SPECIFICATIONS

OPERATING SPECIFICATIONS

The following are the operating specifications for the Heatpulse® 8108 system.

- **Wafer handling:** automatic serial processing, using standard cassettes.
- **Throughput:** Process dependent, approximately 80 wafers per hour (in a null cycle) without flat-finder.
- **Wafer sizes:** 5 inches, 6 inches, and 8 inches (standard).
- **Ramp-up rate:** Programmable, 1 - 180°C per second.
- **Steady-state duration:** 1 - 600 seconds per step.
- **Ramp-down rate:** Programmable, 1 - 180°C per second. Ramp-down rate is temperature and radiation dependent, maximum 150°C per second.
- **Recommended steady-state temperature range:** 400 - 1200°C.
- **ERP temperature accuracy:** +3°C to -7°C, when calibrated against an instrumented thermocouple wafer (ITC).
- **Temperature repeatability:** ± 3°C or better at 1150°C wafer to wafer. (Repetition specifications are based on a 100-wafer set.)
- **Temperature uniformity:** ± 5°C across an 8-inch wafer at 1150°C. (This is a 1-sigma deviation from 100-angstrom oxide uniformity.) For a titanium silicidation process, no more than 1.5 percent increase to uniformity during the first anneal at 650 - 700°C.

AG Associates Heatpulse 8108
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PHYSICAL DIMENSIONS

- **Width** — Monitor-Fab-Wall configurations: 40 in. (102 cm)
  Monitor-Side-Panel configurations: 60 in. (152 cm)
- **Depth** — 42 in. (107 cm)
- **Height** — 82 in. (208 cm)
- **Weight** — Monitor-Fab-Wall configurations: 1800 lbs (816 kg);
  Monitor-Side-Panel configurations: 1840 lbs (835 kg)
- **Shipping weight** — Monitor-Fab-Wall configurations: 2000 lbs (907 kg);
  Monitor-Side-Panel configurations: 2040 lbs (925 kg)

UTILITY REQUIREMENTS

Utility requirements include:

- **Power**
  - Standard Domestic: 208 VAC, 60 Hz; 125 A maximum; 3-phase plus ground and neutral
  - European: 400 VAC, 50 Hz; 90 A maximum; 3-phase plus ground and neutral
  - Japanese: 200 VAC, 50/60 Hz, 125 A maximum; 3-phase plus ground
- **Water Type (Recirculator)** — Refer to the *Heatpulse® 8108 Facilities Manual*.

FACILITY CONNECTIONS

The following table is a summary of the facility connections for the Heatpulse 8108 system:

Table A-1. *Facility Connections*

UTILITY	SERVICE SIZE	CONN. TYPE
Tube Cooling CDA or Utility N2 **Valve Actuation CDA or Utility N2**	1/2 inch 1/4 inch	Swagelok Swagelok
Cooling Water Supply **Cooling Water Return**	1/2 inch 1/2 inch	Swagelok Swagelok
Gas Box Exhaust	4-inch OD	Duct
Cooling Exhaust **Scavenger Hood Exhaust** **Containment Exhaust (Optional)** **OR** **Exhaust Manifold Outlet**	2-inch OD 2-inch OD 2-inch OD 3-inch OD	Duct Duct Duct Duct
Process Gas Exhaust (Scrubber)	3/8 inch	VCR, Male
Process Gas Supply	1/4 inch	VCR, Female
Recirculator Water Supply **Recirculator Water Return**	1/2 inch 1/2 inch	Swagelok Swagelok

UTILITY SPECIFICATIONS

The following table is a summary of the utility specifications for the Heatpulse 8108 system:

