



KODAK High Resolution Plates

KODAK HIGH RESOLUTION PLATE, TYPE 1A

The KODAK High Resolution Plate, Type 1A, records very fine, sharply defined images with green-light exposure. Plates 5 x 5 inches (12.7 x 12.7 cm) and smaller are designed, manufactured, and packaged especially for such microphotographic applications as masks for microelectronics manufacture, reticles for optical instruments, and high-density data storage. Larger plates are intended for somewhat less critical applications of fine images such as large scales or templates, printed-circuit masks, and intermediates for microelectronics masks.

Ultrahigh resolving power, exceeding 2000 lines per millimetre (50,000 lines per inch), coupled with extremely high contrast and microfine granularity, makes this plate useful for the exacting applications of microphotography. Generally, this plate records the best image that diffraction-limited optics can provide. Seldom, in fact, is the resolution of a photographic system limited by the photographic characteristics of the KODAK High Resolution Plate, Type 1A.

KODAK High Resolution Plate, Type 1A, performs well with either negative or reversal processing. This plate has a thin emulsion; before processing, the emulsion is about 6 micrometres thick, and after processing, it is about 4 micrometres thick. This results in improved transfer of detail when a negative made on the plate is contact-printed onto a second high resolution plate or onto a photoresist-coated substrate. The plate is normally supplied with antihalation backing.

KODAK HIGH RESOLUTION PLATE, TYPE 2A

To make sharply defined microimages with *blue-light exposure* or to improve quality with green-light exposure, the KODAK High Resolution Plate, Type 2A, is recommended. This plate has ultrahigh resolving power and a wide exposure tolerance which allows imaging (with good image-size fidelity) of wide and narrow lines in close proximity.

Type 2A Plates have about one-fourth the speed of the KODAK High Resolution Plate, Type 1A, when exposed to green light. However, the speed of the Type 2A Plate can be significantly increased if a broad-band filter is used to expose the plate to blue and green light. This is possible because of the ability of the Type 2A emulsion to limit blue-light scattering. The microfine-grain emulsion has resolving power exceeding 2000 lines per millimetre (50,000 lines per inch). These characteristics,

combined with high contrast, make the plate a versatile medium for microphotographic applications such as mask making for microelectronics, making reticles, and storing high-density data.

KODAK High Resolution Plate, Type 2A, can be reversal-processed for some microimage applications, but the reversal mode is not generally recommended for linewidth smaller than 200 microinches. Since the emulsion has been designed to limit optical scattering, the plate does not need halation protection for most applications. It is, therefore, normally supplied without antihalation backing.

KODAK SPECIAL PRODUCT, TYPE 138-01

KODAK Special Product, Type 138-01, is a photographic glass-plate product for microphotographic applications such as masks for microelectronics manufacture, fine reticles, and high-density data storage. Such applications are made possible by the microfine granularity and ultrahigh resolving power of this product. The photographic speed of the Type 138-01 emulsion is close to that of KODAK High Resolution Plate, Type 1A, and between the speed of Type 1A and that of KODAK High Resolution Plate, Type 2A.

IMAGE PATTERN PLACEMENT

Image patterns should not be located near the edges of any high-resolution plate product. For plates 5 x 5 inches and smaller, the image should be located no closer to any edge than $\frac{1}{4}$ inch. With larger plates, through 8 x 10 inches in size, this dimension should be $\frac{3}{8}$ inch. With plates larger than 8 x 10 inches, the unusable border may be greater than $\frac{3}{8}$ inch. This recommendation is made because of emulsion anomalies near the edge of the plate that are due to manufacturing methods, image stability changes due to processing method, and possible edge damage caused by cutting, packaging, or handling. However, the 0.060- and 0.090-inch-thick KODAK High Resolution Plate, Type 1A, KODAK High Resolution Plate, Type 2A, and KODAK Special Product, