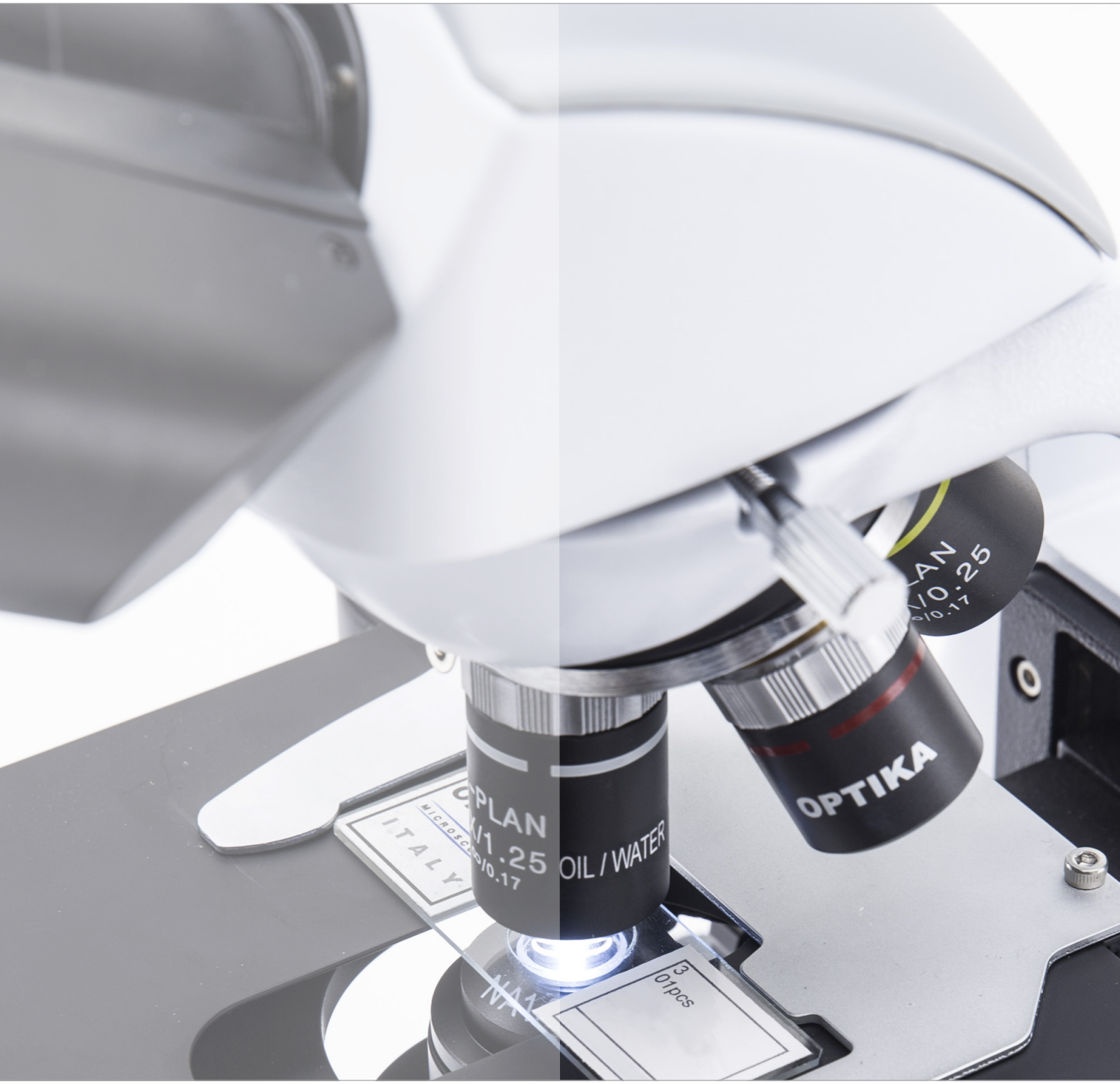
OPTIKA®
MICROSCOPES
ITALY

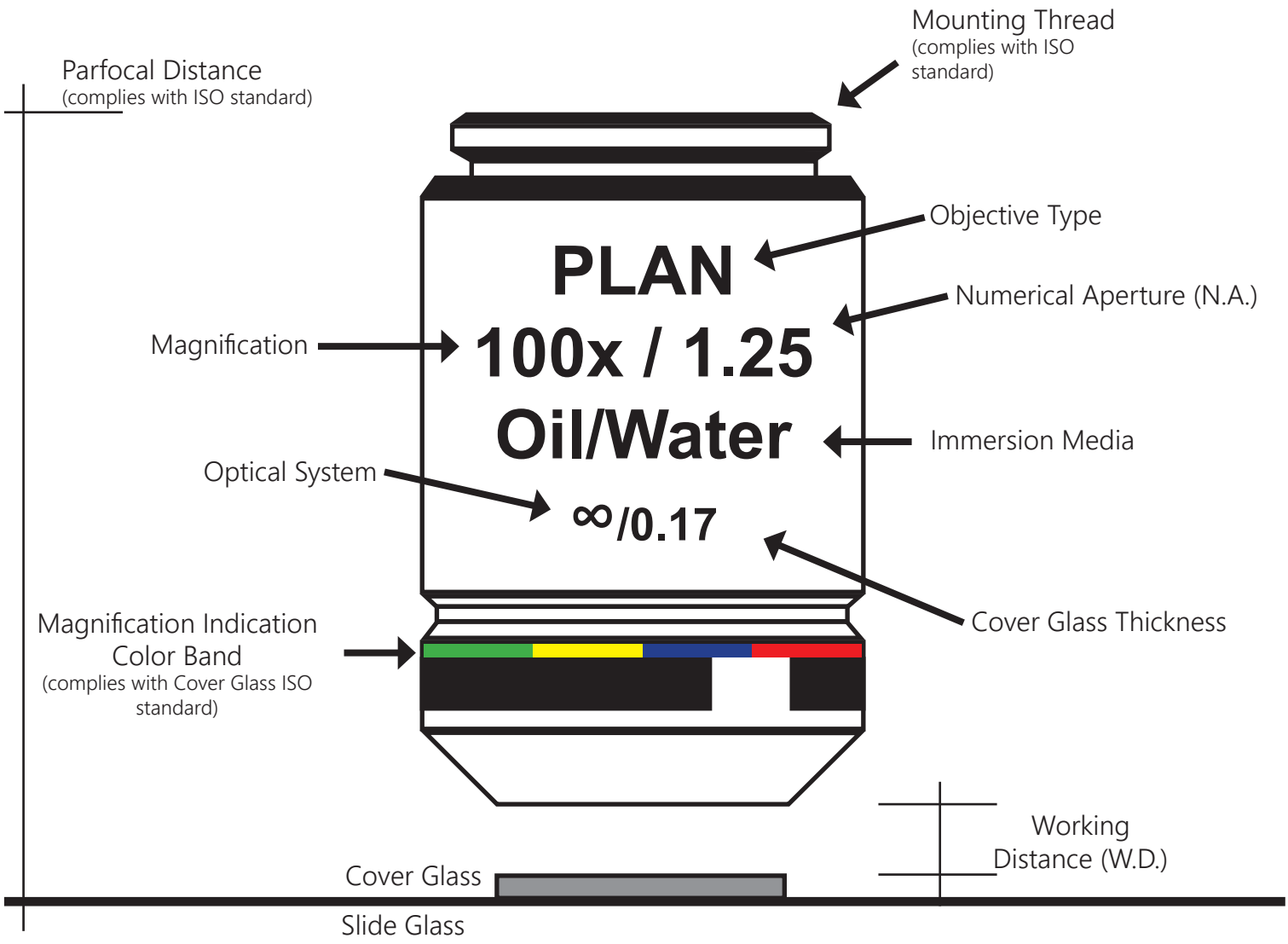
Rev.30.2



OPTIKA OBJECTIVES

Objectives strongly determine the performance of your microscope!
Find the most suitable lenses for your application.

OBJECTIVE FEATURES



Anti-fungus treatment

OBSERVATION METHODS

- BF — Brightfield
- DF — Darkfield
- PH — Phase Contrast
- PO — Polarized Light
- RPC — Relief Phase Contrast
- DIC — Differential Interference Contrast
- FL — Fluorescence
- FL UV — UV Fluorescence

OPTICAL TERMINOLOGY

1. FN and Practical Field of View

The **field number** (FN) is the size (in mm) of the eyepiece diaphragm, which defines the viewable area of a specimen.
The diameter on the sample plane that can actually be viewed through the eyepiece is known as the **practical field of view** (FOV) and is determined by the following formula:

$$FOV = \frac{\text{Eyepiece FN}}{\text{Objective Magnification}} \text{ (mm)}$$

Example:

B-510BF (F.N. 22) with 10x IOS W-PLAN objective

$$FOV = \frac{22}{10} = 2.2 \text{ (mm)}$$

2. Working Distance

The **working distance** (W.D.) is the distance between the objective front lens and the specimen surface (or the surface of the cover glass when using a cover glass objective) when the specimen is in focus.

Objectives can be divided into "normal" WD and "LWD (Long Working Distance)".
LWD objectives are typically used in inverted microscopes. Sometimes LWD are also used in upright metallurgical microscopes.

3. Parfocal Distance

The **parfocal distance** is the distance between the objective mounting plane and the specimen. In OPTIKA objectives, the parfocal distance is typically designed to be 45 mm.

4. Numerical Aperture (NA)

The numerical aperture is the main factor for the performance of an objective (resolving power, focal depth, and brightness).
The NA is determined by the following formula:

$$\mathbf{NA = n \times \sin\theta}$$

n: the **refractive index** of the medium where the lens operates. (Air: n=1, oil: n=1.515)
θ: the **angular aperture** of the lens, that is the half angle of the light cone entering in the objective.