UTILITY	FLOW RATE			PRESSURE		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
CDA or Utility N2 (Cooling)	35 SCFM	40 SCFM	45 SCFM	80 psi	90 psi	100 psi
CDA or Utility N2 (Valve Act.)	<1 SCFM	<1 SCFM	<1 SCFM	80 psi	90 psi	100 psi
Cooling Water Supply	3 GPM	3.5 GPM	4 GPM	30 psi	40 psi	60 psi
Cooling Water Return	2.5 GPM	3 GPM	3.5 GPM	20 psi	30 psi	40 psi
Gas Box Exhaust	0 SCFM	100 SCFM	150 SCFM	.5" H_2O	.75" H_2O	--------
Cooling Exhaust	25 SCFM	30 SCFM	40 SCFM	.5" H_2O	.75" H_2O	--------
Scavenger Hood Exhaust	20 SCFM	25 SCFM	30 SCFM	.5" H_2O	.75" H_2O	--------
Containment Exhaust (Optional)	0 SCFM	0 SCFM	2 SCFM	.5" H_2O	.75" H_2O	--------
OR						
Exhaust Manifold Outlet	45 SCFM	55 SCFM	72 SCFM	.5" H_2O	.75" H_2O	--------
Process Gas Exhaust (Scrubber)	20 SCFM	20 SCFM	20 SCFM	1" H_2O	2" H_2O	2.5" H_2O
Process Gas Supply	20 SCFM	20 SCFM	20 SCFM	20 psi	30 psi	55 psi
Recirculator Water Supply	3 GPM	5 GPM	7 GPM	40 psi	50 psi	60 psi

AG Associates Heatpulse 8108
Rapid Thermal Annealing System

SYSTEM INTRODUCTION

OVERVIEW

The Heatpulse® 8108 system is a single-wafer, cassette-to-cassette rapid thermal processor, capable of processing in inert or corrosive ambients. The system is built for the production environment. It is housed in a compact, through-the-wall frame (which can also be installed stand-alone, if desired). Front views of the 8108 Heatpulse system are shown as follows: Figure 1:2-1a shows the Monitor-Fab-Wall-Mount configuration; Figure 1:2-1b shows the Monitor-Side-Panel-Mount configuration.

8108 system components include:

- Process chamber (also called the oven), containing two high-intensity tungsten halogen lamp arrays
- STD Bus for real-time operation
- Quartz isolation tube
- Robot and robot controller
- Gas control electronics
- ULPA filtration system
- Graphic User Interface (GUI) computer system

The 8108 contains a subsystem for each of the following:

- Electronics (including a dedicated microprocessor)
- Mass-flow-controlled gas handling
- Cooling
- ULPA filtration
- Mechanical assemblies

Software programs, called recipes, specify the details for each process. The system includes a 3-1/2-inch floppy disk drive for process recipe storage.

A three-axis industrial robot automates processing by transporting wafers into and out of the process chamber. It uses closed-loop feedback for precise motion control and accurate positioning.

To provide cold-wall processing, water is circulated through the process-chamber walls. The quartz isolation tube is cooled with nitrogen or compressed air.

