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# Automation in compressed gases

By Ric Boyd, President of CryoVation, LLC

In 1986, with the rapid progression of computer technology, we felt there would be a market for automated filling of compressed gas cylinders. In the mid 1970s, as a young engineer, I had been involved in the development of an automated system for the re-testing of cylinders and it seemed only a natural progression to then automate the filling process.

With the help of a buddy from college, who built and programmed a 386 microprocessor, we had a working, temperature/pressure mode pure gas fill system. But by the time we were finished, hardware had already taken another giant step forward to faster, better technology. However, every improvement came with

large cost increases (for example, faster processors, colour monitors and different programme language).

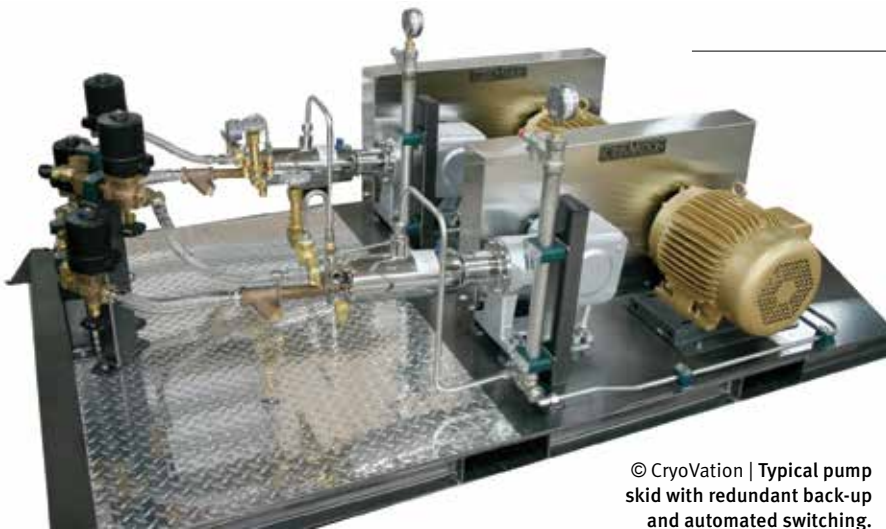
The barrier to entry into the market was the cost of the system (computer, automated valves, pressure and temperature devices, monitor) versus the payback. Labour was not 'cheap' but overheads were certainly a much lower cost than today. Most companies did not yet have desktop computers and were a few years from experiencing dial-up internet connectivity.

It's been almost 30 years and, of course, automated controls have become more widespread throughout our industry. As a younger generation, which grew up on computers and instant access

to information, moves into management it is becoming a 'given' that it only makes sense to automate versus paying someone to manually control their production.

Many of the advantages of automation were not initially realised until systems were utilised for a period of time that allowed reflection. These include:

- **Safety** – Programmed functions constantly monitor and make decisions that affect the safe operation of mechanical components (pumps, valves) and variables (temperature, pressure, purity)
- **Consistency** – An automated system is more likely to replicate a fill 'recipe' on a repeated basis
- **Training requirement** – The time and cost required to train a new employee to manually operate a complete system is much greater than the training to operate an automated system. The training becomes increasingly greater with the complexity of the product being produced ▶



© CryoVation | Typical pump skid with redundant back-up and automated switching.

- ▶ **Remote access** – Being able to remotely access information or make changes through telemetry or network connections. Being able to access daily ‘batch’ reporting also provides a management tool that goes beyond a written log.
- **Optimising equipment** – The heart of most compressed gas systems are pumps and compressors. With automated monitoring and control, these assets are less likely to require maintenance due to operator neglect (cavitation, seal leakage, start-up against high back-pressure). Automated speed control also improves pump life when the pump is only operated at the required, lower speed
- **Reduced product loss** – From accurately filling liquid or shutting off a pump that is not in immediate use, there are savings to be realised in most applications
- **Labour** – An obvious advantage for fill plant operations, but a very large advantage for ‘end-user’ systems that are automated to reduce gas/liquid deliveries and service calls.

I have seen a transition over the past several years, from automation being ‘for the large company’ to automation being considered for even the smaller company and the end-users. The relative price of

control components (Programmable Logic Controllers (PLC), monitoring devices and such like) continue to drop in price as competition, consolidation and overheads escalate. The savvy gas distributor is considering ways to reduce costs, while improving delivery and customer service. In an age where our television programing, cell phones, cars and home monitoring are remotely controlled and automated, it is expected that the workplace be no different.

