

eV TEMPERATURE CONTROL SYSTEM PROVIDES PRECISE HEATING



GASGUARD® eV Temperature Control System.

Customer feedback, operating experience and evolving control technology have contributed to the development of the Versum Materials GASGUARD® eV Temperature Control System, designed to deliver state-of-the-art fabwide heat sourcing and control of electronic specialty gases requiring heating before delivery to the tool.

In comparison with current methods used to heat cylinders of ammonia, CO₂ and other gases, the eV Temperature Control System incorporates state-of-the-art over temperature protection, a single power feed, GFCI protection, integrated monitoring and control, and Class 1, Division 2 approval.

The fully certified, code-compliant eV model includes an electrochemical compression heater/controller and a gas cabinet with two blankets and two heat

traces to accommodate two A or B size cylinders. It also includes a GASGUARD AP11 controller, which provides integrated monitoring and control and offers a single power feed with optional dual power.

These improvements enhance the reliability and safety of gas heating systems and further lower the cost of ownership for semiconductor manufacturers, research and development organizations, universities, and others who use electronic specialty gases and chemicals.

Equally important, this latest heat control system is self-contained, which eliminates issues associated with, for example, remote locations for the blanket controller and other electrical components.

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1,000 CHEMGUARD® GEN III SYSTEMS SOLD

An Important Milestone for DS&S

An important milestone for the Versum Materials DS&S was realized recently with the sale and commissioning of the one-thousandth (1,000) CHEMGUARD® Gen III high-purity, liquid delivery system since its introduction in 2016.

The 1,000-plus units are now running in the latest high-volume semiconductor fabs globally with more than 200 molecules now approved for delivery.

Built on a legacy of more than 30 years of supplying advanced materials and delivery systems to the worldwide semiconductor and electronics industries, Versum Material's DS&S team continues to design

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CHEMGUARD® Gen III Chemical Delivery System.

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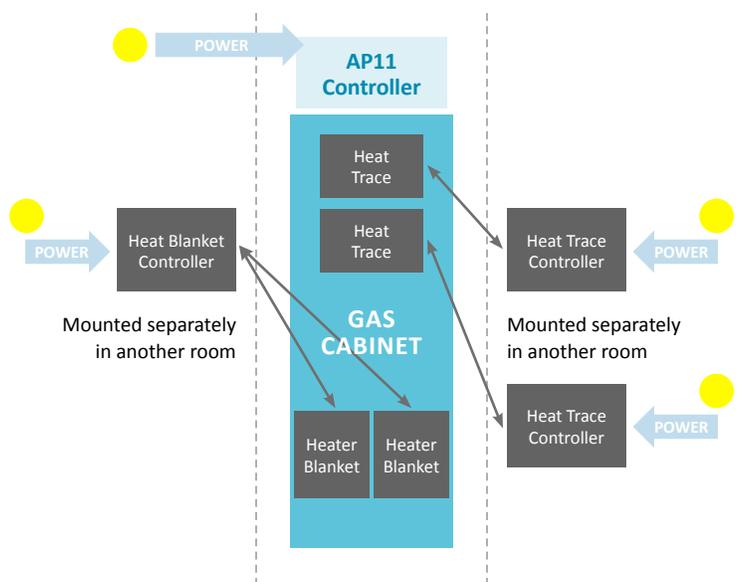
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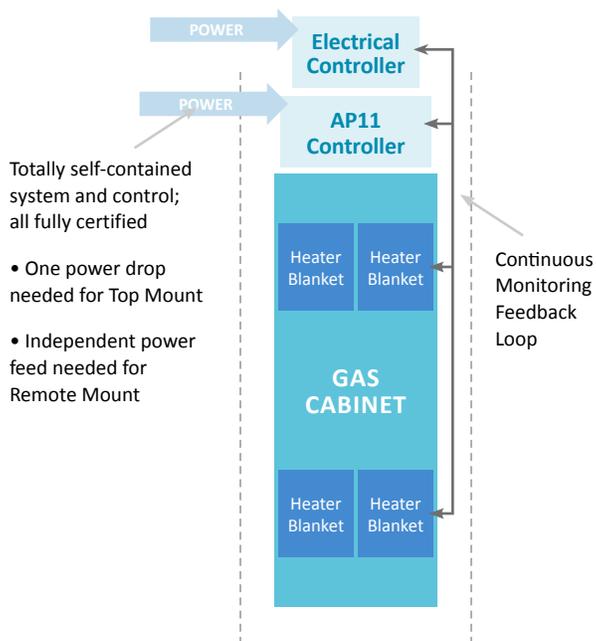
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eV TEMPERATURE CONTROL SYSTEM PROVIDES PRECISE HEATING (Continued from page 1)

