Canon

MACRO ZOOM LENS

C10×12 Fluorite

12–120mm 1:2.2

Instructions

English Edition

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The Canon Marco Zoom Lens C10×12, 12–120mm 1 : 2.2, Fluorite is an interchangeable lens for 16mm motion picture cameras. It is a new Canon-developed 10× zoom lens. It is the first zoom lens using artificial fluorite and boasts high optical performance, including substantial reduction of chromatic aberrations. This new lens has a unique macrophotography function. When this function is used with the focal length set at 12mm, super-close-up photography is possible in which the distance between the object and the front vertex of the lens is only 1 millimeter (0.04 in.).
Furthermore, when the macrophotography mechanism and zooming are used jointly, special photographic techniques become possible.

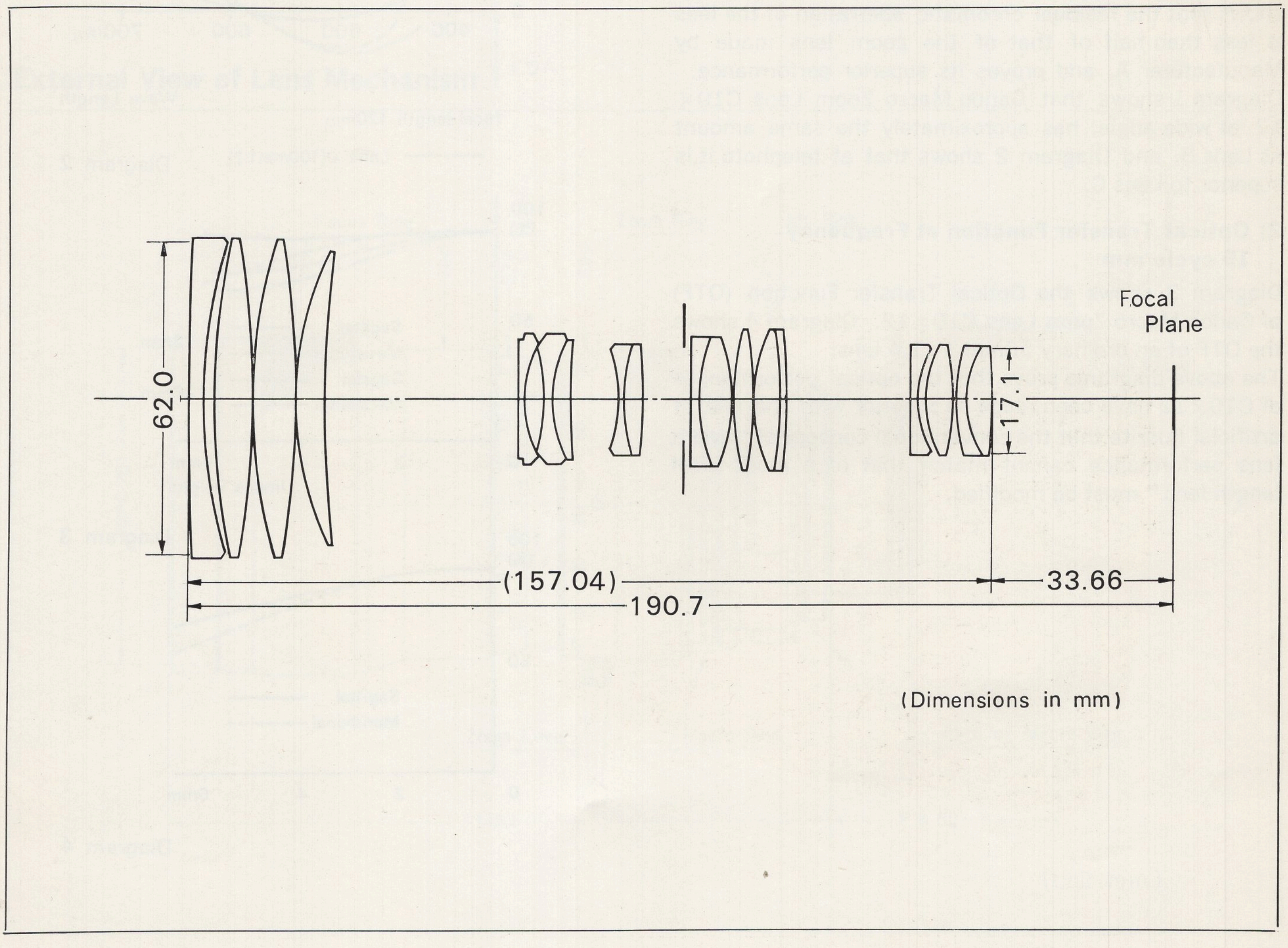
Optical Specifications

Application : For 16mm motion picture camera
Range of Focal Length : 12–120mm
Maximum Relative Aperture : 1 : 2.2
Zoom Ratio : 1 : 10
Image Format Covered : 10.3×7.5mm 12.7mm dia.
Angular Fields of View : Wide 46.9°×34.6°
Tele 4.7°×3.5°
Minimum Object Distance : 1.5m (5 ft) from focal plane
Using Macro Ring ;

Focal length	12mm	50mm	120mm
Object distance	1mm	45cm	104cm

Object Dimensions at Minimum Object Distance :
Wide 105×77cm
Tele 10.7×7.8cm
Macro 50.5×36.2mm (at 1mm)
Distance from Focal Plane to Exit Pupil : −178.7mm

Sectional View of Optical System



Performance Data of Artificial Fluorite

