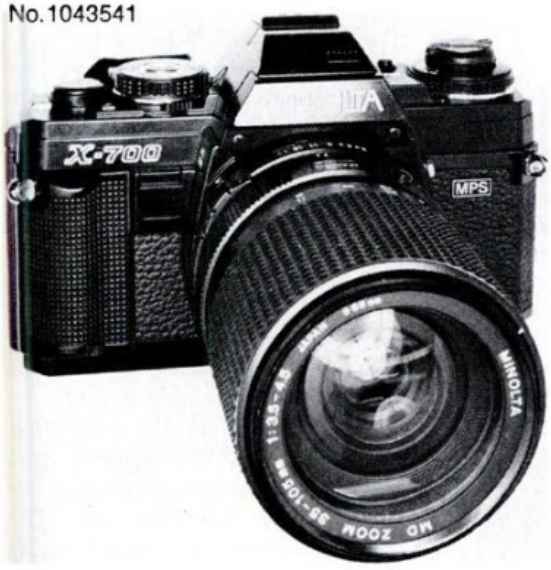
LAB REPORT

By Norman Goldberg and Michele A. Frank

MINOLTA X-700

No. 1043541



Camera Type: 35-mm multimode SLR with programmed, aperture-priority and full manual metering

Normal Lenses: 50-mm Minolta MD, f/1.4, f/1.2, f/1.7, 45-mm f/2, or Minolta MD Zoom f/3.5-f/4.5 (tested)

Shutter: Electronically governed, horizontally traveling, cloth focal-plane type with stepless speeds on automatic from 4 to 1/1,000 sec, stepped speeds on manual from 1 to 1/1,000 sec plus B; release locks when battery voltage is low

Viewfinder: Fixed, eye-level type, eight optional service-center interchangeable viewfinders; standard (supplied) finder has central rangefinder spot in microprism ring on Acute Matte/Fresnel field; aperture window; shutter-speed scale with LEDs, "A", "M", and "P" mode letters; over/underexposure indicator; exposure-bias warning; flash-ready signal (LED next to "60") blinks to indicate flash recycled and correct flash exposure with electronically-matched Minolta flash units

Exposure Meter: Through-lens, full-aperture readings, using single silicon photodiode; measurements are made at full aperture for finder display, then at taking aperture for automatic/programmed-exposure modes; off-film-plane flash reading with electronically matched Minolta electronic-flash units using second silicon cell located in side of mirror compartment; plus/minus two EV exposure bias; EV range 1-18 (1 sec at f/1.4 to 1/1,000 sec at f/16) with ASA 100 film; ASA range 25-1,600; AE lock; system uses two 1.5-volt alkaline, silver-oxide A76 or S76 or equivalent batteries, or one three-volt lithium cell

Flash Synchronization: Hot shoe and PC terminal, X at 1/60 sec or slower; extra contacts on hot shoe for electronically matched flash units

Loading: Conventional, multislot spool, hinged, removable back

Film Transport: Single-stroke, 130° winding angle after 30° ready position

Other Features: Electronic self-timer with audible beep, depth-of-field preview lever; audible 4 Hz piezo warning when finder speed indication is 1/30 sec or slower when finger contacts "touch switch"; integral front hand grip; memo holder on back; three-position main switch with indication for off, on, or on with audible piezoelectric slow-speed warning and self-timer operating indication

Weight: 988.7 g (34.87 oz.) with 35→105-mm f/3.5-4.5 lens

Dimensions: L., 141.5 mm (5.57 in.); H., 91.2 mm (3.59 in.); D., 142.8 mm (5.62 in.) with 35→105-mm f/3.5 lens

Accessories: Full line of lenses from wide-angle to telephoto, plus zooms and macros; micro equipment; data back; Motor Drive 1, Auto Winder G, wireless controller IR-1 set; Auto Electroflash 280 and 360 PX

Price: $399.50, body only; 35→105-mm f/3.5-f/4.5 zoom lens, $438.50

Distributor: Minolta Corp., 101 Williams Dr., Ramsey, N.J. 07446

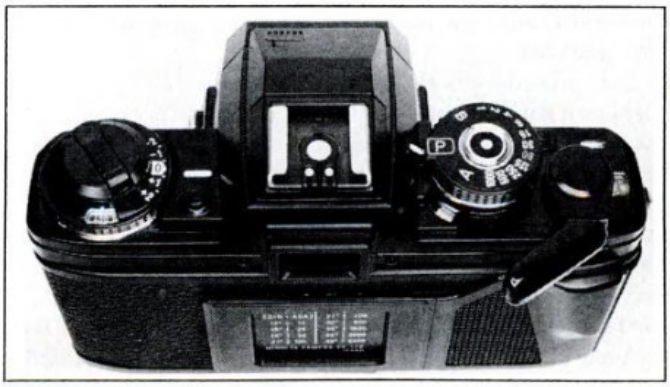
Field Check

By Steve Pollock

The X-700 is Minolta's most automated and most versatile SLR. It therefore has potential appeal to a wide range of users, from absolute neophytes to streetwise photojournalists.

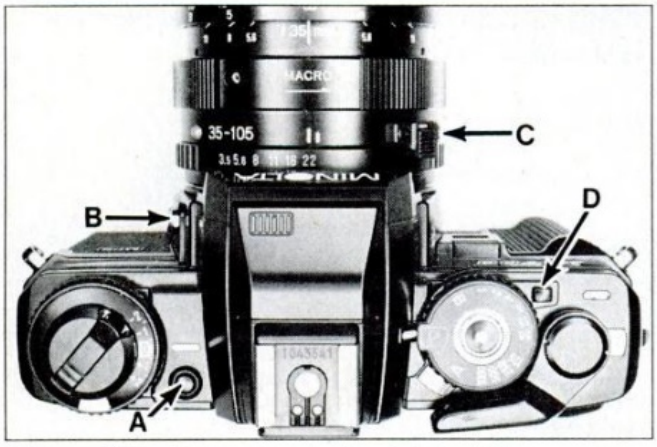
Surely the outstanding feature of the X-700 is its programmed auto-exposure system (see "Programmed Exposure SLRs: Are They for You?" in our July 1982 issue). Like other fully automatic cameras, the X-700 sets both lens aperture and shutter speed, according to a predetermined "program." What is unusual is that the X-700's program tends to favor higher shutter speeds and wider apertures than other models. This can be of great advantage when photographing fast-moving subjects, or in low-light work, where 1/60 sec at f/1.4 is a lot more practical than 1/15 sec at f/2.8.

