

# UL 60950-23

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## Information Technology Equipment – Safety – Part 23: Large Data Storage Equipment



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Underwriters Laboratories Inc. (UL)  
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Northbrook, IL 60062-2096

UL Standard for Information Technology Equipment – Safety – Part 23: Large Data Storage Equipment,  
UL 60950-23

First Edition, Dated April 23, 2007

### **Summary of Topics**

***This Standard is the first edition of UL 60950-23. This binational Standard is based on IEC 60950-23, first edition.***

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The new requirements are substantially in accordance with UL's Proposal(s) on this subject dated December 15, 2006.

As indicated on the back side of the title page (page 2), this UL Standard for Safety is an American National Standard. Attention is directed to the note on the back side of the title page of this Standard outlining the procedures to be followed to retain the approved text of this ANSI/UL Standard.

The UL Foreword is no longer located within the UL Standard. For information concerning the use and application of the requirements contained in this Standard, the current version of the UL Foreword is located on ULStandardsInfoNet at: <http://ulstandardsinfo.net/ulforeword.html>

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The requirements in this Standard are now in effect, except for those paragraphs, sections, tables, figures, and/or other elements of the Standard having future effective dates as indicated in the preface. The prior text for requirements that have been revised and that have a future effective date are located after the Standard, and are preceded by a "SUPERSEDED REQUIREMENTS" notice.

New product submittals made prior to a specified future effective date will be judged under all of the requirements in this Standard including those requirements with a specified future effective date, unless the applicant specifically requests that the product be judged under the current requirements. However, if the applicant elects this option, it should be noted that compliance with all the requirements in this Standard will be required as a condition of continued Listing, Recognition and Follow-Up Services after the effective date, and understanding of this should be signified in writing.

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CAN/CSA-C22.2 No. 60950-23-07  
*First Edition*  
(IEC 60950-23: 2005, MOD)

Underwriters Laboratories Inc.  
UL 60950-23  
*First Edition*



## Information Technology Equipment – Safety – Part 23: Large Data Storage Equipment

April 23, 2007

This national standard is based on publication IEC 60950-23, First Edition (2005).

Approved  
by  
Standards Council  
of Canada



ANSI/UL 60950-23-2007

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This Standard is issued jointly by the Canadian Standards Association and Underwriters Laboratories Incorporated. Amendments to this Standard will be made only after processing according to the Standards writing procedures by both the Canadian Standards Association and Underwriters Laboratories Incorporated.

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The most recent designation of ANSI/UL 60950-23 as an American National Standard (ANSI) occurred on April 23, 2007.

This ANSI/UL Standard for Safety, which consists of the First Edition, is under continuous maintenance, whereby each revision is ANSI approved upon publication.

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 set of revised requirements. Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at <http://csds.ul.com>.

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**CONTENTS**

<b>PREFACE .....</b>	<b>4</b>	<b>DE</b>
----------------------	----------	-----------

<b>FOREWORD .....</b>	<b>7</b>
-----------------------	----------

1 Scope .....	9
2 Normative references .....	9
3 Terms and definitions .....	10
4 Protection of persons in the work cell .....	10
5 Interlock override .....	11
5.1 General .....	11
5.2 Visual indicator .....	11
6 Emergency stop system .....	12
7 Endurance tests .....	13
8 Abnormal operation .....	14

**Annex A (informative) Bibliography**

<b>Annex NAE (informative) U.S. and Canadian regulatory requirements</b>	<b>D1</b>
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**PREFACE**

DE

This is the common CSA and UL Standard for Information Technology Equipment – Safety – Part 23: Large Data Storage Equipment. It is the first edition of CAN/CSA-C22.2 No. 60950-23 and the first edition of UL 60950-23. This standard is based on IEC 60950-23, first edition.

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This common standard was prepared by the Canadian Standards Association (CSA) and Underwriters Laboratories Inc. (UL). The efforts and support of representatives of leading industry companies and organizations are gratefully acknowledged.

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This Standard is considered suitable for use for conformity assessment within the stated scope of the Standard.

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This Standard was reviewed by the CSA Subcommittee on Safety of Electronic Equipment within the Field of Audio/Video, Information, and Communication Technology, under the jurisdiction of the CSA Technical Committee on Consumer and Commercial Products and the CSA Strategic Steering Committee on Requirements for Electrical Safety, and has been formally approved by the CSA Technical Committee.

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This Standard has been approved as a National Standard of Canada by the Standards Council of Canada.

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This Standard has been approved by the American National Standards Institute (ANSI) as an American National Standard.