The Canon Macro Zoom Lens C10×12 Fluorite incorporates the same artificial fluorite as in Canon Lenses FL-F 300mm 1 : 5.6 and FL-F 500mm 1 : 5.6 high quality telephoto lenses for single-lens reflex cameras which are already on the market. The C10×12 is fully backed by Canon's optical design and techniques which made possible the development of Canon Lenses FL-F 300mm 1 : 5.6 and FL-F 500mm 1 : 5.6. The Canon Macro Zoom Lens C10×12 possesses the following high optical performances:

1) Chromatic Aberration of Canon Macro Zoom Lens

Diagram 1 shows the value of the residual chromatic aberration of the C10×12, whose apochromatic was perfected with the use of artificial fluorite. The diagram shows that the residual chromatic aberration of the lens is less than half of that of the zoom lens made by Manufacturer A, and proves its superior performance.
Diagram 1 shows that Canon Macro Zoom Lens C10×12, at wide-angle, has approximately the same amount as Lens B, and Diagram 2 shows that at telephoto it is superior to Lens C.

2) Optical Transfer Function at Frequency 15 cycle/mm

Diagram 3 shows the Optical Transfer Function (OTF) of Canon Macro Zoom Lens C10×12. Diagram 4 shows the OTF of an ordinary 50mm 1 : 1.4 lens.
The above diagrams prove that the optical performances of C10×12 have been made so superior with the use of artificial fluorite that the conventional concept of "zoom lens performance cannot match that of a mono-focal length lens" must be modified.

