



1655 Scott Boulevard
Santa Clara, CA 95050-4169
(408) 985-2400
FAX No. (408) 296-3256



Subject 22

1655 Scott Blvd.
Santa Clara, CA 95050
March 28, 1996

TO: Casualty Council of Underwriters Laboratories Inc.,
Consumer Advisory Council,
Electrical Council of Underwriters Laboratories Inc.,
Subscribers to UL's Standards Service for Amusement and Gaming Machines

SUBJECT: Report of the Meeting of the Industry Advisory Conference of UL for Amusement and Gaming Machines; Request for Comments on Proposed Requirements for the Fourth Edition of the Standard for Amusement and Gaming Machines, UL 22; PROPOSED EFFECTIVE DATES

SUMMARY OF TOPICS

The following topics were discussed at the meeting:

1. Physical Stability Test
2. Leakage Current Test
3. Grounding and Bonding within Redemption Games
4. Flammability of Decorative Plastic Parts
5. Nameplate Marking Location
6. Incandescent Lamp Replacement Marking
7. Oxygen Bomb Test
8. Definitions for Operator and Service Persons
9. Harmonization
10. Uniform Interpretation of the Standard
11. UL Certification Processes
12. Flame Spread Test
13. Mechanical Hazards
14. UL's Quarterly Follow-Up Service Audits
15. International Markets, Including Electromagnetic Compatibility Directive (EMCD) and Low Voltage Directive (LVD)
16. Marking Requirements in Accordance with the American National Standard for Product Safety Signs and Labels, ANSI Z535.4-1991
17. Usage of Metric Values

(Continued)

A not-for-profit organization
dedicated to public safety and
committed to quality service



SUMMARY OF TOPICS (cont'd)

- 18. Environmental Awareness in Standards
- 19. Additional Agenda Items
- 20. Meeting Close – Next IAC Meeting

COMMENTS DUE: MAY 23, 1996

A meeting of the Industry Advisory Conference of UL for Amusement and Gaming Machines was held on December 7 and 8, 1995 at the Sunnyvale Hilton in Sunnyvale, California. The purpose of the meeting was to discuss pertinent issues (as noted above) relating to the standard and industry overall.

Attached as Appendix A are proposed requirements for UL 22. These proposals correlate to the numbered items noted in this report. Attached as Appendix B is a list of those who attended the meeting. Questions regarding interpretation of requirements should be directed to the responsible UL Staff. Please see Appendix C of this bulletin regarding designated responsibility for the subject product category.

Please note that proposed requirements are of a tentative and early nature and are for review and comment only. Current requirements are to be used to judge a product until these requirements are published in final form.

PROPOSED EFFECTIVE DATES

The proposed requirements specified in 4.8.1, 31.1, 31.2, 31.5, 31.6, 31.6.1, 31.7, 31.8, and Figures 31.1 and 31.2 will necessitate a review of currently Listed products. Therefore, UL proposes that the new requirements become effective 12 months after publication. This is intended to give manufacturers sufficient time to implement the new leakage current test measurement method and meter. This also includes the time needed by UL to verify that manufacturers are using the new method and meter.

The remainder of the requirements will not require a review of currently Listed products. Therefore, UL proposes that these requirements become effective upon publication.

* * * * *

The following report is not intended to be a verbatim transcript of the discussions at the meeting, but is intended to record the significant features of those discussions.

1. PHYSICAL STABILITY TEST**RATIONALE**

A proposed revision to paragraph 35.7 of the standard was discussed. Currently, it requires that freestanding products a) with a height exceeding 1 meter (39-3/8 inches) and b) weighing more than 25 kilograms (55.1 lb.) be subjected to a force not exceeding one-fifth the weight but not more than 250 Newtons (56.2 pounds-force) applied at a height not exceeding 2 meters (78-3/4 inches) from the floor. Doors and drawers that may be opened by operators or service persons for servicing are to be opened in the most unfavorable position for this test. The unit shall not tip over as a result of this test.

The present wording of the test requirement is written from the perspective that overbalancing, due to an external force, may occur during operator or service person servicing. UL suggested a proposal with an intent that would help protect users, in addition to service personnel, against the hazard of overbalancing. In this proposal, the force of the test would be applied at the height of the user controls. UL considers this method to be a more realistic and accurate representation of a force that could be applied when a machine is in use in the field. UL is therefore proposing to revise current paragraph 35.7 and add paragraph 35.7.1 to help clarify the stability requirements regarding freestanding appliances.

Additionally, UL reviewed paragraphs 35.1, 35.2, and 35.9 and has determined that they should also be revised for clarification. UL has concluded that paragraph 35.1 should be revised to consider the weight of a replenishable reservoir (i.e., coin boxes and redemption ticket dispensers) when performing a stability test. The proposed revision would be a more accurate and appropriate test method. UL has also considered to revise the requirements in 35.9 regarding loading. Currently a "150-pound person" is specified as a load. However, the stability of certain amusement rides could be compromised when several "passengers" board a ride. Therefore, additional consideration should be given for rides that could carry multiple loads (more than one passenger). UL proposes to revise paragraph 35.9 to address this scenario.

IMPACT

The proposed revisions, if adopted, would clarify requirements relating to physical stability and formalize current practice. UL anticipates that a review of currently Listed products will not be necessary should the proposals be adopted. However, UL invites comments from industry regarding these new proposals to determine if manufacturers have encountered field incidents involving overturned machines.

2. LEAKAGE CURRENT TEST

BACKGROUND

Industry requested UL to consider raising the present leakage current limits specified in paragraph 31.1 of the standard to 3.5 mA. Partial reasoning is due to an increase in the use of switchmode power supplies and motor-driven assemblies that require line-to-ground filtering components and the assumption that grounded outlets are a likelihood in most commercial locations.

DISCUSSION

Information was presented on extensive experimental work concerning suitable leakage current limits derived from a UL experiment in the late 1960's and early 1970's. The objective was to determine the threshold of leakage current that would produce an unacceptable degree of startle reaction. The consequences of involuntary reaction (i.e., bodily injury due to falling, spillage of hot liquids) were of concern to UL.

As a result of the experiment, a current of 0.5 mA was determined to be the level for which most persons would not experience a significant startle reaction. This data was then used by the American National Standards Committee, C101 for the development of the American National Standard for Leakage Current for Appliances, ANSI C101. The 1992 edition of ANSI C101 continues to specify use of the 0.5 ma level for leakage current.

The proposal to raise the leakage current to 3.5 mA was derived from information technology equipment where switching power supplies are used. This limit was proposed to ease the restrictions on higher leakage current that resulted from line filters used to suppress EMI emissions. UL requested that additional technical rationale be provided to support any increase to the present leakage limits. UL

encourages comments from industry regarding the suitability of the proposal to increase the present leakage limits.

Additionally, UL proposed a revision that would include a new leakage current test meter and modified leakage current test measurement circuits. The new meter and circuit are consistent with those specified in the American National Standard for Leakage Current for Appliances, ANSI C101-1992.

RATIONALE

Presently, leakage current values are recorded using a meter that incorporates a high-impedance average responding voltmeter. This meter was specified in ANSI C101.1-1986 and earlier editions of the standard. Measurements obtained from the meter are recorded in ac milliamperes (mA).

UL is proposing the use of the leakage current meter specified in the latest edition of ANSI C101-1992. This would result in the addition of new Figure 31.2. Features of the proposed leakage current meter include:

- 1) The incorporation of a body impedance circuit and frequency sensitive network. This combination permits the meter to more accurately respond to the high frequency components found in non-sinusoidal leakage current waveforms.
- 2) Inclusion of a true rms-responding voltmeter.
- 3) Measurement readings in Measurement Indication Units (MIU's).

The term MIU refers to the numerical indication of a defined measurement instrument and coincides numerically with milliamperes only at low frequencies. An MIU is intended to relate a numeric value corresponding to the degree of physiological effect rather than a value which relates to a current magnitude. UL has determined that this method of conveying the effect of leakage current is more accurate. Therefore, UL proposes the addition of paragraph 4.8.1 to define leakage current in terms of MIU instead of milliamperes.

UL is also proposing revisions to existing requirements in Section 31 and the addition of new paragraphs 4.8.1 and 31.6.1 and Figure 31.2 to incorporate the new measurement system.

