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OLYMPUS®

HIGH QUALITY OPTICS

Microscope Objectives and Eyepieces



Olympus High Quality Optics

OBJECTIVES

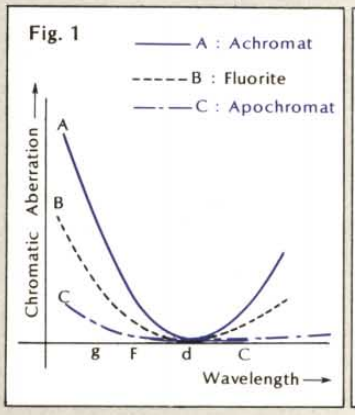
Generally speaking, microscope objectives are divided into various types according to their optical performance and applicative. From the stand point of optical performances, such as numerical aperture (N.A.), and corrections of various aberrations, the Olympus objectives are divided into three types – achromats, fluorites and apochromats. The performance of an objective basically depends upon its resolving power. This resolving power is influenced by the N.A. and several aberrations. An increase in N.A. usually results in an increase of these aberrations. In designing an objective, one of the biggest deterrents to an increase of the resolving power of the objective is chromatic aberration. Depending on the degree of correction of this aberration, three main types of objectives are obtained. They are called achromats, fluorites (semi-apochromats) and apochromats.

■ACHROMATS

Achromats are corrected for chromatic aberration of two colors – red and blue, with secondary spectrum left uncorrected. A doublet composed of a positive and a negative element can be made achromatic for two colors – red (C) and blue (F), in consideration of the luminous efficiency of the eye.

In Fig. 1, curve "A" represents the relationship between the wavelength and the chromatic correction of the achromat. This achromat is sufficient for microscopy that does not require especially high resolution and photomicrography in color. In case of color photography, using a filter that absorbs violet will result in obtaining a sharper image.

Fig. 1



Achromatic objectives are also available as plan achromats, with special additional correction for image field curvature.

■FLUORITES (or SEMI-APOCHROMATS)

The name "fluorite" is derived from the material used in lens manufacture. It has a refractive index of 1.434, is isotropic and belongs to the cubic or isometric crystal system. Fluorites make possible the attainment of a high order of correction for three colors, chromatically, and are preferable to achromats in case more stringent resolution is required in the center of field.

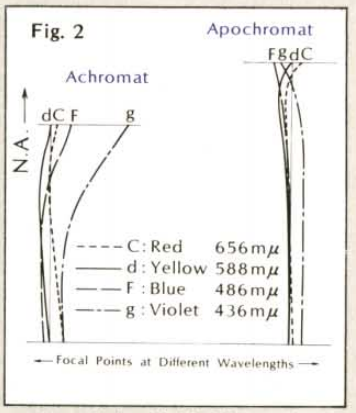
The curve "B" represents the optical characteristics of the fluorite. The chromatic aberration of a fluorite is considerably smaller throughout the entire spectrum compared to the achromat (curve "A").

■APOCHROMATS

Objectives corrected chromatically for three colors and spherically for three colors. These corrections are superior to those of the achromatic series of objectives. Curve "C" in Fig. 1 shows the relationship between wavelength and chromatic aberration of the apochromat, while Fig. 2 represents the differences in focal points of four given wavelengths (Red, Yellow, Blue and Violet) of an achromat (left curves) and an apochromat (right curves). The curves clearly show the superior correction of the apochromat.

If it is possible to eliminate the chromatic aberration, the resolving power of an objective can be increased by increasing its N.A. As shown in Fig. 2, the N.A. of the apochromat is considerably larger than that of the achromat (by 30% to 50%). Therefore the apochromat is capable of forming a very sharp image with increased resolution of details. The same considerations are valid for photomicrography in color.

Fig. 2



It is recommended to use the eyepieces K or WF, or the photo eyepieces FK for photomicrography.

Apochromats are also available as plan apochromats, with special additional correction for image field curvature.

■PLAN

Plan objectives are capable of producing a flat image to the edge of the field. Plan achromats are corrected for two colors, hence the other colors of the secondary spectrum are not brought to the same focus. They are therefore invaluable for the visual observation and photomicrography of flat objects such as stained smears and sections.

Biological Objectives



A wide selection of Olympus biological objectives is available for research and routine use. The Olympus biological objectives are designed to be used with a mechanical tube length of 160mm.

■ACHROMATS

Corrected chromatically for red (C line) and blue (F line), most popular for general use.

Objective	N.A.	W.D.	Remarks
4X	0.10	19.87mm	
4X-3	0.10	18.77	Semi-flat.
10X	0.25	5.40	
F-10X	0.25	6.86	Semi-flat.
20X	0.40	1.58	
40X	0.65	0.39	
S-40X-16	0.65	0.62	Spring-loaded, semi-flat.
S-60X	0.80	0.26	Spring-loaded.
S-100X	1.30	0.14	Spring-loaded,oil,semi-flat.
I-100X	1.30	0.14	Iris diaphragm, oil.



■FLUORITES

Corrected for three colors chromatically; with excellent resolution, but not corrected completely for the secondary spectrum of three colors.