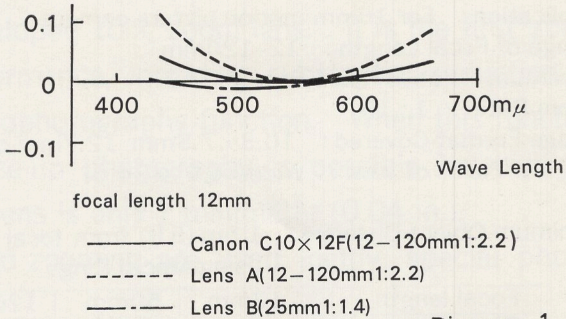


Diagram 1

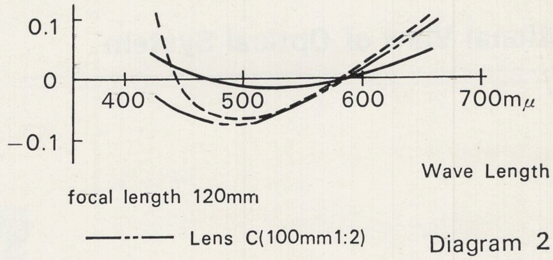


Diagram 2

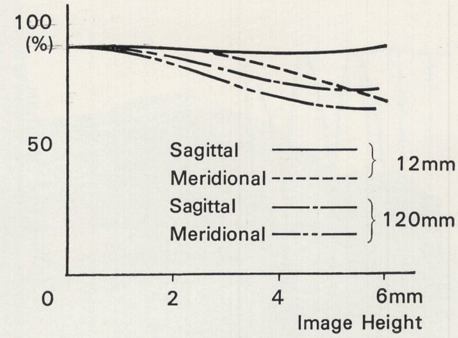


Diagram 3

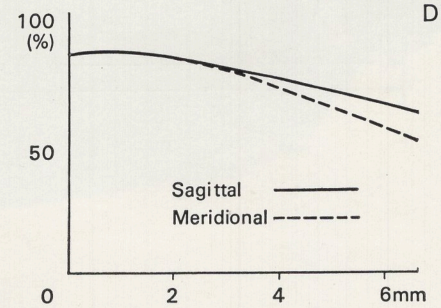


Diagram 4

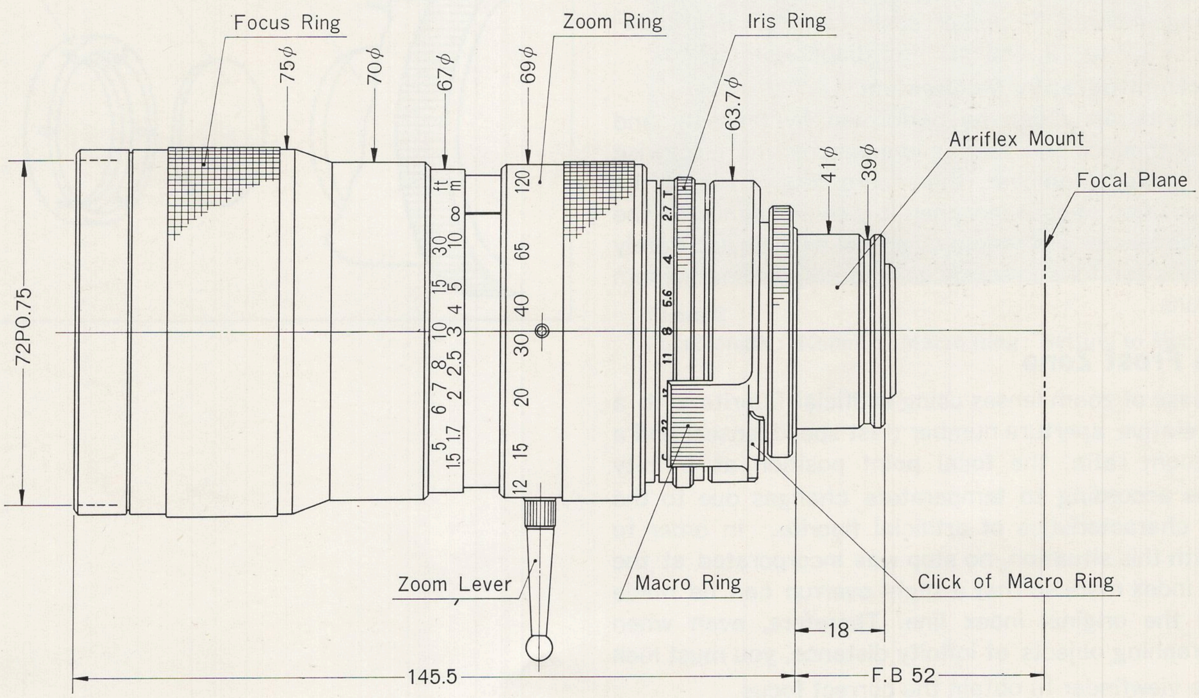
Mechanical Specifications

Mount :	Arriflex Mount, C Mount
Zoom Control :	Rotating ring with lever (Lever position is changeable)
Direction :	Clockwise for telephoto*
Torque :	800 g-cm
Angular Rotation :	120°
Focus Control :	Rotating ring
Direction :	Clockwise for infinity*
Torque :	800 g-cm
Angular Rotation :	100.4°
Iris Control :	Rotating ring
Direction :	Clockwise for opening*
Torque :	800 g-cm
Angular Rotation :	95°
f/stop :	2.2, 2.8, 4, 5.6, 8, 11, 16, 22, close
T/stop :	2.7, 4, 5.6, 8, 11, 16, 22
Macro Control :	Rotating ring
Direction :	Clockwise for macro*
Torque :	1200 g-cm
Angular Rotation :	90°
Weight :	Approx. 1 kg (2.2 lbs)
Finish :	Black anodized
Range of Temperature :	−10°C to +40°C

*View from the front of lens :

Subject to alterations.

External View of Lens Mechanism



(Unit : mm)

Types of Lens Mounts

This lens can be mounted on cameras with Arriflex mounts such as Arriflex 16 St, 16M or other cameras having the same mounts. The flange focal distance of this lens is set at the prescribed measurement of 52.00 ±0.01. Therefore, excellent focus can be obtained by just mounting it on a camera that has accurate measurements. When you wish to readjust the flange focal distance, please consult your nearest Canon Dealer or Canon Service Center. The lens with C-mount is available by custom order.

Operations

1. Zooming

