Canon FD Lens L-Series

Expanding Horizons In Photography
Canon's Ultrahigh-Performance L-Series FD Lenses
The Ideal Achievement of Canon's Comprehensive Optical Engineering Capabilities

A superb camera body is a prerequisite for taking quality pictures. However, no matter how superb it may be, the camera body alone does not suffice. It requires equally superb matching interchangeable lenses. Canon's ultra-high-performance L-series FD lenses have been developed as the ideal and ultimate achievements of Canon's longstanding expertise in optical engineering.

Each lens has been developed to attain the optical performance of the "ideal lens". An ideal lens is an imaginary lens which meets the following three optical preconditions essential for the ideal reproduction of picture subjects: (1) a dot should be depicted as a dot, (2) a plane should be depicted as a plane, and (3) the picture should be a perfect reproduction of the subject with respect to its shape. The "ideal" lens meeting all these requirements reproduces the subject to perfection. To achieve high-performance lenses which can rival their "ideal" counterparts in optical capabilities, close methodological studies of optical theories become necessary. However, in practice, it is extremely difficult to create lenses that can approach the "ideal" in performance. Major obstacles in achieving this include (1) drawbacks attributable to the spherical curvatures of the elements, (2) problems arising from lens materials, and (3) problems caused by varying refractive indexes and the wavelengths of various colors of incident light. Any differences caused by conditions such as those mentioned above between the "ideal" lens and a lens being evaluated are called aberrations. To minimize such aberrations, optical design theories have been established. The L-series FD lenses have been developed to achieve the ultimate in correcting these aberrations. These lenses embody advanced optical concepts and are backed by excellent precision processing. They use special lens materials, and special aspherical lens elements, fluorite lens elements, and UD glass elements. Consequently they give extremely high performance. The designation "L" for Canon L-series ultrahigh-performance lenses stands for "luxury" and is indicative of the utmost aspiration to the "ideal lens".

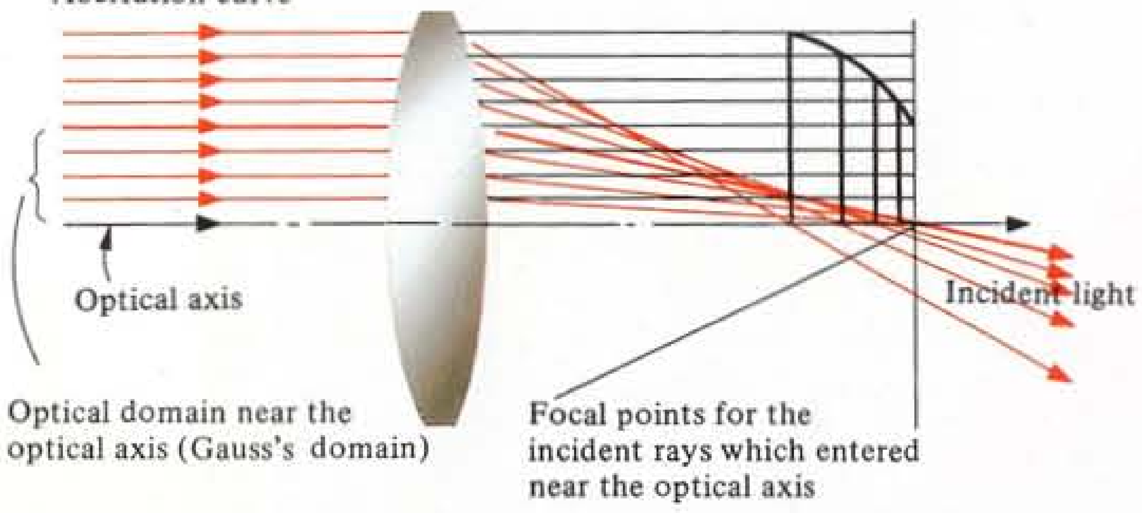

Aspherical element


Fluorite element

There are roughly two types of aberrations or deviations from the "ideal" lenses. These are (1) Seidel's five monochromatic aberrations and (2) chromatic aberration attributable to different wavelengths.

If an image is formed in a small area (called "Gauss's domain") using only the incident rays that are near the optical axis (i.e. rays at very small angles of incidence), aberrations are scarcely detectable. If only such incident rays close to the optical axes could be used, the "ideal lens" could be realized. However, the requirements for photographic lenses include large apertures and an ability to form sharp images, edge-to-edge, with uniform brightness over the entire image area. In practice, different photographic situations call for a wide range of interchangeable lenses such as wide-angle and telephoto lenses making it virtually impossible to achieve such "ideal lenses" since more than the rays in the vicinity of the optical axis must be used. In addition, the chromatic dispersion of the lens elements affects their optical performance. These various aberrations can be divided roughly into two categories based on how they affect image formation. One refers to monochromatic aberrations called "Seidel's five aberrations" (i.e. spherical aberration, comae, astigmatism, image field curvature, and image distortion). The other is chromatic aberration which is caused by the different wavelengths of the incident light. All these aberrations influence each other in complex ways and affect the image-forming performances of lenses. Aberrations remaining in a lens are called "residual" aberrations. Distinctive expressive nuances, such as softly out-of-focus images, are produced by these residual aberrations.

Aberration curve



Spherical aberrations, visible as flares, caused by spherical lenses affect picture clarity. This becomes a major problem for fast lenses with large apertures such as f/1.2. Some of the L-series lenses have eliminated this problem by using an aspherical lens element.

Spherical aberrations are caused by spherical elements in the following manner. Incident light coming from a subject, and travelling along the lens's optical axis, does not converge at a single focal point on the optical axis after passing through the lens, but spreads slightly. As a result, clear images become

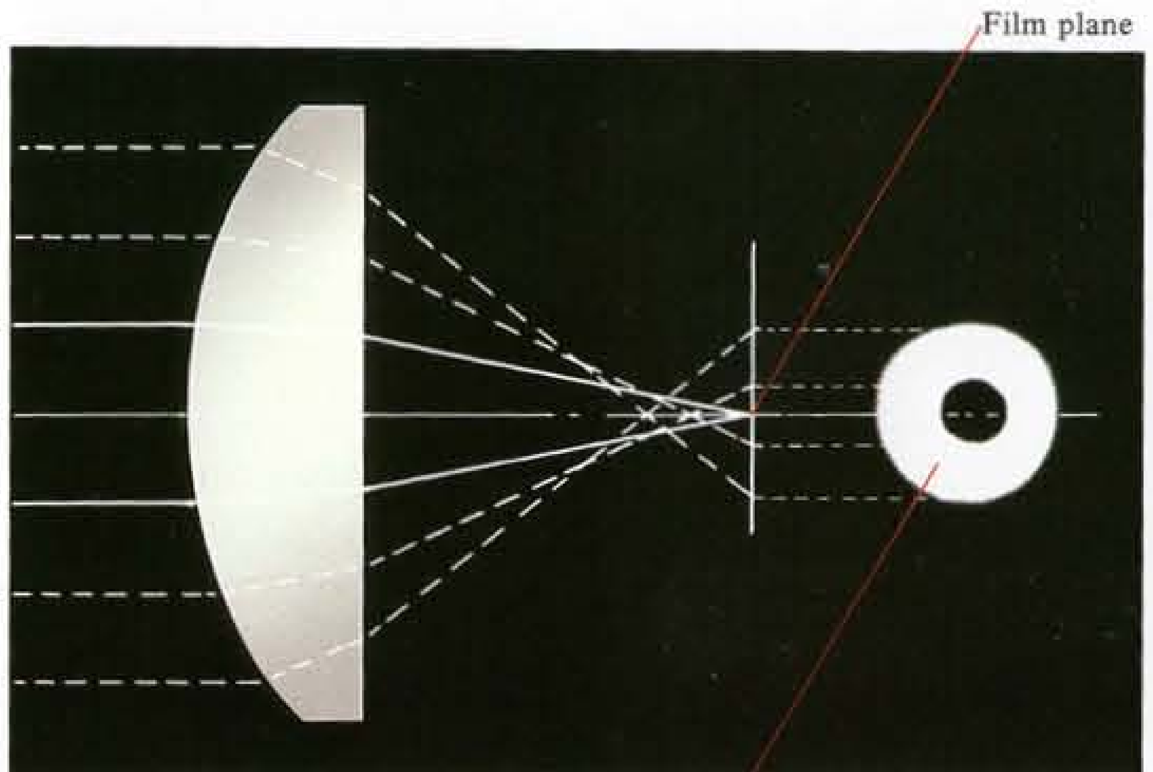

Shot with a lens incorporating an aspherical element


Shot with a spherical lens

impossible to obtain. In other words, incident light of different wave lengths converges at different places on the optical axis depending on where it entered the lens surface, at the periphery or at the lens center. Thus, images formed by incident light rays which pass near the optical axis are surrounded by images formed by other rays which pass through the lens periphery. This results in what is called "flare". Pictures displaying flare can appear rather flat as though viewed through a veil, since they lack definition. In particular, large-aperture lenses generate much flare due to large differences in the refractive indexes of their central portions and peripheries. Smaller apertures produce less flare. However, when using larger apertures, greater flare is inevitable. To thoroughly solve this problem, aspherical lenses have been developed with special surface curvatures, to make all incident rays converge at one point.

Aspherical lenses exhibit several excellent optical characteristics which are extremely difficult to achieve using spherical lenses. These include (1) the elimination of large aperture spherical aberration, and (2) the elimination of wide-angle distortion.

Most lenses have curvatures which represent sections of spheres. In contrast, aspherical lenses have peculiar shapes, and specially formed peripheries for optimal refraction of incident light to produce precise convergence. Lenses with non-spherical lens curvatures on their rotation symmetry are called



Spherical aberration caused by a spherical lens

"aspherical" lenses. Because of the aspherical shape, lens mass production is technically difficult.

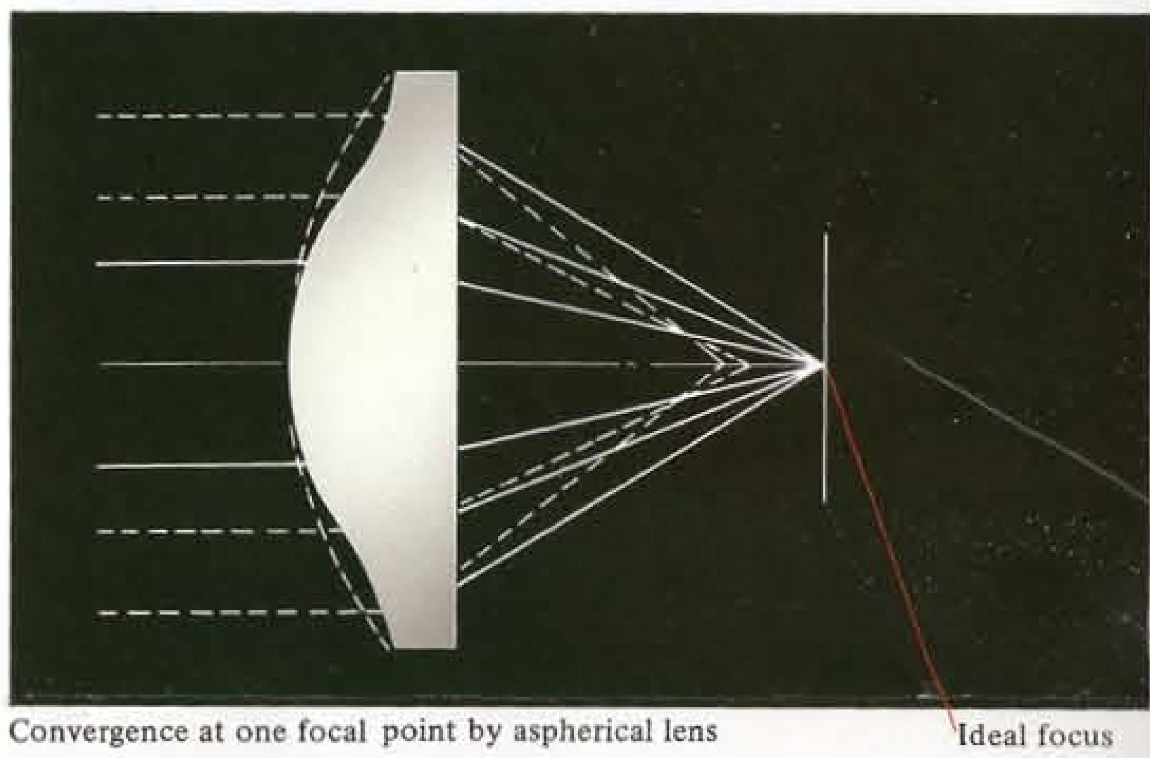
Aspherical lens characteristics:

(1) Elimination of large-aperture spherical aberration

With a large-aperture spherical lens, incident light converges at various places depending on where it entered due to different refractive indexes between peripheral portions and central portions. Spherical aberration appears as low-contrast, flat pictures. In many cases, smaller apertures correct this condition, but this inevitably becomes a major drawback when pictures require wider apertures. To eliminate this objectionable feature, aspherical lenses have varying curvatures which permit all incident rays to focus at one point. For example, the FD 85mm f/1.2L short-telephoto lens, featuring an extremely large f/1.2 maximum aperture, uses an aspherical element as its second element. The lens enjoys an established reputation for its capabilities to shoot high contrast pictures up to its maximum aperture. This is attributable to the aspherical lens element.

