作成承認印	配布許可印
ニコン カメラ CS推進部 GM	

AF Zoom-Nikkor 24-120/3.5-5.6D

Ai-s

REPAIR MANUAL

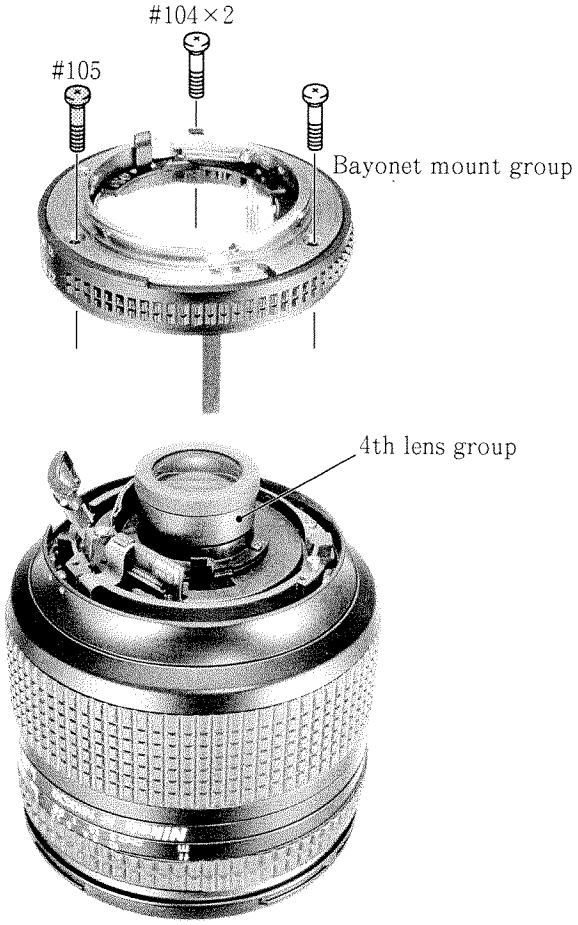
Nikon | NIKON CORPORATION
Tokyo, Japan

Printed in Japan September 1996

DISASSEMBLING／ASSEMBLING／ADJUSTMENT

NOTES ON DISASSEMBLING

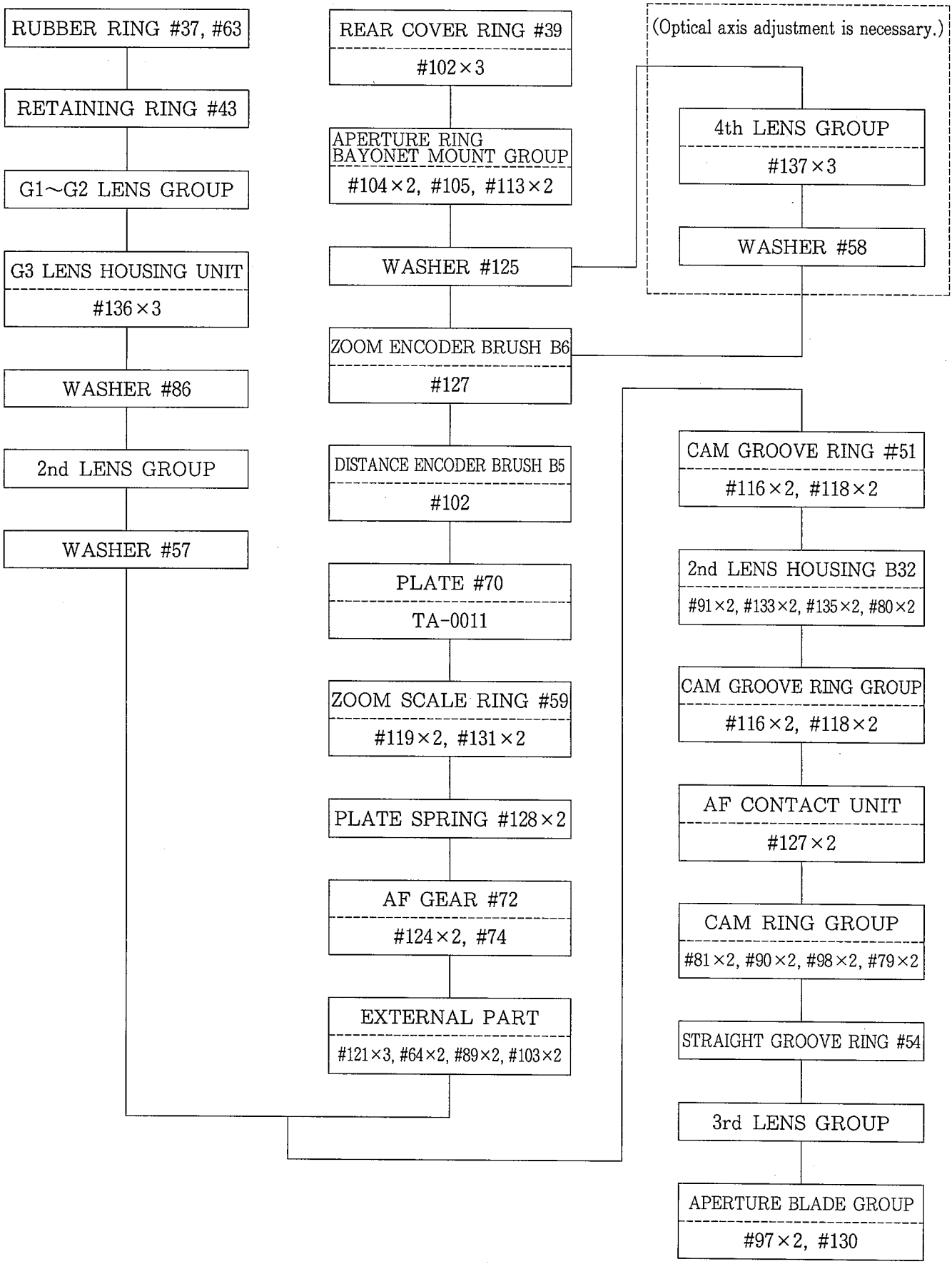
When you remove the 4th lens group and reassemble it as it was, an asymmetric shape appears in the projected image, requiring optical axis adjustment.
This instruction includes procedures for working without the 4th lens group. In normal repair operations, do not remove the 4th lens group other than for replacement.



Optical axis adjustment equipment will be available at Nikon Corporation, Tokyo, Nikon Inc., Nikon Europe B.V. and Nikon Singapore.
The equipment has not been completed yet due to production delays. For the time being, send products which require optical axis adjustment to Nikon, Tokyo.

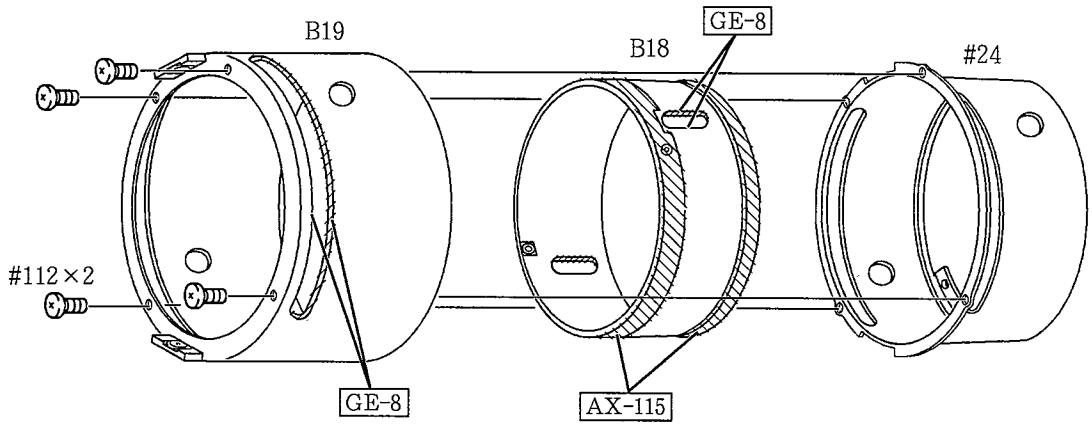
※Optical axis adjustment equipment will be sent as soon as possible.
Materials for the optical axis adjustment equipment will be available and distributed to the above four locations.

1. DISASSEMBLING PROCEDURE

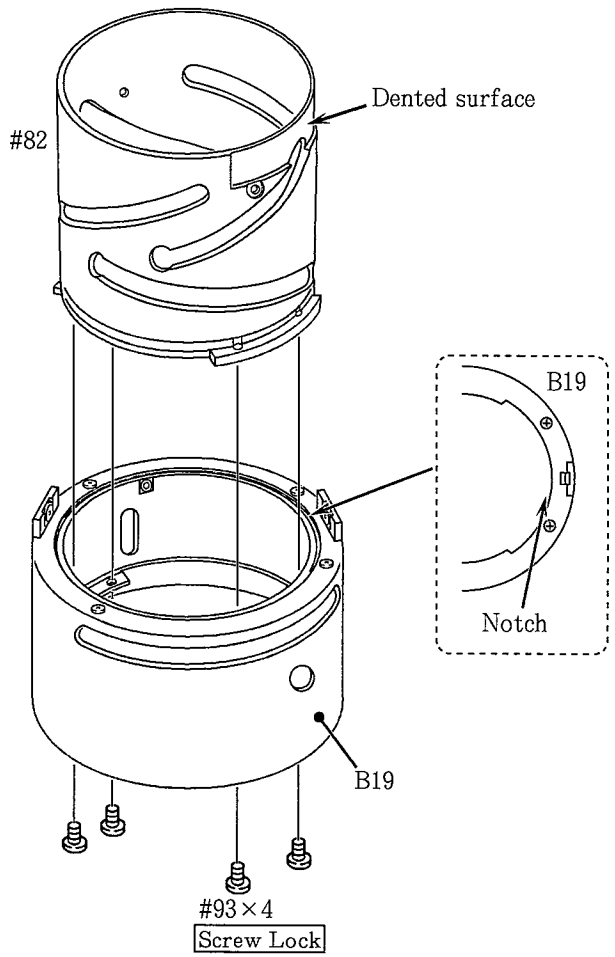


2. ASSEMBLING／ADJUSTMENT

STRAIGHT GROOVE RING GROUP



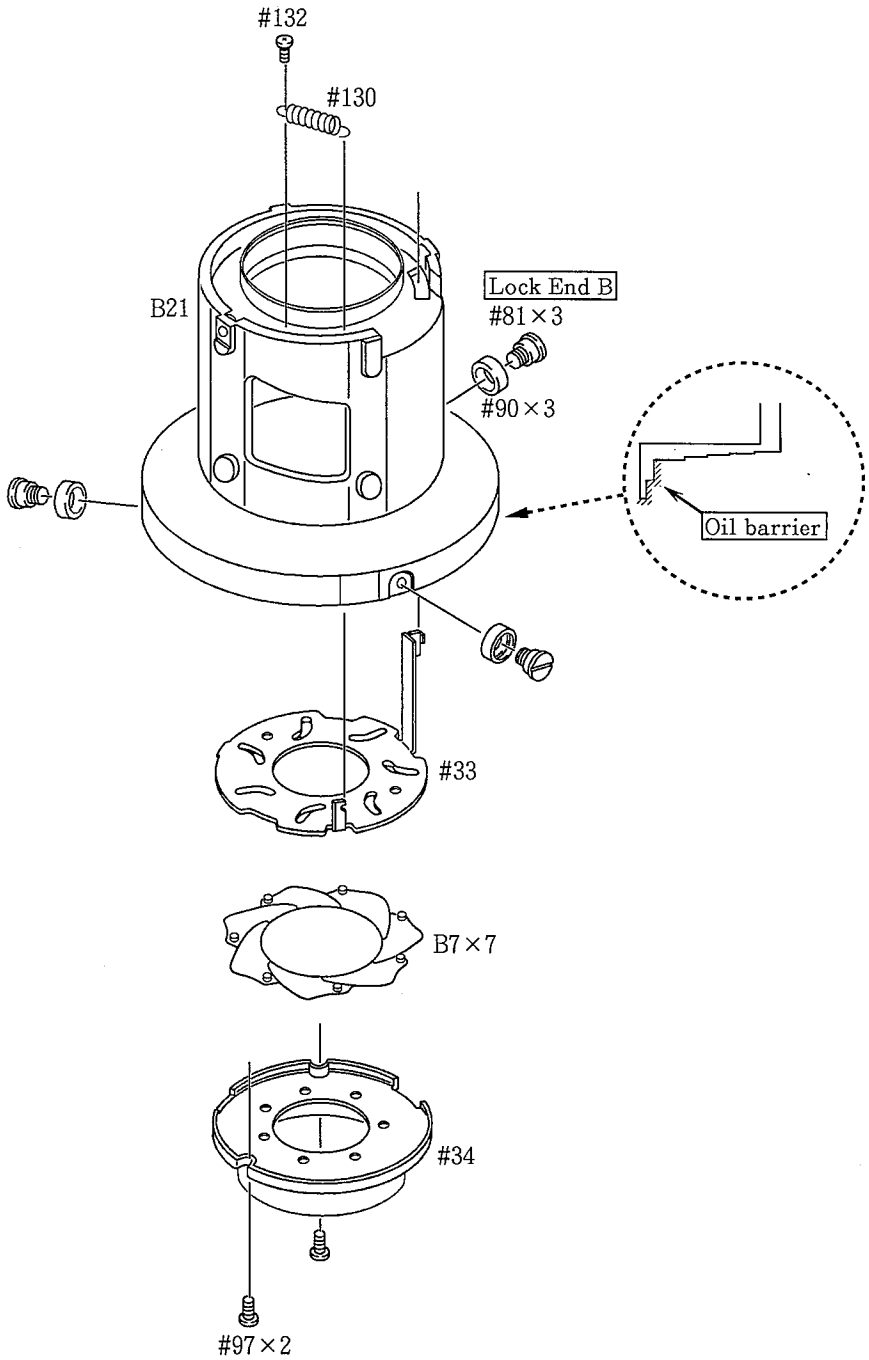
CAM RING #82



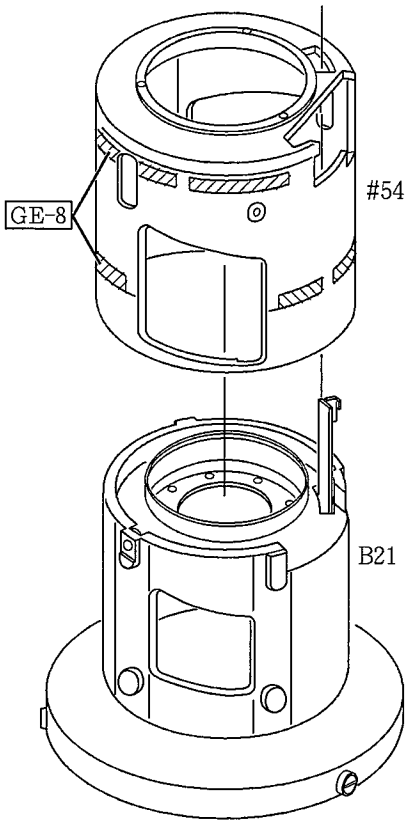
● Apply GE-8 oil to 6 locations in the cam groove on cam ring #82.

Note: As shown in the figure on the left, mount the cam ring at the location where the dented surface of #82 aligns with notch on the B19.

