INTERNATIONAL STANDARD

ISO 18925

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Imaging materials — Optical disc media — Storage practices

Matériaux pour l'image — Milieu pour disque optique — Pratiques de stockage

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 18925 was prepared by Technical Committee ISO/TC 42, *Photography*.

This International Standard is one of a series of standards dealing with the physical properties and stability of imaging materials. To facilitate identification of these International Standards, they are assigned a number within the block from 18900 to 18999 (see annex A).

Annexes A to C of this International Standard are for information only.

Introduction

Use of optical disc material is becoming widespread in audio, video and computer applications. Preservation of this information is becoming of increasing concern to society, particularly as the recorded information becomes older and frequently of greater value to libraries, archives, museums, government agencies and commercial organizations.

The stability of optical discs is dependent upon that of the complete system. This includes the stability of the material itself, the equipment on which it is run and, in systems, upon the necessary software. ISO 18921, *Compact discs (CD-ROM) — Method for estimating the life expectancy based on the effects of temperature and relative humidity* specifies a methodology for estimating the life expectancy of the CD-ROM. Other optical discs will be addressed in future International Standards. These standards consider only the effects of temperature and humidity and do not include other factors such as light, corrosive gases and particulates. International Standards are not available on the life expectancy of hardware and the problems associated with hardware wearing out or becoming obsolete.

Optical disc users should store discs under conditions that will extend their life and should handle the material so that it will not be subjected to stress and undergo physical breakdown during use. This International Standard addresses the concerns of long-term storage.

A major component of a large number of optical discs is the polycarbonate substrate. Polycarbonate is a very durable material, but it does absorb moisture and there is always an equilibrium between the ambient humidity and the moisture content of the disc. Polycarbonate is susceptible to decomposition under certain conditions and given a suitable catalyst.

The second component of most optical discs is the reflective layer. This layer is usually some highly reflective metal such as aluminium, silver or gold. Each of these materials is subject to reaction with various chemicals that may be found in the environment. Aluminium, for example, combines readily with oxygen to form aluminium oxide. Silver combines with sulfur to tarnish and form silver sulfides. Gold is known to react with chlorine to form gold chlorides.

A third component of these discs is some type of seal coat. This is typically a UV-cured polymer whose purpose is to protect the reflective layer and any other material layers in the disc.

A fourth component, in the case of some recordable optical discs, is the dye layer. For magneto-optic or phase change discs, additional layers are also included.

Regardless of the inherent stability of the various disc layers, it is known that good storage conditions will extend the life of all optical discs. While a good storage environment cannot reverse any degradation that has already occurred, it can slow down additional deterioration.

A single storage condition is described in this International Standard. This condition is intended for discs that contain recorded information of long-term value. Various manufacturers' studies indicate that the life expectancy of well manufactured optical discs is in excess of 50 years under typical room ambient conditions (see [1] and [2] in the Bibliography).

Imaging materials — Optical disc media — Storage practices

1 Scope

This International Standard establishes extended-term storage conditions for optical discs and provides recommendations concerning the storage conditions, storage facilities, enclosures and inspection for optical discs. It is applicable to discs made for audio, video, instrumentation and computer use.

Recommendations are general in nature and the manufacturer's cautions for specific material should be considered. Relaxation from these recommendations, whether before or after recording, will generally result in shortened life expectancy.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO/IEC 10149:1995, *Information technology — Data interchange on read-only 120 mm optical disks (CD-ROM)*

ISO/IEC 15486:1998, *Information technology — Data interchange on 130 mm optical disc cartridges of type WORM (Write Once Read Many) using irreversible effects — Capacity: 2,6 Gbytes per cartridge*

ISO 18921:—[1], *Imaging materials — Compact discs (CD-ROM) — Method for estimating the life expectancy based on the effects of temperature and relative humidity*

ISO 18923:2000, *Imaging materials — Polyester-base magnetic tape — Storage practices*

IEC 60908:1999, *Compact disc digital audio system*

NFPA 75-1995, *Electronic computer/Data processing equipment*[2]

NFPA 232-1995, *Protection of records*[2]

UL 72-1990, *Tests for fire resistance of record protection equipment*[3]

1) To be published.

2) Available from the National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101, USA.

