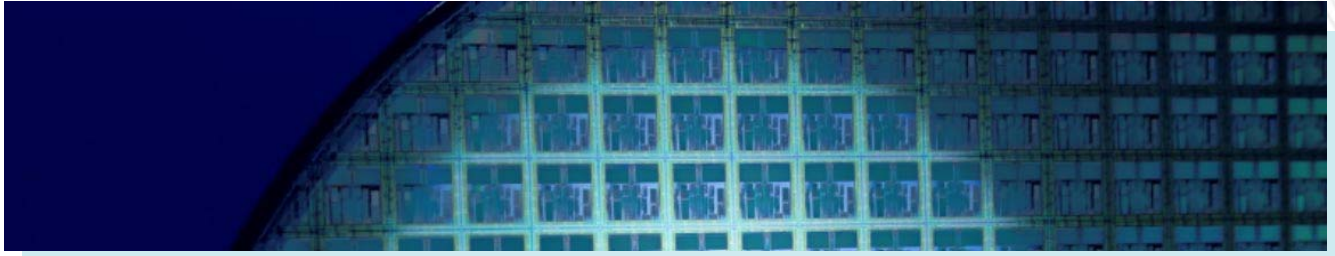


WHITE PAPER: IMPROVED RELIABILITY AND SAFETY IN A NEW STATE-OF-THE-ART FABWIDE HEAT SOURCING AND CONTROL SYSTEM



SAFETY AND RELIABILITY

Applicable to ammonia, CO₂, and other gases requiring heating before delivery to tool.

ABSTRACT

Customer feedback, operating experience and evolving control technology have contributed to the development of the Versum Materials GASGUARD® eV® Heat 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 Heat Control System is a self-contained system with state-of-the-art over-temperature protection, a single power feed, GFCI protection, integrated monitoring and control, and Class 1, Division 2 approval. These improvements are expected to 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.



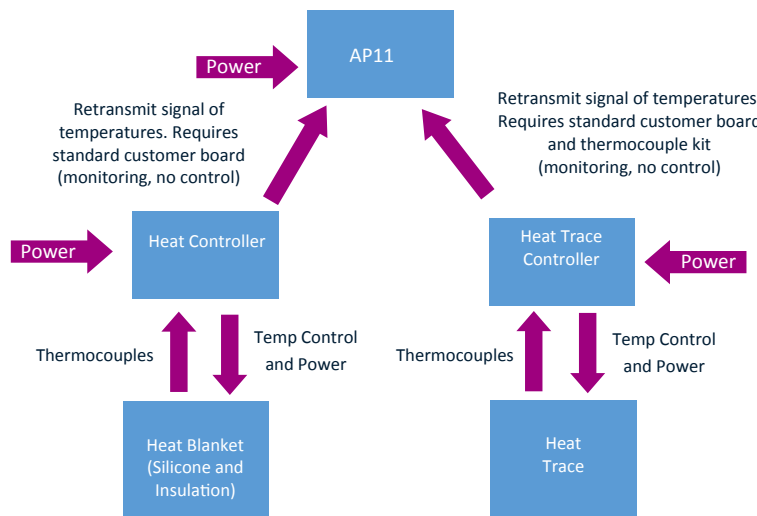
INTRODUCTION

About one-third of the gas cabinets in a fab have heat tracing; large fabs may have hundreds of such cabinets. Obviously, lowering the cost of ownership for equipment for heating certain electronic specialty gases is vital to semiconductor manufacturers, in addition to achieving enhanced reliability and safety.

Today's typical heat control systems, introduced in 1999, are similar to the GASGUARD Legacy Heat Trace System shown in Figure 3. While these systems continue to operate safely and reliably, there is room for improvement, especially in developing more customer-friendly features.



Fig. 3—GASGUARD Legacy Heat Trace System



The latest GASGUARD eV Heat Control System shown in the Figure 4 block diagram is a four-zone heat control application that incorporates several key improvements:

- Lower installation costs
- Over temperature protection reliability
- Integrated solid-state monitoring and control
- Stronger, single piece blanket.
- Single power feed
- GFCI protection
- Class 1, Division 2, ATEX, CE, CSA and other approvals

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.