APERTURE BLADE HOUSING GROUP



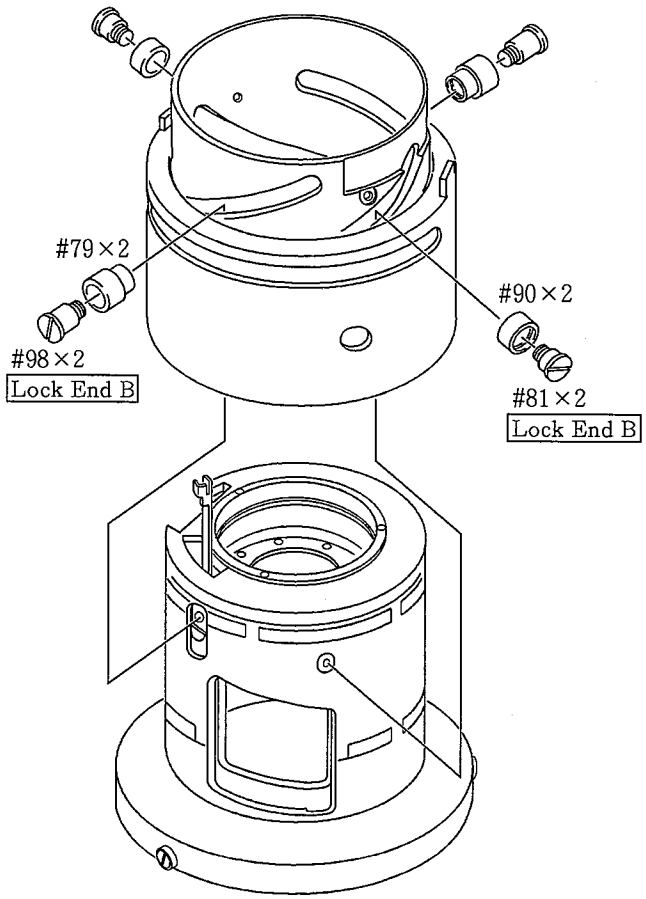
STRAIGHT GROOVE RING #54



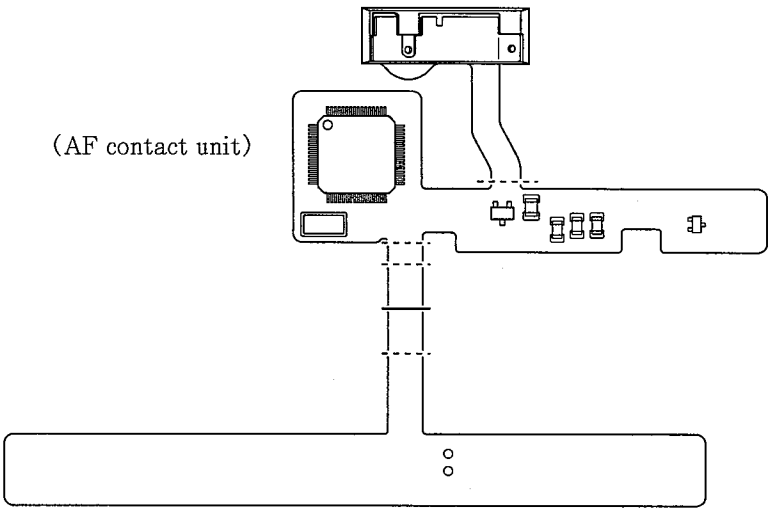
● Apply AX-115 oil to four locations in the linear advancing groove inside #54.

Note: When disassembling or assembling the lens without removing the 4th lens group unit, make sure to attach the 3rd lens group unit to B21.

ASSEMBLING CAM RING GROUP

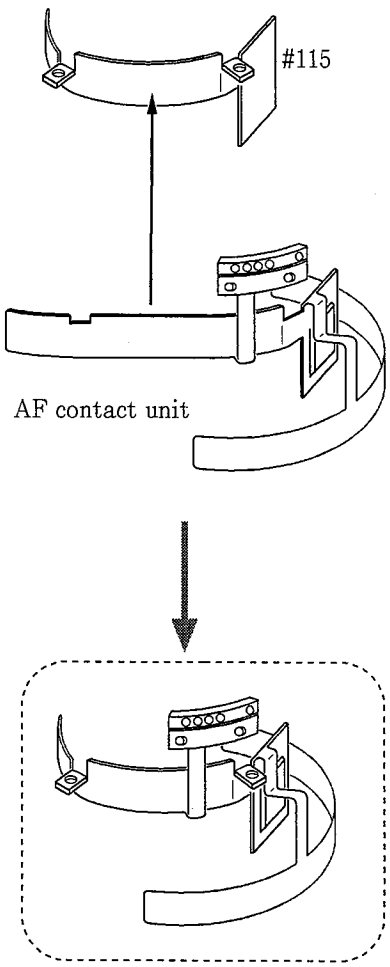


AF CONTACT UNIT

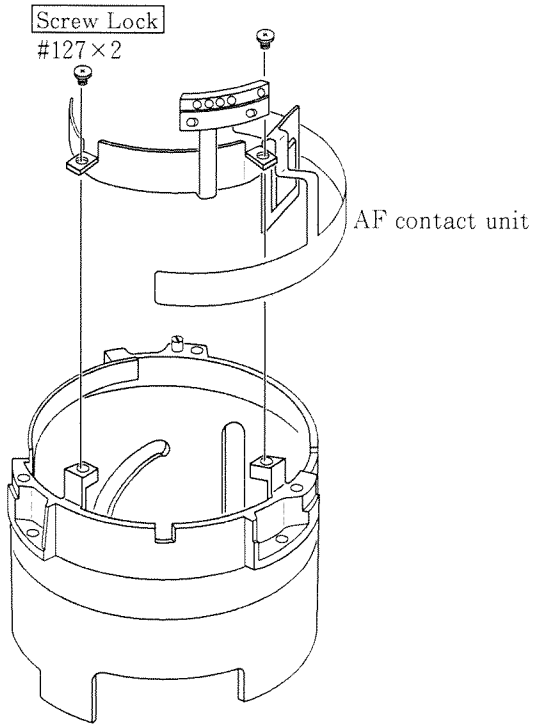


——— : Fold outside

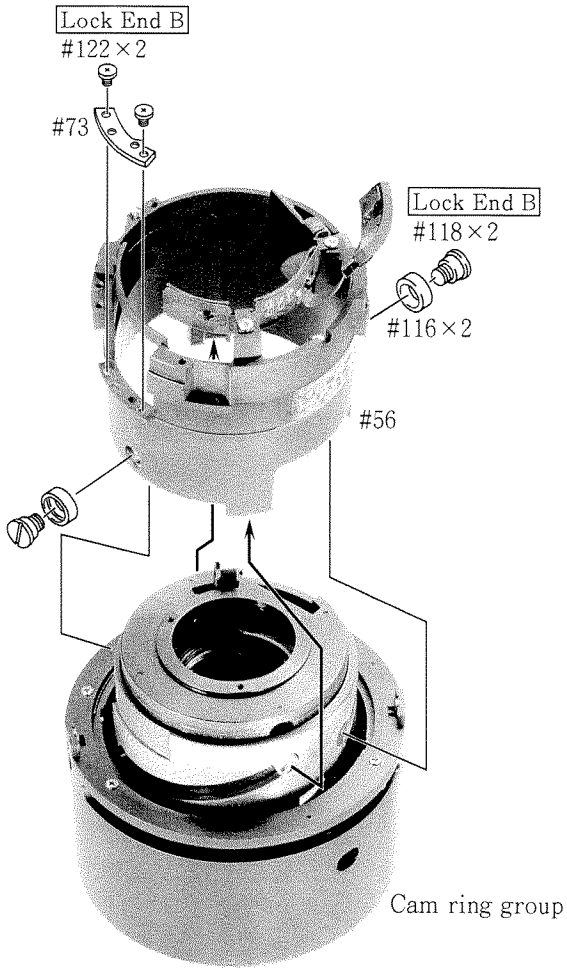
------- : Fold inside



ATTACHING AF CONTACTS UNIT

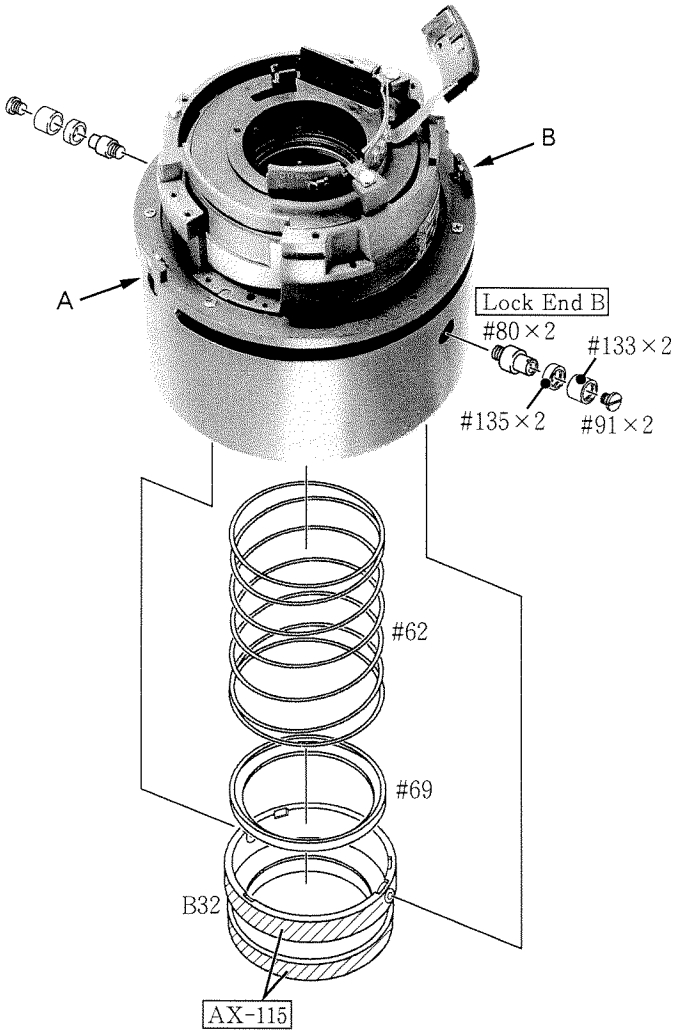


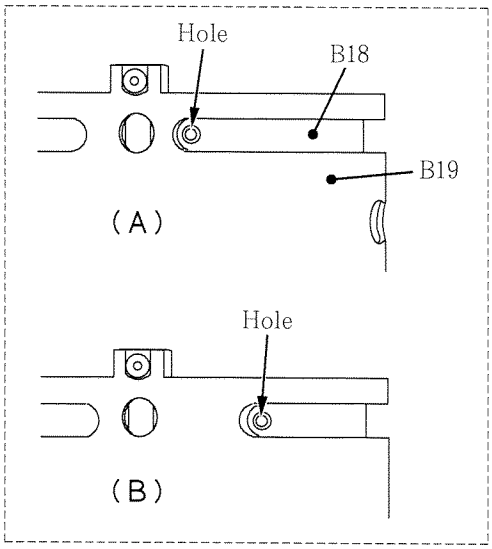
CAM GROOVE RING GROUP



- Apply GE-8 oil slightly to the linear advancing groove inside #56.
- Insert the guide ring of the cam ring into the linear advance groove inside #56.

2nd LENS HOUSING

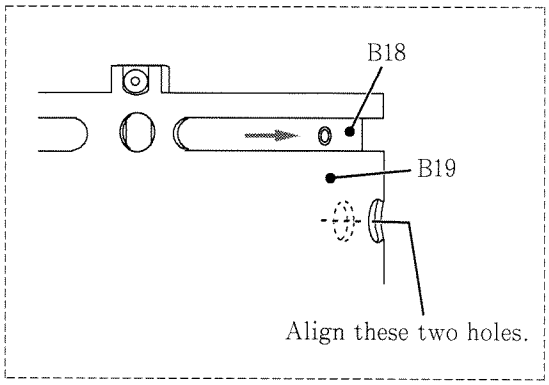




＊Mounting procedure for the 2nd lens group chamber unit

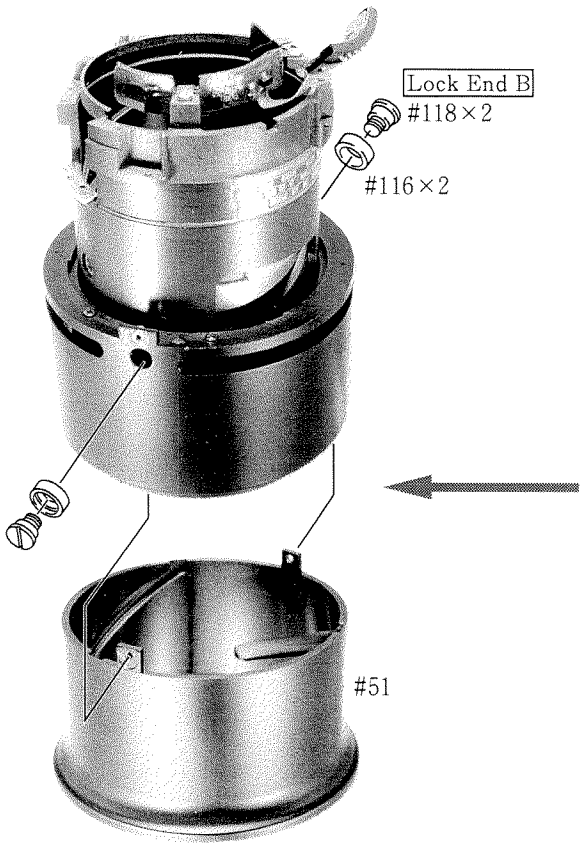
① Rotate B18 until both screw holes are aligned at positions A and B respectively as shown in the figure above.

Note: If only one of the two screw holes comes to the proper location, rotate B18 by half a turn in the reverse direction.

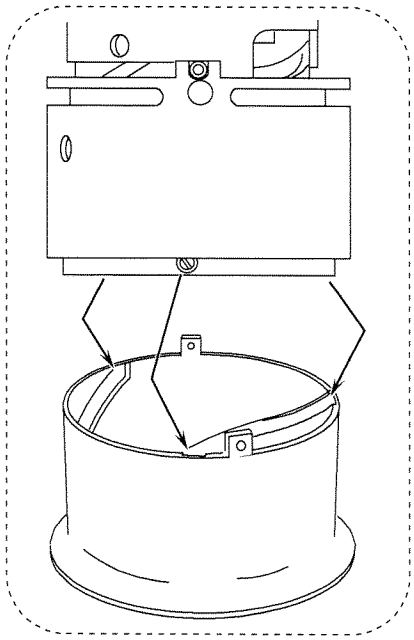


② Making sure that both screw holes are properly aligned, rotate B18 in the direction of the arrow as shown in the figure on the left. Next mount the 2nd lens group chamber B32 while aligning holes on B18 and B19.

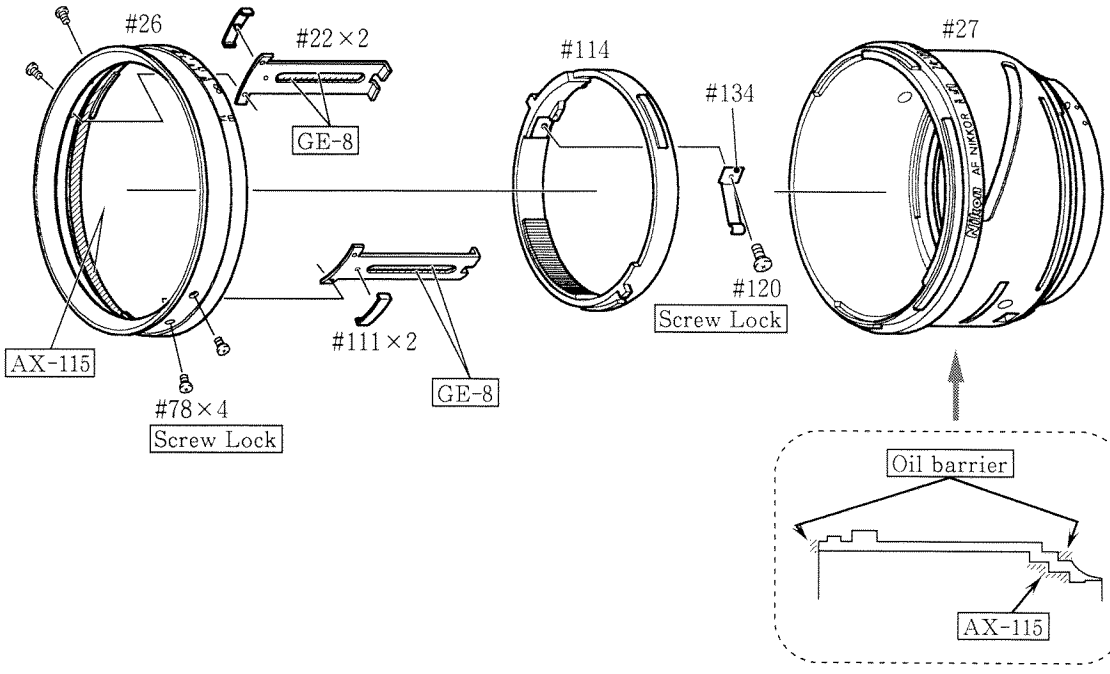
CAM GROOVE RING #51



- Apply GE-8 oil to three locations in the cam groove inside #51.
- As shown in the figure below, set the lens at the Tele side for easier mounting.