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Note: Although the intended primary application of this Standard is stated in its Scope, it is important to note that it remains the responsibility of the users of the Standard to judge its suitability for their particular purpose.

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DE**Level of harmonization**

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This standard adopts the IEC text with national differences. This standard is published as an equivalent standard for CSA and UL.

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An equivalent standard is a standard that is substantially the same in technical content, except as follows: Technical national differences are allowed for codes and governmental regulations as well as those recognized as being in accordance with NAFTA Article 905, for example, because of fundamental climatic, geographical, technological, or infrastructural factors, scientific justification, or the level of protection that the country considers appropriate. Presentation is word for word except for editorial changes.

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All national differences from the IEC text are included in the CSA and UL versions of the standard. While the technical content is the same in each organization's version, the format and presentation may differ.

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DE**Reasons for differences from IEC**

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The national differences in this binational Part 23 Standard are included to reference the binational version of IEC 60950-1, which is designated as CAN/CSA-C22.2 No. 60950-1/UL 60950-1, to address issues related to references to the first and second editions of CSA/UL 60950-1, and to address additional requirements for switches (Clause 6) and U.S. and Canadian regulatory requirements (Annex NAE).

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The effective date for CSA International will be announced through CSA Informs or a CSA certification notice.

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DE**UL effective date**

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The effective date for UL is available on UL's website at [www.ul.com](http://www.ul.com).

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**General**

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National differences from the text of the International Electrotechnical Commission (IEC) Publication 60950-23, Information Technology Equipment – Safety – Part 23: Large Data Storage Equipment, Copyright 2005, are indicated by the following margin notations:

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There are six types of national differences, as noted below. The national difference type is noted in the margin next to the affected text. The standard may not include all types of these national differences.

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D1 – national differences based on national regulatory requirements which result in equivalent or more stringent requirements than in IEC 60950-23.

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D2 – national differences based on other than national regulatory requirements which result in equivalent or more stringent requirements than in IEC 60950-23.

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DI – national differences based on IEC final draft international standards (FDIS). DI national differences may be less stringent than, equivalent to, or more stringent than requirements in IEC 60950-23.

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DC – national differences based on UL and CSA component requirements. DC national differences may be less stringent than, equivalent to, or more stringent than component requirements in IEC 60950-23.

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D3 – national differences based on binational requirements which result in less stringent requirements than in IEC 60950-23.

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DE – editorial national differences that correct typographical errors in IEC 60950-23 or revise the terminology, but do not alter the technical intent of the requirements. This notation is also used for informative statements such as the Preface.

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National differences have been incorporated into the body of the standard. If national differences necessitate the deletion of IEC 60950-23 text, the IEC 60950-23 text has been retained but has been ~~lined out~~. Text added as a result of national differences has been underlined. Text added as the Preface and Annex NAE is not underlined.

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Annex NAE has been included at the back of the standard. Pointers to this annex are provided in the right-hand margin of the body of the standard to direct the user to this informative annex. The pointer text is provided in ***BOLD ITALICS***. An examples of such a pointer is shown here in the right-hand margin.

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DE ***NAE***  
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The text, figures, and tables of International Electrotechnical Commission Publication 60950-23, Information Technology Equipment – Safety – Part 23: Large Data Storage Equipment, Copyright 2005, are used in this standard with the consent of the International Electrotechnical Commission.

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

### INFORMATION TECHNOLOGY EQUIPMENT – SAFETY – Part 23: Large data storage equipment

#### FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

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9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60950-23 has been prepared by IEC technical committee 108, Safety of electronic equipment within the field of audio/video, information technology and communication technology.

The text of this standard is based on the following documents:

FDIS	Report on voting
108/144/FDIS	108/150/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This standard Part 23 of IEC 60950 is to be used in conjunction with IEC 60950-1, hereafter referred to as "Part 1". All references to clauses and subclauses in IEC 60950-1 are to the second edition. If the relevant clause or subclause has been renumbered in IEC 60950-1, second edition, the first edition reference is identified in parentheses directly after the second edition reference.

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This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

IEC 60950 consists of the following parts, under the general title *Information technology equipment – Safety*:

Part 1: General requirements

Part 21: Remote power feeding

Part 22: Equipment installed outdoors

Part 23: Large data storage equipment

In this standard, the following print types are used:

- requirements proper and normative annexes: roman type;
- *compliance statements and test specifications: italic type;*
- notes in the text and in tables: smaller roman type;
- terms that are defined on Clause 2 and in IEC 60950-1: SMALL CAPITALS.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed;
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## INFORMATION TECHNOLOGY EQUIPMENT – SAFETY – Part 23: Large data storage equipment

### 1 Scope

NAE

This part of IEC 60950 specifies requirements for information technology equipment (ITE) with self contained data storage systems that contain hazardous moving parts. These data storage systems are typically large enough to permit a person to enter completely, however, the systems also include similar large equipment permitting complete limb or head access to the area containing hazardous moving parts. These requirements are additional to the relevant requirements in IEC 60950-1. The maximum three dimensional reach of a cartridge accessory assembly typically has a minimum motion envelop of 0,75 m<sup>3</sup> or more.

