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NATIONAL STANDARD
OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 2985-2008

Replacing GB/T 2985-1999

Biological microscope

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Foreword

This Standard replaces GB/T 2985-1999 *Biological Microscope*.

Main differences between this Standard and GB/T 2985-1999 are:

- Add performance requirements of photography and video system. And provide the corresponding test methods.
- Electrical Safety Performance Requirements are developed according to the relevant requirements of GB 4793.1-2007 *Safety Requirements For Electrical Equipment For Measurement, Control, And Laboratory Use - Part 1: General Requirements*. The test methods are also specified correspondingly.
- The requirements to four technical indicators - "objectives aberration correction and clear vision", "requirements for condenser", "revolving nosepiece positioning error" and "fine tuning mechanism backlash" in the previous version are changed from "reference to other relevant standards" to "specific indicator requirements".
- The mechanical tube length of universal microscope was modified to 160 mm or ∞ .
- The fit dimension of eyepieces and objectives tube of the universal microscope is modified to $\phi 23.2 \frac{F8}{h8}$.
- The magnification tolerance of objectives and eyepieces of microscope is modified to $\pm 5\%$.
- There is no specific provisions for models of Test Tool SY-1 type bacterial inspection slide, and SY-2 type blood cell inspection slide. That is, delete SY-1 type and SY-2 type.
- Modify the Test Tool 600 lines/mm grid grating to 600 lines/mm grating.
- Delete the sampling plan of type inspection in inspection rules.

This Standard was proposed by China Machinery Industry Federation.

This Standard shall be under the jurisdiction of National Technical Committee (SAC/TC 103) on Optics and Photonics of Standardization Administration of China.

Drafting organizations of this Standard: University of Shanghai Science and Technology, Ningbo Yongxin Optics Co., Ltd., Ningbo Teaching Instrument Co., Ltd., Ningbo Huaguang Precision Instrument Co., Ltd., Wuzhou Oka Optical Instrument Co., Ltd., Ningbo Sunny Instruments Co., Ltd., Guangzhou Liss Optical Instrument Co., Ltd., Nanjing Jiangnan Novel Optics Co., Ltd., Motic China Group Co., Ltd., and Phenix Optics Co., Ltd.

Participating organization of this Standard: Chongqing Photoelectric Instrument Co., Ltd.

The main drafters of this Standard: Huang Weijia, Hu Yu, Mao Lei, Wang Guorui, Xu Liming, Zhang Jinghua, Shen Xiaojiang, Li Migao, Li Xi, Xiao Qian, and Wu Guotong.

The previous versions replaced by this Standard are as follows:

— GB 2985-1982, GB 2985-1991, GB/T 2985-1999.

Biological microscope

1 Scope

This Standard specifies the classification, basic parameters, requirements, test methods, inspection rules, marks, packaging, storage and transportation of biological microscope products.

This Standard applies to various types of biological microscopes, observed in visible light, with mechanical tube length of 160 mm or infinite.

This Standard applies to various types of biological microscopes (hereinafter referred to as the microscope) that adopt photography and video technology to perform the image viewing and processing.

2 Normative references

The articles contained in the following documents have become part of this Standard when they are quoted herein. For the dated documents so quoted, all the modifications (excluding corrections) or revisions made thereafter shall not be applicable to this Standard. For the undated documents so quoted, the latest editions shall be applicable to this Standard.

GB/T 2609 Microscopes - Objectives

GB/T 2828.1 Sampling procedures for inspection by attributes - Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection (GB/T 2828.1-2003, IDT ISO 2859-1:1999)

GB/T 9246 Microscopes - Oculars (eyepieces)

GB/T 9247 Microscopes - Condensers

GB/T 15464 General-purpose specification for the packaging of instrumentation products

GB/T 22055.1 Microscopes - Screw threads for objectives and related nosepieces - Part 1: Screw thread type RMS (4/5in×1/36in) (GB/T 22055.1-2008, IDT ISO 8038-1:1997)

GB/T 22056 Microscopes - Marking of objectives and eyepieces (GB/T 22056-2008, MOD ISO 8578:1997)

GB/T 22057.1 Microscopes - Imaging distances related to mechanical reference planes

c) Laboratory microscope: Not more than 0.004 mm;

d) Research microscope: Not more than 0.002 mm.

4.11 The allowable difference of magnification of microscope objectives shall not exceed $\pm 5\%$.

4.12 The allowable difference of magnification of microscope eyepieces shall not exceed $\pm 5\%$.

4.13 For the microscope with tilting eyepieces sleeve, when the eyepieces sleeve rotates for 360° , the center displacement of the image on the eyepieces focal plane shall not be more than 0.6mm.