(2) Elimination of wide-angle image distortion

Pictures taken using aspherical wide-angle lenses have no distortion even in their peripheries. This is because aspherical lenses are designed to compensate for image distortion through the use of ideal lens shapes. Aspherical lens elements also contribute to reducing the overall lens size. For example, the FD 14mm f/2.8L uses an aspherical lens element with an extremely accurate aspherical shape for the front first surface of its second lens element. This element has made it possible to achieve a compact lens design; although it is a super wide-angle lens (with an extremely wide diagonal angle of view of 114°) capable of reproducing distortion-free normal images. With a large maximum aperture of f/2.8, its maximum outer diameter measures a mere 74mm.

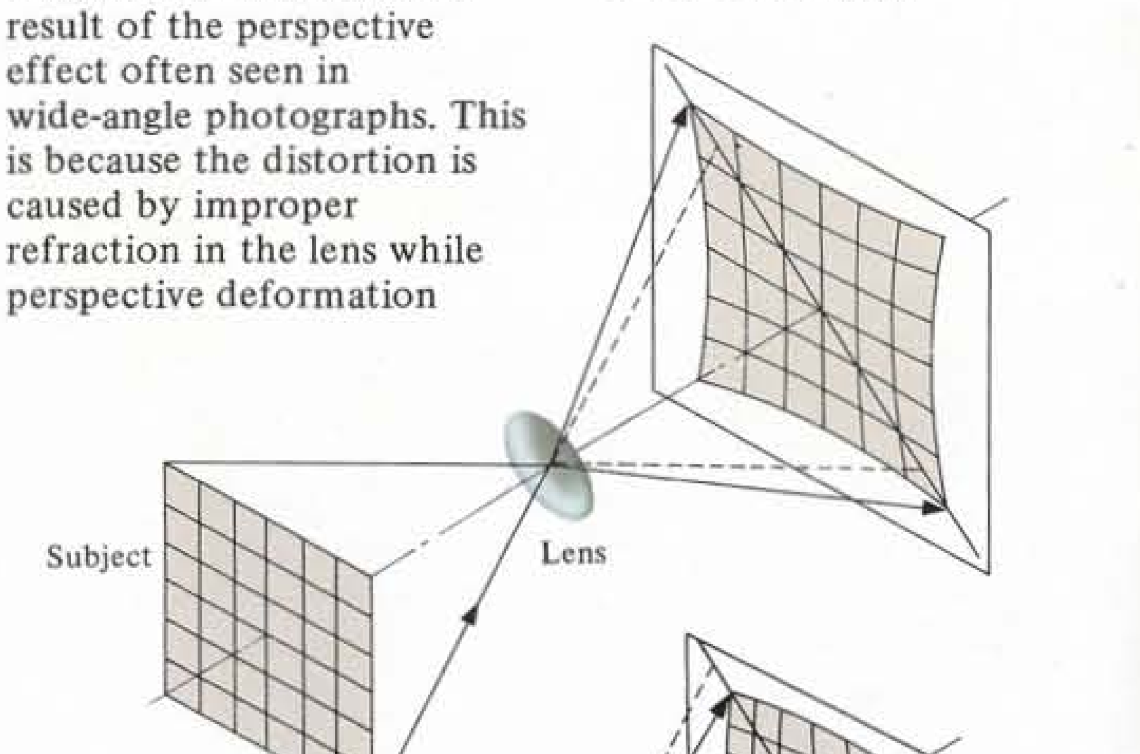


Convergence at one focal point by aspherical lens

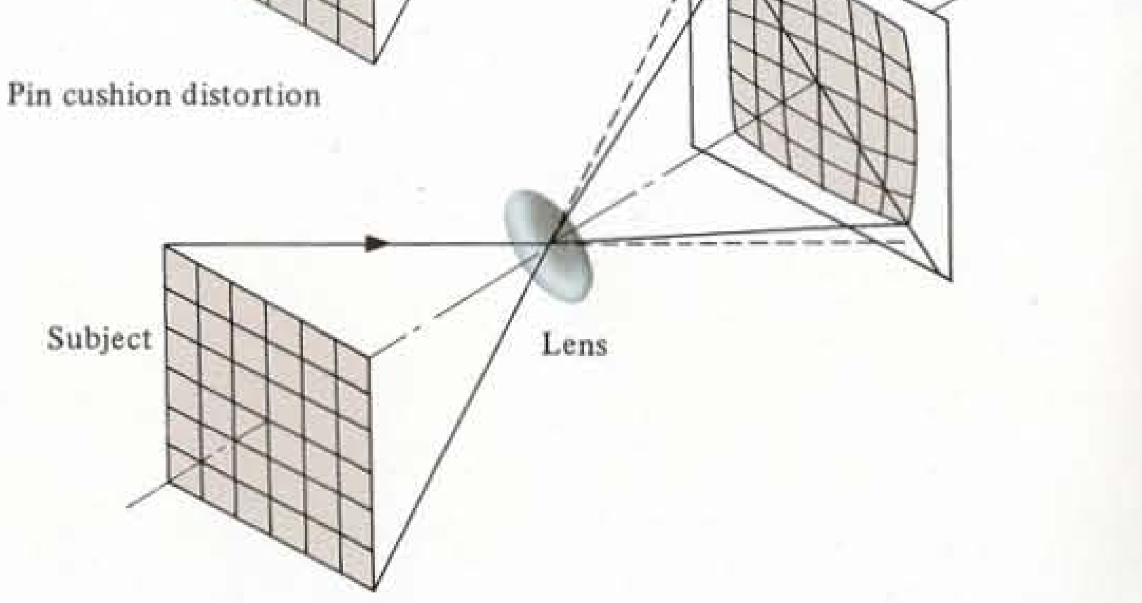
Aspherical lenses eliminate pin cushioning and barrel-form distortion which is found in photographs taken using conventional wide-angle and short focal length zoom lenses.

Picture distortion refers to a phenomenon in which the photograph does not accurately represent the subject. For example, a square plane figure may be imaged like a pin cushion or a barrel shape in the image field. Thus, pictures are distorted even if their sharpness remains completely unaffected. The distortion dealt with here is, however, quite different from image deformation obtained as a result of the perspective effect often seen in wide-angle photographs. This is because the distortion is caused by improper refraction in the lens while perspective deformation expresses subject depth.

In general, zoom lenses tend to show barrel distortion as zooming approaches the wide-angle end while pin cushion distortion increases at the telephoto end. Since aspherical lenses eliminate these types of distortion, they are used in the super wide-angle lenses, wide-angle lenses, and wide-angle zooms in the L-series product line. Using aspherical elements in its wide-angle zooms, Canon has led in the application of aspherical elements. Among others, the FD 20 – 35mm f/3.5L incorporates an aspherical element for enhanced optical performance while at the same time eliminating barrel distortion.



Pin cushion distortion



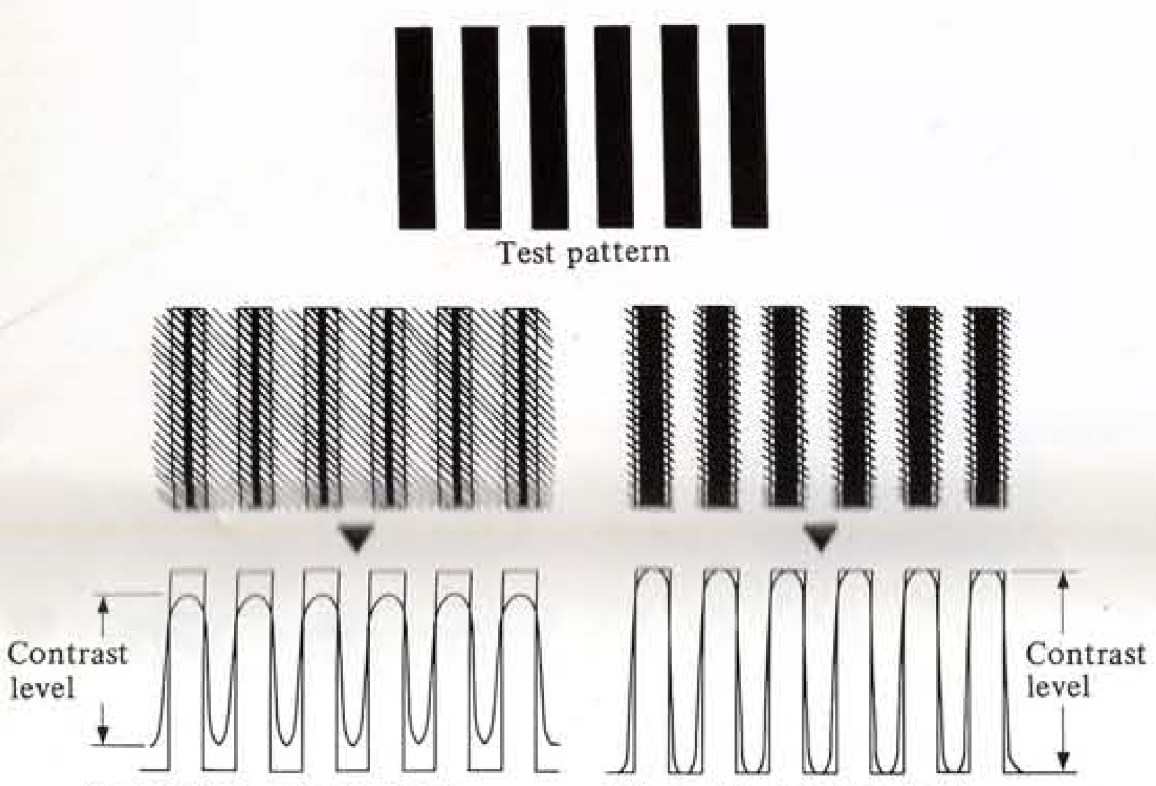
Barrel form distortion

For best results use Canon SLR camera bodies with Canon FD lenses

Canon FD interchangeable lenses are designed and manufactured to be used with Canon SLR camera bodies. When so used, they will give best optical performance by capitalizing on the superb capabilities incorporated in the camera bodies.
Canon will not be responsible for accidents, breakdowns, substandard picture quality, etc. that are attributable to the use of interchangeable lenses of other makes with Canon camera bodies. To make picture-taking your lifelong pleasure, remember to use Canon FD lenses on your Canon camera.

Due to their extremely complex aspherical shape, state-of-the-art engineering capabilities, far higher than those required for the development of spherical lenses, are indispensable in the following three areas to develop aspherical lenses; (1) designing, (2) polishing, and (3) measurement.

