



1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49

**INTERNATIONAL ELECTROTECHNICAL COMMISSION**

**TECHNICAL COMMITTEE NO. 108: SAFETY OF ELECTRONIC EQUIPMENT  
WITHIN THE FIELD OF AUDIO/VIDEO, INFORMATION TECHNOLOGY AND  
COMMUNICATION TECHNOLOGY**

**Background**

International Electrotechnical Commission standard IEC60950-1 currently has no specific requirements for the mechanical strength of slide/rails when used with rack mounted ITE equipment. The absence of a strength requirement may expose ITE users and servicers to potential hazards and this concern has been expressed by safety test house engineers in recent years. However, there is currently no sub-clause in the standard that addresses the potential hazards resulting thereof (see attachment 1.0 UL/CSA Binat draft memorandum AI 10 Draft Letter to US CAN NCs.doc).

As a result of these concerns, a Bi-National [UL/STP & CSA/TC108] ad-hoc committee of mechanical safety experts was formed whose purpose is to draft a proposed requirement which will resolve these concerns and also bring consistency to the several varying requirements of different manufacturers and test house certifying engineers to mitigate the safety concerns that they perceive. Such requirements have covered a full range of somewhat arbitrarily chosen requirements, from "no test required" to "slide/rails must withstand 3X the weight of the EUT mounted to the slide/rails" or even "4X", understood to be derived from wall mounted equipment and also from IEC60065, which does address the hazard for audio video equipment (see reference from UL 60065, 7<sup>th</sup> Edition, sub-clause 19.6 on attachment 1.0).

Since the state -of-the-art of slide/rail design does not lend itself well to arbitrary values such as 4X or even 3X for large servers, it is not practical to simply adopt similar requirements from IEC60065 (only the version with US. Canada National Differences applies) or other IEC standards. ITE racks contain products that are heavy to begin with and the slide/rail mechanisms must perform additional functions to attaching the servers to the racks. The practicality of a slide/rail function has been unnecessarily impacted by this past approach and a hazard based study is in order, to determine the mechanical strength that is reasonable, as a means to avoid the hazards resulting from rack mounted equipment becoming detached from their mounting means (slides/rails) and causing injury to persons



49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65  
66  
67  
68  
69  
70  
71  
72  
73  
74  
75  
76  
77  
78  
79  
80  
81  
82  
83  
84  
85  
86  
87  
88

**Rationale**

For the purposes this proposal, as addressed by the ad-hoc committee on strength of rack slide rails, the hazard is defined as;

“The mechanical failure of the slide/rail resulting in the possibility of physical injury due to the falling of the slide/rail mounted equipment.”.

