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**Information technology — Office  
equipment — Information to be  
included in specification sheets for  
data projectors**

*Technologies de l'information — Équipements de bureau —  
Information à inclure dans les feuilles de spécifications pour  
projecteurs de données*

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## Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)) or the IEC list of patent declarations received (see <http://patents.iec.ch>).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 28, *Office equipment*.

This third edition cancels and replaces the second edition (ISO/IEC 21118:2012), which has been technically revised.

The main changes compared to the previous edition are as follows:

- progress of light source technologies (from lamp to laser, LED, etc.);
- diversification of input/output signals (HDMI, display port, HDBase-T, etc.);
- move toward higher resolution (4K, 8K, pixel shift technology, etc.);
- description of colour quality (colour gamut ratio).

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

# Information technology — Office equipment — Information to be included in specification sheets for data projectors

## 1 Scope

This document specifies the information to be included in the specification sheets for front projection type data projectors and the form of specification sheets.

This document is not applicable to units for a rear screen projection.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

ISO 7779:2018, *Acoustics — Measurement of airborne noise emitted by information technology and telecommunications equipment*

ISO 11201, *Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a work station and at other specified positions in an essentially free field over a reflecting plane with negligible environmental corrections*

IEC 60107-2:1997, *Methods of measurement on receivers for television broadcast transmissions — Part 2: Audio channels — General methods and methods for monophonic channels*

IEC 61947-1, *Electronic projection — Measurement and documentation of key performance criteria — Part 1: Fixed resolution projectors*

## 3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

### 3.1 data projector

display equipment that converts electrical signals containing image information from automatic data processing machines into optical signals and projects onto a projection screen

### 3.2 light valve

light-modulation device (such as a transmissive or reflective liquid crystal display, or a micro mirror device) used to create an optical image from an external light source that corresponds to an electrical signal

### 3.3 wide-angle end

minimum focal length position of the zoom lens

### 3.4

#### **lens shift**

projecting function which is vertical or horizontal repositioning of the projection lens relative to the *light valve* (3.2) to compensate for projector to screen alignment differences

### 3.5

#### **image position**

presentation of shifts of projected image on horizontal and vertical directions

Note 1 to entry: It is calculated as per [Formulae \(1\)](#) and [\(2\)](#):

$$X_{\text{shift}} = (X_{\text{cpi}} - X_{\text{axis}}) / W_{\text{pi}} \times 100 \% \quad (1)$$

$$Y_{\text{shift}} = (Y_{\text{cpi}} - Y_{\text{axis}}) / H_{\text{pi}} \times 100 \% \quad (2)$$

where

$X_{\text{shift}}, Y_{\text{shift}}$  are the horizontal and vertical image shift ratios;

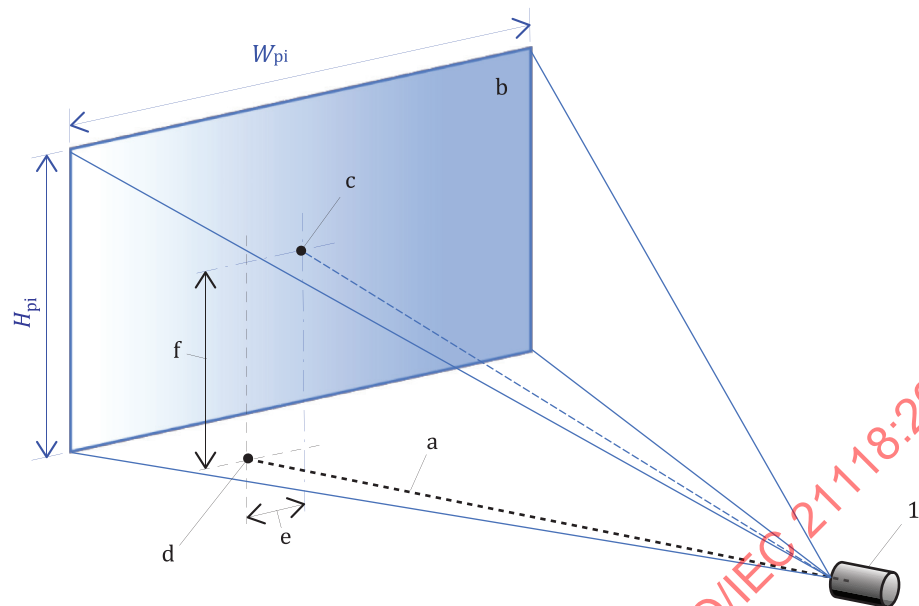
$X_{\text{cpi}}, Y_{\text{cpi}}$  are  $x$  and  $y$  coordinates of  $P_{\text{cpi}}$  ( $X_{\text{cpi}}, Y_{\text{cpi}}$ ) (as shown in [Figure 1](#)), the centre of the projected image;

$X_{\text{axis}}, Y_{\text{axis}}$  are  $x$  and  $y$  coordinates of  $P_{\text{axis}}$  ( $X_{\text{axis}}, Y_{\text{axis}}$ ) (as shown in [Figure 1](#)), the point at which the axis of the projection lens intersects the screen;

$W_{\text{pi}}, H_{\text{pi}}$  are the overall width and height of the projected image.