The equipments shall be installed in a RESTRICTED ACCESS LOCATION, such as a data centre. The exceptions for 2.1.3 and 4.5.4 (4.5.1 in IEC 60950-1, first edition) noted in 1.2.7.3 of IEC 60950-1 do not apply to this Part 23. DE

NOTE 1 An example of equipment covered by this scope is an automated information mass storage and retrieval system that uses integral hazardous moving parts for the handling of recorded media (for example, tape cartridges, tape cassettes, optical disks, etc.) and similar functions.

This standard is not applicable to equipment with non-self-contained hazardous moving parts, such as robotic equipment installed in an industrial environment.

NOTE 2 For standards related to robotic equipment in an industrial environment, see IEC 60204-1, IEC 60204-11 and ISO 10218.

### 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies. All references to IEC 60950-1 in this standard are replaced by the equivalent UL and CSA 60950-1 binational Standards as listed below. (Either the first or second editions of CSA/UL 60950-1 may be used.) All relevant Standards referenced in the Part 1 Standard (Annex P, including P.1 and P.2) also apply to this Part 23 Standard and are not listed below. All references to clauses and subclauses in IEC 60950-1 are to the second edition. If the relevant clause or subclause has been renumbered in IEC 60950-1, second edition, the first edition reference is identified in parentheses directly after the second edition reference. D2 D2 D2 D2 D2 D2 D2 D2

IEC 60947-5-5:1977, *Low-voltage switchgear and controlgear – Part 5-5: Control circuit devices and switching elements – Electrical emergency stop device with mechanical latching function*

IEC 60950-1:2005, *Information technology equipment – Safety – Part 1: General requirements* D2 D2

IEC 60073:2002, *Basic and safety principles for man-machine interface, marking and identification – Coding principles for indicators and actuators*



IEC 61058-1:2002, *Switches for appliances – Part 1: General requirements*

CAN/CSA-C22.2 No. 60950-1-03 or CAN/CSA-C22.2 No. 60950-1-07, *Information Technology Equipment – Safety – Part 1: General Requirements* D2  
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UL 60950-1, First or Second Edition, *Information Technology Equipment – Safety – Part 1: General Requirements* D2  
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### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60950-1 and the following apply.

NOTE Defined terms are printed in SMALL CAPS where they occur in the text.

**3.1 WORK CELL** space within the equipment of such size that a person may completely or partially (for example, entire limb or head) enter and where mechanical hazards may be present

NOTE A WORK CELL may contain more than one compartment. A compartment can be used for either operational or service purposes.

### 4 Protection of persons in the work cell

During normal use, no hazards within the meaning of IEC 60950-1 shall be accessible at an outer ENCLOSURE of the equipment.

The equipment shall be provided with safeguards to reduce the risk of injury due to hazardous moving parts in the WORK CELL. For protection against other hazards, the WORK CELL shall be treated as an OPERATOR ACCESS AREA.

NOTE 1 Examples of safeguards include interlocks, barriers and awareness signals, together with designated procedures and training.

NOTE 2 The design should take into account the fact that some authorities may require installation of fire detection and extinguishing systems in WORK CELLS.

Access to a WORK CELL or any of its compartments shall be controlled by either of the following methods:

– Method 1 – No key or TOOL is needed to gain entry to the WORK CELL. Interlocks meeting the requirements of 2.8 of IEC 60950-1 shall be provided to prevent access to the WORK CELL while power is available to the hazardous moving parts in that compartment. Power to the moving parts shall not be restored until the doors are closed and latched.

– Method 2 – A key or TOOL shall be used to gain and control access to the WORK CELL and access to the WORK CELL shall be prevented while power is available to the hazardous moving parts in that compartment. The operating and servicing instructions, as appropriate, shall specify that the key or TOOL must be carried by the person while in the WORK CELL.

NOTE 3 The key or TOOL may be used as the means to remove power before access to the WORK CELL or compartment.

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Opening of the interlocked access door into any compartment of a WORK CELL containing hazardous moving parts, or an access door between a compartment containing hazardous moving parts and one that has been disabled, shall automatically remove drive power from those moving parts and fully stop them without the need of software control within 3 s.