IMPACT

The proposed new leakage current instrument and method will not significantly affect the readings of leakage current for most currently Listed products. Products with simple leakage paths from line voltage parts through linear impedance (i.e., resistive or capacitive paths) would produce the same readings of leakage current with both instruments. Products having high frequency leakage current might produce a lower leakage current reading with the new instrument because of the higher input impedance at high frequencies.

Products having DC leakage current would produce lower DC readings with the new instrument. The current instrument, which incorporated an averaging-type meter, would indicate a reading of 1.11 times the average of the rectified value (in this case, the DC value times 1.11). The new instrument can indicate the true DC value correctly.

A review of currently Listed products would be required if the proposal is adopted. However, to give manufacturers time to comply with the new leakage current test measurement method and meter, UL proposes that the new and revised requirements become effective 12 months after publication.

3. GROUNDING AND BONDING WITHIN REDEMPTION GAMES

DISCUSSION

Generally, redemption equipment does not contain a metal framework, making it difficult for manufacturers to establish equipment grounding and component/accessible conductive surface bonding. Industry has asked UL to clarify the present grounding and bonding requirements in UL 22. UL explained that the intent of the requirements is to have an effective path to earth ground to enable overcurrent protective devices to function in the case of a single fault condition. UL explained that accessible conductive surfaces and components not likely to become energized at a hazardous voltage (greater than 42.4 V peak) under a single fault condition do not require bonding.

The IAC had a question whether certain accessible parts were likely to become energized. As examples, members noted coin door areas, speaker grilles, and metal control shafts. UL responded that the answer would require a case-by-case inspection of the accessible part in question. Regardless, the following considerations are always required. The proximity of the accessible part to parts operating at hazardous voltage would be examined. Also, the likelihood that the accessible part could become energized at a hazardous voltage under a single fault would be considered.

Another question was asked regarding the requirement for the insulation color of bonding conductors. It was noted that the standard did not contain a requirement for bonding conductor insulation color. UL clarified that the insulation of bonding conductors could be any color except green or green with one or more yellow stripes.

RATIONALE

For clarification, UL is proposing the addition of a new paragraph, 13.2.3.1, that specifies the color of insulation used on bonding conductors may be any color other than that of the grounding conductor (green with or without one or more yellow stripes).

IMPACT

The proposed requirement is for clarification. No review of currently Listed products will be required should the proposal be adopted.

4. FLAMMABILITY OF DECORATIVE PLASTIC PARTS

RATIONALE

Industry has requested UL to exempt small plastic external parts from a flammability rating (reference paragraph 6.2.1 of the standard). These external parts would not be part of the appliance enclosure and would not enclose live parts. An original industry idea proposed an exception to flammability requirements if the decorative plastic part has a maximum dimension of 6 inches (15 cm) and a maximum volume of 4 cubic inches (62.5 cubic cm). Discussions involved the rationale for this idea and the type of revision that could be included in UL 22. However, most members mentioned that the size limitation may be confusing.

Although there are no specific requirements in UL 22 for decorative plastic parts, the IAC acknowledged that small inconsequential parts are not a fuel source for fire and should not require a flame rating. UL concurred and mentioned that there has never been an intent to control small parts. Therefore, UL proposes new paragraph 4.4.1 to define decorative plastic parts and new paragraph 6.2.1.1 to exempt them from flammability requirements.

IMPACT

The proposals clarify existing requirements. No review of currently Listed products will be required should the proposals be adopted.

5. NAMEPLATE MARKING LOCATION**RATIONALE**

Currently, paragraph 50.2 in UL 22 specifies that the nameplate marking be located on the front of the appliance. Manufacturers have been designing amusement games for years with only one marking, usually provided at the rear of the machine. There have been no documented cases acknowledging any problems with markings on the back of machines. The IAC discussed this proposal and found it to be appropriate. Therefore UL is proposing that the marking location specified in paragraph 50.2 be revised to include any location except the bottom.

IMPACT

Manufacturers will have greater flexibility in selecting a marking location while not compromising the level of safety contemplated by the standard. Therefore, no review or retest of currently Listed machines will be required should the proposal be adopted.

6. INCANDESCENT LAMP REPLACEMENT MARKING**RATIONALE**

UL is concerned with the risk of fire that could result due to excessive heat from a replacement lamp with a higher wattage rating. A majority (if not all) of UL's standards specify that the maximum rating of replacement bulbs should coincide with the rating of the lampholder. This requirement originated in the Standard for Portable Electric Lamps, UL 153. To eliminate unnecessary risks of fire, UL is proposing that similar marking requirements be incorporated into UL 22 as new paragraphs 50.31, 50.32, and 50.33.

Industry questioned the intent of the proposal, and whether it was directed at attendants or service personnel. UL mentioned that the proposals were directed at both types of personnel. Other members questioned whether the voltage or maximum wattage should be marked, and whether all types of bulbs should be included.

The group concluded that the marking be proposed for filament-type (incandescent) bulbs. Although wattage is typically the indicator of heat, it was also concluded that the marking specify watts and volts, unless the bulb is intended for a nominal 120-volt circuit. Then, the voltage marking would not be required. UL explained that a higher wattage lamp could affect other components and wiring, which could not only affect the performance of the machine but could possibly create a hazard.

IMPACT

Since UL is already applying this requirement in evaluations, no review or retest of currently Listed products would be required should the proposals be adopted.

7. OXYGEN BOMB TEST

RATIONALE

The oxygen bomb test described in paragraph 46.1 of UL 22 (and other UL standards) is obsolete. Since the rubber industry stopped using oxygen bombs and replaced the bomb test with an air oven aging test, UL proposes to do the same. The rubber industry has supported the replacement of the oxygen bomb test with the air oven aging test because of the dangers involved with oxygen under pressure and because it is more convenient.

UL explained that it is proposing to replace the test with an Air Oven Aging Test as specified below. As proposed in revised paragraph 46.1 and new Table 46.2, UL plans to:

- a) Replace the 96 hour oxygen bomb test at 70°C with a 70 hour air oven aging test at 100°C, and
- b) Replace the 168 hour oxygen bomb test at 80°C with a 168 hour air oven aging test at 87°C.

IMPACT

Since the air oven aging test is considered equivalent to the oxygen bomb test, no review, modifications, or retest of currently Listed products will be required if this proposal is adopted. Manufacturers would not be required to conduct accelerated aging tests according to the air oven aging test on products that have already been tested with the oxygen bomb.

8. DEFINITIONS FOR OPERATOR AND SERVICE PERSONS

DISCUSSION

UL explained that it wanted to clarify the definitions of an "operator" and "service person" in paragraphs 4.9 and 4.16 of the standard. UL has determined that these definitions need development for easier interpretation of the accessibility requirements in the standard.

The IAC had difficulty defining the roles of operators, attendants, and service persons. Apparently, access to the interior of machines could be made available to untrained people; however, the question was whether these people had access to live or moving parts that could be hazardous.

Some members presented an idea to qualify areas of a machine, rather than personnel. Others thought that markings could be used to prevent untrained persons from entering hazardous areas. Other members noted that interlocks prevent access to any hazardous voltages, thus alleviating any potential problem.

The CSA mentioned that it considers any accessible compartment that may present a shock hazard or access to hazardous parts as a user/attendant area. The CSA, which considers the attendant a user because both are untrained, therefore requires a cautionary shock marking near that compartment.

The group discussed those areas that it considered were not accessible to untrained persons. After discussion, it was noted that manufacturers have to protect untrained persons from injuring themselves, regardless of what title they may have. The following changes to the glossary in UL 22 were suggested:

- a) Change the term "operator" to "attendant."

- b) Revise the definition of Operator Servicing to Attendant Servicing. The attendant would only be responsible for clearing coin jams, removing coins, price changing, cleaning the machine, replacing lamps and fuses, and resetting circuit breakers in user accessible areas.
- c) Revise the definition of Service Person to include the replacement of tapes, discs, program boards, accessories, conversion kits, and miscellaneous items not in user accessible areas and change "qualified" to "authorized" for clarification.
- d) Add a new paragraph to define user as the player of the machine.

However, it was also suggested that a cautionary marking, similar to that used in CSA C22.2 No.1, be proposed for UL 22 for those areas in a machine where an untrained person may have possible access. This marking would notify persons of areas with electrical and mechanical hazards.