Legacy System



GASGUARD eV Temperature Control System



A comparison of the two-zone GASGUARD® eV system with the Legacy offering.

eV Design Highlights

The design team that developed the Versum Materials eV Heating Temperature Control System addressed and solved several perceived issues with current heat sourcing:

- Liquefied compressed gases are hazardous and must be safely used. By increasing over temperature protection reliability, cylinders are protected against overheating. Safety redundancy is also built in.
- Rather than undergoing a “peaks and valleys” flow of heat, the eV system with its diversification of method provides very steady temperature and pressure to ensure uninterrupted gas flow. Oscillation is measured at less than a degree.
- The blanket is an innovation. Stronger, made from silicone rubber and now a single piece, it means faster cylinder changes. Heat trace components are included, and the blanket is wired into the system.
- By incorporating everything into a single cabinet and one location, issues that can result from dealing with remote equipment, such as blanket controllers, or miswiring of cable ends in two locations, are eliminated.

- Customers are freed from dealing with most power requirements and certifications, which means significant savings in installation costs. The pre-tested, skid-mounted eV system is virtually a single plug-in to a standard breaker. No holes must be drilled in the cabinet. Previously, there were five on-site power connections required of the end user. GFCI protection is now included, and the system is approved for shipment globally.
- The life span of the eV system has been extended, largely by the replacement of electromechanical switches with solid-state circuitry.
- Heat trace switches in current systems can only be reset by removing the cylinders. The new system allows all settings to be changed via the AP11 controller screen.

A Versum Materials engineering team is also finalizing the two-stage development of a self-contained bulk eV Temperature Control System that will accommodate two Y-cylinders. The team has designed and

produced a totally redesigned controller and is currently redesigning the system’s blankets.

This new bulk system that will be rolled out in 2019 will significantly increase the current flow limits for ammonia, which are 50 slpm with a 70°F set point and 100 slpm with a 100°F set point.

Additional Product Information

- GASGUARD EV TEMPERATURE CONTROL SYSTEM DATA SHEET (<http://bit.ly/2AfSGbG>)
- GASGUARD EV WHITEPAPER (<http://bit.ly/2P0lgTV>)



The GASGUARD® eV Temperature Control System provides very steady temperature and pressure, minimizing downtime.

VERSUM MATERIALS PARTICIPATES IN THREE SEMICON SHOWS



The Versum Materials team at SEMICON Taiwan emphasized ION-X sub-atmospheric dopant gas storage and delivery and CHEMGUARD® Gen III CG400NT automated chemical delivery systems.

Versum Materials wrapped up another successful year of participation in the annual SEMICON shows in Taiwan, Korea and China.

Versum Materials Global Marketing Communications Manager Carolyn Neilson (Carolyn.Neilson@versummaterials.com) said the company showcased its next-generation CMP slurries, ultra-thin dielectric and metal film precursors, formulated cleans and etching products and delivery equipment at all three venues.

Highlighted at Taiwan and China was the CHEMGUARD Gen III CG400NT automated chemical delivery system, featuring a reduced footprint to maximize floor space and reduce exhaust requirements and the ION-X sub-atmospheric dopant gas storage and delivery system for the safe storage and delivery of sub-atmospheric dopant gases such as arsine, phosphine and boron trifluoride. ION-X is a joint development of NuMat Technologies and Versum Materials.

At the Korea show, visitors had the opportunity to see two new pieces of equipment – the GasKeeper™ Intelligent Remote Controller and the Cylinder Automover Transport System. Both are manufactured at the Korean VMHYT facility, part of the DS&S group.

The GasKeeper adds Internet of Things (IoT) technology to control and monitor the VMHYT gas cabinet controller system via a mobile device and observe the inside of units with a closed circuit television or surveillance system.