Telephoto is obtained by turning the zoom ring clockwise. (View from front of lens.) Four screw sockets are available for positioning the zoom lever.

2. Focusing

The focus is set at a long distance when the focus ring is turned clockwise. (View from front of lens.)

3. Iris Setting

Maximum aperture is obtained by rotating the iris ring clockwise. (View from front of lens.) Besides the F-number, the orange-colored T-number scale consists of graduations from 2.7 to 22, and "C" for diaphragm closed.

4. Macrophtography Mechanism

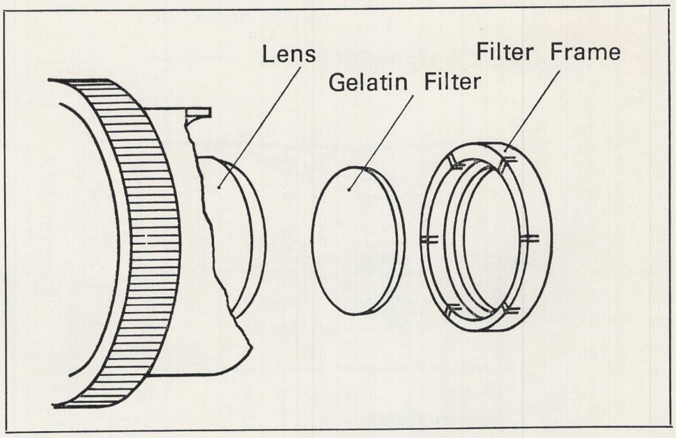
Macrophotography can be performed by pressing and releasing the lock and turning the macro ring clockwise until it stops. Moreover, the macro ring is set at the proper position in between when it is to be aligned to the shot to be taken. The macro ring must be in an accurately locked position for correct focusing during ordinary zoom operations.

In the Frost Zone

In the case of zoom lenses using artificial fluorite with a small relative aperture number (fast speed lenses) and a large zoom ratio, the focal point position at infinity changes according to temperature changes due to the special characteristics of artificial fluorite. In order to cope with this situation, no stop was incorporated at the infinity index mark so that a slight overrun can be made beyond the original index line. Therefore, even when photographing objects at infinity distance, you must look into the viewfinder to obtain the correct focus.

5. Filter Frame

The circular gelatin filter, 28mm in diameter, is put into the filter frame for use. The filter frame is pushed in at the rear end of the lens. Canon has available a series of 72mm front screw-in type filters.



