all medical gases are lost to leaks, reducing this figure will likely be the single most important energy saving activity any hospital can undertake. A recent EU study showed that minimizing medical gas far surpassed other technologies like installing variable speed drives in terms of the overall impact on energy savings.

		Gas Leak Cost		
Leak DIA	Gas Loss CFM	CFM Loss/day	$Loss/day	$Loss/year
1/32	1.60	2,304	$0.51	$186.00
1/16	6.45	9,288	$2.04	$744.00
1/8	25.80	37,152	$8.17	$2,981.00
1/4	103.20	148,608	$32.68	$11,928.00
3/8	234.00	336,960	$74.13	$27,036.00

Note: Based on 100psi, $0.22/MCF, 8760 hours/year
Source: Department of Energy

Vogtlin Flow Meters and Controllers Monitor System Usage

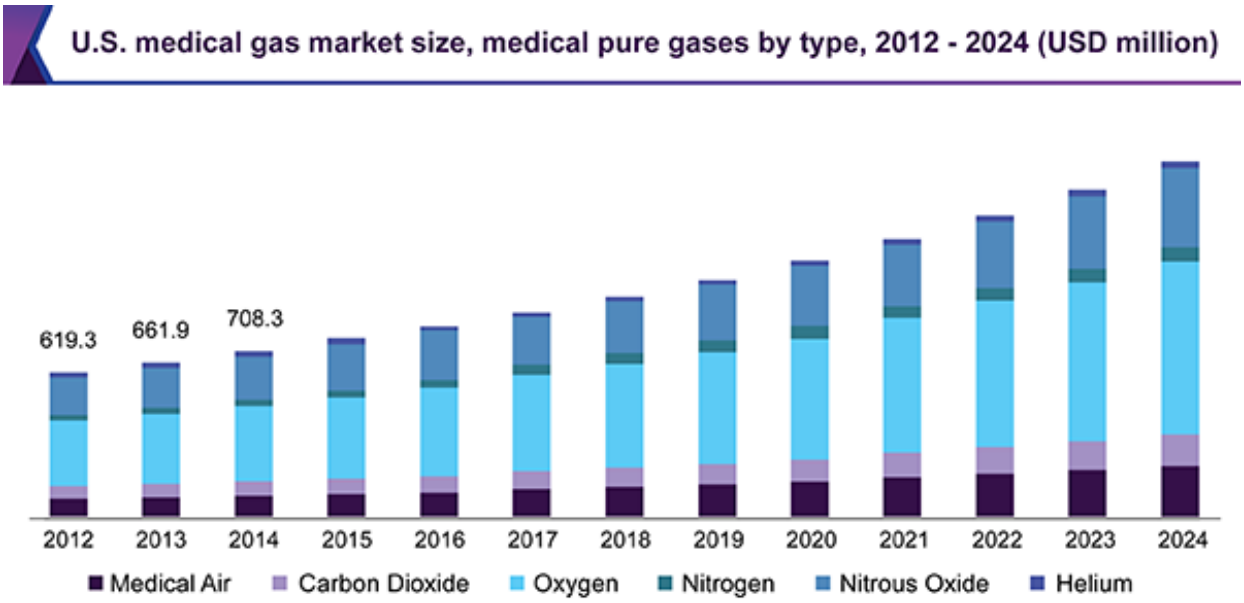
Your first step towards reducing costs is to install Vogtlin flow meters and controllers on each medical gas (usually done upon commissioning). The flow data captured by Vogtlin Flow Meters and Controllers provide an indication of where savings are possible at the department level - and how much is possible across the entire medical facility. They do this by providing an overall baseline of medical gas usage of each individual gas for each medical facility activity. Any deviation from this baseline - without a corresponding change in activity - would tend to suggest a system leak. After leaks are identified and repaired, a new baseline can then be determined. One material management director in a Florida facility reported an immediate payback on his mass flow meters & controllers when they helped him identify gas flow in piping leading to a decommissioned section of his medical facility. "After installing the flow meters/controllers, we discovered a substantial variation in the readings on particular lines and overall gas consumption. The source of the anomaly was quickly identified and corrected, resulting in significant gas savings." Multiple Medical gas cylinders and medical air leaks can also cause a drop in overall system pressure. This can cause equipment to cycle more frequently, increasing maintenance costs and facility downtime. Using flow meters and controllers to monitor multiple lines helps operators optimize loading.

The Next Step

Getting a handle on waste can also be remedied with a survey - and the technology of choice is a battery operated Vogtlin Mass Flow meter with built-in regulator. These instruments are easily installed with compression fittings. The Award-Winning RED-Y Compact 2 series is multi-directional in nature, makes it relatively easy to locate in the system & identify the leak source. Later, the survey report should list all identifiable leaks by location. It should also contain the reporting tools to calculate/demonstrate the potential cost savings from repairing these leaks.

Common applications within Medical Fields

- **Medical Centers:** Acute care, hospitals, surgery centers, emergency (EMS) and wound care
- **Life Sciences:** Pharmaceutical, biotech and life science R&D
- **Professional Practices:** Medical, dental and veterinarian
- **Long-term Care:** Nursing homes and home healthcare
- **Labs:** Analytical, commercial, life sciences and universities
- **Separated Invoicing:** for hospital/clinics/lab departments sharing the same source of medical gas
- **Leak Detection:** on gas lines, on safety vent and on medical gas source
- **Independent Gas Consumption Invoicing:** between the health departments with data acquisition



Bottom Line

Mass flow measurement, combined with regulators and controllers, is required to implement an ongoing leak and efficiency management program. As a Vogtlin Rep, we bring the mass flow expertise to the table and solve the issues within your medical gas and air system. We also recommend you should identify a medical gas supplier with expertise in your area to partner with to pinpoint better medical gas management. Teaming up with those in your area should be mutually beneficial. The above graph shows the U.S. medical gas market size, medical pure gases by type for the foreseeable future.

Vögtlin offers customized solutions for your gas supply from Battery-operated local gas meters and regulators, to central consumption measurement reported to PC's with LC-display.