The revolutionary robotic technology of the Cylinder Automover moves and positions heavyweight cylinders between storage areas and gas cabinets, using a joy stick control and a proprietary position-detecting system.

All three shows focused on the expanding smart manufacturing initiatives spreading throughout the semiconductor industry. The SEMICON Korea theme was most appropriate, “Smart Starts Here.”

Additional Product Information

- NEWS RELEASE (www.versummaterials.com/versum-materials-to-exhibit-at-semicon-taiwan)

1,000 CHEMGUARD® GEN III SYSTEMS SOLD (Continued from page 1)

and build safer, more reliable delivery equipment for high-purity gas and liquid distribution.

“The CHEMGUARD Gen III system has been very well received by Versum Materials major customers, especially with its built-in redundancies,” said Jeff Chung, DS&S Asia Sales Manager.

Said David Eshelman, CHEMGUARD Product Manager, “The CHEMGUARD product family was introduced in 1999 under the Schumacher brand. Our customers’ original requests for improved safety and uptime helped to create the CHEMGUARD systems.”

Eshelman further explained that those requirements still exist today, but with each node, the molecules and processes used have become much more technically challenging. “The specific needs of today’s

specialty, flammable or highly energetic molecules have been addressed by the unique CHEMGUARD Gen III model designs.”

Capitalizing on its materials and delivery systems expertise, Versum Materials recently created an experienced, multi-disciplined team to review new molecules as they ramp and gain market acceptance. The team evaluates the molecule safety and process needs and helps speed the time-to-market for new molecules and processes by having a delivery solution ready when technology ramps.

“When our team says ‘Go,’ we know that a molecule is CHEMGUARD-ready,” said Eshelman. “The next node is right around the corner. We want the market to know that the established CHEMGUARD system continues to advance to meet the demands of a changing marketplace.”



Additional Product Information

- CHEMGUARD GEN III CONTROLLER RETROFIT DATA SHEET (<http://bit.ly/2PO164F>)
- CHEMGUARD GEN III 500 DATA SHEET (<http://bit.ly/2zlnFU8>)
- CHEMGUARD GEN III 100 – 400 DATA SHEET (<http://bit.ly/2QhjOBd>)

CHEMGUARD® 350 SOLVES CHALLENGES

As the CHEMGUARD® product line continues to grow, it is tested with new safety and process challenges. This is usually driven by new molecules coming online in research and development and then later in high-volume manufacturing.

Recently a key tool OEM approached the Versum Materials DS&S group to provide a high-purity molecule delivery solution of a highly viscous new material. Once heated to the correct temperature window this viscous material flows as a liquid to the process tool. The OEM noted that this new process was expected to ramp quickly into manufacturing at a key end customer in Taiwan if successful.

The application called for 100 percent uptime so a dual tank liquid system (DTLR) was needed to ensure the tool maintained as close to a 100 percent uptime as possible.

Within a very short time, the DS&S Product Engineering team was able to use the new Versum Materials DS&S eV integrated heating technology developed for our GASGUARD gas cabinet product lines.

The eV system worked well with the CHEMGUARD liquid system and quickly gained the necessary third party certifications, including SEMI S2 that were needed for the CHEMGUARD system to be incorporated into standard production at the end customer.

The CHEMGUARD CG350 heats the molecule in a safe, process-stable manner and provides the reliable uptime needed for high-volume manufacturing. Both the process tool manufacturer and end semiconductor manufacturer were pleased with the results and continued to ramp up the new process.

RIGHT: The CHEMGUARD® family is more than just a piece of standalone equipment. It is designed to interface directly to most OEM tools.

BELOW: (CHEMGUARD® system components from left to right): BCD (200 liter), Liquid VMB, CHEMGUARD® Gas Delivery System, Process Tool.



Additional Product Information

- CHEMGUARD 350 DATA SHEET (<http://bit.ly/2zqvRm9>)



GASGUARD® AP11 CONTROLLER RELIABILITY



A technician collects data from two GASGUARD® cabinet AP 11 controllers, which are designed to keep the gas flowing.

The GASGUARD AP11 Controller has achieved more than 40 million operating hours with a reliability rating of 99.9994 percent from the company's more than 31,000 GASGUARD gas delivery cabinets and systems installed worldwide.