I used the X-700 in bright sunlight, dull haze, and indoor gloom. In almost all cases, the program (designated by a green "P" on the shutter-speed dial) set shutter/aperture combinations very close to what I would have chosen. Except, of course, it worked a lot faster, keeping the camera ever ready for action.

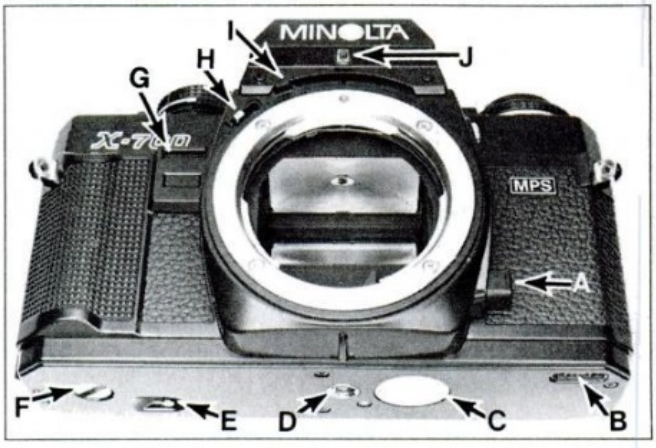


Contoured, checkered back panel aids grip stability. Trip button at center of shutter dial is sensitive to conductivity in fingertip to turn on LED display in finder. Further pressure trips camera.

For tripod-mounted shooting, including some macro work,



Film speed is set by lifting, turning knurled rim of dial around base of rewind knob. Exposure bias can be changed after button (A) is pressed. Button (B) is lens-mount bayonet-latch release. Lens is shown set to its smallest f-stop and locked there with slide latch (C) for programmed exposure automation, which also requires shutter speed dial to be set on "P", as shown. Setting the dial to its "A" marking switches system into aperture-priority exposure automation. When dial is set to either of the two positions it locks until button (D) is pressed. Small serrated tab at front base of dial is switch arm to turn circuits off, select for/against beeper warning signals.



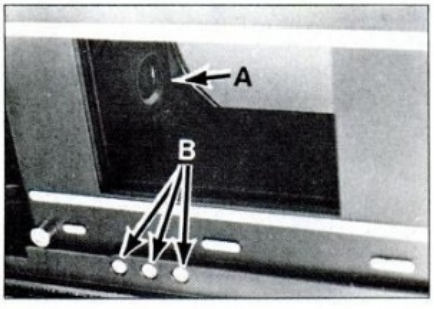
Press lever (A) for depth-of-field preview. Bottom has motor-contact block (B), battery compartment (C), tripod socket (D), rewind shift button (E), motor coupling (F). Note checkered finger grip on right side (user's perspective). Pulling up tab (G) switches in self-timer. LED below tab blinks as self-timer operates. Pushing tab down past its neutral position locks exposure setting, useful for close-up readings. F-stop coupling (H) detects use of MD series lenses at their smallest stop for program mode of auto-exposure. Second f-stop coupling (I) traces manually selected f-stops. Finder periscope window (J) projects image of f-stops into finder.

I wanted maximum depth of field, regardless of the shutter speed necessary. In such cases (or with mirror lenses, or other non-"MD" lenses and attachments), one can simply switch to the aperture-priority ("A") or manual-exposure ("M") mode.

One shortcoming of the program system is that the user is not kept fully informed of its operation. A row of LEDs in the viewfinder indicates the shutter speed that the camera is choosing. This is essential information, but I also wanted to know which aperture was being used. I found out by working backward: I noted the shutter speed indicated in the "P" mode, then shifted the shutter-speed dial to "A". Next, I changed the aperture setting (which reads out directly in the viewfinder) until that same shutter speed was indicated.

This procedure is almost as inconvenient as it sounds, but is really only necessary for a short while. After a few rolls of film, one gets the general idea of what lens opening goes with which shutter speed. However, these combinations vary somewhat with the maximum aperture of the lens in use, so perhaps a homemade chart or list would come in handy.

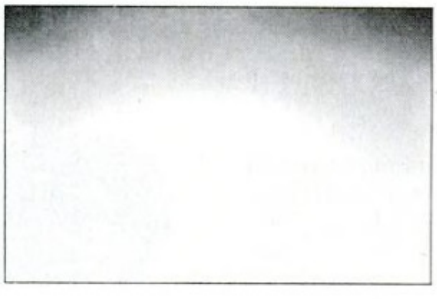
Accurate depth-of-field preview is not possible in the "P" mode, because the camera simply stops down to the f-stop set on the aperture ring, usually f/16 or f/22, rather than to the one that will actually be chosen. Once again, switching to "A" or manual solves the problem. For maximum action stopping in the "P" mode, the lens can be taken off its smallest aperture setting (which on current lenses is colored green, and can be locked in place). Selecting a larger aperture, such as the f/5.6 suggested by Minolta, reprograms the X-700 for even higher shutter speeds and wider apertures than usual. However, in this case lens openings smaller than f/5.6 cannot be set, so bright-light shooting with fast film may produce overexposure.



Looking into mirror box from rear, with shutter locked open, reveals window (A) through which photocell measures light reflected off film to control flash duration of matched flash unit. Three contacts (B) are for special data-back accessory.

Meter-sensitivity pattern

Center-bottom-weighted



The "P" symbol in the viewfinder blinks if a larger-than-minimum aperture is set while the camera is in the programmed mode. Otherwise, the "P" LED glows steadily. When other modes are used, either "A" or "M" appears. In all modes, a beeper sounds to warn that an exposure of 1/30 sec or longer is necessary. Thankfully, the beeper can be switched off.

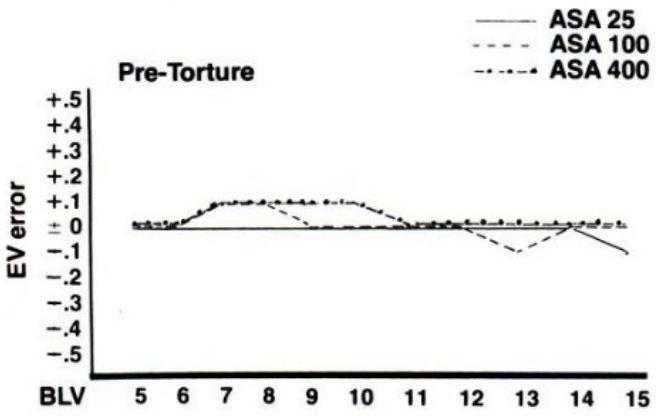
An exposure-trimming dial, concentric with the film-rewind knob, is adjustable in ½-EV increments over a plus/minus 2 EV range. When this control is moved from its normal "0" setting, another blinking LED in the viewfinder is actuated. Minolta deserves praise for placing all LEDs and other viewfinder markings against a black background, *outside* of the picture area.

