Microscopy Product Training

Product Marketing
June 2012

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OVERVIEW AND PRESENTATION FLOW

- Glossary and Important Terms
- EO Microscopy Product Line and Offering
- Choosing an Objective
- Transmission Objective Overview
- Setting Up a Simple System
- Reflective Objectives
- Mounting and Tube Lengths

GLOSSARY AND IMPORTANT TERMS

- **Numerical Aperture** – function of the focal length and entrance pupil diameter
- **Oil Immersion** – medium used on objectives with an NA higher than 0.95
  - Examples: Air, water, glycerin, paraffin oil, synthetic oil, anisole, bromonaphthalene
  - Indices of refraction ranging between 1.01 – 1.65
- **Working Distance** – Distance between the surface of the specimen and the front face of the objective when in focus
  - LWD, ELWD, SLWD, ULWD
- **Field of View** – the size of the image formed by the lens on to the sensor

EDMUND OPTICS PRODUCT OFFERING

- Infinity Corrected Objectives
- Finite Conjugate Objectives
- Reflective Objectives
- Stereo Microscopes
- Miscellaneous
  - Accessories, eyepieces, relay lenses, couplers, reticles, micrometers, pocket and direct microscopes, simple magnifiers

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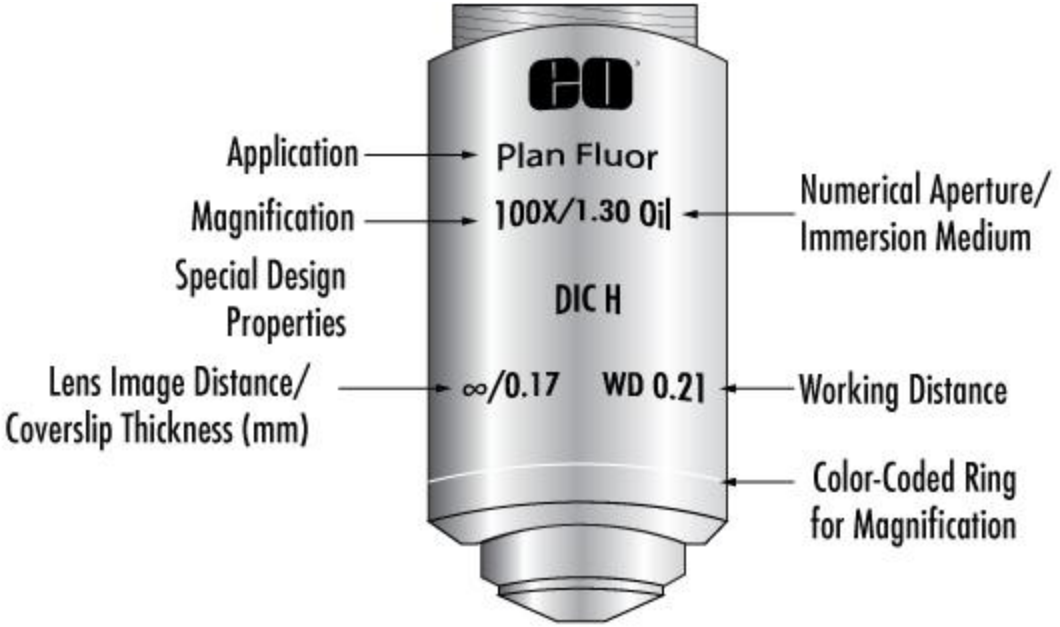
TRANSMISSION OBJECTIVE SPECS