INDEX RING #27, DISTANCE SCALE RING #26

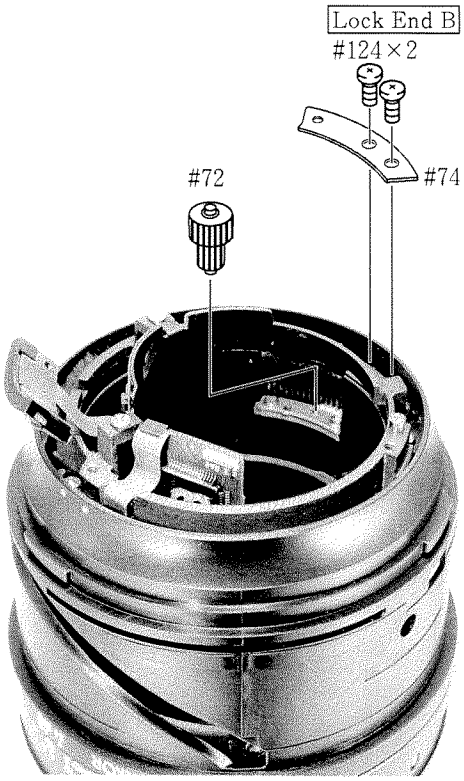


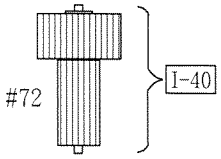
ASSEMBLING EXTERNAL PART

- Mount the external part at the location where the distance scale ring is set to the close distance side.

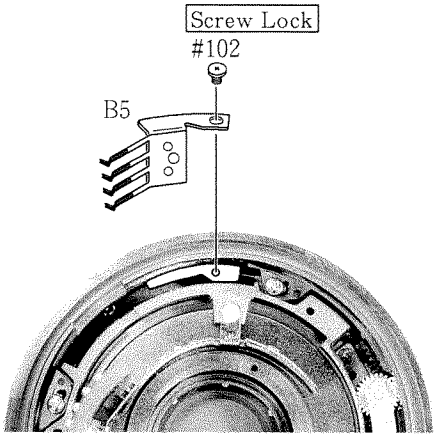
Note: When attaching guide ring units (#64, #89, #103), make sure that the infinity mark (∞) on the distance scale ring is aligned with the indicator.

AF GEAR

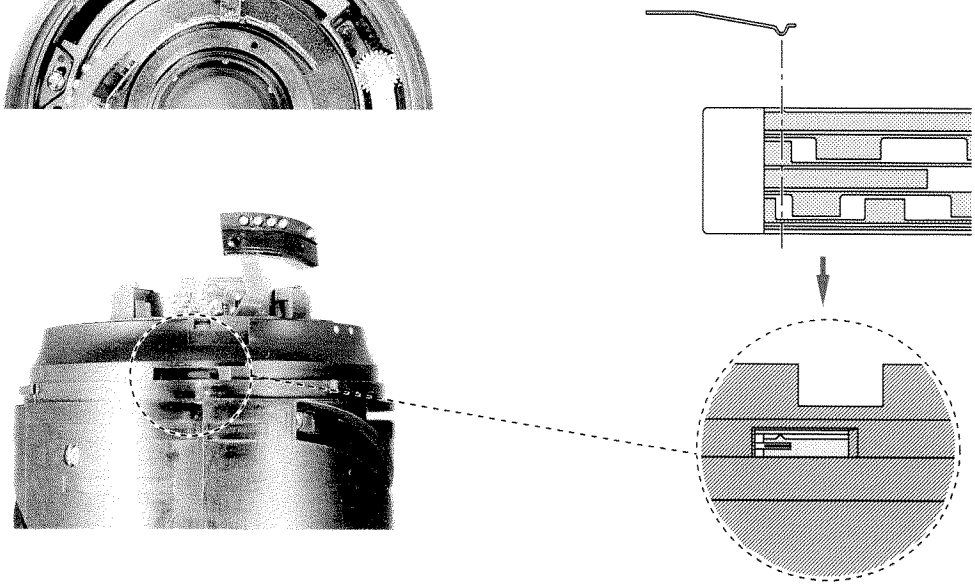




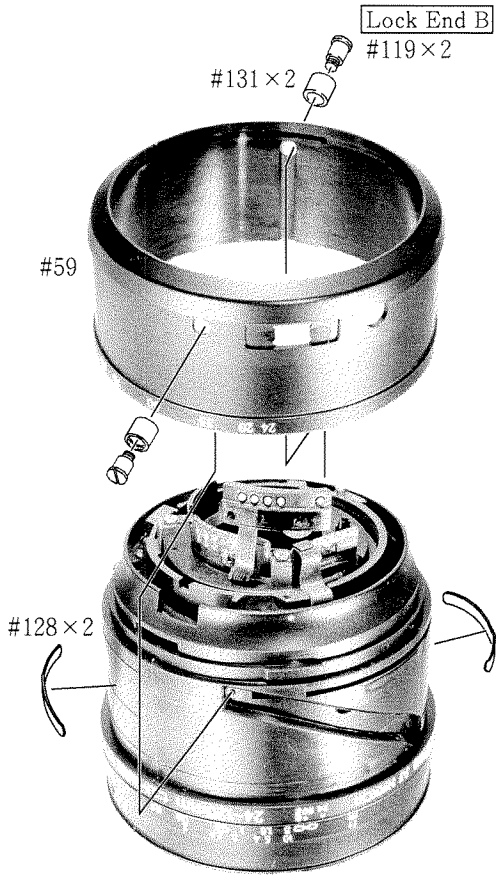
ADJUSTMENT OF DISTANCE ENCODER BRUSH POSITION

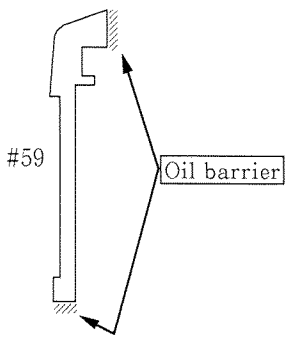


① Attach focus ring to the infinity stopper.
② Unfasten screw #102 and let the brush tip come into contact with the line as shown in the figure.
③ Fasten screw #102 and turn the focus ring several times to check the location of the brush.
④ Secure screw #102 using Screw Lock.



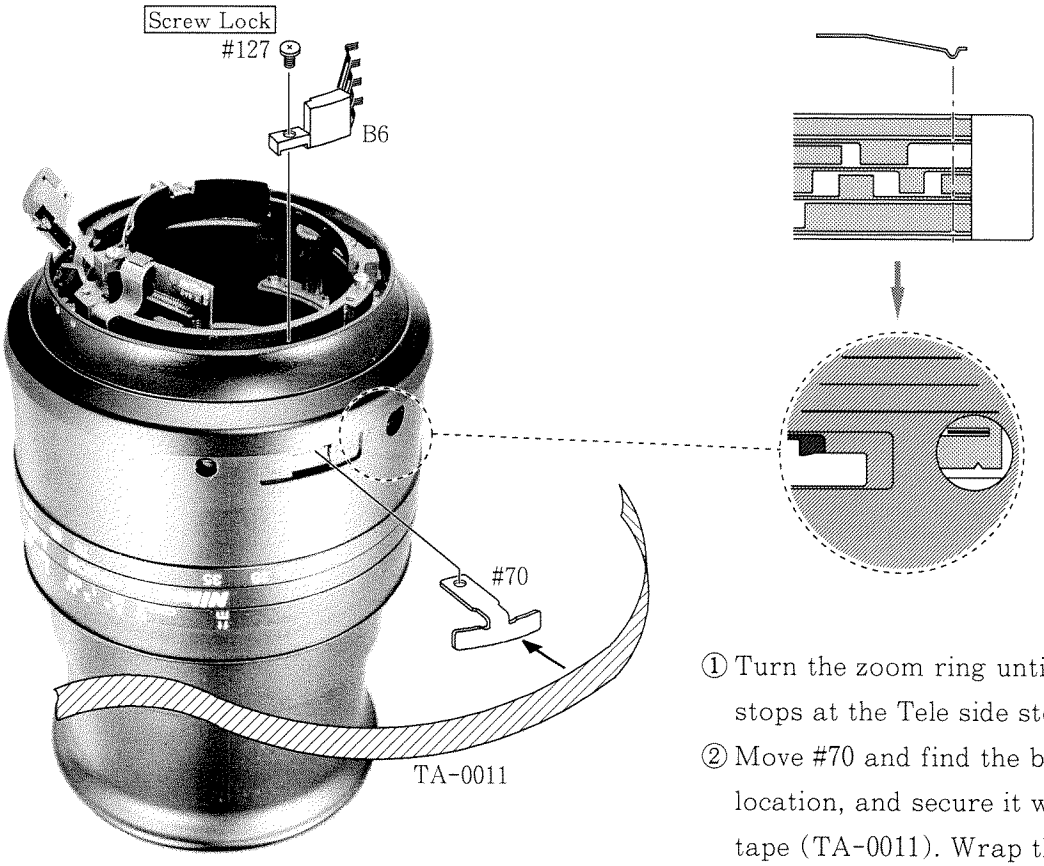
ZOOM SCALE RING #59





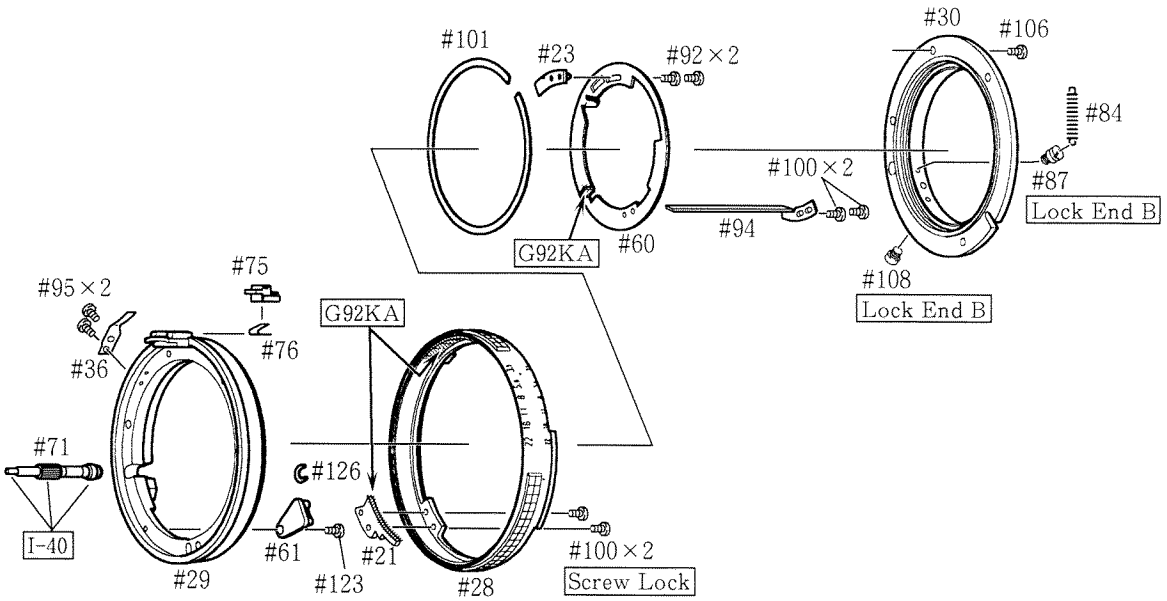
● Apply GE-8 oil to two locations in the linear advance groove inside zoom scale ring #59.

ADJUSTMENT OF ZOOM ENCODER BRUSH POSITION

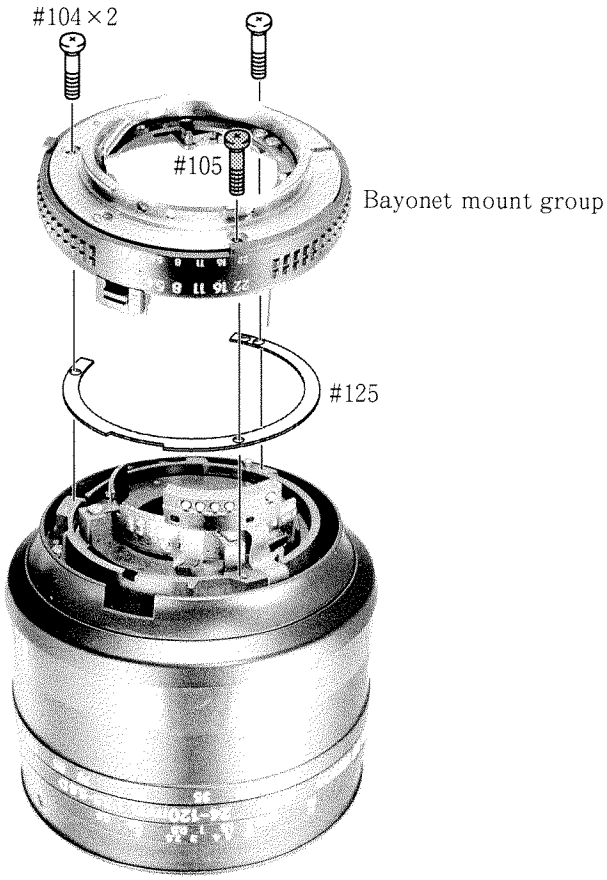


① Turn the zoom ring until it stops at the Tele side stopper.
② Move #70 and find the brush location, and secure it with tape (TA-0011). Wrap the tape once around.

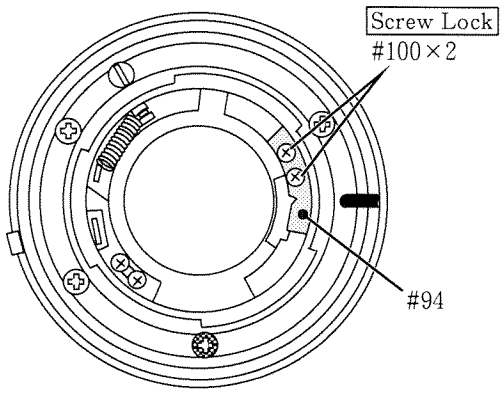
APERTURE RING, BAYONET MOUNT GROUP



ASSEMBLING BAYONET MOUNT GROUP



ADJUSTMENT OF APERTURE OPENING



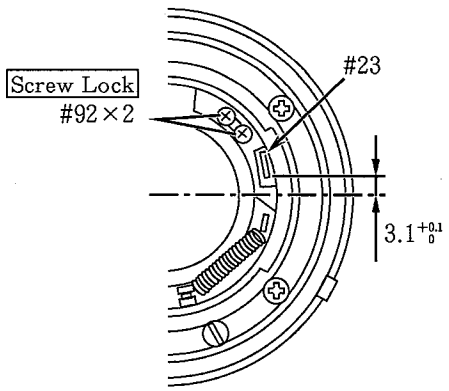
Aperture setting	Inscribed circle diameter (mm)	Toleance (mm)
3.5	16.25	17.54 ～ 15.66
4	14.28	15.43 ～ 13.22
5.6	9.93	11.15 ～ 8.85
8	6.98	7.84 ～ 6.22
11	4.93	5.75 ～ 4.22
16	3.48	4.06 ～ 2.98
22	2.46	2.87 ～ 2.10

① Unfasten screws #100×2 and move part #94 to adjust the aperture diameter.
As a guide to adjustment, the full aperture (f/3.5) should be the same size as the inside aperture of part #33.

- Aperture diameter should be within the allowable range when the diaphragm ring is rotated forward and backward.
- Aperture lever should be within the allowable range when the aperture lever is snapped by your finger.

② After adjustment, secure screws #100×2 using Screw Lock.

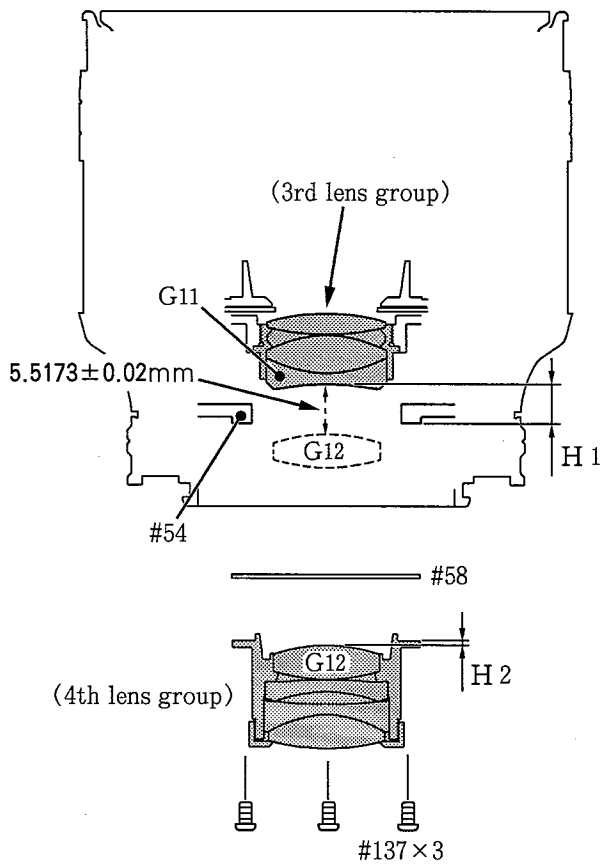
ADJUSTMENT OF APERTURE LEVER POSITION



Unfasten screws #92×2 to adjust the position of the aperture lever #23 so that it comes into the rated value of $3.1^{+0.1}_{0}$ to bring the aperture diameter whitin rated value at full aperture.
After adjustment, fix screws #92×2 using Screw Lock.