4.14 The optical axis of the lighting system and observation system shall be consistent; the lighting in the field shall be uniform, without the phenomenon of one light side and one dark side or light barring. When the condenser rises to the highest position, the top of the condenser shall be below the surface of the stage from 0.03mm to 0.4mm.

4.15 The dark field condenser shall be evenly illuminated. When there is no specimen placed on the stage, the dry type dark field condenser's field shall be basically dark; background of immersion type dark field condenser's field shall be relatively dark; specimen under observation shall be clear and sufficiently bright.

4.16 There shall be reliable sealing measures for immersion bright field condenser and immersion dark field condenser.

4.17 Microscope binocular system performance

4.17.1 The difference of the magnification of two systems on the left and right sides of the binocular microscope shall comply with the following requirements:

a) When the field angle of the eyepieces does not exceed 50° , it is not more than 2.0%.

b) When the field angle of eyepieces exceed to 50° , it is not more than 1.5%.

4.17.2 The spectrum color of two systems on the left and right sides of the binocular microscope shall be basically same. The difference of the light and dark shall not be more than 18%.

4.17.3 The azimuth difference of the field image plane shall not more than $40'$ of the two systems on the left and right sides of the binocular microscope.

4.17.4 Within the scope of 55mm - 75mm of the binocular pupil distance, the center deviation of the left and right field shall comply with the following requirements:

a) Up and down: 0.2mm;

b) Right and left external sides: 0.2mm;

c) Right and left internal sides: 0.4mm.

4.17.5 Outgoing beam coming from the left and right of the binoculars sleeve shall be in the parallel condition. The measurement shall be conducted at any position within the scope of the pupil distance of 55-75mm. And the permissible deviation of parallel shall comply with the following requirements:

a) Divergence in the horizontal direction shall not be more than 60';

b) Convergence in the horizontal direction shall not be more than 30';

c) Intersection in the vertical direction shall not be more than 30'.

4.17.6 When the two systems on the left and right of the binoculars sleeve is in zero visibility, the high-low difference shall not be more than 1.5mm between end faces of two eyepieces sleeves.

4.18 Microscope photography and video system performance

4.18.1 The image observed by the eyepieces shall be synchronous with that observed on the display screen. And the object space focusing volume shall not exceed $\pm 0.05\text{mm}$.

4.18.2 Cleaning scope of the photography, video field shall comply with the following requirements:

a) Universal microscope: Not less than 45%;

b) Laboratory microscope: Not less than 60%;

c) Research microscope: Not less than 75%.

4.18.3 The image center of the display screen field shall be basically consistent with that in the eyepieces field. And the maximum center offset shall not exceed one fifth of the diagonal of the display screen field.

4.18.4 The image orientation observed on the display screen shall be basically consistent with that observed by the eyepieces.

4.18.5 The field within the display screen shall be clean; with uniform brightness; and without shadows, spots, streak and various reflected light spot affecting the observation or flare phenomenon.

4.19 Electrical safety performance of the microscope

4.19.1 For microscope with electrical equipment, test voltage is maintained for 5s when it rises to the specified values in Table, without breakdown and arcing (AC and DC tests are

5.11.2 Test procedure

Contact the measurement head of the measurement instrument TO the stage (or the microscope limb). Firstly, unidirectionally rotate the fine tuning focal hand wheel to a position; read the indicator value on the measurement instrument. Then rotate the fine tuning focal hand wheel by several scales towards the same direction; and immediately reversely rotate it to the original position. Read the indicator value on the measurement instrument. The difference of both reading values is the backlash value. When inspecting, it shall be detected at a least three positions, within the scope of fine tuning focal. The maximum value shall be the measured value.

5.12 Permissible deviation of the magnification of microscope objectives

5.12.1 Test tools

- a) Micrometer eyepieces;
- b) Same as 5.5.1 b);
- c) Dedicated microscope frame (the focal length of the tube lens shall match with that of the tested objectives).

5.12.2 Test procedure

5.12.2.1 For the objectives with mechanical tube length of 160mm, install the objectives to be inspected on a dedicated microscope frame. The distance between the object place (where the calibrated dial is located) and the place of eyepieces reticle shall be 195 mm. Then focus the reticle, so as the imaging is clear on the calibrated dial. Measure as per the application and reading methods of micrometer eyepieces. The measured relative error of the objectives' nominal magnification shall be the measured value.