UL requests comments regarding this topic. In particular, UL wants to know which one of the following approaches is preferred by industry:

- a) New definitions of service person, operator, attendant, and user in UL 22 or
- b) Specification of a cautionary marking on all access doors and panels (other than coin, cashbox, or ticket dispenser doors).

9. HARMONIZATION

BACKGROUND

A formal request to prepare a binational standard for the amusement and gaming machine industry was submitted to UL on January 31, 1995 by the Amusement and Music Operators Association (AMOA). The AMOA had previously received comments regarding the development of a binational standard from the Amusement and Music Operators Association of Canada (AMOC). Canadian operators, having discussed the laws in Canada for third party safety certification of electrical equipment, have determined that a harmonized or binational standard would encourage more manufacturers to seek dual safety certification (U.S. and Canada) of their equipment.

Industry representatives have suggested that harmonization be pursued through concurrent revisions to the UL and Canadian Standards Association (CSA) standards, rather than through a binational standard. UL and CSA support this approach due to the time, research, and industry funding that would be required to develop and maintain a binational standard.

DISCUSSION

Representatives from UL and CSA planned to develop a comparison list between UL 22 and CSA C22.2 No. 1. They will work on the comparison list to help identify like and unlike requirements. This will be presented to industry for comment in the near future. To help industry convey its ideas for harmonization to the safety certification agencies, it was suggested that separate industry meetings be held to coordinate ideas and present them to CSA and UL. The group then decided to set a future timetable for harmonization. Industry members planned to meet separately to develop a plan of action and study the harmonization issue before providing UL and CSA with information.

10. UNIFORM INTERPRETATION OF THE STANDARD

DISCUSSION

UL recognizes the need for uniform interpretation of requirements. Industry has also expressed this concern. UL responded by mentioning that systems are currently in place to enhance communications between offices. A monthly video conference has been established between domestic offices to discuss pertinent issues relating to the standard. Additionally, UL continually welcomes opinions from industry regarding interpretations. One industry member asked if there was a system or list of interpretations regarding UL 22. UL proceeded to explain its significant interpretation (SI) program. The program is intended to clarify issues involving interpretations of requirements among UL's offices. Once interoffice agreement has been achieved, the SI system can be used to trigger a proposal or announcement bulletin to industry if required. Although the program is designed as an internal function and manufacturers do not typically receive the "SIs," UL mentioned that these interpretations, when beneficial, can be published in UL bulletins.

The systems noted above are all used to support uniform interpretation of UL 22. However, UL stressed that the avenues of communication have to be open for UL to function effectively. When developing requirements, UL cautioned that it is not advisable to focus on uniform interpretation to a point where a requirement becomes too restrictive. The development of requirements requires focus on the safety concepts of fire, shock and injury hazards and a clear understanding of intent. UL encouraged the IAC to provide feedback regarding the application of requirements in the standard. Additionally, it was noted that manufacturers should discuss any significant interpretations regarding their products with the applicable UL designated engineers.

11. UL CERTIFICATION PROCESS

DISCUSSION

The IAC deliberated on key issues that could possibly simplify and help manufacturers comply with the UL certification process. The following items were discussed:

A. Service Delivery

Due to the general nature of the amusement game industry (low volume and quick turnaround), the IAC noted that speed and efficiency should be key components for an investigation. Industry would like to see an upgraded service that would fit its needs and still meet all applicable specifications/regulations.

UL replied that many programs already exist at UL that could help industry achieve this objective. However, many of these programs require that the manufacturers bear the responsibility for the Listing process. Manufacturers have to be adept at providing information to UL and must be knowledgeable of all the program requirements to comply with the parameters of these particular programs.

It appears that it would take a considerable amount of time for most manufacturers to comply with the stringent requirements applied in many of these programs. Therefore, UL would like to develop an alternate program for industry. UL requests comments from industry to develop a proposal.

B. Component Issues

The topic of the component selection process developed as a result of the discussion on service delivery. Industry members said that components were a confusing, if not problematic, issue. UL advised that manufacturers use the Recognized Component Directories (yellow books) to select

components evaluated by UL. It was noted that reading the descriptive introduction to the component categories to understand the general guidelines for components covered in the category is also important.

Generally, during the evaluation of a component, it is not known how the component will be installed in the end-use application. As a result, conditions of use, phrased "conditions of acceptability" (C of A's), are an important feature of a UL component evaluation. The C of A's can include temperature, spacing, and enclosure considerations when using components in the end-product application.

UL advised manufacturers to request documentation from the component manufacturer (the UL report if necessary) to determine the conditions of acceptability. In response to an industry member's question about the availability of "C of A's," it was explained that UL cannot publish them because they are proprietary information.

Even with this advice, manufacturers still foresee problems when selecting components. Some members noted that many vendors are unable to obtain the UL documentation or, at times, are even unaware of UL. By the time they obtain the UL documentation, manufacturers are already committed to a particular component. To alleviate this situation, UL suggested that manufacturers be more interactive with the UL engineer in charge of their particular project. The UL engineer should be able to help identify conditions of acceptability for any questionable component.

C. Obsolete and Unlabeled Products

The discussion centered on the existence of products in the field that do not bear the marking of a recognized safety certification organization. Although some of these machines are still being manufactured, many of them are not in production or are obsolete. The IAC noted that UL's Field Evaluation Program, although used to label such products installed in a specific job site, really has not addressed this issue. Although "site-evaluated," machines are constantly shipped in and out of arcades, therefore rendering the FEP inconsequential. Additionally, game operators said that the program is an expensive process.

UL believes that its role with obsolete products and unlabeled products in the field remains undefined until manufacturers, distributors, and game operators can agree upon some type of retrofit or refurbishing program.

The IAC also mentioned that a major problem with older, UL Listed games is replacement parts. These parts are usually not Listed or Recognized Components. When they are retrofitted in the original machine, the machine has to be evaluated to maintain the integrity of the Listing. It was noted that typically operators will buy the most convenient part that is best available to fix the machine in as timely a manner as possible.

UL explained that the issue has become one of field modification. It was also noted that even the use of Recognized Components for replacement parts does not necessarily ensure that the machine will comply with the requirements of the standard. There are times when the machine may require testing to ensure compliance with UL certification. UL mentioned that it has a retrofit/refurbishing program for other product categories, although it would have to be tailored for this industry. It was anticipated that UL staff would review other programs for reference, and check the relevance of retrofitting at distribution or service centers.

It was concluded that the industry should inquire about UL certification programs. The IAC suggested that industry submit a proposal for a model program (that would incorporate retrofits, conversions, and similar scenarios). UL will then review the proposal and evaluate its suitability.

D. Import products

UL recognized that the traditional Listing process for import products translates to a costly evaluation of components. A product having an international certification label does not necessarily comply with UL 22. An international label does not provide "blanket" coverage, although UL will examine certification reports from foreign safety agencies, (TUV, VDE, etc.) to assist in evaluating the product and its components.

After a brief examination of this topic, it was determined that an ad hoc be formed to study this issue.

E. Accessory Kits and Field Conversions

The need for a Listing process for accessory kits and field conversions was discussed. Although UL 22 currently contains requirements for field-installed accessories in Supplement SA of the standard, members believe that a more streamlined process should be in effect.

Members had questions about what would technically comprise a kit. Decals, new boards, lights and controls (low voltage parts) could all be a part of a kit that would essentially change an existing game to a new game. Some members questioned how a game could still maintain its Listing after a "conversion" process. UL mentioned that universal game cabinets have been Listed and would still comply with the standard with any Listed kit installed. Specified kits could be installed in any Listed cabinet with such a process.

The group concluded that UL would develop a proposal where a cabinet could be conversion ready. Industry members volunteered to help UL with this proposal.

* * *

The result of the above discussion was the formation of an ad hoc group to evaluate the suitability of items B through D.

12. FLAME SPREAD TEST

DISCUSSION

The background for the requirement in paragraph 6.6.2 of UL 22 originated from UL's concern that games, constructed of large, unbroken surfaces of combustible materials (i.e., wood-based products), were located in establishments where children represent a significant customer base. Flame spread requirements were intended to represent a yardstick by which the spread of fire on an exposed large surface of combustible material could be measured and then controlled. In the event of a fire, patrons would need sufficient time for an orderly egress. The test for determining a material's flame spread index (FSI) is specified in UL 723, the Standard for Test for Surface Burning Characteristics of Building Materials.