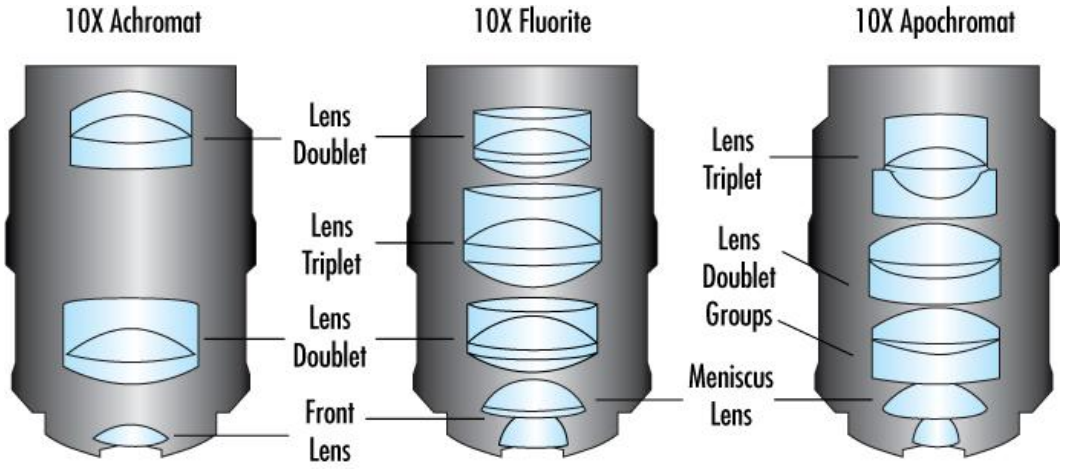


Magnification	1X	2X	3X	4X	10X	20X	40X	60X	100X
Color Code	Black	Gray	Red	Yellow	Green	Light Blue	Light Blue	Dark Blue	White

Typical color code for magnifications

HOW TO CHOOSE THE RIGHT OBJECTIVE

- **Achromatic** ~ 3-5 lens elements
- **Fluorite** ~ 5-9 lens elements
- **Apochromatic** ~ 9-18 lens elements



Achromatic – corrected for chromatic aberration at the red and blue wavelengths only

Apochromatic – corrected for chromatic aberration at the red, blue, and yellow wavelengths

Fluorite – to be used in low light level detection, specifically fluorescence emission

Plan – objective lens that produces a flat (planar) image by correcting the spherical aberration/curvature of the field of an achromatic/apochromatic lens

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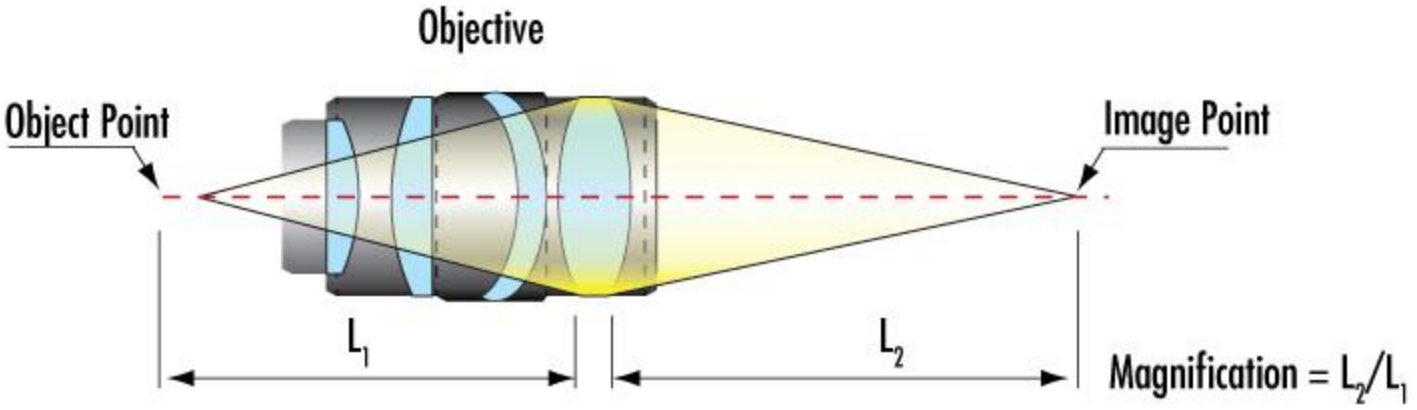
FINITE CONJUGATE OBJECTIVES

- Light from a source is focused (not from infinity)
- Characterized by DIN or JIS standards
- Utilized when cost and ease of design are concerns
  - Offer little to no filtering or in-line illumination
  - No tube lens required for focus
  - Account for majority of basic microscope systems where only simple magnification and lighting is required



