

Canon

Service Manual

ENGLISH EDITION

CANON LENS

**EF 50mm 1:1.0L
(C21-6222)**

**EF 85mm 1:1.2L
(C21-7272)**

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CY8-1200-059

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TECHNICAL INFORMATION

EF 50mm f/1.0L

Introduction

1. Development Brief

The EF 50mm f/1.0L lens is the world's first f/1.0 lens for an SLR camera. The lens was developed to meet the needs of professional photographers, and features high optical performance at maximum aperture and high-contrast image quality. It was designed to meet the requirements of those who place much importance on image quality, brightness, and blur effect with full aperture photography.

2. Features

- Low flare and high contrast despite the f/1.0 maximum aperture using two aspherical lenses.
- Floating element construction compensates for distance-sensitive aberration changes and provides quality images at all distances.
- Provides high performance by using glass with a high refractive index to correct curvature of field.
- Great color balance by using a new multi-layer coating developed exclusively for the high refractive index glass.
- The 50mm focal length and the ultra-large f/1.0 aperture give pleasant blur effects for objects not on the focal plane.
- USM (ultrasonic motor) provides quiet AF performance.
- Good manual focusing "feel" using electronic manual focusing ring.

3. SPECIFICATIONS

3-1 Format:	24 x 36mm
3-2 Focal length/aperture:	50mm; 1:1.0
3-3 Optical structure:	11 elements in 9 groups , with 2 aspherical surfaces; G3 R1, G8 R2 (Super Spectra Coating)
3-4 Angle of view (at infinity):	Diagonally (43.2 mm) 46° Vertically (24 mm) 27° Horizontally (36 mm) 40°

3-5 Focusing:

System: Autofocus: Ultrasonic motor (USM)
Manual: "Powered manual focus" using USM
Focusing Element: Double helicoid
Range: 0.6m (MACRO); 1.0m to infinity
Drive speed: 1.0 second (Actual operation between infinity and closest focus, not including AF ranging)
Rotation angle, amount of extension

Condition	Rotation angle	Extension
0.6m to infinity	196°07'	11.44mm
1.0m to infinity	1°07'	0.065mm

Distance scale 1 2.2 2.5 3 3.5 4 5 7 10 15 30 ft (green)
0.6 0.7 0.8 0.9 1 1.2 1.5 2 3 5 10 m (gray)

Maximum magnification, field of view

Condition	Magnification (power)	Field of view (mm)
0.6m	0.11	228 x 342

3-6 Mount

Type: Canon EF mount
Signal transfer: EOS system, with 5 signals as follows :

- A) Lens condition
- B) Lens type
- C) Metering data
- D) Focal length
- E) AF drive information

3-7 Aperture mechanism

Diaphragm control: Automatic only using EMD, no manual ring
Aperture range: f/1.0 (indicated on lens) - f/16 (not indicated on lens)
Diaphragm blades: 8
D-O-F Scale: Provided (f/4 8 11 16)
IR Focusing Index: Provided

3-8 Filter: 72mm, 0.75mm pitch, (Usable: only one)

3-9 Dimensions & weight: 91.5mm diameter x 81.5mm length / 985g

3-10 Related products

Hood: ES-79
Lens cap: E-72
Lens case: LH-D12 (hard case)
(Lens stores with one filter and caps on)
Dust cap: Common to all EF lenses

4 Optical performance

(1) Flare elimination and curvature of field reduction

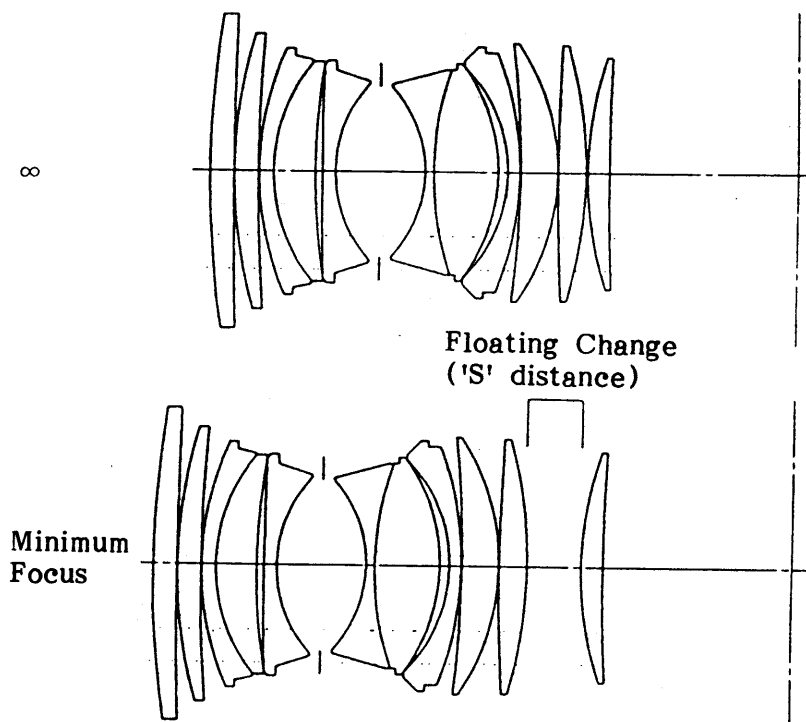
Because Gauss Type lenses have strong concave surfaces on both sides of the diaphragm, flare caused by peripheral refraction can be a problem with ultra-large aperture lenses such as an f/1.0. With the EF 50mm f/1.0L, refraction of concave surface is divided between both aspherical lenses, thus the luminous flux is refracted slightly, to eliminate the flare. The curvature of field generated by the weakening of the refraction of the concave surfaces is compensated by optimal arrangement of the high refraction glass elements. Also, good color balance is achieved with the EF 50mm f/1.0L using a multi-layer coating developed exclusively for use on high index glass.