When UL originally researched this topic, it contacted representatives from the Building Officials and Code Administrators International (BOCA). Originally it was found that the current flame spread index of 200 was derived from requirements in Section 79 of BOCA. This section specifies that commercial establishments having materials with exposed surfaces larger than 10 ft² shall have those materials comply with the maximum 200 FSI requirement. The flame spread covers anything in that particular location based on the occupancy of the establishment in question. Since family entertainment centers are commercial establishments, the maximum 200 FSI requirement applies to this type of product. UL mentioned that the BOCA requirement is specifically applicable to any large exposed combustible surface area -- the issue is the safety of the room and the ability to clear the room in time in case of fire.

A member of industry had questions about the BOCA requirement. He mentioned he had talked to BOCA individuals who said that the 200 index concerns the paneling of the interior of the building site (in this case a family entertainment center). He questioned the rationale and validity of the requirement. Upon further research and discussions with BOCA representatives, this information appears to be correct. However, UL is continuing to research this topic to determine the exact intent of the requirement. UL will update the IAC when additional information is received.

Some members of industry also questioned the validity of the requirement, and whether there were any cases that cited a problem with flame spread. However, others mentioned that the industry could be liable if it does not do its best to prevent the spread of fires in an arcade atmosphere. UL noted that the intent was to assure that the spread of fire would be controlled to give people time to exit the premises. Also, since the requirement is consistent with a national building code and could be used by a local authority having jurisdiction (or building inspector), UL advised that the requirement not be revised at this time.

As a result of the discussion, the IAC decided to form an ad hoc group to study this topic.

13. MECHANICAL HAZARDS

DISCUSSION

New games are being developed where motion is involved. With the production of more sophisticated games (motion-based video games and kiddie rides are examples), UL is concerned that both manual and motor-driven movement could create mechanical hazards, such as crush and pinch points. UL asked for ideas from industry to discuss this topic.

It was summarized that definitions for pinch points, crush points, and clearances between moving parts may have to be reevaluated and included in the standard. The CSA mentioned that it had looked into this area, but had not developed any requirements. UL mentioned that the Consumer Product Safety Commission has a book defining the dimensions of human parts. This book could be used as a guide to develop requirements. An ad hoc committee was formed to study this topic.

14. UL'S QUARTERLY FOLLOW-UP SERVICE AUDITS

DISCUSSION

Industry has questioned the necessity of redundant (quarterly) UL inspections. A representative of UL's Follow-Up Services (FUS) Department discussed UL's position concerning inspections and audits. To maintain its accreditation status with various states and agencies, UL is required to perform quarterly product audits at a manufacturer's facility. The representative emphasized that the audit is product-based rather than system-based. He also explained that FUS is a mechanism to make sure that the manufacturer is producing Listed, Recognized, or Classified products as described in the FUS procedure in compliance with the UL Certification service.

It is UL's position to look at products on the production line during each visit. If there is no production, UL will evaluate samples that are not in production (whether they are in storage, shipping crates, or on display).

Some industry members noted that inspections are sometimes inconvenient due to heavy production schedules, limited personnel, or other related business matters. When asked if inspections could be planned, UL noted that the inspections have to be unannounced for UL to maintain its accreditation.

Additionally, it was noted that there are times a UL representative will visit a manufacturing facility when the production line is shut down. Some industry members suggested being prepared by having at least one sample of each model in storage for the UL representative to evaluate (in case there is no production). UL noted that arrangements can be made to alleviate these types of situations. The representative encouraged industry members to tell their manufacturers that UL is flexible. Manufacturers are encouraged to notify field representatives if there will be no production at their factories. They were also encouraged to contact their field representatives to work out an arrangement if there are ongoing problems regarding visits.

15. INTERNATIONAL MARKETS, INCLUDING ELECTROMAGNETIC COMPATIBILITY DIRECTIVE (EMCD) AND LOW VOLTAGE DIRECTIVE (LVD)

DISCUSSION

A representative of UL's International Compliance Services Department presented information concerning global safety certification. The focus was on the European Union's CE Marking, and the NOM (Norma Oficial Mexicana) Certification Mark for Mexico. In this presentation, the steps required for amusement game manufacturers to get certification for their products were explained. The discussion included identification of the directives that typically apply to amusement products, the effective dates of these directives, and the options available to help manufacturers comply with the relevant directives.

Manufacturers may choose to use a European Norm as a means to determine compliance. A European norm is a basic harmonized European standard that is very similar to (and often derived from) an international standard, like an International Electrotechnical Commission (IEC) standard. Several Directives may be applicable for one product, depending on its construction. Additionally, the product may require a third party certification from a Notified Body. Although it is the manufacturer that actually places the CE Marking on the product (a type of "self-declaration"), all of the above scenarios could be required before the CE Marking is actually "legitimate."

In addition to the above, a technical file and Declaration of Conformity are required. Not only is the construction of the product verified, but some means of internal quality control is needed as well (an industry member noted that UL Follow-Up Service is a good means of internal quality control).

Several of the directives are already in effect, including the Machinery Directive (January 1, 1995) and Electro-Magnetic Compatibility Directive (January 1, 1996). The Low Voltage Directive has been in effect since 1974, although the CE Marking is not required for this directive until January 1, 1997.

For this industry, EN60335-1, Safety of Household and Similar Electrical Appliances (similar to IEC 335) is the European standard typically used to evaluate amusement and gaming machines, and EN60065, Safety Requirements for Mains Operated Electronic and Related Apparatus for Household and Similar General Use (similar to IEC 65) is the standard used to evaluate video games for the Low Voltage Directive. In order to prepare for self-declaration, UL advised that manufacturers use these standards and appropriate deviations to evaluate their products. Also, although the titles to the above standards specify "Household" products, these standards include commercial products.

Additionally, other standards must be used to comply with the EMC directive. Among these are emission and "immunity" standards (in particular EN55014, Limits and Methods of Measurement of Radio Disturbance Characteristics of Motor-Operated and Thermal Appliances for Household and Similar Purposes, Electric Tools and Similar Electric Apparatus, and EN50082-1, Electromagnetic Compatibility - Generic Immunity Standard Part 1: Residential, Commercial and Light Industry) that apply to amusement products and could pose problems if not studied carefully.

UL also advised manufacturers to study all applicable directives and standards and document all of the pertinent applicable information, since it is the manufacturer's responsibility to declare compliance.

Concerning Mexico, it was mentioned that the NOM certification is required for many electrical products. The Mexican government has encouraged private organizations to take responsibility for safety certification for products entering Mexico. NOM certification can only be granted to a *local* representative registered in Mexico. It is especially important to note that certification cannot be transferred from one representative to the other. Therefore, if a manufacturer sells a product to two importers, typically each importer will obtain its own NOM certificates.

Additional information regarding certification for Mexico and the Mexican market can be obtained by calling NAFTA Facts at (202) 482-4464. For questions or help with foreign certification, contact the ICS Department at the UL office to which you normally submit products.

16. MARKING REQUIREMENTS IN ACCORDANCE WITH THE AMERICAN NATIONAL STANDARD FOR PRODUCT SAFETY SIGNS AND LABELS, ANSI Z535.4-1991

DISCUSSION

The American National Standards Institute (ANSI) has developed and published a series of standards (the ANSI Z535 series) containing guidelines for developing cautionary and warning markings for use on products. The Standard for Product Safety Signs and Labels, ANSI Z535.4-1991, contains guidelines for the type of cautionary and warning markings most like those required by UL standards.

Although not required by UL, an industry member noted that the ANSI guidelines (strictly warning labels and symbols) mentioned above are a good source. He noted that the ANSI standard has good definitions and pictorials and is a good common reference that would benefit all industry members.

UL welcomes any comment from industry if there is interest in adding any particular marking to UL 22.

17. USAGE OF METRIC VALUES

DISCUSSION

UL introduced this item to garner opinions from industry regarding a possible future conversion to the metric system. Currently, UL 22 presents requirements containing numerical values in the U.S. Customary System (English units) with a conversion to metric units provided in parentheses. Paragraph 2.2.1 in the introduction section of the standard states: "If a value for a measurement is followed by a value in other units in parentheses, the second value may be only approximate. The first stated value is the requirement."