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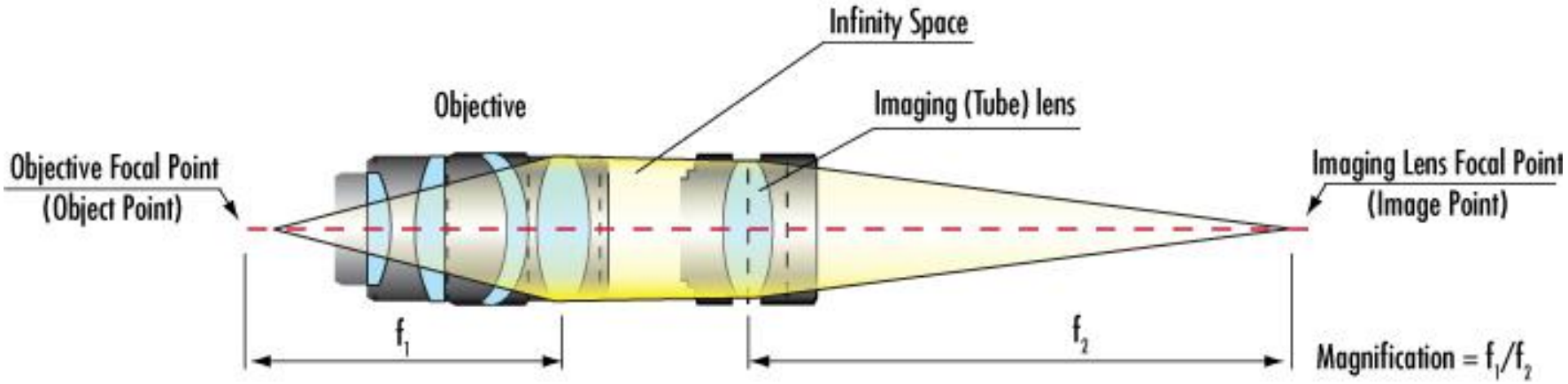
INFINITY CORRECTED OBJECTIVES

- Offer longer working distances
  - Allows for larger samples, elaborate mechanics, and room to operate (dyes, reagents, catalysts)
- Allow for addition of in-line components
  - Filters, beamsplitters, and mechanics
- Light rays focused with assistance of secondary/tube lenses
  - Set at specific, long distance from objective (~160-200mm)
- Enable in-line illumination
  - Improved lighting and convenient for space constraints



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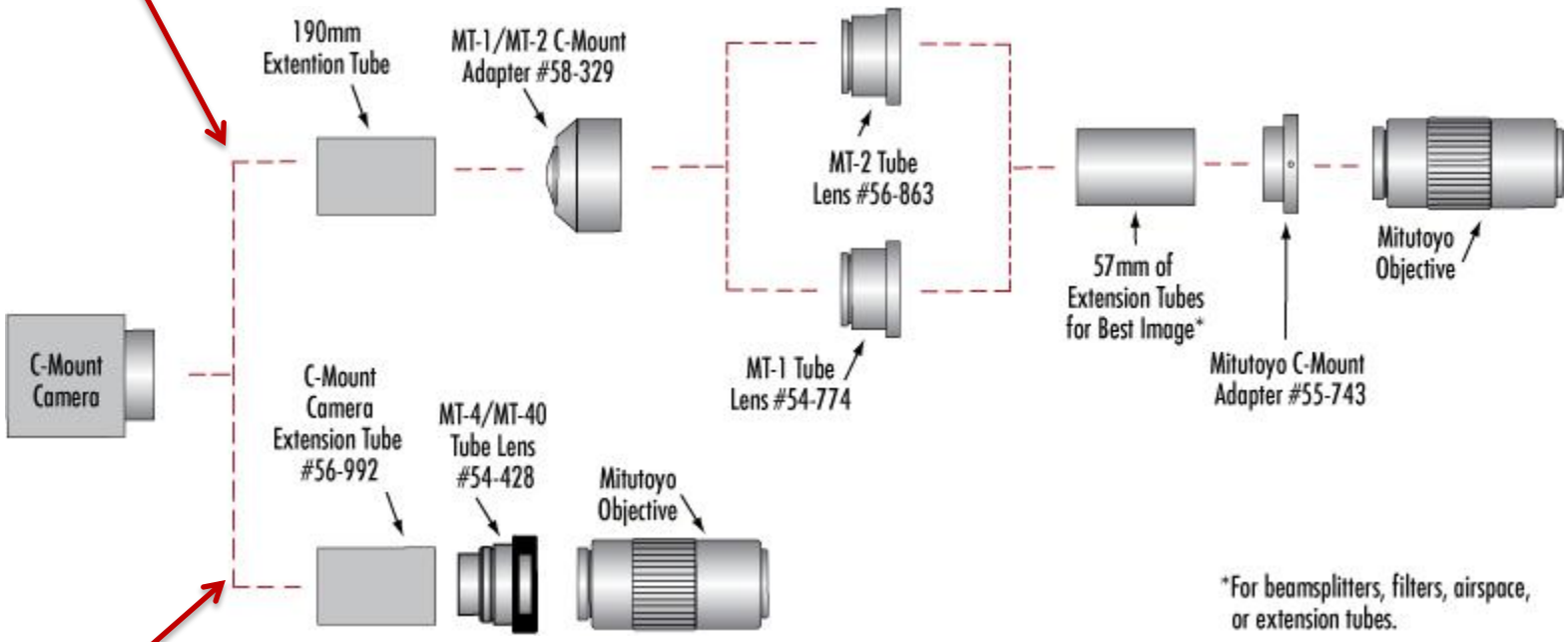
INFINITY CORRECTED OBJECTIVES