SYSTEM OVERVIEW

This latest addition to the evolving GASGUARD delivery systems and equipment product line introduced by Air Products in 1983, includes a GASGUARD® AP11 controller, a GASGUARD AP1602 ECC heater/controller board and a gas cabinet with two blankets and two heat traces that can accommodate two A or B size cylinders with automatic crossover and automatic purge.

A second cabinet version is available that will accommodate three cylinders, the third being a purge cylinder that does not require heating.

The Versum Materials GASGUARD eV Heat Control System incorporates a newly redesigned heater blanket manufactured and supplied by Powerblanket®, Salt Lake City, Utah.

INDIVIDUAL COMPONENTS

AP11 Controller:

A key feature of the 8-inch high controller mounted on the top of the cabinet is its user-friendly 10.4" color touch screen for all data entry, i.e. set points, and for continuous heat trace monitoring, which helps ensure that any problems that do occur can be quickly addressed. (Figure 5)

The fully configured and fully automated modular AP11 controller displays more information for the eV heat control system, including its two heat trace and two blanket temperature readings and alarm set points. The controller's high-speed microprocessor means faster screen updates.

Other advantages of the state-of-the-art AP11 controller are solenoid management allowing uninterrupted gas supply while the controller is in service, simplified troubleshooting using smart indicators, its focus on reliable performance based on its design and testing processes, for example, HALT methodology and an optional Auto Recovery System (ARS) that provides a second microprocessor for redundancy and to enhance uptime.

Fig. 4—System Architecture

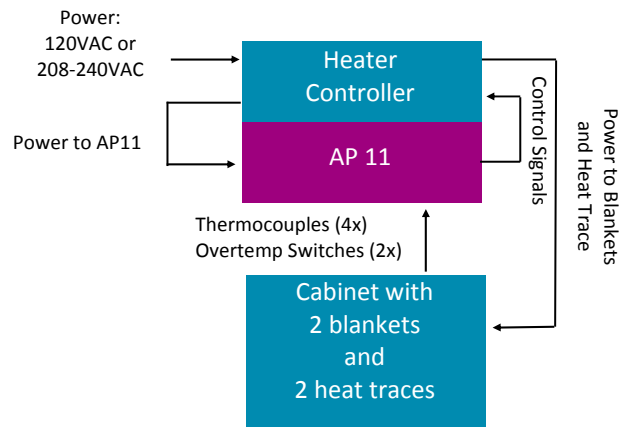


Fig. 5—AP11 Controller

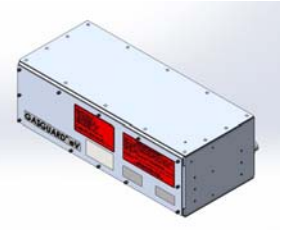


AP1602 Heater/Controller:

This specially designed heat control board is located inside of the AP11 controller is responsible for the integrated monitoring and control of temperature and protection against cylinder overheating. (Figure 6)



Fig. 6—Packaging



Blanket:

The nine-layer silicone rubber Power blanket has single-piece construction for both the heater and insulation, dual voltage (120V or 208-240V), and hardwired over temperature protection via redundant bimetallic switches for central and redundant thermocouples. A single blanket part number covers all A and B cylinders. (Figure 7)