Objective	N.A.	W.D.	Remarks
FL S- 40X	0.75	0.49mm	Spring-loaded.
FL S- 60X	0.95	0.15	Spring-loaded, correcting collar.
FL S-100X	1.30	0.10	Spring-loaded, oil.

Flourites furnish sharper images with better color correction than achromats. Their optical construction is not as complex as the fully corrected apochromats, hence they are intermediate in cost between the achromats and the apochromats, closer to the latter in performance.



■APOCHROMATS

Olympus apochromats permit considerable improvement in chromatic and spherical aberration correction. Corrected chromatically and aplanatically for three colors. These corrections are superior to those of the achromatic series of objectives. The Apo 40X, dry, is provided with a correction collar to spherically correct for a thinner or thicker cover glass, while the oil immersion 40X features an N.A. 1.00 for high resolution.

Objective	N.A.	W.D.	Remarks
Apo 40X	0.85	0.23mm	Spring-loaded, correcting collar.
Apo 40X (oil)	1.00	0.19	Iris diaphragm, spring-loaded, oil.



Biological Objectives

■PLAN ACHROMATS

These objectives are capable of producing a flat image to the edge of the field, completely eliminating field curvature. It is therefore invaluable for visual observation, especially for the examination over a wide field, and photomicrography of flat objects. All Olympus plan achromats except 1.3X and 2X can be used with our super widefield microscopes.

Objective		N.A.	W.D.	Remarks
Plan 1.3X		0.03	19.92 mm	
Plan 2X		0.05	18.29	
Plan 4X	Super Wide-field	0.10	6.48	
Plan 10X		0.25	7.18	
Plan 20X		0.40	0.78	Spring-loaded.
Plan 40X		0.65	0.22	Spring-loaded.
SW Plan 100X		1.25	0.08	Spring-loaded, oil.
Plan 100X		1.25	0.14	Spring-loaded, oil.



■PLAN APOCHROMATS

Olympus plan apochromats incorporate high-power concave lenses among the front and rear lens components of the lens construction, making its design more complex and its chromatic correction more difficult.

To manufacture such a superior objective requires many breakthroughs in production techniques as well as lens design, multi-layer coating, and a high degree of elimination of decentration errors.

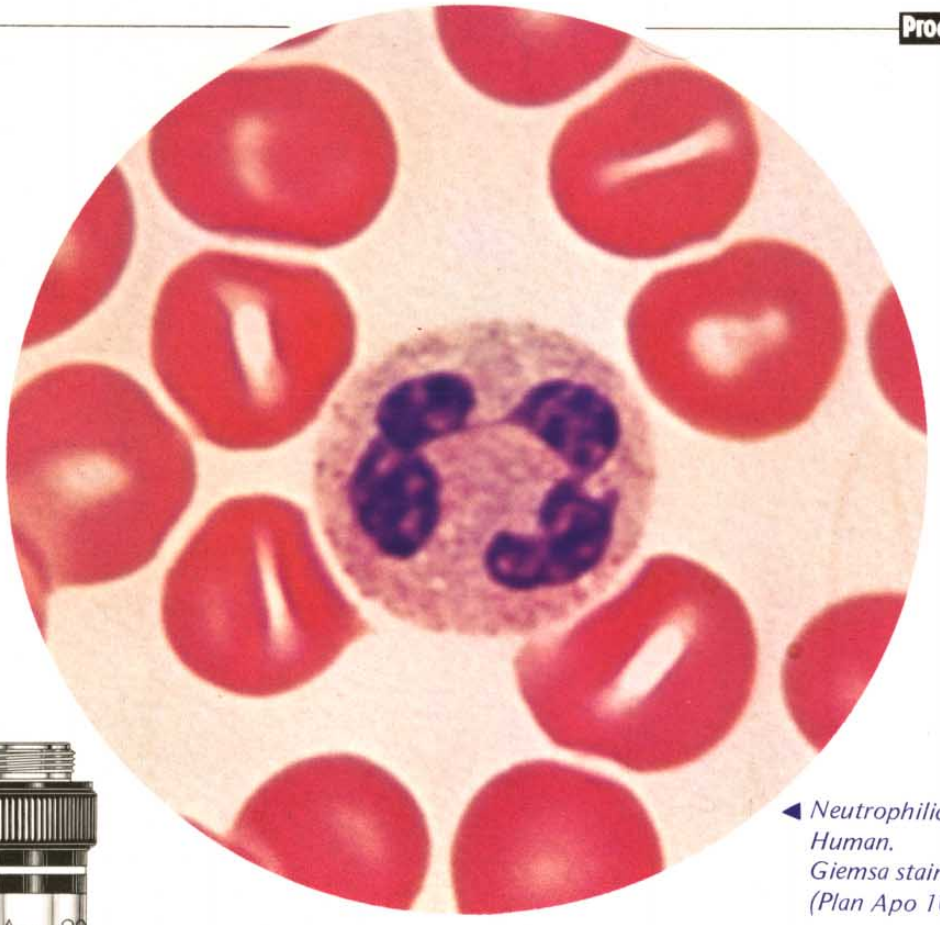
The successful completion of our series of plan apochromats is the result of Olympus' outstanding engineering technology that has overcome the difficulties in both design and production. The complete correction of flatness of field is invaluable for visual observation and photomicrography of flat objects or sections, while a unique multi-layer coating developed by Olympus has been employed in designing this series to reduce detrimental reflection on all the air-glass surfaces.

