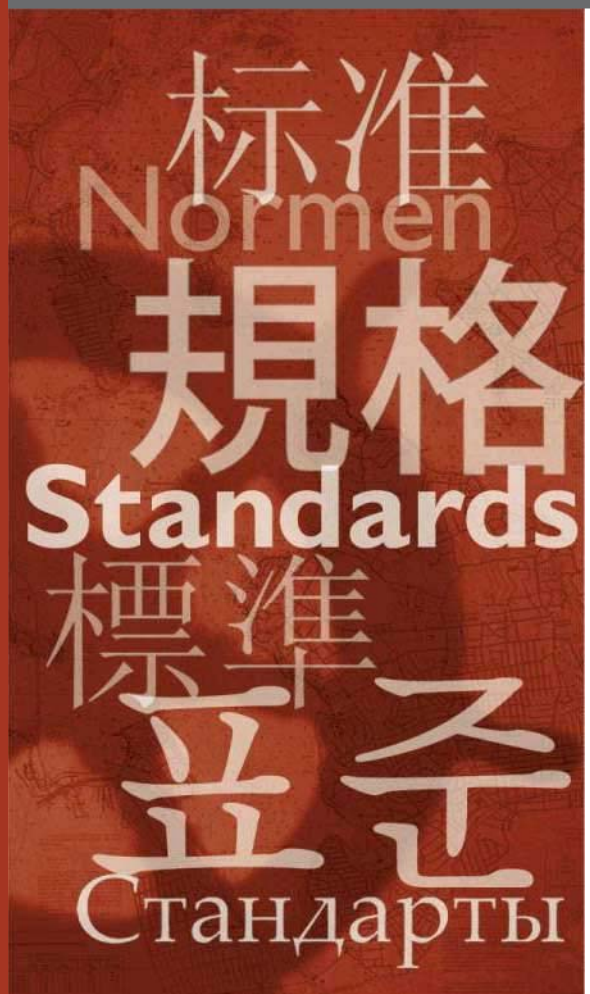
Tool and Sub-Systems – Low and Zero-Cost Solutions



Andreas Eberhard
VP Technical Services
Power Standards Lab (**PSL**)

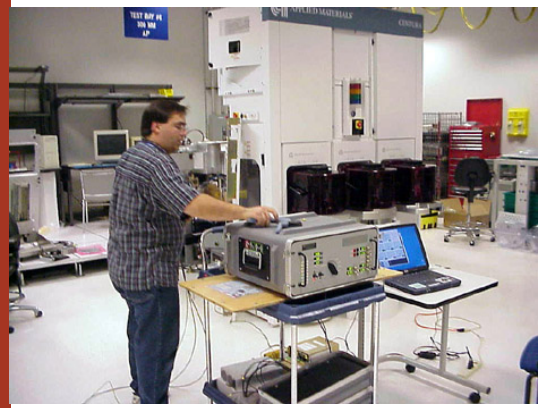
1201 Marina Village Parkway #101
Alameda, CA 94501
W:+001.510 522 4400
M: +001.510.919.4369

aeberhard@powerstandards.com
www.powerstandards.com

Tool vendors: why comply with SEMI F47?

- Reasons not to comply:
  - Compliance costs money
  - Certification costs money
- Reasons to comply:
  - Required by most 300mm fabs:
    - Intel, IBM, Motorola, TI, Fujitsu, NEC
  - Increased reliability – reduced service costs
- It's the real world…

