Procedural Review Voting Sheet
Editorial Change(s) to a published Standard or Safety Guideline (Independently from a Letter Ballot)

REGION/LOCALE: North America
GLOBAL TECHNICAL COMMITTEE: EH&S
EVENT: NA Winter 2025
DATE OF MEETING: 02/27/2025
PLACE OF MEETING: SEMI HQ, Milpitas, CA
TC CHAPTER CO-CHAIRS: Chris Evanston (Salus Engineering), Sean Larsen (Lam Research)
STANDARDS STAFF: Kevin Nguyen

I. Document Title

Document Title

SEMI S2-0724, Environmental, Health, and Safety Guideline for Semiconductor Manufacturing Equipment

II. Type 2 Editorial Change

Editorial changes that meet the requirements of the Regulations (see *Regulations* ¶¶ 8.9.4 & 8.9.5) are approved by a simple majority vote in a regularly scheduled meeting of the TC Chapter. [See PM 2.11.4]

Original section/paragraph number and at least one full sentence are required in "FROM" and "TO" fields.

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FROM:

R4-3 Derivation of § 19, Seismic Force Guidelines

R4-3.1 The horizontal forces (F_p) of 94% and 63% of the equipment weight (W_p), found in §§ 19.2.1 and 19.2.2, were based on following assumptions for factors in the design lateral force formula 32-2 in § 1632.2 of the 1997 Uniform Building Code (UBC):

- a_p = 1.0 (i.e., treat the equipment as a rigid structure)
- C_a = 0.53 (i.e., seismic zone 4, soil profile type S_D, and site 5 km from a seismic source type A)
- I_p = 1.0 and 1.5 for non-HPM and HPM equipment, respectively (refer to Table 16-K)
- h_x/h_r = 0.5 (i.e., equipment attached at point halfway between grade elevation and roof elevation)
- R_p = 1.5 (i.e., shallow anchor bolts), not from Table 16-K but § 1632.2 explanation of R_p.

$$F_P = \frac{a_p\, C_a\, I_p}{R_p}\left(1 + 3\left(\frac{h_x}{h_r}\right)\right) W_p \qquad \text{(R4-1)}$$

R4-3.2 *Assumptions Used for Above Derivation*

R4-3.2.1 Regarding the selection of 1.0 as the value for a_p – Table 16-O of the 1997 UBC assigns values of a_p depending on the type of building component under consideration. Line 3-B is for electrical, mechanical, and plumbing equipment which generally describes semiconductor manufacturing equipment, as is assigned an a_p value of 1.0. Line 3-C is the only line in the equipment group (3) that is assigned an a_p value greater than 1.0. Since this 3-C line is

To:

R4-3 Derivation of § 19, Seismic Force Guidelines

R4-3.1 At the time of developing the revisions to §19 and Related Information 4 for SEMI S2-0821, the S2 Seismic Task Force was aware of several different regional approaches used to determine forces from seismic events that should be anticipated to be acting on installed equipment. Some of these approaches are summarized below. In light of this variety, the task force focused on providing minimum force considerations that are sufficient for fundamental equipment safety, rather than for code compliance. Given the long history of the force values that have been used in S2 assessment and their apparent success for safety, the task force decided not to change how the forces are calculated. Since then, the formula (originally published in the Uniform Building Code (UBC) and now published by the American Society of Civil Engineers (ASCE) in ASCE-7 and referenced from the International Building Code (IBC) which replaced the UBC) upon which the calculations were based has been modified, but the task force believes the historic values are, nonetheless, sufficient.

R4-3.2 The horizontal force value that is the result of the UBC/ASCE based calculation is a force which equipment attachments should be designed to resist. It is not necessarily the force that will be experienced by the equipment. However, the task force believes it is an appropriate value for that force.

R4-3.~~1~~3 The horizontal forces (F_P) of 94% and 63% of the equipment weight (W_P), found in §§ 19.2.1 and 19.2.2, were based on following assumptions for factors in the design lateral force formula 32-2 in § 1632.2 of the 1997 Uniform Building Code (UBC)~~:~~ and an additional divisor of 1.4 selected by the originating task force (for SEMI S2-0200), the basis of which is unknown.

- a_p = 1.0 (i.e., treat the equipment as a rigid structure)
- C_a = 0.53 (i.e., seismic zone 4, soil profile type S_D, and site 5 km from a seismic source type A)
- I_p = 1.0 and 1.5 for non-HPM and HPM equipment, respectively (~~refer to~~ as described in Table 16-K)
- h_x/h_r = 0.5 (i.e., equipment attached at point halfway between grade elevation and roof elevation)
- R_p = 1.5 (i.e., shallow anchor bolts), not from Table 16-K but § 1632.2 explanation of R_p.
- Wp = the weight of the equipment.

$$F_P = \left[\frac{a_p\, C_a\, I_p}{R_p}\left(1 + 3\left(\frac{h_x}{h_r}\right)\right)\right] \times \frac{1}{1.4}\, W_p \qquad \text{(R4-1)}$$

NOTE XX: In 1997 UBC defines a hazardous production material (HPM) as a solid, liquid, or gas that has a degree-of-hazard rating in health, flammability, or reactivity of class 3 or 4 and that is used directly in research, laboratory, or production processes that have as their end product materials that are not hazardous.

