IS&C SPECIFICATIONS

IMAGE SAVE AND CARRY

130 mm magneto-optical disk cartridge
for IS&C information interchange

(Version 1.0)

IS&C COMMITTEE / July, 1992

Supplement of IS&C Specifications

130mm magneto-optical disk cartridge for IS&C information interchange

1. In the following paragraphs the description of (tentative) shall be deleted and partly corrected (~~~).

13.4 Clamping force (see annex O). [Page 6]

[Type A] : from 5N to 14N (tentative)
[Type B] : from 5N to 14N (tentative)

13.5 Capture cylinder for the hub (see Figure 12 in ISO/IEC 10089) [Page 6]

L_{58} = 0,7 mm min (tentative)

15.2 Baseline reflectance [Page 11]
15.2.3 Requirement

from 0,16 to 0,24 (tentative)

17.1.2 Characteristics of pre-recorded information [Page 15]
17.1.2.1 Groove-related signals

- Cross-track maximum signal ratio
  $0{,}85 \leq (I_1 + I_2)\max / (I_1 + I_2)a \leq 1{,}00$ (tentative)

- Push-pull ratio
  [polarization parallel to the grooves]
  $0{,}50 \leq (|I_1 - I_2|) / (I_1 + I_2)a \leq 0{,}65$ (tentative)

- Cross-track signal moduration ratio
  [polarization parallel to the grooves]
  $0{,}20 \leq [(I_1 + I_2)\max - (I_1 + I_2)\min] / (I_1 + I_2)a \leq 0{,}5$ (tentative)

- On-track signal ratio
  $0{,}7 < I_{ot}/I_o \leq 1.00$ and $0{,}135 \leq$ (Baseline reflectance) x I_{ot}/I_o

17.4.1 Media initialization [Page 17]

total primary defects shall be less than 50 (tentative)

19.2 Hub center hole life [Page 18]

the loading life of 20 000 (tentative) times/side.

Annex M (normative) – Edge distortion test [Page 22]

M.3 The dimensions shall be as follows (see Figure M.1).
D = 11,50 mm ± 0,01 mm (tentative)
E = 11,60 mm min (tentative)

Annex N (normative) –Compliance test [Page 24]

N.3 The test gauge
Posts P3 and P4
Dc = 5,50 mm ± 0,01 mm (tentative)

N.5 Requirements
the annular surface of its post shall not exceed 0,35 mm (tentative)

Annex S (normative) – Guide lines for sector replacement [Page 30]

S.1 Media initialization with certification
b) A column in the data field contains more than two (tentative) defective bytes.

2. Following paragraphs shall be corrected as follows.

[Page 16,the second line from the botom]
Io is the signal in the same Channel 1 obtained from an ungrooved, unrecorded area.

19.4 Life of disk clamp area [Page 18]

After 20 000 times/side loading there shall not be any trouble which is caused by disk clamp area. The loading test shall be carried out by the drive in conformance with IS&C specifications of 130 mm magneto–optical disk drive.

Annex W (normative) – Write power and pulse width of Type B condition [Page 34]

The SFP figures shall be (FF)h, until the power caliblation disk is available.

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Annexes

IS&C specifications - 130 mm magneto-optical disk cartridge for IS&C information interchange

1 Scope

IS&C specifications modify ISO/IEC 10089 for information interchange in IS&C systems.

The modifications have concerns with
- the environment in which the characteristics are to be tested;
- the environment in which the cartridges are to be operated;
- the mechanical, physical and dimensional characteristics of the case and of the optical disk;
- the magneto-optical characteristics and the recording characteristics for recording the information, for reading the information and for erasing it many times, so as to provide physical interchangeability among IS&C systems;
- one format for the physical disposition of the tracks and sectors, the error correction codes, the modulation methods used for recording and the quality of the recorded signals;

IS&C specifications additionally define two test conditions (Type A and Type B).

The modified clauses are listed below.

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10 Dimensional and mechanical characteristics of the case
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IS&C specifications neglect the clause 18(Format B), annex D, annex E and annex H.
IS&C specifications define the additional clauses and annexes, which are listed below.

17.1.2.4 Sector size accuracy
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Annex L Definition of air cleanliness: class 1 000 000 and class 100 000
Annex M Edge distortion test
Annex N Compliance test
Annex O Test method for measuring the adsorbent force of the hub
Annex P Write power and Erase Power
Annex Q Relaxation by zones of the requirement for signals
Annex R Control track table
Annex S Guidelines for sector replacement
Annex T Write and erase cycle test
Annex U Measurement of read stability
Annex V Test method for measuring hardness of the disk surface
Annex W Write power and pulse width of Type B condition

2 Conformance

A 130 mm magneto-optical disk cartridge is in conformance with this IS&C specifications if it meets all the mandatory requirements of clauses 8 to 19. Unless otherwise stated the descriptions described in ISO/IEC 10089 are applied for this IS&C Specification.

3 Normative references

This Specification is based on ISO standard ISO/IEC 10089:1991. Unless otherwise specified, parties to agreements based on this IS&C Specification are requested to investigate ISO/IEC 10089:1991 and ISO technical reports such as "Testing method of optical disk cartridge" (Tentative) and "Defect management" (Tentative), and are encouraged to investigate the standards such as ISO 683-13:1986 and ISO 950:1986.

4 Conventions and notations

In this IS&C specifications the same conventions and notations described in ISO/IEC 10089 shall be applied.

5 List of acronyms

In this IS&C specifications the same list of acronyms described in ISO/IEC 10089 shall be applied.

6 Definitions

In this IS&C specifications the same definitions described in ISO/IEC 10089 shall be applied.

7 General description

IS&C Specification adds the following sentences to the original description of ISO/IEC 10089. The optical disk cartridge which is conformance with IS&C Specification shall be attached with the IS&C label. The way of displaying IS&C label is provided from the Medical Information Development Center, headquarters of IS&C committee.

8 Environments

In this IS&C Specification the same environmental conditions described in subclauses 8.3 and 8.4 of ISO/IEC 10089 shall be applied.

8.1 Testing environment

Unless otherwise specified, tests and measurements made on the ODC to check the requirements of this IS&C Specification shall be carried out in an environment where the air immediately surrounding the ODC is within the following conditions.

Temperature	: 23 °C ± 2 °C
Relative humidity	: 45 % to 55 %
Atmospheric pressure	: 75 kPa to 105 kPa
Air cleanliness	: Class 100 000 max (see annex L)

Before testing, the ODC shall be conditioned in this environment for 48 h minimum. No condensation on or in the ODC shall occur.

8.2 Operating environment

Optical disk cartridges used for data interchange shall be operated in an environment where the air immediately surrounding the ODC is within the following conditions.

Temperature	: 5 °C to 55 °C
Relative humidity	: 10 % to 80 %
Wet bulb temperature	: 29 °C max
Atmospheric pressure	: 75 kPa to 105 kPa
Temperature gradient	: 10 °C/h max
Relative humidity gradient	: 10 %/h max
Magnetic field	: During loading and unloading of the cartridge the magnetic field strength at the recording layer shall not exceed 48 000 A/m.
Air cleanliness	: Class 1 000 000 max (see annex L)

No condensation on or in the ODC shall be allowed to occur.