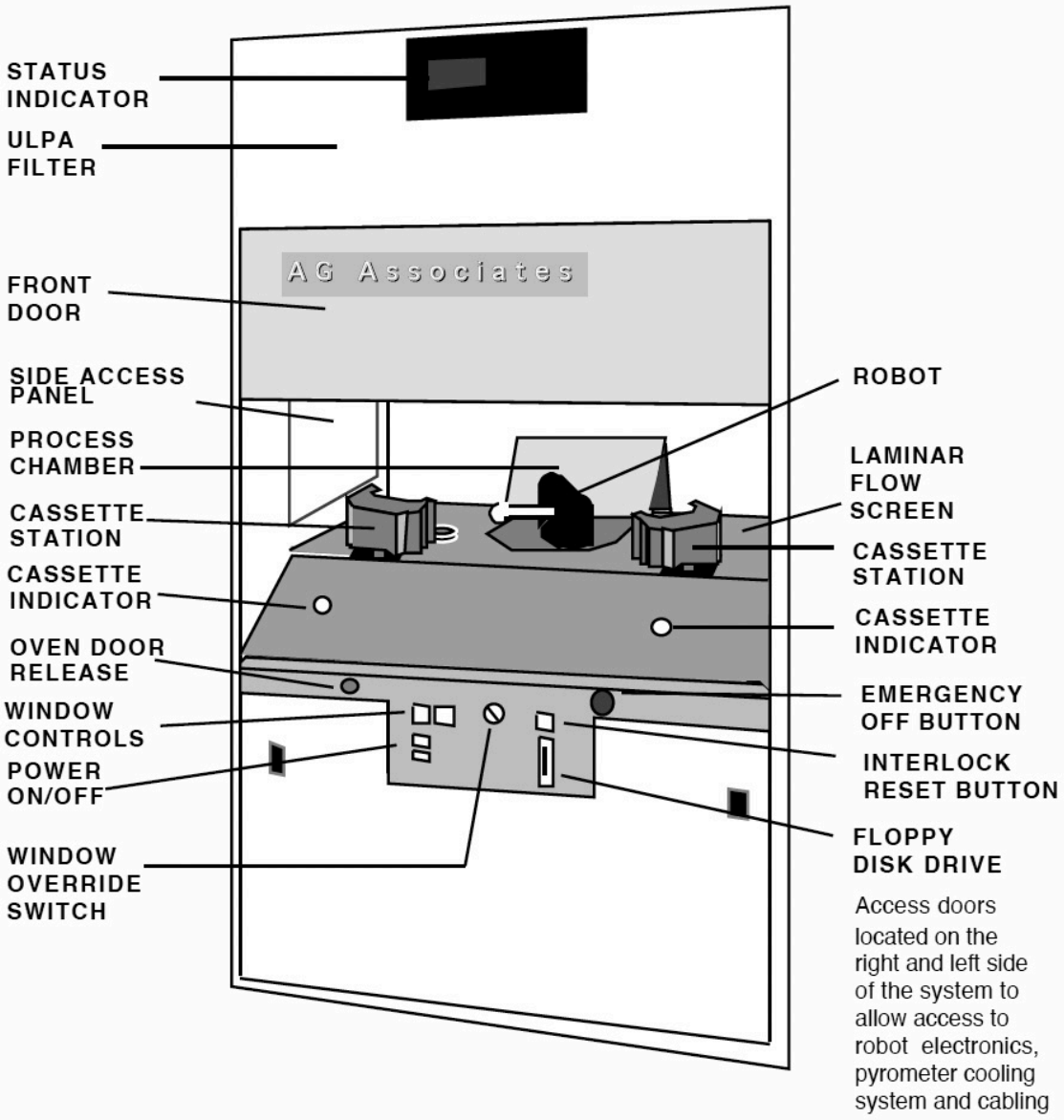


Figure 1:2-1a. *8108 Heatpulse System Features (Monitor-Fab-Wall Mount)*

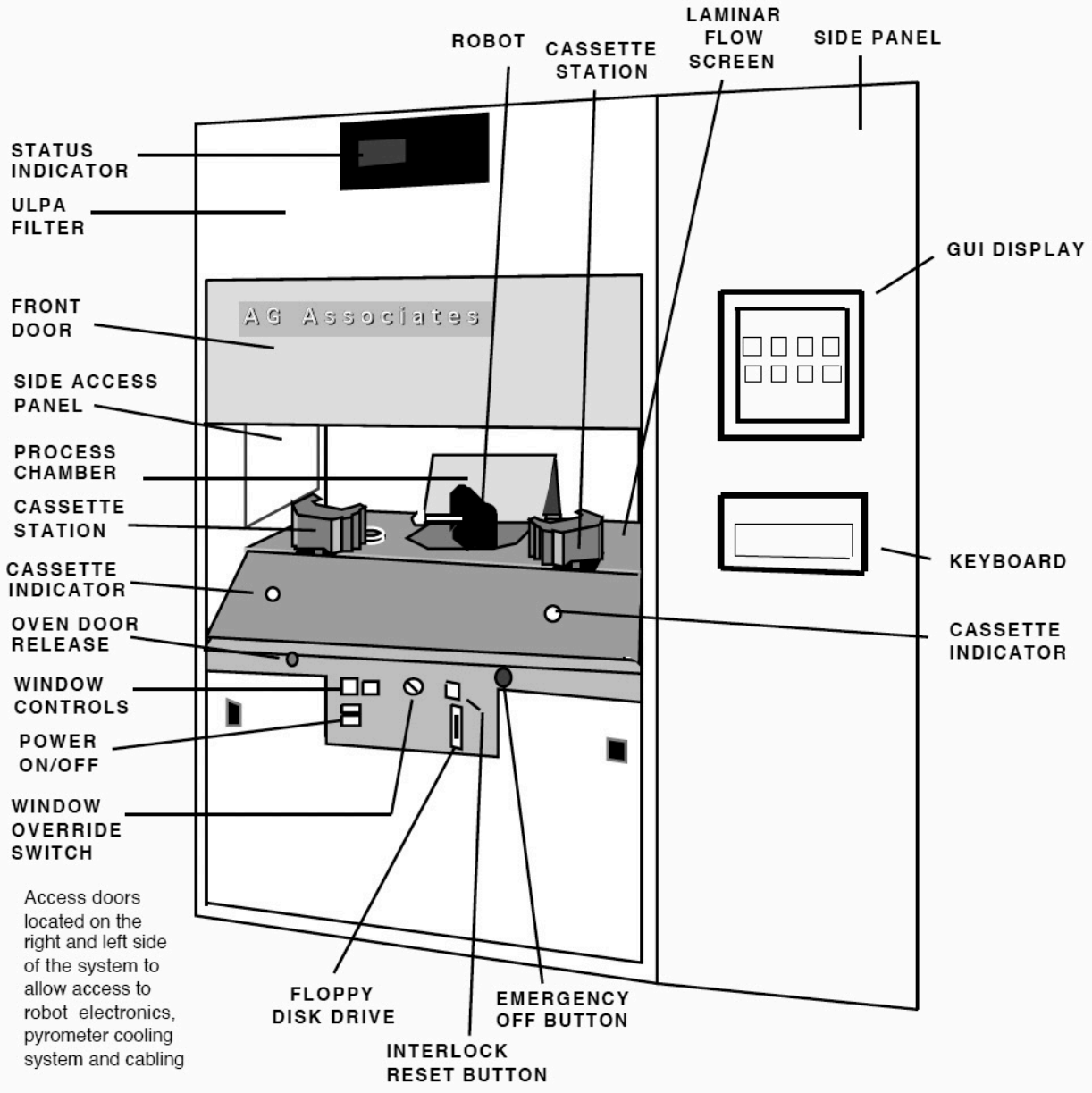


Figure 1:2-1b. *8108 Heatpulse System Features (Monitor-Side-Panel Mount)*

FEATURES

The Heatpulse 8108 system contains many capabilities which provide significant advantages over conventional batch processing in the production of VLSI circuits. Cleanroom integrity, precise temperature control and measurement, software flexibility, and the physical structure of the system (designed for the production environment) are among these advantages.

Contaminant-Free Processing

The Heatpulse 8108 system is designed with the cleanroom environment in mind. The following are the key features which make this Heatpulse system contaminant-free:

- Stainless-steel laminar flow processing floor and ULPA filter located in the processing area to reduce the number of particles in the environment. The walls of the processing area are also stainless steel.
- Design which prevents particles from circulating around the wafer-handling area, which allows the front panel door to remain open during processing.
- Easy service access available from rear and side panels.
- Through-the-wall installation, which maintains cleanroom integrity.
- No belts and pulleys (a large source of particle contamination) exist in the 8108 wafer-handling area.
- Front touch-screen controller remotely mounted to further reduce particle attraction.

