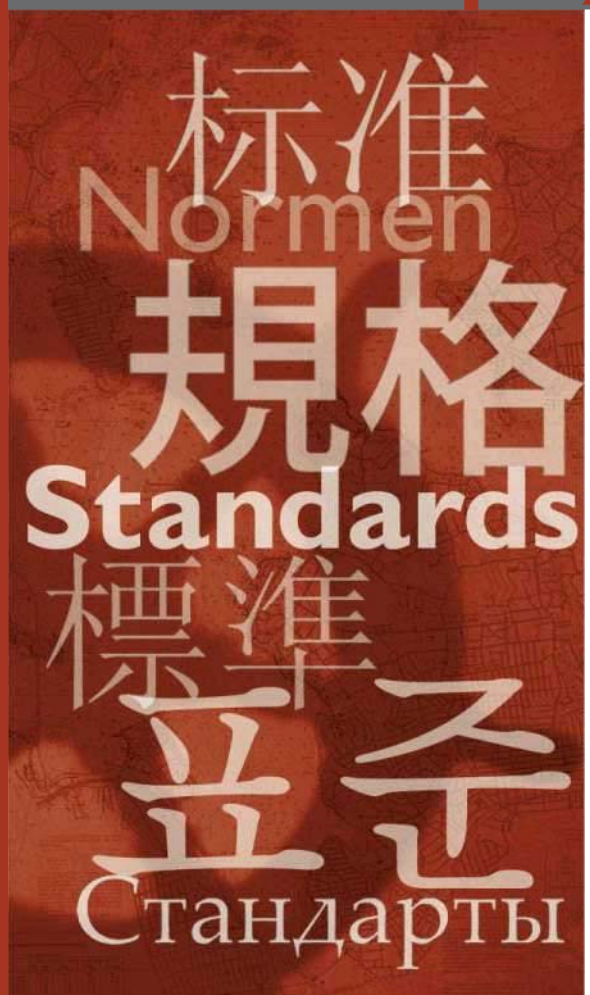
SEMI F47-0706 and IEC Voltage Sag Standards - Differences, overlaps, and similarities



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F47-0706 and IEC 61000-4/11 & -4/34 Voltage Dip Immunity

- ‘Sags’ in US, ‘Dips’ in Europe
- Requires equipment to tolerate voltage dips / sags
- -4-11 up to 16 amps per phase
- -4-34 more than 16 amps per phase
- -4-11 already mandatory in EU

  (EMC Directive – CE Marking)
- For ALL Industries

  (Machinery, Consumer Products… etc.)

Overlaps between SEMI F47-0706 and IEC 61000-4/11 & -4/34

- Both the IEC and SEMI Standards use the same test methods (with exception of Note 4 in SEMI standard).
- The SEMI standard uses IEC standards to define the voltage sag generator
- Some test point durations are the same
- Some test point levels are the same
- Both standards use single and phase-to-phase testing only – 3 phase sags are not required.

SEMI F47 vs SEMI F42 vs IEC61000-4-34

- **SEMI F42-0600 (replaced by IEC 61000-4-34)**

  "This standards defines the test method used to characterize the susceptibility of semiconductor manufacturing and test equipment."

  How to test…

- **SEMI F47-0200 (replaced by SEMI F47-0706)**

  "This standards defines the voltage sag ride-through capability required for semiconductor manufacturing and test equipment."

  What to test…

Differences between SEMI F47-0706 and IEC 61000-4/11 & -4/34

- SEMI F47-0706 for three phase-to-phase testing methods, IEC 61000-4-34 permits only two phase-to-phase methods.
- The standards have differences in test levels and durations.
  - IEC defines test points based on the Class of equipment (Class 1, 2, 3 and X)
  - From the IEC 61000-4-34 standpoint, the SEMI F47 test point fall into Class X equipment.
  - The IEC standards have short interruption test point requirements (Table 2 in standard), SEMI F47-0706 does not.