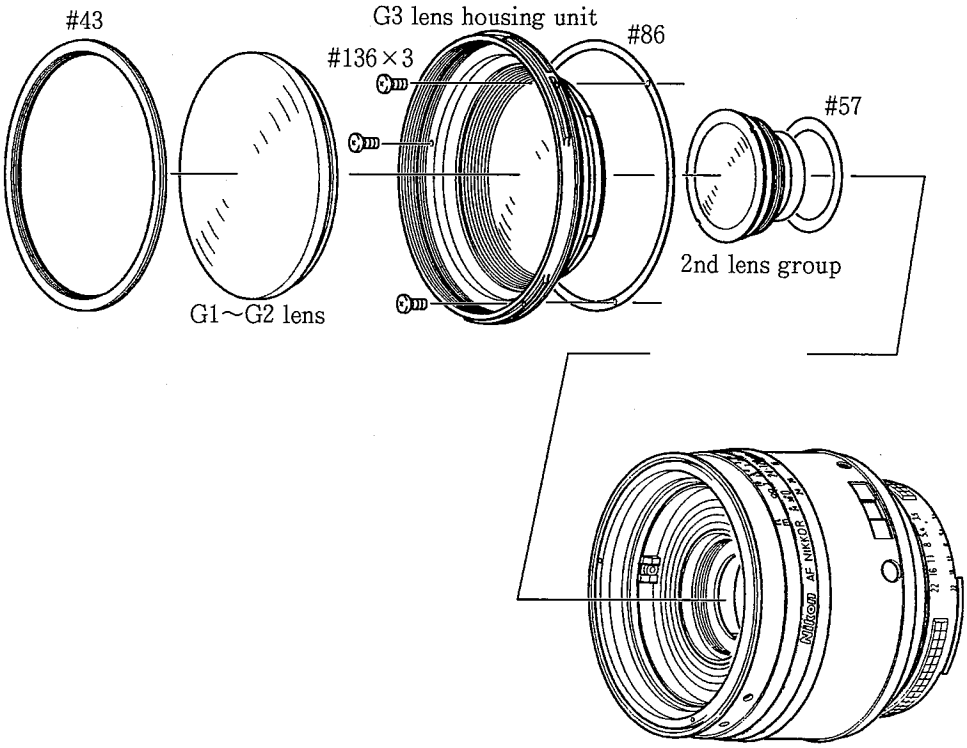
Reference : When adjusting the rated value of $3.1^{+0.1}_{0}$, set the aperture ring to f/3.5 and mount the tool J18004-1 on the bayonet mount. If becomes much easier to adjust if you mount the aperture lever #23 based on the groove of the tool as a reference.

ADJUSTMENT OF DISTANCE AMONG G11 AND G12 LENS

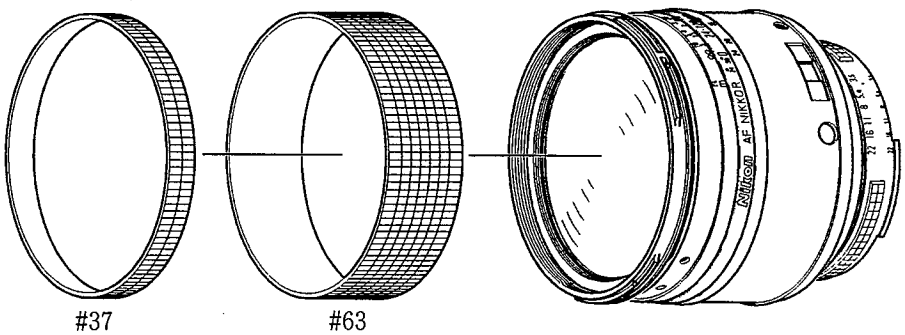


① Mount the 3rd lens group and attach zoom ring to the wide stopper.
② Set the lens on the measuring stand with the bayonet mount facing up.
③ Measure the length (H1) from G11 lens to the 4th lens group mounting surface of #54 using the digital micrometer.
④ Measure the length (H2) from G12 lens to the mounting surface of the 4th lens group using the digital micrometer.
⑤ Calculate the following equation. (Unit: mm)
5.5173 − (H1−H2) = Thickness of washer #58
⑥ Decrease the thickness of washer #58 so that the value becomes equal to the value listed above.
⑦ Mount the washer #58 and the 4th lens group.

G1～G3 LENS GROUP, 2nd LENS GROUP



RUBBER RING #37, #63

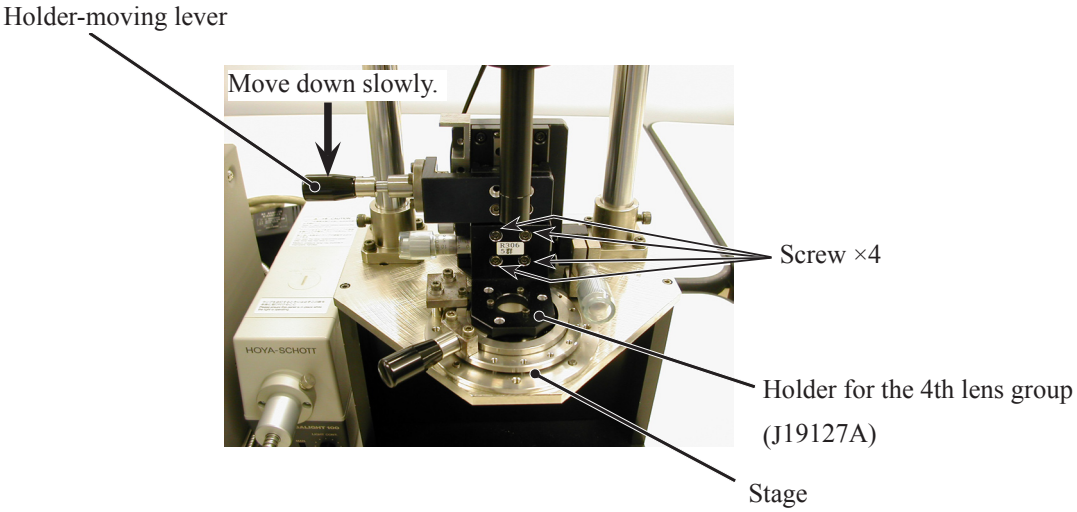


Lens Alignment

Note: This adjustment is required when the 4th lens group is removed.

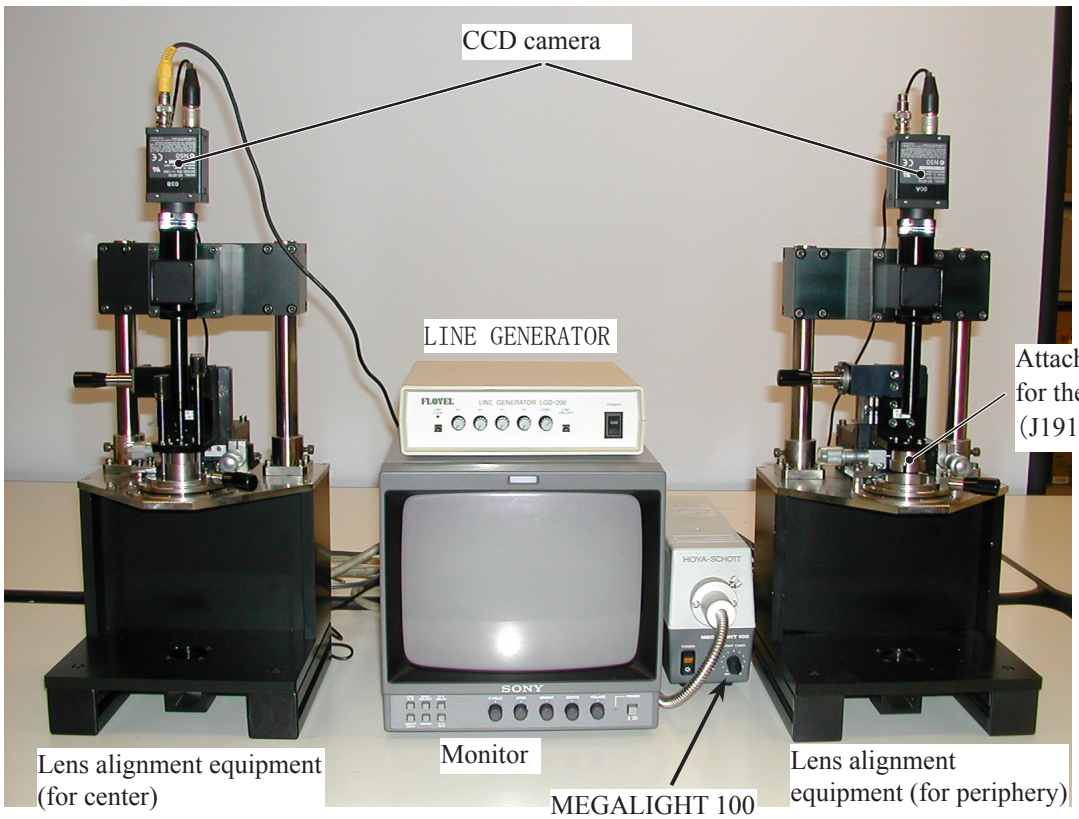
(1) Preparation of Lens optical alignment equipment

・ Fix the attachment holder for the 4th lens group (J19127A) in the lens equipment.
How to fix: Move down the holder-moving lever slowly so that the holder touches the stage. Then tighten 4 screws to fix it.



・ Create the center positioning tool (ref. Page L15-14 for how to create it).
・ Create cardboards in which "Lens alignment chart" and "Viewers" are fit. (ref. Page L15-16 for how to create them.)
※ As for AF24-120/3.5-5.6D, the below equipment (left) for center is NOT used.

Lens optical alignment equipment



サービス計画課 M

Back view of Lens optical alignment equipment

・ Connect each cable to the appropriate equipment with the same number. (e.g. Connect up ① to‘ ①)

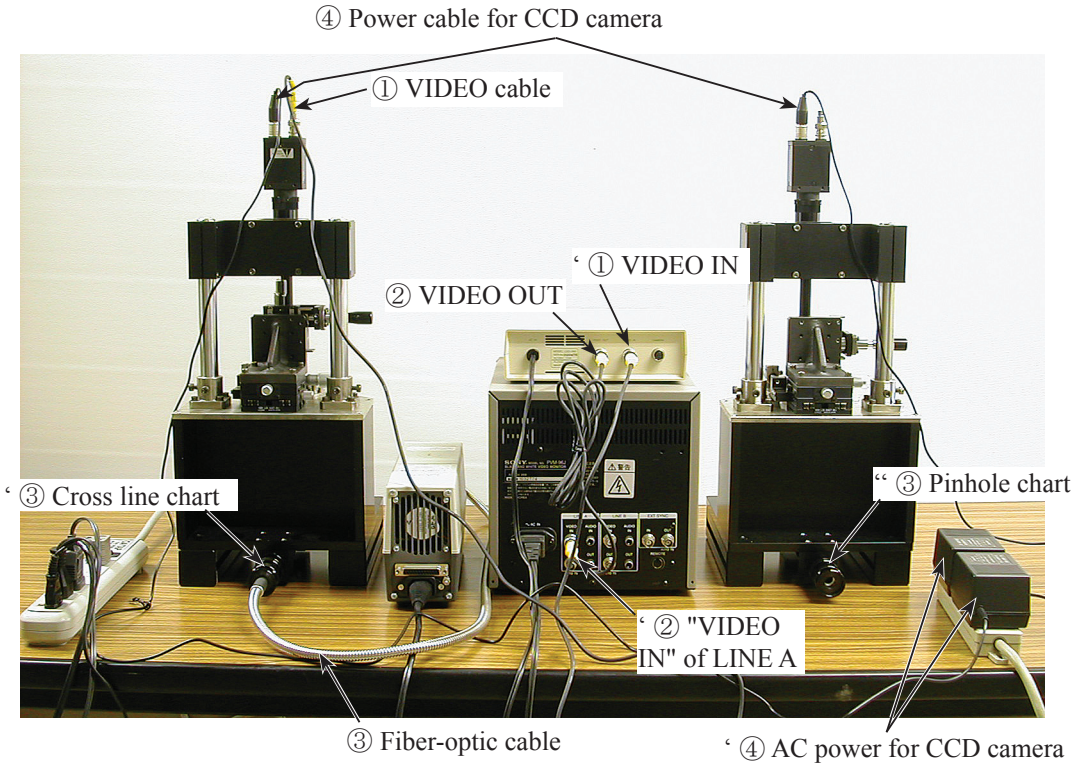
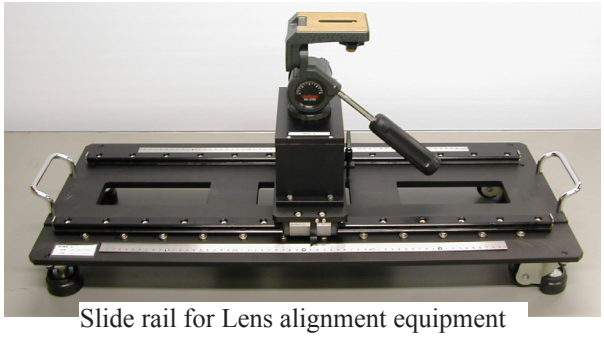
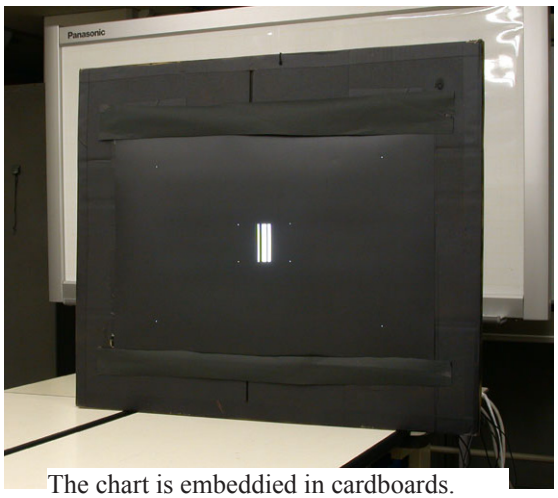


Chart shooting equipment for alignment



Slide rail for Lens alignment equipment

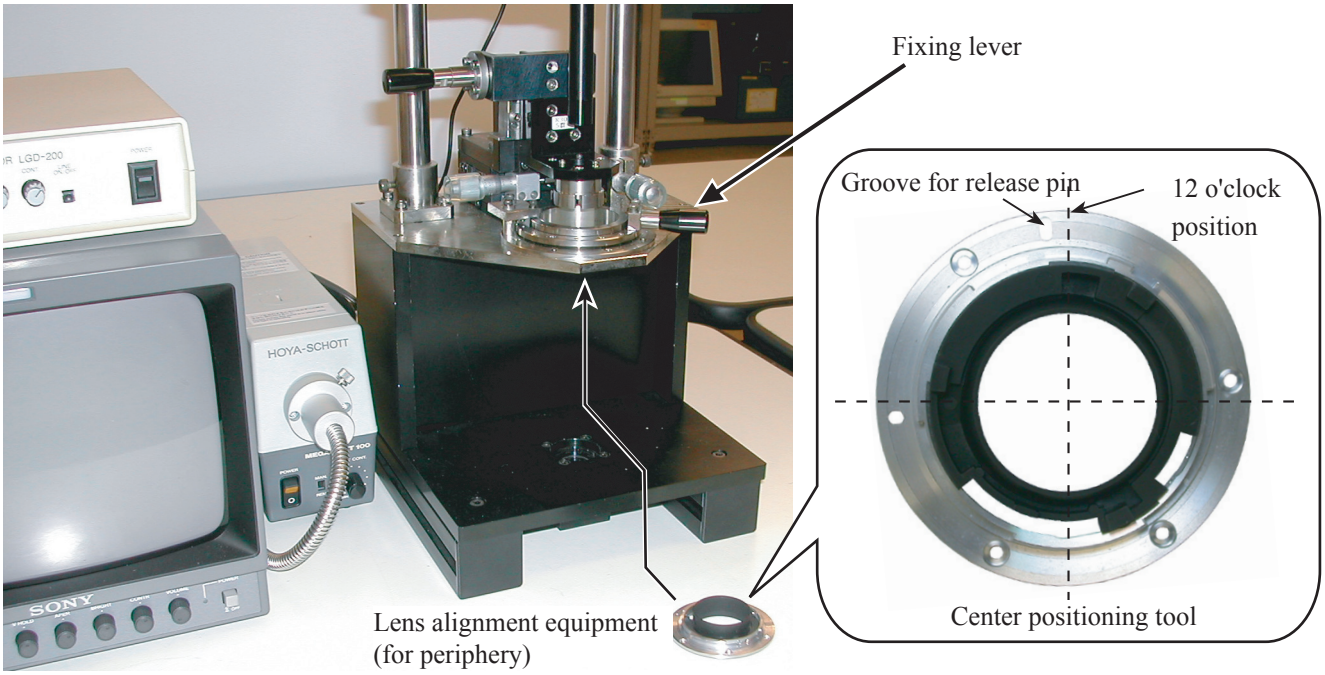


The chart is embeddied in cardboards.