UL said it is proposing to take a proactive approach by converting all units of measurement in UL standards to the metric system. This would provide long term benefits such as:

- Encouraging and helping industry's conversion to the metric system.
- Easing comparison and harmonization of UL standards with CSA and IEC standards.

The latter benefit is particularly important, considering current marketing trends toward a global economy. Since most of the world uses metric units, UL wanted to stress that it is important to consider this issue.

The first reaction from industry members was to keep the standard as it currently is with the metric values in a parenthesis since the issue is not safety-related. However, other members thought that a more progressive stance should be taken. They suggested a date be provided by which the change would be implemented.

The group concluded that it should poll other industry members to get a reaction concerning the change. Industry would suggest January 1, 2000 as the date by which all units of measurement will be described in metric units. However, it was suggested that English units would remain in parenthesis. This topic will be discussed at future industry meetings.

18. ENVIRONMENTAL AWARENESS IN STANDARDS

DISCUSSION

This item was introduced to inform IAC members that UL is addressing environmental issues regarding safety certification. UL wants to keep industry aware that many countries are generating environmental requirements (such as packaging, recycling, disposal of hazardous materials) that could impact the amusement and gaming industry.

Many international organizations are becoming more aware of the environmental impact of requirements and test methods. Many international standards are now being written or modified to consider environmental issues such as those noted above. UL has implemented such changes to certain requirements and test methods in some UL standards, such as the elimination of references to asbestos materials and of test methods that use solutions containing mercury. UL also pointed out that many European countries have added requirements, such as the banning of bromides as a component for flame-retardant material. UL mentioned that it can help answer questions concerning environmental issues that may pertain to this industry.

19. ADDITIONAL AGENDA ITEMS

DISCUSSION

A. Internal Wiring (UL 22, paragraph 14.2.2)

Members questioned the relevance of the 0.71 mm requirement for accessible internal wiring during operator servicing noted in paragraph 14.2.2 of UL 22. Even with the exceptions (wiring from a secondary circuit derived from a Class 2 transformer or isolated transformer limited to an impedance of less than 8 amps – see exception numbers 2 and 3 to paragraph 23.3), it was noted that many machines do not comply with this requirement. Many times 22 AWG wiring is used, especially at coin door mechanisms or lamps. The wiring at these locations normally does not comply with the exceptions although this typically does not present a hazard.

UL noted that it would review any proposals from industry regarding a revision to 14.2.2. An invited guest mentioned he would research the topic and present UL with a proposal.

B. Transformers

UL proposed that overload and short-circuit tests for transformers be specifically introduced into UL 22. Although there are no specific written requirements, UL has typically performed these tests on transformers that are not Listed or Recognized. Appendix A to UL 22 references UL 1585, the Standard for Class 2 and 3 Transformers, which UL uses to evaluate these types of transformers. However, there is no reference to UL 506, the Standard for Specialty Transformers. Although a reference to UL 506 could be included, the tests could be included in UL 22 for easier reference.

UL plans to develop a future proposal bulletin for industry comment.

C. Spill Test

CSA proposed the inclusion of the spill test in CSA C22.2 No.1 into UL 22 for harmonization purposes. In this test, 1 liter of water is spilled on the unit (as the unit is tipped 5 degrees). The purpose of the test is to see if any liquid can spill into cracks and seams and eventually contact live parts. CSA then asked for comments from the IAC.

After discussion, many members were not convinced that the test is necessary or practical. Therefore, it was the opinion of the group that a similar test not be incorporated into the UL standard.

20. MEETING CLOSE – NEXT IAC MEETING

It was acknowledged that the meeting was a success due to active participation and discussion of the various topics. The group said it would meet once a year. A tentative time was set for early December 1996 in the Santa Clara area. Specific dates will be announced.

REQUEST FOR COMMENTS ON PROPOSALS

Please provide the following:

1. Your comments concerning the meeting report and the proposed requirements; and
2. Your comments concerning the proposed effective dates, should the proposals be adopted.

Written comments should be sent to the attention of Paul Lloret at UL's Santa Clara office, 1655 Scott Blvd., Santa Clara, CA 95050-4169. Comments may be sent by mail or faxed to (408) 556-6045. Please reference all correspondence to Subject 22.

All comments should be sent by May 23, 1996.

Subject 22

-17-

March 28, 1996

Unless specifically requested to do so, UL will not acknowledge comments showing concurrence with these proposals.

UNDERWRITERS LABORATORIES INC.

REVIEWED BY:

Paul Lloret

PAUL LLORET (Ext. 32410)
Engineering Assistant
Standards Department
Fax No. (408) 556-6045

Craig Sato

CRAIG SATO (Ext. 32356)
Staff Engineer
Engineering Services 313A

SR: GD
0022____.3SB

PROPOSED REQUIREMENTS ARE OF A TENTATIVE AND EARLY NATURE AND ARE FOR REVIEW AND COMMENT ONLY. CURRENT REQUIREMENTS ARE TO BE USED TO JUDGE A PRODUCT UNTIL THESE REQUIREMENTS ARE PUBLISHED IN FINAL FORM

A P P E N D I X A

PROPOSED REQUIREMENTS AND PROPOSED EFFECTIVE DATES FOR THE FOURTH EDITION OF THE STANDARD FOR AMUSEMENT AND GAMING MACHINES, UL 22

For your convenience in review, proposed additions to existing requirements are shown underlined and proposed deletions are shown ~~lined-out~~. Proposed new requirements are identified by (NEW). In the case of extensively revised paragraphs, the original text is identified by (CURRENT) and is ~~lined-out~~, followed by the proposed text identified by (PROPOSED). A paragraph proposed to be deleted is identified by (DELETED) and is shown ~~lined-out~~.

Numbered items correspond to the numbered items in the meeting report.

1. PHYSICAL STABILITY TEST

35 Physical Stability Test

35.1 Under all conditions of servicing and intended use after installation, a fully assembled appliance shall not become physically unstable to the degree that it ~~may~~ results in a risk of injury to users, operators, or service personnel. Attention is to be given to the location of replenishable receptacles such as coin boxes and redemption ticket dispensers. They are to be filled or unfilled when determining the most unfavorable conditions for testing.

35.1 revised date of publication

35.2 An appliance shall not tip over when tilted 10 degrees from its intended upright position while all doors, covers, gates, or drawers, ~~and the like~~ are in place and closed.

35.2 revised date of publication

35.7 A freestanding appliance more than 1 meter (39-3/8 inches) high and weighing more than 25 kilograms (55.1 lb) shall not tip over when a force equal to one-fifth the weight of the appliance, but not more than 250 Newtons (56.2 pounds-force) is applied in any direction, except upward, at a height not exceeding 2 meters (78 3/4 inches) from the floor the position of the user controls (joysticks, push buttons, steering wheels, and similar items). For this test, all doors, drawers, frames, and the like that can be opened for operator or service personnel servicing are to be opened and in the most unfavorable position. Separate tests may be performed when operator and service extensions are different or when stabilizers are used in accordance with 35.8.

35.7 revised and separated into 35.7 and 35.7.1 date of publication

(NEW)

35.7.1 A freestanding appliance shall not tip over when tilted 10 degrees from its intended upright position. For this test, all doors, drawers, frames, and the like that can be opened for operator or service personnel servicing are to be opened and in the most unfavorable position. Separate tests may be performed when operator and service extensions are different or when stabilizers are used in accordance with 35.8.

35.7 revised and separated into 35.7 and 35.7.1 date of publication

35.9 The stability of an amusement ride for children shall be such that it cannot be overturned by a 150-pound (68-kg) person getting on, getting off, or while on the ride in any position. If the ride is intended for more than one passenger, the effect of multiple 150-pound persons (up to and including the manufacturer's specification for a passenger limit) is to be considered when determining the most unfavorable conditions for testing.

35.9 revised date of publication

2. LEAKAGE CURRENT TEST

(NEW)

4.8.1 MEASUREMENT INDICATION UNIT (MIU) – The output voltage across the meter, in millivolts RMS as shown in the measurement instrument in Figure 31.2, divided by 500 ohms. The instrument indication is equal to the RMS value in milliamperes when the frequency is 60 Hz (sinusoidal current). The reading is not always a direct indication of the RMS or other common amplitude quantifier of leakage current when the leakage current is of complex waveform or frequency other than 50 or 60 Hz.

