Safety Precautions

When using this product, observe the precautions regarding its specifications, functions, and use that are described in this document. Failure to do so may impair the safety of the product.

Before Using This Product

In order to achieve the best performance of this product and to keep the product in its best condition so that it can be used for many years, read this document thoroughly before using this product. After reading, retain it in a safe place.

Precautions regarding Transfers Outside Japan

This product is subject to the Foreign Exchange and Foreign Trade Act of Japan. If you intend to transfer products or technologies from a country other than Japan, please contact Mitutoyo in advance.

Conventions Used in This Document

■ Safety reminder conventions warning against potential hazards

NOTICE Indicates a situation which, if not avoided, **may result in property damage**.

■ Conventions indicating referential information or reference location

Indicates reference location if there is information that should be referred to in this document or an extraneous User's Manual.
Example: (📖 "3. Maintenance")

Precautions for Use

- This product is a reference instrument that is used to measure flatness. Do not use it for any purposes other than measuring flatness.
- This product is a precision instrument. It must be handled carefully. Be careful not to jolt or apply excessive force to any of its parts during storage or use.
- If this product is jolted or exposed to excessive force, the accuracy of the product may be impaired.
- Before using this product, wipe dirt off of the product and the target measurement surface by referring to 📖 "3. Maintenance".
- It is recommended to use this product in a location with minimal dust, filth, and vibrations. It is also recommended to place this product on a surface plate during use.
- It is recommended to use this product in an environment of around 20 °C where temperature fluctuations are minimal.
  Avoid using this product in locations directly exposed to drafts of hot air, cool air, or air conditioning.
- Prior to use, be sure to perform sufficient thermal stabilization of this product along with the gage to be measured.

Limited Warranty

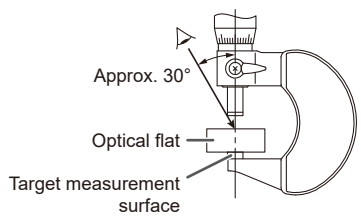
This product has been manufactured under strict quality management, but should it develop problems within one year of the date of purchase in normal use, repair shall be performed free of charge. Please contact the agent where you purchased the product or Mitutoyo sales representative.

1. Overview

Optical flats are used to inspect flatness by means of optical interference. They are best used for inspecting mirror-finished surfaces of gauges such as micrometers or gauge blocks.

2. Flatness Measurement Employing Interference Fringes

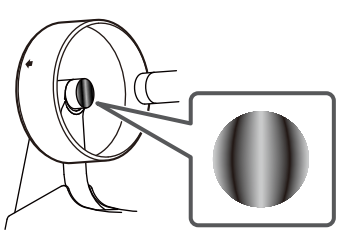
Interference fringes appear in a variety of colors. Perform measurement by focusing on one of those colors.
In this document, an explanation is provided by using red interference fringes as an example.
Take a reading at a position that is tilted approx. 30° relative to the axis of the target measurement surface as shown in the figure on the right.
If a reading is taken at a position that is at an acute angle to the axis, interference fringes may not be observed.



NOTICE Indicates a situation which, if not avoided, may result in property damage.

Caution should be exercised when pressing the optical flat against the target measurement surface. Failure to do so risks damaging the measurement surface of the optical flat.

2.1 Calculating from the Number of Interference Fringes



Flatness (F) = λ/2 × n (μm)
n = The number of interference fringes
λ/2 = 0.32 μm (red interference fringes)
λ = The wavelength of the light being observed (μm)

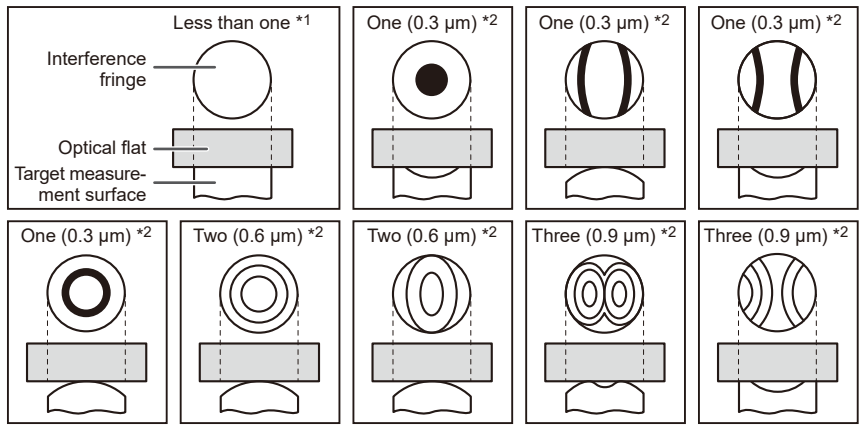
1 Clean the optical flat and the target measurement surface. (📖 "3. Maintenance")

