

## ***GASGUARD® Bulk Specialty Gas Supply (BSGS) Systems: Making the Best Better***

### ***The Leader in Electronic Spec Gas (ESG) Bulk Delivery***

Reliability through redundancy and customer-focused innovation are the driving forces in the evolution of Air Products' GASGUARD Bulk Specialty Gas Supply (BSGS) systems. We have established an exceptional record of safety and reliability for our state-of-the-art Type I (manual), Type II and Type III (automated) and Type IV (liquid delivery) BSGS systems. Product line uptimes exceed 99.995 percent including prototype models! The reliability enhancements result from FMEA analysis will greatly improve that number for future systems. New enhancements include upgraded electronics and component redundancies for Type I and II systems; a universal pigtail; and a new Y-cylinder blanket heater.

In addition, the company has introduced a new 20,000-lb. ISO container for ultra-high purity ammonia and other low vapor pressure liquid ESG for global distribution.

We understand the high cost of downtime to your facility and continue to update our BSGS system as well as other bulk delivery capabilities to help drive

down your cost of ownership. Since 1993 when Air Products pioneered the concept of high purity bulk ESG delivery, we have extended our leadership position in the delivery of bulk electronic specialty gases. We have sold more than 175 Bulk Specialty Gas Supply (BSGS) delivery systems at customer sites throughout the world.

Our installed BSGS base includes nearly 60 systems manufactured and sold by our Korean subsidiary, Hanyang Technology Co. Ltd., and our Japanese joint venture partner, Daido Air Products Electronics, Inc (DAP).

*This is a typical GASGUARD BSGS system installation at a major East Coast semiconductor manufacturing facility. Designed for the delivery of large product volumes, the cost benefits of our BSGS systems include savings of up to 50 percent on bulk purchases, improved gas quality, greater consistency, higher reliability and enhanced safety.*



*Designing in reliability through redundancy is a key focus of our BSGS systems. We understand how much downtime costs our customers.*



Air Products can offer you a complete portfolio of BSGS systems for ESG products amenable to bulk supply, all designed to help lower your cost of ownership. Every bulk gas delivery system is designed to help our global electronics customers meet increasing budget pressures, speed-to-market challenges and new applications, including 300-mm wafer production.

With the dramatic increase in bulk electronic specialty gas consumption in the fiber optic, flat panel and LED markets, plus heightened demand from epitaxial wafer manufacturers, 200-mm fabs and now 300-mm fabs, Air Products continues to drive new customer-focused innovations in this area, including our three latest upgrades.

*New Air Products' AP3 controller technology offers many operating advantages with our latest BSGS systems.*

## **System Electronics, Redundancy Upgrades**

Air Products is the market leader in manufacturing and supplying BSGS systems to the electronics industry. Offerings include our BSGS Type I (manual for inert gases), Type II (semi-automated for NH<sub>3</sub>, NF<sub>3</sub> and N<sub>2</sub>O), Type III (fully automated for HCl and Cl<sub>2</sub>) gas delivery systems and Type IV liquid TCS and SiCl<sub>4</sub> delivery systems.

We have extensively upgraded our Type I and Type II gas delivery systems with the latest electronics technology, including our own state-of-the-art AP3 controllers. They offer increased I/O, fault monitoring, graphical display and Ethernet-capable communication.

Air Products has also updated many other key components, as well as added redundant systems, including dual power supplies for the controller

and low voltage electronic circuits. Our latest BSGS delivery systems comply with NEMA 4 standards and are more robust for outdoor use.

## **New Universal Pigtail**

Our new universal pigtail for BSGS systems features active and reserve source container connections and the new AP3 controller technology that controls automatic purge, crossover and shutoff.

Previous Type I and II systems had only one controller. Multi-controller technology allows fabs to control everything at the source of the changeout. The AP3 controllers are networked with Ethernet so that if one fails, the other two will continue to deliver process gas. This redundant arrangement also means the source can be separated from the BSGS system, for example placed outside the fab at a remote location, saving valuable indoor space.

The new universal pigtail works for all source container types, Y-cylinders, tube trailers, drums, etc., which means BSGS systems now can accommodate growth without adding more equipment.

## **Y-Cylinder Blanket Heater**

Another significant BSGS system upgrade is our new Y-cylinder blanket heater, which provides a big advantage over our previous "top loading" heaters.

With our blanket heater, customers can keep our Y-cylinders on their original shipping skid and simply wrap the heater around the cylinder and insulation blanket on top. There is much less handling, which is critical to safety, since no lifting by crane is required. Customers don't have to worry about rotating the cylinder to orient the valve/dip tube.