Even when used for super widefield observation, these plan apochromats provide a flat field of view with excellent contrast and resolution for field numbers up to 29 (compared with the conventional field number of 21).

Every plan apochromat, composed of special optical components, completely eliminates spherical aberration, chromatic difference of spherical aberration, coma, etc. and gives a highest possible resolution for its magnification by high N.A. The resolving power is exceptionally good at the center of field, while field curvature, astigmatism, and higher order coma are sufficiently corrected to ensure the good resolution at the edge of its field.

Objective	N.A.	W.D.	Remarks
Plan Apo 4X	0.16	4.35mm	
Plan Apo 10X	0.32	0.16	Spring-loaded.
Plan Apo 20X	0.65	0.14	Spring-loaded.
Plan Apo 40X	0.95	0.10	Spring-loaded, correcting collar.
Plan Apo 100X	1.30	0.09	Spring-loaded, oil.

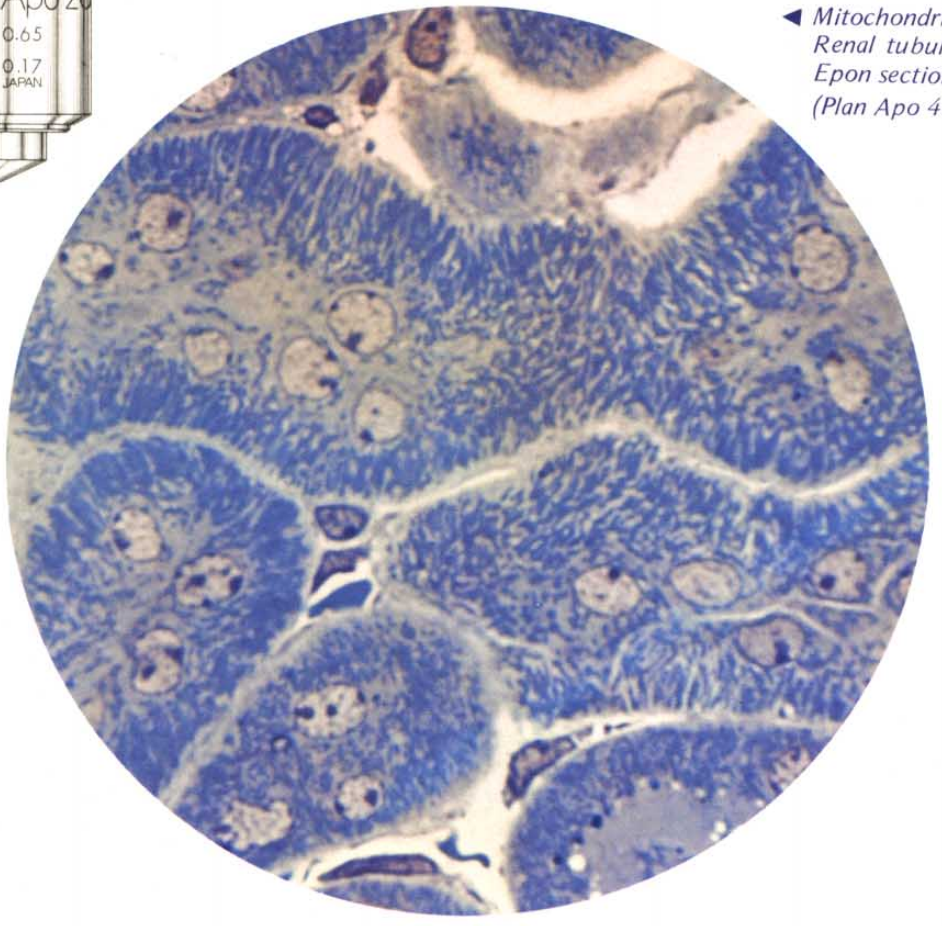




◀ *Neutrophilic leucocyte.*
Human.
Giemsa stain.
(Plan Apo 100X)



Cross section
(Plan Apo 20X)



◀ *Mitochondria.*
Renal tubules of rat.
Epon section, toluidine blue stain.
(Plan Apo 40X)

Special Biological Objectives

■PHASE CONTRAST OBJECTIVES

Olympus phase contrast objectives, in combination with our phase contrast condensers offer a convenient and highly efficient method for the observation and photomicrography of unstained or other low contrast specimens. Each objective power is available in four contrasts . . . PL, PLL, NH and NM. These letters designate the following contrasts:

N = Negative; P = Positive; H = High; M = Medium; LL = Low-Low

This very wide range of phase contrasts offers a practically unlimited range of combinations to suit the most demanding and varied requirements.

Objective	N.A.	W.D.	Remarks
PC 10X	0.25	5.78mm	
PC 20X	0.40	1.60	
PC S-40X	0.65	0.39	Spring-loaded.
PC S-100X	1.30	0.11	Spring-loaded, oil.
PC FL S-40X	0.75	0.49	Spring-loaded.
PC FL S-100X	1.30	0.10	Spring-loaded, oil.