SEMI F47, IEC 61000-4-11, -34

- Pass/fail criteria - SEMI F47
- Determined by customer
  - Generally accepted:
    - Recovery without operator intervention
    - Components – full rated operation

- Pass/fail criteria – IEC 61000-4-34
  - Range of choices from “no damage” to “full rated operation” (because of various industries)

IEC 61000-4-11 & -4-34

Performance Criteria

1. Normal performance within limits specified by the manufacturer
2. Temporary loss of function or degradation of performance which ceases after the disturbance ceases, and no operator intervention is necessary
3. Temporary loss of function or degradation of performance. Correction requires operator intervention
4. Loss of function or degradation of performance which is not recoverable. Damage, or loss of data

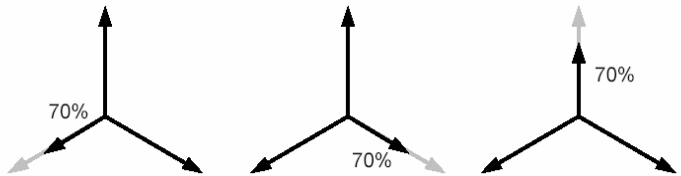
Comparisons of Standards

Standard	Worst Case Voltage Sag Test Point	Defines Test Instrument Requirements & Setup
SEMI F47-0706 For: Semiconductor Tools, Subsystems, & Components	10/12 cycles 50% Vnom	For the most part refers to IEC documents
IEC 61000-4-11 Not Industry Specific: Electrical Equipment < 16A	10/12 cycles 40% Vnom (Class 3)	Yes
IEC 61000-4-34 Not Industry Specific: Electrical Equipment >16A	10/12 cycles 40% Vnom (Class 3)	Yes