How to Use the Macro Ring

1. Macrophotography

Closer focusing is possible by using the macro ring.
The relations of the macro ring and the object dimensions are as follows:

Scale of Focus Ring	Scale of Zoom Ring	Position of Macro Ring	Min. Object Distance	Object Dimensions (cm)
1.5m (5ft)	12mm	Lock	1.5m (5ft)	105×77
	120mm			10.7×7.8
		Setting to Stop	104cm (3.4ft)	7.5×5.5
	12mm		1mm (0.04in)	5.0×3.6

In Photo 1, the object distance is 1.5m (5 ft.) and the focal length is 120mm. In Photo 2, the lens is focused on an object at an object distance of 1mm (0.04 in.) when zoomed to a focal length of 12mm.

Photo 1
Focal length : 120mm   Macro Ring : Lock

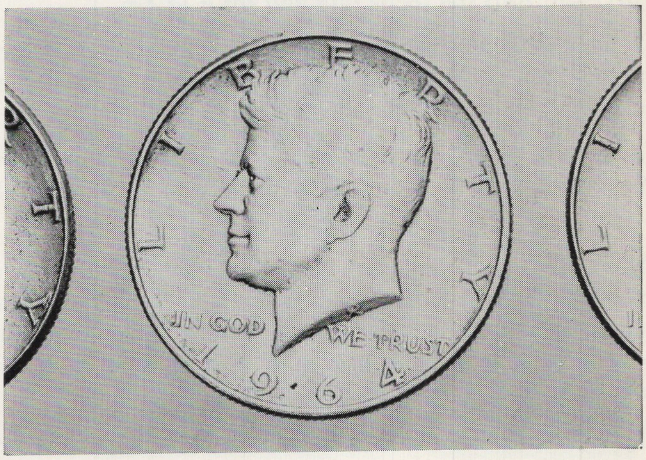


Photo 2
Focal length : 12mm   Macro Ring : Setting to stop

2. Multipoint Focus

As shown in Diagram 5, when the focus ring is set at 1.5m (5 ft.), the macro ring turned to Stop position, and the lens zoomed from 120mm to 12mm, the object distance changes from 1.04m (3.4 ft.) to 1mm (0.04 in.). In other words, the object distance moves consecutively from 1.04m to 1mm. This is called multipoint focus. (See the line marked 1 in Diagram 5.)

Operation Example

The following operations are performed in order to change the moving range of this sharp focus when the focus ring is set at 4m and the macro ring is turned to 9°, the object distance changes from 3.6m to 0.5m. (See the line marked 2 in Diagram 5.)

Steps

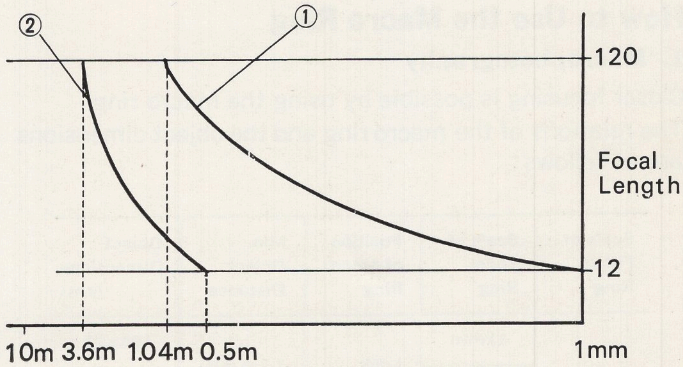
1. Keep the macro ring locked, set the zoom ring at 120mm, turn the focus ring and set it at 4m.

2. Keep the focus ring as is, set the zoom ring at 12mm, unlock and then turn the macro ring and focus on an object at the object distance of 0.5m.