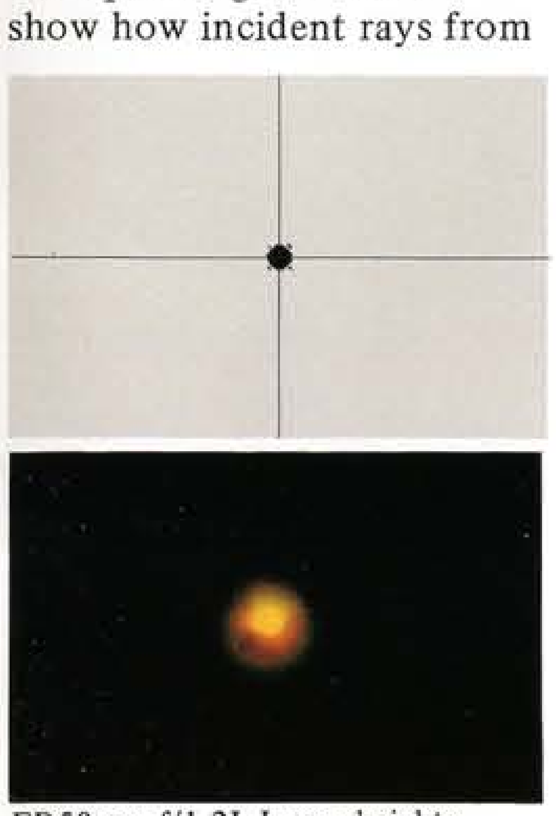
There are two major reasons why most lenses are manufactured with spherical curvatures. First, spherical curvatures can easily be expressed numerically which facilitates design. Second, production is relatively easy. Far higher engineering capabilities than those conventionally required to manufacture spherical lenses become essential for the production of aspherical lenses, i.e. for (1) the design, (2) the polishing, and for (3) the measurement.
Because of their continuously varying curvatures, expressing the shape of aspherical lenses numerically at the design stage is extremely difficult. To facilitate this operation, Canon has adopted computer simulation techniques.
Canon's longstanding polishing techniques for spherical lens production were no longer applicable to aspherical lens surfaces. For this reason, completely new equipment had to be developed. New measurement equipment using laser technology had to be developed as well.
As discussed, the production of aspherical lenses has become possible through the R & D of completely new equipment and manufacturing systems.



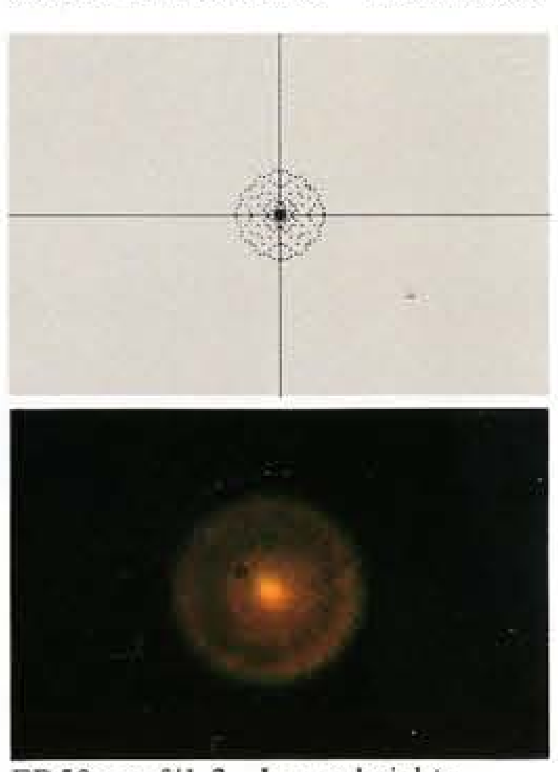
Shot with a spherical lens — Shot with an aspherical lens

The high performance of aspherical lenses can easily be understood by examining the spot diagrams. The aspherical lens displays a sharp convergence of dots and provides extremely flare-free reproductions.

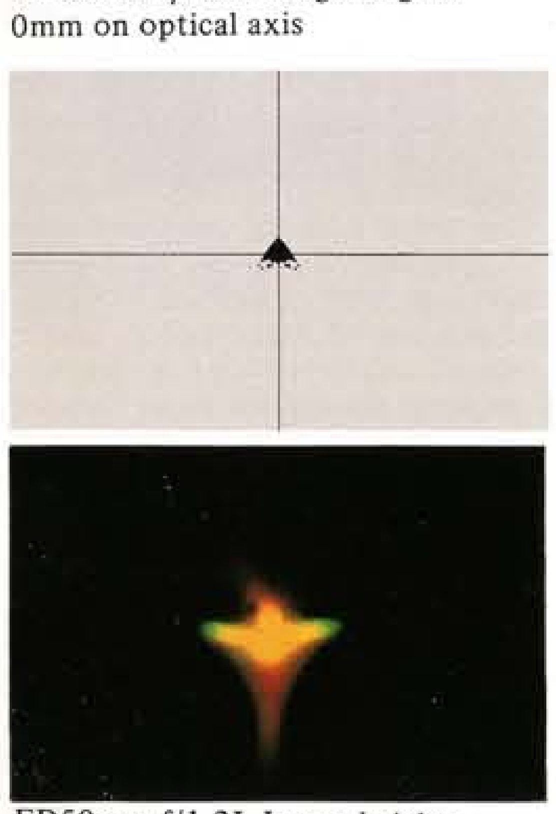
The spot diagrams below show how incident rays from one point on a subject converge at the film plane. The black dots represent the places where image-forming light has impinged. The difference between the degrees of dot convergence directly represents the amount of flare inherent in spherical counterparts. The high performance of aspherical lenses can be thus visualized.



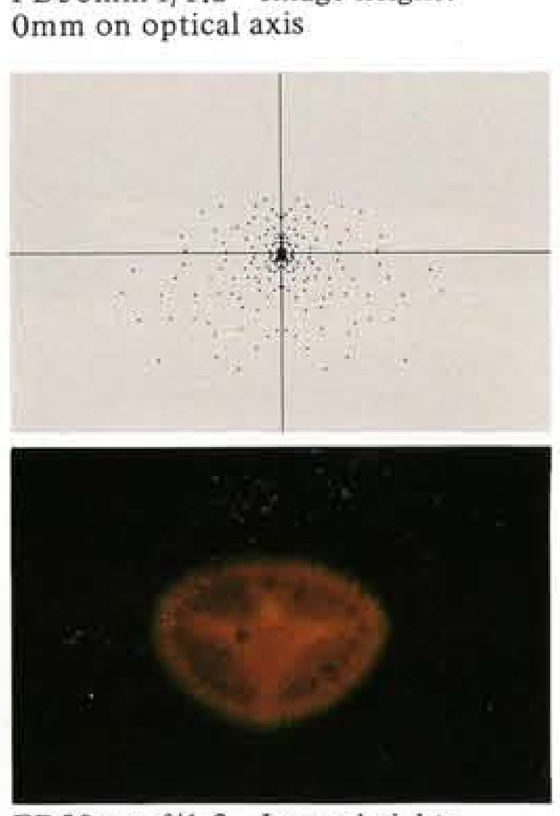
FD50mm f/1.2L Image height: 0mm on optical axis



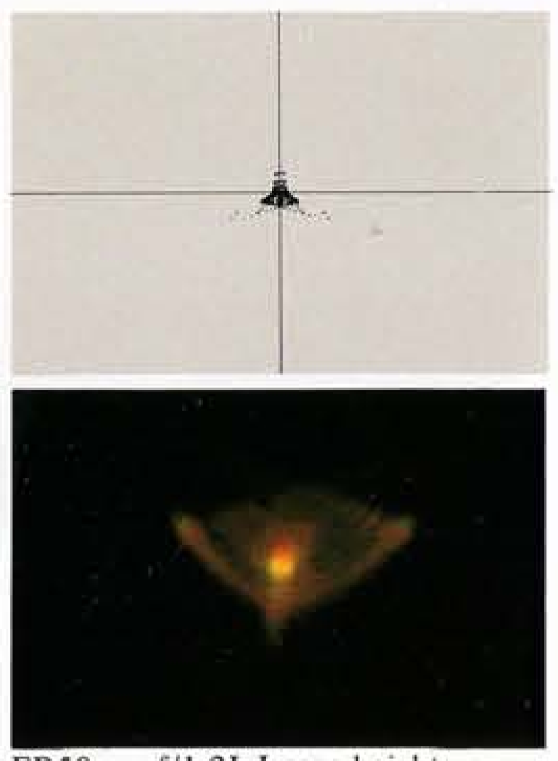
FD50mm f/1.2 Image height: 0mm on optical axis



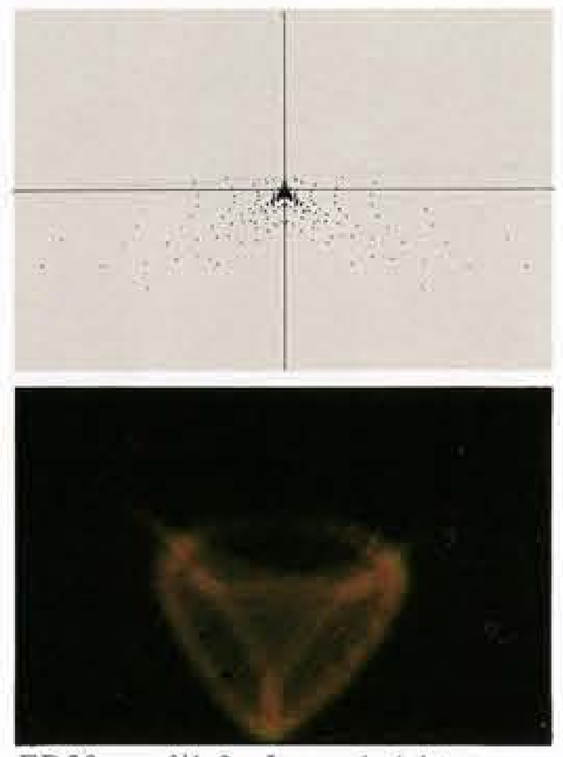
FD50mm f/1.2L Image height: 8mm above optical axis



FD50mm f/1.2 Image height: 8mm above optical axis



FD50mm f/1.2L Image height: 16mm above optical axis



FD50mm f/1.2 Image height: 16mm above optical axis

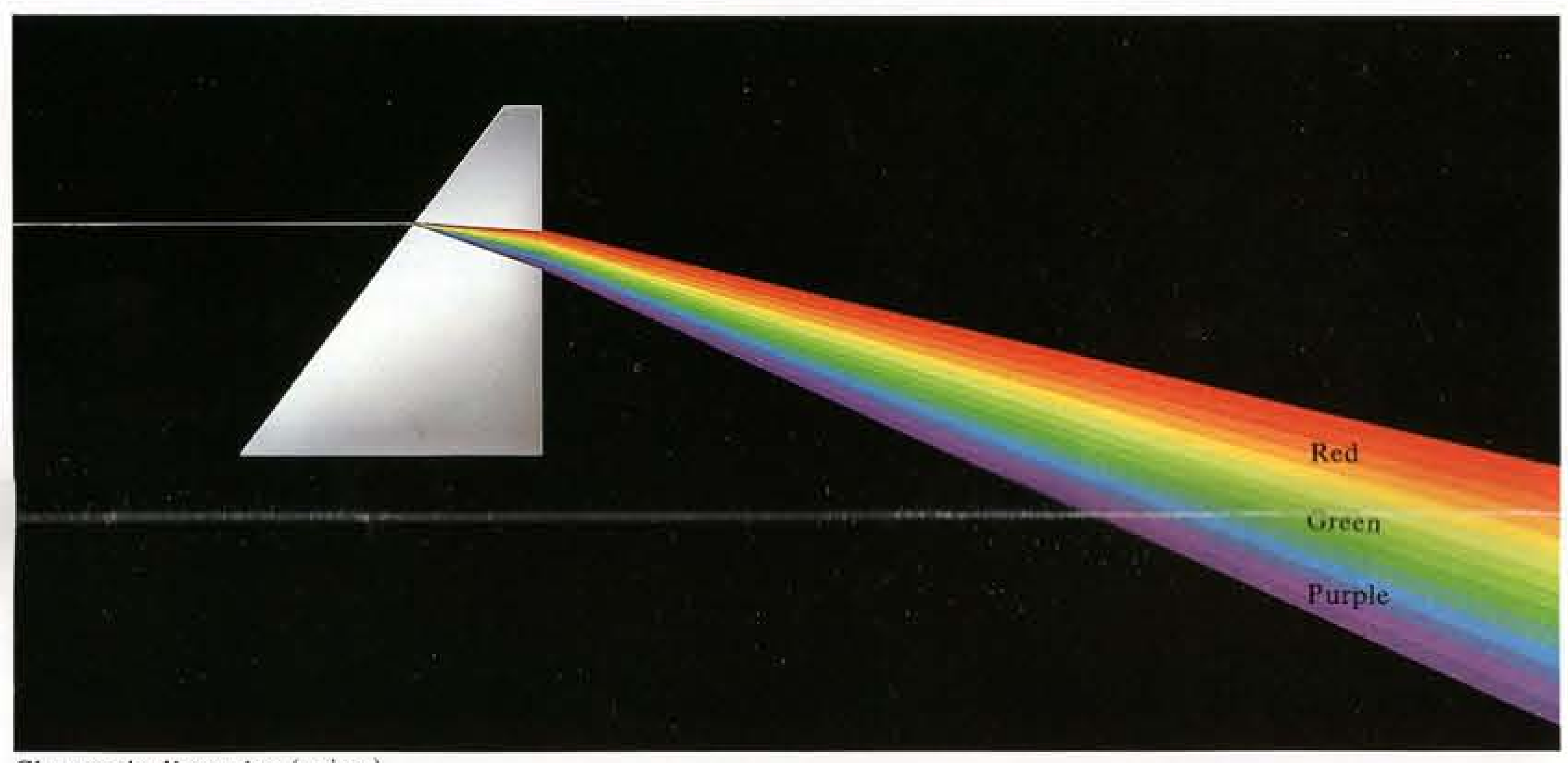
Since the introduction of the FD 55mm f/1.2AL, the world's first aspherical SLR camera lens went on mass production, Canon has constantly been breaking fresh ground in the world of photography by adding a variety of new aspherical lenses to its interchangeable lens product line.