(2) Floating mechanism

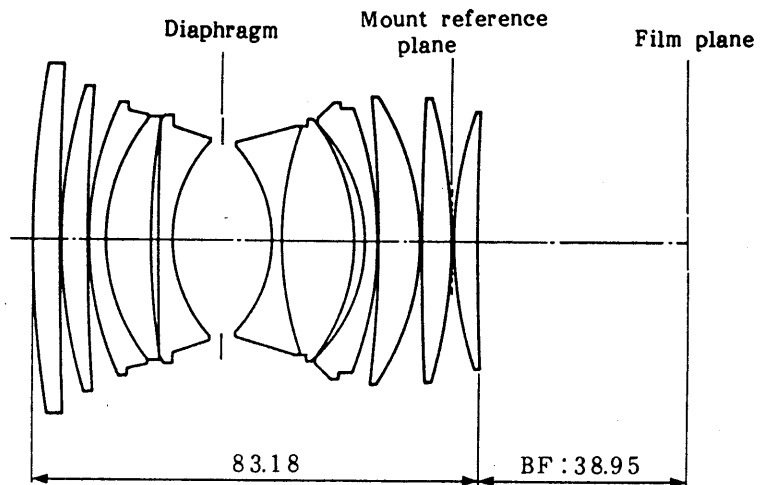
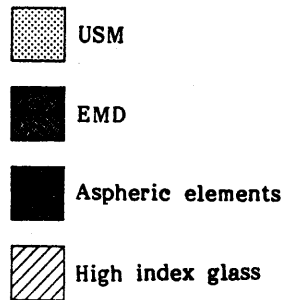
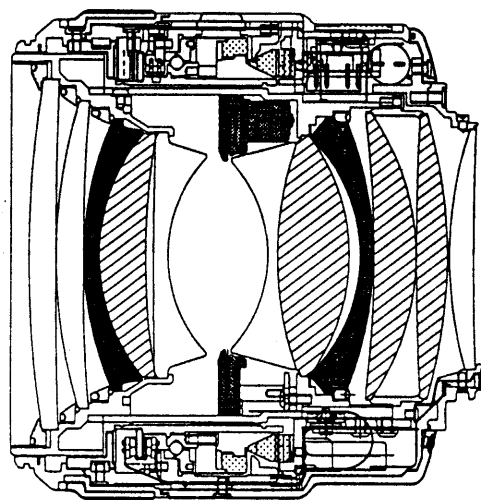
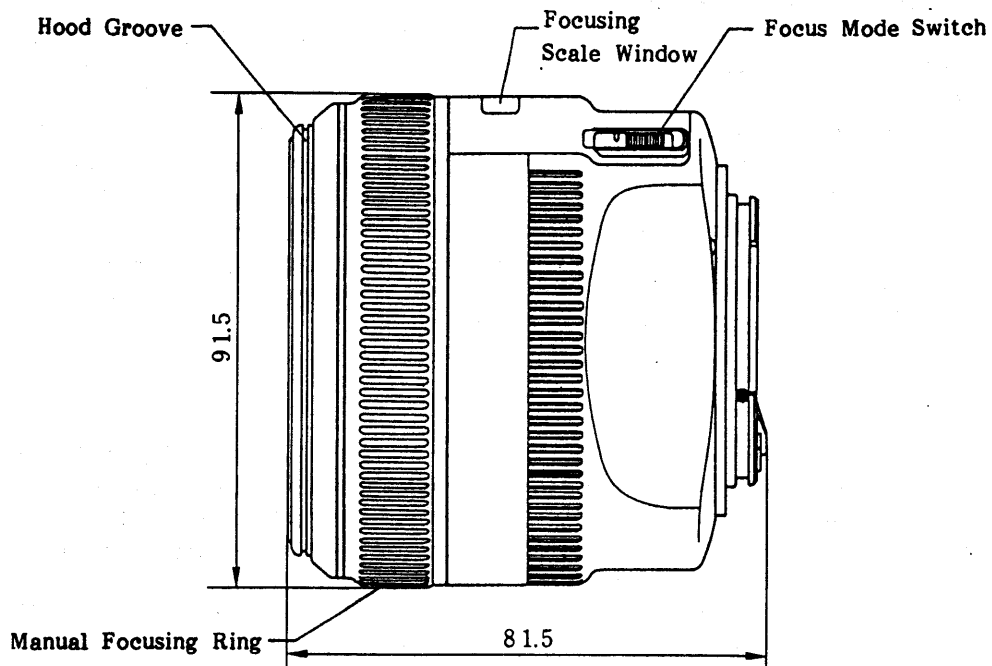
In a floating mechanism design, part of the focusing lenses remains fixed (or moves independently) during focusing, enabling the lens to compensate for aberration alterations with close-up shots and enabling good optical performance to be maintained throughout the entire shooting range. Although the aberration compensation operation differs depending on the lens, with ultra-large-aperture lenses such as the EF 50mm f/1.0L, high image quality is a must throughout the entire range (especially at close shooting distances).

In the EF 50mm f/1.0L the rearmost element, a positive meniscus, is stationary during focusing while the front ten elements move. The EF 50mm f/1.0L attains high image quality throughout the entire shooting range - from infinity to the closest shooting distance - by using this floating mechanism to compensate for curvature of field at close shooting distance and for spherical aberration alterations which are caused by the ultra-large-aperture of the lens at medium and close focusing distances.

Floating Focusing



5. CONTROLS and OPTICAL SCHEMATIC



TECHNICAL INFORMATION

EF 85mm f/1.2L

Introduction

1. Development Brief

The EF 85mm f/1.2L lens is an ultra-large aperture short telephoto lens developed to meet the needs of professional photographers by providing high contrast and superior optical performance especially at maximum aperture.

The 85mm focal length, while serving as a standard lens for many, does not cause the foreshortening effect of a 50mm in tight head shots, nor compress too much either. These features make it an ideal lens for applications such as portraiture and landscape photography.

The large f/1.2 aperture meets the needs of professionals in special fields such as commercial and fashion photography by providing high image quality, brightness, and pleasing out of focus blur.

2. Features

- Realizes low flare and high contrast despite the f/1.2 maximum aperture using an aspherical lens element.
- Employs floating mechanism to compensate for aberration alterations during focusing and to provide high image quality at all shooting distances.
- Designed to provide high performance by using glass with a high refractive index to compensate curvature of field.
- The 85mm focal length and the ultra-large f/1.2 aperture give a pleasing blur effect.
- USM (ultrasonic motor) provides superior AF performance with quiet operation.
- Superior manual focusing "feel" through the use of powered manual focusing.