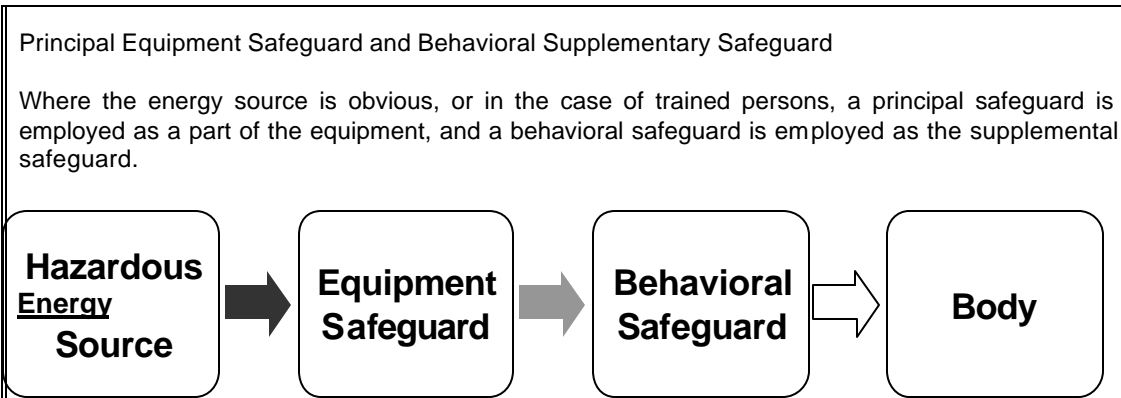


Here, the potential Hazardous Energy Source is a product that contains significant mass and which is mounted on slide-rails in a rack. The purpose of the slide/rails is to provide a function that permits the product to be opened like a drawer in the rack for the purpose of installing options, servicing and/or maintaining the product under consideration. Such products may be installed in standard ITE racks, audio-video racks, telecom racks or the like. Typically, such products may include computers such as Servers or other electronic equipment, most of which are of significant mass.

Should the slide/rail fail, due to its lack of robustness, under conditions of normal use or reasonably foreseeable abuse, the hazard generated will be a Kinetic Energy Injury resulting from an inelastic collision to the human body, characterized by laceration puncture, abrasion, contusion, and crush.

We would also characterize this potential hazard has as being generally obvious to the general population. Users usually know that products are heavy and that there could be significant injury during mechanical failure of the slide/rail. If there is an activity on the rack mounted equipment that causes a mechanical failure to occur, it is often accompanied by audio/visual and tactile feedback that a failure is beginning.

Based on the above characteristics of the hazard, we can now begin to define our Safeguards:





89  
90 The Hazardous Energy Source is defined above as the slide/rail mounted equipment of substantial  
91 mass that is mounted to a rack.

92  
93 The Equipment Safeguard is a robust mechanical design which can be confirmed by test in  
94 accordance with the proposal below. Please note that the engineering criteria applied are dependent  
95 on both the weight of the equipment and the foreseeable forces applied to the equipment when the  
96 drawer is in an extended position. A simple arithmetic expression is no longer used (as in "4X" such  
97 as the IEC60065 Sub-clause attached). We have attached an excel spreadsheet program to assist  
98 the ad-hoc in performing the new arithmetic calculations, but which is not intended to appear in the  
99 body of the standard.

100  
101 The Behavioral Safeguard is accomplished by adding a label in a clearly visible location of the rack  
102 that conveys the following message or equivalent: "Do Not Stack".

103  
104 Rational for the significant requirements in the following proposal can be summarized as follows:

105  
106 X.X.1.1: The center of gravity was chosen to apply the downward force because in general,  
107 when installing equipment in a rack, it is foreseeable that previously installed equipment of  
108 similar size/mass may be pulled out into the service position (fully extended) and used to set  
109 the new equipment on while positioning and installing the new slide/rails. In this scenario, it is  
110 not likely that the new equipment would be significantly off-centered from the installed  
111 equipment that it is being set on.

112  
113 150% of the equipment mass is derived from the mass of the equipment, and a 50%  
114 tolerance allowed for manufacturing differences in the rails which effectively adds a safety  
115 buffer.

116  
117 The 329 N to 534 N additional force is accounting for equipment that is about to be installed in  
118 a rack being placed or set on a previously installed piece of equipment where the previously  
119 installed equipment is being used as a temporary shelf or work space. It is assumed that 534  
120 N is the maximum mass of equipment allowed to be safely lifted by people alone without the  
121 use of mechanical lifting devices. Equipment having a mass greater than 534 N will have  
122 mechanical lifting devices and it is therefore unlikely that the equipment being installed will be  
123 set on any equipment previously installed in the rack. Several manufacturers use a mass of  
124 approximately 534 N as their recommended maximum unassisted lifting mass.

125  
126 X.X.1.2: The 250 N force is considered a force likely to be encountered during servicing of  
127 the equipment, and normal operations around equipment. The force is partially derived from  
128 the existing 60950 standard, section 4.1, and partially from research into normally  
129 encountered plug forces seen on various manufacturers' equipment. The application of force  
130 at the most unfavorable position is taking into account the servicing of a fully extended piece  
131 of equipment, leaning on or bumping into an extended piece of equipment and other  
132 reasonably foreseen circumstances which may be encountered.