5. Resolving Power

The lateral resolution of a microscope is the minimum distance between two points, which still makes it possible to distinguish them.
The **resolving power** (ε) is the reciprocal of the **lateral resolution**.
The larger the NA, the higher the resolving power.

The following formula is commonly used for the calculation of the resolution.

$$\varepsilon = 0.61 * \frac{\lambda}{N.A.} \quad \text{(Raleigh's formula)}$$

λ: Wavelength of radiation in use (λ=0.55 μm for visible light.)
NA: Objective NA

Example:
IOS W-PLAN 100X (NA=1.25), λ=0.55 μm

$$\varepsilon = 0.61 * \frac{\lambda}{N.A.} = 0.61 * \frac{0.55}{1.25} = \frac{0.3355}{1.25} = 0.2684 \text{ μm}$$

6. Aberrations

The main aberrations (defects of the system in forming a sharp and resolved image), which afflict the microscopes, and their possible corrections can be summarized as follows:

- Geometric
- Chromatic

While we can neglect some aberrations like Astigmatic or Coma, the main Geometric aberrations are:

(1) **Field Curvature**
The image of a plane object, that is the set of radiations coming from the points that form an extended object perpendicular to the optical axis, is formed on a curved surface.
The aberrant arrangement on the image plane is then referred to as **field curvature**.
Therefore, when you focus perfectly on the central part of the image, blurring occurs in the peripheral areas of the image. To have the entire image in focus, including the periphery, you need to correctly compensate for this type of aberration.

(2) **Distortion**
When there is no exact correspondence between the real object and its representation on the image plane, this aberration is called "**distortion**". When distortion is present, a square image appears in the shape of a barrel or pincushion.
This aberration affects only the shape and is due to the features of the optical system in use, which having a certain

physical thickness (even variable) moves away from the theory of the thin lens.
Physically, the effect is due to the different magnification power of the various parts of the optical system, which generally varies radially with respect to the optical axis.

(3) **Chromatic Aberration**
Chromatic aberrations are the types of optical aberration that occur in refractive optical systems with light formed by a set of electromagnetic radiations of different wavelengths.
The phenomenon of refraction deviates the path of the light of an angle that also varies according to the wavelength of the radiation. Just like a prism breaks down the white light into its components, so even a converging lens will have different points of focus depending on the wavelength of the incident light and will create an image with undesirable coloured halos.

7. Objectives denomination

(1) **Achromatic**
The most common objectives used in laboratory microscopes are Achromatic objectives, for which perfect coincidence is obtained for only two colours of the spectrum (red and blue).
Both are brought to a single common focal point.

(2) **PLAN Achromatic**
These objectives have the same corrections of chromatic aberrations as an Achromatic objective.
PLAN Achromatic objectives provide flatness corrections with respect to achromatic objectives.
It is important to specify that an PLAN Achromatic objective must inform (according to ISO standard) on which FOV is planar.

(3) **PLAN Fluorite (SemiAphochromatic)**
Fluorite objectives are derived from advanced glass formulations containing materials such as fluorite or newer synthetic substitutes that significantly improve optical aberration correction. Like Achromatic, Fluorite objectives are chromatically corrected for red and blue light, but are also spherically corrected for two or three colours instead of a single colour, such as Achromatic. Fluorite objectives have a higher numerical aperture, which translates into brighter images and better resolving power.

(4) **PLAN APO (Apochromatic)**
Apochromatic objectives have the highest level of correction.
Apochromatics almost completely eliminate chromatic aberration, are usually chromatically corrected for three colours (red, green and blue) and are spherically corrected for two or three wavelengths.
Due to their high level of correction, apochromatic lenses usually have higher numerical apertures for a given magnification than Achromatic or Fluorite objectives.

8. Observation Modes

(1) **Brightfield**
Brightfield observation does not require any special accessories.
The light generated by the light source is optimized by the condenser, passes through the sample and then collected by the objective that forms an image.

(2) **Darkfield**
Oblique illumination not direct on the sample.
The method uses the phenomenon of diffraction and refraction of the light produced by the contours and the structure of the object. .

(3) **Phase Contrast**
Invented in 1932 by Zernicke, it exploits the differences in refractive index and thickness between the sample and the surrounding area.
It allows the observation of samples not stained (or not stainable) and of extremely small thickness, that in brightfield cannot be observed.

(4) **Relief Phase Contrast**
Modulation phase contrast is a new modification of conventional phase contrast which leads to visible improvements of image quality in light microscopy. In particular: contrast, focal depth, sharpness, three dimensionality, planeness, and halo artifacts can be improved.

(5) **Polarized light**
This technique is based on the properties of some anisotropic or birefringent substances (minerals, vitamins, chlorophyll, collagen, etc.).
It is used in specific areas of microscopic analysis, in particular mineralogy, in which case it is possible to collect unique and subjective data for the recognition of the mineral (thanks to the use of polarized light), but also in some applications in biology or medicine (gout analysis, study of cell membranes).

(6) **DIC - Differential Interference Contrast**
Like phase contrast, this method is used to observe transparent structures not otherwise visible in brightfield.
It combines interference and polarization effects and provides more contrasted images with a three-dimensional effect.

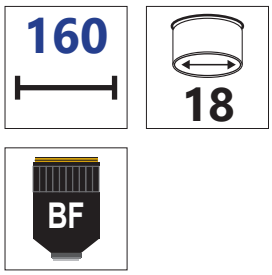
(7) **Fluorescence**
Certain substances, when reached by light with high energy and low wavelength, have the property to emit radiation with a wavelength greater than the exciting radiation. The substances that behave in this way are said to have a primary fluorescence.
In substances that do not have this characteristic it is possible to induce a secondary fluorescence by colouring them with fluorescent substances called fluorochromes, which are organic compounds capable of reacting chemically with the substrate without altering and have an observable fluorescence in the specific localization sites even at a minimum concentration.

Table of contents

Achromatic Objectives - ACH Series

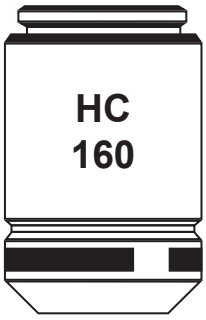
These cost-effective standard **Achromatic** objectives for transmitted light brightfield observation are best-suited to routine work as well as educational and training purposes.

ACH objectives are designed for B-60, M-100FX & M-100FLed.



CODE	MAG.	NUMERICAL APERTURE	W.D. (mm)	F.N.	OPTICAL SYSTEM	COVERGLASS THICKNESS (mm)	IMMERSION	SPRING	REMARKS
M-131	4x	0.10	18	18	160	0.17			
M-132	10x	0.25	7	18	160	0.17			
M-133	20x	0.40	2	18	160	0.17			
M-134	40x	0.65	0.53	18	160	0.17		O	
M-135	60x	0.80	0.13	18	160	0.17		O	
M-136	100x	1.25	0.13	18	160	0.17	OIL	O	

Achromatic Objectives - HC Series

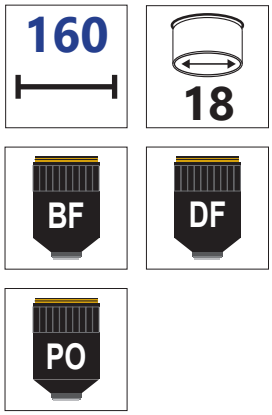


HC **Achromatic** objectives ensure versatile and reasonably priced entry-level lenses for brightfield, darkfield and simple polarization applications.

They are specifically designed to achieve optimal contrast and thus maximize yield on an instrument intended for education on F.N. 18.

100x/1.25 (oil) can operate using water instead of oil for training purposes.

HC objectives are designed for B-150.



CODE	MAG.	NUMERICAL APERTURE	W.D. (mm)	F.N.	OPTICAL SYSTEM	COVERGLASS THICKNESS (mm)	IMMERSION	SPRING	REMARKS
M-137	4x	0.10	18	18	160	0.17			
M-138	10x	0.25	7	18	160	0.17			
M-139	20x	0.40	2	18	160	0.17			
M-141	40x	0.65	0.53	18	160	0.17		O	
M-142	60x	0.80	0.45	18	160	0.17		O	
M-143	100x	1.25	0.13	18	160	0.17	OIL /WATER	O	

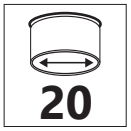
Plan Objectives - N-PLAN Series

N-PLAN (**Plan Achromatic**) objectives stand out for their quality/price ratio, providing a recommendable soultion especially in the educational field and for routine laboratory applications.

Designed to ensure field flatness up to F.N. 20, with 160mm tube length.

100x/1.25 (oil) can operate using water instead of oil for training purposes.

N-PLAN objectives are designed for B-150PL, B-190PL, B-290 & B-380 Series, with finite optical system.



CODE	MAG.	NUMERICAL APERTURE	W.D. (mm)	F.N.	OPTICAL SYSTEM	COVERGLASS THICKNESS (mm)	IMMERSION	SPRING	REMARKS
M-164	4x	0.10	15.2	20	160	0.17			
M-165	10x	0.25	5.5	20	160	0.17			
M-166	20x	0.40	3.5	20	160	0.17			
M-167	40x	0.65	0.45	20	160	0.17		O	
M-168	60x	0.85	0.45	20	160	0.17		O	
M-169	100x	1.25	0.13	20	160	0.17	OIL /WATER	O	
M-059	100x	1.25	0.13	22	160	0.17	OIL	O	IRIS

Plan Objectives - IOS N-PLAN Series

IOS N-PLAN (**Plan Achromatic**) objectives stand out for their quality/price ratio, providing a recommendable soultion especially in the educational field and for routine laboratory applications.

Designed to ensure field flatness up to F.N. 20, based on infinity-corrected optical system.

100x/1.25 (oil) can operate using water instead of oil for training purposes.

IOS N-PLAN objectives are designed for B-290 & B-380 Series, with infinity-corrected optical system.