Added 4.8.1 effective 12 months after publication

31 Leakage Current Test

31.1 The leakage current of a cord-connected appliance rated for a nominal 250 volts or less supply when tested in accordance with 31.2 – 31.9 shall not be more than the value in (a), (b), or (c) when the open circuit voltage between the accessible part and earth ground or between two simultaneously accessible parts exceeds 42.4 volts peak:

- a) 0.75 milliamperes MIU when the grounding conductor is connected and switch S1 of the measurement circuit illustrated in Figure 31.1 is closed,
- b) 1.0 milliamperes MIU when the grounding conductor is opened and switch S1 is closed or with the grounding conductor connected and switch S1 is opened, and
- c) 2.0 milliamperes MIU when the grounding conductor and switch S1 are both open.

(31.1. continued)

Exception No. 1: If an appliance has a grounding conductor detector-interrupter that de-energizes the appliance when the connection opens between accessible conductive parts of the appliance and the service equipment ground, the leakage currents shall be not more than 3.5 milliamperes MIU.

Exception No. 2: The measurement in (a) only refers to accessible surfaces that are not grounded.

Revised 31.1 effective 12 months after publication

~~31.2 Leakage current refers to all currents, including capacitively coupled currents, that may be conveyed between exposed conductive surfaces of an appliance and ground or other exposed conductive surfaces of the appliance.~~

Deleted 31.2 effective 12 months after publication

(CURRENT)

~~31.5 The measurement circuit for leakage current shall be as illustrated in Figure 31.1. The measurement instrument is defined in (a) (c). The meter that is actually used for a measurement need only indicate the same numerical value for a particular measurement as would the defined instrument. The meter used need not have all of the attributes of the defined instrument.~~

- ~~a) The meter is to have an input impedance of 1500 ohms resistive shunted by a capacitance of 0.15 microfarad.~~
- ~~b) The meter is to indicate 1.11 times the average of the full wave rectified composite waveform of voltage across the resistor or current through the resistor.~~
- ~~c) Over a frequency range of 0 100 kilohertz, the measurement circuitry is to have a frequency response ratio of indicated to actual value of current that is equal to the ratio of the impedance of a 1500 ohm resistor shunted by a 0.15 microfarad capacitor to 1500 ohms. At an indication of 0.75 milliamperes, the measurement is not to have an error of more than 5 percent.~~

(PROPOSED)

31.5 Typical measurement circuits for leakage current with the ground connection open are illustrated in Figure 31.1. The measurement instrument is specified in Figure 31.2. The meter to be used for a measurement need only indicate the same numerical value for a particular measurement as would the specified instrument; it need not have all the attributes of the defined instrument. Over the frequency range 20 Hz to 1 MHz with sinusoidal currents, the performance of the instrument is to be as follows:

- a) The measured ratio V_1/I_1 with sinusoidal voltages is to be as close as feasible to the ratio V_1/I_1 calculated with the resistance and capacitance values of the measurement instrument shown in Figure 31.2.
- b) The measured ratio V_3/I_1 with sinusoidal voltages is to be as close as feasible to the ratio V_3/I_1 calculated with the resistance and capacitance values of the measurement instrument shown in Figure 31.2. V_3 is to be measured by the meter M in the measuring instrument. The reading of meter M in RMS volts can be converted to MIU by dividing the reading by 500 Ω and then multiplying the quotient by 1,000. The mathematic equivalent is to multiply the RMS voltage reading by two.

Revised 31.5 effective 12 months after publication

(CURRENT)

~~31.6 Unless the meter is being used to measure leakage from one part of an appliance to another, the meter is to be connected between the accessible parts and the grounded supply conductor.~~

(PROPOSED)

31.6 Unless the measurement instrument is to be used to measure leakage current from one part of a product to another, it is to be connected between accessible parts and the supply conductor connected to ground (the grounded or grounding conductor) that has the least extraneous voltages introduced from other equipment operated on the same supply. For products rated 120 volts or 240 volts, with one supply conductor grounded, this is likely to be the grounded supply conductor.

Revised 31.6 effective 12 months after publication

(NEW)

31.6.1 When a grounded conductor is not connected to the product under test (for example, a 240-volt, 2-conductor product supplied by a 120/240 volt source), the instrument return lead is to be connected to either the grounded or grounding conductor of the supply, depending on the other electrical loads connected to the branch circuit that are operating at the time the test is conducted. The conductor introducing the least extraneous voltage, as indicated by the lowest leakage current reading, is to be used. When necessary to reduce the effects of extraneous voltages in environments introducing these voltages, an isolating transformer is to be used.

Added 31.6.1 effective 12 months after publication

31.7 A sample of a product is to be tested for leakage current starting with the as received condition - the as received condition being without prior energization. The supply voltage is to be adjusted to rated voltage. Then, the sample appliance is to be prepared and conditioned for leakage-current measurement as follows:

- a) The sample is to be representative of the wiring methods, routing, components, component location and installation, and the like, of the production unit.
- b) The grounding conductor is to be open at the attachment plug and the sample isolated from ground.
- c) The sample is to be conditioned for not less than 8 hours in an ambient temperature of 21 – 27°C (70 – 80°F) with a relative humidity of approximately 50 percent.
- d) The test is to be conducted at the ambient conditions specified in (c).
- e) The supply voltage is to be adjusted to rated voltage.

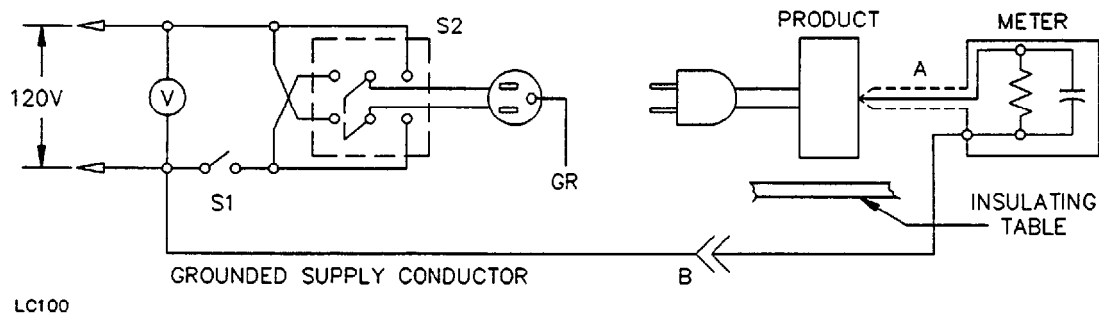
Revised 31.7 effective 12 months after publication

31.8 The test sequence, with reference to the measuring circuit, Figure 31.1, is to be as follows:

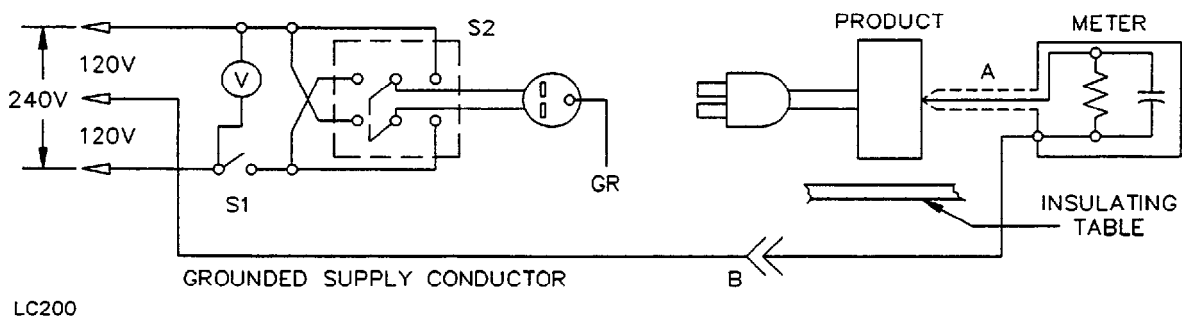
- a) With switch S1 open, the appliance is to be connected to the measuring circuit. Leakage current is to be measured using both positions of switch S2, and with ~~all of the appliance~~ product switching devices in their normal operating positions.
- b) Switch S1 is then to be closed energizing the appliance, and within 5 seconds, the leakage current is to be measured using both positions of switch S2, and with ~~all of the appliance~~ product switching devices in their normal operating positions.
- c) The leakage current is to be monitored until thermal stabilization ~~is obtained~~. Both positions of switch S2 are to be used in determining this measurement. Thermal stabilization is to be obtained by operation as in the Temperature Test, Section 33.
- d) The leakage current is also to be monitored with switch S1 open while the product is at operating temperature and while cooling.