Except as permitted in 5.1, it shall not be possible to start or restart the system until all relevant access doors are closed and latched.

Where it is possible to enter a WORK CELL completely, an automatically activated mechanical interlock shall be provided so that the door cannot be closed inadvertently, if this closure would allow the system to be restarted. It shall be possible to open any door from inside the WORK CELL without the use of a key or TOOL. The means of opening the door from inside the WORK CELL shall be readily identifiable and visible, whether the door is open or closed, irrespective of the operating status of the equipment.

*Compliance is checked by inspection.*

## 5 Interlock override

### 5.1 General

If it is necessary for a SERVICE PERSON to override a SAFETY INTERLOCK for access to a WORK CELL or compartment, an override system complying with 2.8.6 of IEC 60950-1 shall be provided. In addition, when an override system is used, an emergency stop system shall be provided in accordance with Clause 6, and shall comply with the operational endurance requirements of Clause 7.

*Compliance is checked by inspection.*

### 5.2 Visual indicator

A set of two or more bright flashing indicators complying with IEC 60073 shall operate under the following conditions:

- a) for a WORK CELL or compartment that can be entered completely, to indicate the equipment is being restored to normal operation and motion is pending, or
- b) for any equipment, when the interlock is overridden and drive power is available to hazardous moving parts.

The indicators shall be readily visible at any point within the WORK CELL or relevant compartment, and at the point of entry. For condition a), the indicators shall operate for a minimum of 10 s prior to movement of a hazardous moving part along the most significant axis. If condition a) can occur while condition b) is in effect, there shall be a change of light sequencing such that the change in status will be obvious to persons in or at the point of entry to the WORK CELL.

NOTE The most significant axis is usually the horizontal (X) axis.

*Compliance is checked by inspection and test.*

## 6 Emergency stop system

This clause only applies if a SAFETY INTERLOCK override is provided as specified in Clause 5.

An emergency stop system shall override all other controls, remove drive power from hazardous moving parts and employ automatic braking, if necessary, to cause all these moving parts to stop.

Components of the emergency stop system shall be of an electromechanical type. An emergency stop control may consist of:

- a switch complying with IEC 61058-1, that also meets the requirements of 2.8.4, 2.8.7, 2.8.8 of IEC 60950-1, and that is provided with a latching type mechanism meeting the requirements of IEC 60947-5-5, or equivalent, or
- an emergency stop device in accordance with IEC 60947-5-5, or DE
- a switch complying with either UL 508, UL 1054, UL 61058-1, CAN/CSA C22.2 No. 61058-1 or CSA C22.2 No. 14 and provided with a latching type mechanism meeting the requirements of IEC 60947-5-5. DC  
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NOTE 1 In the United Kingdom an emergency stop system complying with the requirements of IEC 60204-1 and ISO 13850 is required where there is a risk of personal injury.

Restarting of the mechanical system shall only be possible by initiating a start control procedure after the emergency stop control has been manually reset.

For equipment where a person may completely enter the WORK CELL, the emergency stop system shall include a minimum of two emergency stop controls, one outside the WORK CELL and one within the WORK CELL. The system start up procedure shall include a non-hazardous method to ensure no person is present in the WORK CELL. If it can be shown, after application of the 7.1 single fault tests to the movement control circuitry or other sensing means, that such tests do not by-pass the non-hazardous start up procedure, the emergency stopping distance test of this subclause is not required.

For equipment where a person may only partially enter a WORK CELL or compartment, a minimum of one emergency stop control shall be provided outside of the WORK CELL. The emergency stop system shall be operable by the person needing to have access to the WORK CELL.

An emergency stop control provided outside the WORK CELL shall be readily visible and shall be located on the equipment such that the person operating it can see if the WORK CELL is occupied. The installation instructions shall require that space be provided around the control so that an OPERATOR OR SERVICE PERSON can easily reach and activate it.

An emergency stop control provided inside the WORK CELL shall be readily accessible from anywhere inside the WORK CELL and shall be provided with lighting to permit easy identification. It shall consist of a red palm or mushroom head button or be provided with an indirect arrangement, such as an easily identifiable red safety cable, that activates the emergency stop system.

Compliance is checked by inspection and, if necessary, the following tests.