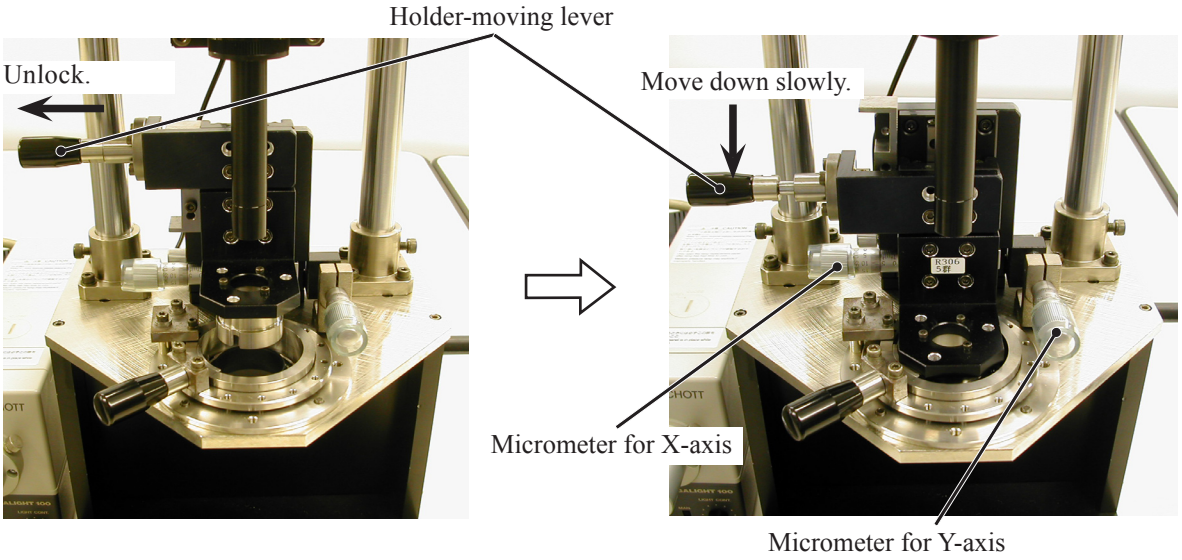
サービス計画課 M

(2) Temporary positioning of 4th lens group

① Mount the (self-made) center positioning tool on the lens alignment equipment (for periphery) by setting the groove in place slightly to the left (in a counterclockwise direction) from the below 12 o'clock position. Then turn the tool clockwise all the way to the right, and move the lever to the left to fix it.



② Unlock the holder-moving lever, and move the holder down slowly by the lever.



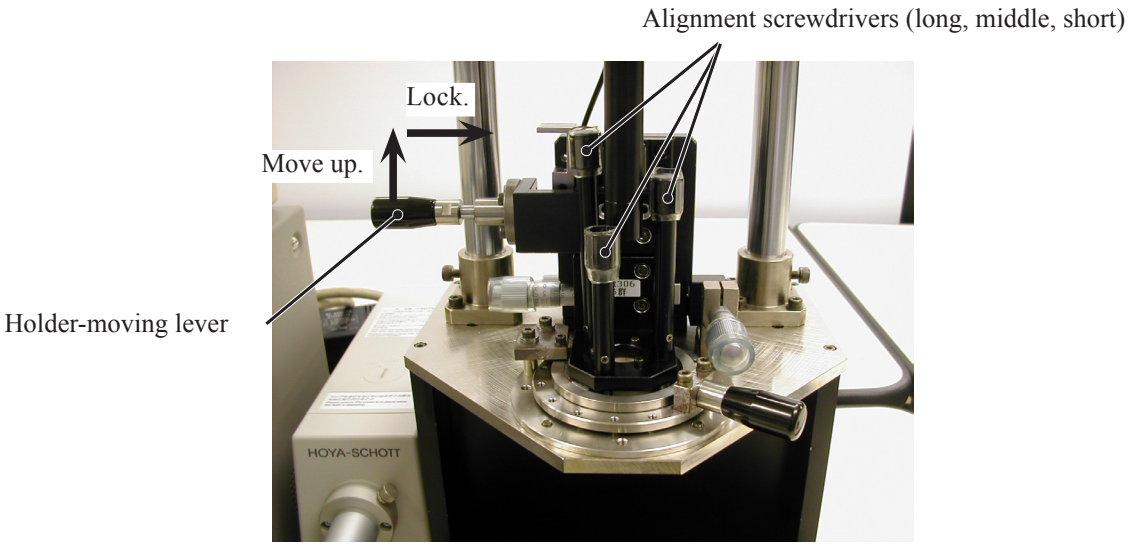
③ Adjust the holder's position by rotating the micrometers for X-axis or Y-axis so that the holder does not touch the protection ring of the center positioning tool.

Note) Without this alignment, the 4th lens may be damaged by the holder.

④ Move the fixing lever of the alignment equipment to the right, and remove the center positioning tool from the equipment.

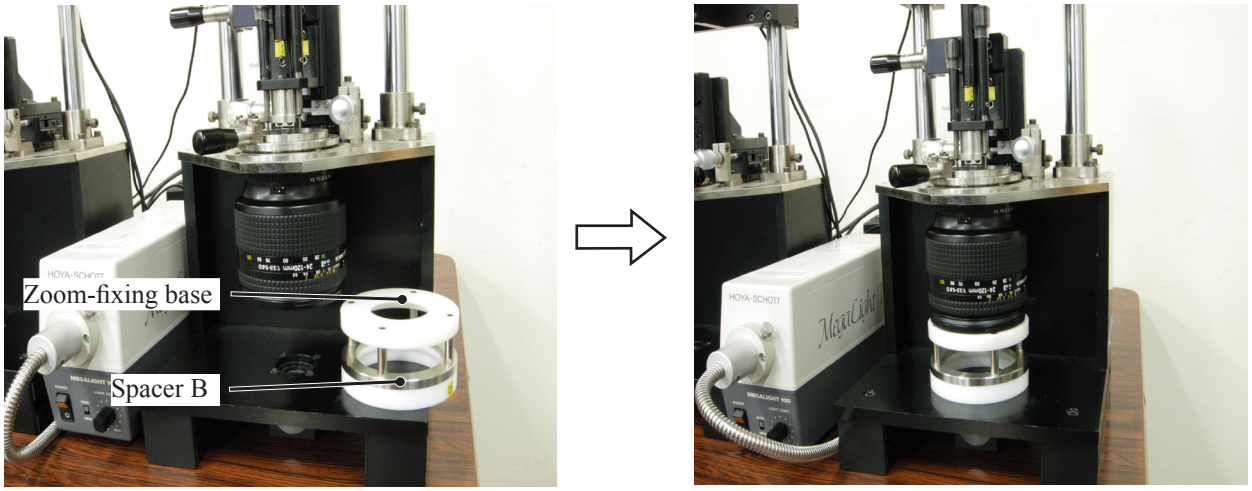
サービス計画課 M

⑤ Insert the 3 alignment screwdrivers (long, middle, short) in the 4th lens group holder, and move the holder-moving lever up to lock the holder.



⑥ With the 3 screws of the 4th lens chamber of the lens being loose, mount the lens to be examined on the equipment (for **periphery alignment**). **(ref.** ① for how to attach it.)

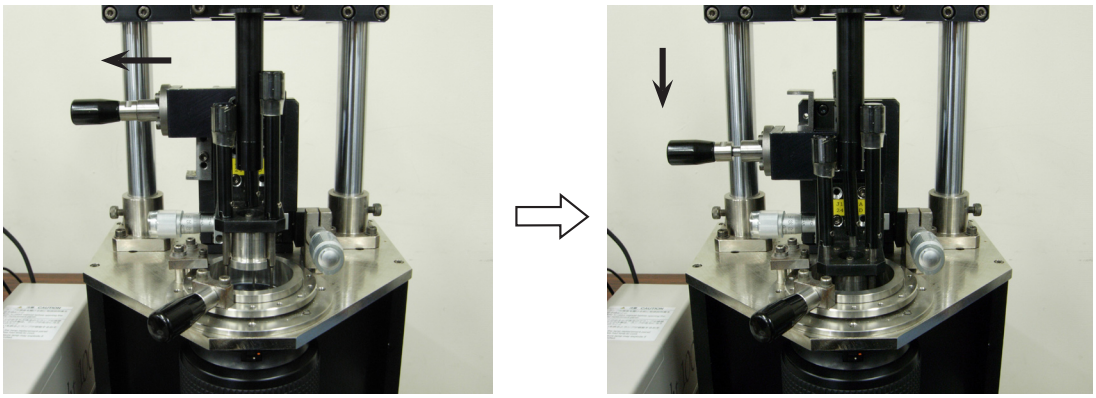
⑦ Set the lens to WIDE-end. Place the zoom-fixing base, spacers (D) in position, then turn the zoom ring until the lens touches the zoom fixing base.



サービス計画課 M

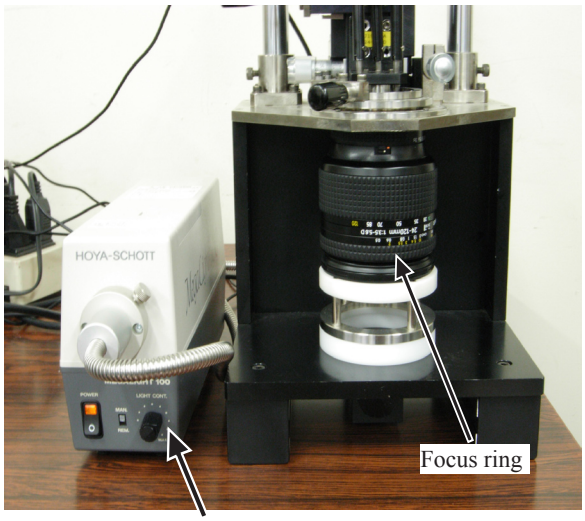
⑧ Unlock the holder-moving lever, and move the holder down slowly by the lever. Insert the 3 alignment screwdrivers (long, middle, short) in the loosened screw holes of the 4th lens chamber.

Note) Because the screws cannot be seen, when inserting the alignment screwdrivers, put them straight down in the screw holes so that the screws can be easily found.



⑨ Turn the power of the Monitor, LINE GENERATOR, and MEGALIGHT 100 to ON. By checking the screen of the Monitor, rotate the micrometers (X and Y) so that the intersection point of the cross lines*1 (calibrated) comes in the center of the Monitor.

*1 Adjust the cross lines by turning the "LIGHT CONT." knob of "MEGALIGHT 100" and the focus ring until the calibration of the cross lines can be seen clearly.



Note) In case the cross lines are tilted, adjust them by turning the chart, which is screwed in the rear tube of the equipment.

⑩ When the intersection point of the cross lines comes in the center, tighten the 3 screws of the 4th lens chamber with the alignment screwdrivers.

Note) When the holder is raised, the intersection point of the cross lines is misaligned. So make an adjustment by considering this.

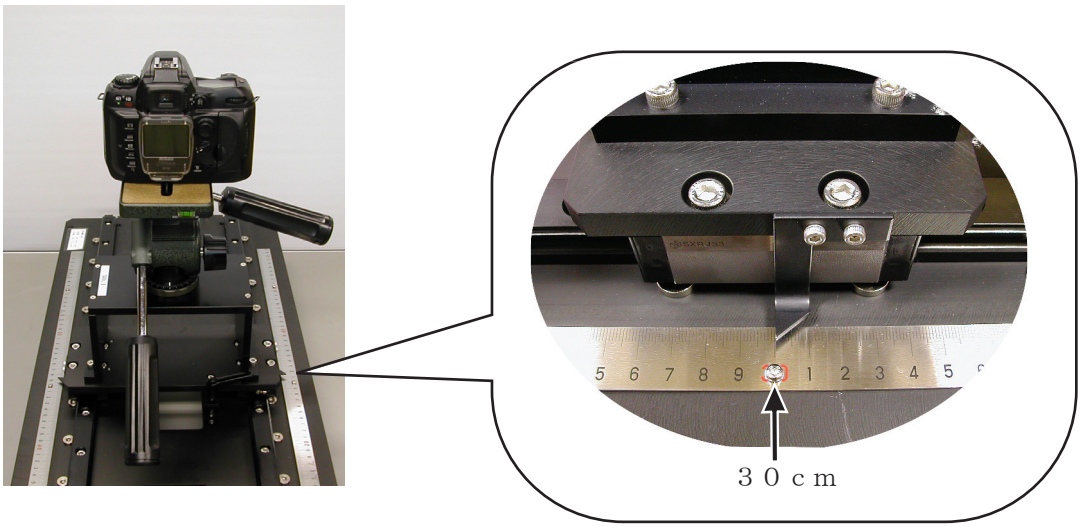
⑪ Move the holder-moving lever up slowly to lock the holder, and remove the lens from the equipment (for periphery).

サービス計画課 M

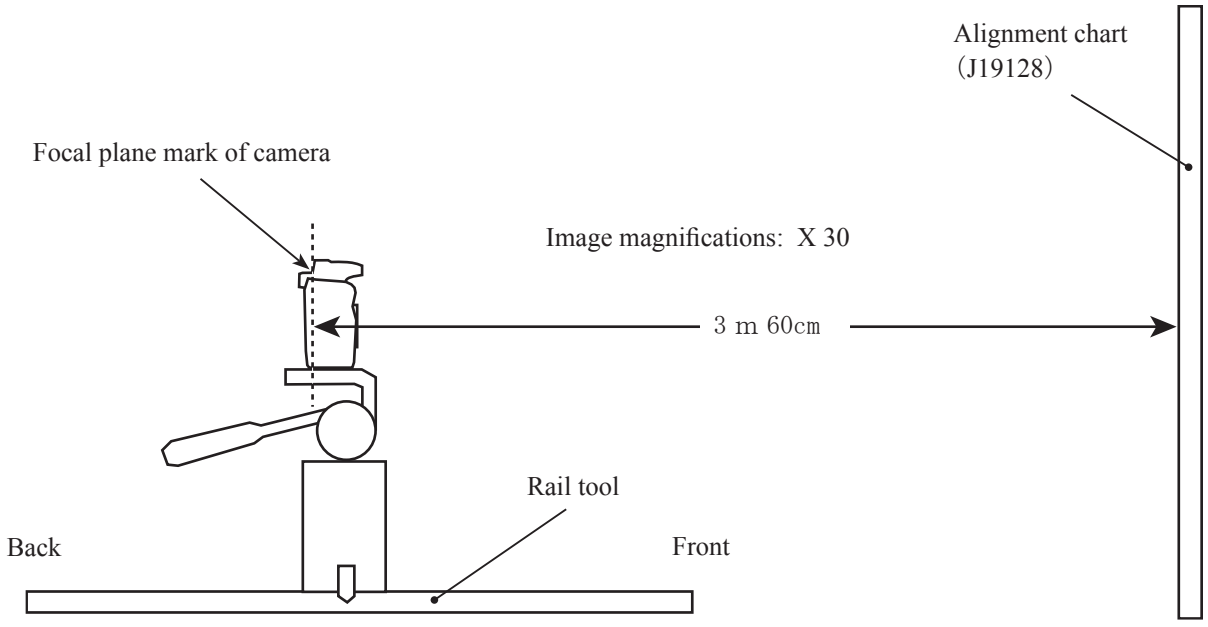
(3) Chart shooting for the 4th lens group alignment

① Prepare a camera (D100). Set the shutter speed to “M1/80”and the focus mode to “S”. On the shooting menu, set “Image Quality” mode to “RAW”, “WB” to “Preset”and “ISO” to “200”.

② Set up the camera (D100) on a tripod on the slide rail. Set the indication pointer of the tripod to **30 cm**.



③ Set the alignment chart (J19128) as shown below.



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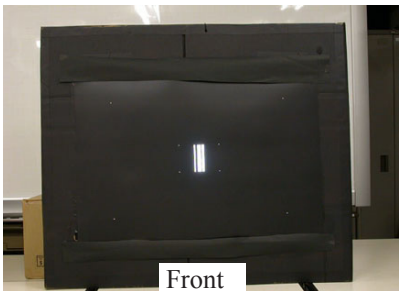
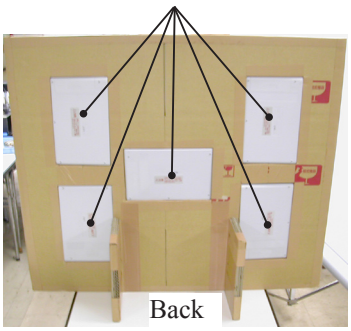
④ Turn the power of viewers (5 pcs.) to ON.

(Note: If the batteries of viewers are exhausted with decreased brightness, the shooting data cannot be obtained correctly.)

Viewer× 5 pcs.

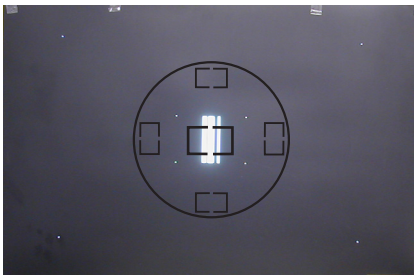




⑤ Fit the lens to be examined in the camera (D100). Set the zoom to TELE (120 mm).

⑥ By looking through the viewfinder, adjust the height and tilt to make the chart fill the entire finder field frame.

⑦ Adjust the tilt of the slide rail to make the 3 chart lines position in the center of the viewfinder, when the tripod is slid all the way to the front and back.



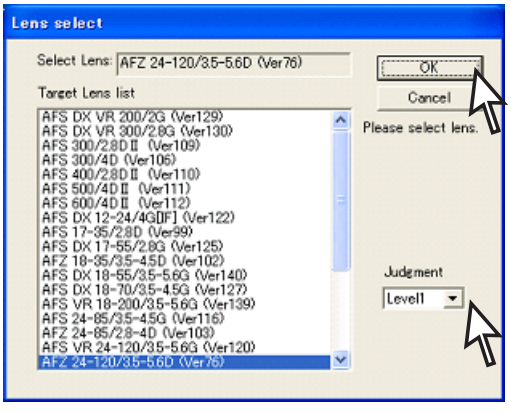
⑧ Connect the PC and camera via USB cable. (Camera setting: Mass Storage)

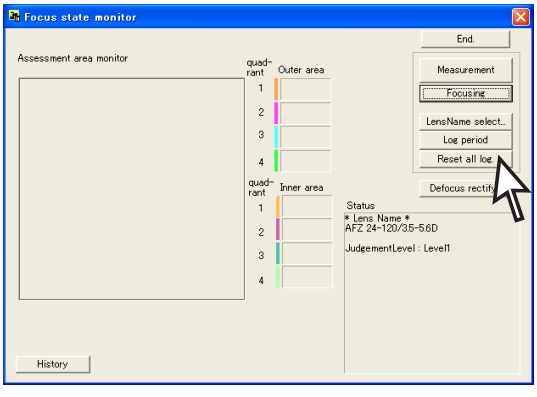
⑨ Start the adjustment software (LWM.exe).

⑩ Confirm that the lens to be examined is selected on "Lens Select" screen. Then click "OK" button.

Note: Select "Level 1" for "Judgment" as standard.

⑪ “Click the "Reset all log" button.





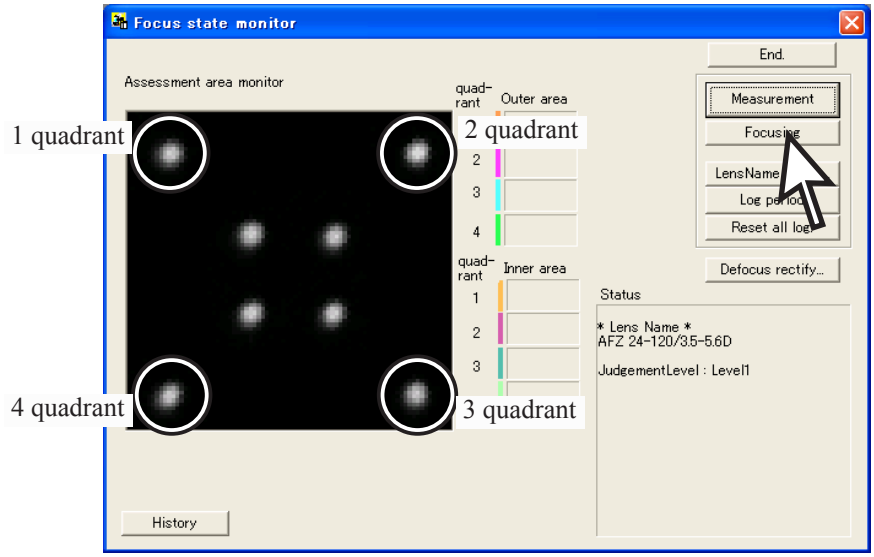
⑫ Set the indication pointer of the tripod back to 30 cm, and click "Focusing" button. AF is activated to focus and the shutter is released.

⑬ Check that the shape of shot 8 point images (as shown below) becomes as perfect as circle.

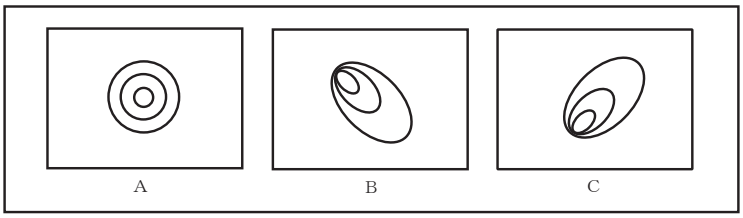
※ In case the point images are ellipsoid, perform from ① to ⑧ of "(4) **4th lens group alignment" to make** a temporary adjustment by moving the point at the intersection of the crossed lines so that the images become as perfect as circle. Then start from ⑫ to make a readjustment.

~~Refer to the below for the moving direction of the 4th lens group.~~

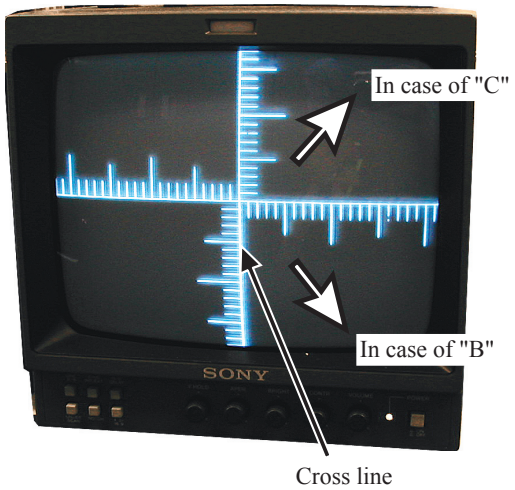
The direction of the movement of the rear lens group for adjustment: If point image of 1-3 quadrants is like "B", move the intersection point towards lower right direction. If point image of 2-4 quadrants is like "C", move the interseciton point towards upper right direction. △ (Revision)



Point image



Moving direction of intersecting point



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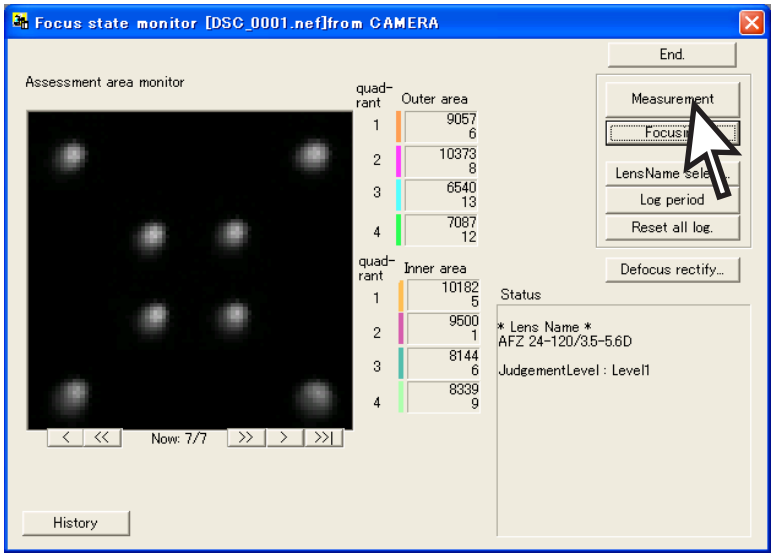
⑭ Set the focus mode of the camera (D100) to "M".

⑮ Slide the tripod to the front by 30 ± 0.1 cm.

⑯ Click the "measurement" button of the adjustment software.

⑰ When the shutter of the camera is released, slide the tripod to the back by 10 ± 0.1 cm and make a remeasurement.

⑱ Again, slide the tripod to the back by 10 ± 0.1 cm and make a remeasurement.
Repeat this operation 4 more times, totalling in 7 measurements. (The total sliding distance is 60 cm.)



Note 1: When the below warning is given, there may be some defects in the brightness of the viewers and/or parallelism of the chart and camera, etc. So correct the above and make a remeasurement.

Note 2: When the below warning is given, recheck that the Quality mode of the camera is set to RAW.

Note 3: When the below warning is given, recheck that the zoom ring of the lens is set to TELE-end.

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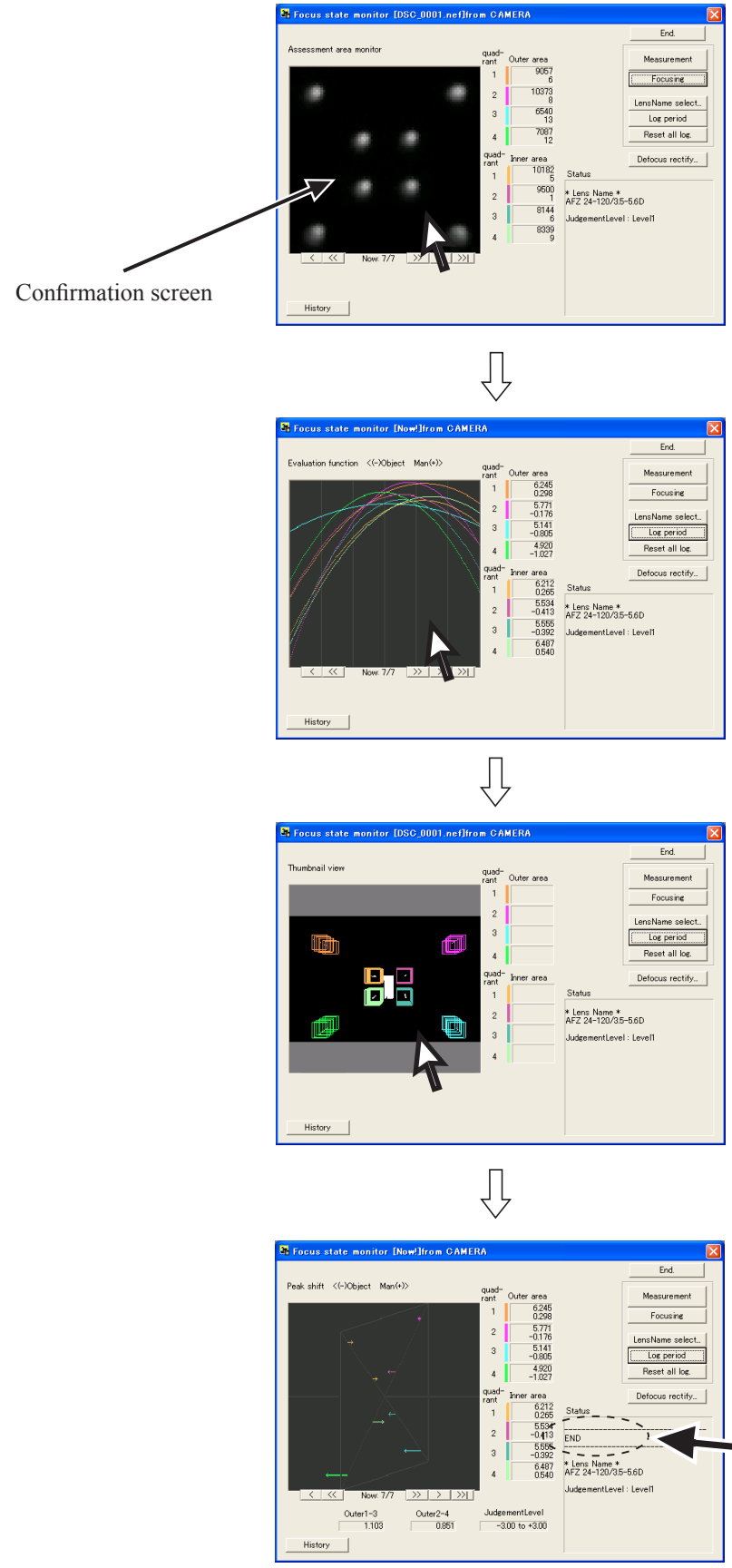
⑲ After the 7 measurements, point the cursor to the confirmation screen of the software. Click it 3 times, and if "END" is displayed on the Information, the lens optical alignment is completed.
If "END" is NOT displayed, go to the next “(4) 4th lens group alignment” to readjust.



(4) 4th lens group alignment

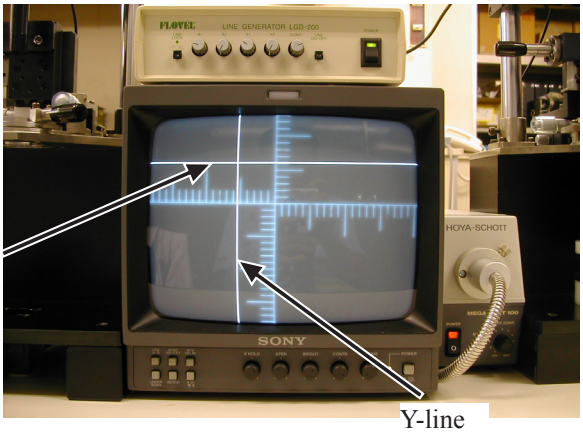
① Mount the lens on the equipment (for center). (ref. ① of (2) for how to fit in it.)

② Set the lens to WIDE-end. Place the zoom-fixing base, spacers (D) in position, then turn the zoom ring until the lens touches the zoom fixing base.

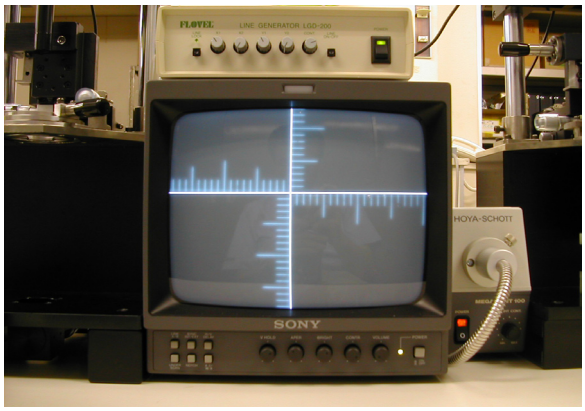
③ Turn the power of the monitor, LINE GENERATOR, and MEGALIGHT100 to ON.

④ Press the "LINE ON/OFF" button of LINE GENERATOR. Turn the knobs of "X1" and "Y1" so that X- and Y-lines are displayed on the monitor.
Superpose these X- and Y-lines on the cross lines of the CCD camera. Then press "LINE LOCK" button to fix these X- and Y-lines.

LINE GENERATOR



⇩



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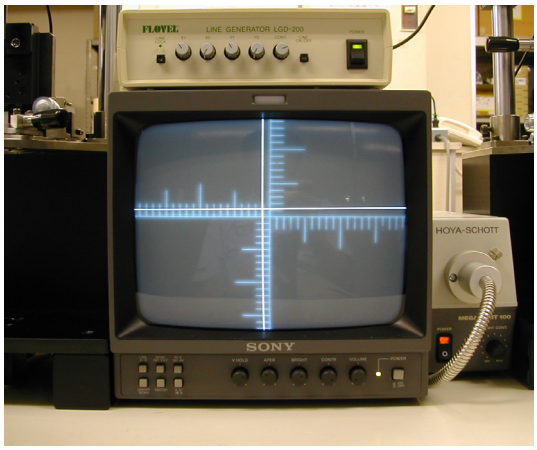
⑤ Unlock the holder-moving lever, and move the holder down slowly by the lever.

⑥ Insert the alignment screwdrivers (long, middle, short) into the screw holes of the 4th lens chamber, and loosen the 3 screws.

⑦ Rotate the micrometers (X and Y), and shift the cross lines by the scales that were results of the chart shooting of the 4th lens group alignment.
(e.g. Refer to "Pic.1" for the case of <X directions:+1, Y directions:-1>)



Pic.1

⑧ Fix the 3 screws of the 4th lens chamber with the alignment screwdrivers. Move the holder-moving lever up to lock the holder.

⑨ Check that a shift length caused by the cross lines and the X/Y lines is equal to the scales (1 = 1 scale of the calibrated cross lines) of the results of "Chart shooting of the 4th lens group alignment". (ref. Pic.1)

Note: After fixing the 3 screws of the 4th lens chamber, if a shift length is different from the results of the chart shooting, repeat the procedure from ④ to ⑧ until they become equal.

⑩ Turn each power of the monitor, LINE GENERATOR, and MEGALIGHT 100 to OFF. Remove the lens from the equipment (for periphery).
Then go back to “(3) Chart shooting of the 4th lens group alignment” and repeat the procedure (3) and (4) until the result becomes "END".

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How to create positioning tool of 4th lens-group holder for lens alignment (AF 24-120/3.5-5.6D)

1: Summary

1-1: This is a positioning tool of the 4th lens group holder for lens alignment, in order to secure the position for attaching the 4th lens group temporarily.

2: Preparation

2-1: The following is used:

- ＊ Rear cover ring (JAA78071- Part no. :1K631-287) X 1 pc.
- ＊ Bayonet mount (JAA78071- Part no.: 1K404-157) X 1 pc.
- ＊ Mount rotation stopper screw (JAA78071- Part no.: 1K120-012) X 1 pc.

3. Procedure

3-1: Put the bayonet mount as shown in Fig. 1.

Put with the groove, in which the lock pin of camera body enters, just upward.

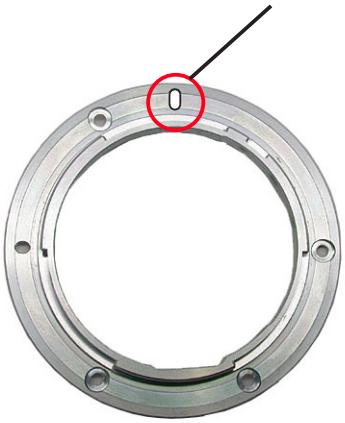
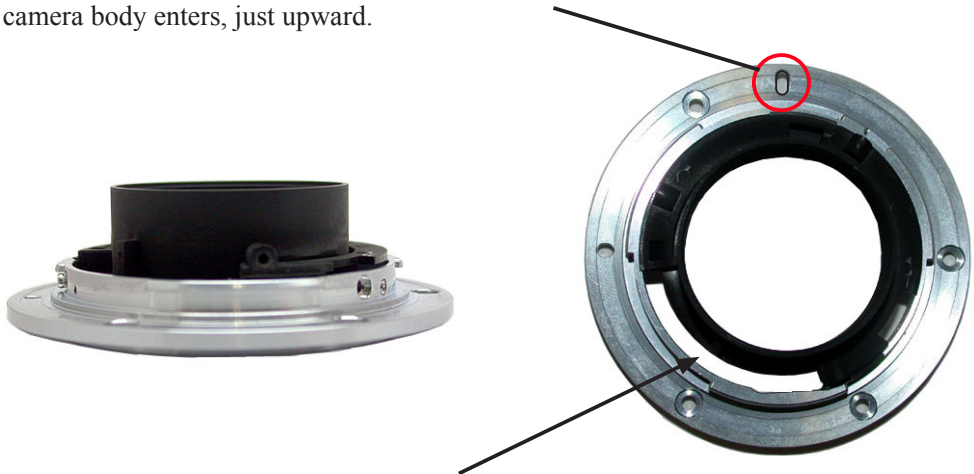


Fig. 1

3-2: Mount the reversed rear cover ring on the position of Fig. 1, and attach them as shown in Fig. 2.

Put with the groove, in which the lock pin of camera body enters, just upward.



Large notch of rear cover ring.

Fig. 2

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3-3: Turn the rear cover ring clockwise, which was attached to the bayonet mount. Then stop at the position as shown in Fig.3-1.

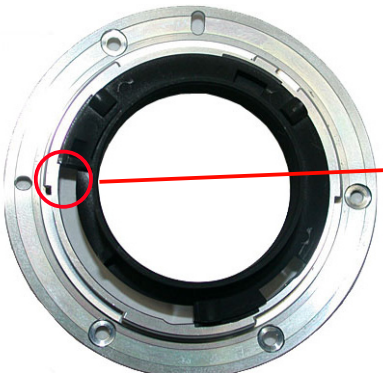


Fig. 3

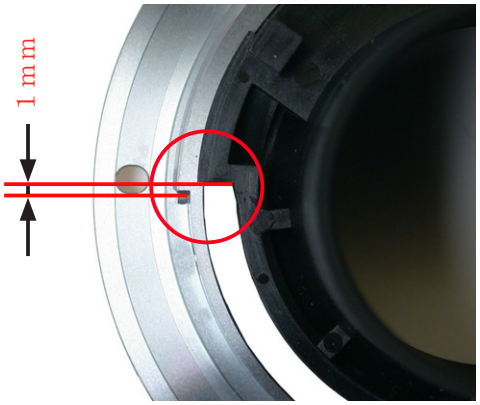
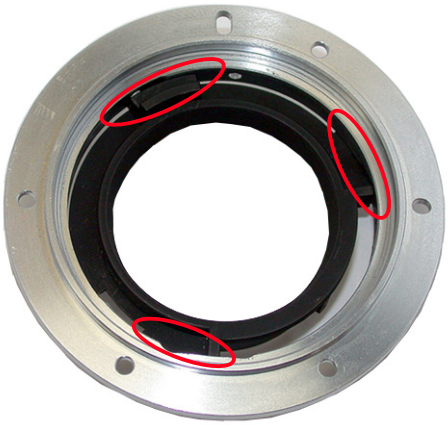


Fig. 3-1

3-4: Fix the following 3 locations of the rear cover ring with the instant glue.

Fig. 4

3-5: Turn the bayonet mount over. Reinforce the following 3 locations with the adhesive to attach the bayonet mount and rear cover ring firmly.



3-6: Attach the mount rotation stopper screw at the appropriate position.

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How to create Setting board of "Lens alignment chart" and "Viewer"

1. Summary

1-1: In order to get necessary data for lens alignment, this board is created to use for setting a special chart and light viewers (for chart illumination), when taking pictures of the special chart with a digital camera.

2. Preparation

2-1:Prepare a board (760 x 880 x 20 mm) or 2 package cardboard boxes (size 2.33).

(Note) Because you have to cut out the shape to embed light viewers, choose package cardboard boxes (size 2.33) or material which can be easily cut. － ref. Fig. 1

3. Procedure (In this document, 2 package cardboards are used)

3-1: As for the 1st flattened cardboard box (size 2.33), check the positions for embedding the light viewers, and cut out the shape at 5 locations (shaded parts/size 154 x 245 mm) as shown below. － ref. Fig. 2

(Note) Cutting the shape slightly smaller than the actual size of viewers makes it easier to fit the positions of viewers tightly.

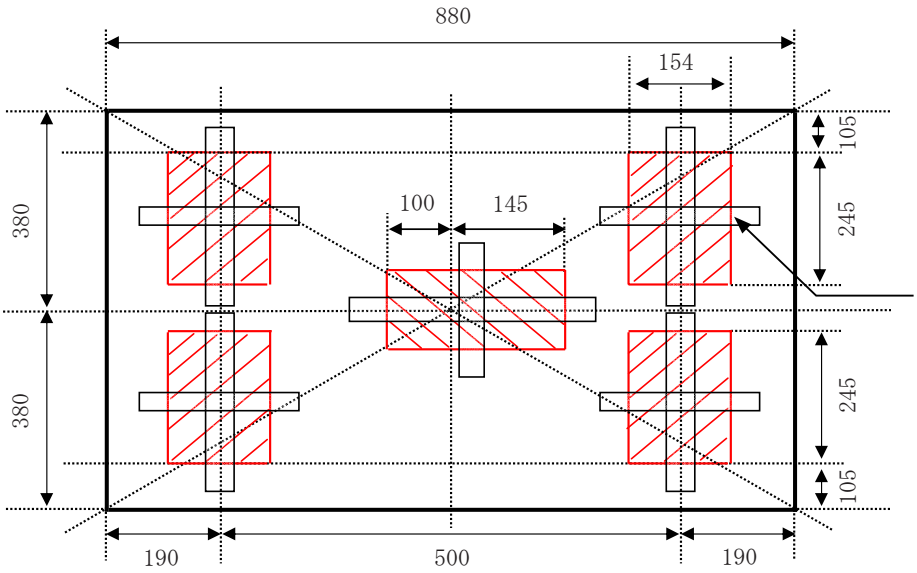
3-2:Put the 2nd flattened cardboard box (size 2.33) and the above cut-out 1st cardboard together as one, and fix them by taping at 4 sides. － ref. Fig. 3

3-3:Then as for the 2nd flattened cardboard box, cut out the shape again by matching the cut-out size of 3-1 for each viewer. － ref. Fig. 4

3-4:Reinforce the edges of cut-out parts with tape.

(Note) To prevent viewers falling off, secure them with tape around the edges. － ref. Fig. 5

3.5: Blacken around the setting board (with black spray, etc).



To prevent viewers falling off, attach Velcro tape on the back of the cardboard. In this document, 2mm-width Vercro (hook and loop fastener) is used.

4. Prevent Viewers from falling off (In this document, 2-mm width Velcro tape is used.)

4-1: As shown above, when viewers are embedded, secure them with square pieces of Velcro tape (hook and loop fastener) on the back of the cardboard to prevent viewers falling off.

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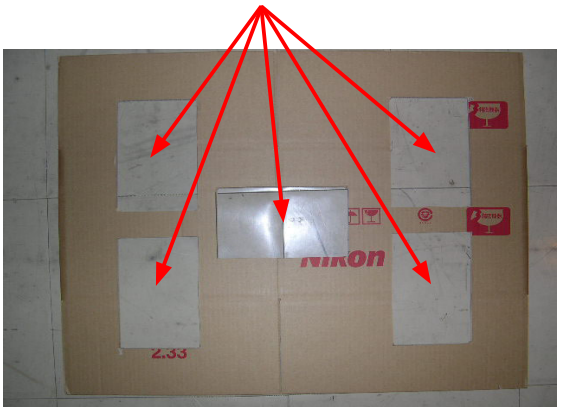
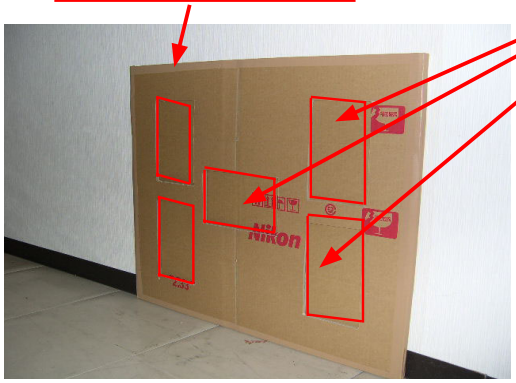
(Fig. 1- Prepare 2 package cardboard boxes, and flatten them as below.)

(Fig. 2 - As for the 1st flattened cardboard box, cut out the <154 x 245 mm sized> shape at 5 locations.)

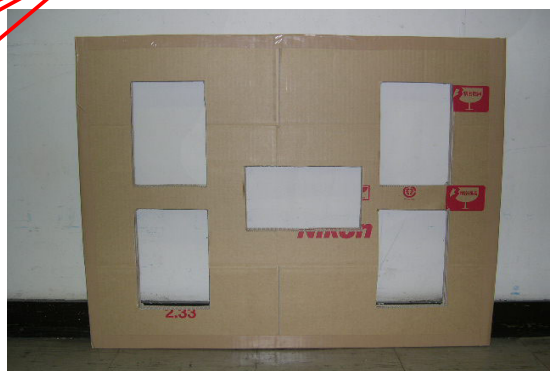


(Fig. 3- Package cardboard boxes)
Put the 2nd flattened cardboard box and the 1st cut-out cardboard together as one as shown below.

Fix them by taping at 4 sides.



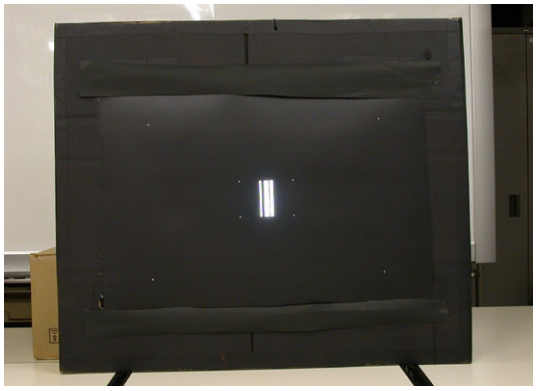
(Fig. 4- As for the 2nd flattened cardboard box, cut out the shape in the same way as Fig.2. All cardboards are cut out as below.
Cut out by matching the size of the 1st cutting.



(Fig. 5- Light viewers are embedded.)

To prevent viewers falling off, secure the viewers with tape around the edges.

(Fig. 6- Setting board is blackened with the chart being attached.)



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ADJUSTMENT OF SHIFT FOCUS (TELE AND WIDE)

1. Align the ∞ mark on focus ring to index. Set aperture to full aperture.
2. Read the value on both Wide and Tele sides respectively.
3. Calculate the following equation.

$(A-B) \div 2.0 = C$

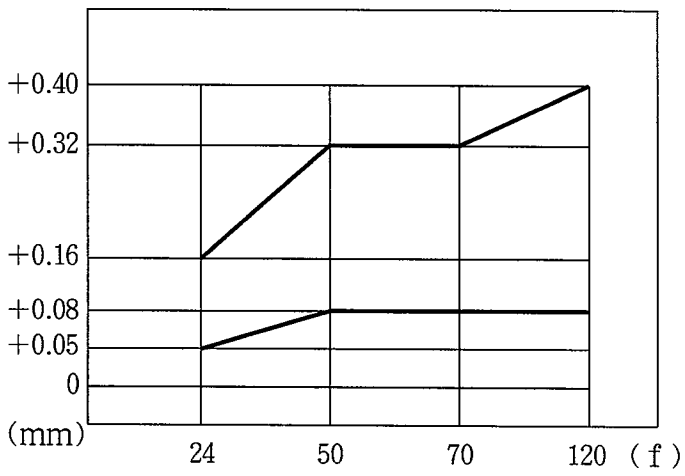
A= Value of Tele side (mm)
B= Value of Wide side (mm)
C= Amount (mm) of adjustment of 1st lens group washer #86

4. Adjust the thickness of washer #86 by the value C calculated from the above equation.
   If the value C is positive, thicken the washer by the value, and if negative, thin the washer.
   Note : Insert thin washer between thick washers when mounting washer #86.
   (Refer to page L15.)

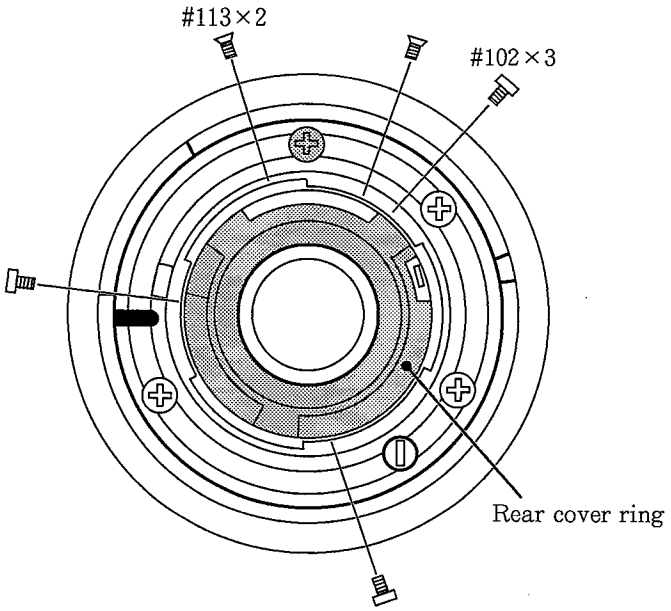
ADJUSTMENT OF BACK FOCUS

1. Align the ∞ mark on focus ring to index. Set aperture to full aperture.
2. Readout values at either Wide or Tele side.
3. Remove the aperture ring.
4. If the value is above the standard, increase the thickness of the washer, otherwise decrease it.
5. Confirm that the value is within the standard range.
   (Refer to page L13.)

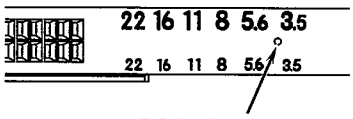
Focal lenght (f)	Standard (mm)
24mm	+0.05 ～ +0.16
50mm	+0.08 ～ +0.32
70mm	+0.08 ～ +0.32
120mm	+0.08 ～ +0.40



REAR COVER RING



ATTACHING METER COUPLING SHOE



(1) Take out aperture ring #28.