If an ODC has been exposed during storage and/or transportation to conditions outside those specified in this clause, it shall be acclimatized in the operating environment for at least 2h before use. In the operating environment an ODC shall be capable of withstanding a thermal shock of up to 20 °C when inserted into, or removed from, the drive.

9 Safety requirement

In this IS&C Specification the same safety requirement described in ISO/IEC 10089 shall be applied.

10 Dimensions and mechanical characteristics of the case

In this IS&C Specification the same dimensions and mechanical characteristics of the case described through subclauses 10.1 to 10.18 in ISO/IEC 10089 shall be applied.

The cartridge shall meet the requirement of the edge distortion test defined in annex M.

The cartridge shall meet the requirement of the compliance test defined in annex N. The requirement guarantees that a cartridge can be constrained in the proper plane of operation within the drive.

11 Dimensional and physical characteristics of the disk

In this IS&C Specification the same dimensional and physical characteristics of the disk described in subclauses 11.1, 11.2, 11.3, 11.4, 11.5, 11.7, and 11.9 of ISO/IEC 10089 shall be applied.

11.6 Axial acceleration

The acceleration of the recording layer along any fixed line normal to the disk reference plane shall not exceed 10 m/s^2 in a bandwidth from 30 Hz to 1,5 kHz for a rotational frequency of the disk of 30,0 Hz ± 0,3 Hz. The acceleration shall be measured by the optical system defined in 15.1.1 and 15.1.2 of ISO/IEC 10089.

11.8 Radial acceleration

The acceleration of any track along a fixed radial line shall not exceed 3 m/s^2 in a bandwidth from 30 Hz to 1,5 kHz, as measured by the optical system, at a rotational frequency of the disk of 30,0 Hz ± 0,3 Hz.

12 Drop test

In this IS&C Specification the same drop test described in ISO/IEC 10089 shall be applied.

13 Interface between disk and drive

In this IS&C Specification the same interface between disk and drive described in subclauses 13.1, 13.2 and 13.6 of ISO/IEC 10089 shall be applied.

13.3 Magnetizable material

The magnetizable material shall be ferritic stainless steel (ISO 683-13, Type 8) or any suitable material with similar magnetic characteristics so as to meet the requirement of the absorbent force of the hub defined in annex O.

13.4 Clamping force (see annex O)

The clamping force exerted by the spindle shall be as follows:
[Type A] : from 5 N to 14 N (tentative)
[Type B] : from 8 N to 14 N (tentative)

13.5 Capture cylinder for the hub(see figure 12 in ISO/IEC 10089)

The capture cylinder is defined as the volume in which the spindle can expect the centre of the hole of the hub to be at the maximum height of the hub, just prior to capture. The size of the cylinder limits the allowable play of the disk inside its cavity in the case. This cylinder is referred to perfectly located and perfectly sized alignment and location pins in the drive, and includes tolerances of dimensions of the case and the disk between the two pins mentioned and the centre of the hub. The bottom of the cylinder is parallel to the reference plane P, and shall be located at a distance of

L_{58} = 0,7 mm min (tentative)

above the reference plane P of Side B of the case when Side A of the disk is to be used. The top of the cylinder shall be located at a distance of

L_{59}= 3,8 mm max

above the same reference plane. The diameter of the cylinder shall be

D_{12} = 3,0 mm max

Its centre shall be defined by the nominal values of L_{46} and L_{51}.

14 Characteristics of the substrate

In this IS&C Specification the same characteristics of the substrate described in ISO/IEC 10089 shall be applied.

15 Characteristics of the recording layer

In this IS&C Specification the same characteristics of the recording layer described in subclauses 15.2.1, 15.2.2, 15.3.1, 15.3.2, 15.3.4 and 15.3.6 of ISO/IEC 10089 shall be applied.

The requirement of this clause shall be met for the linear polarization of the optical beam, both when parallel and when perpendicular to the tracks. IS&C Specification additionally defines two conditions (Type A and Type B) in terms of wave length, λ/NA, and rotational frequency. Unless otherwise stated, all tests in this clause shall be carried out under the conditions of 15.1.1, and 15.1.2, 15.1.3, 15.1.4.

15.1 Test conditions

15.1.1 General

IS&C Specification defines the general conditions described in 15.1.1 of ISO/IEC 10089 as ISO condition, Type A condition and Type B condition.

[ISO condition]

a)	Environment	: Test environment
b)	Wavelength (λ)	: 825 nm $^{+15\ nm}_{-10\ nm}$
c)	λ/NA	: 1,560 µm ± 0,040 µm (NA = 0,53)
d)	Filling of the lens aperture specified in ISO/IEC 10089	: 1,0 max
e)	Variance of the wavefront of the optical beam at the recording layer	: λ^2/180 max
f)	Detection method	: see annex A in ISO/IEC 10089
g)	Extinction ratio	: 0,01 max (see annex A in ISO/IEC 10089)
h)	Rotational frequency of the disk	: 30,0 Hz ± 0,3 Hz
i)	Direction of rotation of the disk	: Counter-clockwise when viewed from the objective lens.

[Type A condition]

a)	Environment	: Test environment
b)	Wavelength (λ)	: 780 nm $^{+15\ nm}_{-10\ nm}$
c)	λ/NA	: 1,560 µm ± 0,040 µm (NA = 0,50)
d)	Filling of the lens aperture specified in ISO/IEC 10089	: 1,0 max
e)	Variance of the wavefront of the optical beam at the recording layer	: λ^2/180 max
f)	Detection method	: see annex A in ISO/IEC 10089
g)	Extinction ratio	: 0,01 max (see annex A in ISO/IEC 10089)
h)	Rotational frequency of the disk	: 40,0 Hz ± 0,4 Hz
i)	Direction of rotation of the disk	: Counter-clockwise when viewed from the objective lens.

[Type B condition]

a)	Environment	: Test environment +15 nm
b)	Wavelength (λ)	: 825 nm -10 nm
c)	λ/NA	: 1,560 µm ± 0,040 µm (NA = 0,53)
d)	Filling of the lens aperture specified in ISO/IEC 10089	: 1,0 max
e)	Variance of the wavefront of the optical beam at the recording layer	: λ^2/180 max
f)	Detection method	: see annex A in ISO/IEC 10089
g)	Extinction ratio	: 0,01 max (see annex A in ISO/IEC 10089)
h)	Rotational frequency of the disk	: 60,0 Hz ± 0,6 Hz
i)	Direction of rotation of the disk	: Counter-clockwise when viewed from the objective lens.

15.1.2 Read conditions

IS&C Specification specifies the read power range for User Zone separately for the test conditions defined in 15.1.1.

Marks on the disk are read from the disk with a constant optical power.