Note 2 to entry: The horizontal image shift ratio is positive when  $P_{\text{cpi}}$  is at the right of  $P_{\text{axis}}$ , and negative when  $P_{\text{cpi}}$  is at the left of  $P_{\text{axis}}$ .

Note 3 to entry: The vertical image shift ratio is positive when  $P_{\text{cpi}}$  is above  $P_{\text{axis}}$ , and negative when  $P_{\text{cpi}}$  is below  $P_{\text{axis}}$ .

**Key**

- 1 projection lens
- a Axis of projection lens.
- b Projected image.
- c Centre of projected image;  $P_{cpi} (X_{cpi}, Y_{cpi})$ .
- d Intersection of axis of projection lens and surface of projected image;  $P_{axis} (X_{axis}, Y_{axis})$ .
- e Horizontal image shift.
- f Vertical image shift.

**Figure 1— Shifted image position****3.6****projection distance**

distance between the projector and the screen measured in linear units (i.e. metres, feet, or inches)

Note 1 to entry: This distance is considered to be the distance from the image displayed on the screen to the outermost element of the projection lens.

[SOURCE: IEC 61947-1:2002, 3.29]

**3.7****rear screen projection**

projection with image projected through a light-transmitting screen to the audience side of the screen

[SOURCE: IEC 61947-1:2002, 3.30]

**3.8****standard outside dimensions**

maximum dimensions of the product after removing the packaging, including any protrusions

**4 Measuring methods and conditions**

The measuring methods and conditions in terms of the performance specification items in [Table 1](#) shall be in accordance with [Annex B](#).

## 5 Items in specification sheets

[Table 1](#) lists the items that shall appear in the specification sheets. Items whose properties shall be included in the specification sheets are marked as “R” (required), while other items whose properties are given for information are marked as “O” (optional).

Values in the specification of light output, contrast ratio (full white/full black) and centre to corner zone ratio shall be defined as averages of productions. The lower-limit values of the product at the time of shipment shall be at least 80 % of the values in specification sheets for these three items.

The specification sheets shall have a statement indicating accordance with this document. The terminology shown in the “Item” column of [Table 1](#) shall be used in the specification sheets. Items marked as optional may be omitted, along with any items that do not apply to the particular projector model. If an item is omitted; the order of items included in the specification sheets shall maintain the same order as shown in [Table 1](#).

The form of the specification sheets shall be as given in [Annex A](#).

**NOTE** The term “specification sheets” applies to documents which describe the performance characteristics of the data projector which can be included in instruction manuals, product catalogues or on websites.

**Table 1 — Performance specification items**

No.	Item	R/O	Item specification	Description example
1	Product number, type name, or model number	R	The product name, type name, model numbers, or product numbers shall be indicated.	—
2	Display system	R	The light valve type and the display system shall be indicated.	a) LCD, micro mirror, other b) transmitting, reflecting c) single display device, 3 display devices, other
3	Optical system	O	The optics for colour separation and convergence should be indicated.	a) dichroic mirror separation-prism convergence system b) time sharing separation/convergence system c) other
4	Display device			
4.1	Size of effective display area	R	Diagonal size, number of display device and aspect ratio shall be indicated.	33 mm × 3 / 1,3 in × 3, aspect ratio 4 : 3
4.2	Number of pixels	R	Pixel count per display device and pixel dimensions shall be indicated.	786 432 pixels (1 024 × 768) 1 024 000 pixels (1 280 × 800)
		O	Pixel count per projected image inclosing enhanced pixel number and such technology should be indicated.	2 211 840 pixels (2 048 × 1 080) by pixel shift
4.3	Other	O	Additional features of the display device should be indicated.	
5	Projection lens			

"R" in the R/O column means required items and "O" means optional items.