133  
134 X.X.1.3: Testing the end stops of slide/rails is being considered by the ad-hoc committee,  
135 however due to the complexity of simulating this dynamic test requirement, the actual  
136 proposal criteria is still being investigated.

137  
138 X.X.2: To inform users that the rack mounted equipment is not meant for use as a shelf or  
139 workspace, the graphic symbol is used as a visual reminder. There is concern expressed by  
140 manufacturers about the limited space available for additional labels, especially in the small  
141 1U (EIA) and 2U design points. The graphic is small and not accompanied by any wording on



108/HBSDT (experts\_adhoc\_slide\_rails)  
DATE 08/17/2005

142 the label itself to conserve space, however its meaning must also be described in the user's  
143 manual.

144  
145

## 146 **Proposal**

147

### 148 **X.X.1 Rack Mounted Equipment**

149

150 For equipment intended for mounting on racks, any slide/rails allowing the equipment to slide  
151 away from the rack for installation, service, maintenance and the like, shall be adequate.  
152 Note Slide/rails include bearing slides, friction slides or other equivalent mounting means.

153

154 Such slide/rails shall have end stops that prevent the equipment from unintentionally sliding  
155 off the mounting means.

156

157 Compliance is checked by inspection and available data, or where necessary, by the following  
158 tests in X.X.1.1, X.X.1.2.

159

160 The equipment and its associated slide/rails shall remain secure during the tests and shall be  
161 able to perform one complete cycle of travel on its slide/rails after completion of the test. End  
162 stops shall retain the equipment in a safe position and shall not allow the equipment to slide  
163 past the end of the slide/rails.

164

#### 165 X.X.1.1 Mechanical Strength Test, 330 N

166

167 The slide/rail mounted equipment is installed in a rack in accordance with the manufacturer's  
168 instructions; with the slide/rail mounted equipment in its extended position, a force in addition  
169 to the weight of the equipment is applied downwards through the centre of gravity for 1 min. to  
170 account for user or service personnel stacking on top of installed rack mounted equipment in  
171 the extended position, during equipment installation. The total force applied to the slide/rails  
172 shall be equal to the greater of the following two values:

173

174 - 150% of the equipment mass plus 330 N (74 lbf).

175

176 - 150% of the equipment mass, plus an additional mass equal to the equipment mass but not  
177 to exceed 530 N (120 lbf.).

178

179

#### 180 X.X.1.2 Mechanical Strength Test, 250 N

181

182 The slide/rail mounted equipment is installed in a rack in accordance with the manufacturer's  
183 instructions; a 250 N (56 lbf.) force is applied to the slide/rail mounted equipment, in every  
184 direction except upward to include the most unfavorable position of the slide/rail mounted  
185 equipment, for a period of 1 minute. The force is applied to the slide/rail mounted equipment  
186 in its fully extended (service) position as well as its normally recessed (operating) position.

187

188

#### 189 X.X.1.3 Mechanical Strength Test, End Stops

190

191 Additional requirements on the strength of end stops are being considered at this time.

192

193

194

195



108/HBSDT (experts\_adhoc\_slide\_rails)  
DATE 08/17/2005

196  
197  
198  
199  
200  
201  
202  
203  
204  
205  
206

### X.X.2 Rack Mounted Equipment Marking

For all slide/rail mounted equipment, a label shall be affixed to this equipment, in a location visible to operators when the unit is in its fully extended service position which has the following or similar wording:

Caution: Slide/rail mounted equipment is not to be used as a shelf or a work space.