Although research had been conducted on aspherical lenses at various camera manufacturers, a number of years had to elapse before the first aspherical lens finally appeared on the general photographic market, except for a few special-purpose aspherical lenses. The Canon FD 55mm f/1.2AL (see

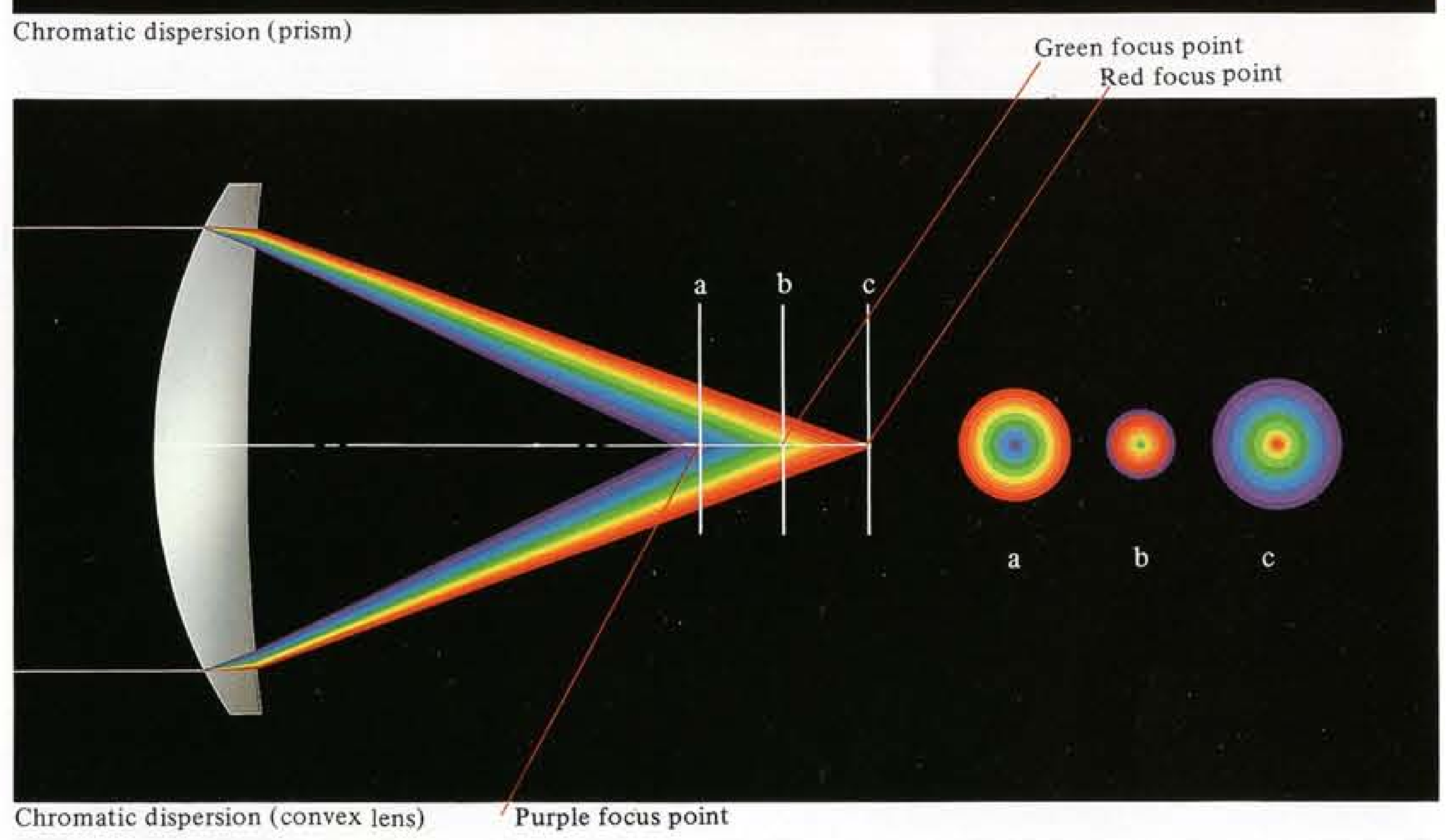
photo) was the world's first interchangeable SLR aspherical lens to go into mass production. It was introduced to the market in March of 1971. Following this, the FD 24mm f/1.4L and the FD 85mm f/1.2L aspherical lenses debuted on the occasion of the 1974 Photokina. Canon thus has taken the lead in expanding new horizons in aspherical lens application, even in the realm of interchangeable lenses. The L-series, at the moment, includes a total of five aspherical lenses. The history of these aspherical lenses also reveals Canon's advanced optical engineering capabilities.

White light contains all the colors of the rainbow, or a broad spectrum of light. Because of wavelength differences, chromatic aberration takes place. In particular, the correction of chromatic aberration becomes a crucial factor in designing telephoto lenses.

To produce ideal pictures, the correction of chromatic aberration became one central problem to be solved. Chromatic aberration is generated when white light such as sunlight is focused since it contains the broad spectrum of colors observed using a prism. This phenomenon results from the different wavelengths of these colors and is called dispersion of light. Chromatic aberration can be optically defined as deviation in focusing position from a reference focus point. In other words, if a film is placed at a green focus point, all other image-forming colors will converge on the film plane slightly in front of or behind the green focal point producing a surrounding flare. This means a decrease in sharpness. Chromatic aberration increases with focal length because of the different locations of the focal points of the various colors produced by light dispersion. For this reason, the correction of chromatic aberration is still one of the most important R & D themes to be worked out when designing telephoto lenses.



Chromatic dispersion (prism)



Chromatic dispersion (convex lens)

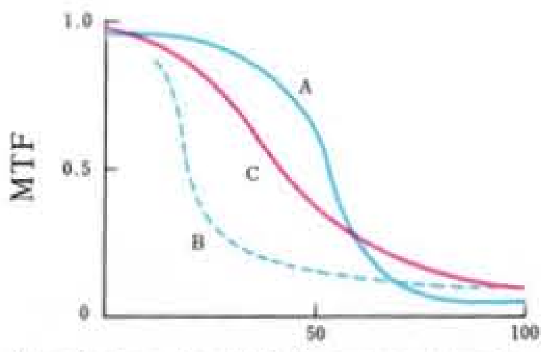
With regular optical glass, residual chromatic aberration, or the secondary spectrum, theoretically can not become smaller than the amount calculated by the following equation: the focal length x 2/1,000mm. To overcome this drawback, fluorite came into use as a new lens material featuring various valuable optical characteristics not to be found in regular optical glass.

To compensate for chromatic aberration, two regular optical glass elements are combined to create achromatic lenses. These lenses are capable of compensating for chromatic aberration in two wavelengths: for the yellow (d-rays) and the purple (g-rays). However, light in other wavelengths, remains uncompensated for such as the red (c-rays). Namely, an achromatic lens can only compensate for chromatic aberration at two wavelengths. The remaining chromatic aberration or the residual chromatic aberration or "secondary spectrum" theoretically can not become smaller than a amount given by the equation; the focal length x 2/1,000mm, when optical glass materials are used. To overcome this restriction, fluorite was adopted as a new type of optical material. Fluorite lenses are capable of compensating for chromatic aberration at three wavelengths with fluorite's distinctive optical characteristics, significantly different from regular optical glass materials. A fluorite element characterized by its anomalous dispersion is made from a large-size artificial calcium fluoride (CaF_2) crystal. In addition to a higher degree of anomalous dispersion, it has a lower dispersion index when compared with an optical glass counterpart. (Thus, these characteristics are effective for minimizing the secondary spectrum). An achromatic lens made by combining a convex fluorite element with a concave optical glass element eliminates nearly all chromatic aberration.
In addition to fluorite, there is an excellent optical glass material which is highly effective in compensating for chromatic aberration, called "UD" glass.
This is produced by dosing optical glass with fluorides. This new material features excellent fluorite optical performance. The development was made possible by two difficult production technologies. These involve the mixing of the required ingredients of the glass and then homogenizing this to form a quality optical glass material. The excellent optical performance of many of the L-series lenses, (in particular, the high optical definition of the telephoto lenses) results largely from the developments of these fluorite and UD glass materials.

Sharpness depends almost entirely on two factors; resolving power and contrast. MTF graphs are used to determine the sharpness of Canon lenses. Why the L-series lenses have such excellent sharpness can be understood from these graphs.

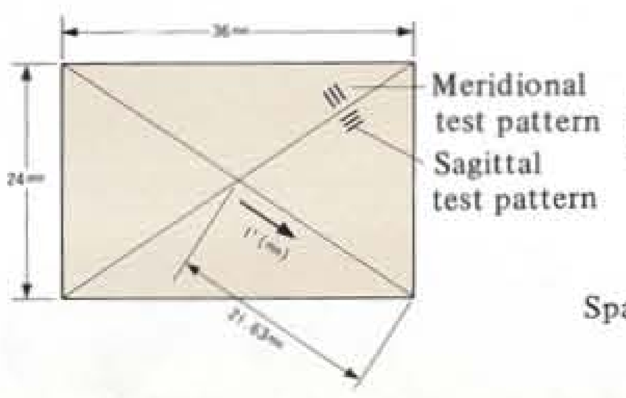
When discussing the optical performance of any lens, the sharpness, or the clarity of picture images are often examined. What is, sharpness? Sharpness involves the following lens qualities: resolving power and contrast. Resolving power is the ability of a lens to precisely reproduce fine detail from the subject; contrast contributes varied levels of shading or density to the subject picture. The incorporation of both qualities is a prerequisite for any high-performance lens. To determine lens sharpness, a method called the MTF (Modulation Transfer Function) is employed which uses test charts consisting of black and white lines drawn alternately and equally spaced within spaces of 1mm. A number of charts are available, each with a different number of lines (1 to 100 lines) drawn within such 1mm spaces. These charts are photographed using a lens being evaluated. The lens' reproduction capabilities, derived from an MTF test, are then numerically expressed in the form of MTF curves. (In actuality, measurement is conducted electronically). Taking the MTF graph below as an example, the perfect reproduction condition is expressed by an MTF value of 1 which refers to a 1:1 ratio, or a ratio of perfectly-reproduced contrast to a unity value of 1 which represents the contrast of the test chart used. The number of black lines in the test chart is converted into a spatial frequency. By measuring the amplitude, or the MTF value, at each spatial frequency, sharpness can be determined.

The "C" curve shown in the graph represents high resolving power all across the spatial frequency range by always maintaining relatively high MTF values. Only high-performance lenses that show ideal MTF curves such as this are added to the Canon FD lens product line, especially, to its select L-series.