Table 1 (continued)

No.	Item	R/O	Item specification	Description example
5.1	Zoom	R	Zoom magnifications shall be indicated.	Power zoom (1,4 ×)
5.2	Focus	R	Method of focus adjustment shall be indicated.	Manual or powered
5.3	Lens shift	O	Image position, fixed/variable, manual/powered should be indicated. Indicate lens shift range, fixed/variable type and manual/powered. Range of single vertical lens shift may be described as "Lens shift XX % to XX %" Image position for fixed lens shift. Image position for variable shift. In case an optical axis position is unavailable, an illustration may be used.	Fixed lens shift: xx (%) Vertical lens shift range, XX %(up) - XX %(down) XX %(right) - XX %(left) (see 3.5)
5.4	Focal length f/number	O	-	$f = 52 \text{ mm} — 73 \text{ mm}$ $f / 2,5 — 2,9$
5.5	Changeable lens	O	If the projection lens can be changed, it should be indicated.	Yes or no
6	Light source	R	Light source type shall be indicated. If the light source type is a lamp, the lamp type, wattage and quantity shall be indicated.	Lamp, laser diode, LED, other high pressure mercury lamp, 300 W, × 2
7	Life expectancy of light Source	O	The time when light source output halves should be indicated. In the case of lamp, see IEC 61947-1. Other case of light source, driving sequence is continuous lighting. The operating mode shall be indicated.	20 000 h at normal mode
8	Screen size [projection distance]	R	The minimum and maximum diagonal sizes of the projected image shall be indicated.	Minimum: 58,4 cm / 23 in to maximum: 762 cm / 300 in
		O	The associated projection distance should also be indicated. For products with an indefinite measurement, the projection distance should be indicated using illustrations.	Projection distance: 1,2 m to 11,5 m
9	Throw ratio	O	Throw ratio = projection distance / width of the projected image. When projection distance differs from the definition given in 3.6, it shall be explained independently.	Throw ratio: 0,5
10	Number of colours	O	The maximum number of reproducible colours shall be indicated.	16 700 000 colours
11	Light output	R	The light output on a projected screen shall be measured and indicated.	As average value of production units 2 000 lm (see B.2.2)
"R" in the R/O column means required items and "O" means optional items.				

Table 1 (continued)

No.	Item	R/O	Item specification	Description example
12	Contrast ratio (full white/full black)	O	The ratio of screen illuminance between the full white and full black levels of projected images should be indicated. Measurement conditions shall be indicated.	As average value of production units 2 000: 1 in high contrast mode for iris ON, standard lens (see B.2.3)
13	Centre to corner zone ratio	O	The ratio between the centre illuminance and 4-peripheral-point average illuminance of a full-white image should be indicated.	As average value of production units 85 % (see B.2.4)
14	Colour gamut ratio	O	The reference standard colour gamut area-coverage ratios in the CIE 1931 xy chromaticity diagram. The operating mode shall be indicated.	90 % (sRGB) (see B.6)
15	Speaker	R	The output power of the speaker shall be indicated.	10 W × 2 stereo (see B.3)
		O	The number of speakers and whether stereo or monaural should be indicated as well.	2 speakers, stereo
16	Displayable scanning frequency			
16.1	Horizontal	R	The range of displayable horizontal frequencies shall be indicated. Detail of corresponding frequency may be indicated in a separate sheet.	15 kHz to 100 kHz
16.2	Vertical	R	The range of displayable vertical frequencies shall be indicated. Detail of corresponding frequency may be indicated in a separate sheet.	50 Hz to 120 Hz
17	Input compatibility			
17.1	Data input signal	O	The maximum input resolution for a data signal input should be indicated. Notational convention method shall be indicated as well. If there are two or more signal types (systems), all of them should be specified.	Maximum input resolution 1 280 × 800 dots (resizing display)
17.2	Video input signal	O	The displayable video signal type (system) should be indicated.	NTSC, PAL / SECAM
18	Signal input/output terminals			

"R" in the R/O column means required items and "O" means optional items.

Table 1 (continued)

No.	Item	R/O	Item specification	Description example
18.1	Image signal input/output terminals	R	The signal type, connector type, and number of connectors shall be indicated. Any order of entries and contents are acceptable. If the terminal has several functions, these may be entered as remarks.	HDMI: 2 RGB input: 3 RGB output: 1 RGB input terminals (mini-D-sub 15-pin × 2, DVI-I × 1) RGB output terminal (mini-D-sub 15-pin) Video/S-video input: 1 line Video input port (RCA pin) S-video terminal (mini-DIN 4-pin)
18.2	Audio signal input/output terminals	R	The signal type, connector type, and number of connectors shall be indicated. Any order of entries and contents are acceptable. If the terminal has several functions, these may be entered as remarks.	Audio input terminal (stereo mini jack)
18.3	Other signal input/output terminals	O	Control signal input/output terminals and other relevant descriptions should be given. Any order of entries and contents are acceptable.	Mouse input terminal LAN port and USB terminal
19	Control input/output			
19.1	Control input/output terminals	O	Control signal input/output terminals should be indicated.	—
19.2	Network monitoring control communication means	O	Available means in network monitoring control communication should be indicated.	SNMP
19.3	Other input/output information	O	Other related input/output information should be indicated.	—
20	Acoustic noise	O	The noise value should be measured as a sound pressure level (see <a href="#">B.4</a> ). Acoustic power level should also be indicated. The operating mode shall be indicated. Acoustic power level should be measured in accordance with ISO 7779.	Sound pressure level at the bystander positions: 35 dB at normal operation mode. Acoustic power level: 4,5 B at normal operation mode.
21	Operating temperature	R	The temperature range within which the product normally operates shall be indicated.	5 °C to 35 °C
	Operating humidity	O	The humidity range within which the product normally operates should be indicated.	20 % to 70 %
22	Operation position	O	Acceptable position of projection should be indicated.	Desktop, ceiling, portrait
23	Power requirements	R	The rated voltage and frequency shall be indicated.	AC 100 V, 50 / 60 Hz
24	Maximum power consumption	R	The maximum power consumption shall be indicated in watts. Information about other modes should also be indicated.	380 W (see <a href="#">B.5.3.1</a> )
"R" in the R/O column means required items and "O" means optional items.				