3. Then, the object distance moves from 3.6m to 0.5m by changing the zoom ring rotating from 120mm to 12mm.

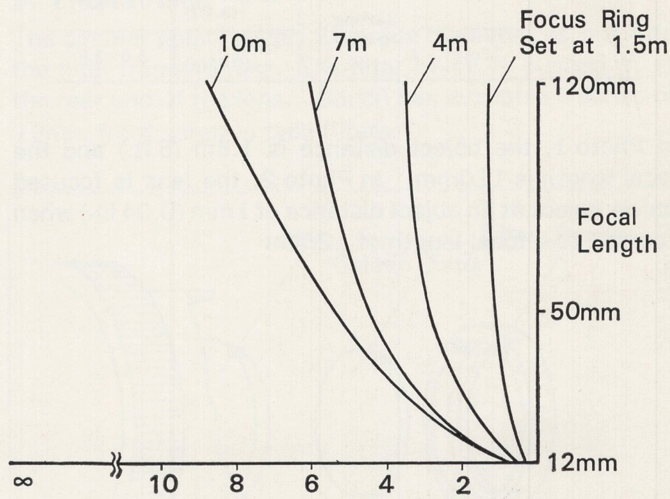
Note : Above mentioned operations are in the case of the object distance at 3.6m and focal length at 120mm and object distance at 0.5 and 12mm. In your actual operations, repeat steps 1 and 2 in order to obtain sharp focus.

Diagram 6 shows the relationship between object distance and focal length when the macro ring is turned to 40° and the focus ring is changed.
Diagram 7 shows the relationship between object distance and focal length when the focus ring is set at 5m and the macro ring is changed.



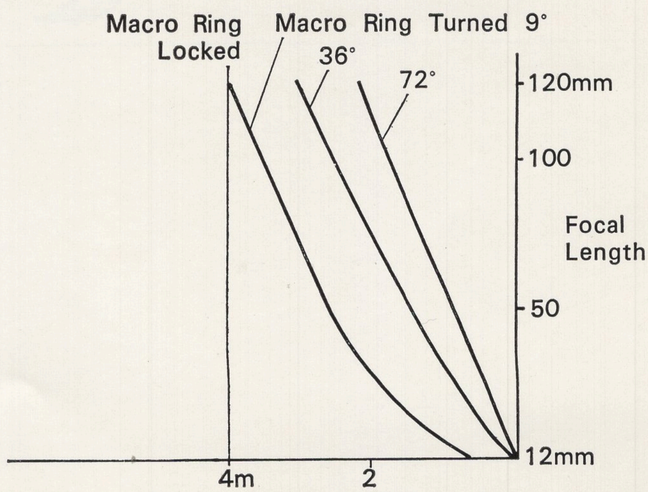
Object Distance

Diagram 5



Object Distance

Diagram 6



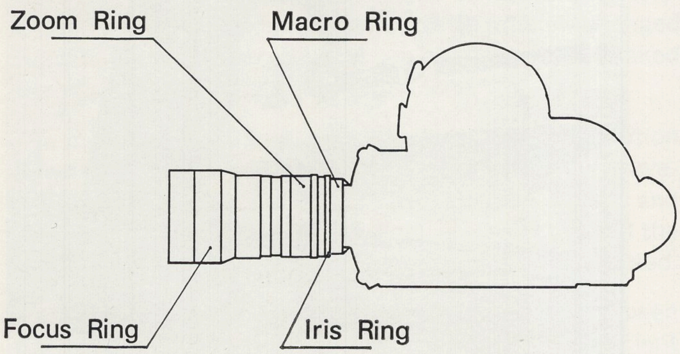
Object Distance

Diagram 7

3. Examples of Multipoint Focus

Next, let us explain these diagrams by using photo examples. In Photo 3, the lens is focused on the flowers in the foreground at an object distance of 0.5m (1.6 ft.) and with the focal length set at 12mm. When zooming is performed, the focal point, in accordance to the focal length, moves to the man in the middle. At the telephoto end, when the focal length is 120mm, the lens is focused on the closed-up face of the girl who is standing at an object distance of 4m (13 ft.) as shown in Photo 4. Completely different and new types of photographs can thus be obtained as compared with the simple zooming and close-up methods utilizing a unique macro mechanism.