Fig. 7—Blanket on Cylinder

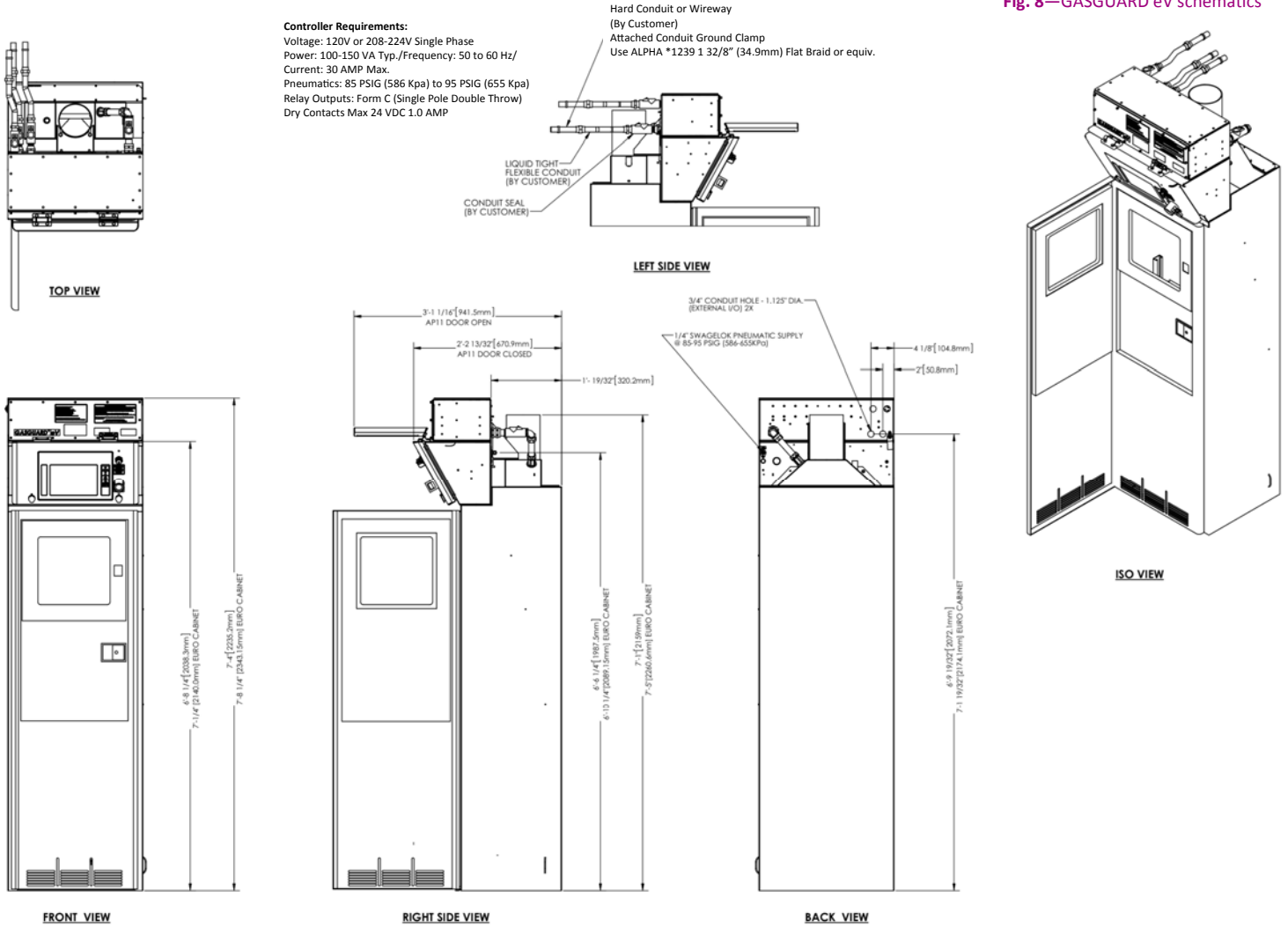


DESIGN HIGHLIGHTS

The design team that developed the Versum Materials eV Heating 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 considered to be 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 already 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 have to 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 Class 1, Division 2. It 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.

Fig. 8—GASGUARD eV schematics



SPECIFICATIONS

Size	2-Cyl: 92.1875"H x 24.125"W x 26.4375"D 3-Cyl: 92.1875"H x 38.125"W x 26.4375"D
Weight	2-Cyl: 425 lb. empty 3-Cyl: 525 lb. empty
Power	
Single Power Feed:	2-Cyl: 120 VAC, 12A, 50/60Hz, 3-wire or 3-Cyl: 208-240 VAC, 6A, 50/60Hz, 3-wire
Controller Powered Separate from Heaters (2-Cyl):	
Heaters	120 VAC, 11A, 50/60Hz, 3-wire
Controller	100-240 VAC @ 150 VA maximum, 50/60Hz, 3-wire or
Controller Powered Separate from Heaters (3-Cyl):	
Heaters	208-240 VAC, 6A, 50-60Hz, 3wire
Controller	100-240 VAC @ 150 VA maximum, 50/60 Hz, 3-wire

SUMMARY

As designed, and compared with currently available systems, the Versum Materials eV Heating Control System offers the best available technology for fabwide heat sourcing and control for ammonia, CO₂ and other specialty gases.

Among its many advances are improvements in reliability, safety, monitoring and control, over-temperature protection reliability, power requirements, installation costs and blanket design.

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