R4-3.~~2~~4 *Assumptions Used for Above Derivation*

[renumber subsequent paragraphs as appropriate]

Justification: In the body of S2 (§19.2), there are minimum horizontal forces given at 94% and 63% of the equipment weight for equipment containing HPMs and not, respectively. S2 has an RI4 that in part aims to explain the origin of these values.

> 19.2 *Anticipated Seismic Forces* — The seismic forces anticipated to be experienced by the equipment (refer to ¶ 19.1) should be at least the following:
>
> 19.2.1 For equipment containing hazardous production materials (HPMs), a horizontal force equal to 94% of the weight of the equipment.
>
> 19.2.2 For equipment not containing HPMs, a horizontal force equal to 63% of the weight of the equipment.

With regard to RI4, there was a desire expressed by some committee members for more background to explain:

- why the minimum force values used in SEMI Section 19 have not been modified with changes in the UBC (now ASCE via IBC) equation and the variety of region differences in this concept, and
- a factor (=1.4) that was used, and mentioned, in the previous version of the RI not mentioned in the current version but still influencing the force values.

The previous version of the RI (e.g., in S2-0715) had the same core equation (without the 1/1.4 factor) which outputs .883 or 1.325 for non-HPM and HPMs, respectively based on the assumed conditions stated in the RI.

$$\frac{(1.0)(0.53)(1.0_{nHPM} \,/\, 1.5_{HPM})}{1.5}\left(1+3\left(\frac{1}{2}\right)\right)W_p = .883_{nHPM} \,/\, 1.325_{HPM}\ W_p$$

The equation was from UBC 1997 for the force which attachments for permanent equipment supported by a structure shall be designed to resist.

"*1997 UBC –SECTION 1632 - LATERAL FORCE ON ELEMENTS OF STRUCTURES, NONSTRUCTURAL COMPONENTS AND EQUIPMENT SUPPORTED BY STRUCTURES …* **1632.1 General.** Elements of structures and their attachments, permanent nonstructural components and their attachments, and the **attachments for permanent equipment supported by a structure shall be designed to resist the total design seismic forces prescribed in Section 1632.2"** [1632.2 has the force equation].

We cannot know with certainty why, but the TF that originally developed the S2 criteria also introduced a reduction of the UBC-formula-calculated force by dividing it by 1.4.

- $F_{p\,(yield)} = F_{p\,(ultimate)}/1.4$
  $= [1.32]/1.4\ W_p$
  $= [0.94]\ W_p$

Thus, the force values originally introduced into S2 (at least at S2-0200) were 0.883/1.4 = 0.63 Wp and 1.325/1.4 = 0.94 Wp (actually 0.95 Wp).

Regardless of the real source and reason of the 1.4 factor, the recent TF finds that the output numbers have been sufficient for safety in the industry, and proposes to explain the 1.4 factor in the RI as shown in the proposed revision.

Motion	To approve the above editorial change(s).
Motion by/ 2nd by	By: Lauren Crane / Lam Research Second: Lucian Girlea / Nikon Precision Inc.
Discussion	None
Vote	16 **Y**-0 **N** ; If Y > 50% Motion passes, **GO TO III**

III. Safety Check

Note: See *Regulations* § 15 for further information.

Motion			
		This is not a Safety Document, when all safety-related information is removed, the Document is still technically sound and complete. (*Regulations* ¶ 8.7.1)
	x	**This is a Safety Document**, when all safety-related information is removed, the Document is not technically sound and complete. (*Regulations* ¶ 8.7.2)
	x	Safety Checklist (*Regulations* ¶ 15.3) is complete and has been included with the Document throughout the balloting process. (*Regulations* ¶ 15.1.2)

Motion by/2nd by	By: Eric Sklar / Safety Guru, LLC Second: Lauren Crane / Lam Research
Discussion	None
Vote	14 **Y** -0 **N**; Motion passed.

IV. Intellectual Property Check

Note: This Document may cover all or part of a Standard or Safety Guideline. Regardless of the coverage, this IP check applies to the entire Standard or Safety Guideline*. See *Regulations* § 16 for further information.

x	The TC Chapter meeting chair asked those participating, if they were aware of any patented technology that might be relevant (see *Regulations* ¶ 16.3.1.1) to the Standard or Safety Guideline; or, any copyrighted items or trademarks that are used/reproduced (see *Regulations* ¶ 16.4.1.2) in the Standard or Safety Guideline. (Also see, *Regulations* § 8.8)				
	x	The question is NOT answered in affirmative (No potentially material patented technology or use/reproduction of copyrighted items/trademarks is known.)	**GO TO SECTION V.**		
		The question is answered in affirmative	Is any of the known IPs a patented technology?		**Yes, at least one of them is a patented technology**	**GO TO IV (a) "Patented Technology" subsection**
					No	**GO TO IV (b) "Copyright items" subsection**

V. Action for this Document

Motion	x	This Document passed TC Chapter review and will be forwarded to the ISC A&R SC for procedural review.
		This Document failed TC Chapter review and will be returned to the TF for rework.
		This Document failed TC Chapter review and work will be discontinued.

Motion by/ 2nd by	By: Lauren Crane / Lam Research Second: Lucian Girlea / Nikon Precision Inc.	
Discussion	None	
Vote	11 **Y** -0 **N**; Motion passed.	
Final Action	x	Motion passed
		Motion failed