■LONG WORKING DISTANCE OBJECTIVES



The Olympus long working distance objectives specially designed for observation of culture specimens include C20X, LWD C20X and LWD C Plan 40X. The C20X achromatic objective is corrected for use of a cover glass approximately 1.2mm thick, instead of an ordinary cover glass of 0.17mm thickness, while the LWD C20X and LWD C Plan 40X corrected for a cover glass of 1.0mm ±0.3mm. The LWD C20X features an extra-long working distance 5.44mm and the LWD C Plan 40X corrected for field curvature with an extra-long working distance 2.0mm, exceptionally long distance for an objective of this magnification; with a correcting collar.

Objective	N.A.	W.D.	Remarks
C20X	0.4	1.60mm	For cover glass 1.2 mm thickness.
LWD C20X	0.4	5.44	For cover glass 1.0 mm thickness.
LWD C Plan 40X	0.55	2.00	For cover glass 1.0 mm thickness correcting collar.



■POLARIZING OBJECTIVES

Olympus polarizing objectives are used for the observation of birefringent objects in polarized light. They are carefully selected for freedom from strain, and are capable of detecting birefringence. This is useful in the analysis of fine structure in living cells, as well as for observation and measurements of geological, petrological and ore specimens.

Objective	N.A.	W.D.	Remarks
PS 4X	0.10	18.5 mm	Strainfree, for Olympus Polarizing Microscope Model POS.
PS 10X	0.25	5.4	
PS 40X	0.65	0.39	
PO 4X	0.10	19.0	Strainfree, for Olympus Polarizing Microscope Models AHP-1, -2 and BHA-P
PO 10X	0.25	7.0	
PO 20X	0.40	1.6	
PO 40X	0.65	0.6	
PO 100X	1.30	0.14	



■NO COVER OBJECTIVES



Objectives for general use are corrected for a cover glass thickness of 0.17mm. If a specimen, however, requires no cover glass, these objectives cannot give satisfactory results. In such a case, no cover objectives are recommended for best results.

Objective	N.A.	W.D.	Remarks
No Cover Plan 40X	0.65	0.47mm	No cover
No Cover Fluorite FL40X	0.75	0.53	
No Cover Fluorite FL60X	0.95	0.15	

■ REFLECTIVE OBJECTIVES

The reflective objectives developed by Olympus are unique aplanatic objectives, completely free of chromatic, spherical aberrations and coma over the full spectral range. Therefore, image focus remains constant over the entire visible spectrum and including the ultraviolet range. Their long working distance and field flattening abilities find a wide range of applications from microscopy to microspectrophotometry.

Objective	NA.	W.D.	Remarks
MO 30X	0.41 – 0.16	8.00mm	Thickness of quartz cover glass 0.7 mm.
MO 90X	0.65 – 0.16	1.47	
MO 175X	0.95 – 0.30	0.10	Glycerine immersion.



Metallurgical Objectives



In keeping with the varied requirements for metallurgical routine or research applications, Olympus makes available a full choice of reflected light objectives from 1.3X to 120X magnifications. You can choose achromats, plan achromats, darkfield, phase contrast or polarizing and interference contrast objectives. All Olympus metallurgical objectives are parcentric and parfocal. All glass-to-air surfaces are anti-reflection hard-coated for greatest image brightness and contrast (especially important with axial illumination).

■ACHROMATS

Olympus metallurgical achromats are corrected spherically for yellow light (the region of highest visual sensitivity) and chromatically for red and blue, and are well corrected for astigmatism and coma. They offer long working distances and high image contrast.

They are sufficiently free of optical strain to be of use in routine polarizing microscopy (though not in preference to the special Olympus strainfree achromats designed specifically for that purpose).

Objective	N.A.	W.D.	Remarks
M 6X	0.12	14.05mm	Short mount; for upright and metallurgical microscopes.
M 10X	0.25	6.50	
M 40X	0.65	0.58	
M 100X (oil)	1.30	0.34	
M 5X	0.10	27.00	Long mount; for upright and inverted metallurgical microscopes.
M 10X	0.25	7.60	
M 20X	0.40	2.10	
M 40X	0.65	0.50	
M 100X (oil)	1.30	0.35	



■PLAN ACHROMATS

Olympus plan achromats for metallurgical use are corrected for field curvature to give a flat image over the entire field of view, when focused in the center of the field. Specially recommended for photomicrography.

Objective	N.A.	W.D.	Remarks
M Plan 1.3X	0.03	48.99mm	For upright and inverted metallurgical microscopes; long mount; corrected for field curvature.
M Plan 2.5X	0.05	42.00	
M Plan 5X	0.10	3.30	
M Plan 10X	0.25	7.10	
M Plan 20X	0.40	0.72	
M Plan 40X	0.63	0.39	
M Plan 100X (oil)	1.25	0.16	
M Plan 100X (dry)	0.90	0.29	
M Plan 40X	0.63	0.47	For upright metallurgical microscopes; short mount; corrected for field curvature.
M Plan 120X (oil)	1.25	0.31	



■METALLURGICAL PLAN ACHROMAT M PLAN 100X, DRY

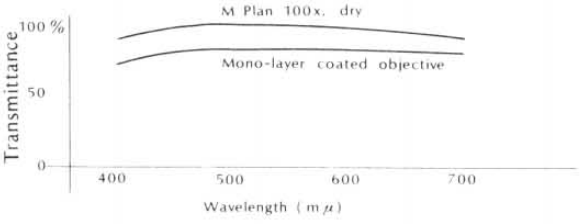


This dry system objective requires no oil immersion to facilitate microscopic work at high power magnifications. This high power objective is a very convenient one for specimens that cannot or should not be immersed. This N.A. 0.9, 100X objective was developed for this purpose. It is corrected completely for field flatness, capable of producing a flat image to the edge of the field with good resolution. It is therefore invaluable for visual observation and photomicrography of flat objects such as polished metal surfaces and other opaque specimens.