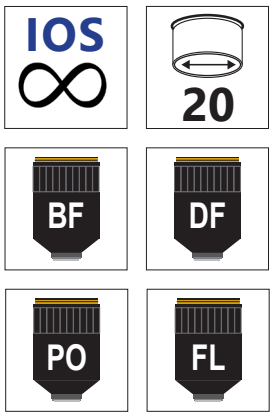
CODE	MAG.	NUMERICAL APERTURE	W.D. (mm)	F.N.	OPTICAL SYSTEM	COVERGLASS THICKNESS (mm)	IMMERSION	SPRING	REMARKS
M-144	4x	0.10	16.8	20	∞	0.17			
M-145	10x	0.25	5.8	20	∞	0.17			
M-146	20x	0.40	5.1	20	∞	0.17			
M-147	40x	0.65	0.43	20	∞	0.17		O	
M-149	60x	0.80	0.14	20	∞	0.17		O	
M-148	100x	1.25	0.13	20	∞	0.17	OIL /WATER	O	

Plan Objectives - IOS N-PLAN POL Series

IOS N-PLAN POL (**Plan Achromatic**) objectives stand out for their flexibility in different techniques and quality/price ratio, providing a recommendable solution with a dedicated design not to affect the polarized light, hence ensuring good contrast and measurement precision. Extensively used in education field and for laboratory routine applications.

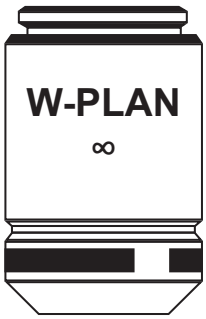
These **strain-free** objectives are designed to ensure field flatness up to F.N. 20, based on infinity-corrected optical system.

IOS N-PLAN POL objectives are designed for B-383POL.



CODE	MAG.	NUMERICAL APERTURE	W.D. (mm)	F.N.	OPTICAL SYSTEM	COVERGLASS THICKNESS (mm)	IMMERSION	SPRING	REMARKS
M-144P	4x	0.10	16.8	20	∞	0.17			
M-145P	10x	0.25	5.8	20	∞	0.17			
M-146P	20x	0.40	5.1	20	∞	0.17			
M-147P	40x	0.65	0.43	20	∞	0.17		O	
M-149P	60x	0.80	0.14	20	∞	0.17		O	
M-148P	100x	1.25	0.13	20	∞	0.17	OIL /WATER	O	

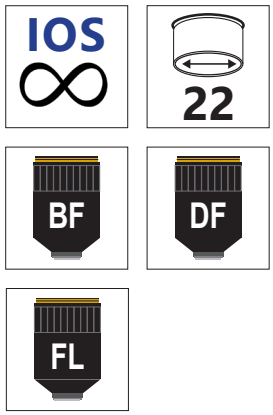
Plan Objectives - IOS W-PLAN Series



IOS W-PLAN (**Plan Achromatic**) objectives represent the best cost-effective choice for high contrast and resolution, matching all the requirements of labs requiring routinary optics.

They are designed to ensure field flatness up to F.N. 22, based on infinity-corrected optical system.

IOS W-PLAN objectives are designed for B-510 Series and upright modular systems.



CODE	MAG.	NUMERICAL APERTURE	W.D. (mm)	F.N.	OPTICAL SYSTEM	COVERGLASS THICKNESS (mm)	IMMERSION	SPRING	REMARKS
M-1049	2x	0.05	19.4	22	∞	0.17			*
M-1125	4x	0.10	17.3	22	∞	0.17			
M-1126	10x	0.25	10	22	∞	0.17			
M-1127	20x	0.40	5.1	22	∞	0.17			
M-1128	40x	0.65	0.54	22	∞	0.17		O	
M-634.1	50x	0.95	0.19	22	∞	0.17	OIL	O	
M-1129	60x	0.80	0.14	22	∞	0.17		O	
M-1130.1	100x	0.36 - 1.25	0.18	22	∞	0.17	OIL	O	IRIS
M-1130	100x	1.25	0.13	22	∞	0.17	OIL	O	

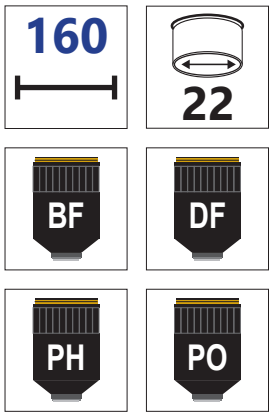
* Additional lens needed when using 2x on B-510 Series

Plan Objectives - W-PLAN PH Series

W-PLAN PH (**Plan Achromatic**) objectives deliver outstanding performance in phase contrast technique, providing a great contrast generally required in high-level education and routine laboratory needs.

These phase contrast objectives are designed to ensure field flatness up to F.N. 22, with 160mm tube length.

W-PLAN PH objectives are designed for B-380, with phase contrast and infinite optical system.



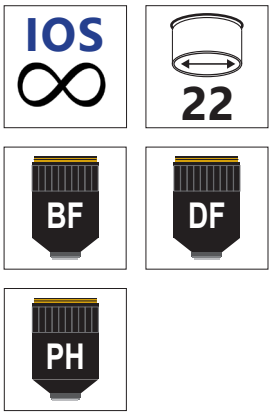
CODE	MAG.	NUMERICAL APERTURE	W.D. (mm)	F.N.	OPTICAL SYSTEM	COVERGLASS THICKNESS (mm)	IMMERSION	SPRING	REMARKS
M-170	10x	0.25	12.2	22	160	0.17			
M-171	20x	0.40	5	22	160	0.17			
M-172	40x	0.65	0.37	22	160	0.17		O	
M-182	100x	1.25	0.13	22	160	0.17	OIL	O	

Plan Objectives - IOS W-PLAN PH Series

IOS W-PLAN (**Plan Achromatic**) PH objectives deliver outstanding performance in phase contrast technique, providing a great contrast generally required in high-level education and routine laboratory needs.

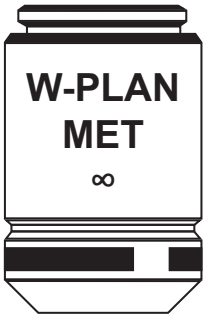
These phase contrast objectives are designed to ensure field flatness up to F.N. 22, based on infinity-corrected optical system.

IOS W-PLAN PH objectives are designed for B-380, B-510 and upright modular systems with phase contrast, and infinity-corrected optical system.



CODE	MAG.	NUMERICAL APERTURE	W.D. (mm)	F.N.	OPTICAL SYSTEM	COVERGLASS THICKNESS (mm)	IMMERSION	SPRING	REMARKS
M-1120.N	10x	0.25	10	22	∞	0.17			
M-1121.N	20x	0.40	5.1	22	∞	0.17			
M-1122.N	40x	0.65	0.54	22	∞	0.17		O	
M-1123.N	100x	1.25	0.13	22	∞	0.17	OIL	O	

Plan Objectives - IOS W-PLAN MET Series



IOS W-PLAN (**Plan Achromatic**) MET objectives deliver precise performance without the need of the cover slide, being NCG (no cover glass). They are intended to be used in metallurgical and epi-illumination applications especially, being addressed for routine laboratory needs.

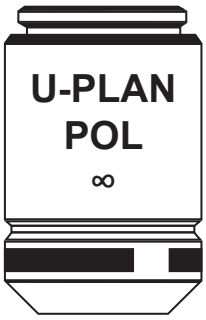
IOS LWD W-PLAN MET 2.5x objective includes a depolarizer plate and delivers precise performance without the need of the cover slide, being NCG (no cover glass). It is the ideal solution to reach optimal contrast for epi-illumination with low-magnification.
Long Working Distance provides a wider working space between the objective front lens and the specimen, a benefit for a variety of samples.

They are designed to ensure field flatness up to F.N. 22, based on infinity-corrected optical system.

IOS W-PLAN MET objectives are designed for B-380 and B-510 used in metallurgical applications.

CODE	MAG.	NUMERICAL APERTURE	W.D. (mm)	F.N.	OPTICAL SYSTEM	COVERGLASS THICKNESS (mm)	IMMERSION	SPRING	REMARKS
M-1099	2.5x	0.08	11.3	22	∞	-			DEPOLA-RIZER
M-336	5x	0.12	15.5	22	∞	-			
M-338	10x	0.25	10	22	∞	-			
M-339	20x	0.40	5.8	22	∞	-			
M-335	50X	0.75	0.32	22	∞	-		O	
M-698.2	100x	0.80	3.2	22	∞	-			

Plan Objectives - IOS U-PLAN POL Series



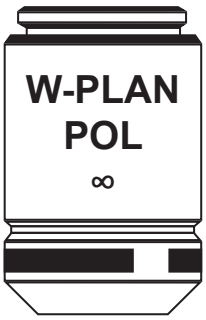
IOS U-PLAN (**Plan Achromatic**) POL objectives stand out for their flexibility in different techniques and deliver top-class performance when used with polarized light. The specific design makes them perfect for polarized light, driving to a formidable contrast and measurement precision, ideal for routine analysis in material science.

These **strain-free** objectives ensure field flatness up to F.N. 22, based on infinity-corrected optical system.

IOS U-PLAN POL objectives are designed for upright modular systems used in polarized light applications.