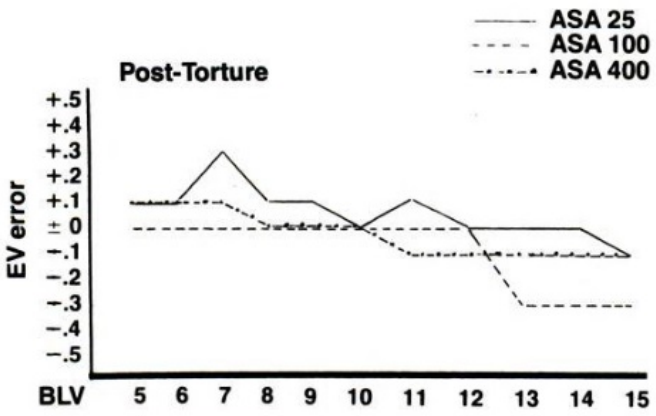
Most of my X-700 exposures were accurate, but there were a few problems. Predictably, strong backlighting tended to cause underexposure, as did the placement of dark subjects in front of bright backgrounds. These difficulties, common to reflected-light meters, were easily avoided by use of the exposure-lock button on the camera front. Pushing the button down "holds" the desired auto-exposure reading, until the device is released.

Pulling up on this same switch arms the electronic self-timer, which is then actuated by the shutter-release button. An LED under the timer signals its progress, and (if one desires) the beeper plays in time.

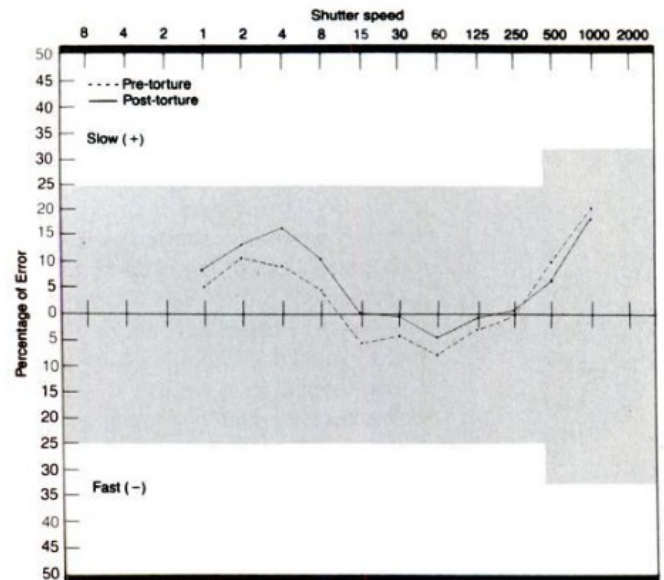
A more unusual problem cropped up when I tried to */continued on page 121*

PROGRAMMED MODE





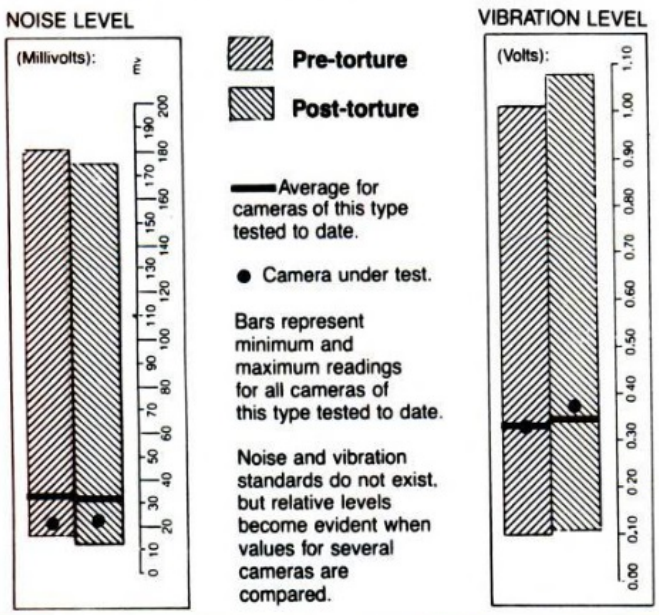
SHUTTER PERFORMANCE



Suggested ANSI (formerly ASA) shutter-accuracy standards are shown by shaded area. Higher speeds have more tolerance.

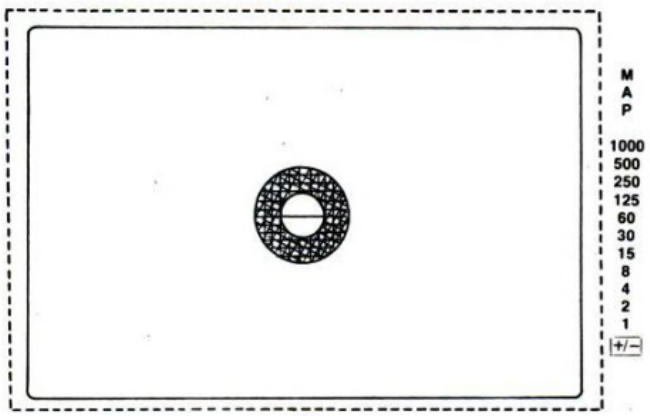
Extreme temperature test	Speed	Average % error			
	1 15	20°C	+5.20	+49°C	−4.80
	1 125		+14.10		−8.38
	1 500		+28.00		−10.50

NOISE AND VIBRATION



VIEWFINDER display and framing accuracy

Picture area is defined in viewfinder by solid line. Actual picture is broken line.



EXPOSURE SYSTEM

EV ERROR: Top figures are pre-torture, low figures post-torture.