3. SPECIFICATIONS

3-1 Format: 24 x 36mm

3-2 Focal length/aperture: 85mm; 1:1.2

3-3 Optical structure: 8 elements in 7 groups , including 1 aspherical lens; G3 1st surface (Super Spectra Coating)

3-4 Angle of view (at infinity):

Diagonally (43.2 mm)	28°30'
Vertically (24 mm)	16°00'
Horizontally (36 mm)	24°00'

3-5 Focusing:

System: Autofocus: Ultrasonic motor (USM)
Manual: "Powered manual focus" using USM

Focusing Element Double helicoid

Range: 0.95m to infinity

Drive speed: 1.2 second (Actual operation between infinity and closest focus, not including AF ranging)

Rotation angle, amount of extension

Condition	Rotation angle	Extension
0.95m to infinity	223°05'	13.01mm
Infinity overrun	3°05'	0.18mm

Distance scale

3.2	3.5	3.7	4	4.5	5	6	7	8	10	12	15	20	30	ft (green)
0.95	1	1.1	1.2	1.3	1.5	1.7	2	2.5	3	4	5	7	10	m (gray)

Maximum magnification, field of view

Condition	Magnification (power)	Field of view (mm)
0.95m	0.11	226 x 339

3-6 Mount

Type: Canon EF mount

Signal transfer: EOS system, with 5 signals as follows :

- A) Lens condition
- B) Lens type
- C) Metering data
- D) Focal length
- E) AF drive information

3-7 Aperture mechanism

Diaphragm control: Automatic only using EMD, no manual ring

Aperture range: f/1.2 (indicated on lens) - f/16 (not indicated on lens)

Diaphragm blades: 8

D-O-F Scale: Provided (f/4 8 11 16)

IR Focusing Index: Provided

3-8 Filter: 72mm, 0.75mm pitch, (Usable: only one)

3-9 Dimensions & weight: 91.5mm diameter x 84mm length / 1025g

3-10 Related products

Hood: ES-79

Lens cap: E-72

Lens case: LH-D12 (hard case)
(Lens stores with one filter and caps on)

Dust cap: Common to all EF lenses

4 Optical performance

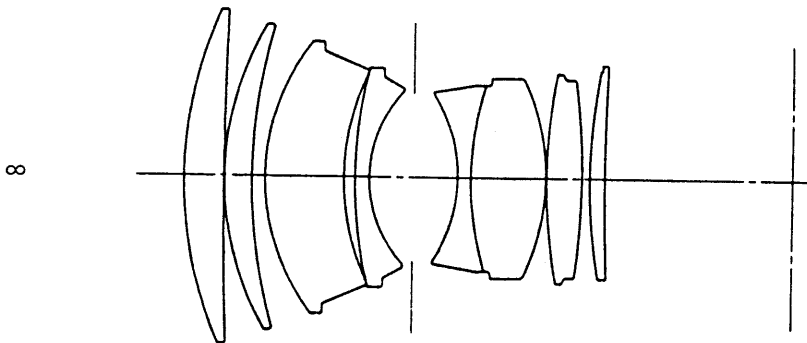
(1) Flare elimination and curvature of field compensation

Because Gauss Type lenses have strong concave surfaces on both sides of the diaphragm, flare caused by peripheral refraction can be a problem with ultra-large aperture lenses. With the EF 85mm f/1.2L, flare is reduced by allotting part of the function of the two strong concave surfaces to the aspherical surface of the G-3 lens element. The curvature of field generated by the weakening of the refraction of the concave surfaces is compensated by optimal arrangement of the high refraction glass elements.

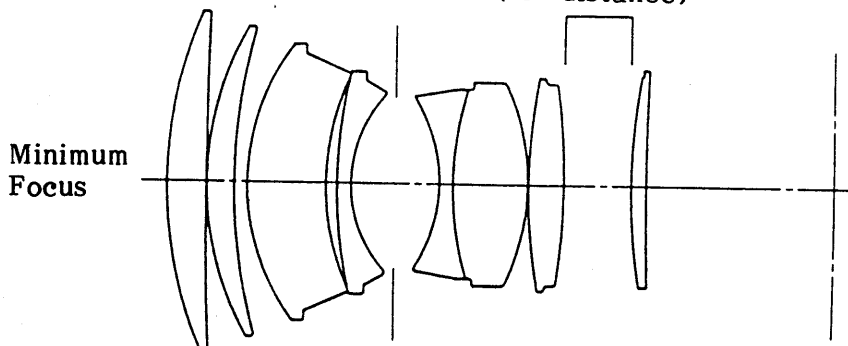
(2) Floating mechanism

The EF 85mm f/1.2L the rearmost element, a positive meniscus, is stationary during focusing while the front seven elements (in six groups) move. The EF 85mm f/1.2L attains high image quality throughout the entire shooting range - from infinity to the closest shooting distance - by using this floating mechanism to compensate for curvature of field at close shooting distance and for spherical aberration alterations which are caused by the ultra-large-aperture of the lens at medium and close focusing distances.

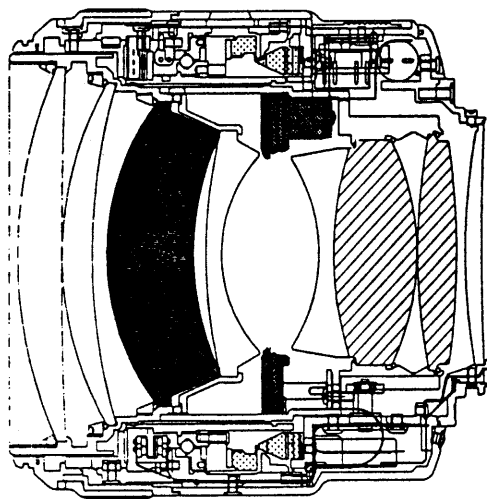
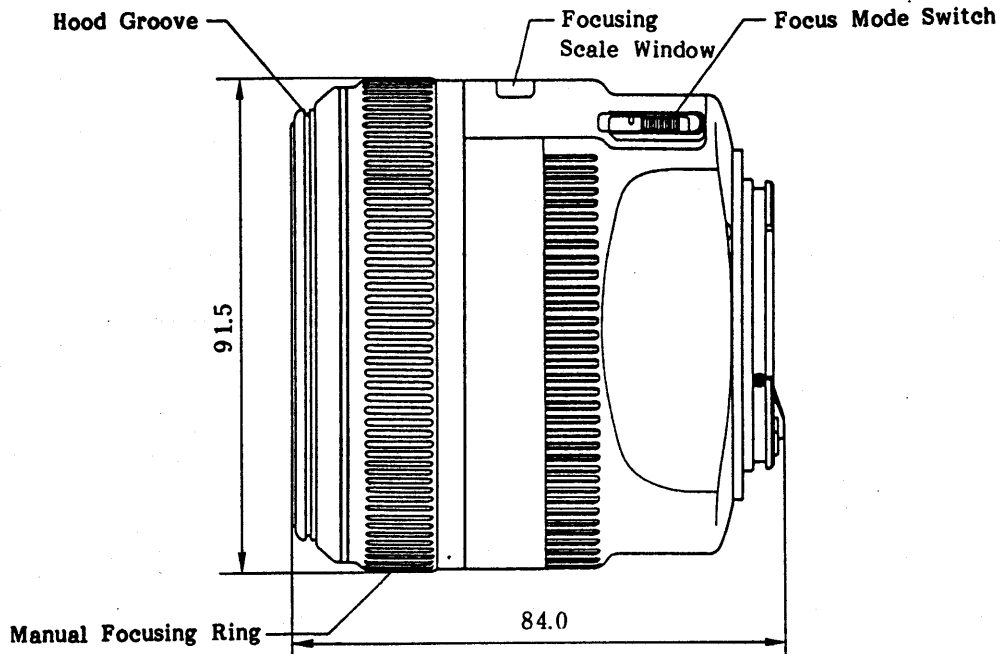
Floating Focusing