3) Available from the Underwriters Laboratories, 333 Pfingsten Road, Northbrook, IL 60062, USA.

X3.212-1995, *Information systems — 130 mm rewritable optical disc cartridge for information interchange*[4)]

Japanese Ordinance No. 306, *Regulation on fire-hazard materials under Fire Protection Law*[5)]

JIS S 1037: 1998, *Fire-resistive containers*[6)]

3 Terms and definitions

For the purposes of this International Standard, the following terms and definitions apply.

3.1
blister
localized delamination that looks like a bubble

3.2
compact disc
CD
optical disc format in which the information layer is located at one surface of a substrate and the data can be read by an optical beam

NOTE CD is the subject of IEC 60908.

3.2.1
compact disc-recordable
CDR
recordable optical disc in which information can be recorded to certain areas in the compact disc format

NOTE Information can be recorded one time and read many times.

3.2.2
compact disc read-only memory
CD-ROM
optical disc to which information is transferred during manufacture to certain areas in the compact disc format

NOTE 1 Information can be read many times.

NOTE 2 CD-ROM is the subject of ISO/IEC 10149.

3.2.3
compact disc-rewritable
CD-RW
recordable optical disc in which information can be recorded to certain areas in the compact disc format

NOTE Information can be erased and new information recorded many times and read many times.

3.3
container
box, can, or carton used for storage and shipping of recording materials

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4) Available from the National Committee for Information Technology Standards, 125 Eye St., NW, Suite 200, Washington, DC 20005, USA, e-mail: service@cssinfo.com.

5) Available from the Center for Governmental Issues Services, Building No. 2 of the Ohtemachi-Godo-Chosha Governmental Offices, Chiyoda-ku, Ohtemachi 1-3-2, Tokyo, Japan.

6) Available from the Japanese Standards Association, Minato-ku, Akasaka 4-1-14, Tokyo, 107, Japan.

3.4
digital versatile disc
DVD
digital video disc (superseded)
optical disc format in which one or more information layers are located between two substrates and the data can be read by an optical beam

3.5
delamination
separation of a laminate into its constituent layers

3.6
dew point
temperature at which moisture begins to condense on a surface

See **relative humidity** (3.16)

EXAMPLE The more humid the air, the higher the dew point temperature.

3.7
enclosure
folder, envelope, sleeve or clam shell intended for physical protection against mechanical damage

3.8
extended-term storage conditions
storage conditions suitable for the preservation of recorded information having permanent value

3.9
fire-protective storage
facilities designed to protect records against excessive temperatures, water and other fire-fighting agents, and steam developed by insulation of safes or caused by the extinguishing of fires and collapsing structures

3.10
insulated record container
storage box designed to withstand elevated temperatures and conforming to national standards and regulations

3.11
isoperm lines
lines of constant life plotted as a function of temperature and relative humidity

3.12
life expectancy
LE
length of time that information is predicted to be retrievable in a system at 21 °C and 50 % RH

3.13
magnetic field intensity
level of the magnetic field at a point in space

3.14
medium
material on which the information is recorded

NOTE Plural is media.

3.15
MO disc
optical disc in which the information is recorded using magneto-optical technology in some specified format

NOTE Information can be recorded, read many times and overwritten many times.

3.16
relative humidity
RH
ratio, defined as a percentage, of the existing partial vapour pressure of water to the vapour pressure at saturation

NOTE It is usually, but not always, equal to the percentage of the amount of moisture in the air to that at saturation.

3.17
storage environment
conditions for storing materials, i.e. temperature, relative humidity, cleanliness of facilities and atmospheric pollutants

3.18
storage housing
physical structure supporting materials and their enclosures

NOTE It may consist of drawers, racks, shelves or cabinets.

3.19
system
combination of material, hardware, software and documentation necessary for recording and/or retrieving information

3.20
WORM disc
optical disc in which the data in specified areas can be written only once and read multiple times by an optical beam

4 Environmental conditions

4.1 Humidity and temperature limits

The average relative humidity of an extended-term storage environment shall be maintained between 20 % RH and 50 % RH. Cycling of relative humidity shall not be greater than ± 10 %. Ideally, the maximum temperature for extended periods should not exceed 25 °C, and a temperature below 23 °C is preferable. The peak temperature shall not exceed 32 °C. Generally, useful life will be increased by storing discs at low temperature and low relative humidity, since chemical degradation is reduced at these conditions (see annex B). Storage of discs below – 10 °C and below 10 % RH is not recommended.