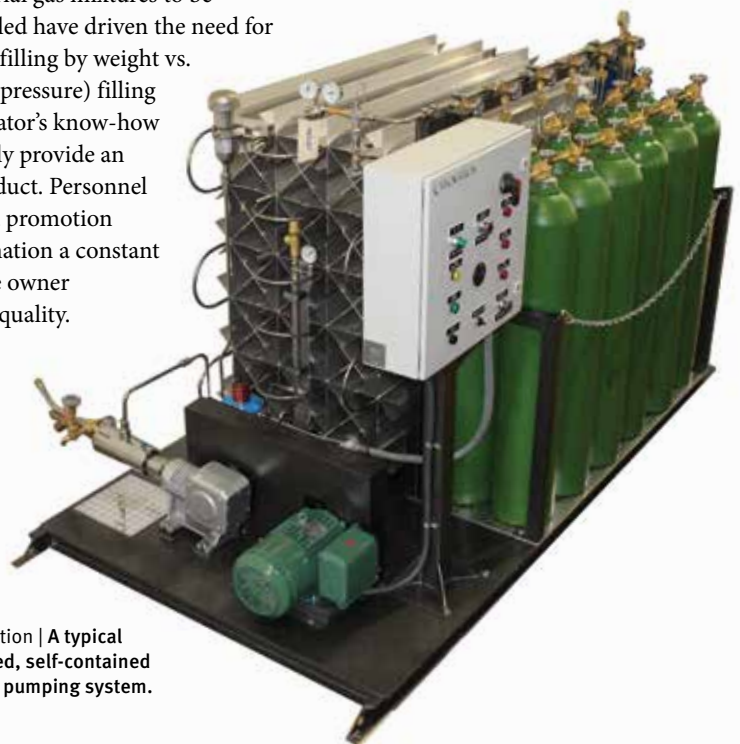
Gas applications also drive the need for automation. Today’s long ‘recipe’ list of industrial gas mixtures to be accurately filled have driven the need for gravimetric (filling by weight vs. temperature/pressure) filling and the operator’s know-how to consistently provide an accurate product. Personnel turnover and promotion makes automation a constant that gives the owner assurance of quality.

A sub-set of automation is the semi-automated control system. At a much reduced cost, many of the features of full automation may be realised without the full investment in complete automation. A PLC controlled semi-automated system will provide the operator with the assurance that the complete system

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is being accurately monitored (pump function, pressure, temperature), provide stored recipe data, audible and/or visual prompting and allow remote access.

Automation does not eliminate the need for support and maintenance. In fact, the automated system, due to increased complexity, requires better planning for spare parts, maintenance of ▶



© CryoVation | A typical automated, self-contained end-user pumping system.



© CryoVation | A typical fully automated and large volume end-user pumping system.

► key components and technical support. At higher production loads, the cost of downtime may be exponentially higher. An advance decision should be made whether to train in-house personnel, utilise the equipment manufacturer's technicians or use a qualified, local service provider. Consideration should be made as to the scope of spare parts that need to be stocked if the manufacturer does not maintain stock of certain items. And finally, if downtime must be minimalised, redundant components may be necessary, such as back-up cryogenic or vacuum pumps.

#### End-user automation

Controlling assets, product levels and gas/liquid control at customer locations (end-users) has greatly benefitted from automation. Telemetry systems, asset tracking programmes and PLC controlled gas distribution technology all combine to save costs while improving the knowledge of the customer's needs.

With the advent of 'mini' bulk and


PLC controls, it is feasible to automate even a smaller end-user application to provide a constant, uninterrupted supply of compressed gas without continually changing out cylinders. A small, skid-

**“...it is feasible to automate even a smaller end-user application to provide a constant supply of compressed gas without continually changing out cylinders”**

mounted system can provide the required pump, vaporiser and control components to maintain a gas supply 24/7.

As network and wireless technology have improved, it is easier to remotely monitor a customer's installation. Important data may include liquid level, high pressure storage pressure, pump function and vaporiser switching. Change requests no longer necessitate a service

call to the site (low and high pressure set points, or pump cool-down time, for example). Also, feedback from the system can provide immediate notification of any fault condition that may require rectification.

Although no-one knows where automated technology will take our industry over the next 20-30 years, it will surely allow us to do more with limited resources and better compete to grow our respective markets. 

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