The read power is the optical power incident at the entrance surface, used when reading, and is specified as follows for the stated zones (see 16.2):

a) PEP Zone
The read power shall not exceed 0,5 mW.

b) SFP Zone
The read power shall not exceed the value given in byte 6 of the PEP Zone (see 16.4.3.1.4).

c) User Zone
The read power shall be within the range given below under the condition of temperature range from 5 °C to 55 °C.

[ISO condition]	Read power : from 1 mW to 1,5 mW
[Type A condition]	Read power : from 1 mW to 1,8 mW
[Type B condition]	Read power : from 1 mW to 2,0 mW

15.1.3 Write conditions

15.1.3.1 Bias power

Marks are written on to the disk by pulses of optical power superimposed upon a specified bias power as given below for the conditions defined in 15.1.1.

[ISO condition]	Bias power : 1,5 mW ± 0,1 mW
[Type A condition]	Bias power : 0,0 mW(tentative)
[Type B condition]	Bias power : not exceed 0,2 mW

15.1.3.2 Write power and pulse width

IS&C Specification specifies the details of testing conditions and the maximum write power for the test conditions defined in 15.1.1.

The pulse shape shall be as specified in annex B of ISO/IEC 10089.

The write power is the optical power incident at the entrance surface, used when writing in the User Zone. Testing shall be carried out under the condition of temperature of 23°C ± 2°C.

The write power condition outside of this temperature range is determined as specified in annex P.

Testing shall be carried out upon a specified write power and pulse width as given below.

[ISO condition]

Testing shall be carried out at either

- a constant pulse width and a write power appropriate to the radius, as given in bytes 22 - 24 or 25 - 27 of the SFP Zone (see 16.5.2), or
- a constant write power given in byte 31 and a pulse width appropriate to the radius, as given in bytes 32 - 34 of the SFP Zone (see 16.5.2).

Write power : The value shall not exceed 8.5 mW.
Write pulse width : The value shall be within the range from 60 nsec to 120 nsec.

For radii other than 30 mm, 45 mm, or 60 mm the values shall be linearly interpolated from the above.

[Type A condition]

Write power : 9,0 mW
Write pulse width : 51 nsec for inner radius
: 69 nsec for medium radius
: 69 nsec for outer radius

[Type B condition] (see annex W)

Write power : 10,0 mW
Write pulse width : 40 nsec for inner radius

(track number 0 - 5 000)

: 55 nsec for medium radius
(track number 5 001 - 10 000)
: 65 nsec for outer radius
(track number 10 001 - 18 750)

15.1.3.3 Write power accuracy

IS&C Specification specifies write power accuracy as given below.

[ISO condition]

In all cases the actual power used shall be within 5 % of those selected.

[Type A condition and Type B condition]

The accuracy of write power shall be within 20 % of that specified in the control tracks, i.e. the disk shall have ±20 % of the write power margin. The value accuracy of write power in the control tracks shall be within 5 %.

15.1.3.4 Write pulse width accuracy

IS&C Specification specifies write pulse width accuracy as given below.

[ISO condition]

In all cases the actual pulse width used shall be within 5 % of those selected.

[Type A condition and Type B condition]

The accuracy of write pulse width shall be within 15 % of that specified in the control tracks.
The value accuracy of write pulse width in the control tracks shall be within 5 %.

15.1.3.5 Magnetic field

The requirement for all tests shall be met for all magnetic field intensities, at the recording layer during writing, in the range from 18 000 A/m to 32 000 A/m.

The write magnetic field shall be normal to the recording surface.

The direction of the write magnetic field shall be from the entrance surface to the recording layer.

15.1.4 Erase conditions

The erase power is the optical power required for any given track at the entrance surface to erase marks written according to 15.1.3 to a specified level (see 15.3.6 in ISO/IEC 10089).

The actual erase power shall be within 10 % of that specified in the control tracks.

IS&C Specification specifies the erase power for the conditions described in 15.1.1 given below. Testing shall be carried out under the condition of temperature at 23 °C ± 2 °C. The erase power condition outside of this temperature range is specified in annex P.

Testing shall be carried out upon a specified erase power as given below.

[ISO condition]

- A d.c. power given in bytes 45 - 47 of the SFP Zone (see 16.5.2),
- or a constant pulse width and an erase power appropriate to the radius, as given in bytes 35 - 37 or 38 - 40 of the SFP Zone (see 16.5.2),
- or a constant erase power given in byte 44 and a pulse width appropriate to the radius, as given in bytes 45 - 47 of the SFP Zone (see 16.5.2). The required power shall not exceed 8,5 mW.

[Type A condition]

d.c. erase power : 10,0 mW

[Type B condition]

d.c. erase power : The value shall be given in byte 101 - 103 of the SFP Zone. The value shall not exceed 11,0 mW.

Unless the values can be specified, the erase condition shall be as follows.

d.c. erase power : 11,0 mW

15.2 Baseline reflectance

In this IS&C Specification the same baseline reflectance described in subclauses 15.2.1 and 15.2.2 of ISO/IEC 10089 shall be applied.

15.2.3 Requirement

At any point in the Formatted Zone, except in the Reflective Zone and in the Lead-out Zone the value R_m shall be within 12% of the value of R, and shall be within the range from 0,16 to 0,24 (tentative).

15.3 Magneto-optical recording in the User Zone

IS&C Specification specifies the temperature range from 5 °C to 55 °C for the descriptions of 15.3.1, 15.3.2, 15.3.3, 15.3.4, 15.3.5 and 15.3.6 of ISO/IEC 10089.

IS&C Specification revises the value of figure of merit for magneto-optical signal narrow-band signal-to-noise ratio, and cross-talk ratio.

The other descriptions of this subclause 15.3 of ISO/IEC 10089 shall be applied to IS&C Specification.

IS&C Specification defines the relaxation by zones of the requirements for signals (see Annex Q).

15.3.3 Figure of merit for magneto-optical signal

The figure of merit F is expressed as the product of R, sin θ and cos 2β, where R is the reflectance expressed as a decimal fraction, θ is the Kerr rotation and β is the ellipticity of the reflected beam. The polarity of the figure of merit is defined to be negative for a written mark in an Fe-rich Fe-Tb alloy layer and with the write magnetic field in the direction specified in 15.1.3. In this case the direction of Kerr rotation is counterclockwise as viewed from the source of the beam.

The polarity and the value of the figure of merit shall be specified in bytes 364 and 365 of the SFP Zone (see 16.5.2).
This nominal value shall be

$$0,0027 \leq | F | \leq 0,0050$$

The measurement of the actual value F_m shall be made according to annex C in ISO/IEC 10089. This actual value F_m shall be within 12 % of the nominal value.

15.3.5 Cross-talk ratio

The test shall be carried out on any group of five adjacent unrecorded tracks in the User Zone.

Write on the centre track n under the conditions given in 15.3.4 of ISO/IEC 10089.

Read tracks $(n - 1)$, n and $(n + 1)$ under the conditions specified in 15.1.2 c).

The cross-talk ratio is:

$$20 \log_{10}\left(\frac{\text{signal level of track } n+1}{\text{signal level of track } n}\right) \quad \text{and} \quad 20 \log_{10}\left(\frac{\text{signal level of track } n-1}{\text{signal level of track } n}\right)$$

It shall be lower than -26 dB in the range of tracking error not more than ±0,1 µm.