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*While the mechanical system is operating at its maximum kinetic energy (carrying maximum load capacity at maximum speed) the emergency stop system is to be activated, and the distance to stop measured. The results of the distance measurements shall show that after activation of the emergency stop system, any subsequent motion in any direction would be unlikely to present a risk of injury.*

*The maximum stopping distance from the point of activation, along the most significant axis, shall be 1 m or less. In addition, if there is an end point along the most significant axis beyond which the hazardous moving part does not operate, there shall be at least 150 mm of empty space available between this end point and the nearest fixed mechanical part, providing sufficient space for a person not to be harmed. The requirements of Clause 8 apply.*

NOTE 2 The most significant axis is the one with the longest travel distance. This is usually the horizontal (X) axis

## 7 Endurance tests

Except as referenced in Clause 6, this clause only applies when a SAFETY INTERLOCK override is provided as specified in Clause 5, or if any OPERATOR accessible cable contains hazardous voltages.

Movable cable assemblies are tested to ensure that no mechanical damage occurs that could result in any of the following:

- a malfunction of the SAFETY INTERLOCK system;
- compromise any compartment separation barriers or MECHANICAL ENCLOSURES;
- expose a person to other hazards.

If the voltage in these cables and movement control circuitry are above the limits for an SELV CIRCUIT during normal operation or after a single fault, mechanical endurance tests shall be applied to ensure that no electrical shock hazard results.

For cables that carry only voltages meeting the requirements for SELV CIRCUITS, if it can be shown that single open-circuit or short-circuit fault testing of these cables and movement control circuitry would not result in a hazard, they are exempt from the mechanical endurance tests.

*Compliance is checked by inspection and, when necessary, by the following mechanical endurance tests.*

*The mechanical system, including the means (for example, limit switches) that limit movement during normal operation, are subjected to 100 000 cycles of operation at rated load and maximum speed through the maximum length or rotation of travel permitted by the design.*

*After the cycling*

- a mechanical function check (for example, hazardous moving parts to operate electromechanical switches; end of travel mechanical stop, etc.) and a visual inspection, are conducted. Mechanical stops and electromechanical switches shall perform as intended. There shall be no evidence of loss of mechanical integrity. All safety-related functions (including emergency stop systems, and the like, as applicable) shall operate normally; and

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– the assembly cables that control the hazardous moving parts, other than those containing only SELV CIRCUITS, are examined for damage that exposes conductors carrying a HAZARDOUS VOLTAGE or hazardous energy level. No conductor shall be broken and no individual strands shall have penetrated the insulation. If damage cannot be determined by inspection, the cable assembly shall pass an electric strength test of 1 000 V, in accordance with 5.2.2 of IEC 60950-1, applied between the conductors carrying HAZARDOUS VOLTAGES and foil wrapped around the body of the cable.

## 8 Abnormal operation

Under single fault or abnormal operating conditions, adequate means shall be provided to limit the movement of the hazardous moving parts so that they do not become a hazard, such as by extended travel or by having parts detach and be ejected from the moving assembly. Such means shall be capable of stopping these moving parts under rated load, maximum speed conditions and at maximum extension.

*Compliance is checked by inspection, and, if necessary, by test. The ENCLOSURE or compartment separation barriers shall contain any part that may become detached during the test.*

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**Annex A**  
(informative)  
**Bibliography**

IEC 60204-1, *Safety of machinery – Electrical equipment of machines – Part 1: General requirements*

IEC 60204-11, *Safety of machinery – Electrical equipment of machines – Part 11: Requirements for HV equipment for voltages above 1 000 V a.c. or 1 500 V d.c. and not exceeding 36 kV*

ISO 10218, *Manipulating industrial robots – Safety*

ISO 13850, *Safety of machinery – Emergency stop – Principles for design*

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**Annex NAE**  
(informative)

D1

**U.S. and Canadian regulatory requirements**

This annex provides examples of and references for regulatory requirements that might apply to some equipment. Applicability of these requirements is dependent on the construction of the equipment and its intended installation and use.

This annex is not intended to provide a complete list of all of the applicable requirements, only to serve as a reference for requirements that most commonly apply to this type of equipment.

For complete requirements, the National Electrical Code, ANSI/NFPA 70, the Canadian Electrical Code, Part I, or other referenced document must be consulted.

Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.

NOTE 1 Underlining to indicate text added to IEC 60950-23 is not used in this annex.

NOTE 2 The complete text of Annex NAE is a D1 national difference.

**Annex NAE**

D1

Clause No.	Topic/summary	NEC	CEC
1	<b>Automated information storage equipment</b> For ITE (computer) room applications, automated information storage equipment, which is enclosed storage and retrieval equipment that moves recorded media between storage and electronic computer equipment, that is intended to contain more than 0,76 m <sup>3</sup> of combustible media shall have provision for either automatic sprinklers or a gaseous agent extinguishing system with an extended discharge.	NFPA 75 Sections 3.3.2, 6.2.1.2, 8.1.4 and A.8.1.4	

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