Manual input: aperture	ASA	25			100			400		
	BLV	5	10	15	5	10	15	5	10	15
	3.5	±0.0 ±0.0	±0.0 ±0.0	+0.1 ±0.0	±0.0 ±0.0	±0.0 ±0.0		±0.0 −0.1	+0.1 ±0.0	
	5.6	±0.0 −0.5	±0.0 −0.1	±0.0 ±0.0	−0.1 −0.3	±0.0 −0.1	±0.0	−0.1 −0.4	±0.0 ±0.0	
	8		−0.1 −0.3	+0.1 −0.1	−0.3 −0.4	−0.1 −0.1	−0.1 −0.1	−0.3 −0.5	±0.0 −0.1	
	11		−0.1 −0.3	+0.1 −0.3	−0.3 −0.5	−0.1 −0.3	−0.1 −0.3	−0.3 −0.5	±0.0 −0.1	±0.0 ±0.0
	16		−0.3 −0.3	+0.1 −0.3		−0.1 −0.3	−0.1 −0.3	−0.5 −0.6	−0.1 −0.1	±0.0 ±0.0
	22		−0.3 −0.4	+0.1 −0.3		−0.3 −0.3	−0.1 −0.3	−0.8 −1.0	−0.1 −0.1	±0.0 −0.1

Blank spaces show limits of camera's dynamic range and/or values tested.
BLV: scene luminance = EV @ ASA 100. ANSI tolerances: ±0.5 EV.

MISCELLANEOUS DATA

FUNCTION	PRE-TORTURE	POST-TORTURE
Shutter-trip force:	265 grams	265 grams
Shutter-trip travel:	1.5 mm	1.5 mm
Self-timer:		
Maximum:	10.1 sec	10.1 sec
Synchronization:		
Electronic flash:	0.0 msec @ 1/60	0.0 msec @ 1/60

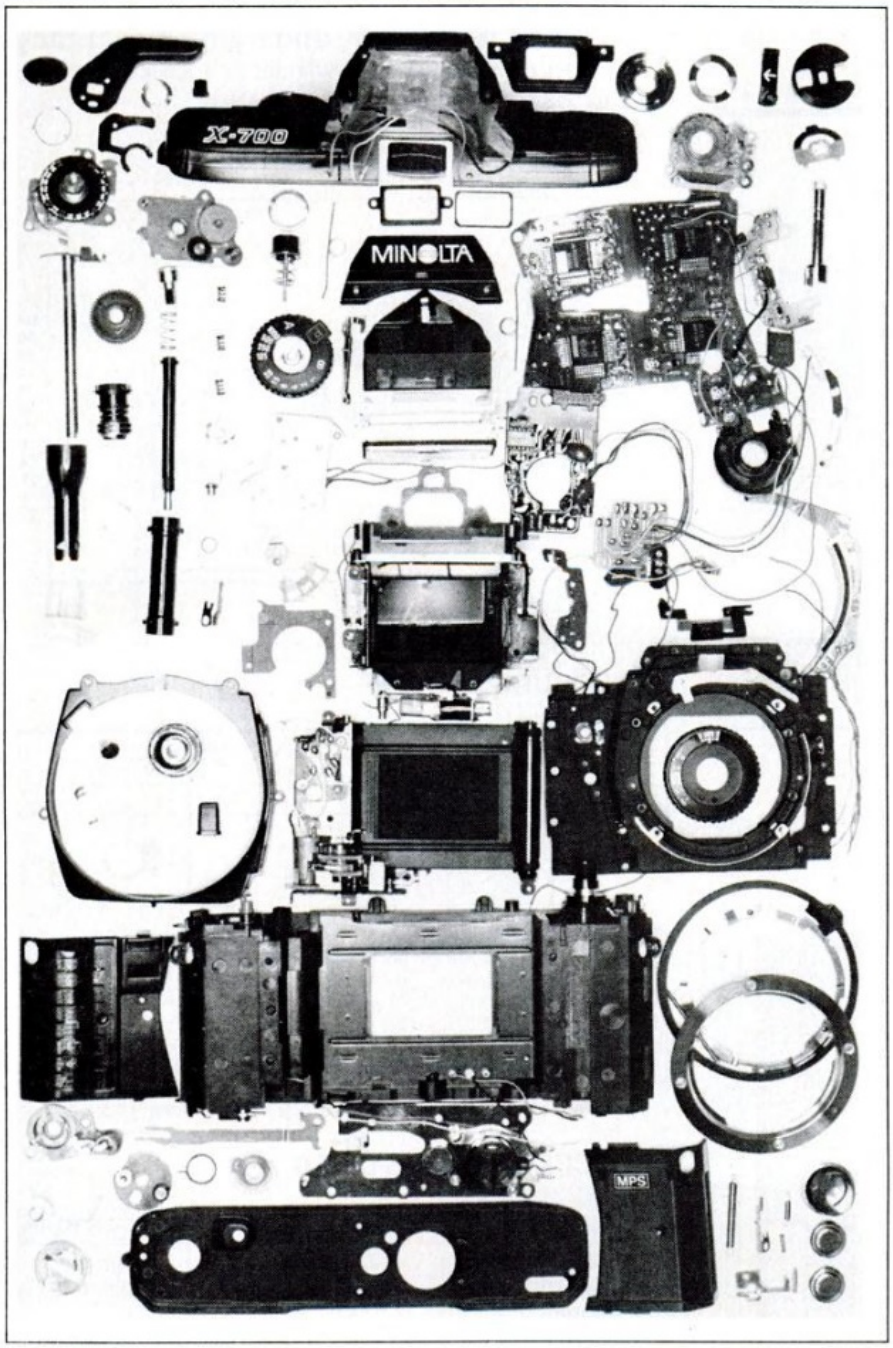
Stripdown Report

Representing the top model of the recent X-series line, the X-700 makes good use of many components from its earlier siblings. Some of these can be traced back to the XG-7. They include the wind, rewind, shutter, diaphragm tracer, and LED prism array for the finder.

The predominant material used to make this camera is plastic, as it has been in the entire X-series. But this one contains the most plastic of the series, from its main casting all the way to its cover panels. These parts are made of glass-fiber-filled polycarbonate, a combination that's widely used in many makes of cameras now, and has proven to be lightweight, tough, and dimensionally stable. The top and bottom cover panels are copper-plated and painted.