Table 1 (continued)

No.	Item	R/O	Item specification	Description example
25	On-mode power consumption	O	The on-mode power consumption shall be indicated in watts. Information about other modes should also be indicated.	300 W (see <a href="#">B.5.3.2</a> )
26	Standby mode power consumption	R	The standby mode power consumption shall be indicated in watts.	2 W (see <a href="#">B.5.3.3</a> )
		O	The standby power consumption at various modes should also be indicated with the mode.	1 W at sleep mode
27	Standard outside dimensions	R	The standard outside dimensions of the product (width, height, and depth, in this order) shall be indicated in millimetres for maximum value.  When dimensions without protrusions are also indicated, they shall be specified within parentheses.	W 270 mm × H 43 mm × D 199 mm  W 270 mm × H 43 mm × D 199 mm (without protrusions)
28	Weight	R	The weight of the main body of the product without accessories shall be indicated in kilograms or grams. Any conditions shall be indicated within parentheses.	15,1 kg (detachable remote controller included)
29	Accessories	R	The names of the accessories supplied together with the product shall be indicated.  Numbers of accessories may also be indicated.	Remote controller, lens cap, RGB cable, mouse cable, power cable, and instruction manual
30	Other functions	O	Features and special functions other than those indicated in items 1 to 25 should be indicated.	—
"R" in the R/O column means required items and "O" means optional items.				

## Annex A (normative)

### Specification sheets

This annex specifies the form for the specification sheets (shown in [Table A.1](#)).

**Table A.1 — Specification sheets form**

Name of product type		
Display system		
Optical system		
Display device	Effective display size	Size: _____ mm/ in Aspect ratio: _____
	Number of pixels	
	Other characteristics	
Projection lens	Zoom	
	Focus	
	Lens shift	
	Focal length $f$	_____ mm
	$f$ /number	$f$ /: _____
	Changeable lens	
Light source		
Life expectancy of light source		_____ h
Screen size and Projection distance		Size: _____ cm / in _____ m
Throw Ratio		
Number of colours		_____ colours
Light output		_____ lm
Contrast ratio (full white/full black)		
Centre to corner zone ratio		_____ %
Colour gamut ratio		_____ %
Speaker		_____ W x _____
Displayable scanning frequency	Horizontal	_____ kHz
	Vertical	_____ Hz
Input compatibility	Data input signal	
	Video input signal	
Signal input/output terminals	Image signal input/output terminals	
	Audio signal input/output terminals	
	Other signal input/output terminals	
	Control input/output terminals	

**Table A.1** (continued)

Control input/output	Network monitoring control communication means	
	Other input/output information	
Acoustic noise (at normal mode)	Noise level: dB Acoustic power level B	
Operating temperature	(_____ to _____) °C	
(Operating humidity)	(_____ to _____) %	
Operation position		
Power requirement	_____ V _____ Hz	
Maximum power consumption	_____ W	
On-mode power consumption	_____ W	
Standby mode power consumption	_____ W	
Standard outside dimensions	_____ mm × _____ mm × _____ mm	
Weight	_____ kg or g	
Accessories		
Other functions		

## Annex B (normative)

### Measuring methods and conditions

This annex shows measuring methods and conditions for the items in the specification sheets. All of experiments and measurements shall be made under the following conditions unless otherwise specified.

#### B.1 Ambient conditions for measurement

- Temperature: from 18 °C to 28 °C.
- Relative humidity: not specified.
- Input voltage: the rated input voltage.
- Frequency of input voltage: the rated frequency.
- Environmental light: It is recommended that the brightness of the measurement room be not higher than 5 lx. The measured value shall be corrected by subtracting the environmental light value.
- Barometric pressure: 86 kPa to 106 kPa.

For equipment whose optical performance (e.g. brightness) varies with ambient temperature, the room temperature during the measurement shall be  $23\text{ °C} \pm 2\text{ °C}$ .

If the rated voltage has some variations, the input voltage at the time of measurement shall be recorded. The voltage variation shall not exceed  $\pm 5\%$  of the input voltage.