5.12.2.2 For the objectives with infinite mechanical tube length, the focal length of tube lens of the dedicated microscope frame shall be the same with that of the measured microscope. The reticle of the micrometer eyepieces shall be located on the second focal plane of the tube lens. Install the objectives to be inspected on the dedicated microscope frame. Measure and calculate as per methods specified in 5.12.2.1. Under special test circumstances – when there is absence of a dedicated microscope frame meeting the specified requirements, it may also be measured and calculated by directly installing a diopter-adjustable eyepieces which is equipped with a calibrated dial on the product to be measured. The latter-method is not suitable to product inspection in factory.

5.13 Permissible tolerance of the magnification of microscope eyepieces

5.13.1 Test tools

Focometer: The uncertainty of measurement is 1%.

- a) If the length of one lens tube of binocular system has been fixed, and the visibility of the other lens tube is adjustable, the measurement shall be conducted according to the requirements after adjusting the visibility index line to zero;
- b) Because the changes of pupil distance will lead to the changes of tube length, binocular system such as both lens tubes will be designed to be able to adjust the tube length. Then both lens tubes shall be adjusted according to the same pupil distance value. Then measure per requirements.

When measuring, select three measuring points, within the pupil distance range of 55 mm-75 mm. The maximum value is the measured value.

5.19 Microscope photography and video system performance

5.19.1 Synchronization of images in eyepieces and display screen

5.19.1 Test tools

- a) Same as 5.3.1 a), 5.4.1 b);
- b) Measurement instrument with the division value of 0.001 mm.

5.19.1.2 Test procedure

Place a blood cell inspection slide on the stage of the microscope to be inspected. Use a 10x objectives and a 10X cross division eyepieces to focus the slide, so as to obtain a clear image. Write down the reading on the measurement instrument. Then switch to photography and video system to observe the specimen image. And focus the specimen to obtain the clearest image on the display screen. Read the readings on the measurement instrument. The difference between both readings is the measured value.

5.19.2 Clear scope of photography and video field

5.19.2.1 Test tools

Same as 5.3.1 b) and 5.3.1 c).

5.19.2.2 Test procedure

Use each objectives and 10x eyepieces to focus the slide of grid grating or bacterial inspection, so as to make a clear image on display screen. When the center image on the display screen is the clearest, measure the clear scope of the image on the display screen. The ratio of the clear scope TO the size of the display screen field (diagonal) shall be the measured value.

5.19.3 Offset of the center of display screen field and eyepieces field

5.19.3.1 Test tools

a) Cross reticle of 0.1mm;

b) Same as 5.3.1 a).

5.19.3.2 Test procedure

Place a cross reticle on the stage of microscope to be inspected. Install a cross division eyepieces in the microscope limb. Firstly, focus the cross reticle with a 10X objectives to coincide its image plane center with the cross center of eyepieces reticle. Then switch to photography and video system. Observe the offset of the cross reticle center, relative to display screen center.

5.19.4 Azimuth difference of images in the display screen and eyepieces field

5.19.4.1 Test tools

a) Grid plate of 0.1mm;

b) Same as 5.3.1 a).

5.19.4.2 Test procedure

Place a grid plate on the stage of microscope to be inspected. Install a cross division eyepieces in the microscope limb. Firstly focus the grid plate with a 10X objectives, to coincide a cross line on its image plane WITH the cross line of eyepieces reticle; and make the horizontal line in a horizontal position. Then switch to photography and video system to observe. The horizontal line of grid plate shall be basically parallel to the horizontal line of display screen frame.

5.19.5 Field quality of display screen

5.19.5.1 Test tools

Same as 5.4.1 b).

5.19.5.2 Test procedure

Place a blood cell inspection slide on the stage of the microscope to be inspected. Focus the slide with a 40X objectives until the imaging is clear. Take the slide down. Use the display screen to observe the filed condition. Then switch to the objectives with other magnifications to observe the filed condition on the display screen.

5.20 Requirements on microscope electrical safety

5.20.1 Withstand voltage test

5.20.1.1 Test tools

7.1 Marks

Each microscope product shall have the following marks at least:

- a) The manufacturer's name or registered trade mark;
- b) Product model or name;
- C) Product serial number (consist of 6-above digits; the first 2 digits represent the product manufacturing year).

7.2 Packaging

The product packaging shall comply with relevant requirements of GB/T 15464.

7.3 Transportation

The microscope shall be transported by any sheltered transportation.

7.4 Storage

The microscope shall be stored in sheltered places. There is no acid gas, alkalis, organic solvents and other hazardous substances in the surrounding.

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