TECHNICAL ARTICLE

3 Solutions for power panels in semiconductor fabs

Machine builders serving the semiconductor industry face some particularly tough requirements for power quality and reliability. Read about three technologies available in panel components that can help meet those requirements.

Dave White, PE
Global Applications Specialist

Matt Daroch
Product Marketing Manager - ERC, Limit Switches, Pilot Devices

ABB Electrification Business

In our not-so-distant history, industrial processes were primarily powered by water. The giant mills that can still be seen around New England, for example, weren't located next to rivers for the scenic benefit. Those rivers were dammed to channel water through sluices, driving water wheels that turned the gears of industry. Too little or too much water created serious production problems.

Today, our machines are driven by electricity. Instead of water in those vintage mills, today's operations managers depend on reliable electric power to keep their facilities humming. Like the water in the mills, too much or too little power (surges or sags) can mean big problems. That's especially true in semiconductor fabs, where even a brief power-quality issue can mean millions of dollars of ruined in-process chips.

Machine builders working with the semiconductor industry need to be especially concerned with power reliability, seeking out panel components with features that are particularly suited to the stringent requirements of fab operations. Below are three aspects of this issue to consider.

1. Power reliability and quality

At the macro level, fabs ensure continuous power by incorporating UPS systems and gensets. These backup power sources include features to quickly and seamlessly come online when the primary power source is lost. Power-switching is also common in fabs that rely on a mix of energy sources, including renewables.

Surges, sags, and brief power interruptions can occur during power switches. These issues can also be created as the high-current motor loads, which are common in fabs, are switched on and off. These power-quality issues can cause issues in fab machinery and sub-fab (cooling, ventilation, etc.) systems.

Overvoltage or surge protection is provided by surge-protective devices (SPD), most of which rely on MOV (metal-oxide varistor) technology. Unfortunately, MOVs have their own reliability issues under certain conditions. Some SPD makers incorporate an added safety feature to mitigate damage caused by MOV failures and thermal runaway. They accomplish this with a solder bridge restraining a spring-loaded contact ejector. If the MOV exceeds the temperature threshold, the solder melts and the spring forcibly ejects the terminal connection, breaking the circuit.

Furthermore, even brief power sags can create problems within the fab machinery. Some power-supply panel components are equipped with a power-reserve source, typically a capacitor or small battery. These reserves obviously do not replace long-term backup resources like a UPS. Rather, they ensure a brief, continuous source of power that enables the power supply and downstream components to ride through momentary power dips.

Momentary power dips can also cause contact chattering in standard coils, leading to unstable power. Where this is an issue, a good solution is to rely on contactors with electronic coils, which are immune to chatter.

Each of these technologies can be relied on to help meet the requirements laid out in SEMI F47-0706, which ensures that fab machinery remains immune to voltage sags that commonly occur on AC power grids.

2. Small form factor

The power distribution units used throughout fabs tend to be very compact, earning them the somewhat derogatory nickname “cigar boxes.” And they tend to be crammed full, making form factor a crucial factor in component selection. Aside from the ability to physically fit all the needed components into the panel, there are also heat considerations. With little or no space between components and, typically, no ventilation slots in the panel, extraneous heat can build up, leading to shortened life.

High-efficiency components are available that can reduce potential heat-related problems. More of their energy passes through the component rather than being lost to heat. Higher-efficiency options include power supplies, disconnect switches or breakers, contactor coils, and other components.

3. Push-in connections

A final reliability consideration relates to connections/terminations of panel components. Many panel builders have settled on ring-tongue terminals, believing them to be superior to standard compression terminals. However, they are still subject to loosening due to vibration and thermal expansion/contraction cycles. The diminished connection results in higher resistance that creates heat, increasing potential safety hazards and the risk of connection failure.

Some component makers have an alternate solution that is less susceptible to loosening: push-in connections. These spring-loaded devices maintain constant pressure, increasing their immunity to losing a solid connection. Plug-in connections are commonplace in heavy-duty industrial applications, and today are finding increased acceptance in low-voltage control panels.

Better panels for fabs

Enhancing your panels for semiconductor makers does not mean making major design changes. There are an unlimited number of incremental improvements you can make. In many cases, those improvements come down to identifying components that offer tangible value to your customers in the semiconductor industry.

ABB Inc.
305 Gregson Drive
Cary, NC 27511
United States

electrification.us.abb.com

Customer Service:
888-862-3290
abbinsidesalessupport@us.abb.com
Monday - Friday, 7am - 5:30pm, Central Time

Tech Support:
888-437-3765
Monday - Friday, 7am - 5pm, Central Time