#### B.2 Light output, contrast ratio (full white/full black), and centre to corner zone ratio measurement procedures and measuring conditions

##### B.2.1 Projector adjustment and other conditions

###### B.2.1.1 Lens setup

The lens zoom shall be set at the wide-angle end if an optical zoom function exists. Focus adjustments shall be made using appropriate patterns generated from an internal or external pattern generator until the sharpest patterns are produced over the whole projection image area. The image position for this test is not specified but the image position used should be recorded.

If the lens is changeable, lens type shall be indicated.

###### B.2.1.2 Brightness, contrast

Brightness (black level) and contrast (video gain) adjustments shall be made in such a manner that all the eight greyscale steps of the greyscale test pattern specified by IEC 61947-1 are visible as shown in [Figure B.1](#).

###### B.2.1.3 Effective pixels area

Regardless of the projected image area, the measurement shall always be conducted by using full screen (use all of the effective pixels) image.

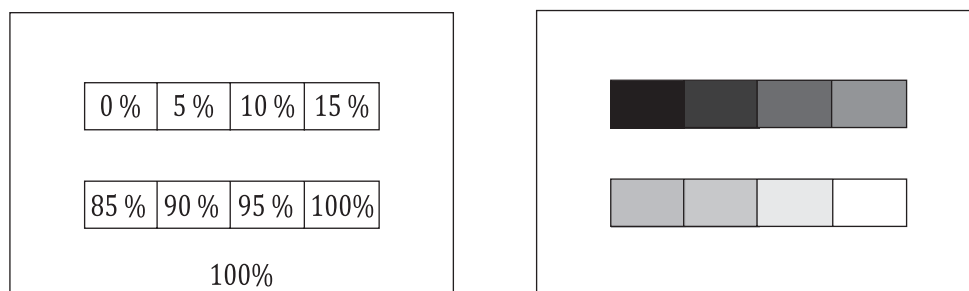


Figure B.1 — Greyscale test pattern

#### B.2.1.4 Measurement signals

The input signal may be an analogue or digital one.

A 100 % full-white pattern and a 0 % full-black pattern shall be used. The analogue signal level of the 100 % full-white pattern shall be  $0,7 \text{ V} \pm 0,007 \text{ V}$  when terminated with a terminating resistance of  $75 \Omega \pm 0,75 \Omega$  at the signal source output.

#### B.2.1.5 Measuring procedure

Measurements shall be made using arbitrary projected size in projector specifications white screen that is free of optical keystone distortion.

#### B.2.1.6 Light meter

A spectral luminous efficiency corrected, cosine-corrected light meter shall be positioned in parallel with the screen and used for making measurements.

#### B.2.1.7 Other

To assure the use of virgin lamps, projectors shall be measured immediately after production. Projectors shall be operated until their brightness stabilizes, and then promptly measured.

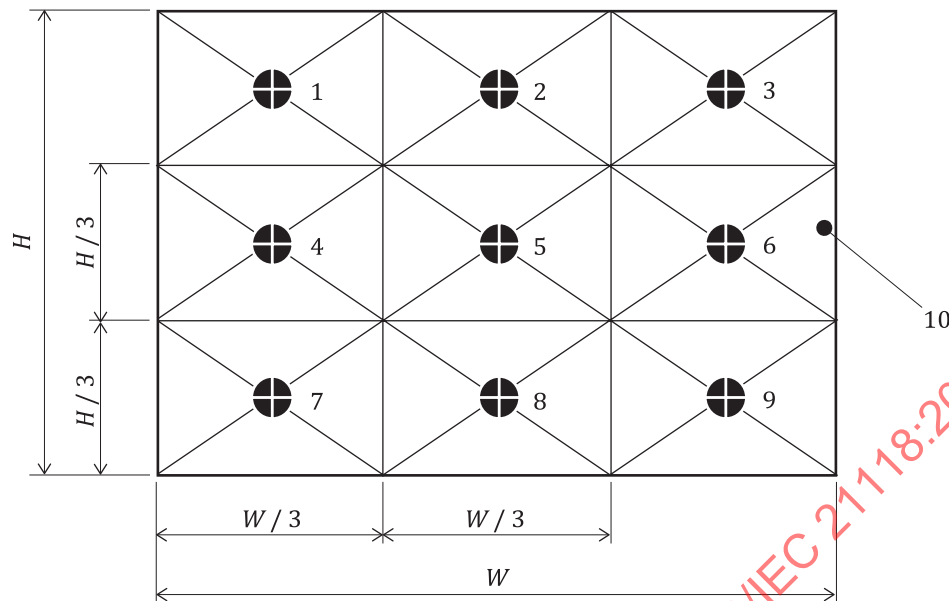
### B.2.2 Light output measuring procedure for data projector

The datum acceptance surface of the detector shall coincide with the focal plane. As shown in [Figure B.2](#), screen illuminance level measurements shall be taken at 9 points (each in the centre of one of the nine zones) in a 100 % full-white pattern image. The measurement field shall be at least 3 pixels by 3 pixels. The average of the nine readings in lux (lumens per square metre) shall be multiplied by the number of square metres covered by the image at the plane of the meter readings.