Tool vendors: require component suppliers to comply with SEMI F47



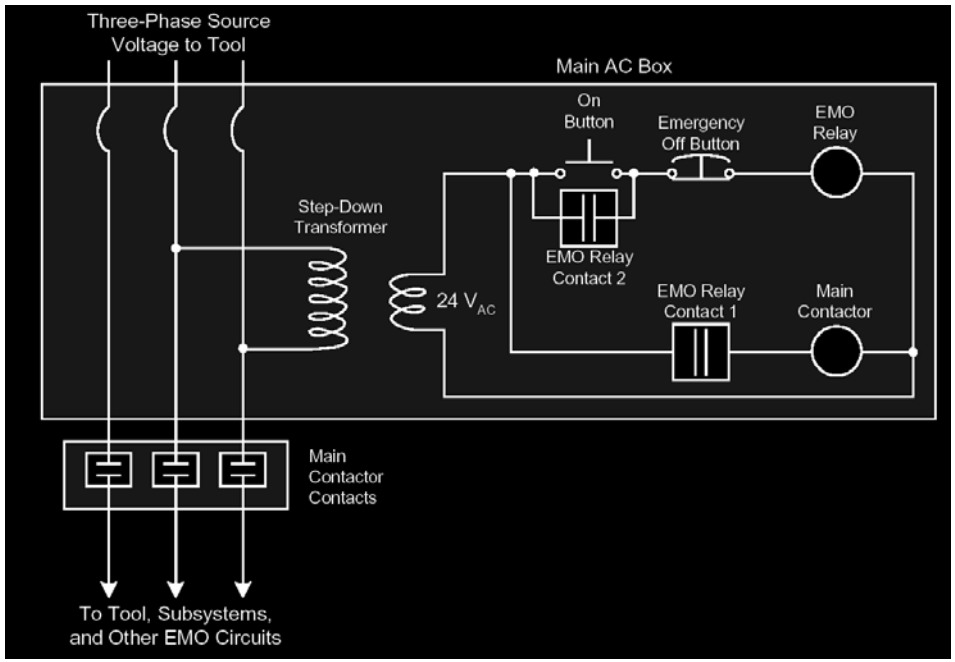
- Necessary but not sufficient
- Makes sense to require subsystem compliance
  - RF Generators
  - Pumps, motors, fans
  - Robots
  - Critical AC related components
- Computers and sensors
- Not sufficient – integration and software issues

Component suppliers: why comply with SEMI F47?

- Because the tool manufacturers demand compliance
- Push-down: customer, equipment supplier, component supplier
- Black box for tool vendors

Low-cost or zero-cost solutions (continued)

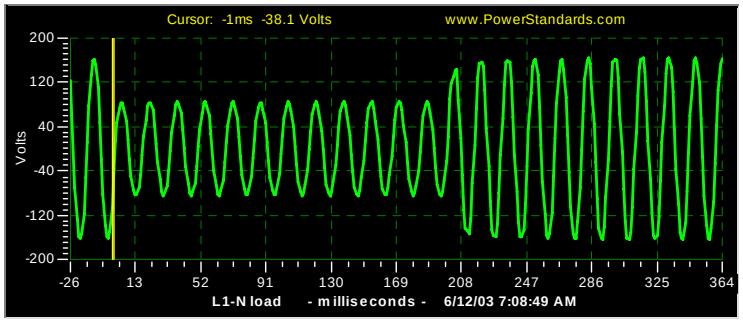
Typical Problem Areas - 1

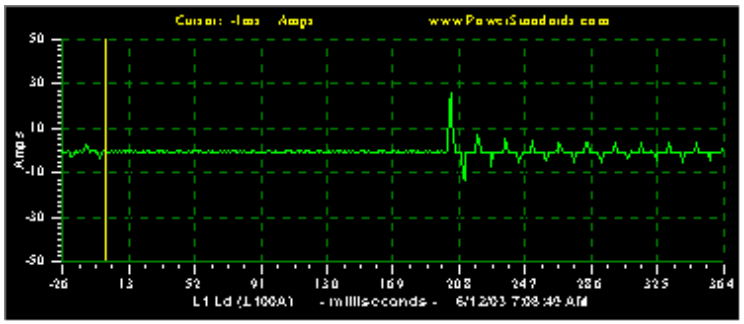


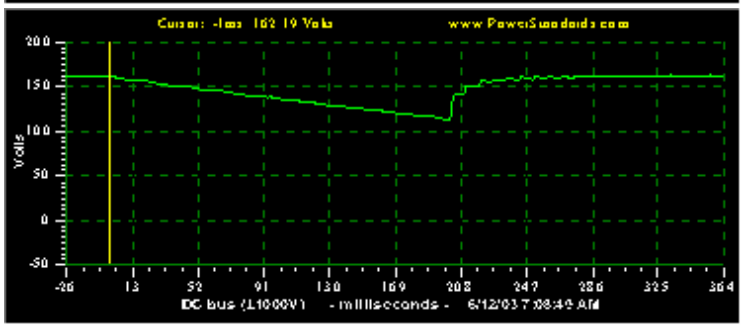
- Power sensitive circuits from **DC 24V**, not from AC sources (Control circuits, interlocks, EMO, etc.)
  - ► From DC Supply Output

