



# PRODUCT SAFETY NEWS

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## OPENINGS IN ENCLOSURES FOR VENTILATION OR ADJUSTMENT:

Openings in instrument enclosures are required for ventilation and adjustment of internal controls. All safety standards recognize these needs, but each authority has developed different tests to establish the maximum allowable sizes of such openings. The restrictions on openings have two objectives: limitation of electric shock hazards, and limitation of fire spreading hazards. Don't forget that other considerations may place more stringent limits on ventilation openings than do safety standards. For example, typically we have had to limit hole sizes to 1/8" diameter to approach EMI specs.

We presently use ventilating hole patterns with 1/8" dia. and 3/16" dia. holes, and 1/8" wide slots. These sizes have been accepted by customers, although the 3/16" holes would not meet the IEC "freely suspended" 4mm probe test.

A review of IEC, UL, and CSA standards suggests that we can meet the intent of most safety requirements for electronic instruments if we:

On top and sides:

1. Limit slots and louvers to less than 4mm finished opening width and
2. Limit round holes to less than 4mm finished opening diameter,

with all live parts recessed at least 4mm inside the opening plus an additional 3mm recess for each 1000 V or fraction thereof above 1000 V (a part operating at 2500 V would have to be recessed at least 10mm).

On bottom panels:

1. Limit slots and louvers to less than 1/4 inch finished opening width,
2. Limit round holes to less than 1/4 inch finished diameter,
3. Eliminate all openings under transformers that are not "fully enclosed" with metal shells or die cast end hills and terminal boards,

with all live parts recessed 1 1/8 inches plus an additional 1/8 inch for each 1000 V or fraction thereof above 1000 V (a part operating at 2500 volts would be recessed at least 1 3/8 inches). Smaller holes would require less recessing of live parts.

For top and sides, these limits are based on the IEC test with a "freely-suspended" 4mm diameter X 100mm long rod, and a UL tapered test finger.

For bottom panels, the limitations are based on a CSA 1/4 inch diameter probe and the UL tapered test finger. Elimination of holes under transformers results from CSA's concern for fire hazard. Holes may be used if the transformer and instrument meet specific short circuit test requirements, or if the holes are screened or baffled. CSA has accepted fiber glass window screen for this purpose.

The real criterion of shock hazard protection is that none of the various test probes should contact live parts when the whole outer surface of the instrument is probed. The larger the hole, the further the tapered probes can penetrate, and the further live parts must be recessed.

These limitations will probably answer most safety standards for laboratory and portable electronic instruments, they may not be sufficiently stringent for medical instruments, data processing equipment, or other units intended for non-technical, non-industrial markets. For example, UL is considering very stringent limitations for data processing units to reduce fire and smoke damage hazards in computer installations. UL also has tough restrictions on allowable openings in TV cabinet tops (3/32" dia.).

Other requirements bearing on the design of ventilation and other openings should be considered. Here are some very brief summaries of the procedures various authorities use to determine the possibility of contact with live parts. It's worth noting that live terminals, etc., that must be exposed for operational reasons are generally acceptable.

IEC:

1. Probe every possible position on all surfaces of the instrument with "jointed" test finger. Probe with rigid test finger using 30 N force.
2. A "freely-suspended" 4mm X 100mm rod shall not become live when the surface is probed.
3. Covers (plug-ins) removable by hand (without tools) during normal operation shall not expose live parts (terminals and sockets excepted). Probe with test fingers.
4. Holes in panels for screwdriver adjustment of internal controls shall not involve risk of electric shock. Test with all possible orientations of a suitable metal tool.
5. Means for line voltage adjustment by hand shall not involve risk of shock.

UL:

1. For holes to 1" diameter, and slots up to 7/8" wide, the tapered probe shall not contact live parts up to 1000 volts, with additional prescribed clearances above 1000 volts.
2. Data processing spec now requires bottom panel ventilating holes to pass a "flaming oil" or "molten PVL and copper" test.

CSA:

1. Probe all openings with 1/4" x 4" rod; no contact with live parts allowed.
2. No openings under unenclosed transformers unless special short circuit tests are passed to demonstrate absence of fire hazards.

The following sketches show the relative sizes of some of the various standard test fingers and probes. The UL tapered probe appears most stringent.