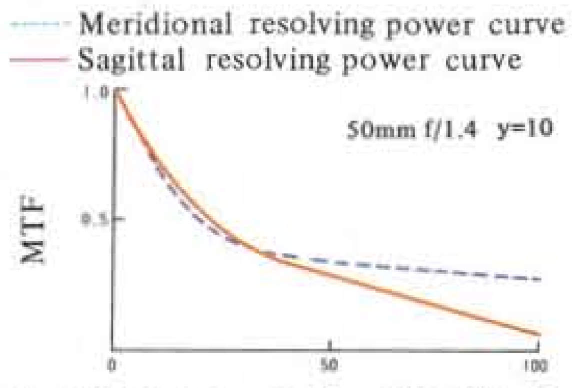


Resolution (spatial frequency/mm)

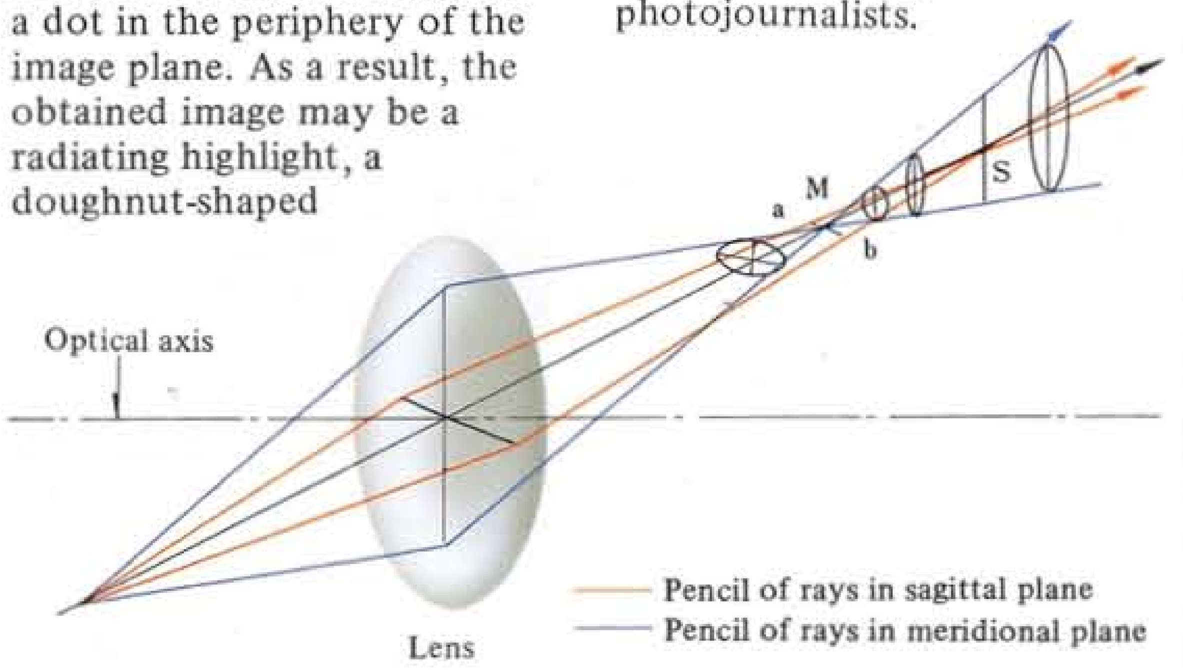
Two MTF curves indicate lens performance with respect to two directions of test patterns. The first curve (drawn using a dotted line in the graph below) indicates the meridional resolving power for a test pattern drawn tangential to the circumference while the second curve (a solid line) indicates the sagittal resolving power for a test pattern drawn perpendicular to the circumference.



To determine the image forming performance at a point distanced from the optical axis on the image plane, it is necessary to take both meridional and sagittal test patterns into consideration. The former and the latter patterns are drawn tangential to and normal to a circumference, respectively, which shares the optical axis as its central axis. MTF measurements are conducted for these patterns laid out in both these directions. In the graph below, a meridional and a sagittal curve are shown as a dotted line and a solid line, respectively. MTF curves obtained this way indicate the astigmatic and comatic aberration of the lens under evaluation. If either one of the curves, the meridional or sagittal curve, drops too far in MTF value, a dot does not come to a focus or image as a dot in the periphery of the image plane. As a result, the obtained image may be a radiating highlight, a doughnut-shaped image, a segment of a line, a comet-like appearance, etc. Out-of-focus highlights are not acceptable from an aesthetic point of view either, since they take on elliptical or comet-like appearance. The high meridional and sagittal MTF values obtained on the L-series lenses also substantiate their solid reputations for their excellent sharpness and capabilities to achieve excellent out-of-focus highlights among photojournalists.



Spatial frequency (number of lines/mm)



Although fluorite has been known as an excellent lens material from early times, it took many years before it came to be used in photographic lenses. Two major obstacles were the difficulty in growing large-size artificial fluorite crystals and the other, high production costs. Canon began marketing its first two fluorite lenses as early as in 1969.

The excellent optical characteristics of fluorite for compensating for chromatic aberration were known as early as the 1800s. Since fluorite was obtainable only as natural crystals, only small fluorite elements had been used in small optical lenses such as microscope objectives. In later years, in the 1920s, technological advancements made it possible to grow artificial crystals and paved the way for applications in telescopes and other optical instruments. However, because of its extremely high price, artificial fluorite could not make headway in photographic applications. Against this backdrop, Canon embarked on the R & D of the production techniques for artificial fluorite and succeeded in developing its first two fluorite lenses in 1969 and marketed them. These were the FL-F300mm f/5.6 (see photo) and the FL-F500mm f/5.6. In 1973, Canon added the FL300mm f/2.8 "FLUORITE" to the new product series. The lens' high optical performance and excellent color reproduction capability won photojournalists' high praise. The current total of seven ultrahigh-performance lenses, characterized by the use of fluorite or UD elements or both, in the L-series have been developed using Canon's many years of comprehensive optical engineering.

Designation	Type	Lens construction	Angle of view Diagonal	Vertical	Horizontal	Minimum aperture	A mark (AE setting for exposure measurement at open aperture)	Aperture	Distance scale (m)	Magnification at the closest distance	Filter diameter (mm)	Length and max. diameter (mm)	Weight (g)	Hard case (LH) Article No.	Hood Article No.	Soft case (LS) Article No.
FD 14mm f/2.8L	Super wide-angle (Aspherical)	14 elements in 10 groups	114°	81°	104°	22	○	Automatic	0.25—2•∞	0.099		83.5×74	500	C13	Built-in	B11
FD 24mm f/1.4L	Wide-angle (Aspherical)	10 elements in 8 groups	84°	53°	74°	16	○	Automatic	0.3—3•∞	0.12	72	68×76.5	430	C13	BW-72	B11
FD 50mm f/1.2L	Standard (Aspherical)	8 elements in 6 groups	46°	27°	40°	16	○	Automatic	0.5—10•∞	0.13	52	50.5×65.3	380	B9	BS-52	A9
FD 85mm f/1.2L	Short-telephoto (Aspherical)	8 elements in 6 groups	28°30′	16°	24°	16	○	Automatic	0.9—10•∞	0.12	72	71×80.8	680	C13	BT-72	B11
FD 300mm f/2.8L	Telephoto (Fluorite and UD)	9 elements in 7 groups	8°15′	4°35′	6°50′	32	○	Automatic	3—50•∞	0.11	48	245×127	2,345	Dedicated-type	Built-in	—
FD 300mm f/4L	Telephoto (UD)	7 elements in 7 groups	8°15′	4°35′	6°50′	32	○	Automatic	3—50•∞	0.11	34	207×85	1,070(+145)	D24	Built-in	—
FD 400m f/2.8L	Super telephoto (UD)	10 elements in 8 groups	6°10′	3°30′	5°10′	32	○	Automatic	4—50•∞	0.11	48	348×166	5,395	Dedicated-type	Built-in	—
FD 500mm f/4.5L	Super telephoto (UD)	7 elements in 6 groups	5°	2°45′	4°	32	○	Automatic	5—50•∞	0.14	48	395×128	2,610	Dedicated-type	Built-in	—
FD 800mm f/5.6L	Super telephoto (UD)	7 elements in 6 groups	3°06′	1°40′	2°25′	32	○	Automatic	14—100•∞	0.057	48	577×154	4,270	Dedicated-type	Built-in	—
FD 20-35mm f/3.5L	Wide-angle zoom (Aspherical)	11 elements in11groups	94°—63°	62°—38°	84°—54°	22	○	Automatic	0.5—3•∞	0.05—0.08	72	84.2×76.5	470	C13	BW-72	B13
FD 50-300mm f/4.5L	Telephoto zoom (UD)	16 elements in 13 groups	40°—8°15′	27°—4°35′	46°—6°50′	32	○	Automatic	2.53—30•∞	0.025—0.144	34	250×104	1,820(145)	Dedicated-type	S-100	—
FD 150-600mm f/5.6L	Telephoto/Super telephoto zoom (UD)	19 elements in 15 groups	16°20′—4°10′	9°10′—2°20′	13°40′—3°30′	32	○	Automatic	3—100•∞	0.07—0.26	34	468×123	4,260	Dedicated-type	Built-in	—


FD 14mm f/2.8L


FD 24mm f/1.4L


FD 50mm f/1.2L


FD 85mm f/1.2L


FD 300mm f/4L


FD 300mm f/2.8L


FD 400mm f/2.8L


FD 500mm f/4.5L


FD 800mm f/5.6L


FD 20-35mm f/3.5L


FD 50-300mm f/4.5L

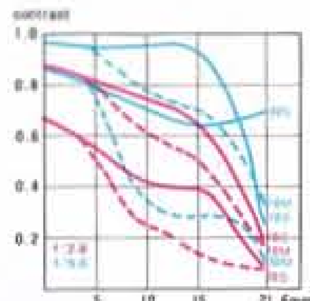

FD 150-600mm f/5.6L

FD14mm f/2.8L
ASPHERICAL

This lens can be called a "true" super wide-angle lens since it features such a large maximum aperture of f/2.8 for its extremely short 14mm focal length. It has a diagonal angle of view of 114° – more than twice that of a 50mm standard lens (46°) and nearly twice that of a 35mm/lens. (63°) The lens is constructed of 14 elements configured into 10 groups. In particular, its second element is aspherical having an extremely high degree of curvature on its front surface. This element almost completely eliminates the distortion that usually is characteristic of super wide-angles and is extremely difficult to correct. The unique aspherical element renders normal image reproduction distortion-free. Spherical aberration is virtually non-existant while excellent sharpness remains. Despite the lens' large maximum f/2.8 aperture, its optical system is remarkably compact. Canon's Floating System eliminates aberrations at close shooting distances and ensures edge-to-edge sharpness throughout the entire focusing range.

Focal length: 14mm
Aperture ratio: 1:2.8
Lens construction: 14 elements in 10 groups
(including 1 aspherical element)
Coating: S.S.C.*
Angles of view: Diagonal: 114°
Vertical: 81°
Horizontal: 104°

Distance scale:
(m) 0.25 (magnification 0.099x) to 2, and infinity
(ft.) 0.9 to 7, and infinity
Focusing: Helicoid
Minimum aperture: f/22
Aperture type: Fully automatic
Filter: Gelatin filter holder
Hood: Permanently attached
Length and max. diameter: 83.5mm x 74mm
Weight: 500g



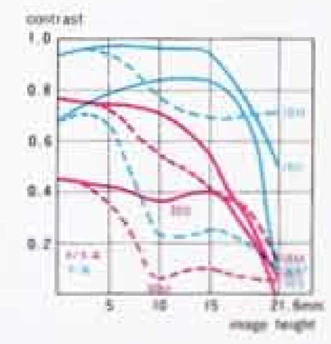
FD24mm f/1.4L
ASPHERICAL

This epoch-making wide-angle lens boasts an extremely large maximum aperture of f/1.4 for its focal length, which is made possible through the incorporation of an aspherical element. With regular spherical lenses, it is not possible to completely eliminate flare which usually increases with aperture size and becomes most obvious at maximum aperture settings. The aspherical element has virtually eliminated flare while, at the same time, enhancing the resolving power and solving the problem of diminishing brightness at the periphery of the image field, a shortcoming of conventional spherical lenses. As a result, the lens is free from halo (often appearing in nighttime snapshots as blurred outlines of light sources such as lighted windows, street lights, etc.). This improvement makes it possible to shoot available-light photographs under relatively poor lighting conditions where the use of flash is not possible. The lens has, thus, drastically expanded the horizons for wide-angle photography. Barrel-form distortion inherent in spherical wide-angle lenses and comae are almost entirely absent. The lens offers excellent contrast as well as the extremely high image definition which is characteristic of aspherical lenses. Because of its relatively moderate distinctive perspective making for easy framing, the lens enjoys a solid reputation as an easy-to-use wide-angle lens. Close-up shooting down to a minimum working distance of 30cm is possible.