A unique multi-layer coating developed by Olympus has been employed in the design of this objective to reduce spurious reflection on all the air-glass surfaces. For metallographic work the results are excellent. Its transmittance is compared with that of a mono-layer coated objective in the graph, below. From this graph, one can see that the multi-layer coating produces a far better gain in image contrast.

The working distance of this objective is considerably longer than that of a conventional objective of equal power. Therefore, the possibility of damage to the front lens of the objective or to valuable specimens is greatly reduced.

Comparison of multi-layer coating and mono-layer coating transmittance



Special Metallurgical Objectives

■METALLURGICAL PHASE CONTRAST OBJECTIVES

The phase contrast objectives MPC are useful for observing and photographing specimen surfaces with very fine structure and the surface of an object which cannot be etched to obtain image contrast.

Each magnification is available in four contrasts – PLL, PL, NM and NH. The MPC objectives are used with matched annular apertures located in the vertical illuminator.

Letter	Contrast	Purpose
P	Positive	Observation of the apparent structure of opaque objects.
N	Negative	Observation of small details.
H	High	For specimens of relatively low contrast.
M	Medium	For specimens of average contrast.
L	Low	For specimens of relatively high contrast.
LL	Low-Low	For specimens of high contrast.

Objective	N.A.	W.D.	Remarks
Achromat MPC 10X	0.25	7.60mm	Contrast types: PLL, PL, NM and NH.
Achromat MPC 20X	0.40	2.10	
Achromat MPC 40X	0.65	0.50	
Achromat MPC 100X	1.30	0.35	



■LONG WORKING DISTANCE OBJECTIVES

LWD M Plan 20X
LWD M Plan 40X

These objectives have been developed by Olympus to facilitate inspection of IC devices and for other industrial applications where an increased working distance is essential. They feature extremely long working distance and good field flatness.

The advantages of these objectives are given below:

1. The free working distance is 4.6mm for the 20X objective and 3.4mm for the 40X objective, both providing excellent flatness of field unmatched by conventional objectives.
2. Anti-reflection multi-layer coating is employed for reduction of flare caused by internal surface reflections.
3. The optimum lens configuration has been computed to eliminate internal reflections, to correct for field curvature and to obtain the desired long working distance without sacrificing resolution and image clarity of these objectives.

Objective	N.A.	W.D.	Remarks
LWD M Plan 20X	0.40	4.60mm	Long mount; flat image, corrected for field curvature.
LWD M Plan 40X	0.55	3.42	



■NEOPAK INCIDENT-LIGHT OBJECTIVES FOR DARKFIELD/BRIGHTFIELD

These objectives are used with the Neopak Metallurgical Microscope Model N and the Brightfield/Darkfield Vertical Illuminator Model A-RLB for the Universal Research Microscope Model VANOX, for investigations in incident-light brightfield and incident-light darkfield.

An annular mirror system has been built in for darkfield illumination. Each Neopak objective contains both a high-quality, fully-coated metallurgical achromatic objective and a matched annular condenser lens. This combination of optics and illuminator puts both types of illumination at the user's fingertips, permitting instant comparison of brightfield and darkfield images of the same specimen detail.

Objective	N.A.	W.D.
Neo 5X	0.10	22.30mm
Neo 10X	0.25	7.50
Neo 20X	0.40	1.70
Neo 40X	0.65	0.62
Neo 50X	0.65	0.60



■STRAINFREE ACHROMATS FOR POLARIZED LIGHT AND DIFFERENTIAL INTERFERENCE CONTRAST MPO AND M PLAN N

The strainfree achromats MPO are used for observation of the surface roughness of finished parts, measurement of birefringence of opaque specimens; as well as measurement of plating thicknesses. The strainfree objectives dry M plan N achromats are used at their full numerical apertures for interference contrast, from 5X to 100X magnification. These give a sharply defined relief-like image with excellent contrast with wide range of zero order to first order interference colors. They work in combination with a modified Wollaston prism.

Both types of objectives are used with analyzer and polarizer.

Objective	N.A.	W.D.	Remarks
MPO 6X	0.12	14.1mm	Short mount; strainfree.
MPO 10X	0.25	6.5	
MPO 40X	0.65	0.58	
MPO 100X (oil)	1.30	0.34	
M Plan 5X-N	0.10	2.65	Long mount; flat image, corrected for field curvature; strainfree.
M Plan 10X-N	0.25	6.93	
M Plan 20X-N	0.40	0.68	
M Plan 40X-N	0.65	0.38	
M Plan 100X-N (dry)	0.90	0.29	



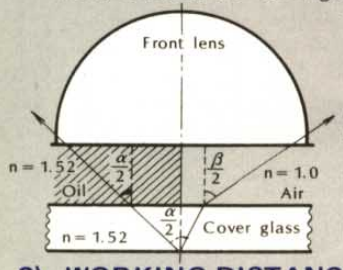
Nomenclature of Objectives and Eyepieces

1) NUMERICAL APERTURE (GENERALLY ABBREVIATED N.A.)