Specific manufacturer's recommendations, when available, should take precedence over the above general recommendations.

For any facility, it is impossible to specify what the best relative humidity and storage temperature should be, since it depends upon the value of the material, the past storage history, the length of time the disc is to be kept, the size of the vault, the cost of various options and the climate conditions where the facility is located.

Lower temperatures within the specified relative humidity range can be difficult to achieve with normal humidity air-conditioning equipment and may require a specialized installation. Automatic control systems are recommended, and they shall be checked frequently enough to determine that the specified temperature and humidity limits are not being exceeded. A reliable hygrometer can be used for humidity measurements.

Where air conditioning is not practical, high humidities may be lowered by electrical refrigeration-type dehumidifiers controlled with a hygrostat. Inert desiccants, such as chemically pure silica gel, may be used, provided the dehumidifier is equipped with filters capable of removing dust particles down to 0,3 µm (micrometres) in size and is controlled to maintain the relative humidity within the specified range. Dehumidification may be required in storage areas such as basements and caves which have inherently low temperatures but which frequently exceed the upper humidity limit.

The recommended humidity and temperature conditions can be maintained either within individual storage housings or within storage rooms containing such housings.

4.2 Contaminants and gaseous impurities

Contaminants can pass through very small cracks or scratches in protective layers, react with reflective or recording layers in the disc and potentially cause loss of data. Best available technologies shall be used to ensure minimization of gaseous impurities such as ammonia, chlorine, sulfides, peroxides, ozone, oxides of nitrogen, smoke and acidic gases. Molecular sieves may be included in storage environments to absorb pollutants and excess humidity. Manufacturers should be consulted for information on maximum acceptable levels of airborne contaminants.

Water shall not be allowed to collect on plastic surfaces. Oil from fingerprints or organic vapours in the environment can migrate through the disc resulting in long-term degradation.

4.3 Magnetic fields

Magnetic fields are a concern only for magneto-optical discs. The optical disc cartridge standard (see X3.212) for magneto-optical discs, for example, specifies maximum field strength at the recording layer of 48 000 A/m (600 oersteds) as a storage condition. The fields specified for magneto-optic discs are higher than for magnetic tape (see ISO 18923) because the optical material must be heated above the Curie temperature by the laser in the presence of this field for recording to occur.

External magnetic fields are most frequently observed near motors and transformers, e.g. commercial building elevator installations. Most of such installations are localized and the field intensity falls off rapidly with separation. A separation of a few metres from the source will usually provide sufficient protection. External fields of a more unanticipated nature may be produced by some headphones and microphones or by cabinet latches.

5 Materials

The materials used for storage housings and enclosures shall be chemically stable and non-debris producing. They shall be free from distortion (warpage).

6 Enclosures

6.1 General requirements

Enclosures shall be resistant to impact moisture and dust intrusion. Enclosures made of paper or cardboard shall not be used. They shall be designed in such a way that neither the disc data nor the label surface is in contact with the enclosure when the enclosure is stored in its proper vertical position. Enclosures shall not be able to be deformed or mechanically compromised in the defined storage conditions. An enclosure lid shall be capable of being latched, attached or locked to prevent accidental opening.

Polystyrene, polypropylene and polycarbonate are suitable plastics for storage enclosures. However, prolonged exposure to strong light, including fluorescent and incandescent lighting, causes yellowing of polystyrene plastics, sometimes accompanied by crazing. Exposure to radiation rich in ultraviolet (UV), such as direct sunlight, is even more harmful and results in physical breakdown of polystyrene and polypropylene (see [3] in the bibliography).

Foam rubber and plastics such as cellulosics, polyvinyl chloride (PVC) and highly plasticized materials shall be avoided.

6.2 Labelling

Enclosures shall provide a means for labelling that allows identification of the recorded information contained within. The labelling shall be non-acid, non-debris and non-oxidant producing, and shall be attached or affixed on the outside of the enclosure in such a manner that it will remain for the life expectancy of the discs. Multiple labels should be kept to a minimum to avoid the possibility of adhesive migration.