Photo 3
Focused on the flowers at 12mm
Focus ring set at 4m. Macro ring turned to 9°



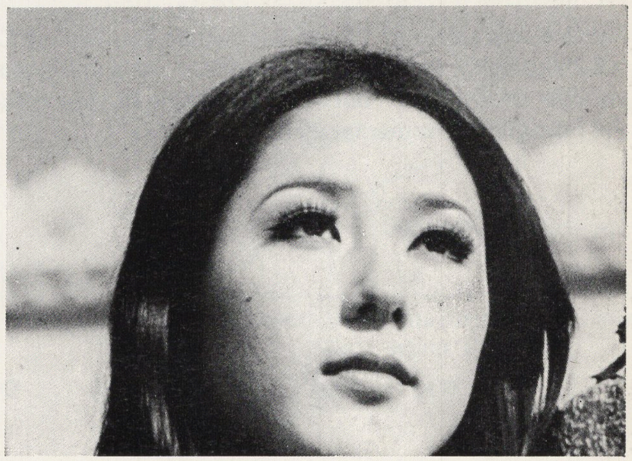


Photo 4
Focused on the girl at 120mm
Focus ring set at 4m. Macro ring turned to 9°

4. Perspective

Photo 5 was taken with an ordinary 120mm telephoto lens. At this focal length, it is impossible to identify the background.

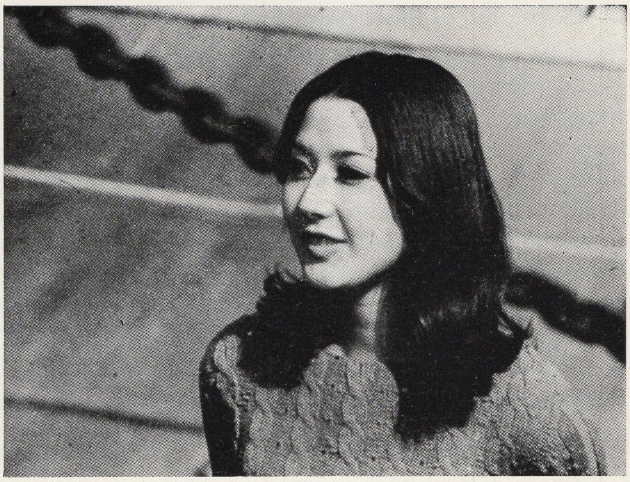


Photo 5
120mm focal length at 1.5m (5 ft.) focusing distance.
Focus ring set at 1.5m Macro ring at locked

Photo 6 was taken at 12mm wide-angle position of C10 ×12 and using the macro mechanism. It is still a close-up view of the girl, but the wide angle of view making the background immediately recognizable.

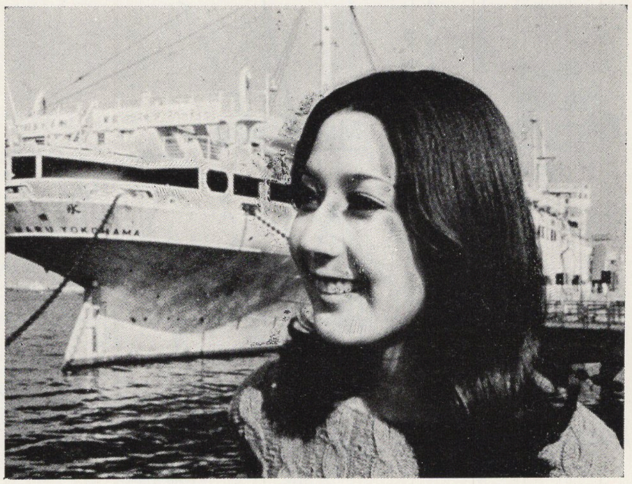


Photo 6
12mm focal length at 0.5m (1.6 ft.) object distance with Macro Ring
Focus ring set at 1.5m Macro ring turned to 9°.

Artificial Fluorite

Fluorite is one of the most recent optical materials, and calcium fluoride (CaF2) is an artificially crystalized material.