### B.2.3 Contrast ratio (full white/full black) measuring procedure

The datum acceptance surface of the detector shall coincide with the focal plane. As shown in [Figure B.2](#), screen illuminance level measurements shall be taken at 9 points in a 100 % full-white pattern image. Further, screen illuminance level measurements shall be taken at 9 points in a 0 % full-black pattern image, as indicated in [Figure B.2](#). The measurement field shall be at least 3 pixels by 3 pixels. The contrast ratio shall be expressed as the ratio of the average of 9-point full-white pattern measurements (in lux) to the average of 9-point full-black pattern measurements (in lux).



**Key**

1 to 9	detector
10	screen
$H$	height of screen
$W$	width of screen

**Figure B.2 — 9 points measuring grid****B.2.4 Centre to corner zone ratio measuring procedure**

The datum acceptance surface of the detector shall coincide with the focal plane. As shown in [Figure B.2](#), screen illuminance level measurements shall be taken at the centre of each of the five zones: 1, 3, 5, 7, and 9 within a 100 % full white pattern image. The measurement field shall be at least 3 pixels by 3 pixels. The measurements (in lux) taken at the centre of the four zones: 1, 3, 7, and 9, shall be averaged. The deviation of the resultant average value from the measurement (in lux) made at the centre of zone 5 shall be expressed as a percentage, which indicates the centre to corner zone ratio.

**B.3 Measuring methods and conditions for audio output**

The rated output power specified in IEC 60107-2:1997, 3.1 shall be applied.

**B.4 Measuring methods and conditions for acoustic noise/sound pressure level****B.4.1 Environment condition for acoustic noise measurement****B.4.1.1 Measuring space and measuring condition for acoustic noise/sound pressure level**

The measurement shall be made under the conditions shown in ISO 7779:2018, Clause 7.

**B.4.1.2 Correction for background acoustic noise**

Accuracy of the correction of background acoustic noise shall meet the conditions for grade 2 as stipulated in ISO 11201.

## B.4.2 Measuring methods and conditions for acoustic noise

### B.4.2.1 Data projector adjustment and other conditions for acoustic noise measurements

#### a) Warm-up time

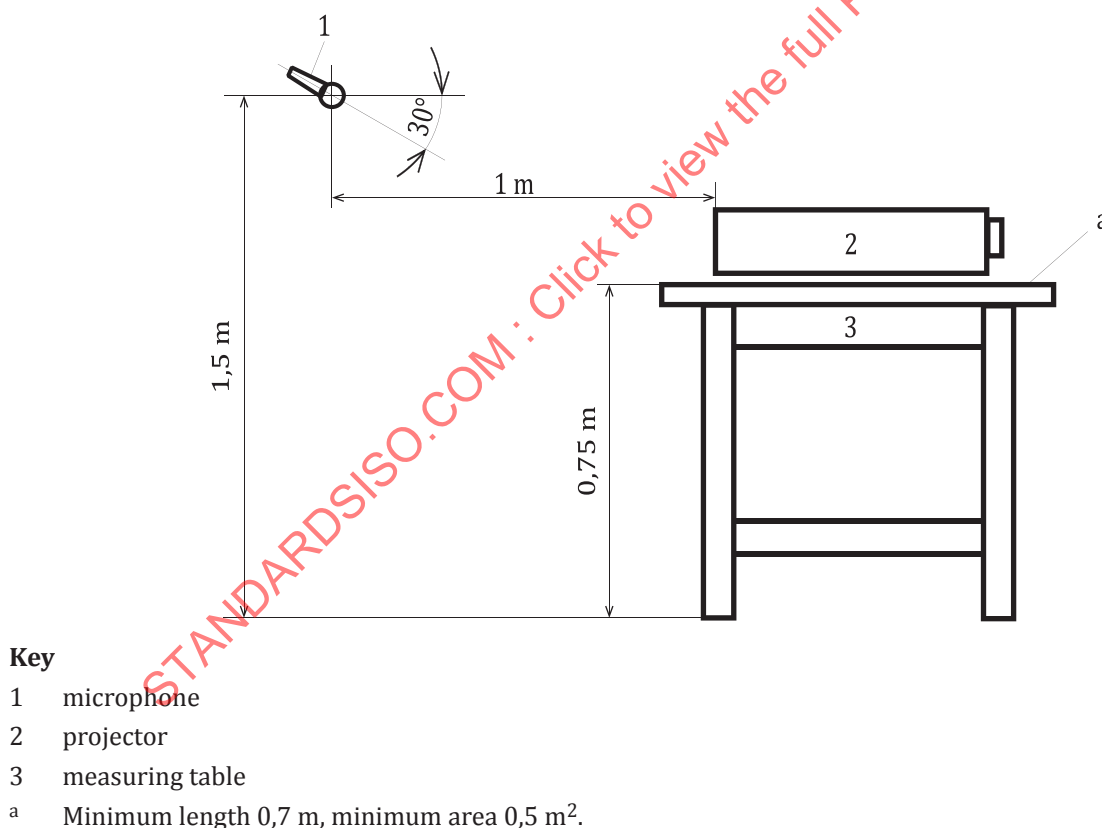
Prior to measurement, the projector shall be operated for a period of time sufficient to allow its temperature to stabilize. If the time required for stabilization is unknown, the projector shall be operated for 30 min or longer.