Revised 31.8 effective 12 months after publication

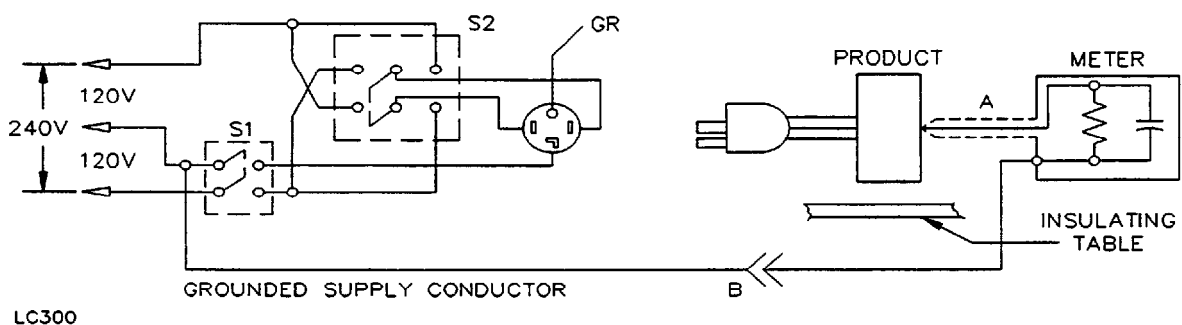
(CURRENT)
Figure 31.1
Leakage current measurement circuit



Appliance intended for connection to a 120 volt power supply.



Appliance intended for connection to a 3 wire, grounded neutral power supply, as illustrated above.

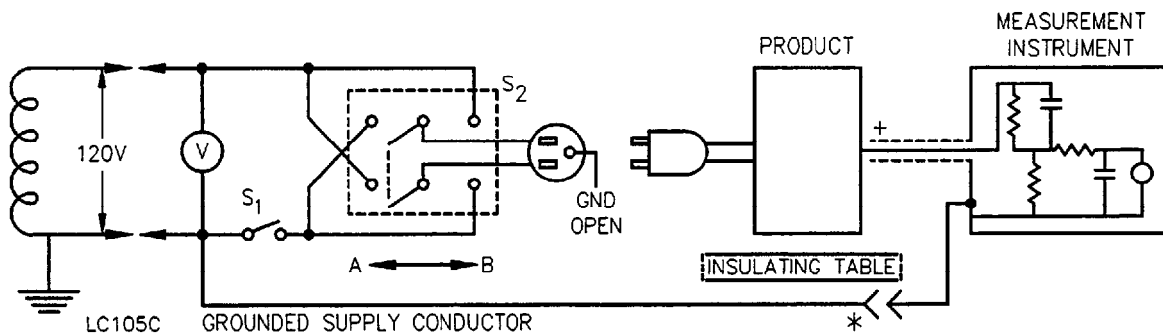


Appliance intended for connection to a 3-wire, grounded neutral power supply, as illustrated above.

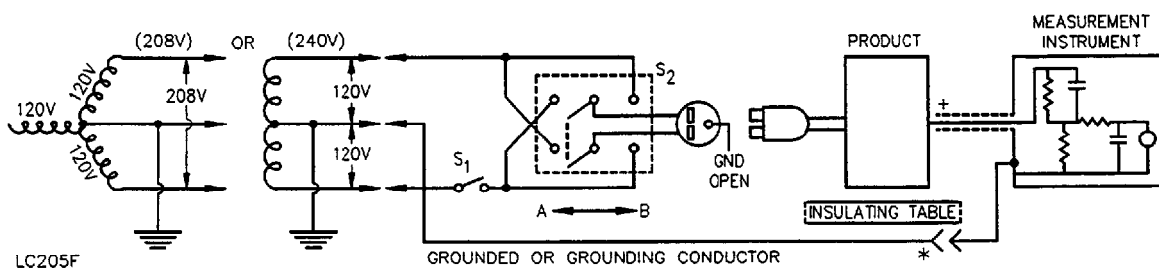
A – Probe with shielded lead.

B – Separated and used as clip when measuring currents from one part of device to another.

(PROPOSED)
Figure 31.1
Typical leakage-current measurement circuits



Product intended for connection to a 120-volt or an end-grounded 2-wire, 240-volt power supply.



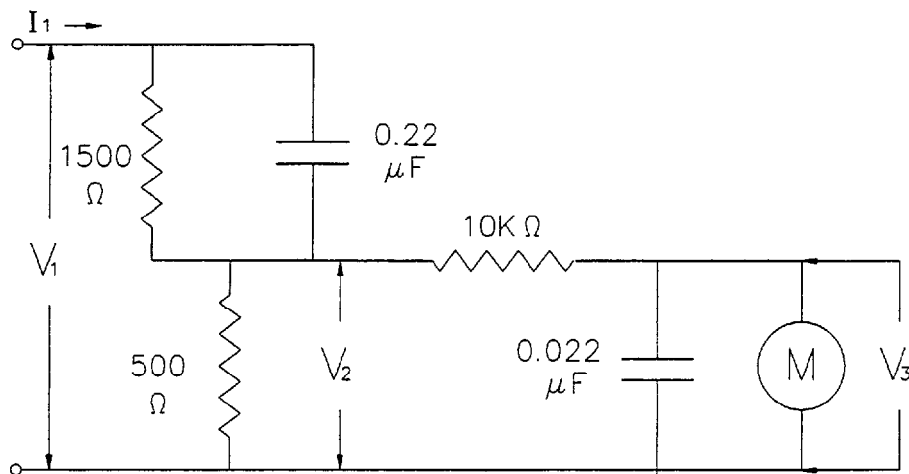
Product intended for connection to a 3-wire 208-volt or a 3-wire 240-volt grounded neutral power supply.
See (paragraphs) 31.6.1 and 31.7.

+ – Probe with shielded lead.

* – Separated and used as a clip when measuring currents from one part of an appliance to another.

Revised Figure 31.1 effective 12 months after publication

(NEW)
Figure 31.2
Measurement instrument for reaction (leakage) current



S3263B

Note — Detailed specifications and guidance for the calibration of this instrument are given in the American National Standard for Leakage Current for Appliances, ANSI C101-1992.

Added Figure 31.2 effective 12 months after publication

3. GROUNDING AND BONDING WITHIN REDEMPTION GAMES

(NEW)

13.2.3.1 The surface of insulation on a bonding conductor shall be any color except green with or without one or more yellow stripes.

13.2.3.1 added date of publication

4. FLAMMABILITY OF DECORATIVE PLASTIC PARTS

(NEW)

4.4.1 DECORATIVE PART – A part (trim, knob, or similar items) used for functional or ornamental purposes only and not as an enclosure of parts.

4.4.1 added date of publication

(NEW)

6.2.1.1 Decorative parts are not required to have a flammability rating.

6.2.1.1 added date of publication

5. NAMEPLATE MARKING LOCATION

50.2 The marking specified in 50.1 shall be located on ~~the front of any surface of~~ the appliance except the bottom.

~~Exception No. 1: An appliance intended to be mounted on a table or counter.~~

~~Exception No. 2: The marking may appear on the rear or side of the appliance near the power supply entry if the complete marking is repeated inside the front access or service door.~~

50.2 revised date of publication

6. INCANDESCENT LAMP REPLACEMENT MARKING

(NEW)

50.31 An appliance provided with an incandescent lamp shall be marked with the word "WARNING" or "CAUTION" and the following statement:

"(TO REDUCE THE) RISK OF FIRE, USE ___ WATT OR SMALLER, ___ VOLT BULB(S)"

Exception: The voltage need not be marked when the bulb(s) is intended for operation on a nominal 120-volt circuit.

50.31 added date of publication

(NEW)

50.32 Regarding 50.31, appliances with two or more bulbs in the same access area may have one marking indicating the maximum wattage, with or without the number of bulbs, when all bulbs are the same wattage. For an appliance with bulbs that are not the same wattage, the number of bulbs and each wattage shall be indicated.