16 Features common to both formats

In this IS&C Specification the same features common to both formats described in 16.3, 16.4 and 16.6 of ISO/IEC 10089 shall be applied.

16.1 Track geometry

16.1.3 Track pitch

Except for the Control Track PEP Zone, the track pitch shall be 1,60 µm ± 0,10 µm.

16.1.4 Track number

Each track shall be identified by a track number.

Track 0 shall be located at radius 30,00 mm ± 0,10 mm.

The track numbers of tracks located at radii larger than that of track -300 shall be increased by 1 for each track.

The track numbers of tracks located at radii smaller than that of track 0 shall be negative and decreased by 1 for each track. Track -1 is indicated by (FF)(FF).

16.2 Formatted Zone

The Formatted Zone shall extend from radius 27,00 mm to radius 61,00 mm and shall be divided as follows. Dimensions are given as reference only, and are nominal locations.

- Reflective Zone	27,00 mm to 29,00 mm
- Control Track PEP Zone	29,00 mm to 29,50 mm
- Transition Zone For SFP	29,50 mm to 29,52 mm
- Inner Control Track SFP Zone	29,52 mm to 29,70 mm (track number -300 to -189)
- Inner Manufacturer Zone	29,70 mm to 30,00 mm (track number -188 to -1)
- Guard Band	29,70 mm to 29,80 mm
- Manufacturer Test Zone	29,80 mm to 29,90 mm
- Guard Band	29,90 mm to 30,00 mm
- User Zone	30,00 mm to 60,00 mm

(track number 0 to 18 750)

- Outer Manufacturer Zone 60,00 mm to 60,15 mm (track number 18 751 to 18 845)

- Outer Control Track SFP Zone 60,15 mm to 60,50 mm (track number 18 846 to 19 063)

- Lead-Out Zone 60,50 mm to 61,00 mm (track number 19 064 to (19 300 - 19 375))

This IS&C Specification dose not specify the format of the Reflective Zone, except that it shall have the same recording layer as the remainder of the Formatted Zone.

The Transition Zone For SFP is an area in which the format changes from the Control Track PEP Zone without servo information to a zone including servo information.

The Inner Manufacturer Zone is provided to allow the media manufacturer to perform tests on the disk, including write operations, in an area located away from recorded information. In this zone, the information in the tracks from track -1 to track -8 is not specified by this IS&C Specification and shall be ignored in interchange.

The purpose of the Guard Bands is to protect and buffer the areas that contain information from accidental damage when the area between the Guard Bands is used for testing or calibration of the optical system.

The User Zone shall start with track 0 and end with track 18 750 defined N.

The Outer Manufacturer Zone shall comprise 95 tracks and shall begin one track after the last user track (track 18 750, see bytes 384, 385 of the SFP Zone). The information in the tracks from 18 751 to track 18 758 is not specified by this IS&C Specification and shall be ignored in interchange. Tracks 18 759 to 18 845 are reserved for testing by the manufacturer.

The Outer Control Track SFP Zone shall begin at track 18 846 (see bytes 8, 9 in the PEP Zone) and shall continue up to track 19 063.

The Lead-Out Zone shall be used positioning purposes only. The Lead-Out Zone shall begin at track 19 064 and shall continue up to 19 300.

From radius 29,51 mm to radius 61,00 mm the Formatted Zone shall be provided with tracks containing servo and address information.

16.4 Control Track PEP Zone

Byte 6 shall be $(28)_H$. Other descriptions are the same as ISO/IEC 10089.

16.5 Control Track SFP Zones

In this IS&C Specification the same Control Track SFP Zones described in subclauses 16.5.1, 16.5.3 and 16.5.4 of ISO/IEC 10089 shall be applied.

16.5.2 Media Information

Bytes 18 to 359 specify read and write parameters at three laser wave length L_1 = 825 nm, L_2 = 780 nm and L_3. For each wave length the baseline reflectance R_1, R_2 or R_3 is specified. The read and write powers are specified for different rotational frequencies N_1 = 30 Hz, N_2 = 40 Hz, N_3 = 60 Hz and N_4 for each wave length. For each value of N four sets of write powers are given: three sets for constant pulse width and one set for constant power. Each set contains three values for the inner, middle and outer radius.

The following mandatory bytes are revised in IS&C Specification:
Bytes 18 to 27, bytes 31 to 34, bytes 44 to 47, bytes 76 to 83, bytes 87 to 90, bytes 100 to 103, bytes 132 to 133, bytes 162 to 169, bytes 173 to 176, and bytes 186 to 189.

Bytes 31 to 34 will be used for the identification of media type in terms of the write sensitivity dependency on the rotational frequencies (to be determined).

Bytes 44, 100 and 186 shall be $(00)_H$.

All values specified in bytes 18 to 359 shall be such that the requirements of clauses 14 and 15 are met.

See annex R - control track table (media information).

17 Format A

In this IS&C Specification the same Format A described in subclause 17.3 of ISO/IEC 10089 shall be applied.

17.1 Track layout

In this IS&C Specification the same track layout described in subclauses 17.1.1 and 17.1.2.3 of ISO/IEC 10089 shall be applied.

17.1.2 Characteristics of pre-recorded information

17.1.2.1 Groove-related signals

The following requirements shall be met (see figure 21 in ISO/IEC 10089):

- Cross-track maximum signal ratio

$$0,85 \leq (I_1 + I_2)\text{max} / (I_1 + I_2)\text{a} \leq 1,00 \text{ (tentative)}$$

where I_1 and I_2 are the outputs of the two halves of the split photo diode detector in the tracking channel (see annex A). $(I_1 + I_2)_{max}$ indicates the maximum signal when the beam crosses tracks, and $(I_1 + I_2)_a$ is the signal obtained from an unrecorded, ungrooved area.

- Push-pull ratio

[polarization perpendicular to the grooves]

$$0,40 \leq (| I_1 - I_2 |) / (I_1 + I_2)_a \leq 0,60$$

[polarization parallel to the grooves]

$$0,50 \leq (| I_1 - I_2 |) / (I_1 + I_2)_a \leq 0,65 \text{ (tentative)}$$

where $(| I_1 - I_2 |)$ is the peak-to-peak amplitude of the differential output of the two halves of the split photo detector in the tracking channel.

- Cross-track signal modulation ratio

[polarization perpendicular to the grooves]

$$0,30 \leq [(I_1 + I_2)_{max} - (I_1 + I_2)_{min}] / (I_1 + I_2)_a \leq 0,60$$

[polarization parallel to the grooves]

$$0,20 \leq [(I_1 + I_2)_{max} - (I_1 + I_2)_{min}] / (I_1 + I_2)_a \leq 0,40 \text{ (tentative)}$$

Over the whole disk this ratio shall not vary by more than 3 dB.

- Phase depth

The phase depth of the grooves equals

$$\frac{n \times d}{\lambda} \times 360°$$

where n is the index of refraction of the substrate
d is the groove depth
λ is the wavelength

The phase depth shall be less than 180 °.

- Track location

The tracks are located at those places on the disk where $(I_1 - I_2)$ equals zero and $(I_1 + I_2)$ has its maximum value.

- On-track signal ratio

$$0,85 \leq I_{ot} / I_o \leq 1,00 \text{ (tentative)}$$

where I_{ot} is the signal in Channel 1 (see annex A in ISO/IEC 10089) when the beam is on track. I_o is the signal in the same Channel 1 obtained fror an ungrooved, unrecorded area.

17.1.2.2 Properties of pre-recorded marks

IS&C neglects the requirement given below.

$$(I_{pmax} - I_{pmin}) / I_0 < 0,20 \text{ over any one track}$$

17.1.2.4 Sector size accuracy

IS&C Specification specifies that the sector size shall be within the range between 21 760 ± 3 channel bits/sector when the sectors contain 1 024 user bytes.

17.1.2.5 Initial state of MO layer in the pre-formatted header and Offset Detection Flag (ODF)

The magnetized direction of magneto-optical layer in the pre-formatted header is the same direction as the erase magnetized direction.

17.2 Sector format

Sector format containing only 1 024 user bytes is adapted.

17.4 Defect management

17.4.1 Media initialization

During media initialization four DMAs are recorded. The user area is divided into one group, which consists of 314 569 data sectors and 2 048 spare sectors. The spare sectors are used as replacement for defective data sectors. Media initialization can include a certification of the user area.

There shall be no defect sectors specified by annex S in the DMAs and total primary defects shall be less than 50 (tentative).

17.4.4 Summary of the location of the zones on the disk

IS&C Specification specifies N in figure 27 of ISO/IEC 10089 equals to 18 750.

18 Format B

IS&C Specification neglects this clause.

19 Life

IS&C specifies this clause for aging life, loading durability, protection from dust, write and erase cycling durability, and read stability.

19.1 Shutter life

The shutter shall operate more than 40 000 times of open/close cycle by the open force less than 3 N. The shutter shall be entirely closed by itself when the cartridge is out from the drive after 40 000 times of open/close cycle.

19.2 Hub centre hole life

The maximum and minimum value of D_9 shall be within the range from 4,004 mm (tentative) to 4,016 mm (tentative) through the length of h_3 throughout the loading life of 20 000 (tentative) times/side.

The hub centre hole life shall be measured by the standard loading equipment (to be determined).

19.3 Location hole life

The maximum value of L_9 shall be less than 4,100 (tentative) mm through the length of L_{10} throughout the loading life of 20 000 (tentative) times/side. The location hole life shall be measured by the standard loading equipment (to be determined).

19.4 Life of disk clamp area

After 20 000 times/side (tentative) loading there shall not be any trouble which is caused by disk clamp area. The loading test shall be carried out by the standard loading equipment (to be determined).

19.5 Write and erase cycling durability

Write and erase cycle durability shall be more than 1 000 000 times (see annex T).

19.6 Read stability

Read stability shall be more than 10 000 000 times(see annex U).
The test shall be carried out by tracing on the identical track.

19.7 Dust protection of the disk surface

The surface of the disk shall be protectively coated by the layer which has anti-electrostatic properties.

19.8 Hardness of the disk surface

The surface of the disk shall be protectively coated by the layer which is resistance to scratching (see annex V).

Annex

IS&C Specification neglects annex D, annex E and annex H in ISO/IEC 10089.

Annex L
(normative)

Definition of air cleanliness: class 1 000 000 and class 100 000

The classification of air cleanliness is based on a particle count with a maximum allowable number of specified minimum sized particles per unit volume, and on a statistical average particle size distribution.

L.1 Definition

The particle count shall not exceed a total of 35 000 000 / 3 500 000 particles per cubic metre of a size 0,5 µm and larger.

The statistical average particle size distribution is given in figure L.1. Class 1 000 000 / 100 000 means that 35 000 000 / 3 500 000 particles per cubic metre of a size of 0,5 µm are allowed, but only 250 000 particles per cubic metre of a size of 5,0 µm and larger.

It should be recognized that single sample distribution may deviate from this curve because of local or temporary conditions. Counts below 35 000 000 / 3 500 000 particles per cubic metre are unreliable except when a large number of samplings are taken.

L.2 Test method

For particles of sizes from the 0,5 µm to 5,0 µm, equipment employing light-scattering principles shall be used. The air in the controlled environment is sampled at a known flow rate. Particles contained in the sampled air are passed through an illuminated sensing zone in the optical chamber of the instrument. Light scattered by individual particles is received by a photo detector which converts the light pulses into electrical current pulses. An electronic system relates the pulse height to particle size and counts the pulses so that the number of particles in relation to particle size is either registered or displayed.

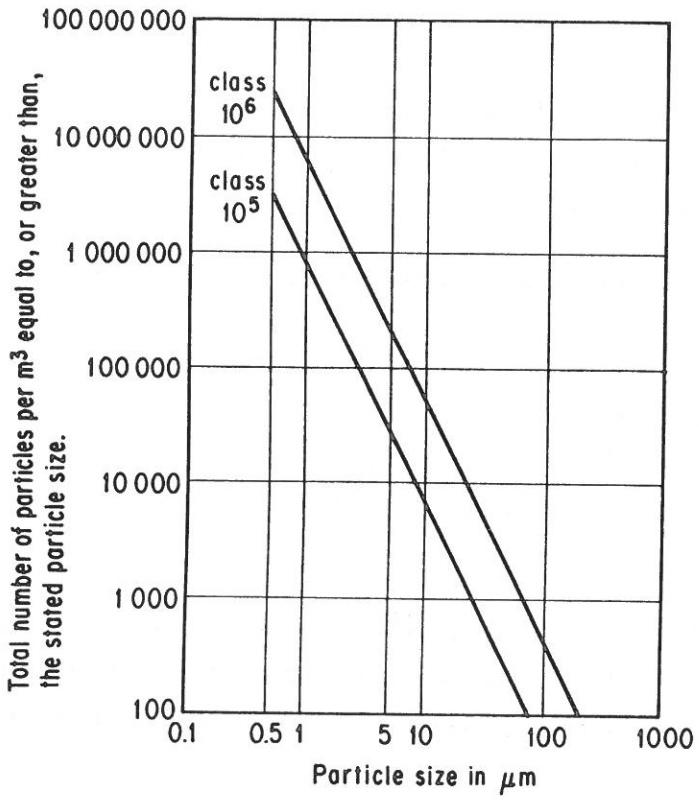

Figure L.1 - Particle size distribution curve

Annex M
(normative)

Edge distortion test

M.1 The distortion test checks if the case is free from unacceptable distortions and protrusions along its edges. The test is made by causing the cartridge to pass through the vertical slot of a gauge while applying a specified force in addition to the gravitational pull.

M.2 The gauge shall be made of a suitable material, e.g. of chrome-plated carbon steel. The inner surfaces shall be polished to a surface finish of 5 μm peak-to-peak.

M.3 The dimensions shall be as follows (see figure M.1):

A = 155,0 mm
B = 136,0 mm ± 0,1 mm
C = 10,0 mm ± 0,1 mm
D = 11,50 mm ± 0,01 mm (tentative)
E = 11,60 mm min (tentative)

M.4 Requirements

When the cartridge is inserted vertically into the gauge, a vertical downward force F of 2,7 N maximum, applied to the center of the top edge of the cartridge, shall cause the cartridge to pass through the gauge.

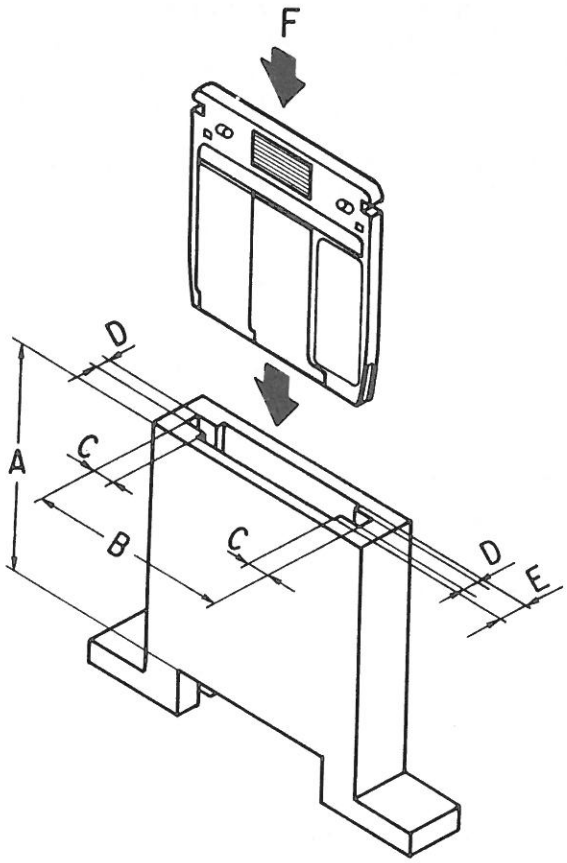

Figure M.1 - Distortion gauge

Annex N
(normative)

Compliance test

N.1 The compliance test checks the flatness and flexibility of the case by forcing the four reference surfaces of the case into a plane. The test is made by placing the cartridge on the supports of a gauge and applying forces on the cartridge opposite to the supports.

N.2 The location of the four reference surfaces S1, S2, S3 and S4 is defined in clause 10.9 and figure 4 of ISO/ICE 10089.

N.3 The test gauge consists of a base plate on which four posts P1, P2, P3 and P4 are fixed so as to correspond to the four surfaces S1, S2, S3 and S4, respectively (see figure N.1). The dimensions are as follows (see figure N.2):

Posts P1 and P2

Da = 6,50 mm ± 0,01 mm

Db = 4,00 $^{+\ 0,00\ mm}_{-\ 0,02\ mm}$

Ha = 1,0 mm ± 0,1 mm

Hb = 2,0 mm max

Posts P3 and P4

Dc = 5,50 mm ± 0,01 mm (tentative)

After assembly, the upper annular surfaces of the four posts shall lie between two horizontal planes spaced 0,01 mm apart.

N.4 The cartridge shall be placed with its reference surfaces onto the posts of the horizontal gauge. A vertical downward force F of 0,4 N (tentative) shall be exerted on the cartridge opposite to each of the four posts.

N.5 Requirements
Under the conditions of N.4, three of the four surfaces S1 to S4 shall be in contact with the annular surface of the respective posts, and any gap between the remaining surface S and the annular surface of its post shall not exceed 0.35 mm (tentative).

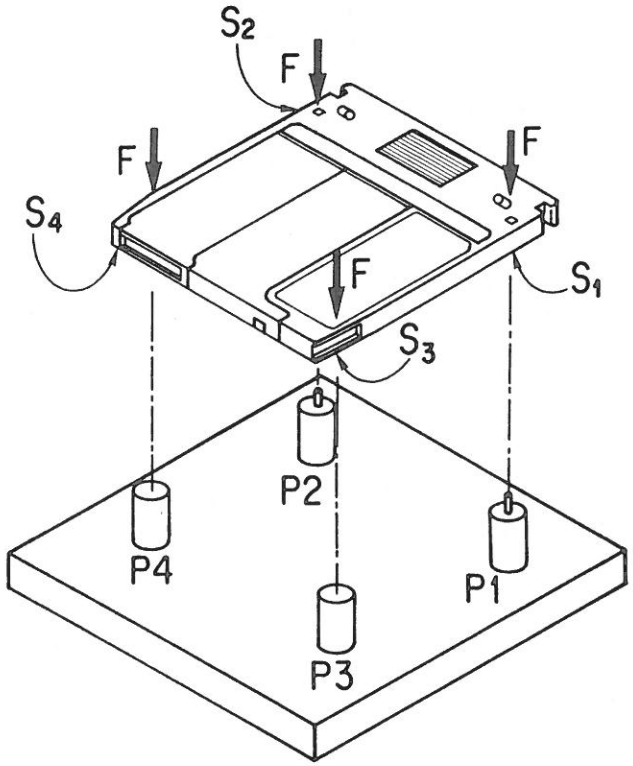

Figure N.1 - Compliance gauge

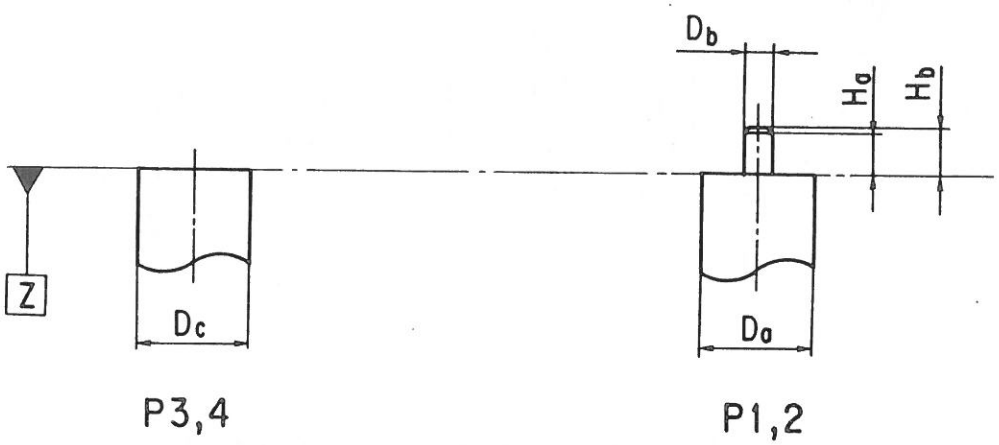

Figure N.2 - Detail of posts

Annex O
(normative)

The methods for measuring the adsorbent force of the hub

O.1 Adsorbent force of the hub is defined as the peak axial force required to remove a clamped disk from the reference spindle head.

O.2 Adsorbent force of the hub is measured by using force gauge and the reference spindle head (see figure O.1).

O.3 The reference spindle head shall be provided by drive makers.

O.4 Requirements
The absorbent force of the hub:

[Type A] from 5 N to 14 N (tentative)
[Type B] from 8 N to 14 N (tentative)

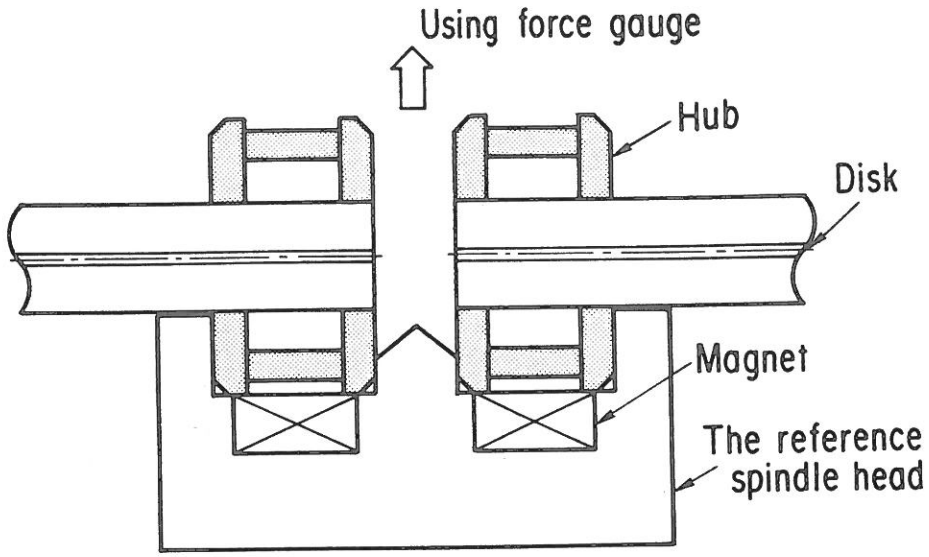

Figure O.1 - Reference spindle head

Annex P
(informative)

Compensation of write power and erase power

The values of write power and erase power contained in the control tracks are described as the values at the temperature of 23 °C only. The write power and erase power should be compensated for the operating temperature of the disk according to the formula:

$$P_t = P_{23} - [\ 0{,}03(\ T_{op} - 23\ )\ ]$$

where P_t is the compensated power, P_{23} is the value described in the control track, and T_{op} is the numeric value of the operating temperature of the disk.

Annex Q
(normative)

Relaxation by zones of the requirements for signals

Table Q.1 shows the zones in which the requirements specified in the body of this Specification shall be satisfied and those in which they can be relaxed.

indicates the zones in which the values of the signals shall be within the ranges specified in this Specification.

indicates the zones in which the ranges is extended from 80% of the lower limit to 120% of the upper limit. The requirement for uniformity is extended from ±12% to 20%.

No marking indicates the zones for which requirements are not applicable.

Table Q.1 - Requirement for signals in each zone

clause	signal	Reflective	PEP	SFP	Manuf.	User	Manuf.	SFP	lead
14.1	Index								
15.1	test cond.								
15.2	Reflectanc								
15.3	MO signal								
17.1	Push-pull								
	Cross trck								
	ID signal								

ANNEX R

Control Track Table (Media Information)

MANDATORY NOT MANDATORY MANDATORY $(00)_H$

	L1 N1	L1 N2	L1 N3	L1 N4	L2 N1	L2 N2	L2 N3	L2 N4	L3 N1	L3 N2	L3 N3	L3 N4
L	18				132				246			
R	19				133				247			
N	20	48	76	104	134	162	190	218	248	276	304	332
PMAX	21	49	77	105	135	163	191	219	249	277	305	333
1T I	22	50	78	106	136	164	192	220	250	278	306	334
1T M	23	51	79	107	137	165	193	221	251	279	307	335
1T O	24	52	80	108	138	166	194	222	252	280	308	336
,5T	25	53	81	109	139	167	195	223	253	281	309	337
,5T	26	54	82	110	140	168	196	224	254	282	310	338
,5T	27	55	83	111	141	169	197	225	255	283	311	339
,25T	28	56	84	112	142	170	198	226	256	284	312	340
,25T	29	57	85	113	143	171	199	227	257	285	313	341
,25T	30	58	86	114	144	172	200	228	258	286	314	342
CPW	31	59	87	115	145	173	201	229	259	287	315	343
TW I	32	60	88	116	146	174	202	230	260	288	316	344
TW M	33	61	89	117	147	175	203	231	261	289	317	345
TW O	34	62	90	118	148	176	204	232	262	290	318	346
1T I	35	63	91	119	149	177	205	233	263	291	319	347
1T M	36	64	92	120	150	178	206	234	264	292	320	348
1T O	37	65	93	121	151	179	207	235	265	293	321	349
,5T	38	66	94	122	152	180	208	236	266	294	322	350
,5T	39	67	95	123	153	181	209	237	267	295	323	351
,5T	40	68	96	124	154	182	210	238	268	296	324	352
,25T	41	69	97	125	155	183	211	239	269	297	325	353
,25T	42	70	98	126	156	184	212	240	270	298	326	354
,25T	43	71	99	127	157	185	213	241	271	299	327	355
00	44	72	100	128	158	186	214	242	272	300	328	356
PE I	45	73	101	129	159	187	215	243	273	301	329	357
PE M	46	74	102	130	160	188	216	244	274	302	330	358
PE O	47	75	103	131	161	189	217	245	275	303	331	359

Annex S
(normative)

Guidelines for sector replacement

Clause 17.4 assumes that a sector is defective and will be replaced by the defect management, for instance when any of the following conditions exist:

S.1 media initialization with certification

Media initialization with certification shall be done using the drives designed for certification.

a) A sector has two or three ID fields each of which has an error detected by the CRC check.

b) A column in the Data field (see figure G.1 in ISO/IEC 10089) contains more than two (tentative) defective bytes.

S.2 write procedure

WRITE command shall be changed with WRITE AND VERIFY command in the IS&C drive.

a) A sector has two or three ID fields each of which has an error detected by the CRC check.

b) A column in the Data field (see figure G.1 in ISO/IEC 10089) contains more than three (tentative) defective bytes.

Annex T
(normative)

Write and erase cycle test

T.1 The test of write and erase durability
The write and erase durability is the cycle which gives no damage to recorded marks under the test conditions.

T.2 Test conditions

Temperature	: 23 °C ± 2 °C
Magnetic field	: 32 000 A/m for erasing and writing
Test area	: Test Zone for drives (track number -154 to -17 or in the vicinity of track number 0)
Write and erase cycle	: 1 000 000 passes on one specified track
Write and erase interval	: less than 6 times/second

Other parameters shall meet either ISO condition, Type A condition or Type B condition.

T.3 Test procedure
1) Erase the specified track using the erase condition in control track.
2) Write a testing signal on the track using the writing conditions in control track.
3) Measure initial NBSNR and error rate.
4) Erase the track using 20% added erase power of erase conditions in control track.
5) Write a testing signal on the track.
6) Do step 4) and step 5) 1 000 000 times continuously. (or after 100 000 times it is possible to extrapolate to 1 000 000 times, see figure T.1)
7) Measure the final NBSNR and error rate.

T.4 Requirements
1) If the final NBSNR is not greater than 45 dB or the difference between initial and final measurements is greater than 2 dB, the disk is not in conformance with the Specification. (see figure T.1)
2) If the error rate ratio between initial and final is greater than 2:1, the disk is not in conformance with the Specification.

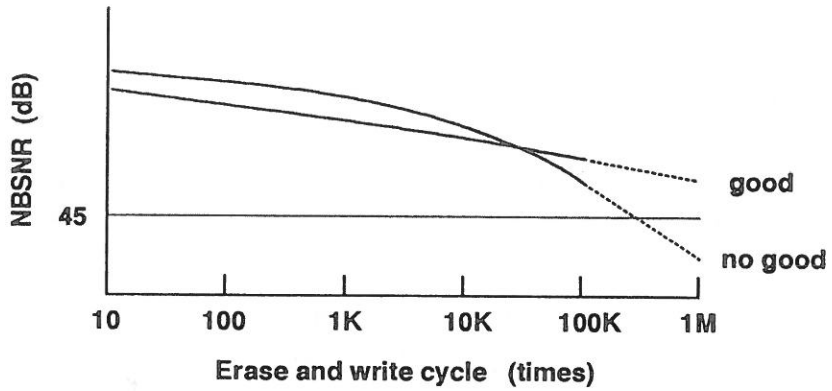

Figure T.1 - Erase and write cycle test

Annex U
(normative)

Measurement of read stability

U.1 The definition of maximum read power
The maximum read power is the highest power which gives no damage to recorded marks under the test conditions.

U.2 Test conditions

Temperature	: 55 °C
Magnetic field	: 32 000 A/m erasing and writing directions
Test area	: Test Zone for drives (track number -154 to -17 or in the vicinity of track number 0)
Read cycle	: 10 million passes continuously on one track

Other parameters shall meet either ISO condition, Type A condition or Type B condition.

U.3 Test procedure
1) Erase three adjacent tracks.
2) Write a testing signal on the centre track using the writing conditions. Step 1) and step 2) may be performed in the test conditions.
3) Set the disk temperature at 55 °C.
4) Set the read power to the maximum power specified in the control tracks.
5) Measure the initial NBSNR.
6) Apply magnetic field as 32 000 A/m (erase direction).
7) Perform 10 million read passes continuously.
(or after 1 million times it is possible to extrapolate to 10 million times, see figure U.1)
8) Measure the final NBSNR.

U.4 Requirements
If the value of NBSNR is not greater than 45 dB or the difference of NBSNR between initial measurement and final measurement is greater than 2 dB, the disk is not in conformance with the Specification. (see figure U.1)

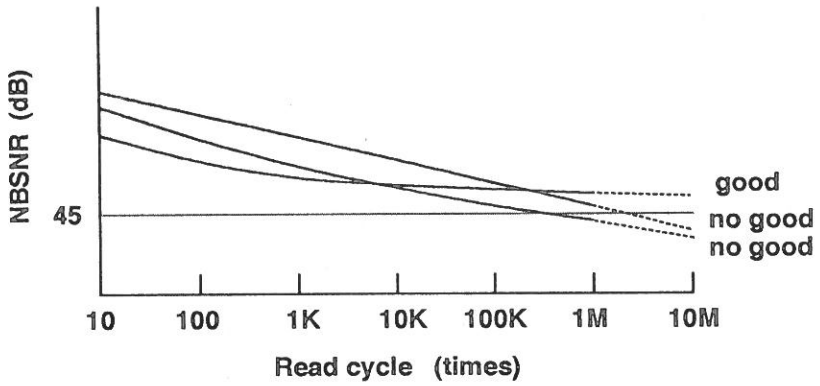

Figure U.1 - Read stability test (normative)

Annex V
(informative)

Test method for measuring the hardness of the disk surface

V.1 The purpose of this test is to determine the hardness of the disk surface.

V.2 Measurement description
The hardness of the disk surface shall be measured by an equipment based on JIS K 5401 (see figure V.1).

V.3 Pencils for the testing
Pencils shall be specified by JIS 6006.

V.4 Testing method

1) Lead shall be sharpened to be roughly 3 mm in length using #400 sandpaper specified by JIS 6252.

2) A testing sample shall be placed with its reference surface toward the disk holder.

3) The pencil shall be held in the pencil holder at an angle of 45° against to the disk surface.

4) A weight of 1,0 ± 0,05 kg shall be exerted on the sample, and the disk surface shall be scratched by the pencil at a length of 3 mm. The scratch test shall be done 5 times.

V.5 Requirements
Under the condition of V.4, the pencil hardness is determined by JIS K5401. The hardness of the disk surface shall be HB minimum of pencil hardness.

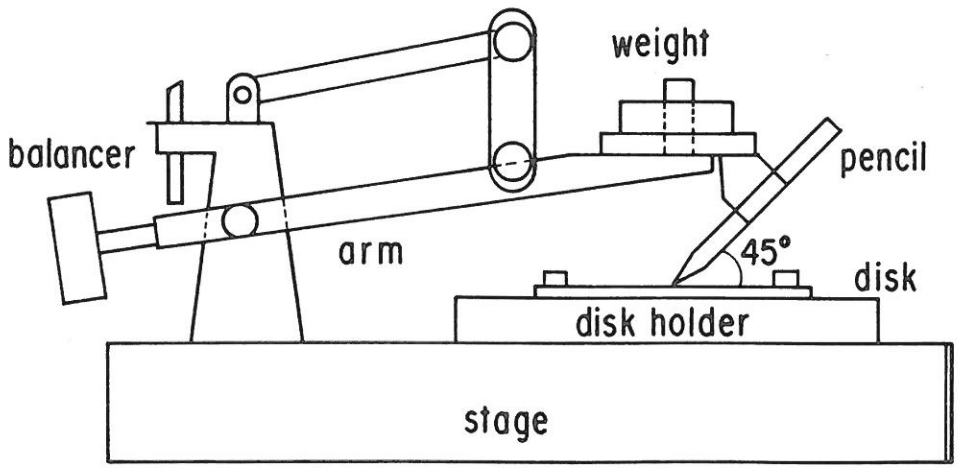

Figure V.1 - Testing equipment

Annex W
(normative)

Write power and pulse width of Type B condition

The SFP figures shall be $(FF)_H$, until the ISO reference disk is available.

The IS&C specification is to be defined as follows;

Write power	:	The value given in byte 87 of the SFP Zone. The value shall not exceed 11,0 mW.
Write pulse width	:	The value given in bytes 88 - 90 of the SFP Zone. The value shall be within the range from 30 nsec to 85 nsec.

In relation to temperature dependency, see Annex P.

Questions about IS&C Specification should be addressed to Headquarters of IS&C committee shown below.

Making copies are prohibited.

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