#### b) Measuring instruments

Measuring instruments specified in ISO 7779:2018, 6.4 shall be employed.

### B.4.2.2 Acoustic noise measuring procedure for data projector

Measurement positions shall be  $1\text{ m} \pm 0,03\text{ m}$  apart horizontally from the centres of the front, rear, left, and right side of the projector and  $1,5\text{ m} \pm 0,03\text{ m}$  above the floor. The microphone shall be positioned  $30^\circ$  below horizontal. The projector shall be placed at the centre of a measuring table that conforms to the requirements stated in ISO 7779:2018, Annex A (see [Figure B.3](#)). Measurements shall be taken at four places (front, rear, left, and right). A-weighted sound pressure level measurements shall be made in both the idling and operating modes. If two or more operating modes exist, the measurements made in all such modes shall be recorded. While measurements are being made, no operation shall be performed on the equipment.



**Figure B.3 — Acoustic noise measuring procedure**

### B.4.2.3 Acoustic noise level (calculation method)

By calculating the average value from the following formula for measurements obtained in the idling mode and all the operating modes, the greatest value shall be used as the acoustic noise level.

$$L_p = 10 \log [1/4 (10^{0,1L_1} + 10^{0,1L_2} + 10^{0,1L_3} + 10^{0,1L_4})]$$

where

$L_p$  is the acoustic noise level;

$L_1$  to  $L_4$  are measurements at the front, rear, left and right sides where corrections for background acoustic noise are made.

## B.5 Power consumption

### B.5.1 Measurement conditions and measurement devices

#### B.5.1.1 Power consumption measurement and power supplies

The average operating power consumption of the data projector is measured as following ways.

- Power consumption is measured at a point between the data projector and the power source/outlet.
- Where the power source of the data projector is via a main line power supply, USB, IEEE 1394, Power over Ethernet, telephone systems or some other method, or some combination of these methods, the net AC electrical power consumed shall be used, as required by the product (considering the conversion loss from AC to DC).
- For data projectors powered by standard low-voltage DC supply (e.g. USB, USB PlusPower, IEEE 1394, Power over Ethernet), a power source shall be used that is appropriate for AC power operation. The power consumed by the power supply conducting AC power operation, shall be measured and recorded as the power consumption of the data projector.
- For data projectors powered by USB, a dedicated hub should be used to power the data projector. For data projectors powered by Power over Ethernet or USB PlusPower, measurements shall be made at the distribution equipment at both the "connected" and "not connected" points, and the difference between the two readings may be recorded as the power consumption of the data projector.

In doing so, the person conducting the measurement shall consider inefficiencies in the power supply or power distribution, to confirm that the DC power consumption is appropriately reflected.

- For data projectors that can get power from both AC power supply and standard low voltage DC power supply, tests operation shall be conducted using AC power.

#### B.5.1.2 Power supply voltage conditions

The power supply voltage conditions and environmental conditions are as described in [Table B.1](#).

**Table B.1 — Power supply voltage conditions and environmental conditions**

Power supply voltage	AC voltage range is $\pm 1$ %, frequency range is $\pm 1$ %. NOTE For products where the maximum power consumption exceeds 1,5 kW, the voltage range is $\pm 4$ %.
Total harmonic distortion (THD) (voltage)	<2 % THD (<5 % THD for products with a maximum power consumption of greater than 1,5 kW)

**Table B.1** (continued)

Ambient temperature	23 °C ± 5 °C
Relative humidity	10 % to 80 %

**B.5.1.3 Measurement devices**

Regarding measurement devices, use an appropriate device that fulfils the following conditions.

- a) Instrument features: Instruments to be used shall have the following characteristics.
  - Rated range of 3 or more for the effective current crest factor;
  - Current range minimum of 10 mA or less.
- b) Instrument resolution: Recognized instruments shall have the following resolutions.
  - 0,01 W or better for measured power consumption values of 10 W or less;
  - 0,1 W or better for measured power consumption values of more than 10 W and less than 100 W;
  - 1 W or better for measured power consumption values of greater than 100 W.
- c) In addition to the above, the following features are also recommended.
  - Minimum frequency response of 3 kHz.