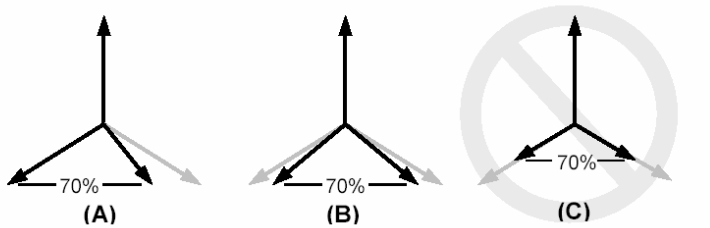
semi

IEC 61000-4-11/34 Voltage Sag Test Modes

- Phase-to-neutral testing



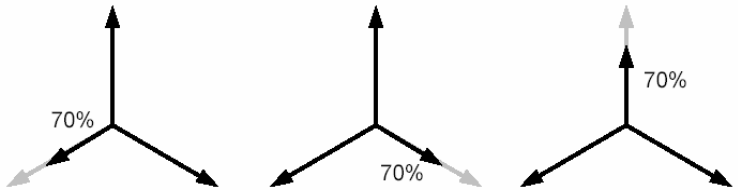
- Phase-to-phase testing



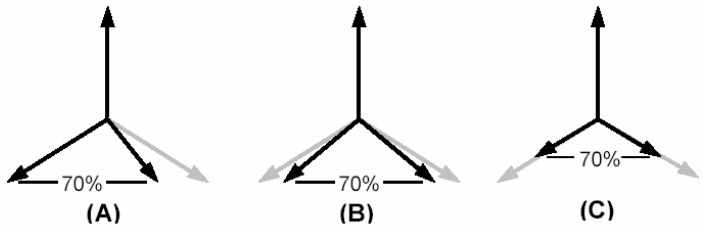
- No three-phase voltage dips

SEMI F47-0706 Test Modes

- Phase-to-neutral testing



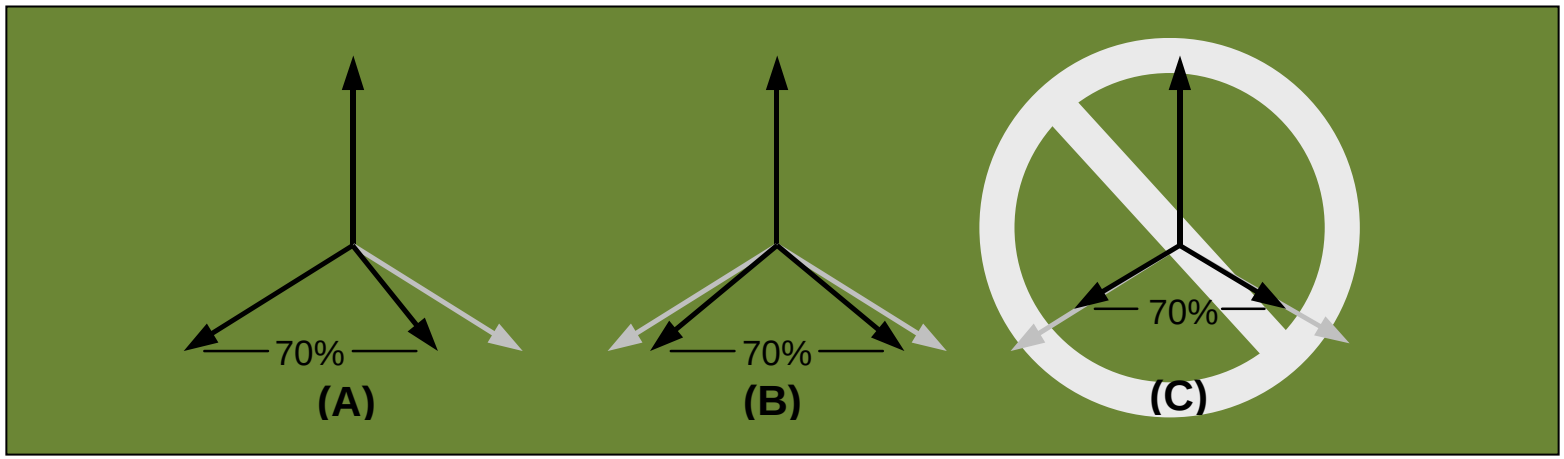
- Phase-to-phase testing



- No three-phase voltage dips

SEMI F47, IEC 61000-4-11, -4-34

Phase shift during sag is <u>required</u> by IEC



(OK for F47)

Test Levels SEMI F47-0706 vs. IEC 61000- 4/11 & 4-34

SEMI F47-0706

Table 1 Required Voltage Sag Immunity

Sag depth[#1]	*Duration at 50 Hz*	*Duration at 60 Hz*
50%	10 cycles	12 cycles
70%	25 cycles	30 cycles
80%	50 cycles	60 cycles

Table R1-1 Recommended Voltage Sag Immunity

Sag depth	*Duration at 50 Hz*	*Duration at 60 Hz*
0%	1 cycle	1 cycle
80%	500 cycles	600 cycles

IEC 61000-4-11/34

Table 1 – Preferred test level and durations for voltage dips

Class[a]	Test level and durations for voltage dips (t_s) (50 Hz/60 Hz)				
Class 1	Case-by-case according to the equipment requirements				
Class 2	0 % during ½ cycle	0 % during 1 cycle	70 % during 25/30[c] cycles		
Class 3	0 % during ½ cycle	0 % during 1 cycle	40 % during 10/12[c] cycles	70 % during 25/30[c] cycles	80 % during 250/300[c] cycles
Class X[b]	X	X	X	X	X

[a] Classes as per IEC 61000-2-4; see Annex B.

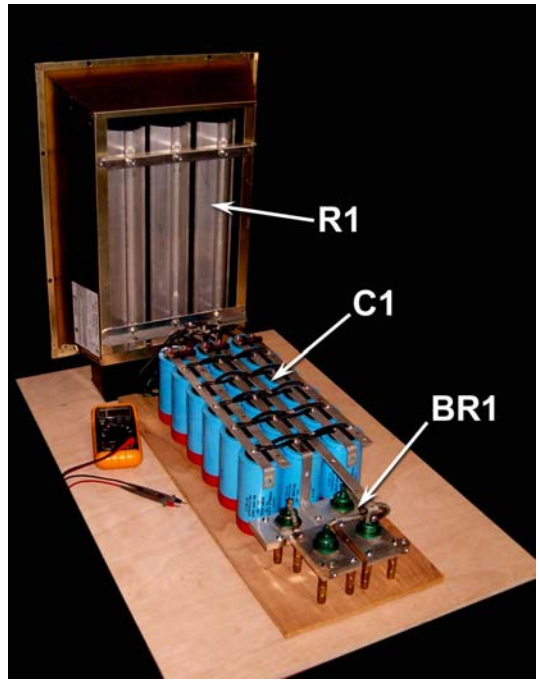
[b] To be defined by product committee. For equipment connected directly or indirectly to the public network, the levels must not be less severe than Class 2.

[c] "25/30 cycles" means "25 cycles for 50 Hz test" and "30 cycles for 60 Hz test".

40% @ 200ms

SEMI F47, IEC 61000-4-11, -4-34

(Electronic AC power sources do not work – not enough peak current)



Why should semiconductor tool manufacturers do SEMI F47/IEC 61000-4-34 Testing?

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