Focal length: 24mm
Aperture ratio: 1:1.4
Lens construction:
10 elements in 8 groups
(including 1 aspherical element)

Coating: S.S.C.*
Angles of view: Diagonal: 84°
Vertical: 53°
Horizontal: 74°

Distance scale:
(m) 0.3 (magnification 0.12x) to 3, and infinity
(ft.) 1 to 10, and infinity
Focusing: Helicoid
Minimum aperture: f/16
Aperture: Fully automatic
Filter diameter: 72mm
Hood: BW-72
Length and max. diameter: 68mm x 76.5mm
Weight: 430g



FD50mm f/1.2L
ASPHERICAL

This L-series standard lens leads all other standard lenses in optical performance. Despite its extremely large f/1.2 maximum aperture, the lens is compact in design and weighs a mere 380g. An aspherical element makes the lens virtually flareless which is inherent in conventional large-aperture spherical lenses and which becomes most obvious at maximum aperture settings. The lens' large maximum aperture makes it possible to produce high-contrast images even under poor lighting conditions. Canon's Floating System optimizes optical performance by minimizing aberrations over the entire focusing distance from the closest working distance of 0.5m to infinity. The lens ensures quality images under a broad range of shooting conditions and situations. Color balance is stringently adjusted through the optimal selection of glass elements and unique combinations of various kinds of coatings. A multi-layer coating provides high transmission coefficients and minimizes ghost images.

Focal length: 50mm
Aperture ratio: 1:1.2
Lens construction:
8 elements in 6 groups (including 1 aspherical element)
Coating: S.S.C.*
Angles of view: Diagonal: 46°
Vertical: 27°
Horizontal: 40°

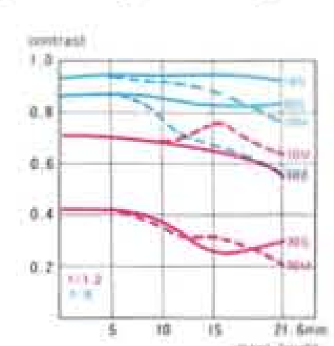
Distance scale:
(m) 0.5 (magnification 0.13x) to 30, and infinity
(ft.) 1.75 to 30, and infinity
Focusing: Helicoid
Minimum aperture: f/16
Aperture: Fully automatic
Filter diameter: 52mm
Hood: BS-52
Length and max. diameter: 50.5mm x 65.3mm
Weight: 380g

FD85mm f/1.2L
ASPHERICAL

Using an aspherical element in its second lens group, this extremely high-speed short-telephoto lens features an outstanding maximum aperture for a lens of this focal length. A very distinctive feature of a quality short focal length telephoto lens is its ability to create a crisp image of the subject with both foreground and background aesthetically diffused at the maximum aperture setting. This lens characteristic has been further enhanced by the use of an aspherical element. Using Canon's advanced optical engineering, the near-ultimate in aspherical element shape has been achieved. This, together with a unique combination of other elements of the lens produced from the most suitable types of optical glass, delivers excellent resolving power throughout the entire aperture range. An especially striking feature of this lens is its high optical performance even at maximum aperture. Crisp, halo-free and flare-free high-contrast pictures can be obtained at any of the aperture settings. This lens is also one of the first short telephoto lenses to employ a "floating system" which minimizes aberrations at close shooting distances. This permits the high aspherical lens performance to be maintained even at short camera-to-subject distances. Overall, this has become one of the favorite lenses used by discriminating professional photographers.

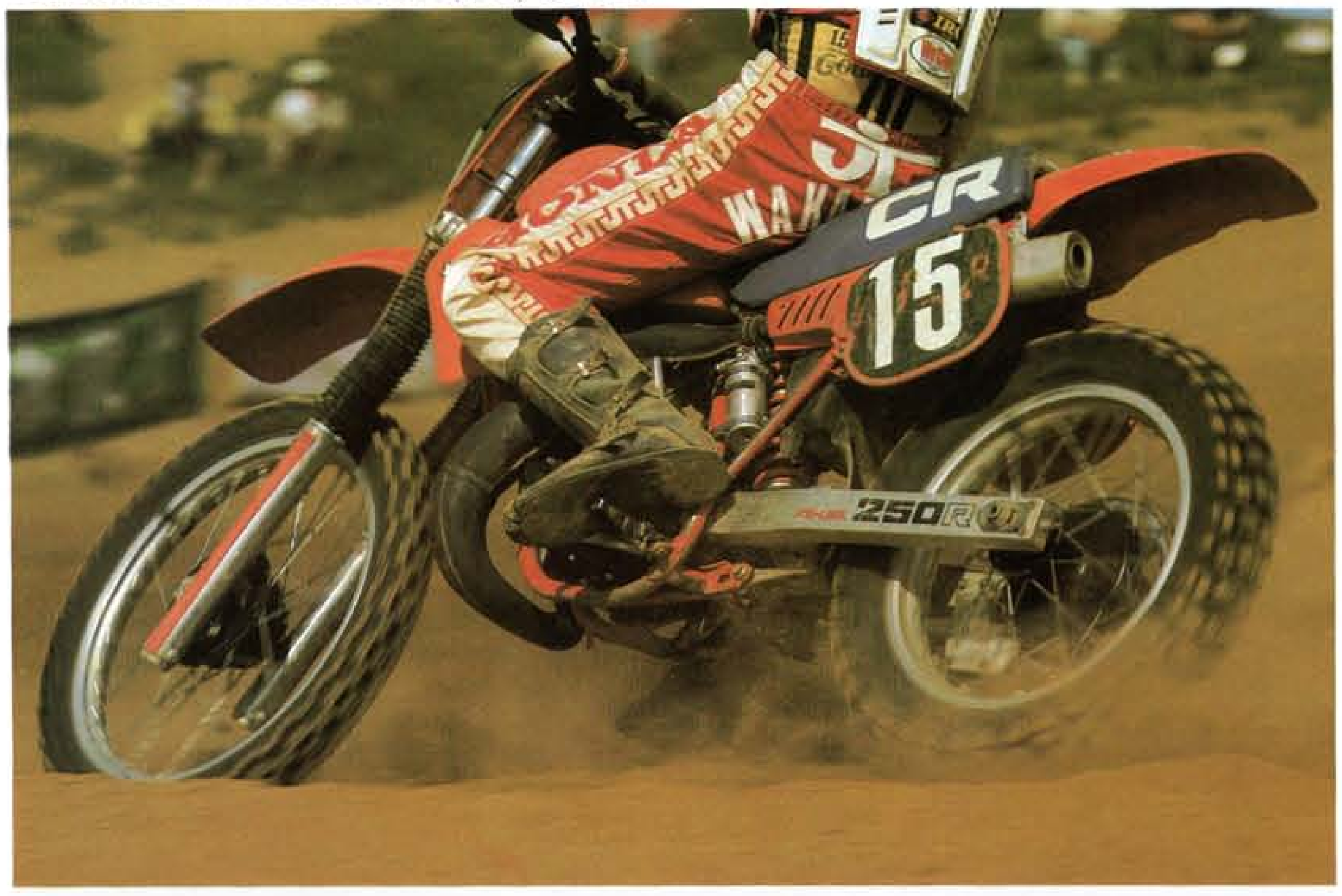
Focal length: 85mm
Aperture ratio: 1:1.2
Lens construction:
8 elements in 6 groups (including 1 aspherical element)

Coating: S.S.C.*
Angles of view: Diagonal: 28°30'
Vertical: 16°
Horizontal: 24°
Distance scale: (m) 0.9 (magnification 0.12x) to 10, and infinity (ft.) 3 to 30, and infinity
Focusing: Helicoid
Minimum aperture: f/16
Aperture: Fully automatic
Filter diameter: 72mm
Hood: BT-72
Length and max. diameter: 71mm x 80.8mm
Weight: 680g



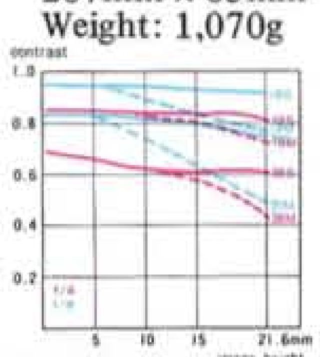
*S.S.C.: Super Spectra Coating

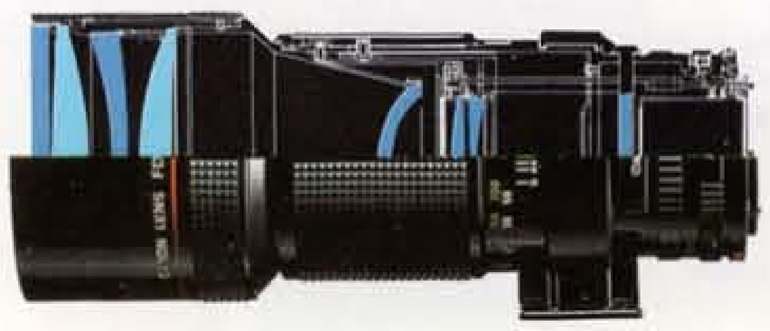
FD300mm f/4L
ULTRA LOW DISPERSION(UD) GLASS



This large-aperture telephoto lens has one of the favorite focal lengths and incorporates two UD elements made of a new optical material called "UD glass". This lens incorporates some of the excellent optical characteristics of a fluorite lens. Measuring 207mm in overall length and weighing a mere 1,070g, the slimmed-down design makes hand-held shots almost child's play. The front section includes two UD glass elements, which like fluorite elements, suppress the secondary spectrum and minimize chromatic aberration, this latter condition is a major factor reducing picture quality. As a result, high-contrast sharp edge-to-edge images are assured over the entire image field. The adoption of Canon's rear group focusing system ensures light and smooth focusing. This system incorporates a vari-pitch focusing cam which provides easy focusing throughout the entire shooting range by gradually decreasing the focal shift as focusing approaches infinity. This provision is especially useful for hand-held shooting.

Focal length: 300mm
Aperture ratio: 1:4
Lens construction:
7 elements in 7 groups (including 2 UD glass elements)
Coating: S.S.C.*
Angles of view: Diagonal: 8°15′
Vertical: 4°35′
Horizontal: 6°50′
Distance scale:
(m) 3 (magnification 0.11x) to 50, and infinity
(ft.) 10 to 200, and infinity
Focusing: Rear group
Minimum aperture: f/32
Aperture: Fully automatic
Filter:
Drop-in type (34mm-diameter dedicated-type filters)
Hood: Built-in type
Tripod mount: Detachable mount
Length and max. diameter:
207mm x 85mm
Weight: 1,070g

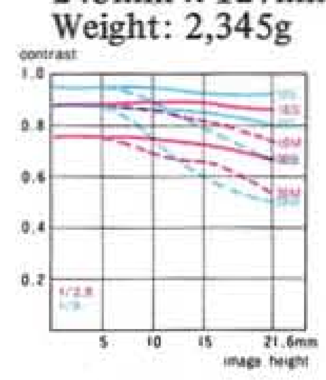


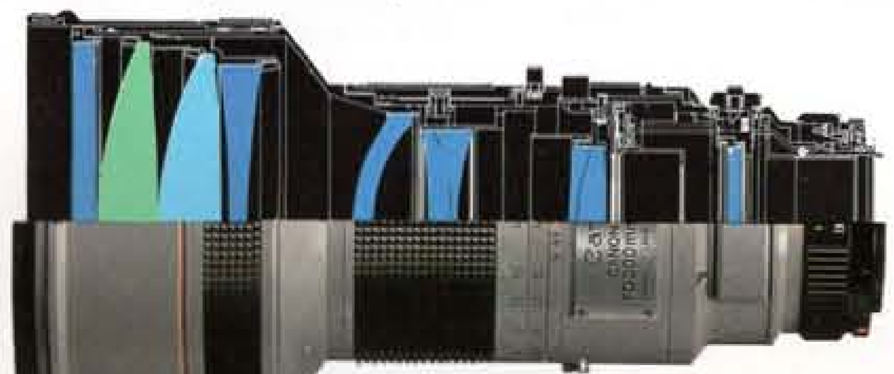


FD300mm f/2.8L
FLUORITE+ULTRA LOW DISPERSION(UD) GLASS

The use of fluorite and UD glass elements has made possible this high-performance telephoto lens which features a large f/2.8 maximum aperture. The second lens element is a fluorite element, which offers such superior optical characteristics as a low refractive index, low dispersion and anomalous dispersion. The third element is of UD glass, which features some of the properties of fluorite lenses. These two elements are optimally combined to suppress secondary spectrum and chromatic aberration problems which occur in telephoto lenses of this focal length. The striking feature of this lens is its extremely high resolving power across the entire image field. Common aberrations such as spherical aberration, comae, astigmatism and other aberrations are eliminated resulting in high resolving power to the maximum f/2.8 aperture. Focusing is rendered easy by Canon's rear group focusing system, vari-pitch cam system and one-touch revolving mount.