	Interior	Exterior	
Material choice:	See Note A	Good	**Repair access:** Fair
Assembly, finish:	Good	Good	**Seal against dirt:** Fair/Good

Do frequently made adjustments require major stripdown? Some
Modular construction? Mostly **Replace key parts easily?** Some
Note A: Good except plastic sprocket coupling



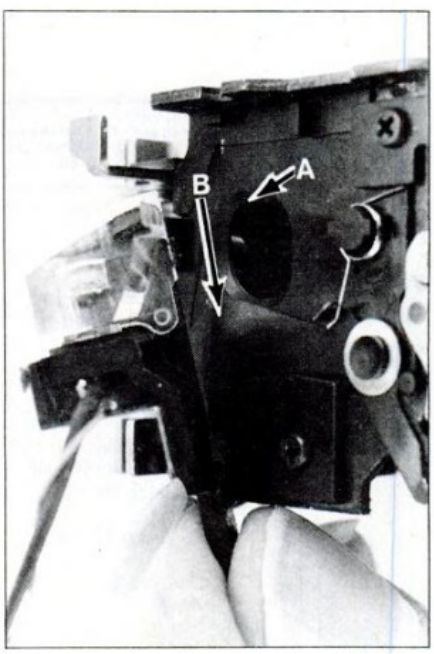
Constructed mostly of plastic, Minolta's X-700 makes use of many parts from previous models, relies heavily on electronics.

From a structural standpoint, the X-700's most important characteristic comes from its junior relative, the XG-M. This was the model that adopted a plastic main body made by casting glass-reinforced plastic around an aluminum stamping that serves as the film gate.

Minolta was the first to make an entire line of 35-mm SLRs with plastic bodies, and the X-700 shows that they're satisfied with the performance record of the preceding models.

The widespread use of plastic throughout the X-700 includes many gears in both the wind and shutter sections. I don't object, except (as I did on all the other three: XG-7, XG-9, XG-M) that the film-drive sprocket coupling should be redesigned if it's going to continue to be made of plastic.

The coupling relies on the engagement of two small lugs */continued on page 167*



Fingers grip mirror box photocell used for flash automation by reading the light reflected from the film during flash shots with specially matched electronic-flash unit. Wires lead to silicon cell behind molded plastic lens/prism that peeks through window (A) in the mirror box's side. Shutter blade (B) covers window until mirror rises.

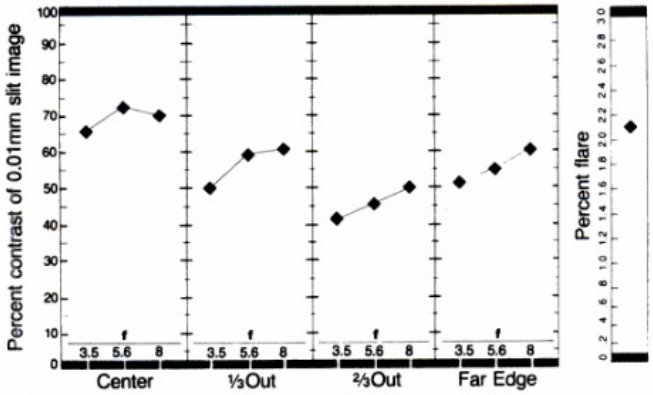
Lens Performance

Minolta MD Zoom 35→105-mm f/3.5-4.5

Ser. No. 1002650

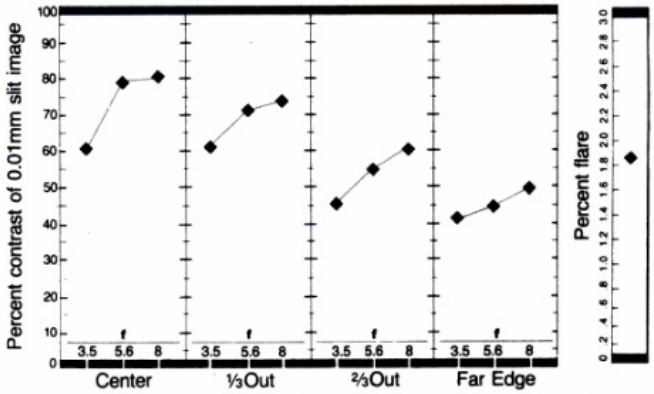
Dimensions: O.D. 64.3 mm (2.53 in.) **L.** 91.1 mm (3.59 in.)
Weight: 478 g (16.86 oz.) **Filter size:** 55-mm
Close working limit (macro mode): 139 mm (5.47 in.)
Close limit field size (macro mode): 104x158 mm (4.09x6.22 in.)

35-mm (shortest)
Focal length: Marked: 35-mm **Measured:** 36.78-mm
f-number: Marked: f/3.5 **Measured:** f/3.34 **T-number:** T-4.11



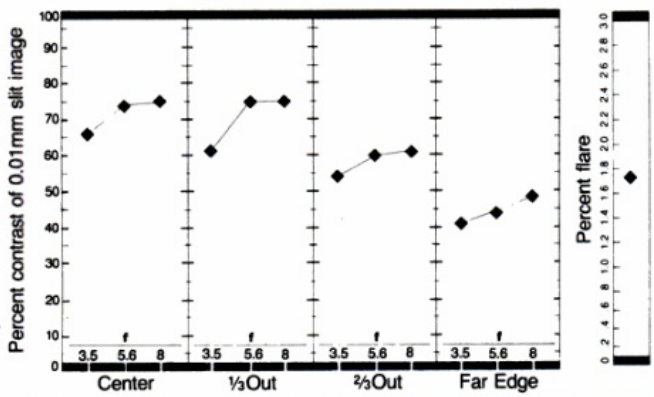
Aberration	1/3 out	2/3 out	Far edge	Notes
Coma	4.5	6.3	6.3	Critical f-stops
Astigmatism	3.5	5.6	3.5	
Lat. chrom.	Slight	Moderate	Moderate	
Long. chrom.	blue-green-red = 0.07 mm			Focus shift
Spherical	f/3.5—f/8 = +0.09 mm			
Distortion	Very slight pincushion			
Vignetting	None beyond f/5.6			
Centering	Perfect			

70-mm (medium)
Focal length: Marked: 70-mm **Measured:** 70.39-mm
f-number: Marked: N.A. **Measured:** f/3.91 **T-number:** T-4.81