(2) Make a hole (ϕ1.1) at the concave portion of aperture ring.
Mount meter coupling shoe on the aperture ring and make another hole (ϕ1.1) based on the hole of meter coupling shoe.

Meter coupling shoe	1K406 - 011	×1
Screw	1K010 - 002 - 1	×2

(3) Mount meter coupling shoe.

(4) Assembling.

INSPECTION OF ENCODER SIGNAL

※ Use an F70 (N70) camera body and AF nikkor lens inspection program for F70／N70 to display encoder signal on the computer monitor when making an inspection.

Inspection method

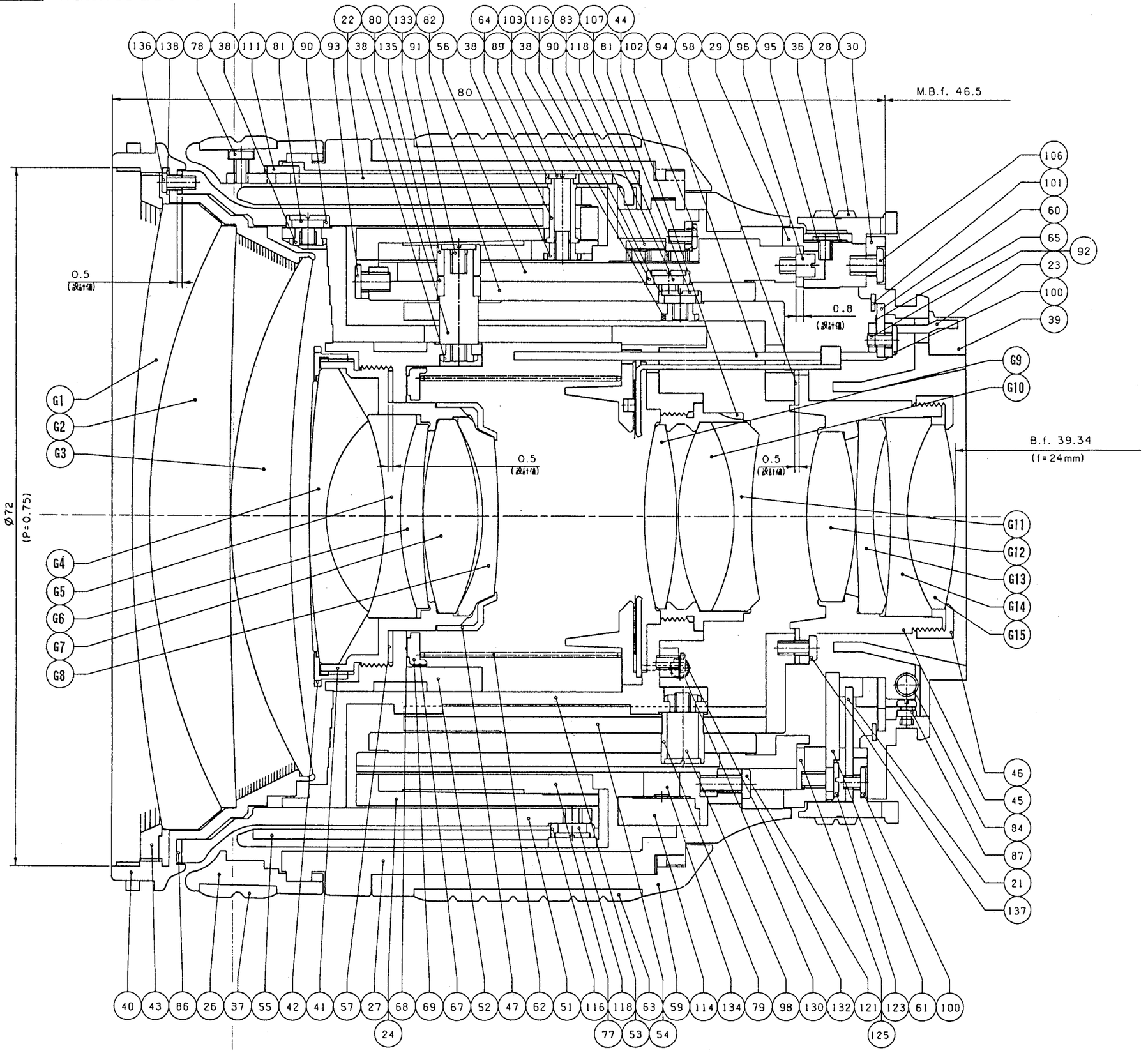
- Start the AF nikkor lens inspection program for F70／N70 and select " 1. READING OF LENS ENCODER SIGNAL ". Make inspection according to instructions as shown on the display.

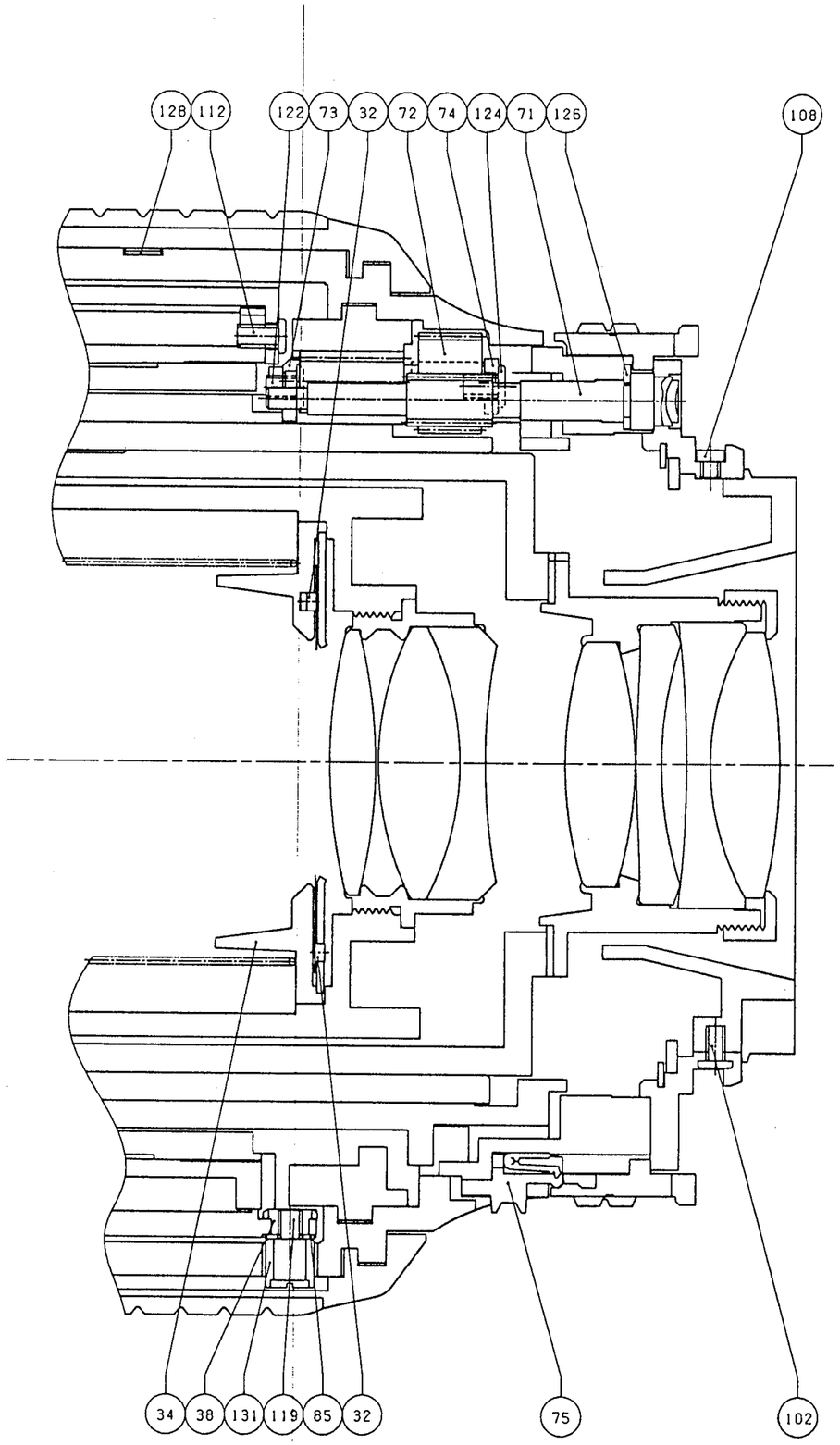
- Encoder signals should be as described in the table below when the zoom and distance scale are set to specified positions.

Zoom ring / Distance scale position	f＝24mm			f＝50mm			f＝70mm			f＝120mm		
	Encoder signal											
	1	2	3	1	2	3	1	2	3	1	2	3
Most infinity position	39h	12h	D3h	39h	96h	D3h	39h	B0h	D3h	39h	11h	D3h
1m	57h	12h	D3h									
Most close distance position	86h	12h	D3h									

◎ If encoder signal values are different from those shown in the table, following causes moust be considered.
Distance brush is mounted in the wrong position, distance brush or FPC is defective, encoder patterns on the FPC are contaminated, or the FPC is fixed in the wrong position.

組立図 Construction of the Lens




128
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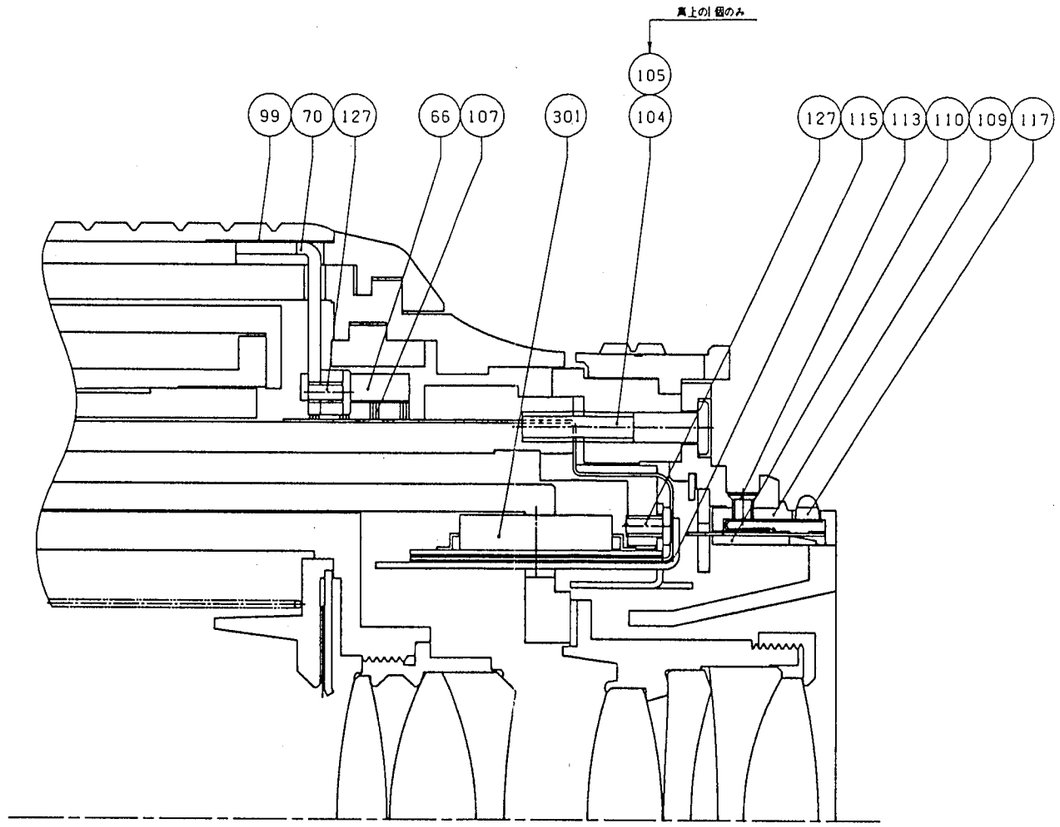
真上の1個のみ
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99
70
127
66
107
301
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113
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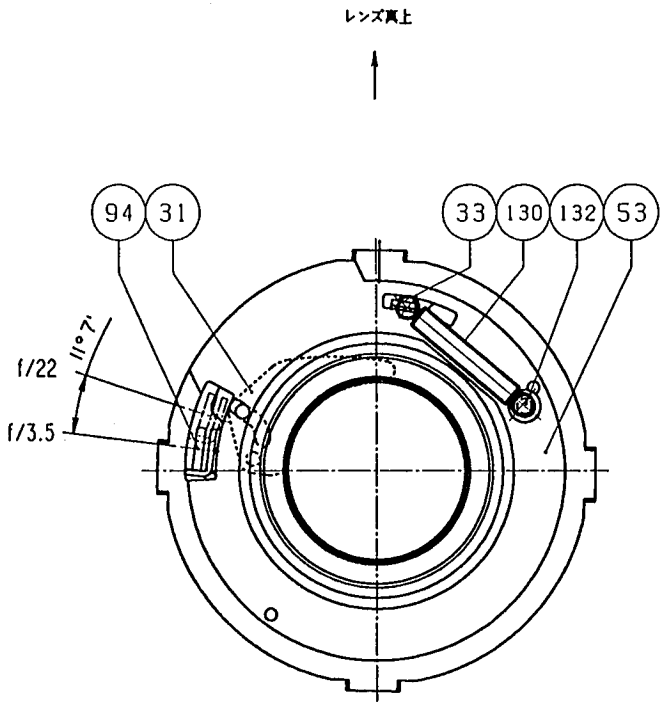
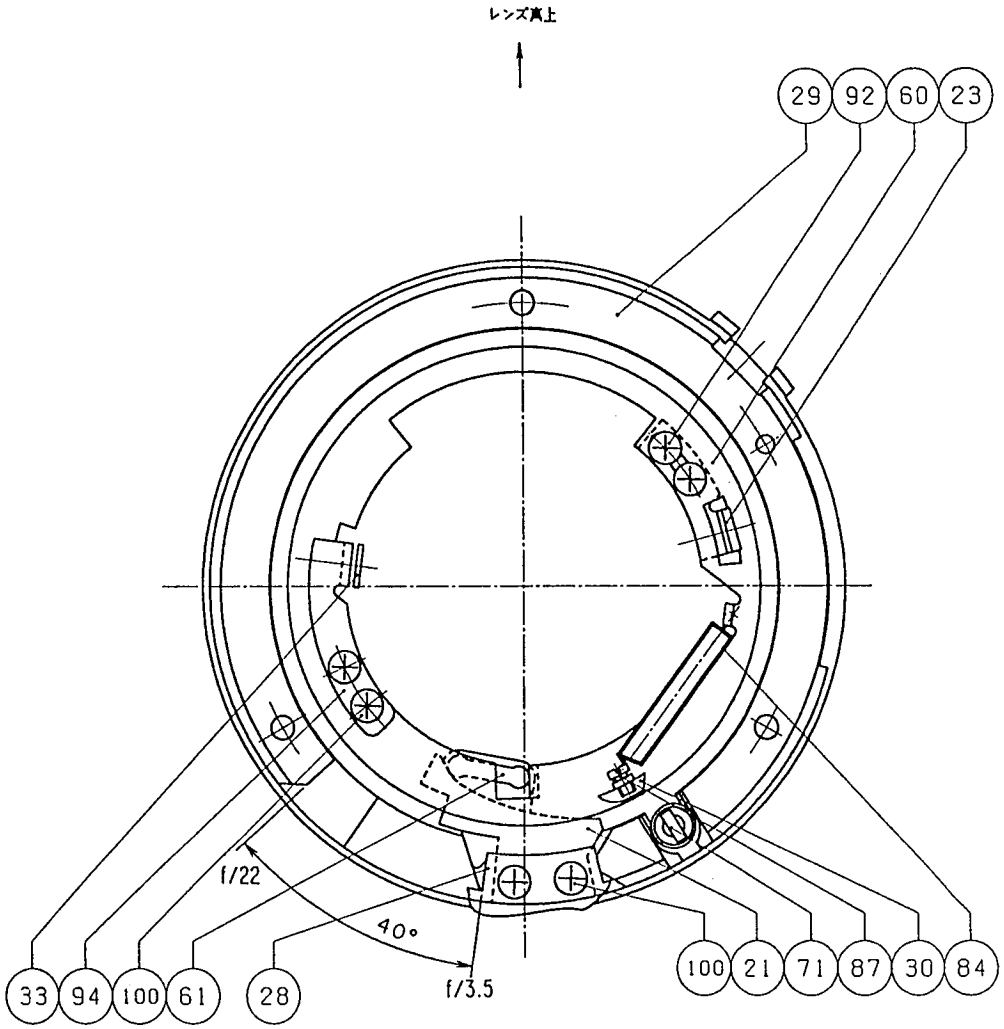
117



レンズ後方より見る



レンズ後方より見る

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