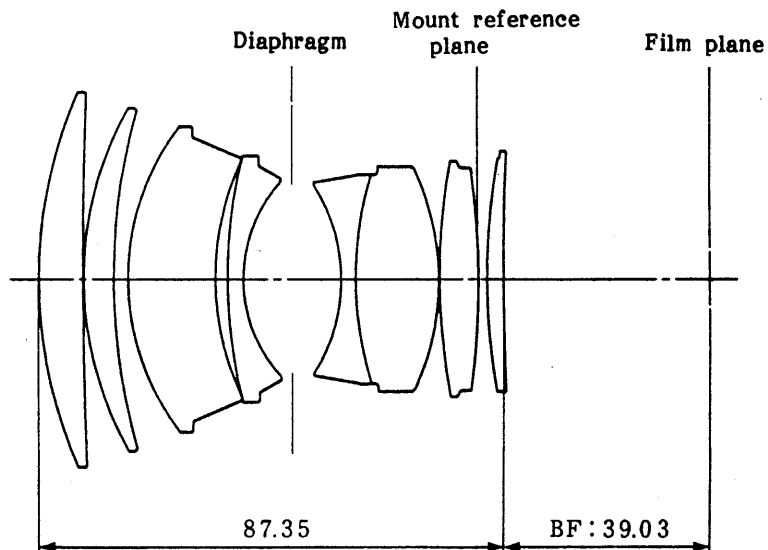
Floating Change
(‘S’ distance)



5. CONTROLS and OPTICAL SCHEMATIC



-  USM
-  EMD
-  Aspheric elements
-  High index glass



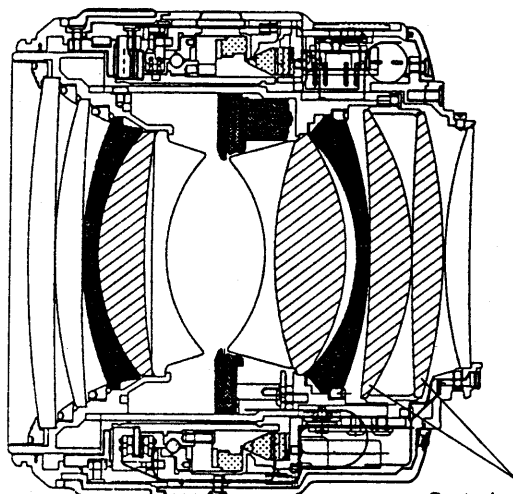
REPAIR INSTRUCTIONS

Special

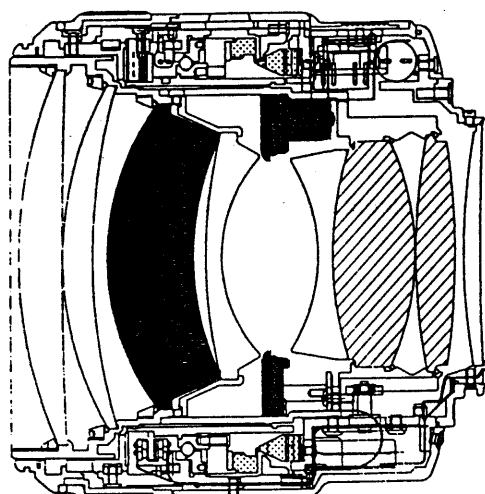
Optical Adjustments:

	EF50mm f/1.0L	EF85mm f/1.2L
Centering	Yes No	Yes No
Tilt	Yes No	Yes No

EF50mm f/1.0L



EF85mm f/1.2L



Centering Adjustment Lenses:
If the screws holding these
elements are disturbed, the
centering adjustment is necessary.

<!!> Set to closest focus and stop down before starting disassembly.

Part No.	Name	Remarks	Plastic Safe?
- ADHESIVES -			
CY4-9102	Acetate cloth tape	For holding flex	Yes
CY4-9303	Double-faced tape	For holding flex	Yes
CY4-9403	Insulating tape	For main flex	Yes
CY9-8002	Bond G-103	For manual focus rubber ring	Yes
CY9-8008	Arontite L	For staking screws in metal	No
CY9-8009	Arontite R	For staking mount stopper screws	No
CY9-8011	Screw-lock	For staking screws in plastic, etc.	Yes
CY9-8091	SO-820	For front lens unit	Yes
- LUBRICANTS -			
CY9-8044	GE-X8	Cam and Guide Barrel grooves, helicoid	Yes
CY9-8086	FF-10	USM Helicoid	Yes
CY9-8089	Elt-oil 190*	Zoom Flex Contact Pattern	Yes

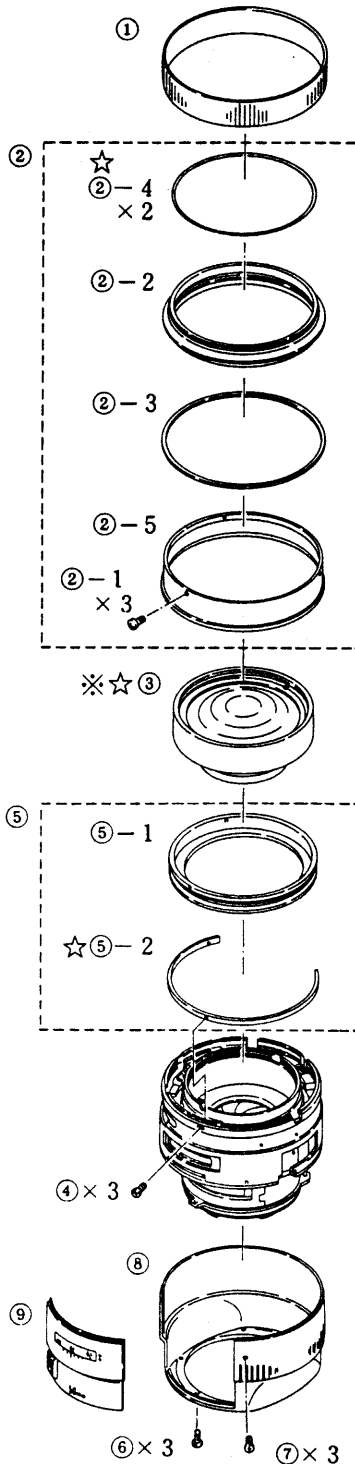
*: Previously labeled Electroil 190

DISASSEMBLY & ASSEMBLY

1. External Parts Disassembly (Front)

✕ DISASSEMBLY

☆ ASSEMBLY



The openings in the dust shield washers (2)-4 should be placed opposite (180°) from each other.