Heating, Cooling, and Temperature Measurement

The following lists the key features of 8108 heating, cooling, and temperature measurement:

- High-intensity radiation which heats wafers for short periods of 1 to 600 seconds at precisely controlled temperatures in the 400-to-1200°C range.
- Tungsten halogen lamps and cold process-chamber walls which allow fast wafer heating and cooling rates, respectively.
- Lamps arranged in 2 banks of 14 lamps each, 1 bank above and the other below the process chamber. Upper lamps which run crosswise and lower lamps which run lengthwise. Thus, the upper and lower lamps are at right angles to each other for optimization of temperature control. In addition, 10-zone lamp control to enable further wafer uniformity.
- The system delivers time and temperature profiles tailored to suit specific process requirements.
- Pyrometer or thermocouple sensing (with DTC option) which offers precise closed-loop temperature control.
- Open-loop intensity control (OLIC) option which offers accurate, repeatable temperature control. (This feature requires ±0.5 VAC at 208 VAC line voltage regulation to function accurately.)
- Purge gas which flows through the process chamber and cooling gas (CDA) which flows around the isolation tube and lamps.
- Water de-ionizing system for oven cooling water to minimize metal corrosion.

Software

The Heatpulse 8108 system features touch-screen operation which is easy to learn. Additional software features are listed below.

- Menu screens which allow a process cycle to be easily defined and executed.
- Status reports continually displayed on the screen as the system operates.
- Self-diagnostic routine active whenever the system is on and terminates the cycle in progress if an abnormal condition is detected.
- Access codes which provide security for the system, recipe programming, and diagnostic functions.
- Highly flexible recipes and process procedures.
- Simple and easy-to-use menu screens.
- Touch-screen menus which eliminate the need for special commands.
- Manual mode which allows engineers and service personnel to activate individual subassemblies and functions.
- Discrete diagnostic routines, using a separate Diagnostic mode, are available.
- Maintenance menu which allows you to customize messages by condition and date to appear on the GUI screen at a set time.
- Thermal processing cycles which may be customized for unique processing requirements.
- Custom recipes created by process engineers which may be saved on floppy diskette and executed by production line operators.

Service Access

The 8108 system has been built for fast servicing in the production environment which provides low mean time to repair (MTTR). The features listed below reflect this purpose:

- Optional menu screen available at the rear of the system, enabled through a key control switch.
- Gas box specifically designed for easy access and maintenance.
- Front access window closes to prevent cleanroom contamination during maintenance for through-the-wall installation.
- Top window, which flips out of the way, enables easier wafer-handling area access.

Wafer Handling, Control, and Accuracy

8108 wafer-handling system features include the following:

- Consistent wafer-to-wafer process cycle repeatability
- Optional send and receive cassette bases which swivel to accommodate loading and unloading by a cleanroom robot in a fully robotic environment
- Antistatic Ion Bar in the laminar flow system which reduces electrostatic charges on wafer handling components.
- Controlled ambient
- Robotic transport of wafers in excess of 80 wafers per hour (in a null cycle without the flat-finder option)
- A process-per-wafer (PPW) feature which enables you to program a different recipe for each wafer in a cassette. For pick-and-place operation, one recipe and be selected for each cassette, or up to 50 different recipes can be programmed when two 25-slot cassettes are used, or 52 recipes when two 26-slot cassettes are used

Safety

The 8108 system was designed with safety in mind. Safety features include:

- Software and hardware interlocks to prevent hazardous gas combinations
- Emergency shut-off buttons in both the front and rear of the system
- Error messages and alarm signals to convey system status
- Domestic 8108 systems are listed by Underwriters Laboratories
- European 8108 systems meet European CE label requirements

Cost Savings

The 8108 offers two features which result in a considerable cost savings when compared to conventional batch processing. Thus, it requires:

- Small tool footprint
- Low energy use
- Few employees for operation and maintenance

APPLICATIONS

The Heatpulse 8108 system is a versatile tool which can be useful for many applications, such as (but not limited to):

- Silicon dielectric growth
- Implant annealing
- Glass re-flow
- Silicide formation and annealing
- Nitridation of metals
- Contact alloying
- Oxygen donor annihilation