CODE	MAG.	NUMERICAL APERTURE	W.D. (mm)	F.N.	OPTICAL SYSTEM	COVERGLASS THICKNESS (mm)	IMMERSION	SPRING	REMARKS
M-1080	4x	0.10	20.8	22	∞	0.17			
M-1081	10x	0.25	5.3	22	∞	0.17			
M-1081.5	20x	0.45	1.56	22	∞	0.17			
M-1082	40x	0.65	0.36	22	∞	0.17		O	
M-1083	60x	0.85	0.30	22	∞	0.17		O	

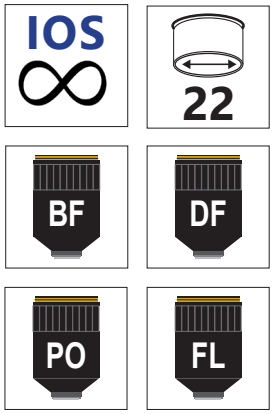
Plan Objectives - IOS W-PLAN POL Series



IOS W-PLAN (**Plan Achromatic**) POL objectives stand out for their flexibility in different techniques and deliver top-class performance when used with polarized light. The specific design makes them perfect for polarized light, driving to a formidable contrast and measurement precision, ideal for routine analysis in material science.

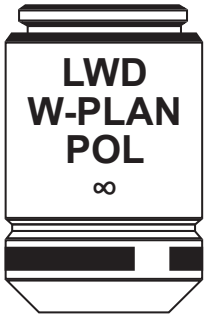
These **strain-free** objectives ensure field flatness up to F.N. 22, based on infinity-corrected optical system.

IOS W-PLAN POL objectives are designed for B-510POL used in polarized light applications.



CODE	MAG.	NUMERICAL APERTURE	W.D. (mm)	F.N.	OPTICAL SYSTEM	COVERGLASS THICKNESS (mm)	IMMERSION	SPRING	REMARKS
M-1131	4x	0.10	17.3	22	∞	0.17			
M-1132	10x	0.25	10.0	22	∞	0.17			
M-1133	20x	0.45	0.40	22	∞	0.17			
M-1134	40x	0.65	0.54	22	∞	0.17		O	
M-1135	60x	0.80	0.14	22	∞	0.17		O	

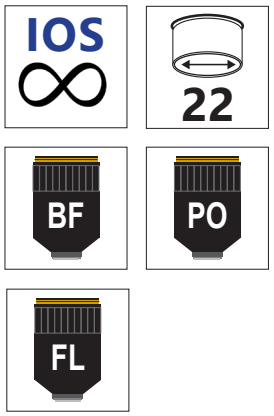
Plan Objectives - IOS LWD W-PLAN POL Series



IOS LWD W-PLAN (**Plan Achromatic**) POL objectives stand out for their flexibility in different techniques and deliver top-class performance when used with polarized light.
The specific design makes them perfect for polarized light, driving to a formidable contrast and measurement precision, ideal for routine analysis in material science/analysis.
Long Working Distance provides a wider working space between the objective front lens and the specimen, a benefit for a variety of samples.
They deliver precise performance without the need of the cover slide, being NCG (no cover glass), specific for epi-illumination.

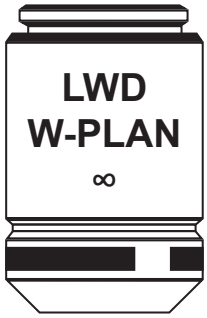
These **strain-free** objectives ensure field flatness up to F.N. 22, based on infinity-corrected optical system.

IOS LWD W-PLAN POL objectives are designed for B-510POL-I used in polarized light applications.



CODE	MAG.	NUMERICAL APERTURE	W.D. (mm)	F.N.	OPTICAL SYSTEM	COVERGLASS THICKNESS (mm)	IMMERSION	SPRING	REMARKS
M-1136	5x	0.12	15.5	22	∞	-			
M-1137	10x	0.25	10.0	22	∞	-			
M-1138	20x	0.40	5.8	22	∞	-			
M-1139	50x	0.75	0.32	22	∞	-			

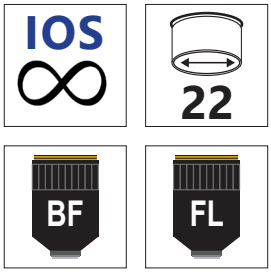
Plan Objectives - IOS LWD W-PLAN Series



iOS LWD W-PLAN (**Plan Achromatic**) objectives are designed for inverted microscopes to ensure high resolution and contrast for various applications, especially clinical examinations and cell testing, and matching all the requirements of labs requiring routinary optics.
Long Working Distance provides a wider working space between the objective front lens and the specimen, a benefit for a variety of samples.

They are designed to ensure field flatness up to F.N. 22, based on infinity-corrected optical system.

IOS LWD W-PLAN objectives are designed for IM-3 and inverted modular systems.



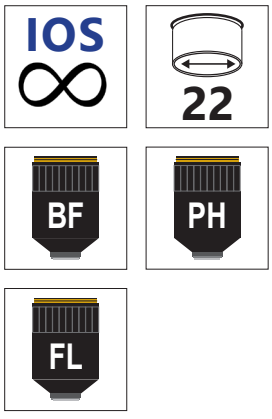
CODE	MAG.	NUMERICAL APERTURE	W.D. (mm)	F.N.	OPTICAL SYSTEM	COVERGLASS THICKNESS (mm)	IMMERSION	SPRING	REMARKS
M-782	10x	0.13	10.4	22	∞	1.2			
M-773	40x	0.60	3.10	22	∞	1.2			
M-786	60x	0.70	1.70	22	∞	1.2			

Plan Objectives - IOS LWD W-PLAN PH Series

IOS LWD W-PLAN (**Plan Achromatic**) PH objectives are designed for inverted microscopes to deliver outstanding performance in (positive) phase contrast technique, providing high resolution and contrast for observation of culture specimens, clinical examinations and cell testing.
Long Working Distance provides a wider working space between the objective front lens and the specimen, a benefit for a variety of samples.

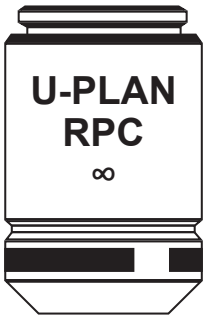
These phase contrast objectives are designed to ensure field flatness up to F.N. 22, based on infinity-corrected optical system.

IOS LWD W-PLAN PH objectives are designed for IM-3 and inverted modular systems.



CODE	MAG.	NUMERICAL APERTURE	W.D. (mm)	F.N.	OPTICAL SYSTEM	COVERGLASS THICKNESS (mm)	IMMERSION	SPRING	REMARKS
M-782.1	4x	0.13	10.4	22	∞	1.2			
M-783N	10x	0.25	7.3	22	∞	1.2			
M-784N	20x	0.40	6.8	22	∞	1.2			
M-785	40x	0.65	3.00	22	∞	1.2			

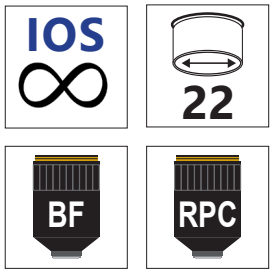
Plan Objectives - IOS LWD U-PLAN RPC Series



IOS LWD U-PLAN RPC (Relief Phase Contrast) objectives are specially designed to provide sharp images in relief phase contrast technique, with a great contrast and a superb three-dimensional effect required in high-level routine laboratory .

They are designed to ensure field flatness up to F.N. 22, based on infinity-corrected optical system.

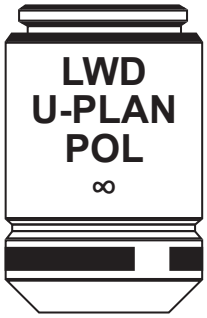
IOS LWD U-PLAN RPC objective is designed for inverted microscopes used in biological applications.



CODE	MAG.	NUMERICAL APERTURE	W.D. (mm)	F.N.	OPTICAL SYSTEM	COVERGLASS THICKNESS (mm)	IMMERSION	SPRING	REMARKS
M-861	4X	0.13	10.75	22	∞	1.2			*
M-862	10x	0.25	7.45	22	∞	1.2			**
M-863	20x	0.40	6.92	22	∞	1.2			**
M-864	40x	0.65	2.74	22	∞	1.2			**

* The use of the slider M-860.1 is required.
** The use of the slider M-860 is required.

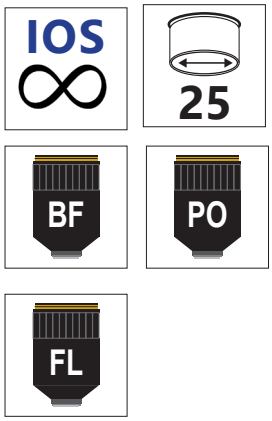
Plan Objectives - IOS LWD U-PLAN POL Series



IOS LWD U-PLAN (**Plan Achromatic**) POL objectives represent the state-of-the-art lenses for upright microscopes, specifically delivering the greatest performance when used with polarized light without the need of the cover slide, being NCG (no cover glass).
The specific design makes them perfect for polarized light, driving to an excellent, ultra-effective contrast and measurement precision.
Long Working Distance provides a wider working space between the objective front lens and the specimen, a benefit for a variety of samples.

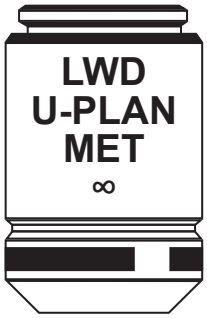
These **strain-free** objectives ensure field flatness up to F.N. 25.

IOS LWD U-PLAN POL objectives are designed for upright modular systems used in polarized light applications.



CODE	MAG.	NUMERICAL APERTURE	W.D. (mm)	F.N.	OPTICAL SYSTEM	COVERGLASS THICKNESS (mm)	IMMERSION	SPRING	REMARKS
M-1090	5x	0.15	10.8	25	∞	-			
M-1091	10x	0.30	10	25	∞	-			
M-1092	20x	0.45	4	25	∞	-			
M-1093	50x	0.55	7.9	25	∞	-			

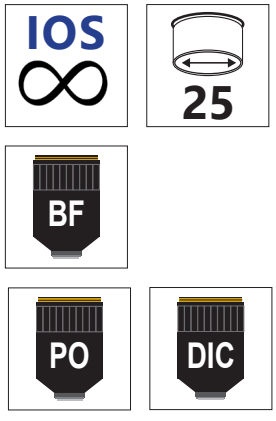
Plan Objectives - IOS LWD U-PLAN MET Series



IOS LWD U-PLAN (**Plan Achromatic**) MET objectives represent the state-of-the-art lenses for both upright and inverted microscopes, specifically delivering excellent performance in the metallurgical field without the need of the cover slide, being NCG (no cover glass).
Long Working Distance provides a wider working space between the objective front lens and the specimen, a benefit for a variety of samples.