The AP11 controller is a continuously evolving technology platform for fab-wide gas delivery that emphasizes reliability, safety, customization and world-class support.

There have been seven generations of this controller in programmable logic controller- and microprocessor-based systems. It is built on a platform for ease of upgrades and modifications and features a touch-screen, human-machine interface, and is

compatible and interchangeable with other GASGUARD systems to provide a seamless transition for controller upgrades.

Any interruption of a semiconductor fab's production can cause downtime, which can be very costly. The GASGUARD AP11 controller was introduced in 2013 with a mission to "keep the gas flowing" in specialty gas delivery systems. The modular design of the controller delivers enhanced reliability, provides fast accessibility to data, simplifies troubleshooting and enables customization.

Safety and reliability are the foundation for GASGUARD AP11 controllers. Each is tested

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INDUSTRY BRIEFS

SEMI Worldwide Semiconductor Billings

Worldwide semiconductor manufacturing equipment billings reached US\$16.7 billion in the second quarter of 2018, one percent lower than the previous record quarter and 19 percent higher than the same quarter a year ago, SEMI, the global industry association representing the electronics manufacturing supply chain, reported.

The data are gathered jointly with the Semiconductor Equipment Association of Japan (SEAJ) from more than 95 global equipment companies that provide monthly data. The quarterly billings data by region in billions of U.S. dollars, quarter-over-quarter growth and year-over-year rates by region are as follows:

The Equipment Market Data Subscription (EMDS) from SEMI provides comprehensive market data for the global semiconductor equipment market SEMI connects more than 2,000 members and 1.3 million professionals.

Silicon Valley Reflects on its Roots

(Editor’s Note: The following story written by Rick Merritt appeared on [eetimes.com](#) on Aug. 17, 2018. Versum Materials operated for many years as a division of Air Products and Chemicals. Air Products traces its involvement with the global electronics industry back to the late 1960s, when it began serving customers in the Silicon Valley and Arizona with specialty gases and other products.)

“They gathered to listen to stories about how it all began here more than 50 years ago. They heard familiar anecdotes about William Shockley, the brilliant and eccentric co-inventor of the transistor. The work won him and two others a Nobel Prize and inspired him to set up Shockley Semiconductor Laboratory.

“The small company moved into a modest Quonset hut at 391 South San Antonio Road with the aim of learning how to design and make practical silicon components. Long since leveled, the site is now home to the sparkling glass business complex – still under construction – that hosted the gathering to dedicate a plaque marking its history.

SEMI WORLDWIDE SEMICONDUCTOR BILLINGS

	2Q2018	1Q2018	2Q2017	2Q18/1Q18 (Qtr.-over-Qtr.)	2Q18/1Q18 (Qtr.-over-Qtr.)
Korea	4.86	6.26	4.79	-22%	2%
China	3.79	2.64	2.51	44%	51%
Japan	2.28	2.13	1.55	7%	47%
Taiwan	2.19	2.27	2.76	-4%	-21%
North America	1.47	1.14	1.23	29%	20%
Europe	1.18	1.28	0.66	-7%	80%
Rest of World	0.96	1.27	0.62	-24%	56%
Total	16.74	16.99	14.11	-1%	19%

Source: SEMI (www.semi.org) and SEAJ, September 2018

“Shockley’s firm largely failed, but the people behind it went on, eventually forming 40 new companies, spawning Silicon Valley,” said James F. Gibbons, a Stanford engineering professor who worked briefly at Shockley Labs.

“Gibbons described Shockley’s 1948 patent on the bipolar junction transistor as ‘the most extraordinary use of imagination I have ever seen in a patent.’ Bell Labs didn’t actually file the patent for six months in part because ‘Shockley wasn’t sure he had a way to describe how to make it,’ he said.

“The inventor promised his investor, Arnold Beckman, that he would ‘collect the most creative team in the world for developing and producing transistors’ at the modest lab.

“One place [in which] Shockley lacked confidence was in people, so he had every



Versum Materials, formerly part of Air Products, began providing gases and services to Silicon Valley in the late 1960s.

candidate take IQ and personality tests,’ recalled Gibbons, who took the tests some time after a core team that included Robert Noyce and Gordon Moore, who later went on to found Intel Corp. ‘The results said that Moore and Noyce were very bright but [would] never be good managers,’ he recalled.”