2 Press the optical flat against the target measurement surface.

3 Take a reading of the number of interference fringes. (📖 "● Example measurements (examples of interference fringe appearance)"

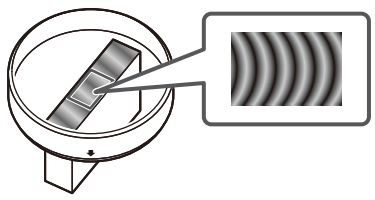
4 Use the equation above to calculate the flatness (F).

● Example measurements (examples of interference fringe appearance)



*1: When none of the interference fringes is visible, the shape of the interference fringes can be used to obtain the flatness. (📖 "2.2 Calculating from the Shape of the Interference Fringes")
*2: Flatness of the target measurement surface calculated from red interference fringes

2.2 Calculating from the Shape of the Interference Fringes

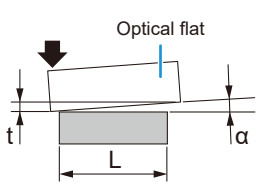


Flatness (F) (μm) = (λ/2) × (b/a)
a = Distance between interference fringe centers (mm)
b = Extent of interference fringe curvature (mm)
λ/2 = 0.32 μm (red interference fringes)
λ = The wavelength of the light being observed (μm)

1 Clean the optical flat and the target measurement surface. (📖 "3. Maintenance")

2 Press the optical flat against the target measurement surface.

3 Lightly push one side of the optical flat with your finger.
» Interference fringes appear when the optical flat is tilted.

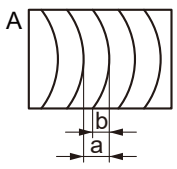


Gap (t) = n × λ/2
n: The number of interference fringes

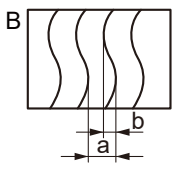
Angle (α) ≃ 180/π × tan (t/L)
L: The length of the target measurement surface

Example: When five red interference fringes appear on the micrometer spindle (ø6.3 mm):
t = approx. 1.6 μm, α = approx. 0.02°

4 Calculate the ratio of a to b as shown in the figures below (A and B) and then use the equation above to obtain the flatness (F).



The ratio of a to b is 5 : 3.
F = 0.32 × (3/5) (μm)



The ratio of a to b is 5 : 2.
F = 0.32 × (2/5) (μm)

3. Maintenance

In order to achieve the best performance of this product and to use the product safely for many years, perform cleaning in accordance with the following items.

- Dust: Brush it off with a lens cleaning brush or a soft ink brush, or wipe it off with gauze.
- Fingerprints or oil stains: Wipe them off with lens paper, or with gauze dipped in a small amount of lens cleaner.

4. Specifications

Code No.	158-117	158-118	158-119	158-120
Model No.	OF-45B	OF-45A	OF-60B	OF-60A
Flatness*	0.2 μm	0.1 μm	0.2 μm	0.1 μm
Diameter	45 mm		60 mm	
Thickness	12.00 mm		15.00 mm	

Code No.	158-121	158-122	158-123	158-124
Model No.	OF-1.8"B	OF-1.8"A	OF-2.4"B	OF-2.4"A
Flatness*	0.000008 in	0.000004 in	0.000008 in	0.000004 in
Diameter	1.8 in		2.4 in	
Thickness	0.5 in		0.6 in	

*: Excluding the area within a distance of 2 mm from the circumference of the measurement surface

Mitutoyo Corporation
20-1, Sakado 1-Chome, Takatsu-ku,
Kawasaki-shi, Kanagawa 213-8533, Japan

Printed in Japan
Date of publication: January 1, 2026 (1)