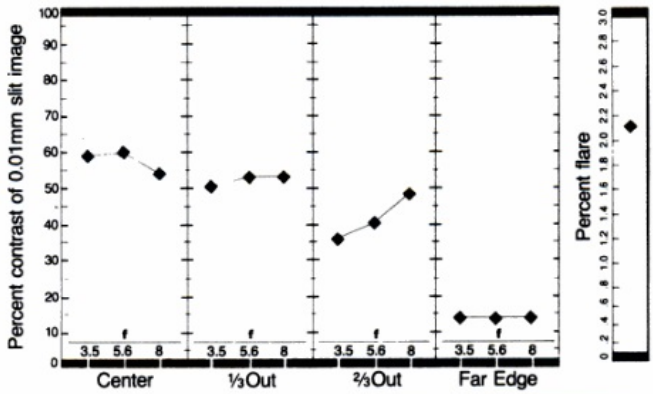
Aberration	1/3 out	2/3 out	Far edge	Notes
Coma	3.5	4.5	6.3	Critical f-stops
Astigmatism	3.5	3.5	3.5	
Lat. chrom.	None	None	None	
Long. chrom.	blue-green-red = 0.05 mm			Focus shift
Spherical	f/3.5—f/8 = +0.02 mm			
Distortion	Moderate pincushion			
Vignetting	None beyond f/5.6			
Centering	Near perfect			

105-mm (longest)
Focal length: Marked: 105-mm **Measured:** 103.37-mm
f-number: Marked: f/4.5 **Measured:** f/4.45 **T-number:** T-5.44



Aberration	1/3 out	2/3 out	Far edge	Notes
Coma	4.5	5.6	5.6	Critical f-stops
Astigmatism	3.5	3.5	3.5	
Lat. chrom.	None	None	None	
Long. chrom.	blue-green-red = 0.05 mm			Focus shift
Spherical	f/3.5—f/8 = +0.02 mm			
Distortion	Moderate pincushion			
Vignetting	None beyond f/5.6			
Centering	Slightly off			

Macro
Focal length: Marked: 35-mm **Measured:** 38.68-mm
f-number: Marked: f/3.5 **Measured:** f/3.86 **T-number:** T-4.75



Aberration	1/3 out	2/3 out	Far edge	Notes
Coma	3.5	3.5	3.5	Critical f-stops
Astigmatism	3.5	3.5	14	
Lat. chrom.	None	Slight	Slight	
Long. chrom.	blue-green-red = 0.09 mm			Focus shift
Spherical	f/3.5—f/8 = +0.21 mm			
Distortion	Slight barrel			
Vignetting	None beyond f/5.6			
Centering	Near-perfect			

Mechanical: With its multimotion operations, this lens could serve as an example of good zoom lens construction. It employs a pair of multistart threaded helicoids; one each for its focus adjustment (front group only moves), and its macro adjustment (entire optical assembly moves). Both helicoids use twin parallel-focusing guide arms. */continued on page 167*

Field Check: Minolta X-700

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shoot close-up nature subjects in low light and at small apertures in the "A" mode. Naturally, the underexposure LED in the viewfinder blinked, indicating that a shutter speed longer than 1 sec was necessary. I blithely continued to shoot (with the camera on a tripod), having learned from past experience that many electronically controlled shutters can give far longer exposures than their conservative manufacturers specify. Well, the X-700 didn't, and my slides were underexposed. This model gives about a 4-sec maximum auto-exposure, as contrasted with about 8 sec for the less-expensive Minolta XG-M. I ended up taking manual-exposure readings, then adjusting the aperture and making manual time exposures on "B".

The X-700 abounds with small touches that make it pleasant to use. Contoured, patterned panels on the front and back of the right side (from the user's viewpoint) provide firm and comfortable gripping surfaces. The electromagnetic shutter release is light and smooth in its action, and also serves to turn on the light meter for a 15-second period after a light touch on the release button. Small buttons near the shutter speed and exposure-trim dials lock them securely in place. Film speeds are easily set by lifting and turning a heavily knurled ring. And a small indicator shows if the shutter has been cocked.

Almost all controls are well shaped, clearly marked, appropriately placed, and positive in operation. Film loading, via a multislotted take-up spool, is quick and secure (although Minolta's spool design is slightly different from most others).

I would have preferred less pressure and more surface area on the depth-of-field-preview plunger, but that is really quibbling. Of more importance, I wish that the X-700 could function without its battery, even at one shutter speed.

As befits its top-of-the-line position, the X-700 accepts a host of accessories. Several alternate focusing screens are available to replace the standard split-image-plus-microprism version, but this exchange can only be made at a repair station. The supplied screen was so bright, contrasty, and positive for focusing that I had no need to try the others.

One "accessory" that I did use is the 35→105-mm f/3.5-4.5 zoom lens. This lens is reasonable in size and weight, and features one-touch operation. It also covers just the range of focal lengths that I use for perhaps 95 percent of my photography.

The images that I made with the zoom are acceptably sharp and contrasty, but they don't seem to be as crisp as comparison photos made with 35-mm f/1.8, 50-mm f/1.4, 50-mm f/3.5 (macro), and 85-mm f/2 Minolta MD lenses. The differences are subtle, and probably would not be noticeable in standard 3½x5-in. color prints. But (with due credit to Paul Simon), "everything looks worse in black and white," including small compromises in image quality.

The zoom's minimum focusing distance of 1.6 m is just not close enough for me, especially at the 35-mm end. A separate "macro" feature is built in, but this is not as convenient or useful as continuous close focusing. (In fairness to Minolta, I have yet to find a wide-angle-to-tele zoom of this range that is good enough for critical use.)

Another interesting accessory is the Minolta 280PX electronic-flash unit. This "dedicated" model automatically sets the X-700 to its flash-synch speed of 1/60 sec. With the flash mounted, the camera also chooses the lens aperture between the widest opening and f/8. This choice is influenced by the available-light level, as measured by the camera's silicon photo cell before exposure. In very low light, the maximum aperture of the lens is set, while under brighter conditions the lens opening may be as small as f/8. This

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tends to balance the levels of ambient and flash illumination.

Minolta calls this system "Programmed flash," and indeed it functions without any user input. In fact, the user does not know the exact aperture being used. The output of the flash is controlled by a separate silicon cell in the camera, reading off the film surface during exposure. (See Stripdown Report for details.)

While the fully programmed flash system is a boon for totally nontechnical users, it does have some limitations. Low-light scenes, which are the most difficult places for accurate focusing, are not ideal for the use of wide-open lens apertures. Also, it is useful to know what aperture is being set, to give an idea of the available depth of field. Therefore, I prefer to use the X-700/PX280 combination with the camera in the "A" mode, at a lens aperture of my selection. This method is simple, convenient, and accurate.

Other Minolta dedicated-flash units will function with the X-700, but only the 280 PX, the tiny Auto CLE, and the upcoming Auto 360 PX couple with the film-plane-reading flash-exposure system. In addition to flash units and an enormous range of lenses, Minolta offers the X-700 user a motor drive and winder, remote-control system, and Multi-Function back (which serves as a data imprinter, clock, or intervalometer).