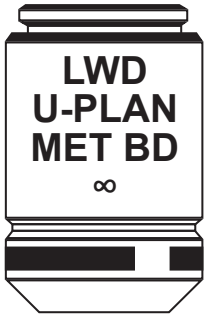
They are designed to ensure field flatness up to F.N. 25.

IOS LWD U-PLAN MET objectives are designed for IM-3, inverted and upright modular systems used in metallurgical applications.



CODE	MAG.	NUMERICAL APERTURE	W.D. (mm)	F.N.	OPTICAL SYSTEM	COVERGLASS THICKNESS (mm)	IMMERSION	SPRING	REMARKS
M-1100	5x	0.15	10.8	25	∞	-			
M-1101	10x	0.30	10	25	∞	-			
M-1102	20x	0.45	4	25	∞	-			
M-1103	50x	0.55	7.9	25	∞	-			
M-1104	100x	0.80	2.1	25	∞	-			

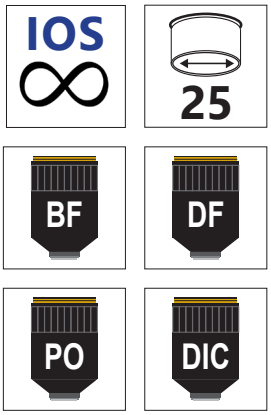
Plan Objectives - IOS LWD U-PLAN MET BD Series



IOS LWD U-PLAN (**Plan Achromatic**) MET BD objectives represent the state-of-the-art lenses for inverted and upright microscopes, specifically delivering excellent performance in the material science field both for brightfield and darkfield techniques, without the need of cover glass, being NCG (no cover glass).
Long Working Distance provides a wider working space between the objective front lens and the specimen, a benefit for a variety of samples. .

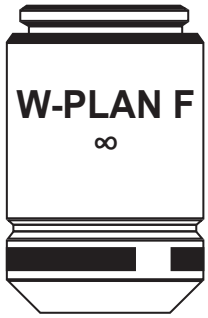
They are designed to ensure field flatness up to F.N. 25, based on infinity-corrected optical system.

IOS LWD U-PLAN MET BD objectives are designed for inverted and upright modular systems used in metallurgical applications with darkfield.



CODE	MAG.	NUMERICAL APERTURE	W.D. (mm)	F.N.	OPTICAL SYSTEM	COVERGLASS THICKNESS (mm)	IMMERSION	SPRING	REMARKS
M-1094	5x	0.15	9	25	∞	-			M26
M-1095	10x	0.30	9	25	∞	-			M26
M-1096	20x	0.45	3.4	25	∞	-			M26
M-1097	50x	0.55	7.5	25	∞	-			M26
M-1098	100x	0.80	2	25	∞	-			M26

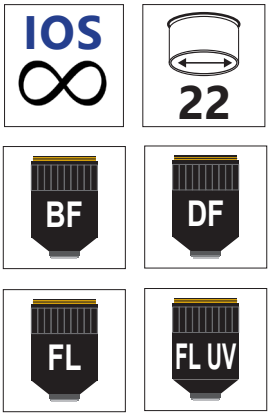
Plan Semi-APO Objectives - IOS W-PLAN F Series



IOS W-PLAN (**Plan Semi-Apochromatic**) F objectives are great to detect fluorescence, even in case of weak signals which will result very clear and visible. They combine superior performance especially in fluorescence with enhanced contrast, matching all the requirements of labs requiring specific lenses for B, G and UV fluorescence.
PLAN-Fluorite (or Semi-Apochromatic) design ensures additional spherical aberration correction for superior resolution and greater numerical apertures.

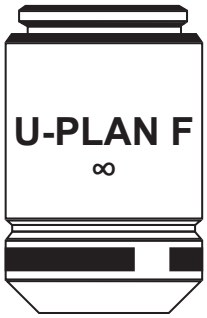
They are designed to ensure field flatness up to F.N. 22, based on infinity-corrected optical system.

IOS W-PLAN F objectives are designed for B-510 and upright modular systems.



CODE	MAG.	NUMERICAL APERTURE	W.D. (mm)	F.N.	OPTICAL SYSTEM	COVERGLASS THICKNESS (mm)	IMMERSION	SPRING	REMARKS
M-1060	4x	0.13	4.7	22	∞	0.17			
M-1061	10x	0.30	4.1	22	∞	0.17			
M-1062	20x	0.50	1.45	22	∞	0.17			
M-1063	40x	0.75	0.5	22	∞	0.17		O	
M-1064	100x	1.30	0.08	22	∞	0.17	OIL	O	

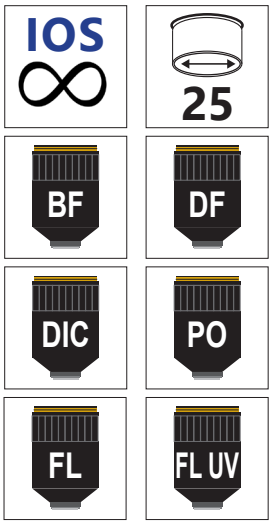
Plan Semi-APO Objectives - IOS U-PLAN F Series



IOS U-PLAN (**Plan Semi-Apochromatic**) F objectives represent the state-of-the-art lenses for upright microscopes, specifically developed for top-class performance and contrast required by the most demanding users.
The PLAN-Fluorite (or Semi-Apochromatic) design ensures additional spherical aberration correction for superior resolution and greater numerical apertures.
A superb resolution and contrast is granted especially for fluorescence applications, being very effective with UV fluorescence, but their extended versatility makes them an excellent product for other microscopic techniques.

They are designed to ensure field flatness up to F.N. 25.

IOS U-PLAN F objectives are designed for upright modular systems.

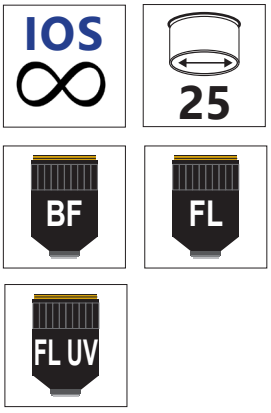


CODE	MAG.	NUMERICAL APERTURE	W.D. (mm)	F.N.	OPTICAL SYSTEM	COVERGLASS THICKNESS (mm)	IMMERSION	SPRING	REMARKS
M-1075	4x	0.13	16.5	25	∞	0.17			
M-1076	10x	0.30	8.1	25	∞	0.17			
M-1077	20x	0.50	2.1	25	∞	0.17			
M-1078	40x	0.75	0.7	25	∞	0.17		O	
M-1079	100x	1.30	0.15	25	∞	0.17	OIL	O	

Plan Semi-APO Objectives - IOS LWD U-PLAN F Series

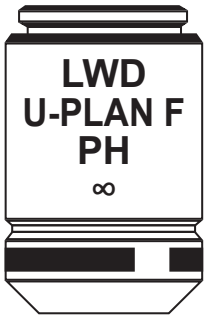
IOS LWD U-PLAN (**Plan Semi-Apochromatic**) F objectives represent the state-of-the-art lenses for inverted microscopes, specifically developed for top-class performance and contrast required by the most demanding users.
Long Working Distance provides a wider working space between the objective front lens and the specimen, a benefit for a variety of samples , whilst the PLAN-Fluorite (or Semi-Apochromatic) design ensures additional spherical aberration correction for superior resolution and greater numerical apertures.
A superb resolution and contrast is granted especially for fluorescence applications, being very effective with UV fluorescence.
They are designed to ensure field flatness up to F.N. 25.

IOS LWD U-PLAN F objectives are designed for IM-3 and inverted modular systems.



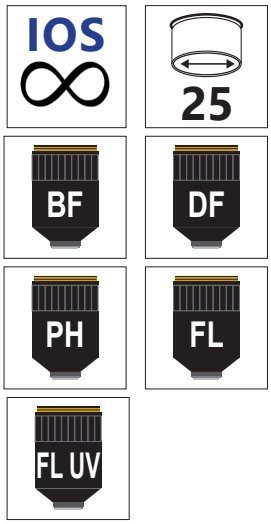
CODE	MAG.	NUMERICAL APERTURE	W.D. (mm)	F.N.	OPTICAL SYSTEM	COVERGLASS THICKNESS (mm)	IMMERSION	SPRING	REMARKS
M-800	4X	0.13	18.52	25	∞	1.2			
M-801	10x	0.30	7.11	25	∞	1.2			
M-802	20x	0.45	5.91	25	∞	1.2			
M-803	40x	0.65	1.61	25	∞	1.2			
M-804	60x	0.75	1.04	25	∞	1.2			

Plan Semi-APO Objectives - IOS LWD U-PLAN F PH Series



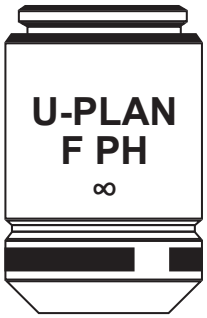
IOS LWD U-PLAN (**Plan Semi-Apochromatic**) F PH objectives represent the state-of-the-art lenses for inverted microscopes, specifically developed for top-class performance and contrast required by the most demanding users.
Long Working Distance provides a wider working space between the objective front lens and the specimen, a benefit for a variety of samples, whilst the PLAN-Fluorite (or Semi-Apochromatic) design ensures additional spherical aberration correction for superior resolution and greater numerical apertures. A superb resolution and contrast is granted especially for the observation of culture specimens in (positive) phase contrast method, but their versatility makes them an excellent product for other microscopic techniques, being very effective with UV fluorescence.
They are designed to ensure field flatness up to F.N. 25.