*The economical Y-cylinder blanket heater installs easily and enables safer container handling.*



## BSGS Benefits Example:

Typical Benefits for NF <sub>3</sub>
<b>APCI has the largest NF<sub>3</sub> bulk package fleet and the largest installed Bulk Specialty Gas System base that features:</b>
• Over 70 ISO modules and 200 Y-cylinders
• Over 100 ISO units shipped out of Hometown, Pa. per year
• The largest BSGS market share globally
• The most experience in BSGS operations
• A four tube ISO module that is below OSHA PSM TQ (29 CFR 1910.119 App.A)

### New 20,000-lb. ISO Container

Our new 20,000-lb. ISO container for ammonia is the first big supply package designed to serve the growing compound semiconductor market. It primarily replaces 500-lb. Y-cylinders.

Safety is a key consideration. The supply option allows us to offer customers ultrahigh-purity ammonia via more efficient and cost-effective bulk distribution, minimizing the need to solely purify ammonia on-site and deal with potential problems and hazards. The container has several important safety features, recessed valves, redundant vapor valves and a liquid withdrawal valve. It also mates with our new universal pigtail.

The new 20,000-lb. ISO container can be used to ship other low vapor pressure ESG products like chlorine.

### Delivering Value

At Air Products, we know what the cost of failure can be. We understand what downtime can cost your fab. That's why our ongoing mission is to design and manufacture BSGS systems for both higher flow and lower flow applications that are safer, consistent, require less handling and improved margin for error.

We strive to maximize BSGS reliability by employing the latest techniques, including failure mode evaluation analysis (FMEA), and incorporating design elements such as dual flow trains and dual process regulators with each flow train.

We strive to deliver value in several ways:

- Implementing preferred offerings that are pre-configured with features based on historical trends.
- Designing offerings with the flexibility to tailor source and delivery systems to grow as your fab expands.
- Focusing on reliability in addition to quality and safety.
- Driving down your total cost of ownership.

### Strong Base of Experience

We are in a unique position to provide evolving, state-of-the-art BSGS systems. This is largely the result of continuous developments and patented technology for the supply of high-purity NH<sub>3</sub>, HCl, NF<sub>3</sub>, TCS, halocarbons and related products. Building on our expertise in bulk atmospheric and gas cabinet delivery systems, Air Products offers the latest advancements in regulators, monitoring, filtration and component design.

New advanced-design BSGS systems have been installed for a variety of applications ranging from epitaxy to device manufacturing to CVD chamber cleaning, fiber optics and LEDs.

BSGS systems have evolved to match ever-changing industry demands, for example, the transition from 200-mm to 300-mm wafers. In full-scale 300-mm factories, large volume gases such as NF<sub>3</sub>, N<sub>2</sub>O, NH<sub>3</sub>, SiH<sub>4</sub> and HCl are best-supplied using BSGS systems, especially those requiring a dedicated cabinet per tool (a recent October 2001 publication in *Solid State Technology* regarding BSGS role in 300-mm fabs can be obtained upon request).

*"We take great pride in having more bulk specialty gas experience in the global electronics market than all of our competitors combined. We now offer a more enhanced BSGS systems portfolio for all ESG products amenable to bulk supply."*

Robert W. Ford  
Bulk Specialty Gas Manager

*A new 20,000-lb. ISO container for ultra-high purity ammonia extends our bulk capabilities for the global compound semiconductor industry. It can also be used for transporting other low vapor pressure liquefied electronic specialty gases.*



Our systems have been installed outdoors at customer sites in a variety of climates, from the cold of Minnesota to the heat of Southeast Asia. Their outstanding performance is a reflection of Air Products' knowledge of customer requirements and our ability to deliver exceptional process gas system reliability and safety.

We can make you life easier, too, because we also operate more than 75 percent of our BSGS systems for customers. Such arrangements capitalize on the company's experience in working at customer sites and have numerous advantages,

- allowing you to concentrate on production and process technology
- minimizing initial capital outlay for bulk delivery systems
- enabling Air Products to assist in operating and maintaining BSGS systems.

At Air Products, our greatest concern is safety. Our success is reflected in our Number One ranking in the industrial gas and chemical industries. That philosophy permeates everything we do and BSGS systems are no exception.

### ***For more information***

This data sheet provides only a brief overview of our broad range of capabilities for bulk delivery of electronic specialty gases and our industry-leading BSGS delivery systems. If you would like more information, contact:

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*Air Products can provide turnkey  
BSGS solutions to electronics  
customer's needs.*

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