- In-line filtering/illumination assembly
  - More complex and detailed system



- Direct video assembly
  - Simple, direct approach for basic imaging

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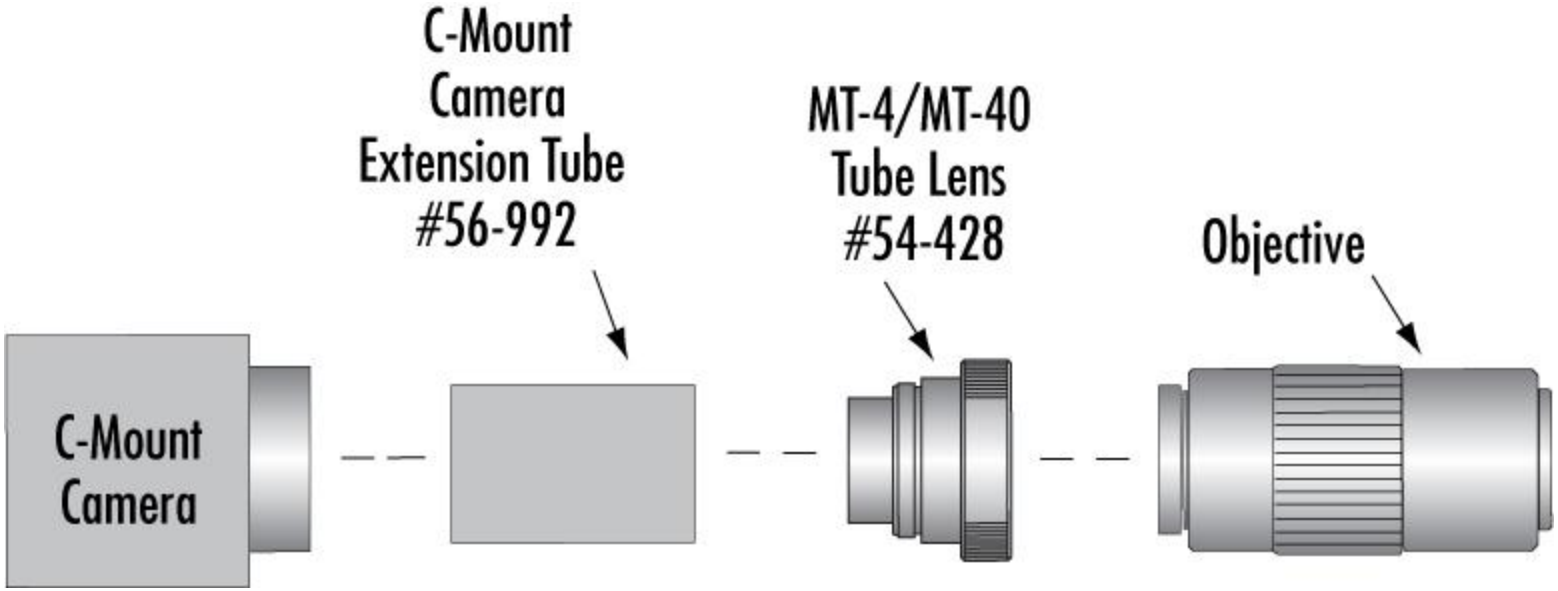
INFINITY CORRECTED OBJECTIVES