The X-700 seems to "fit" a very wide spectrum of photographers. I have handed it to several Instamatic users, showed them how to focus, and then not interfered. Most of their results have been excellent, suggesting that the X-700 is a fine beginner's SLR. On the other hand, its range of features and accessories is so broad that it is well suited for far more sophisticated 35-mm users. I'll miss it when I have to send it back. ●

Lens Performance: X-700

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The zoom motion involves moving the front and rear groups while the central group remains stationary. This motion is propelled by a series of cam slots in three coaxial sleeves. Plastic-bushed cam followers glide effortlessly in the well-machined slots for a butter-smooth feel and backlash-free operation.

The autodiaphragm system is strong and simple. The otherwise well-blackened and baffled interior has one bright rim on one of the elements in the rear group. This is probably the biggest cause of the flare levels at the shorter focal lengths. ●

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with a mating pair of shallow recesses; all plastic of the tough, slippery-nylon type. I'd prefer seeing this coupling made of steel or, if plastic, provide for a deeper engagement and larger parts.

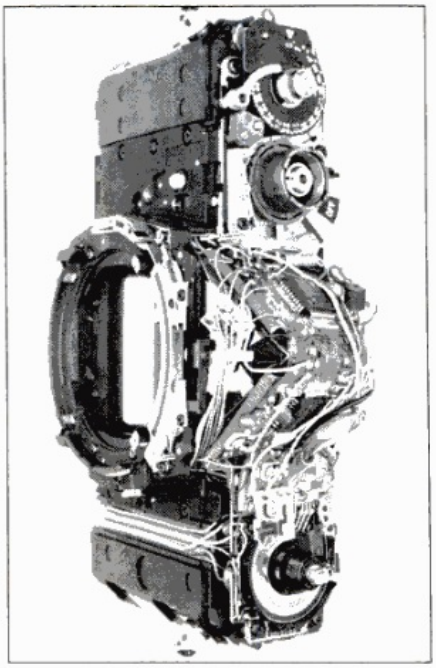
To their credit, Minolta continues a structural reinforcement from their other models in the X-700 with the steel plate on its bottom that serves as the support for the tripod socket and battery compartment. It also serves as a brace between the front plate (an aluminum die-casting) and the main body.

The X-700 distinguishes itself in the way it functions. In a typical 35-mm SLR, pressing the "shutter release" has only an indirect relationship to the shutter's opening and closing. I prefer calling this button the trip button, because it trips the camera's mechanism, which eventually gets around to making the exposure.

To have all these actions occur in the proper sequence, different designs may use mechanical interlocks, electrical switches, electromagnets, and/or sequential timing commands from a microcomputer. The X-700 uses them all.

Three electromagnets, all of them combining the features of a permanent magnet with a wire-wound coil to momentarily neutralize it, are found on the mirror box, while one conventional electromagnet is used in the shutter. The sequential timing is regulated by the high-frequency oscillation of a quartz crystal that provides the time base for signals to each of the magnets.

As Minolta demonstrated in their XD-11, the shutter is easier to regulate than the diaphragm for precise exposure control. So, as with the XD-11, the X-700 makes what amounts to a stopped-down



With its top and front cover panels removed, the Minolta X-700 should scare off anyone but the expert at trying to go farther down into it. Note how the flexible circuit board atop its pentaprism is folded back onto itself to fit under the confines of the top cover. See photo of circuit board elsewhere in this report.

meter reading; its final shutter speed being determined after the diaphragm has been halted in its closing action, just before the mirror is released. The silicon photocell that's measuring the light coming through the viewscreen is located just above the finder's eyepiece.

In manual operation, the speed set on the dial is not influenced by the metering at all, but in either the "A" (aperture-priority auto-exposure) or "P" (programmed auto-exposure) the exposure time is a function of the metering system.

A three-stage trip button, the same used in all other models of this series, starts the sequence by switching on the finder display when the user's finger touches the button. Normally, there's enough conductivity in bare flesh to complete the circuit between the center and rim of the button. If not, soft pressure on the button closes an internal (second-stage) switch that takes over from the first.

Further pressure on the button closes the third-stage switch. This causes a tiny capacitor to dump its charge into the coil of the combination magnet holding the diaphragm open. The resulting pulse momentarily neutralizes the magnet, unlatching the diaphragm, which begins to stop down.

When the light reaching the photocell produces the signal determined by the metering system to be correct, a second combination magnet is energized momentarily. This plunges a stop lever into the gear train attached to the diaphragm actuating lever, stopping the diaphragm from closing down further.

All this time, the quartz "clock" is beating away, parceling out just the right number of milliseconds for the described events to occur. When enough time has elapsed for the diaphragm to stop all the way down (if required), the signal is given to release the mirror by giving the third combination magnet a momentary voltage across its coil.

Just before the mirror reaches the top of its swing, it unlatches the shutter's opening curtain. After the appropriate time, the closing curtain is unlatched by its electromagnet, ending the exposure. Now the mirror returns and the diaphragm reopens.

The above sequence occurs each time the X-700 is tripped, regardless of the operating mode selected. The only differences are the actual exposure times and f-stops, which can be fully controlled by the user, or left up to the camera's automation.

This extends to the use of the flash. Minolta makes use of its own ideas in off-the-film meter readings, until now licensed to others, but not incorporated into their own SLR cameras. The X-700 employs a second silicon photocell, this one located on the left wall of the mirror box. It sits behind a plastic lens/prism designed to peek out of a small hole in the wall and collect a portion of the light reflected from the film's surface during the actual exposure. The hole is covered by a metal shutter that swings away as the mirror rises.

The signal from the mirror box photocell is used to terminate the light output from the specially matched electronic-flash unit when the exposure-control system decides that the film has had just the right dosage.

In addition to the specially matched flash unit, the X-700's list of accessories includes a data back capable of issuing commands to the camera that greatly expand its scope. With the data back and a motor drive, the camera can be programmed to make one or more shots at practically any time interval. Three gold-plated contacts below the bottom film rail of the camera convey signals to and from the data back, while four gold-plated contacts on the camera's bottom do the same job with the motor.