A mathematical relationship that directly connects the resolving power and the light-gathering power of an objective with its aperture. Numerical aperture is the product of the sine of half the angular aperture of a lens, and the refractive index of the medium through which the light passes. It is a very important constant for microscope objectives. The N.A. values can be used for directly comparing the resolving power of all types of objectives, dry, water or oil immersion.
The formula is the well-known:

$$\text{Numerical aperture (N.A.)} = n \cdot \sin\frac{a}{2}$$

"n" is the refractive index of the medium between the front lens and the cover glass. "a" is the angular aperture.

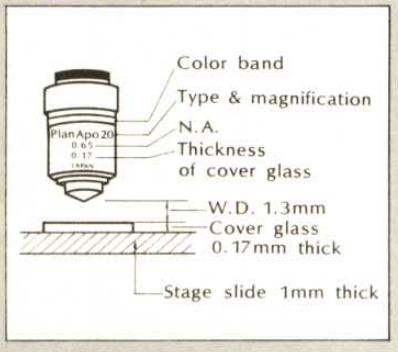


The N.A. of an objective is in direct proportion to its resolving power, and in inverse proportion to the depth of focus. The brightness "I" of an image is formulated below:

$$I = \frac{(N.A.)^2}{M^2} \quad M = \text{magnification}$$

2) WORKING DISTANCE (W.D.)

The distance from the specimen or cover glass to the nearest point of the lens. A longer working distance is convenient to avoid damage to the front lens, specimen or substage condenser or to use with a thicker slide, e.g. a blood counting chamber.



3) COLOR BANDS ENGRAVED ON OBJECTIVES AND MAGNIFICATIONS

Color	Purple	Brown	Red	Orange	Yellow	Yellow green	Cobalt blue	Light blue
Magnifi.	0~	2X~	4X~	7X~	20X~	40X~	60X~	100X~

4) RESOLVING POWER

The ability of a lens to register small detail. Resolving power is of vital importance in critical microscopy. The resolving power of a lens is measured by its ability to separate two points (line structure in the object may be considered as a row of points).
The resolving power of a microscope is now given by the formula

$$R = K\frac{\text{Wavelength } \lambda}{\text{N.A.}} \qquad K = \text{constant}$$

The visible wavelength λ of the light employed is 400 mμ – 700 mμ. A constant K is 0.61 when the N.A. of the condenser is equal to that of the objective. Decreasing the wavelength of the light used increases the resolving power. The higher the resolving power of an objective, the closer the image will be to the true structure of the object.

5) DEPTH OF FOCUS

The distance between the upper and lower limits of sharpness in the image formed by an optical system is termed the depth of focus. Structures outside these limits are more or less blurred. Lack of depth of focus is most apparent in photomicrography, particularly with low power objectives, as the image is projected on the film in one plane.

6) PARFOCALITY

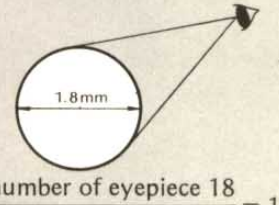
Objectives which can be interchanged and are so mounted that the second conjugate plane will fall at the same position on the microscope axis are parfocal. Each objective, as it is moved into position, does not need to be refocused.

7) ABERRATIONS

As light passes through a lens system, it departs from an ideal focus due to lens aberrations. According to the laws of geometric optics, monochromatic wavelengths are refracted, causing spherical aberration, astigmatism, curvature of field, coma and distortion, while differences between color wavelengths cause chromatic aberration.
These aberrations, unless corrected, tend to produce defective images to greater or less extents. Various lenses for microscopes are corrected to reduce these aberrations as much as possible, depending on the intended uses of these lenses.

8) FIELD NUMBER

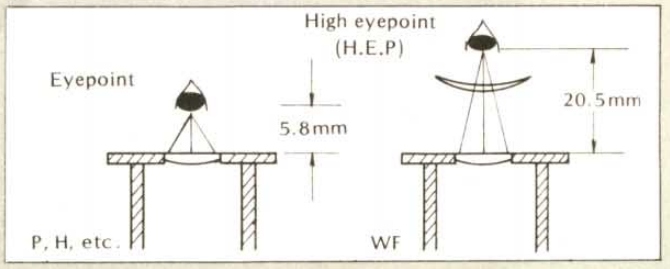
A number which represents in millimeter the size of the image of the field diaphragm that is formed by the lens in front of it.



$$\text{Field of view diameter} = \frac{\text{Field number of eyepiece } 18}{\text{Power of objective } \quad 10} = 1.8 \text{ mm}$$

9) EYEPOINT

The eyepoint of the microscope is situated practically at the second focal point of the eyepiece. It is the point on the axis where all the chief rays cross. In a microscope system, this means that the observer's eye should be positioned at the eyepoint in order to observe the entire microscopic image. Olympus WF eyepieces with a wide field of view are designed for higher eyepoint than in the Huygenian, so that the WF are recommended for observers wearing eyeglasses (the low eyepoint of Huygenian does not permit use of eyeglasses).