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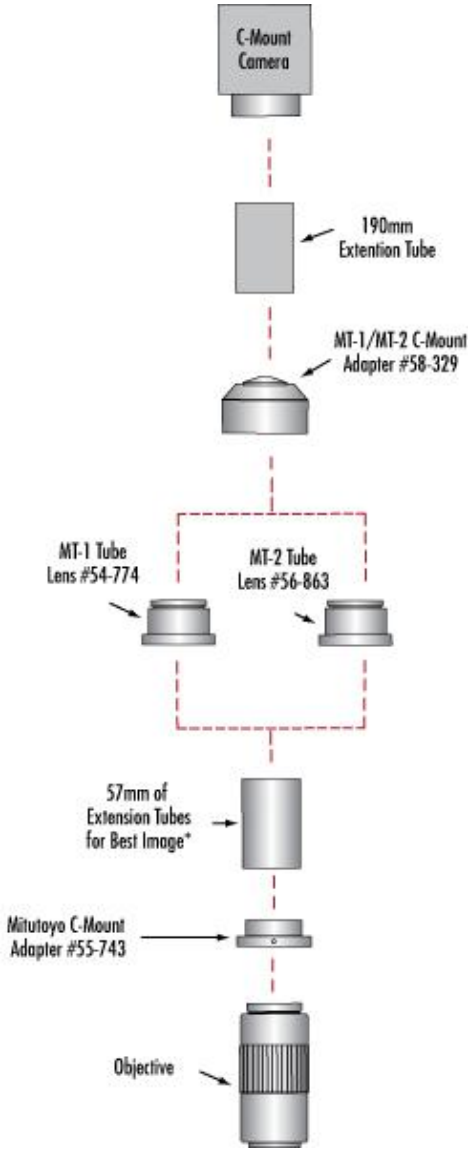
INFINITY CORRECTED OBJECTIVES



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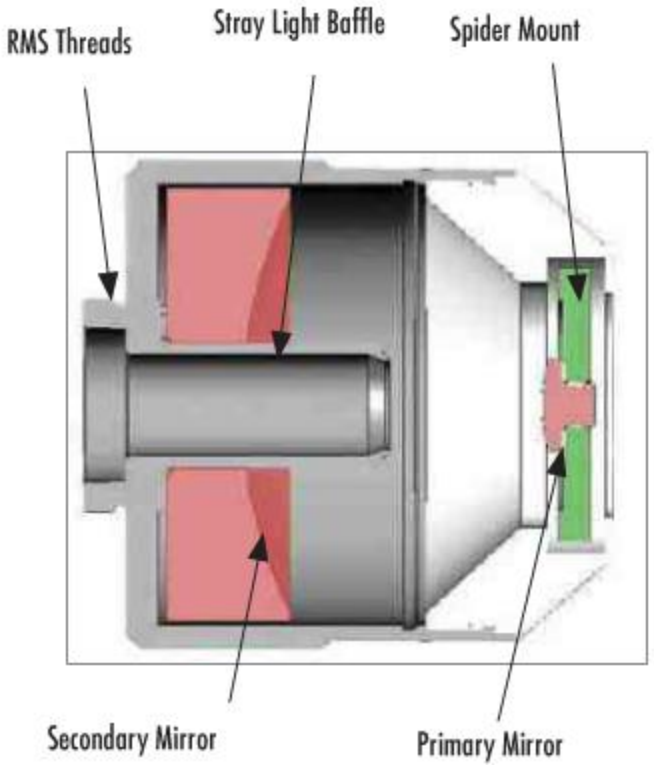
REFLECTIVE OBJECTIVES