Focal length: 300mm
Aperture ratio: 1:2.8
Lens construction: 9 elements in 7 groups (including 1 UD glass element and 1 fluorite element)
Coating: S.S.C.*
Angles of view: Diagonal: 8°15′
Vertical: 4°35′
Horizontal: 6°50′
Distance scale:
(m) 3 (magnification 0.11x) to 50, and infinity
(ft.) 10 to 200, and infinity
Minimum aperture: f/32
Aperture: Fully automatic
Filter: Drop-in type (for 48mm diameter filters)
Hood:
Built-in (The EH-123 extension hood can also be attached.)
Tripod mount: Built-in
Length and max. diameter:
245mm x 127mm
Weight: 2,345g

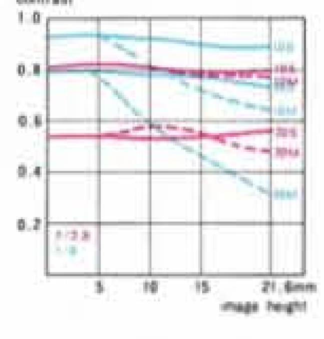


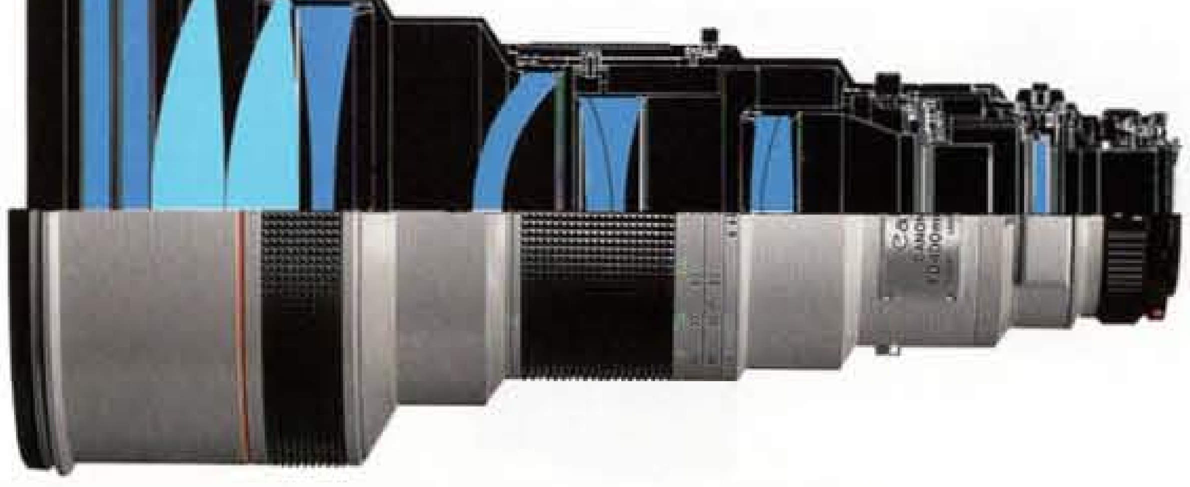


FD400mm f/2.8L
ULTRA LOW DISPERSION(UD) GLASS

This f/2.8 lens has an extremely large maximum aperture for its 400mm focal length. This is a lens photojournalists prefer because of its bright image field, fast speed, compact design and excellent operability. Typical subjects are athletes whose rapid movements can be vividly captured even under poor lighting conditions such as shortly before sunset. Two UD glass elements are employed to minimize the secondary spectrum and to achieve high-contrast pictures with excellent color reproduction at any aperture. During focusing, the overall lens length is held constant by Canon's rear group focusing system; thus, stable camera balance can be maintained. By combining the rear focusing system with a vari-pitch focusing system, the lens focusing is extremely simple.

Focal length: 400mm
Aperture ratio: 1:2.8
Lens construction:
10 elements in 8 groups (including 2 UD glass elements)
Coating: S.S.C.*
Angles of view: Diagonal: 6°10′
Vertical: 3°30′
Horizontal: 5°10′
Distance scale:
(m) 4 (magnification 0.115x) to 50, and infinity
(ft.) 15 to 200, and infinity
Focusing: Rear group
Minimum aperture: f/32
Aperture: Fully automatic
Filter type: Drop-in type (for 48mm diameter filters)
Hood: Built-in
Length and max. diameter:
348mm x 166mm
Weight: 5,395g

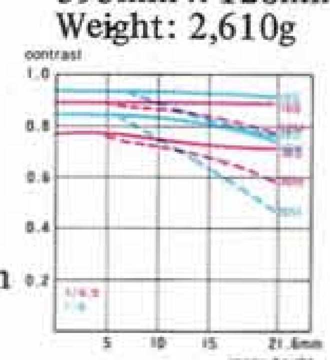


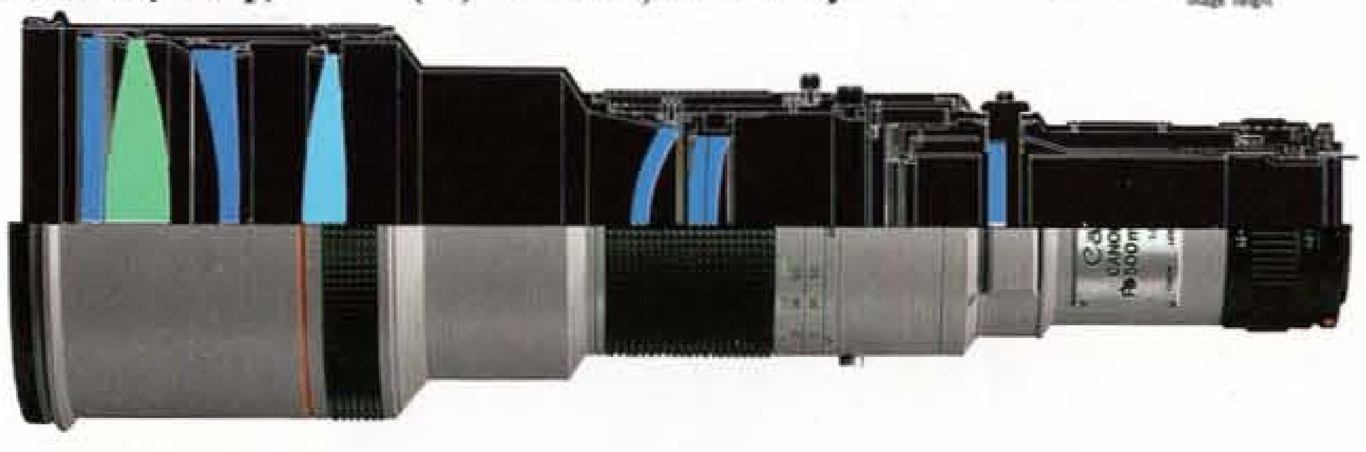


FD500mm f/4.5L
FLUORITE+ULTRA LOW DISPERSION(UD) GLASS

This lens incorporates a UD glass and a fluorite element to reduce the secondary spectrum to a minimum. Superior results are readily apparent; high-contrast high-definition pictures are free from flare and halos. Spherical aberrations, comae and astigmatism are prevented by a 3-element, convex-concave-convex configuration in the first lens section. In the convex lens portion UD glass and fluorite elements are used, which have low refractive indexes. These elements maintain a curvature of field at minimum levels and thereby significally enhance the definition on the periphery of the image field. The subject can, therefore, be brought into extremely sharp, uniform focus over the entire image plane. With a 0.82 telephoto ratio the lens is both compact and lightweight. Focusing adjustments are made extremely easy by Canon rear focusing combined with the vari-pitch focusing system.

Focal length: 500mm
Aperture ratio: 1:4.5
Lens construction:
7 elements in 6 groups (including 1 UD glass element and 1 fluorite element)
Coating: S.S.C.*
Angles of view: Diagonal: 5°
Vertical: 2°45′
Horizontal: 4°
Distance scale: (m) 5 (magnification 0.14x) to 50, and infinity
(ft.) 20 to 200, and infinity
Focusing:
Rear group focusing system
Minimum aperture: f/32
Aperture: Fully automatic
Filter type: Drop-in type (for 48mm diameter filters)
Hood: Built-in (The EH-123 extension hood can also be attached)
Tripod mount: Built-in
Length and max. diameter:
395mm x 128mm
Weight: 2,610g





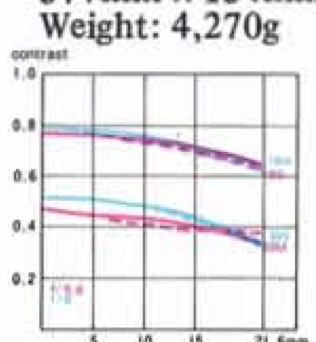
*S.S.C.: Super Spectra Coating

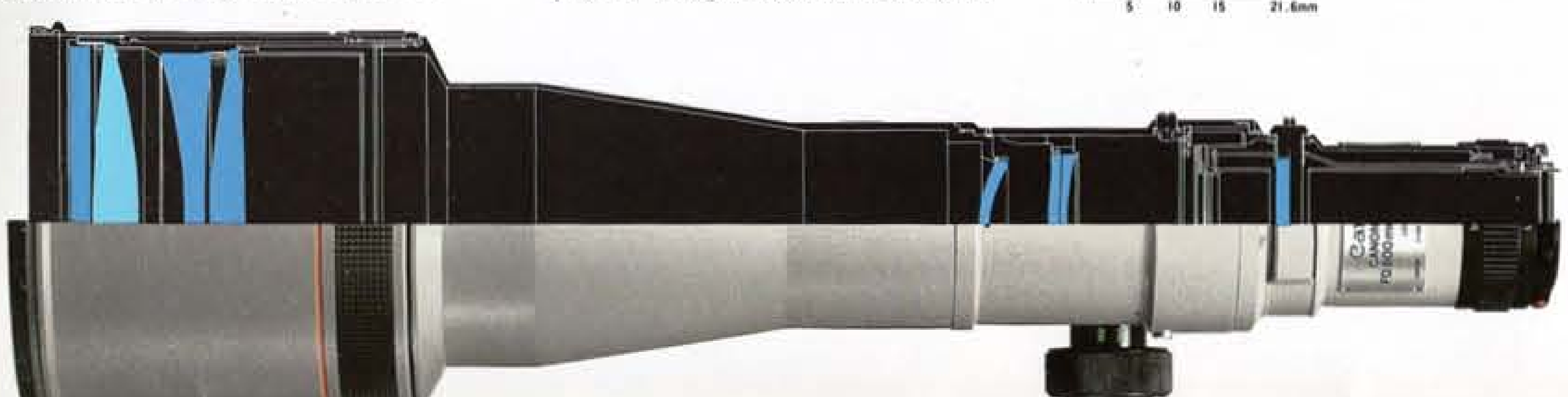
FD800mm f/5.6L

ULTRA LOW DISPERSION(UD) GLASS

This lens has the longest focal length of any in the Canon L-series of FD interchangeable lenses. Its diagonal angle of view is extremely narrow, about 3°. The lens has a magnification 16 times that of a 50mm standard lens and can fill the 35mm viewing frame with an area that is only 1/256th the size of the area covered with the 50mm lens. It incorporates Canon's unique rear group focusing system in which focusing is performed by limiting the movement to the rear lens group. The overall length of the lens remains unchanged during focusing, thereby the maintaining excellent balance over its entire shooting range. The secondary spectrum is minimized by a UD glass element. The unique configuration of glass elements fully compensates for field curvature. This is one of a new generation of super telephoto lenses which delivers superb, consistent optical results over the entire image field.

