

In focus...

Cylinder valves and regulators

By Anthony Wright

The inherent molecular nature of a pressurised and containerised gas implies that it is always looking to escape. Release of the compressed gas within a cylinder can be easily controlled and regulated by a valve and a regulator. Though the primary use of valves and regulators is to control the supply of a particular gas or gas mixture, they are also necessary to prevent gas escaping, potentially causing harm to workers and the environment.

The contrary is also true, high quality valves and regulators are designed to prevent exterior gases – which can cause contamination or even explosions – from entering the cylinder. This safety mechanism is vital for the range of industries which rely on valve technology.

Valves and regulators are used across a breadth of sectors including manufacturing and industry, medical gases, and other areas like specialty gas, fire and rescue, and special applications such as beverage gases and NOS valves for car racing. One area that has seen huge uptake over the past two years has been the medical oxygen industry. The Covid-19 pandemic has exposed pre-existing weaknesses in the medical oxygen supply chain across the globe, in addition to revealing the lack of infrastructure to support onsite oxygen generation plants in low and middle-income countries (LMICs) such as India, Nepal, and multiple African countries.

International oxygen relief efforts have been – and continue to be – undertaken worldwide, with hundreds of thousands of oxygen cylinders being delivered to hospitals and healthcare facilities in need. The importance of the valve and regulator cannot be understated; without a valve, the oxygen does not stay inside the cylinder and without the regulator, there is no way to administer oxygen to the patient.

Manufacturer of both input and outlet regulators for the medical gases sector, BNOS Meditech (Meditech), saw a ‘huge spike’ in demand in the UK and across all its global partners during the pandemic. “We also supplied cylinders and regulators to India during their second wave,” said George Buckenham, Sales Manager at Meditech. “We continue to see Covid-19 related demands globally, however this is not as high as during the first wave.”

Although its top sellers are the British, US and Scandinavian standard regulators, Buckenham revealed that recent sales have been trending towards the company’s German DIN spec regulators due to increased demand coming from Ukraine. The ongoing conflict between Russia and Ukraine has caused severe supply chain disruptions, leaving local hospitals unable to obtain regular medical oxygen deliveries.

The main applications for Meditech’s regulator technology ranges from EMS, hospital, dental, marine and offshore to industrial and armed forces. Commenting on the day-to-day demand, Buckenham revealed that EMS, hospitals and marine/offshore are key markets for the company. “However, we are seeing increased armed forces requirements at the moment,” he added.

To provide additional relief to the people of Ukraine, Meditech is also working with numerous stakeholders and private individuals to supply a range of its medical gas equipment including oxygen cylinders, valves, and regulators. The company is also running a Go Fund Me page and has donated a batch of equipment to the country.

General use trends and innovation

Often accelerated by the demands of customers, new ▶

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▶ innovations and solutions generally revolve around the ease of transport of cylinders and the benefits of digitisation. According to global leader in pressure and measurement equipment WIKA, customers are also asking for instruments with intuitive readings that make it simpler to read the pressure of the gas cylinder and how to best use this information.

Andrey Ruban, Global Segment Manager Industrial and Medical Gases at WIKA, revealed another key trend seen within the industry. It has focused on increasing the robustness of a cylinder regulator to prevent a gas leak if the cylinder should drop or fall over during transit or in-situ. "Placing a valve inside the guard can be a safety option for this scenario," he said. "One of the latest trends is usage of a 'pin' valve on a cylinder. This implies that the valve stays at the user site and can be mounted to a new cylinder during the cylinder exchange process." Becoming more common in beverage applications, Ruban said that a leading international gas major is promoting this type of 'pin' solution for IoT (Internet of Things) capable industrial applications.

To accelerate new advances within the PRD industry, innovations such as IoT and digitisation must take place. Various industrial gas specialists have integrated such 'smart' technology into new devices for a range of purposes including optimising use of oxygen cylinders at home and in the hospital and to allow for smart gas cylinder monitoring.

A specialist in the supply of valve gauges and sensors, WIKA's digital valve integration solutions include its Bourdon tube pressure gauge with an integrated sensor, labelled as the company's most advanced gauge to date. Utilising Industrial IoT (IIoT) technology, the device features an integrated sensor and a mechanical on-site display ranging from 0-400 bar.

"WIKA works with all the major valve manufacturers globally and has been part of many discussions revolving around digitisation and promoting its measuring solutions for valve integration," commented Ruban.

With digital solutions becoming more ubiquitous across the entire industrial gas sector, digitisation is set to be the next revolution in cylinder gas asset management and inventory control. Commenting on the role this burgeoning technology can play in the evolution of valves and regulators, gas expert Stephen B. Harrison of sbh4 Consulting stated that digitisation is penetrating gas cylinders and valves.

"As the costs of sensors, batteries and digital communication tumble and their functionality improves, the cost/benefit of putting tracking and pressure indication on gas cylinders is swinging in favour of mass implementation of digitalisation."

"It will be a win-win for the industrial gases suppliers and their customers," he added.

Industry will also be forced to adapt to the energy transition. With hydrogen technology becoming more commonplace, a manifested transition to the hydrogen economy will require solving the challenges of the hydrogen supply chain. "Trailers, cylinder bundles, single cylinders (and their manifolds), as well as gas supply systems intended for hydrogen require primary and secondary regulators," explained Ruban.

"Thus the risk of embrittlement and selection of appropriate material for gauges and sensors (as valve components) remains a top priority with regards to this gas. For hydrogen usage, WIKA recommends using stainless steel gauges on valves."

Future energy uses

As global industry looks towards meeting net zero emission targets and adopting alternative 'clean' energy and, given the much higher storage pressure required by hydrogen, appropriate technology must also evolve alongside. Hydrogen fuel cells rely on constant and stable pressure supplies as the effects of pressure spikes can be fatal to the fuel cell, creating a need for bespoke valves and regulators.

UK-based precision engineering firm Pressure Tech is helping drive forward future fuel technology. The company manufactures valves and regulators for various hydrogen-related applications, primarily fuel cells. The key for hydrogen regulators is the ability to reduce the gas, which is stored at very high pressures, to much lower levels before it reaches the final application.

Jack Samways, Business Development Manager for the Hydrogen Fuel Cell Market at Pressure Tech provided insight into the use of its regulators to handle hydrogen. "Forward reducing pressure regulators take higher pressures on the inlet side and reduce them down to appropriate levels on the outlet. It's crucial the regulator supplies stable outlet pressures, even under decaying inlet pressure conditions," he said.

The company achieves this using its lightweight LW351 regulator, which offers a low 0.15% decaying pressure effect over a single-stage pressure reduction, meeting the requirements of hydrogen fuel cells to experience constant and stable pressure supply.

This stable and continual gas supply is applied using its CV414-SC cylinder valve, which also helps minimise downtime at the point of refuelling, a key feature for minimising downtime for hydrogen fuel cell drones – the most common application seen by Pressure Tech for its valves and regulators.

"The valve has a quick and simple disconnect feature so if a cylinder refill is required, its low torque design allows users to easily remove the valve from the system to isolate the gas supply, even under high pressure, with the valve remaining attached to the gas cylinder," explained Samways. **GW**

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