IOS LWD U-PLAN F PH objectives are designed for IM-3 and inverted modular systems.



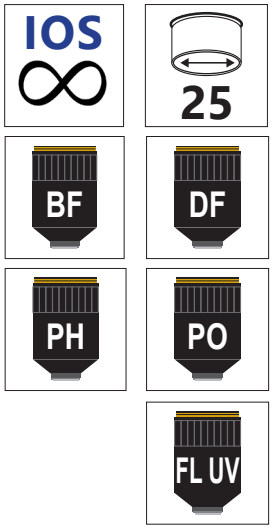
CODE	MAG.	NUMERICAL APERTURE	W.D. (mm)	F.N.	OPTICAL SYSTEM	COVERGLASS THICKNESS (mm)	IMMERSION	SPRING	REMARKS
M-1177	20x	0.45	5.91	25	∞	1.2			
M-1178	40x	0.65	1,61	25	∞	1.2			

Plan Semi-APO Objectives - IOS U-PLAN F PH Series



IOS U-PLAN (**Plan Semi-Apochromatic**) F PH objectives represent the state-of-the-art lenses for upright microscopes, specifically delivering excellent performance in the biological field, when superb quality of the image is needed working in Phase Contrast.
The PLAN-Fluorite (or Semi-Apochromatic) design ensures additional spherical aberration correction for superior resolution and greater numerical apertures.
They are designed to ensure field flatness up to F.N. 25.

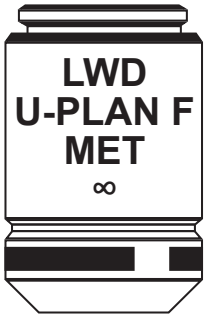
IOS U-PLAN F PH objectives are designed for inverted and upright modular systems used in biological applications.



CODE	MAG.	NUMERICAL APERTURE	W.D. (mm)	F.N.	OPTICAL SYSTEM	COVERGLASS THICKNESS (mm)	IMMERSION	SPRING	REMARKS
M-1310	4x	0.13	16.6	25	∞	0.17			*
M-1311	10x	0.40	2.5	25	∞	0.17			*
M-1312	20x	0.75	0.6	25	∞	0.17			*
M-1313	40x	0.95	0.15	25	∞	0.17		O	*
M-1314	60x	0.90	0.26	25	∞	0.17		O	*
M-1315	100x	1.35	0.13	25	∞	0.17	OIL	O	*

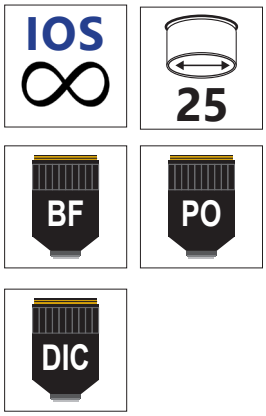
* The use of M-1157 condenser and dedicated phase rings is required

Plan Semi-APO Objectives - IOS LWD U-PLAN F MET Series



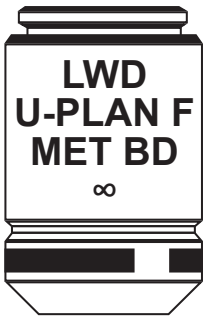
IOS LWD U-PLAN (**Plan Semi-Apochromatic**) F MET objectives represent the state-of-the-art lenses for upright and inverted microscopes, specifically delivering excellent performance in the metallurgical field without the need of the cover slide, being NCG (no cover glass).
Long Working Distance provides a wider working space between the objective front lens and the specimen, a benefit for a variety of samples.
The PLAN-Fluorite (or Semi-Apochromatic) design ensures additional spherical aberration correction for superior resolution and greater numerical apertures.
They are designed to ensure field flatness up to F.N. 25.

IOS LWD U-PLAN F MET objectives are designed for inverted and upright modular systems used in metallurgical applications.



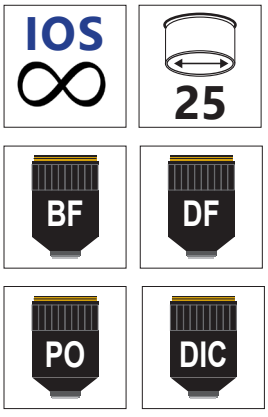
CODE	MAG.	NUMERICAL APERTURE	W.D. (mm)	F.N.	OPTICAL SYSTEM	COVERGLASS THICKNESS (mm)	IMMERSION	SPRING	REMARKS
M-1171	5x	0.15	19.5	25	∞	-			
M-1172	10x	0.30	10.9	25	∞	-			
M-1173	20x	0.50	3.2	25	∞	-			
M-1174	50x	0.80	1.2	25	∞	-			
M-1175	100x	0.90	1	25	∞	-			

Plan Semi-APO Objectives - IOS LWD U-PLAN F MET BD Series



IOS LWD U-PLAN (**Plan Semi-Apochromatic**) F MET BD objectives represent the state-of-the-art lenses for upright and inverted microscopes, specifically delivering excellent performance in the material science field both for bright-field and darkfield techniques, without the need of cover glass, being NCG (no cover glass).
Long Working Distance provides a wider working space between the objective front lens and the specimen, a benefit for a variety of samples.
The PLAN-Fluorite (or Semi-Apochromatic) design ensures additional spherical aberration correction for superior resolution and greater numerical apertures.
They are designed to ensure field flatness up to F.N. 25.

IOS LWD U-PLAN F MET BD objectives are designed for inverted and upright modular systems used in metallurgical applications with darkfield.

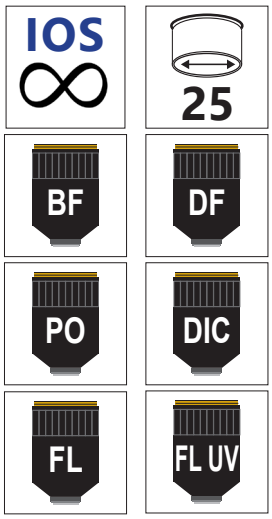


CODE	MAG.	NUMERICAL APERTURE	W.D. (mm)	F.N.	OPTICAL SYSTEM	COVERGLASS THICKNESS (mm)	IMMERSION	SPRING	REMARKS
M-1180	5x	0.15	13.5	25	∞	-			M26
M-1181	10x	0.30	9	25	∞	-			M26
M-1182	20x	0.50	2.5	25	∞	-			M26
M-1183	50x	0.80	1	25	∞	-			M26
M-1184	100x	0.90	1	25	∞	-			M26

Plan APO Objectives - IOS U-PLAN APO Series

IOS U-PLAN APO (**Plan Apochromatic**) objectives represent the state-of-the-art lenses for upright microscopes, specifically delivering excellent performance in the biological research field.
The U-PLAN APO design ensures theoretical spherical aberration correction for superior resolution and greater numerical apertures.
They are designed to ensure field flatness up to F.N. 25.

IOS U-PLAN APO objectives are designed for upright modular systems in biological applications.



CODE	MAG.	NUMERICAL APERTURE	W.D. (mm)	F.N.	OPTICAL SYSTEM	COVERGLASS THICKNESS (mm)	IMMERSION	SPRING	REMARKS
M-1301	2X	0.08	6.2	25	∞	0.17			
M-1302	4X	0.13	16.6	25	∞	0.17			
M-1303	10X	0.40	2.1	25	∞	0.17			
M-1304	20X	0.75	0.6	25	∞	0.17			
M-1305	40X	0.95	0.15	25	∞	0.17		O	
M-1306	60X	0.90	0.26	25	∞	0.17		O	
M-1307	100X	1.35	0.13	25	∞	0.17	OIL	O	

Objective Benchmark Table

OPTICAL CORRECTION	OBJECTIVE SERIES	CODE	MAGNIFICATION	NUMERICAL APERTURE	WORKING DISTANCE (mm)	FIELD NUMBER (mm)	OPTICAL SYSTEM	COVER GLASS THICKNESS (mm)
ACHROMATIC	**ACH**	M-131	4x	0.10	18	18	160	0.17
		M-132	10x	0.25	7	18	160	0.17
		M-133	20x	0.40	2	18	160	0.17
		M-134	40x	0.65	0.53	18	160	0.17
		M-135	60x	0.80	0.13	18	160	0.17
		M-136	100x	1.25	0.13	18	160	0.17
	HC	M-137	4x	0.10	18	18	160	0.17
		M-138	10x	0.25	7	18	160	0.17
		M-139	20x	0.40	2	18	160	0.17
		M-141	40x	0.65	0.53	18	160	0.17
		M-142	60x	0.80	0.45	18	160	0.17
		M-143	100x	1.25	0.13	18	160	0.17