Focal length: 800mm
Aperture ratio: 1:5.6
Lens construction:
7 elements in 6 groups (including 1 UD glass element)
Coating: S.S.C.*
Angles of view: Diagonal: 3°06′
Vertical: 1°40′
Horizontal: 2°35′
Distance scale:
(m) 14 (magnification 0.06x) to 100, and infinity
(ft.) 45 to 300, and infinity
Focusing:
Rear group focusing system
Minimum aperture: f/32
Aperture: Fully automatic
Filter: Drop-in type (for 48mm diameter filters)
Tripod mount: Built-in
Length and max. diameter:
577mm x 154mm
Weight: 4,270g



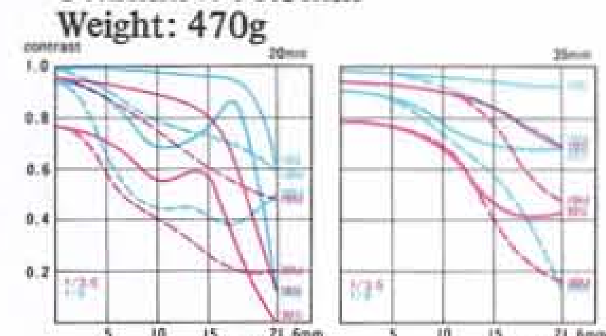


FD20-35mm f/3.5L

ASPHERICAL

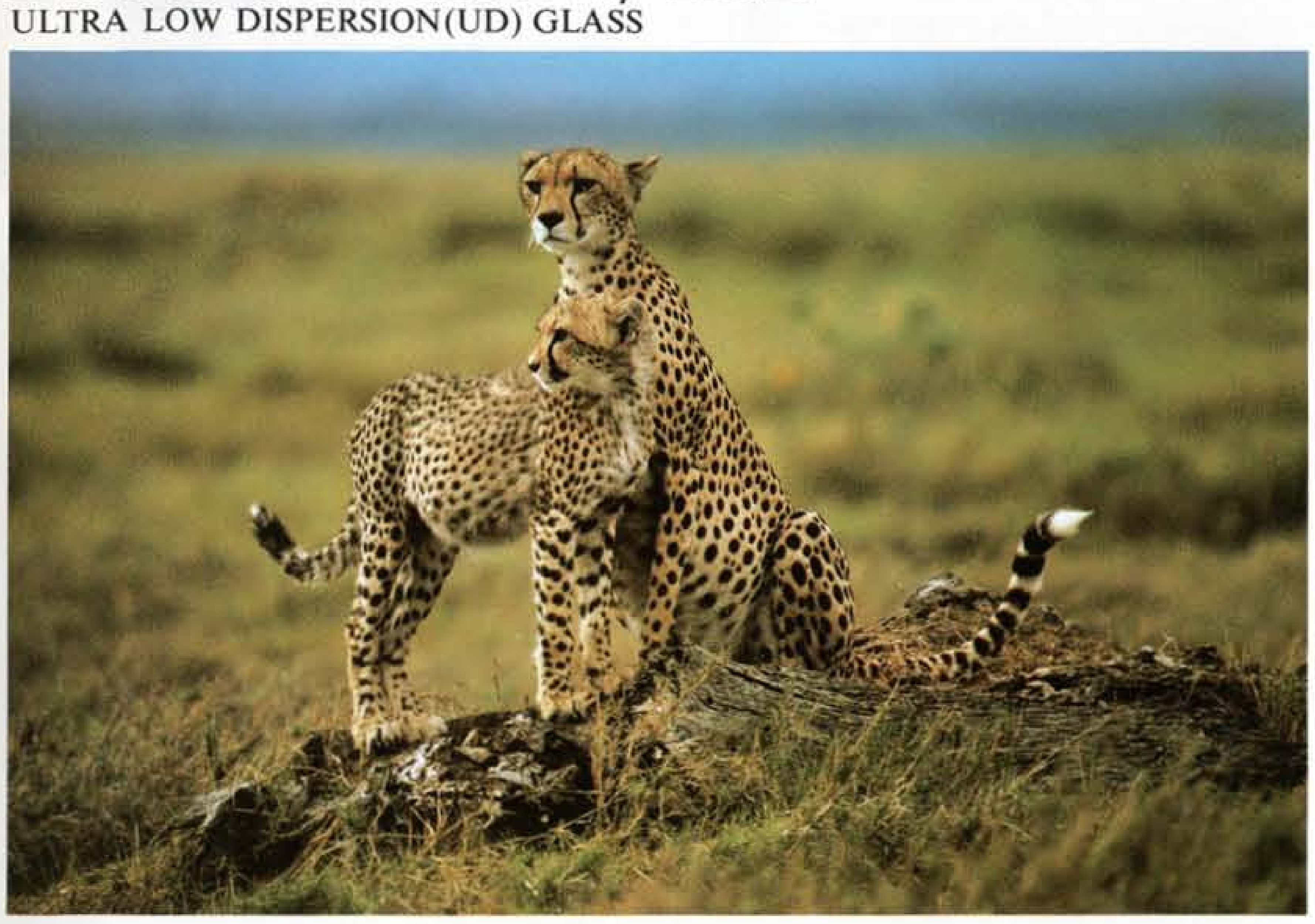
This zoom lens combines the focal range of four fixed focal length lenses: 20mm, 24mm, 28mm and 35mm. Although its zoom ratio appears relatively small, it has enormous expressive potentiality as the actual visual spread is substantial. The aspherical surface of its first element eliminates barrel distortion at short focal lengths. It also assures uniform brightness over the entire picture field, even at short focal lengths, and produces crisp edge-to-edge pictures. A movable flare stopper, not found in conventional lenses, is incorporated to block skew rays which could normally increase towards short lens focal lengths. Canon's unique two-group zooming system not only has enabled a diminished lens size but also compensates for aberrations which would otherwise arise during zooming.

Focal length: 20-35mm
Aperture ratio: 1:3.5
Lens construction:
11 elements in 11 groups (including 1 aspherical element)
Coating: S.S.C.*
Angles of view:
Diagonal: 94° – 63°
Vertical: 62° – 38°
Horizontal: 84° – 54°
Distance scale: (m) 0.5 (0.05x magnification at 20mm focal length and 0.08x magnification at 35mm) to 3, and infinity
(ft.) 1.75 to 10, and infinity
Zooming: Rotary zoom ring
Minimum aperture: f/22
Aperture: Fully automatic
Filter diameter: 72mm
Hood: BW-72
Length and max. diameter:
84.2mm x 76.5mm
Weight: 470g



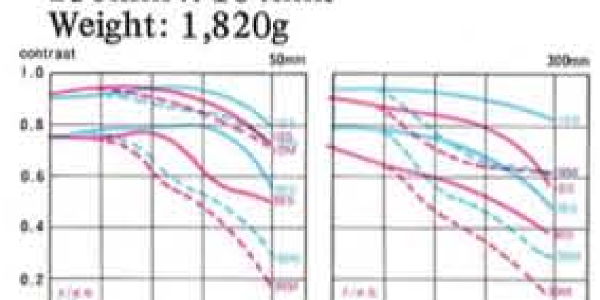
FD50-300mm f/4.5L

ULTRA LOW DISPERSION(UD) GLASS



This lens zooms from standard to full-scale telephoto including the most frequently-used focal lengths. With its 6-power zoom ratio, the lens can satisfactorily cope with most action situations. Despite the high zoom ratio of the lens, its telephoto ratio is below one to achieve a reduced overall length and compact design for enhanced operability. The lens's maximum aperture of f/4.5 is the largest of any in the same focal range. Two UD glass elements maintain the secondary spectrum at minimum levels for superior optical results over the entire focal length range and at all shooting distances.

Focal length: 50 – 300mm
Aperture ratio: 1:4.5
Lens construction:
16 elements in 13 groups (including 2 UD glass elements)
Coating: S.S.C.*
Angles of view:
Diagonal 46° – 8°15′
Vertical 27° – 4°35′
Horizontal 40° – 6°50′
Distance scale: (m) 2.5 (0.025x magnification at 50mm focal length and 0.144x magnification at 300mm) to 30, and infinity
(ft.) 8 to 100, and infinity
Zooming system:
Rotary zoom ring includes a mechanical aberration compensation system (Focusing using a separate focusing ring)
Minimum aperture: f/32
Aperture: Fully automatic
Filter:
Drop-in filter (34mm diameter)
Hood: S-100
Length and max. diameter:
250mm x 104mm
Weight: 1,820g

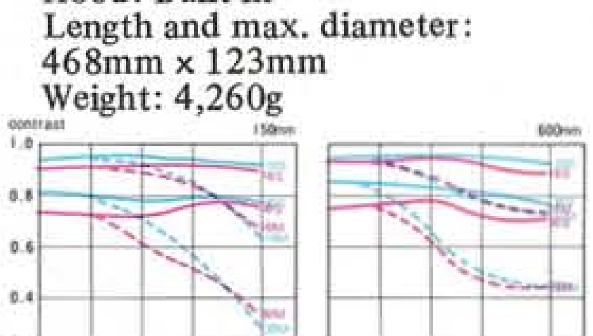


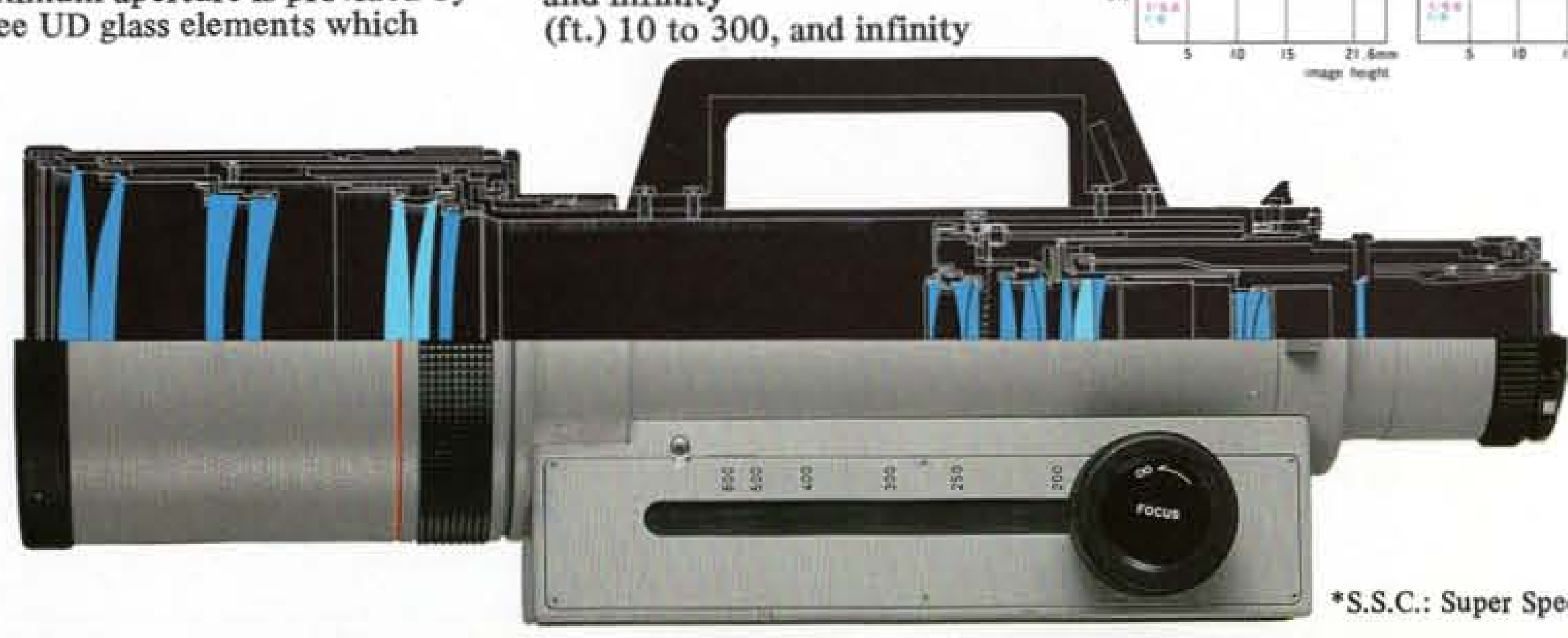
FD150-600mm f/5.6L

ULTRA LOW DISPERSION(UD) GLASS

This lens zooms from 150mm to 600mm, reflecting a high zoom ratio of 4. Its 600mm setting is the longest focal length of any zoom lens currently available. The zoom employs a unique inner focusing system. It involves a maximum displacement of only 33.8mm of the lens group providing the focusing effect for the entire shooting range. The lens has excellent operability due largely to this unique optical design. In addition, both focusing and zooming are performed using the same knob to further increase operability. The large f/5.6 maximum aperture is provided by three UD glass elements which compensate for chromatic aberration.

Focal length: 150 – 600mm
Aperture ratio: 1:5.6
Lens construction:
19 elements in 15 groups (including 3 UD glass elements)
Coating: S.S.C.*
Angles of view:
Diagonal 16°20′ – 4°10′
Vertical 9°10′ – 2°20′
Horizontal 13°40′ – 3°30′
Distance scale:
(m) 3 (0.07x magnification at 150mm focal length and 0.26x magnification at 600mm) to 100, and infinity
(ft.) 10 to 300, and infinity
Zoom system:
Linear slide zoom/focusing knob includes a mechanical aberration compensation system
Minimum aperture: f/32
Aperture: Fully automatic
Filter: Drop-in filter (34mm diameter)
Hood: Built-in
Length and max. diameter:
468mm x 123mm
Weight: 4,260g





*S.S.C.: Super Spectra Coating

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