<!!> IMPORTANT <!!>

Before trying to remove (3), run plenty of solvent (Fronsolve, Alcohol, etc.) in and allow it to soften the bond.

- a. The lens must be set to minimum focus to apply the solvent.
- b. If the bond is not loosened prior to removing (3), the guide collars in the USM focusing mechanism may be deformed.

Bond (3) with SO-820 after installation.

Coat (5)-2 with Elt-oil 190.

2. Main Flex and EMD Removal

※ DISASSEMBLY

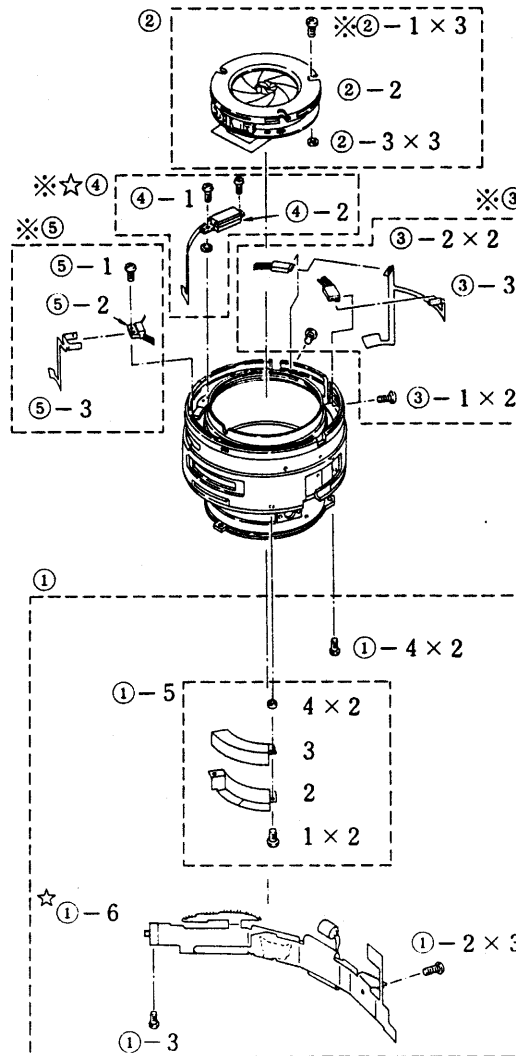
☆ ASSEMBLY

The diaphragm must be stopped down to remove screw (2)-1.

If (3) is disturbed, the manual focus brush position must be adjusted.

If (4) is disturbed, the photocoupler phase must be adjusted.

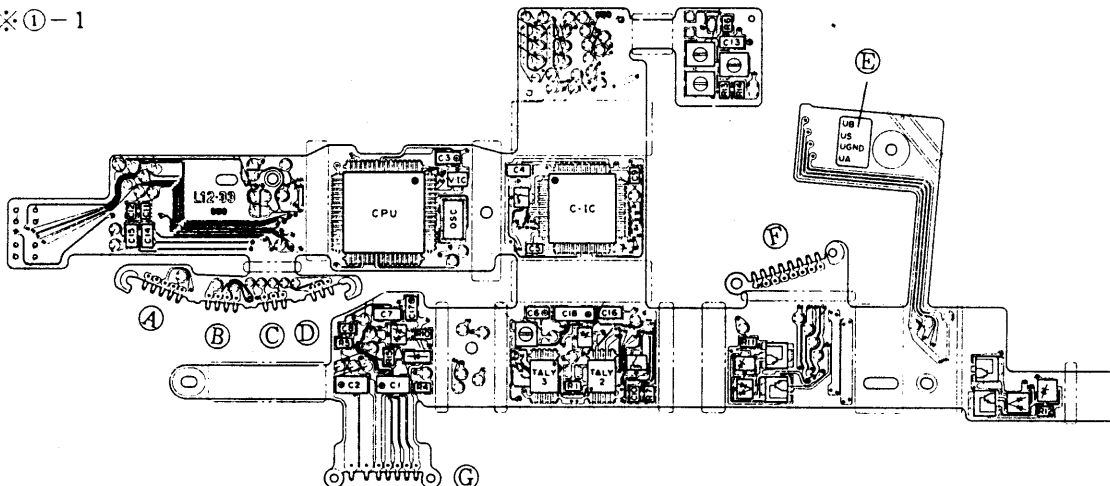
If (5) is disturbed, the infinity switch position must be adjusted.



Unsolder seven connections (A - G) from (1)-1.

(The DC-DC convertor need not be disconnected to remove the flex.)

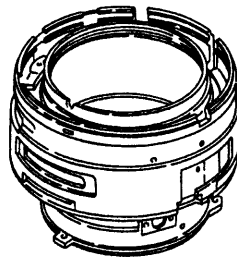
※ ①-1



3. Mount End Disassembly

※ DISASSEMBLY

(2) & (3) N/A to EF85mm f/1.2L, and
(4) & (6) are C Rings.



7

6

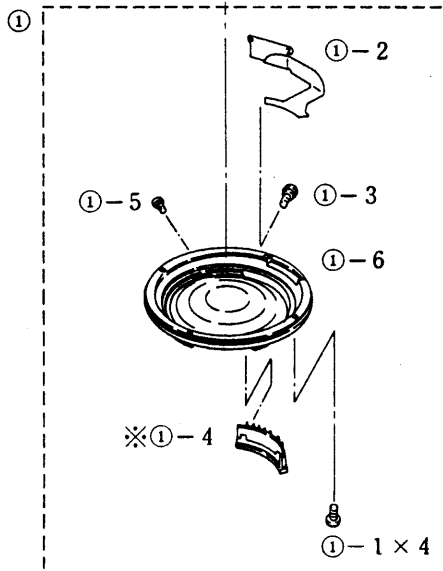
5

4

3

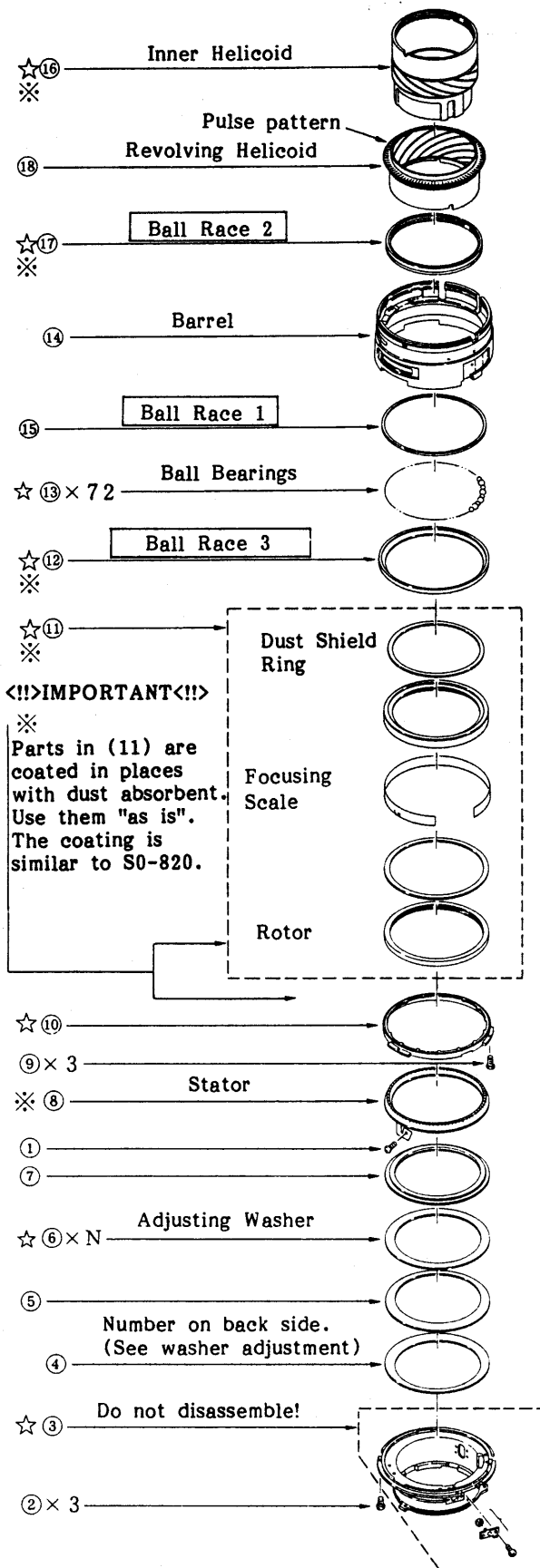
If screws (2) are disturbed,
the optical centering adjust-
ment be performed. (EF 50mm
f/1.0L only)

※ ② × 3

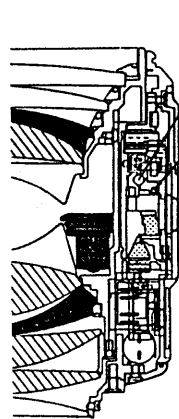


Push outward on the contacts
(1)-4 to remove.

4. USM Focusing Unit Disassembly



Ball bearings (72); two sizes, 36 each.



Ball races (3 pieces)

Impact damage can cause noticeable roughness in focusing by leaving dents in the races.

This can be corrected either by replacing the unit, or by replacing the races (boxed in the view at left).

DISASSEMBLY NOTES

To remove (8), turn the barrel upside-down and let gravity do its work. Take care to not mar the stator pattern with scratches, finger prints or dust. Hold it by the edges and lay it upside-down on a clean surface. This applies to the rotor also.

To remove (11), use a length of thin pliable plastic, such as Delrin. Stick it through the scale window in the barrel and press (11) out.

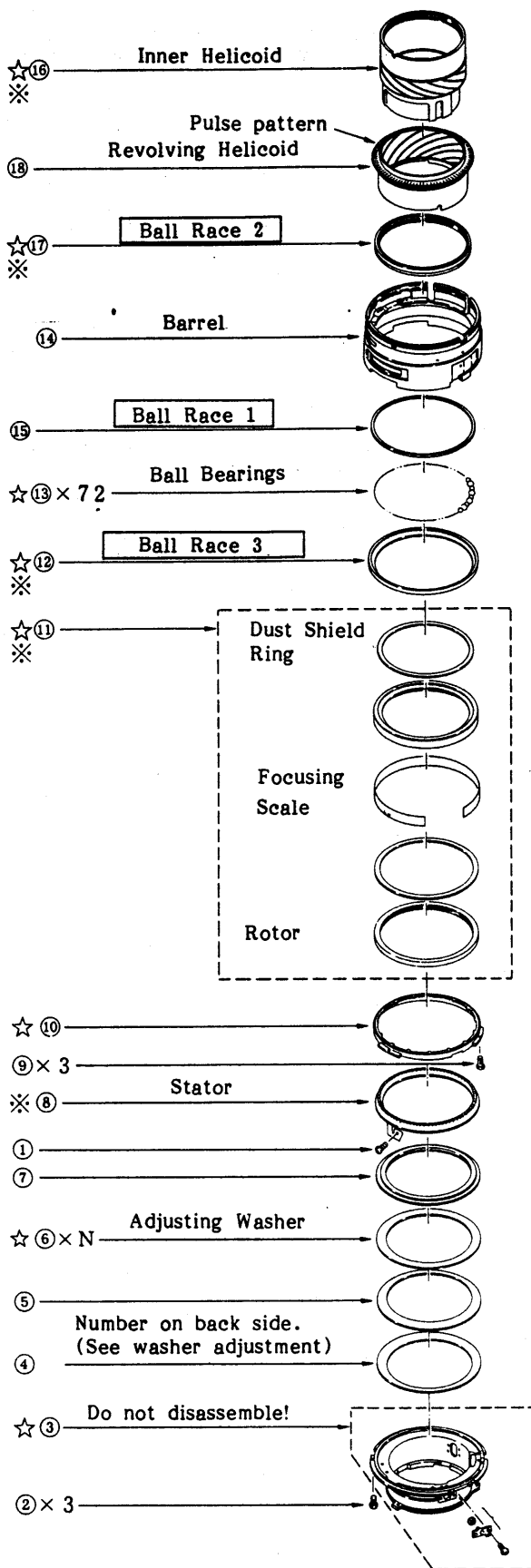
When removing (12) take care with the bearing balls. (For instance, match the inner helicoid up to the barrel and place lens upside-down on the workbench). Carefully remove each ball individually to prevent any of them from contacting the pulse pattern. After the bearing balls are removed, (16), (17), and (18) will come out as a unit when the barrel is lifted.

