MIID: Preventing Contaminating Cross Connections in Semiconductor Process Tools

A presentation to the CMP Users Group

Peter M. Pozniak, Malema Sensors

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Chemical Cross Connections

- Bulk pressurized delivery systems create a need to cross connect the DI Water system with various chemical delivery systems.
- Typical arrangements provide only single containment
- Resulting in the potential cross contamination of these interconnected systems.

Typical Cross Connection arrangement
A better solution

- Sometimes we’ll add check valves to mitigate the potential – *This solution isn’t allowed in potable water systems because of its unreliability.*
Simplest form of Backflow Prevention

- Simple, reliable & inexpensive
- It’s how your sink & dishwasher avoid cross connection
- Approved for use in Potable water systems.
Common Products for Potable Water Systems

- Pressure Bib
- Backflow Preventer
- Hose Bib
- Backflow Preventer
- Irrigation
- Backflow Preventers
- Industrial Reduced Pressure
- Backflow Preventer
The MIID product functions as a backflow preventer in cross connected high purity, critical liquids applications.

Markets serviced include:
- Semiconductor manufacturing
- Biotech
- Pharmaceutical
- Nanotech
Features

- Backflow prevention utilizing the “Double Block & Bleed” method
- Malema proprietary, ultra low level, by-pass leak detection
Classic Double Block & Bleed
Vent Active (Open) or protective mode
Classic Double Block & Bleed
Vent Inactive (Closed) or dispense mode
Typical DI Water Loop

- DI Water Loops like this exist in most every wafer fab
- Under “normal” circumstances they work dependably
Typical Tool Connections

- A major use of DI Water in any process tool is for the safe flushing and dilution of chemical piping systems during maintenance operations.
DI Water & Slurry Loops

- If either pump shuts down
- The fab level pressure drops
- Gravity continues working on the contained liquid and the pressure not only drops but can generate significant vacuum at the POU valve manifold.
How does the MIID address this problem?

- The (MIID) eliminates these problems.
- The design of the MIID prevents back siphonage even if a valve or valves in the Cross Connect manifold leak(s).
- The MIID incorporates a Malema leak sensor that warns of leaking valves before a back siphonage event occurs and before cross contamination results.
MIID standing guard

- MIID acts to prevent cross contamination from occurring
- A Malema leak sensor provides a warning prior to a backflow event
Malema Double Block & Bleed
Vent Active (Open) or protective mode
Malema Double Block & Bleed
Vent Inactive (Closed) or dispense mode
Monitoring?

- The MIID incorporates a Malema leak sensor warning of leaking valves before a back siphonage event occurs and before cross contamination results.
MIID Operation

- Three(3) pneumatic operated valves comprise one channel of a MIID module.
- In the normal, inactive or protective position the connection between the bulk supply and the cross connect point is broken by connection to the drain.
MIID Operation

- When chemical is required by the process:
- Valves 1a & 1b OPEN while Valve 1c CLOSES
- At the end of a dispense cycle the valves return to their normal positions breaking any potential back siphon path by connecting the outlet of the supply valve to the drain line.

One channel of a typical MIID module
MIID Operation

- Any developing back siphon is broken by connection to the vent / drain line
- Preventing a cross contamination event.
- The vent / drain line is monitored by a leak sensor providing an early warning of leaking valves.

One channel of a typical MIID module
Malema Interconnect Interlock Device
Simplified Description

Diagram:
- Dispense Signal
- Chemical
- Process Inert Gas
- LOTO
- 1a
- 1b
- FS
- POU
- Vert / Drain
Test & Validation

- During simulations in Malema’s Lab each valve in the MIID module was equipped with a known leaking valve poppet.
- Several combinations of leaking and non-leaking valves were tested
- No cross contaminations occurred
- All valves were replaced (simultaneously) with known leaking poppets
- No cross contaminations occurred
Modular MIID Backflow Preventer