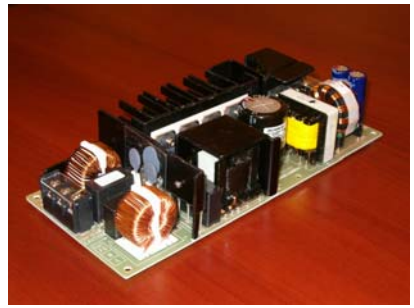
Low-cost or zero-cost solutions (continued)

Typical Problem Areas - 2









- Universal input power supplies

  (AC 85-264V input range)

- Take power from two phase

  (Avoid Phase-Neutral, or get three-phase supplies)

- Load conditions (de-rate…)

Low-cost or zero-cost solutions (continued)

Typical Problem Areas - 3

- Sensors - pressure, speed, unbalance
- Solution: de-sensitize, or insert software time delays

Low-cost or zero-cost solutions (continued)

Typical Problem Areas - 4

- Software adjustments

  (e.g. delays on alarm signals)
- Increased bulk capacitor values
- Hardware delays in sensor signals

  (de-sensitize if possible)
- Use fab-supplied UPS power for critical loads

  (if end-user provides house UPS)

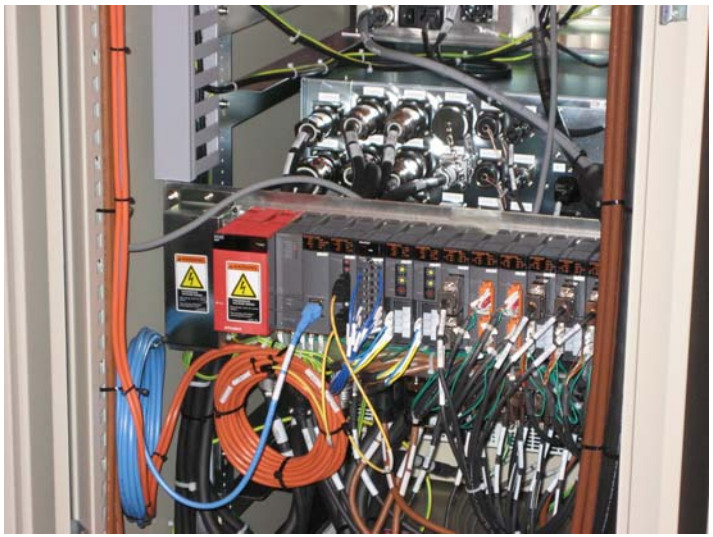
Low-cost or zero-cost solutions (continued)

Typical Problem Areas - 5

- Interaction between subsystems during sags - different responses and alarms
- Components have different pass/fail criteria – e. g RF
- Solution: testing, software adjustments
- Automatic re-start function

Low-cost or zero-cost solutions (continued)

Typical Problem Areas - 6

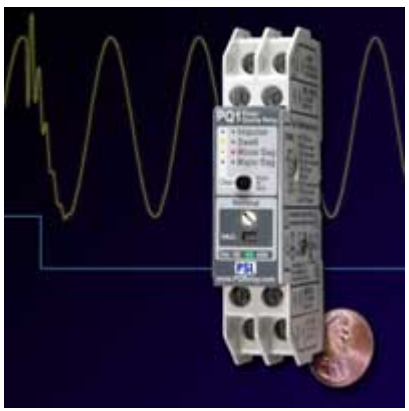


- Avoid mismatched equipment voltages (208Vac powering 230Vac equipment)
- Consider Circuit Breaker Characteristics (Do not use Instantaneous Trip)
- Avoid the use of AC power “ice-cube” general purpose relays

(sensitive from 70-85% Vnom)

Low-cost or zero-cost solutions (continued)