When fluorite is included in an optical system, the chromatic aberration of the system can almost all be eliminated. This is because fluorite possesses special optical characteristics of low dispersion and low refractive index which are not found in ordinary optical glass material.

Canon succeeded in developing a special production method for high grade artificial fluorite, and processing methods, in line with precision production, on a commercially feasible basis. As a result, an apochromatic lens was developed which is guaranteed for high quality because of its superb resolving power and contrast.

The chromatic aberration remains in all lenses made of ordinary optical glass material. And in almost all lenses the volume of residual chromatic aberration is in proportion to the focal length. Therefore, there is the tendency for the residual chromatic aberration to increase in telephoto lens. The residual chromatic aberration is changed to color blurs and flares which can be seen with the naked eye and decrease sharpness of the lens.

The method for eliminating residual chromatic aberration is called the achromatic method. Ordinarily the wavelengths of two points of yellow light (587mμ d line) and bluish purple light (435mμ g line) are selected and the chromatic aberrations of both wavelengths are corrected.

Many optical glasses called rare earth glasses have been developed. But under the achromatic method sufficient correction of chromatic aberration cannot be performed, even when these rare earth glasses are used, in the case of long focal length lenses. This residual chromatic aberration is called the secondary spectrum.

Next, when the wavelength of the third point of the red light (560mμ c line) is selected and the chromatic aberration of this wavelength is simultaneously corrected, this method is called the apochromatic method. Apochromatic lenses give higher optical performances than achromatic lenses. This is because, as shown in Diagram 8, the secondary spectrum has almost completely been eliminated.

Chromatic aberration generally depends on the dispersion and the refractive index of the optical glass material. When the dispersion of light by wavelength is indicated by Abbe index, and when its relation with sectional dispersion ratio is plotted, they line up almost in a straight line as shown in Diagram 9. If the optical glass materials having optical performances that line up on this straight line are used in combinations, it would be theoretically difficult to eliminate the secondary spectrum.
Artificial fluorite has characteristics that are not on this straight line. Therefore, by using combinations of this optical glass material, it can be used as an apochromatic lens to eliminate the secondary spectrum.

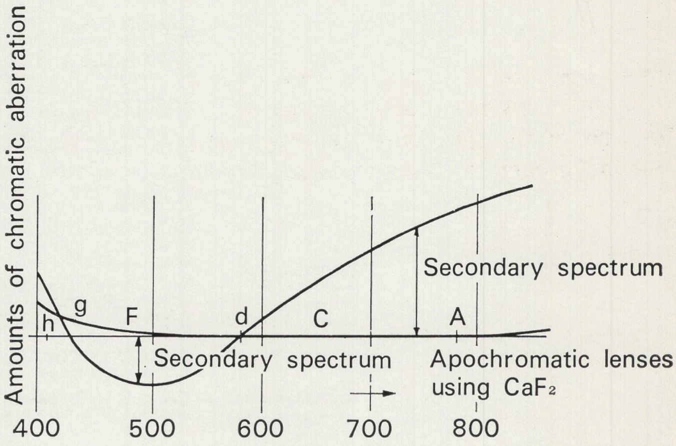


Diagram 8

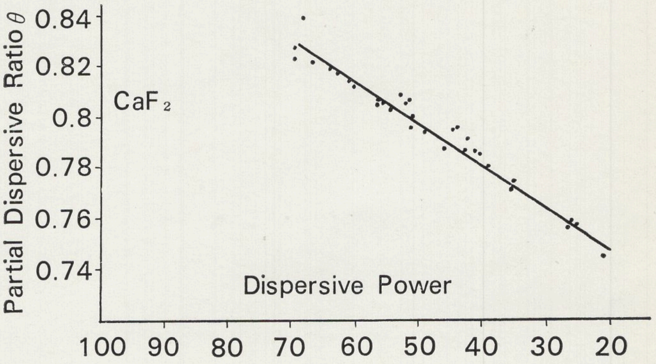


Diagram 9

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