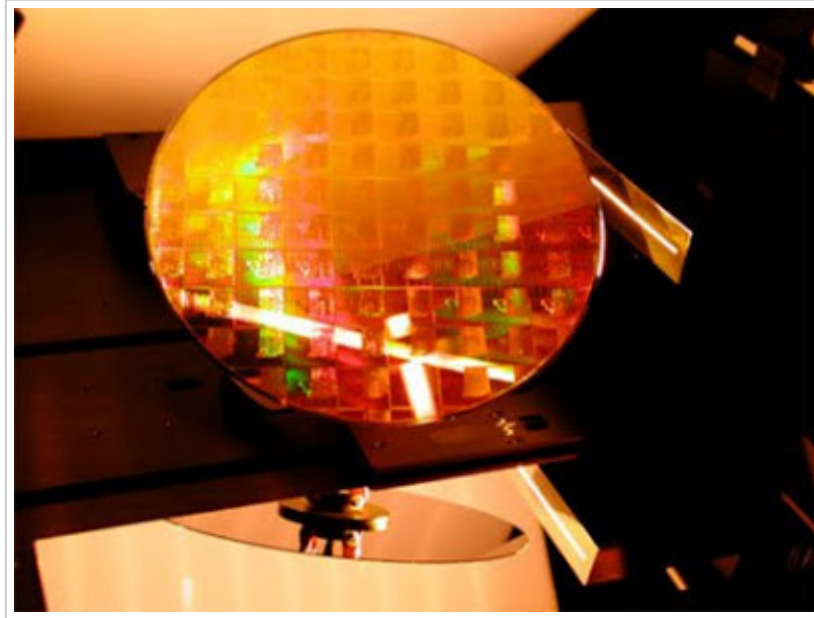


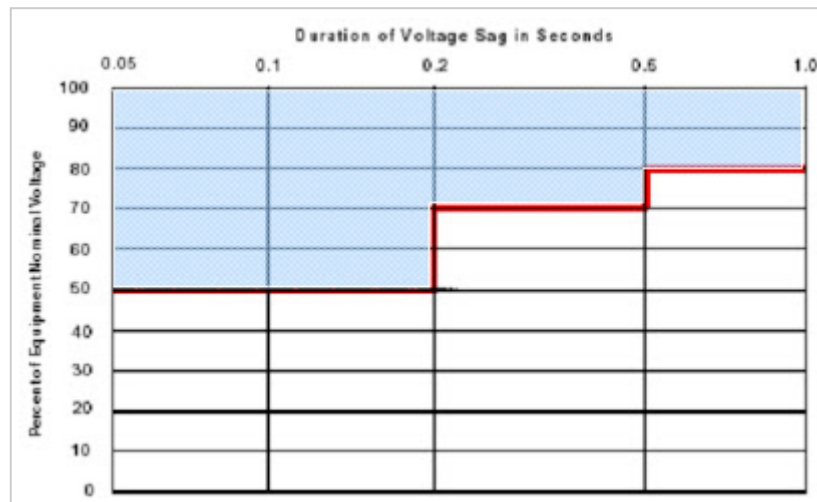
Tuesday, December 23, 2008

What is the SEMI F47 line sag spec all about?

We have all seen lights dim at home or at work and this is an indication that the AC line voltage has been reduced or sagged. Although an occasional dimming of lights can be tolerated, when it comes to factory automation equipment, line sag can be the source of a production shutdown, resulting in significant revenue losses. Since the production of semiconductors, including microprocessors, is a very precise and expensive process, back in 1999 the Semiconductor Equipment and Materials Institute (SEMI), established standards relative to AC line sag immunity. This specification is called the SEMI F47 Voltage Sag Immunity Standard and has been revised periodically. Because many other factory automation processes are equally critical, some of these production products need to comply with the SEMI F47 standard as well.



Basically, this standard requires that the AC-DC power supply that is used in semiconductor production, or in other factory automation equipment, continue to provide the required output voltage and current, even if the input voltage dips below its specified limits. As can be seen in the chart below, in the blue area, the basic specs require that the power supply perform normally even if the input voltage sags down to 50% of its nominal voltage for up to 200 ms, or sags to 70% for up to 500 ms, and sags to 80% for up to one second. Since this sag percentage refers to the nominal line voltage, this means for example that with a nominal 220VAC input, the AC voltage can sag down to 50% or 110VAC for up to 200 ms, down to 70% or 154VAC for 500 ms, and down to 80% or 176VAC for up to one second.



There are additional sag ride-through "recommendations" within the latest version of the standard, which is the SEMI F47-0706 (these recommendations are not requirements) that includes operation of the power supply with 0% input power (no power) for up to 20 ms. This recommendation can be accommodated by insuring the selected power supply has a "hold-up time" specification of 20 ms or longer. Other newly recommended thresholds within the SEMI F47-0706 include sags of 80% for 10 seconds, and continuous sags of 90%. Most power supplies that meet the previous versions of this standard, the SEMI F47-0200, and have a hold-up spec of 20 ms or greater, should be able to meet the new recommendations (not requirements) as well.

The simplest and lowest cost method of complying with the SEMI F47 standard is to use a power supply with a universal input, such as 90 to 264VAC, and operate it from a 220VAC or higher line input. In this way you automatically meet and exceed the standard since this type of power supply can operate down to 90VAC (even lower than the 50% line sag spec of 110VAC). Note that this method does apply to auto-strap power supplies.

Another way of meeting the SEMI F47 is to draw less power than the supply can normally provide (de-rate the supply). If you do this, always check with the manufacturer to confirm that your reduced load will allow the supply to fully meet the SEMI F47 standard. This may require extra testing to confirm compliance, either by the power supply manufacturer or the end-product OEM. Alternatively, the power supply manufacturer may be able to modify the supply to meet the SEMI F47 standard.

Some factory automation equipment require the use of SEMI F47 "certified" power supplies, which means the supplies were tested by an outside agency or laboratory and found to fully comply with the standard (similar to UL certification). If this is a requirement, always look for supplies that have existing certifications from a reliable manufacture, because the cost of getting this type of certification can amount to \$2,000 or more. There is a grandfather clause in the updated standards that provides for equipment that was tested or certified under the previous versions of the standard to not require re-testing or re-certification.

Many industrial-type power supplies are designed and/or certified to meet the SEMI F47. These supplies may be a bit more expensive, but it will be the lowest cost solution, especially if you compare it to the cost of adding an external constant voltage transformer or UPS to the input of the power supply.

Power supply manufacturers such as TDK-Lambda offer supplies that are SEMI F47 certified and supplies that operate with a wide universal input of 90 to 264VAC. In addition, modified supplies can be provided that meet this and other prevailing power supply specifications.

Posted by [Power Guy](#)