OPTICAL CORRECTION	OBJECTIVE SERIES	CODE	MAGNIFICATION	NUMERICAL APERTURE	WORKING DISTANCE (mm)	FIELD NUMBER (mm)	OPTICAL SYSTEM	COVER GLASS THICKNESS (mm)
PLAN	**N-PLAN**	M-164	4x	0.10	15.2	20	160	0.17
		M-165	10x	0.25	5.5	20	160	0.17
		M-166	20x	0.40	3.5	20	160	0.17
		M-167	40x	0.65	0.45	20	160	0.17
		M-168	60x	0.85	0.45	20	160	0.17
		M-169	100x	1.25	0.13	20	160	0.17
	IOS N-PLAN	M-144	4x	0.10	16.8	20	∞	0.17
		M-145	10x	0.25	5.8	20	∞	0.17
		M-146	20x	0.40	5.1	20	∞	0.17
		M-147	40x	0.65	0.43	20	∞	0.17
		M-149	60x	0.80	0.14	20	∞	0.17
		M-148	100x	1.25	0.13	20	∞	0.17
	IOS N-PLAN POL	M-144	4x	0.10	16.8	20	∞	0.17
		M-145	10x	0.25	5.8	20	∞	0.17
		M-146	20x	0.40	5.1	20	∞	0.17
		M-147	40x	0.65	0.43	20	∞	0.17
		M-149	60x	0.80	0.14	20	∞	0.17
		M-148	100x	1.25	0.13	20	∞	0.17
	IOS W-PLAN	M-1049	2x	0.05	19.4	22	∞	0.17
		M-1125	4x	0.10	17.3	22	∞	0.17
		M-1126	10x	0.25	10	22	∞	0.17
		M-1127	20x	0.40	5.1	22	∞	0.17
		M-1128	40x	0.65	0.54	22	∞	0.17
		M-634.1	50x	0.95	0.19	22	∞	0.17
		M-1129	60x	0.80	0.14	22	∞	0.17
		M-1130.1	100x	0.36 - 1.25	0.18	22	∞	0.17
		M-1130	100x	1.25	0.13	22	∞	0.17
	W-PLAN PH	M-170	10x	0.25	12.2	22	160	0.17
		M-171	20x	0.40	5	22	160	0.17
		M-172	40x	0.65	0.37	22	160	0.17
		M-182	100x	1.25	0.13	22	160	0.17
	IOS W-PLAN PH	M-1120.N	10x	0.25	10	22	∞	0.17
		M-1121.N	20x	0.40	5.1	22	∞	0.17
		M-1122.N	40x	0.65	0.54	22	∞	0.17
		M-1123.N	100x	1.25	0.13	22	∞	0.17
	IOS LWD W-PLAN	M-1099	2.5x	0.08	11.3	22	∞	-
	IOS W-PLAN MET	M-337	4x	0.10	17.3	22	∞	-
		M-336	5x	0.12	15.5	22	∞	-
		M-338	10x	0.25	10	22	∞	-
		M-339	20x	0.40	5.8	22	∞	-
		M-335	50X	0.75	0.32	22	∞	-
		M-698.2	100x	0.80	3.2	22	∞	-
	IOS U-PLAN POL	M-1080	4x	0.10	20.8	22	∞	0.17
		M-1081	10x	0.25	5.3	22	∞	0.17
		M-1081.5	20x	0.45	1.56	22	∞	0.17
		M-1082	40x	0.65	0.36	22	∞	0.17
		M-1083	60x	0.85	0.30	22	∞	0.17

IMMERSION	SPRING	BF	DF	DIC	PH	RPC	PO	FL (B,G)	FL (UV)	SCREW THREAD	REMARKS
		★★	-	-	-	-	-	-	-	RMS	
		★★	-	-	-	-	-	-	-	RMS	
		★★	-	-	-	-	-	-	-	RMS	
	●	★★	-	-	-	-	-	-	-	RMS	
	●	★★	-	-	-	-	-	-	-	RMS	
OIL	●	★★	-	-	-	-	-	-	-	RMS	
		★★	★	-	-	-	★	-	-	RMS	
		★★	★	-	-	-	★	-	-	RMS	
		★★	★	-	-	-	★	-	-	RMS	
	●	★★	★	-	-	-	★	-	-	RMS	
	●	★★	★	-	-	-	★	-	-	RMS	
OIL /WATER	●	★★	★	-	-	-	★	-	-	RMS	

IMMERSION	SPRING	BF	DF	DIC	PH	RPC	PO	FL (B,G)	FL (UV)	SCREW THREAD	REMARKS
		★★	★★	-	-	-	-	-	-	RMS	
		★★	★★	-	-	-	-	-	-	RMS	
		★★	★★	-	-	-	-	-	-	RMS	
	●	★★	★★	-	-	-	-	-	-	RMS	
	●	★★	★★	-	-	-	-	-	-	RMS	
OIL /WATER	●	★★	★★	-	-	-	-	-	-	RMS	
		★★	★★	-	-	-	-	★★	-	RMS	
		★★	★★	-	-	-	-	★★	-	RMS	
		★★	★★	-	-	-	-	★★	-	RMS	
	●	★★	★★	-	-	-	-	★★	-	RMS	
	●	★★	★★	-	-	-	-	★★	-	RMS	
OIL /WATER	●	★★	★★	-	-	-	-	★★	-	RMS	
		★★	★★	-	-	-	★★	★★	-	RMS	
		★★	★★	-	-	-	★★	★★	-	RMS	
		★★	★★	-	-	-	★★	★★	-	RMS	
	●	★★	★★	-	-	-	★★	★★	-	RMS	
	●	★★	★★	-	-	-	★★	★★	-	RMS	
OIL /WATER	●	★★	★★	-	-	-	★★	★★	-	RMS	
		★★	★★	-	-	-	-	★★	-	RMS	
		★★	★★	-	-	-	-	★★	-	RMS	
		★★	★★	-	-	-	-	★★	-	RMS	
		★★	★★	-	-	-	-	★★	-	RMS	
	●	★★	★★	-	-	-	-	★★	-	RMS	
OIL	●	★★	★★	-	-	-	-	★★	-	RMS	
	●	★★	★★	-	-	-	-	★★	-	RMS	
OIL	●	★★	★★	-	-	-	-	★★	-	RMS	IRIS
OIL	●	★★	★★	-	-	-	-	★★	-	RMS	
		★★	★★	-	★★★	-	★	-	-	RMS	
		★★	★★	-	★★★	-	★	-	-	RMS	
	●	★★	★★	-	★★★	-	★	-	-	RMS	
OIL	●	★★	★★	-	★★★	-	★	-	-	RMS	
		★★	★★	-	★★★	-	★	-	-	RMS	
		★★	★★	-	★★★	-	★	-	-	RMS	
	●	★★	★★	-	★★★	-	★	-	-	RMS	
OIL	●	★★	★★	-	★★★	-	★	-	-	RMS	
		★★	-	-	-	-	★★★	-	-	RMS	DEPOLARIZED
		★★	-	-	-	-	★★	-	-	RMS	M-860.1 is required
		★★	-	-	-	-	★★	-	-	RMS	M-860 is required
		★★	-	-	-	-	★★	-	-	RMS	M-860 is required
		★★	-	-	-	-	★★	-	-	RMS	M-860 is required
	●	★★	-	-	-	-	★★	-	-	RMS	
		★★	-	-	-	-	★★	-	-	RMS	
		★★	★★	-	-	-	★★★	★★	-	RMS	
		★★	★★	-	-	-	★★★	★★	-	RMS	
		★★	★★	-	-	-	★★★	★★	-	RMS	
	●	★★	★★	-	-	-	★★★	★★	-	RMS	
	●	★★	★★	-	-	-	★★★	★★	-	RMS	

★★★: Very Good ★★: Good ★: Usable - : Not Good ☆: Some Limitations

Objective Benchmark Table

OPTICAL CORRECTION	OBJECTIVE SERIES	CODE	MAGNIFICATION	NUMERICAL APERTURE	WORKING DISTANCE (mm)	FIELD NUMBER (mm)	OPTICAL SYSTEM	COVER GLASS THICKNESS (mm)
PLAN	IOS W-PLAN POL	M-1131	4x	0.10	17.3	22	∞	0.17
		M-1132	10x	0.25	10.0	22	∞	0.17
		M-1133	20x	0.45	0.40	22	∞	0.17
		M-1134	40x	0.65	0.54	22	∞	0.17
		M-1135	60x	0.80	0.14	22	∞	0.17
	IOS LWD W-PLAN POL	M-1136	5x	0.12	15.5	22	∞	-
		M-1137	10x	0.25	10.0	22	∞	-
		M-1138	20x	0.40	5.8	22	∞	-
		M-1139	50x	0.75	0.32	22	∞	-
	IOS LWD W-PLAN	M-782	10x	0.13	10.4	22	∞	1.2
		M-773	40x	0.60	3.10	22	∞	1.2
		M-786	60x	0.70	1.70	22	∞	1.2
	IOS LWD W-PLAN PH	M-782.1	4x	0.13	10.4	22	∞	1.2
		M-783N	10x	0.25	7.3	22	∞	1.2
		M-784N	20x	0.40	6.8	22	∞	1.2
		M-785	40x	0.65	3.00	22	∞	1.2
	IOS LWD U-PLAN RPC	M-861	4X	0.13	10.75	22	∞	1.2
		M-862	10x	0.25	7.45	22	∞	1.2
		M-863	20x	0.40	6.92	22	∞	1.2
		M-864	40x	0.65	2.74	22	∞	1.2
	IOS LWD U-PLAN POL	M-1090	5x	0.15	10.8	25	∞	-
		M-1091	10x	0.30	10	25	∞	-
		M-1092	20x	0.45	4	25	∞	-
		M-1093	50x	0.55	7.9	25	∞	-
	IOS LWD U-PLAN MET	M-1100	5x	0.15	10.8	25	∞	-
		M-1101	10x	0.30	10	25	∞	-
		M-1102	20x	0.45	4	25	∞	-
		M-1103	50x	0.55	7.9	25	∞	-
		M-1104	100x	0.80	2.1	25	∞	-
	IOS LWD U-PLAN MET BD	M-1094	5x	0.15	9	25	∞	-
		M-1095	10x	0.30	9	25	∞	-
		M-1096	20x	0.45	3.4	25	∞	-
		M-1097	50x	0.55	7.5	25	∞	-
		M-1098	100x	0.80	2	25	∞	-