With regard to the measurement instrument, it is preferable to measure the average power consumption over a time interval selected by the operator (the most accurate devices calculate values internally, by dividing the aggregate power consumption by the elapsed time). Alternatively, it is possible to use an instrument which accumulates the power consumption over a time interval selected by the operator, and which can accumulate the displayed time with a resolution of 1 s or less.

**B.5.1.4 Accuracy**

Power consumption is measured with a confidence level of 95 %, with a margin of error of less than 2 %. Measurements shall be recorded in watts.

**B.5.2 Measurement preparation and configuration**

Before the measurement, adjust the settings and configuration of the data projector to be measured appropriately, in accordance with the following instructions.

**B.5.2.1 Maximum power consumption**

Measurement preparation and configuration shall be set as maximum load condition.

**B.5.2.2 On-mode power consumption****B.5.2.2.1 Peripherals**

Connect only the analogue interface, and ensure that peripherals such as other signals, LAN, etc. are not connected.

**B.5.2.2.2 Changing devices**

Confirm that neither changes, such as the removal of circuits, nor other operations, that cannot be used by regular users, are recognized.

**B.5.2.2.3 Analogue and digital interface data projectors**

The analogue interface shall be used to perform the measurement when the data projector is equipped with analogue interface or both of analogue and digital interfaces. For data projectors that are only equipped with a digital interface, the digital signal shall be used for measurement.

**B.5.2.2.4 Models capable of operating at multiple voltage-frequency combinations**

Product models should be tested to determine suitability for each of the power supply conditions for the markets. See [B.5.1.2](#) regarding the power supply voltage conditions of the various markets.

**B.5.2.2.5 External power supply**

For data projectors that are shipped with external power supply, this external power supply shipped with the device shall be used in all tests. Alternative power supplies shall not be used.

**B.5.2.2.6 Colour controls**

All colour controls (hue, saturation, gamma, etc.) shall be set at factory default settings.

**B.5.2.2.7 Display mode**

Regardless of the aspect ratio, input signals and display in full screen mode by utilizing all of the effective pixels (and enhanced pixel function if it has) of the display device.

**B.5.2.2.8 Warm-up**

See [B.4.2.1](#).

**B.5.2.2.9 Stability**

All measurements of power consumption shall be recorded after being stable of reading on the measurement instrument within 1% range for 3 min.

**B.5.2.3 Standby mode power consumption**

Measurement preparation and configuration shall be set under conditions a) and b) below:

- a) External equipment shall not be connected.
- b) If the projector has a power shutoff mechanism, such as a power-on/off switch, keep it at power-on status.

**B.5.3 Measurement method****B.5.3.1 Maximum mode power consumption**

The power consumption at the rated input voltage shall be measured and the highest value shall be recorded.

**B.5.3.2 On-mode power consumption**

- a) Connect the data projector into the outlet or power source and connect the test device.
- b) Turn on the power of all testing devices and adjust the voltage and frequency as appropriate.

- c) Confirm that the data projector is operating normally and ensure that all adjustable settings are set to factory default values.

For devices with adjustable light output power, set to the brightest mode.

For internal speakers, cable/wireless LAN, and TV tuners adjust to settings that consume the least possible power.

- d) Use the remote control or the on/off switch on the body of the data projector to set the data projector to the on mode.
- e) A 100 % full-white pattern and a 0 % full-black pattern shall be used or input 100 % white patterns into the analogue interface. The analogue signal pattern level shall be within  $0,7 \text{ V} \pm 0,007 \text{ V}$  of the  $75 \Omega \pm 0,75 \Omega$  end of the signal output source.
- f) Set to appropriate display mode (see [B.5.2.2.7](#)).
- g) Allow sufficient time for the temperature and operation to stabilize before measuring. (see [B.5.2.2.8](#)).
- h) Set the power meter current range. The power meter maximum value, derived from the crest factor ( $I_{\text{peak}} / I_{\text{rms}}$ ), shall be greater than the peak oscilloscope current reading.
- i) Wait until the reading on the power meter has stabilized, then read the effective power consumption value in watts from the power meter. The reading is considered stable if it remains unchanged by more than 1 % for a period of three minutes (see [B.5.2.2.9](#)).
- j) Record the power consumption.

### B.5.3.3 Standby mode power consumption

Power consumption shall be measured using [B.5.2.3](#).

## B.6 Colour gamut ratio

### B.6.1 Calculating colour gamut area

The colour gamut area is the area surrounded by the coordinates of RGB in the CIE 1931 xy chromaticity diagram as shown in Figure B.4.

The colour gamut area ( $S$ ) should be calculated by the following formula.

$$S = 1/2 |(x_r - x_b)(y_g - y_b) - (x_g - x_b)(y_r - y_b)|$$