Olympus Eyepieces

Progress through Precision

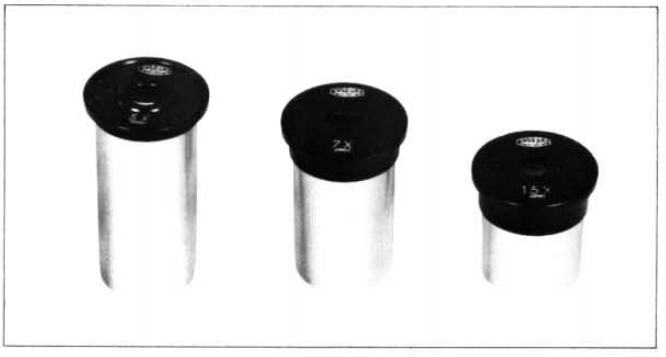


All Olympus eyepieces are hard coated for high transmission and contrast, and are parcentric. They are available both for biological and metallurgical applications, singly and in matched pairs for binocular work. Each eyepiece is designed to give excellent image rendition, when properly used in combination with Olympus objectives. It is, therefore, important to select the correct combination of eyepiece and objective in accordance with your microscopic applications.

■HUYGENIAN (H) AND RAMSDEN (R) EYEPIECES

These eyepieces are recommended for general use, especially for use in combination with objectives 20X or lower.

Eyepiece	Focal Length	Field Number
Huygenian 5X	50mm	19
Huygenian 7X	35.7	18
Ramsden 15X	16.7	8.5



■PHOTO EYEPIECES P

Corrected for color as well as for field flatness. Recommended for flat field observation and photomicrography in combination with all Olympus objectives.

Eyepiece	Focal Length	Field Number
P 7X	35.7mm	18.5
P 10X	25.0	13.4
P 15X	16.7	9.5
BiP 7X	35.7	18.5
BiP 15X	16.7	9.5



■COMPENSATING EYEPIECES K

Corrected for chromatic differences of magnification and curvature of field. Recommended for use with objectives 40X or higher. These eyepieces are recommended for color photomicrography with apochromatic objectives.

Eyepiece	Focal Length	Field Number
BiK 5X	50mm	21
K20X	12.5	7.5
BiK20X	12.5	7.5



Olympus Eyepieces

■WIDEFIELD EYEPIECES WF

•Well corrected for residual aberrations of the objective, these high eyepoint eyepieces feature a wider field of view for easier scanning and comprehensive observation and photomicrography.

Eyepiece	Focal Length	Field Number
WF10X	25mm	18
WF15X	16.7	12
BiWF10X	25	18
BiWF15X	16.7	12



■SUPER WIDEFIELD EYEPIECES SW

The SW eyepieces available include SW7X and SW10X. The SW7X eyepiece scans a flat field of view 260% larger than the standard WF10X eyepiece, while the SW10X scans a 217% larger field than the WF10X. The obvious time-saving benefits in routine and research work increase efficiency and provide a considerable reduction in eyestrain and fatigue. Each eyepiece is provided with diopter adjustment.

Eyepiece	Focal Length	Field Number
BiSW 7X	35.7mm	29
BiSW10X	25	26.5



■MEASURING EYEPIECES WITH MICROMETER DISC

Eyepiece	Micrometer Disc
Micro P7X	10/100mm
Micro WF10X	10/100mm



■EYEPIECE WITH POINTER

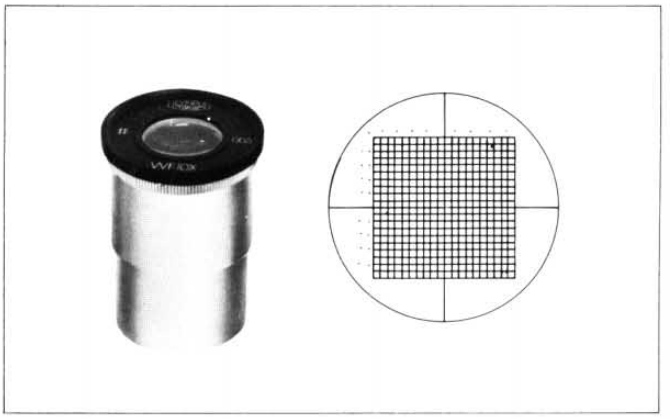
With this eyepiece, the demonstrator can move any particular structure in the field of view to the tip of a pointer attached to the eyepiece diaphragm for the student to observe. The pointer is movable to cover any part of the field. This eyepiece serves as a teaching aid.