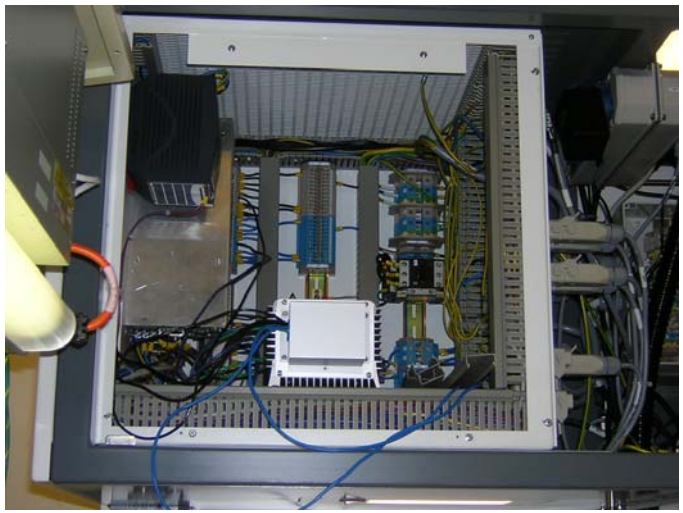
Typical Problem Areas - 7



- Delay settings on phase-sense relays, GFI (do not violate SEMI S2!)
- Change recovery settings on Adjustable Speed Drives
- Disable or change pre-programmed under-voltage trip limits

Low-cost or zero-cost solutions (continued)

Typical Problem Areas - 8



- Do not use phase monitoring relays in interlock circuits
- Utilize a non-volatile memory
- Use robust inverter drives that allow for lower DC bus levels

Low-cost or zero-cost solutions (continued)

- Power quality sensor PQ1 –

  use software to record customer-caused

  events outside SEMI F47, and use software

  to reset and restart process after voltage dip event

- Senor can be used as a defense against power

  Power Disturbances at end-user (finger pointing)

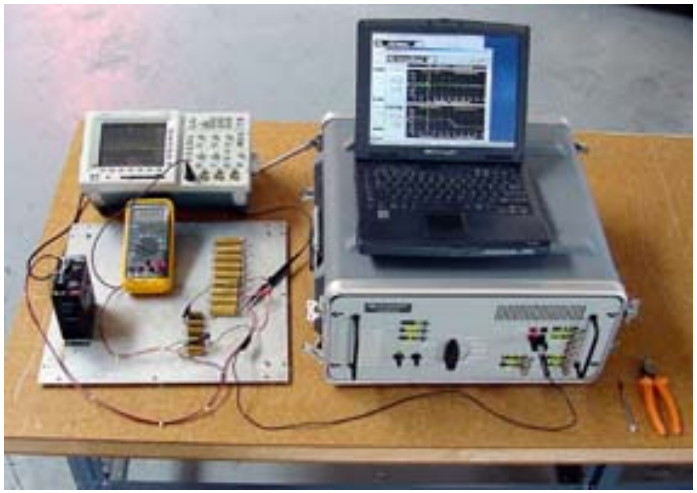
POWER QUALITY RELAY
E220936

Low-cost or zero-cost solutions (continued)

- Don’t get incorrectly blamed by customers
- Converts Voltage Sags from an Energy Storage issue into a Software issue
- Huge cost savings

POWER QUALITY RELAY
E220936

Low-cost or zero-cost solutions (continued)



- **Testing and Tweaking**

  (Small Engineering changes during test, try different capacitors on DC supplies etc.)

Low-cost or zero-cost solutions (continued)

- None of these solutions requires making the power better
- All of these solutions are low cost, or free
- Find the sensitivities during testing
- Every tool can be made SEMI F47 compliant!

Higher-cost solutions

- Power conditioning at sensitive spots (as a last resort)
  - Dip-proofing inverter
  - Sag corrector
  - UPS
- UPS for entire tool (not allowed by many end-users due to cost and maintenance issues – batteries!)

Conclusion: low-cost and zero-cost dip immunity solutions are available.

- Find the sensitivities during testing.
- Adjust the design (hardware, software) as required
- Power conditioning is not usually necessary
- Future designs: design for dip immunity from the start
  - Already the case at major tool manufacturers
  - Pre-test during design stage or with Beta-Tools

Why should semiconductor tool manufacturers do SEMI F47 Testing and Certification?

PSL

- Lower maintenance cost
- No need for unnecessary and expensive power storage devices
- End-users can't blame tool vendors
- Self-defense weapon if PQ1 is integrated
- Mandatory requirement by most end-users
- Competitive Advantage
- Improvement of electrical tool design

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More information

http://www.PowerStandards.com/SEMIF47.htm

E-mail: aeberhard@powerstandards.com