It is permitted to use the following symbol to provide this information if its meaning is also contained in the operator instructions:



207  
208  
209  
210  
211  
212  
213  
214  
215  
216  
217  
218



218  
219  
220  
221  
222  
223  
224  
225  
226  
227  
228  
229  
230  
231  
232  
233  
234  
235  
236  
237  
238  
239  
240  
241  
242  
243  
244  
245  
246  
247  
248  
249  
250  
251  
252  
253  
254  
255  
256  
257  
258  
259  
260  
261  
262  
263  
264  
265  
266  
267  
268  
269  
270  
271

## APPENDIX

### Referenced Documents:

#### 1.0 AI 10 Draft Letter to US CAN NCs.doc

August (Draft), 2003

To: U.S. and Canadian National Committees for IEC TC108

- ANSI/USNC IEC TC108 TAG
- CSC/IEC/TC74 (MT-2)

From: Bi-National Working Group (BNWG) for CSA/UL 60950-1

Subject: Rack Mounted ITE

U.S./Canadian National Committees for IEC TC108:

Certifiers are being requested to certify to IEC 60950-1 rack-based ITE systems containing sub-assemblies that slide out on rails. IEC/CSA/UL 60950-1 is not clear what Mechanical Strength (sub-clause 4.2) requirements should apply to such constructions, both to the complete systems and the sub-assemblies themselves. Mechanical strength requirements in sub-clause 4.2 are only explicitly specified for wall and ceiling mounted equipment, and equipment with handles.

This subject was introduced at the July 15-16 meeting of the Bi-National Working Group (BNWG) for CSA/UL 60950-1. Consensus was reached that the subject will be difficult to address since there are a number of factors that need consideration, such as wide range of configurations and weight (mass) of both racks/cabinets and sub-assemblies, and the need for separate considerations for testing complete rack assemblies versus individual sub-assemblies, etc. Therefore, the BNWG suggested that the U.S. and Canada should form an industry task group to research the issue and develop a proposal to present to the IEC TC108 HBST so appropriate requirements can be included in the HBSE-based standard currently under development.

At this time the BNWG formally requests that the Canadian and US National Committees for IEC TC108 consider forming a task group of experts to study the issue and attempt to develop and propose an appropriate set of mechanical strength requirements for ITE rack systems and sub-assemblies. The BNWG requests that the subject be introduced at your next National Committee meetings, presently scheduled for September 2003.

Note - UL 60065, the U.S. Standard for audio-video equipment, contains a U.S. National Difference from IEC 60065 7<sup>th</sup> Edition in sub-clause 19.6 that attempts to address rack-mounted equipment by grouping it with Wall and Ceiling mounted equipment. Also, 12.4 of IEC 60065, 7<sup>th</sup> Ed contains a requirement for Drawers. Please see attachment for an excerpt.

Thank you in advance for your consideration of this request.

Sincerely,

BNWG  
c/o Barbara Davis  
60950 BNWG Secretary



271  
272  
273  
274  
275  
276  
277  
278  
279  
280  
281  
282  
283  
284  
285  
286  
287  
288  
289  
290  
291  
292  
293  
294  
295  
296  
297  
298  
299  
300  
301  
302  
303  
304  
305  
306  
307

**Attachment**

References from IEC/UL 60065, 7<sup>th</sup> Edition. Underlined portions are U.S. National Differences.

**19.6 Wall or ceiling or equipment rack mounting means**

The mounting means of apparatus intended for wall or ceiling or equipment rack mounting shall be adequate.

Compliance is checked by inspection of the construction and of available data, or where necessary, by the following test.

The apparatus is mounted in accordance with the manufacturer's instructions, a force in addition to the weight of the apparatus is applied downwards through the centre of gravity, for 1 min. The additional force shall be equal to three times the weight of the apparatus but not less than 50 N. The apparatus and its associated mounting means shall remain secure during the test.

**12.4 Drawers**

Drawers which are intended to be partially pulled out from the apparatus shall have a stop of adequate mechanical strength in order to prevent HAZARDOUS LIVE parts becoming ACCESSIBLE.

Compliance is checked by the following test:

The drawer is pulled out in the intended manner until the stop prevents further movement. A force of 50 N is then applied for 10 s in the most unfavourable direction.

After the test, the apparatus shall show no damage in the sense of this standard; in particular no HAZARDOUS LIVE parts shall become ACCESSIBLE.