- Two mirror, Schwarzschild reflective objective type

- Reflective vs. Refractive
  - Reflective provides chromatic correction over broad spectral ranges
  - Reflective offers variety of coating options for deep UV, IR, and laser line performance

- Important Specifications
  - **Transmitted Wavefront Error** - difference between the wavefront from when it enters and exits the system
  - **Obscuration** - central portion of primary mirror that does not transfer rays

- Edmund Optics offers TECHSPEC® ReflX™ Objectives



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REFLECTIVE OBJECTIVES

- **Infinity corrected** – Ideal for focusing applications
  - Focusing broadband or multiple laser source to a single point
- **Finite conjugate –** Ideal for imaging applications
  - Excellent resolution - no additional focus elements needed
  - Interchangeable with standard microscope objectives

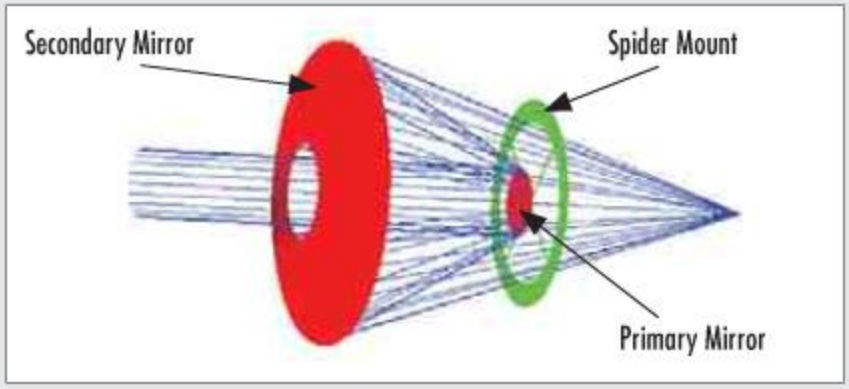

Figure 2: Infinity-Corrected Objective

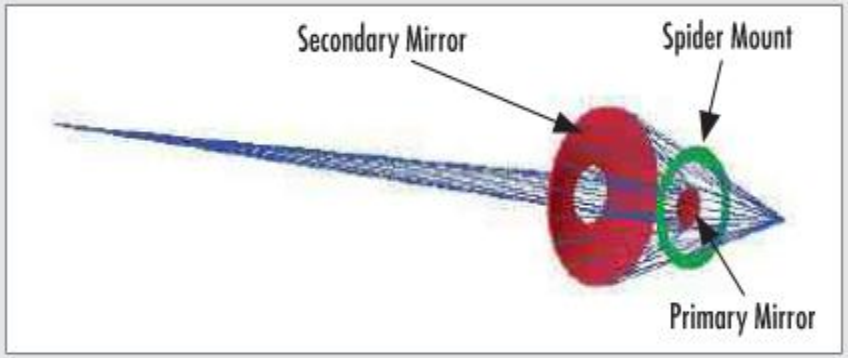

Figure 3: Finite-Conjugate Objective

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MOUNTING THREADS AND TUBE LENGTHS

- **Royal Microscopy Society (RMS)** - 0.8” x 36TPI, Whitworth
  - Society Thread
  - ~200mm tube length
- **Deutsches Insititut fur Normung (DIN)** - 0.7965”, 36TPI, 55` Whitworth
  - 45mm standard objectives
  - 160mm tube length
  - Object to image distance 195mm, fix object distance at 45mm, and remaining 150mm for internal real image position (10mm from end of tube)
- **Japanese Industrial Standards (JIS)** - 0.7965”, 36TPI, 55` Whitworth
  - 36mm standard objectives
  - 170mm tube length
    - Rare cases have slight variation on Parfocal Distance and Tube Length

Typical Objective Manufacturer Specifications

- **Mitutoyo Standards** - 26mm x 0.706mm pitch (36 TPI), 200mm tube lens focal length, 95mm parfocal distance
- **Olympus Standards** - RMS thread type, 180mm tube lens focal length, 45mm parfocal distance
- **Nikon Standards** - M25 thread type, 200mm tube lens focal length, 60mm parfocal distance
- **Zeiss Standards** - RMS thread type, 165mm tube lens focal length, 45mm parfocal distance