GASGUARD AP11 CONTROLLER RELIABILITY

(Continued from page 4)

rigorously to industry standards using Highly Accelerated Life Testing (HALT), Failure Mode and Effects Analysis (FMEA) and third-party Nationally Recognized Testing Labs (NRTL) procedures.

The GASGUARD AP11 controller incorporates standard features that have proven critical to prevent disruption of gas supply. In the event of a fault, the controller’s Automatic Recovery System (ARS) keeps gas flowing while the issue

resolves itself within milliseconds. There are additional built-in redundancies and fail-safe valves. Safety systems cover UV/IR flame detection, venting, purging, shutdown and dual isolation valves.

Additional Product Information

- AP11 CUSTOM FACILITATION OPTIONS
GASGUARD OVERVIEW DATA SHEET
(<http://bit.ly/2DFubbg>)

HOW DO YOU SPELL SMART? INDUSTRY 4.0 AND THE FUTURE OF SEMICONDUCTOR MANUFACTURING



BY KERRY LANZA, DS&S PRODUCT MANAGER

Industry 4.0 is coming. It is the next major industrial revolution that will redefine manufacturing as we know it today. But what does Industry 4.0 bring to benefit an industry that already has highly advanced sophisticated manufacturing techniques?

A little about Industry 4.0

The concept of Industry 4.0 was first coined by the German government to describe the fourth industrial revolution enabled by new technologies like artificial intelligence (AI), big data, cloud computing and the Industrial Internet of Things (IIoT). The first industrial revolution was powered using steam and water power, the second using electricity and the third through computerization.

Industry 4.0 takes innovative developments that are available today and integrates them to produce a modern, smarter production model. It merges real and virtual worlds and is based on Cyber-physical Systems (CPS) and Cyber-physical Production Systems (CPPS).

A little about Smart Factories

James Moyne defines Smart Factories as an "Improvement in manufacturing operations through integration of systems, linking of physical and cyber capabilities, and taking advantage of information including leveraging the big data evolution." The term describes an environment where machinery and equipment can improve processes through automation and self-optimization. The benefits also extend beyond just the physical production of goods and into functions like planning, supply chain logistics, and even product development.

Yet, the core value of the smart factory still happens within the four walls of the plant. The structure of a smart factory can include a combination of production, information, and communication technologies, with the potential for integration across the entire manufacturing supply chain.

As the smart factory slowly emerges, the roles that people take on will evolve from what they are currently doing in today's factories. People will take on more complex roles while automation will conquer the tasks that are repeatable, mundane or currently impacted by labor shortage. Studies indicate that technology, overall, does not eliminate jobs. As factories get more technologically advanced, the number of indirect jobs needed to support them will increase proportionately. In turn, new suppliers in new industries will emerge, fueling the advancements from outside the smart factory.

Implications for Versum Materials

Versum Materials is addressing the key SEMI industry trends of: improving manufacturing efficiency as measured by productivity, quality and cost; optimizing capital through lost time reduction, process improvements, throughput, and back end automation; refining resource (labor) use and allocation; and the advancement of Industry 4.0 or "smart" factories.

Versum Material's Goal: assist customers in getting more productivity out of a facility while reducing cost of ownership, improving efficiency and maximizing asset utilization. For example, a "smarter gas cabinet" will improve the overall user experience by providing:

- Improved existing capabilities such as fault detection
- New capabilities such as predictive maintenance
- Data for high quality on-line manufacturing solutions
- Supply chain network management solutions (ordering systems or parts online for example)

Versum Materials is the leader in "smart" delivery systems.



Versum Materials continually tunes its gas cabinets to run "smarter."

We are just a click or a call away...

For more information, please contact DS&S Product Manager Kerry Lanza by email, Kerry.Lanza@versummaterials.com, or by phone at **610-778-5526**.

Visit our website, www.versummaterials.com. Contact DS&S globally at **+1-800-837-2724** or in Korea at **82-31-500-8200**. DS&S Tech Service can be reached globally at **866-624-7677**.

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