50.32 added date of publication

(NEW)

50.33 The markings referenced in 50.31 and 50.32 shall be located where visible during relamping.

50.33 added date of publication

7. OXYGEN BOMB TEST

46.1 A gasket of rubber compound, other than foamed rubber that is depended on for protection against rain, shall have physical properties as specified in Table 46.1 before and after ~~exposure for 96 hours to oxygen a pressure of 300 ± 10 psi (2067 ± 69 kPa) and a temperature of 70 ± 1°C (158 ± 2°F) as specified in Table 46.1~~ the accelerated aging conditions specified in Table 46.2.

46.1 revised date of publication

(NEW)

Table 46.2
Accelerated Aging Conditions

Material	Test program
Rubber or neoprene	70 hours in an air-circulated oven at $100^{\circ} \pm 1^{\circ}\text{C}$ ($212^{\circ} \pm 1.8^{\circ}\text{F}$)
Thermoplastic	168 hours in an air-circulated oven at $87^{\circ} \pm 1^{\circ}\text{C}$ ($189^{\circ} \pm 1.8^{\circ}\text{F}$)

Table 46.2 added date of publication

A P P E N D I X B

ATTENDANCE AT THE DECEMBER 7 AND 8 MEETINGS OF THE
IAC FOR
AMUSEMENT AND GAMING MACHINES

Industry Representatives *(Associated Companies and Fax Numbers)*

*Lauran Bromley	Bromley Inc.	
*John Buras	Premier Technology	708-350-1097
John Druga	J & J Precision Machine	904-454-7343
Herbert Foss	WMS Games Inc.	312-961-1611
*Peter Hanchar	SEGA Pinball	708-345-7718
Stuart Heller	Kiddie Rides USA	303-399-8144
Dennis Keeney	Skee-Ball Amusement Games	215-997-8982
Greg Malavazos	Quick Silver Dev. Co., Inc.	510-895-9747
Rick Meyette	Time Warner Interactive	408-434-5800
Tom Reid	Carousel International Corp.	314-392-7125
*Bob Ring	Stuart Entertainment, Inc.	303-795-2508
Jim To	SEGA Enterprises, Inc. (USA)	415-802-1754
Eric Torres	Kiddie's Manufacturing., Inc.	809-897-3377
Larry Voelker	Smart Industries Corp., Mfg.	515-265-3148
*Brian White	Doyle & Associates Inc.	208-746-3921
David Wise	Bob's Space Racers	904-677-0794

Invited Guests *(Associated Companies and Fax Numbers)*

Michael Evans	Kiddie Rides, USA	303-399-8144
Orly Friesen	Ralph's Automatic Coin	604-525-0061
*John Jaron	Grand Products	708-427-0281
Jeff Lankiewicz	Coin Concepts, Inc.	908-390-3373
Paul McDonald	ISSS	510-796-7944
*Hayao Nakayama	SEGA Enterprises Ltd.	03-5736-7055
*Jon Pederson	Nintendo	206-861-2477
Frank Seninsky	Alpha Omega Amusements	908-254-6223
Richard Trindle	AAMA	708-290-9121
Timo Venalainen	CSA	416-747-2476

Subject 22

-B2-

March 28, 1996

UL Staff

Catherine Barale (Chairperson)
Darrin Conlon
Paul Lloret
Bob Miller
Maria Mueller
Bruce Santo
Craig Sato
John Thompson

Santa Clara
Melville
Santa Clara
Santa Clara
Northbrook
Santa Clara
Santa Clara
RTP

*Not in attendance

*Mr. Tetsuo Ono, representing Japan Amusement Machine Manufacturers Association (JAMMA)
substitute for Mr. Hakayama

APPENDIX C

DESIGNATED RESPONSIBILITY FOR UL PRODUCT CATEGORY ASMU, AMUSEMENT AND GAMING MACHINES

The individuals shown in the following table are involved with the investigation of products covered under the subject category. The Primary Designated Engineer (**shown in UPPERCASE letters**) coordinates the establishment and uniform interpretation of UL requirements applicable to the product category. The Designated Engineers (**shown in lowercase letters**) work with the Primary Designated Engineer to interpret requirements and maintain standards.

Should you have questions regarding the interpretation of the requirements proposed in this bulletin or any adopted requirements that affect your product, you are encouraged to contact the individual at the office to which you normally submit your products.

The Industry Advisory Conference (IAC) Chairperson for the subject category is Catherine Barale at UL's Santa Clara office. The IAC Chairperson oversees the significant interpretations made by the Primary Designated Engineer and arbitrates any differences regarding interpretation of UL requirements.

CCN	Office/Subsidiary	Responsible Engineer	Extension
ASMU	Camas	Randy Mayorga	55603
	Melville	Darrin Conlon	22872
	Northbrook	Maria Mueller	42944
	RTP	John Thompson	11621
	Santa Clara	CRAIG SATO	32356



Underwriters Laboratories Inc.®

A not-for-profit organization dedicated to public safety
and committed to quality service

July 16, 1995

Revision pages for

Standard for

Amusement and Gaming Machines

UL 22, Fourth Edition

Attached to this transmittal notice is a reprinted title page for the fourth edition of UL 22.

Attention is directed to the note on the title page of this standard outlining the procedure to be followed to retain the approved text of ANSI/UL 22-1995.

Revised and/or additional pages may be issued from time to time.

With the inclusion of the accompanying material, the standard consists of pages dated as shown in the following checklist:

Page	Date
1	April 20, 1994 (Reprinted July 16, 1995)
2 – 72, SA1, SA2, A1	April 20, 1994



Documents

Document Sharing Hub

APRIL 20, 1994
(Title Page Reprinted: July 16, 1995)



1

UL 22

Standard for

Amusement and Gaming Machines

First Edition — June, 1977
Second Edition — August, 1979
Third Edition — November, 1987

The first and second editions were titled Standard for Amusement Machines.

Fourth Edition

April 20, 1994

Approval as an American National Standard (ANSI) covers the numbered paragraphs on pages dated April 20, 1994. These pages should not be discarded when revised or additional pages are issued if it is desired to retain the ANSI approved text.

An effective date included as a note immediately following certain requirements is one established by Underwriters Laboratories Inc.

Approved as ANSI/UL 22-1979, February 15, 1979
Approved as ANSI/UL 22-1988, October 28, 1988
Approved as ANSI/UL 22-1995, April 18, 1995

Revisions of this standard will be made by issuing revised or additional pages bearing their date of issue. A UL Standard is current only if it incorporates the most recently adopted revisions, all of which are itemized on the transmittal notice that accompanies the latest published set of revision pages.

ISBN 1-55989-572-1

COPYRIGHT © 1977, 1995 UNDERWRITERS LABORATORIES INC.

CONTENTS

FOREWORD

INTRODUCTION

1	Scope	5
2	General	5
3	Terminology	6
4	Glossary	6

CONSTRUCTION

5	General	7
6	Frame and Enclosure	7
7	Mechanical Assembly	11
8	Accessibility of Uninsulated Live Parts, Film-Coated Wire, and Moving Parts	13
9	Protection Against Corrosion	17
10	Insulating Material	18
11	Current-Carrying Parts	19
12	Supply Connections	19
13	Grounding and Bonding	23
14	Internal Wiring	26
15	Splices and Connections	28
16	Separation of Circuits	29
17	Motors	29
18	Overcurrent Protection	30
19	Motor-Overload Protection	30
20	Capacitors	31
21	Receptacles	32
22	Switches and Controllers	32
23	Secondary Circuits	32
24	Printed-Wiring Boards	34
25	Spacings	34
26	Coin, Currency, and Credit Mechanisms	36
27	Protection Against Risk of Fire, Electric Shock, or Injury to Persons	37
28	Covers and Guards	39

PERFORMANCE

29	General	40
30	Starting Current Test	40
31	Leakage Current Test	40
32	Input Test	44
33	Temperature Test	44
34	Dielectric Voltage-Withstand Test	50
35	Physical Stability Test	52
36	Handle Test	53
37	Abnormal Operation Tests	53
38	Internal Wiring Flexing Test	55
39	Strain Relief Test	56
40	Bonding Test	56

UL 22

ISBN 1-55009-572-1

Amusement and Gaming Machines