IMMERSION	SPRING	BF	DF	DIC	PH	RPC	PO	FL (B,G)	FL (UV)	SCREW THREAD	REMARKS
		★★	★★	-	-	-	★★★	★★	-	RMS	
		★★	★★	-	-	-	★★★	★★	-	RMS	
		★★	★★	-	-	-	★★★	★★	-	RMS	
	●	★★	★★	-	-	-	★★★	★★	-	RMS	
	●	★★	★★	-	-	-	★★	★★	-	RMS	
		★★	-	-	-	-	★★★	★★	-	RMS	
		★★	-	-	-	-	★★★	★★	-	RMS	
		★★	-	-	-	-	★★★	★★	-	RMS	
		★★	-	-	-	-	★★★	★★	-	RMS	
		★★	-	-	-	-	-	★★	-	RMS	
		★★	-	-	-	-	-	★★	-	RMS	
		★★	-	-	-	-	-	★★	-	RMS	
		★★	-	-	★★★	-	-	★★★	-	RMS	
		★★	-	-	★★★	-	-	★★★	-	RMS	
		★★	-	-	★★★	-	-	★★★	-	RMS	
		★★	-	-	★★★	-	-	★★★	-	RMS	
		★★	-	-	-	★★★	-	-	-	RMS	
		★★	-	-	-	★★★	-	-	-	RMS	
		★★	-	-	-	★★★	-	-	-	RMS	
		★★	-	-	-	★★★	-	-	-	RMS	
		★★★	-	-	-	-	★★★	-	-	RMS	
		★★★	-	-	-	-	★★★	-	-	RMS	
		★★★	-	-	-	-	★★★	-	-	RMS	
		★★★	-	-	-	-	★★★	-	-	RMS	
		★★★	-	★★☆	-	-	★★★	-	-	RMS	
		★★★	-	★★★	-	-	★★★	-	-	RMS	
		★★★	-	★★★	-	-	★★★	-	-	RMS	
		★★★	-	★★★	-	-	★★★	-	-	RMS	
		★★★	-	★★★	-	-	★★★	-	-	RMS	
		★★★	★★★	★★☆	-	-	★★	-	-	M26	
		★★★	★★★	★★★	-	-	★★	-	-	M26	
		★★★	★★★	★★★	-	-	★★	-	-	M26	
		★★★	★★★	★★★	-	-	★★	-	-	M26	
		★★★	★★★	★★★	-	-	★★	-	-	M26	

★★★: Very Good ★★: Good ★: Usable - : Not Good ☆: Some Limitations

Objective Benchmark Table

OPTICAL CORRECTION	OBJECTIVE SERIES	CODE	MAGNIFICATION	NUMERICAL APERTURE	WORKING DISTANCE (mm)	FIELD NUMBER (mm)	OPTICAL SYSTEM	COVER GLASS THICKNESS (mm)
PLAN SEMI APO	IOS W-PLAN F	M-1060	4x	0.13	4.7	22	∞	0.17
		M-1061	10x	0.30	4.1	22	∞	0.17
		M-1062	20x	0.50	1.45	22	∞	0.17
		M-1063	40x	0.75	0.5	22	∞	0.17
		M-1064	100x	1.30	0.08	22	∞	0.17
	IOS U-PLAN F	M-1070	4x	0.13	16.43	25	∞	0.17
		M-1071	10x	0.30	8.13	25	∞	0.17
		M-1072	20x	0.50	2.03	25	∞	0.17
		M-1073	40x	0.75	0.74	25	∞	0.17
		M-1073.1	60x	0.90	0.26	25	∞	0.17
		M-1074	100x	1.28	0.18	25	∞	0.17
	IOS U-PLAN F	M-1075	4x	0.13	16.5	25	∞	0.17
		M-1076	10x	0.30	8.1	25	∞	0.17
		M-1077	20x	0.50	2.1	25	∞	0.17
		M-1078	40x	0.75	0.7	25	∞	0.17
		M-1079	100x	1.30	0.15	25	∞	0.17
	IOS LWD U-PLAN F	M-800	4X	0.13	18.52	25	∞	1.2
		M-801	10x	0.30	7.11	25	∞	1.2
		M-802	20x	0.45	5.91	25	∞	1.2
		M-803	40x	0.65	1.61	25	∞	1.2
		M-804	60x	0.75	1.04	25	∞	1.2
	IOS LWD U-PLAN F PH	M-1177	20x	0.45	5.91	25	∞	1.2
		M-1178	40x	0.65	1,61	25	∞	1.2
	IOS U-PLAN F PH	M-1310	4x	0.13	16.6	25	∞	0.17
		M-1311	10x	0.40	2.5	25	∞	0.17
		M-1312	20x	0.75	0.6	25	∞	0.17
		M-1313	40x	0.95	0.15	25	∞	0.17
		M-1314	60x	0.90	0.26	25	∞	0.17
		M-1315	100x	1.35	0.13	25	∞	0.17
	IOS LWD U-PLAN F MET	M-1171	5x	0.15	19.5	25	∞	-
		M-1172	10x	0.30	10.9	25	∞	-
		M-1173	20x	0.50	3.2	25	∞	-
		M-1174	50x	0.80	1.2	25	∞	-
		M-1175	100x	0.90	1	25	∞	-
	IOS LWD U-PLAN F MET BD	M-1180	5x	0.15	13.5	25	∞	-
		M-1181	10x	0.30	9	25	∞	-
		M-1182	20x	0.50	2.5	25	∞	-
		M-1183	50x	0.80	1	25	∞	-
		M-1184	100x	0.90	1	25	∞	-

OPTICAL CORRECTION	OBJECTIVE SERIES	CODE	MAGNIFICATION	NUMERICAL APERTURE	WORKING DISTANCE (mm)	FIELD NUMBER (mm)	OPTICAL SYSTEM	COVER GLASS THICKNESS (mm)
PLAN APO	IOS U-PLAN APO	M-1301	2X	0.08	6.2	25	∞	0.17
		M-1302	4X	0.13	16.6	25	∞	0.17
		M-1303	10X	0.40	2.1	25	∞	0.17
		M-1304	20X	0.75	0.6	25	∞	0.17
		M-1305	40X	0.95	0.15	25	∞	0.17
		M-1306	60X	0.90	0.26	25	∞	0.17
		M-1307	100X	1.35	0.13	25	∞	0.17

IMMERSION	SPRING	BF	DF	DIC	PH	RPC	PO	FL (B,G)	FL (UV)	SCREW THREAD	REMARKS
		★★★	★★	-	-	-	-	★★★	★★★	RMS	
		★★★	★★	★	-	-	-	★★★	★★★	RMS	
		★★★	★★	★	-	-	-	★★★	★★★	RMS	
	●	★★★	★★	★	-	-	-	★★★	★★★	RMS	
OIL	●	★★★	★★	★	-	-	-	★★★	★★★	RMS	
		★★★	★★★	-	-	-	★★	★★★	★★★	RMS	
		★★★	★★★	-	-	-	★★	★★★	★★★	RMS	
		★★★	★★★	-	-	-	★★	★★★	★★★	RMS	
	●	★★★	★★★	-	-	-	★★	★★★	★★★	RMS	
	●	★★★	★★★	-	-	-	★★	★★★	★★★	RMS	
OIL	●	★★★	★★★	-	-	-	★★	★★★	★★★	RMS	
		★★★	★★★	-	-	-	★★	★★★	★★★	RMS	
		★★★	★★★	★★☆	-	-	★★	★★★	★★★	RMS	
		★★★	★★★	★★★	-	-	★★	★★★	★★★	RMS	
	●	★★★	★★★	★★★	-	-	★★	★★★	★★★	RMS	
OIL	●	★★★	★★★	★★★	-	-	★★	★★★	★★★	RMS	
		★★★	-	-	-	-	-	★★★	★★★	RMS	
		★★★	-	-	-	-	-	★★★	★★★	RMS	
		★★★	-	-	-	-	-	★★★	★★★	RMS	
		★★★	-	-	-	-	-	★★★	★★★	RMS	
		★★★	-	-	-	-	-	★★★	★★★	RMS	
		★★★	★★	-	★★★	-	-	★★★	★★★	RMS	
		★★★	★★	-	★★★	-	-	★★★	★★★	RMS	
		★★★	★★★	★	★★★	-	★★	★★★	★★★	RMS	
		★★★	★★★	★★★	★★★	-	★★	★★★	★★★	RMS	
		★★★	★★★	★★★	★★★	-	★★	★★★	★★★	RMS	
	●	★★★	★★★	★★★	★★★	-	★★	★★★	★★★	RMS	
	●	★★★	★★★	★★★	★★★	-	★★	★★★	★★★	RMS	
OIL	●	★★★	★★★	★★★	★★★	-	★★	★★★	★★★	RMS	
		★★★	-	★★☆	-	-	★★	-	-	RMS	
		★★★	-	★★★	-	-	★★	-	-	RMS	
		★★★	-	★★★	-	-	★★	-	-	RMS	
		★★★	-	★★★	-	-	★★	-	-	RMS	
		★★★	-	★★★	-	-	★★	-	-	RMS	
		★★★	★★★	★★☆	-	-	★★	-	-	M26	
		★★★	★★★	★★★	-	-	★★	-	-	M26	
		★★★	★★★	★★★	-	-	★★	-	-	M26	
		★★★	★★★	★★★	-	-	★★	-	-	M26	
		★★★	★★★	★★★	-	-	★★	-	-	M26	

IMMERSION	SPRING	BF	DF	DIC	PH		PO	FL (B,G)	FL (UV)	SCREW THREAD	REMARKS
		★★★	-	-	-	-	★★	★★★	★★★	RMS	
		★★★	★★	-	-	-	★★	★★★	★★★	RMS	
		★★★	★★	★★★	-	-	★★	★★★	★★★	RMS	
		★★★	★★	★★★	-	-	★★	★★★	★★★	RMS	
	●	★★★	★★	★★★	-	-	★★	★★★	★★★	RMS	
	●	★★★	★★	★★★	-	-	★★	★★★	★★★	RMS	
OIL	●	★★★	-	-	-	-	★★	★★★	★★★	RMS	

★★★: Very Good ★★: Good ★: Usable - : Not Good ☆: Some Limitations

Note

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