All this dependence on electronics calls for a careful look at the way Minolta packs the necessary components into the X-700. The flexible circuit board is one of

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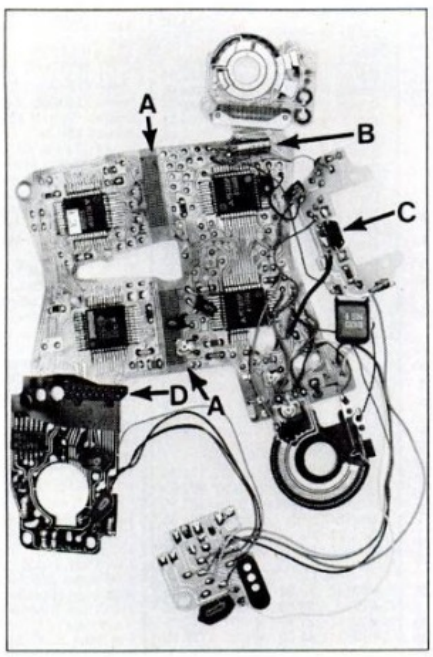
the most complex seen to date. Its printed wires are found on both sides, doubling the circuit complexity found on more conventional one-sided flexible circuits.

Now double this again by making the flexible board twice as large as a normal one. It must be folded in half to fit in the camera, draped over the pentaprism, with side "wings" that extend to the film and shutter-speed dials at opposite ends of the camera. So far, so good.

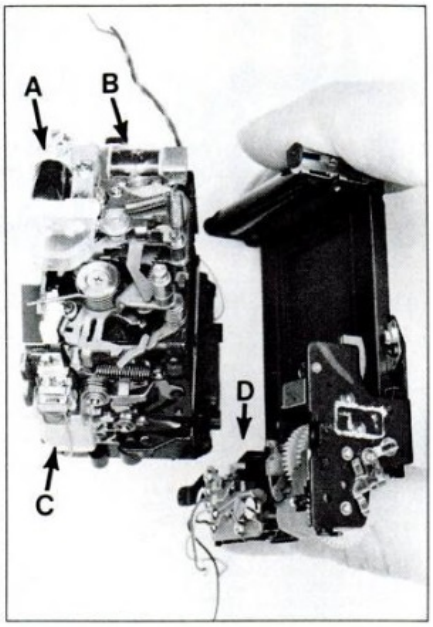
Now we encounter wires running from the four electromagnets, remote-control outlet, synchro switch and outlet, hot shoe, piezo-electric beeper, self-timer/AE lock switch, data back and motor contacts, and various other switches. There are six wires just for the f-stop-setting tracer board.

To make the deep stripdown for this report, 37 wires had to be desoldered. To keep track of any solder connection that might inadvertently break loose during handling while the camera was apart, no less than 89 solder points had to be identified, color-coding noted, and origins traced. Regular readers of these reports know how I agonize for the repair industry, who must view such tedium with less than glee.

With a large percentage of the wires soldered to connections located well inside of the flexible circuit board, rather than the (preferred) edges, it takes a delicate touch to avoid damaging the circuit. One compensation is the heat-resistant insulation used on the wires, making the soldering operation practical. Several adjustments can be reached without removing a single wire, but many others require a major stripdown, and this could prove costly.



Flexible circuit board is double-sided. In addition, it's folded in half at (A-A) to fit in camera. Quartz oscillator (B) is time-base for most of camera's functions. Other components include silicon photocell (C), photodiode array (D).



Looking at lower-right corner of mirror box shows three combination magnets: (A) releases diaphragm, lets it stop down; (B) arrests diaphragm; (C) releases mirror. When mirror rises it trips shutter, shown in fingers but normally wrapped around mirror box. Fourth magnet (D) releases closing curtain, ending exposure.

Minolta seems to have taken many precautions to insure a minimum of trouble from the X-700; all switch contacts are gold-plated, the three combination magnets are well-shrouded against dust, and the photocell wires are shielded against electrical interference.

Furthermore, the shutter is one Minolta has gotten a lot of mileage out of, beginning with their XG-7 and including the elegant little CLE. Its distinctive design makes use of rubberized cloth curtains running horizontally on a three-axis system, one of these being coaxial. It's a modular unit, and it wraps around the rear and sides of the mirror box.

The mirror itself is suspended on a compound linkage that permits the mirror to be longer than if it were a simple suspension. The longer mirror helps reduce darkening of the top of the viewscreen with extralong lenses. Lacking any damping system other than the ubiquitous foam strip to cushion its action, the geometry of its actuating mechanism nonetheless provides a reasonably gentle impact at the top of its swing.

Frequent mention has been made in this report to previous models with similar construction. For those interested in reading our Lab Reports on them, see the following issues: July '79 (XG-7), Nov. '80 (XG-9), Mar.'82 (XG-M). ○

LENS TEST GLOSSARY

(See Lab Report on page 115)

Aberrations: A flawlessly manufactured lens may still exhibit residual aberrations (image faults). Often, certain aberrations are permitted by the designer to minimize others felt to be more harmful to image quality.

Astigmatism: Causes lines radial to the optical axis, and lines perpendicular to these, to focus in two different planes. Improved by stopping down.

Centering: The center of curvature of each lens surface should lie on a common line.

Coma: Comet- or tear-drop-shaped images of off-axis points of light. Improved by stopping down.

Contrast test: Contrast levels are compared electronically between the image of a coarse and fine slit, and the result is expressed as a percentage.

Critical f-stop: The largest opening at which the aberration being examined is considered to be under satisfactory control.

Distortion: Causes image of window frame (for example) to bow out (barrel type) or in (pincushion type), but does not influence sharpness. Not improved by stopping down.

Flare: Causes an overall loss in contrast. Sometimes called "veiling glare."

Flare test: The lens is presented to a target consisting of a totally black spot surrounded by a uniformly bright field of infinite dimension. The amount of light nergy present in the center of the image of the black spot is measured and expressed as a percentage of the light energy in the image of the bright surround.

Lateral chromatic aberration: A variation of magnification with color. Not improved by stopping down.

Spherical aberration: Causes a focus shift as the lens is stopped down.

T-number: The actual maximum f-number divided by the square-root of the percentage of transmitted light.

Vignetting: Causes underexposure at the corners of the film. Improved by stopping down.

Misc. terms and practices: *Close working limits* are measured from the target to the foremost portion of the lens when it is set to its closest focusing position. The *close-limit field size* is measured at this point. The portions of the image field examined during both the contrast and star tests are the center, 1/3 out, 2/3 out, and far edge for rectangular formats and correspond to the following positions within the 24 × 35-mm format of a 35-mm camera's image; the center, 6 mm off-center, 12 mm off-center, and 18 mm off-center. Square formats are examined at the center, halfway to the edge, at the edge, and at the corner. ○