Before removing (16) mark its relative position with (18).

Brush a light coat of FF-10 onto the helicoid threads and the inner helicoid guide roller grooves.

DO NOT touch the pulse pattern when removing (17). (The threads are staked with Screw-lock. Run in some solvent before unscrewing it).

4. USM Focusing Unit Disassembly (cont.)



ASSEMBLY NOTES

When installing (17) apply a little screw-lock to the threads and tighten it firmly. (If not tightened firmly, it is likely to loosen due to the ultrasonic vibration. On the side which functions as the ball race, and on the other two ball races, apply a small amount of EF-10.

When installing (16), it should protrude about 5mm from (18) to facilitate installing the bearing balls.

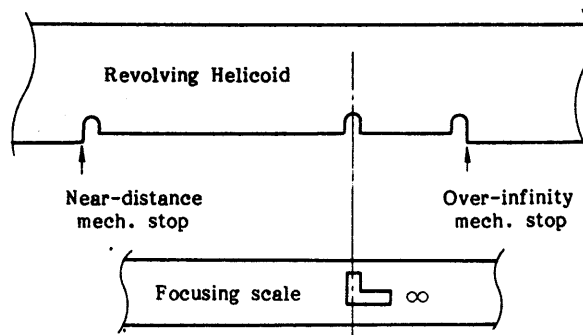
When installing the bearing balls (13) fix the inner helicoid and set the revolving helicoid to make installing the balls easier. Install large and small balls alternately. (The larger balls are shiny; the small balls are not.)

Tighten (12) until it is just snug, then back off about 10°, or about 7mm on the circumference.

(This should give the required 0.01 to 0.02mm of thrust play. Play should be minimized commensurate with smooth operation.)

Manually check the helicoid for smoothness and apply about 10mm of screw-lock on opposite sides.

When installing (11), align the normal temperature infinity mark on the focusing scale with the notch in the revolving helicoid.



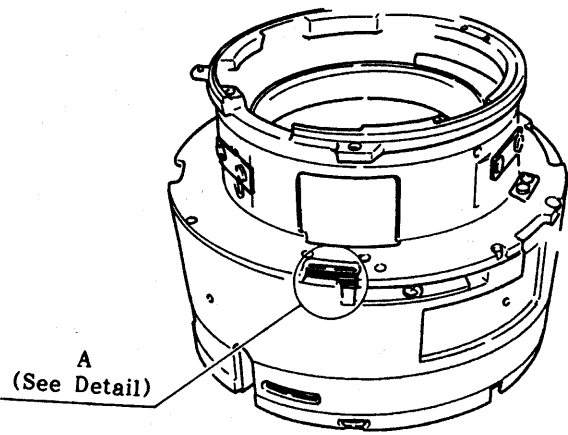
The ears on (10) must fit into the slots on (8).

Adjusting Washers (6):

Due to production variations of Ball Race 2 and assembly procedure, the pressure with the USM drive can vary slightly when the ball race parts are replaced. Service facilities with a 20X tool scope should adjust as outlined on the next page (This adjustment maintains the proper pressure (1.4kg) between the stator and rotor. Differences in the cupped washers (4) and (5) are compensated with the adjusting washer). Any change will probably be within ±0.05mm.

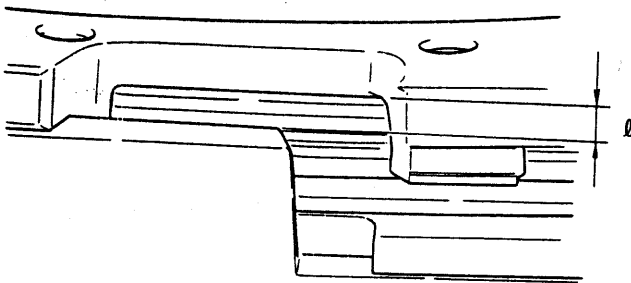
When installing (3), take care not to pinch (4) through (7) between (3) and (14). Take up any radial play away from the side with the scale window.

USM Focusing Unit Washer Selection and Installation

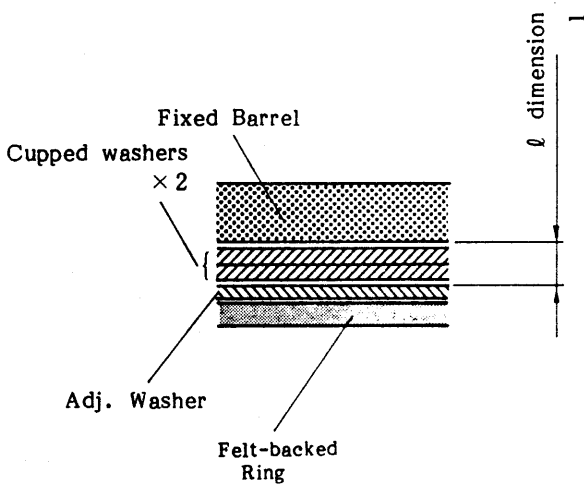


Helicoud and USM Unit

1. Before installing the fixed barrel (3), read the number printed on the cupped washers. This is l' .
2. Attach the fixed barrel and measure the " l " distance with the 20X tool scope.
3. If $|l - l'| < 0.05\text{mm}$, further adjustment is not necessary.
4. If $|l - l'| \geq 0.05\text{mm}$ select a washer to bring it within tolerance.
5. Install the selected washer and recheck.



Detail A



Detail A detail

ADJUSTMENTS

Mechanical and Optical Adjustments (excluding minor "SIZE" adjustments)

Adjustment	Objective	Test Equipment	Location	Page
Optical Centering	Lens Axis Alignment	800mm Lens Focus Collimator (800LFC)	Lens G9,10	18
Focus (Wide)	Infinity Focus Setting	800LFC or 600mm Collimator & Camera	Lens mount & Focus Washers	19
* Focus Limit	Set limits	_____	Limit SW	20
* Manual Focus Phase	True manual focus position reading	Oscilloscope	Brush "L"	21
* Photosensor position		Oscilloscope	Photosensor unit	23

Electrical Adjustments

Adjustment	Objective	Test Equipment	Location	Page
Pulse	Optimize USM Drive Pulse Output	Oscilloscope & Camera	VR8, VR9	22
Best Focus	Align sensor focus with lens focus	_____	AF ADJ0 - 5	25
† USM Reference Frequency	Set USM reference frequency	Frequency Counter	(VR3)	24

* USM Unit Adjustments: The service parts are pre-adjusted.

† Main Flex Adjustment: The service parts are pre-adjusted.

1. OPTICAL CENTERING EF50mm f/1.0L only

This adjustment is necessary if lens elements G9 or G10 are disturbed. (Disturbing the front elements has almost no effect on centering). The 800mm lens focus collimator is required.

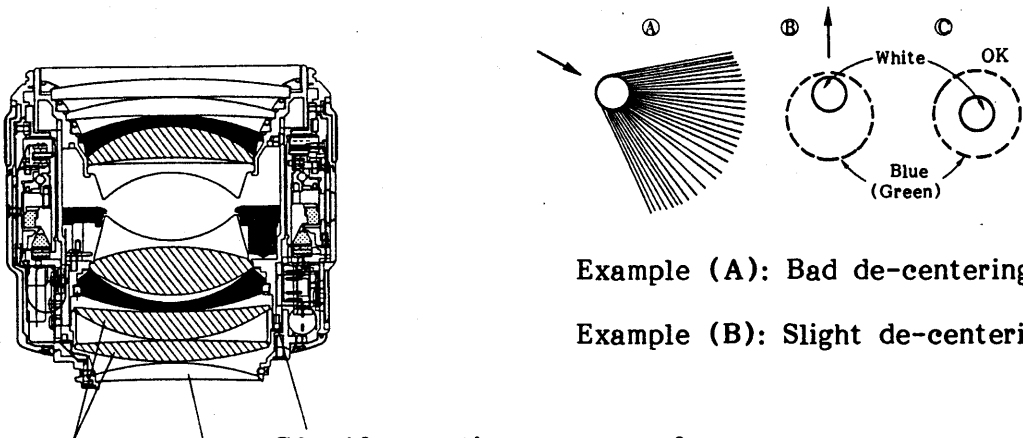
Purpose: To align the optical axes of the lens elements.

Equipment: 800mm Lens Focus Collimator, [Lens Projector (Resolution check)]

Preparation: Remove the lens mount, which includes the rear lens element G-11 (4 screws), the contact assembly cover (2 screws) and lightly tighten the three screws holding the G9, 10 cell. Reinstall the lens mount.

Adjustment:

1. Mount the lens on the 800LFC. Adjust the focus for slight blue (green) flare around the white center of the star image.
2. If the image appears as (A) or (B), adjust G9,10 in the direction of the arrow so the image is as (C).
3. Reassemble and check again. Repeat as necessary.



Example (A): Bad de-centering

Example (B): Slight de-centering

G9, 10
Lens mount (incl. G-11)

G9, 10 mounting screws x 3

STANDARD:

If centering is correct resolution will be good, but we recommend checking resolution as a final check.

		Resolution Table				
Image Height (mm)	0	4	8	12	16	20
S	100	100	63	63	63	63*
50@1.0						
M	100	100	63	63	25*	25*
S		100	100	100	100	63
50@4.0	100					
M		100	63	63	40	25*

S	100	100	63	40	40	63
85@1.2						
M	100	100	63	63	63	40

1 step down in two directions acceptable.

2. FOCUS ADJUSTMENT

A. 800mm Lens Focus Collimator Method

Install the EOS mount adaptor on the collimator and check several lenses from stock for an average. Adjust lenses to that average.

B. Camera Method

Use a known-good camera with a type B (split-image) screen and a magnifier. Check focus on a collimator or with an actual target at least $100f^2$ distant.

Purpose: To adjust infinity focus

Tools: 800mm Lens Focus Collimator, or shop-standard camera body with B screen and magnifier and 600mm collimator, or photographic infinity target.

Standard:

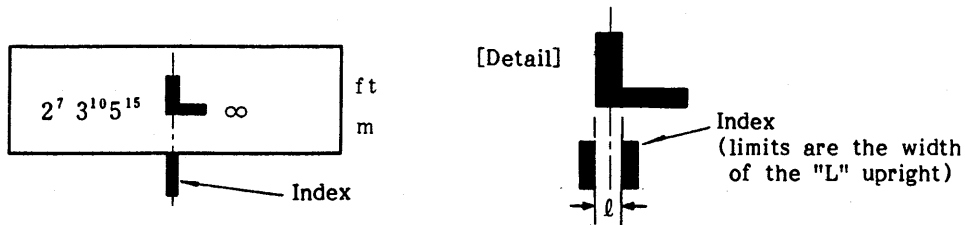


Fig. 6

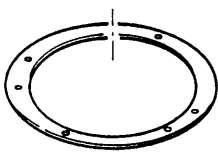
Adjustment:

At the factory, the lens mounts are shaved to give the correct FFD; but this is impossible in the field. Special thin service mounts and focus washers are used. Do not use washers exceeding a total thickness of 0.07mm (Using more may cause a visible gap.)

Due to the extreme size of the rear element, the washer must be trimmed as shown to clear the contact assembly.

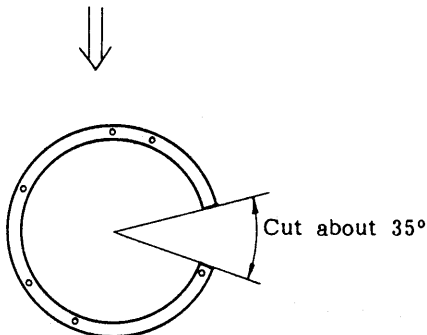
CY1-2178-000 XXX
Service Focus Washers

CY1-2326-000 XXX (85mm f/1.2L)
CY1-2227-000 XXX (50mm f/1.0L)
Service Lens Mounts



Service Use Only.
A SIZE
— $\frac{1}{4}$ A 0.02mm (002)
— $\frac{1}{4}$ A 0.05mm (005)

A	SIZE	A	SIZE
3.2 mm	(320)	3.7 mm	(370)
3.3 mm	(330)	mm	()
3.4 mm	(340)	mm	()
3.5 mm	(350)	mm	()
3.6 mm	(360)		



3. INFINITY FOCUS STOPPER ADJUSTMENT

The USM / Helicoid Unit stocked as a service unit is pre-adjusted, but can be disassembled to replace the ball races. The purpose of the adjustment is to align the focusing index with the end of the infinity "L" where the lens stops when focused past infinity.

Purpose: To adjust the maximum over-travel of the focusing at infinity.

Preparation:

1. Assemble the lens except for external parts, and remove the manual focus ring (5) in External Parts Disassembly.
2. Connect the lens to the camera body.

Adjustment:

1. Loosen the limit switch screws a little. Press the camera SW-1 so the lens searches.
2. Adjust the limit switch position so that the lens stops at the point illustrated.