■EYEPIECES WITH MICROMETER DISCS FOR MEASURING AND COUNTING

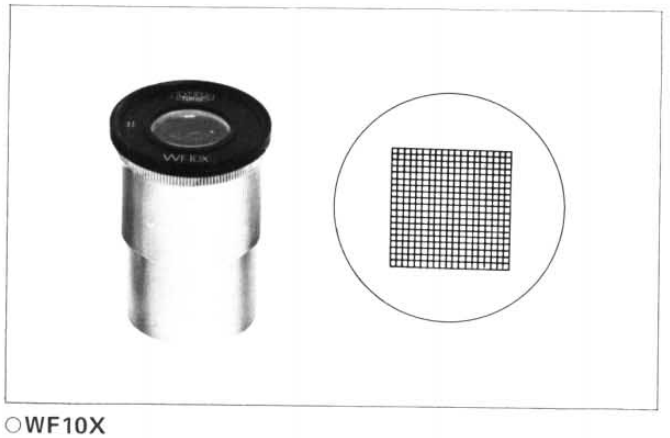
#WF10X

Available with a drop-in micrometer disc with 400 small squares. In conjunction with an objective M40X, total magnification 400X.



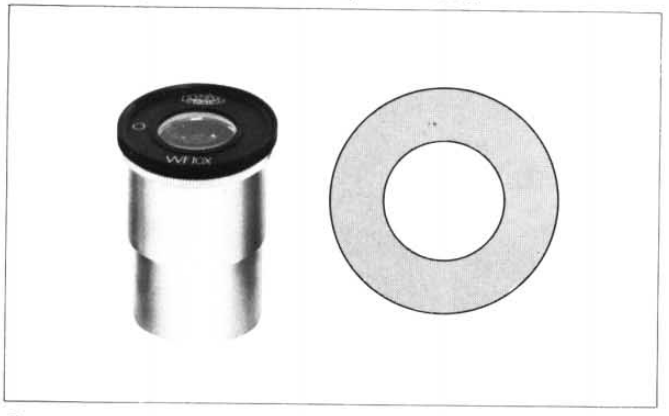
#0.05WF10X

For measurement of particles larger than 0.1mm in diameter. Graduation of the scale is 0.05mm in the actual field of view. Total magnification 100X, in conjunction with an objective 10X.



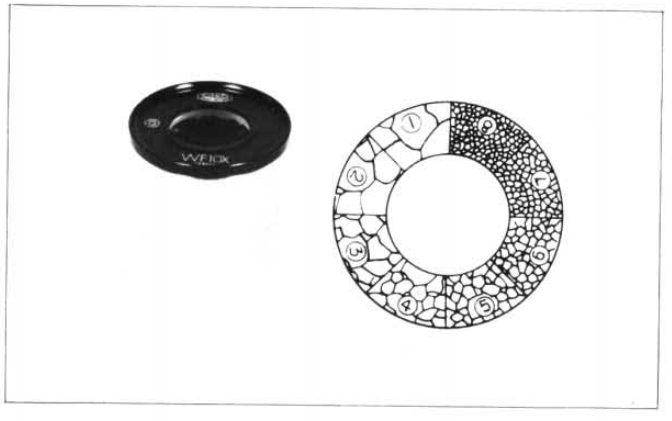
○WF10X

Used with a micrometer disc engraved with a small circle of 0.8mm diameter in the field of view. Total magnification 100X in conjunction with an objective 10X.



◎WF10X

Grain size measuring eyepiece, with 8 grain size reticles grouped around the periphery of the field of view, permitting rapid comparison with the specimen. Total magnification 100X when used with an objective 10X. The inner circle has a diameter of 0.8mm in the actual field of view.



■PHOTO EYEPIECES FK

These eyepieces are recommended for photomicrography and are fully corrected for flatness of field in combination with all Olympus objectives. Magnifications available are 2.5X, 3.3X 5X and 6.7X. Each magnification is computed to focus an image at a projection length of 125mm, which is equal to the film plane distance of the 35mm camera back of the Olympus System Camera Model PM-10. The respective magnifications are engraved on the FK eyepieces. Total magnification of a picture, when the FK eyepiece is used, is computed as:

Total magnification on the 35mm film = objective power x FK eyepiece power.

In case a special camera adapter for large format camera back is used:

Total magnification of large format picture = objective power x FK eyepiece power x 3.

The features of the FK eyepieces are as follows:

1. Excellent resolution not only in the center but also at the periphery.
2. Influence of dust on lens surface is considerably reduced.
3. Parfocality between viewing eyepiece and film plane is greatly improved.
4. Micrometer discs can easily be inserted.

If the magnification indices of the FK eyepieces are doubled, they correspond to the magnifications of regular eyepieces such as 5X, 7X, 10X and 15X.

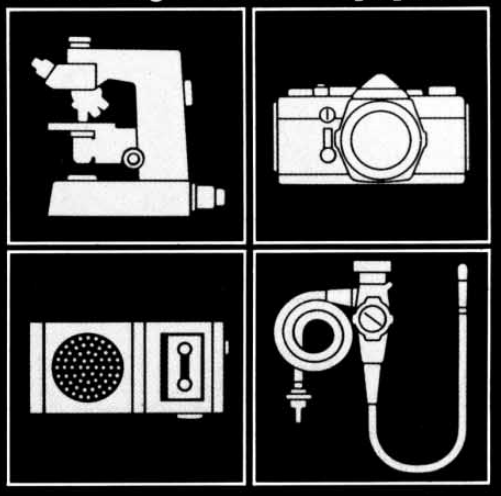
Eyepiece	Remarks
FK2.5X	For photomicrography
FK 3.3X	
FK 5X	
FK 6.7X	



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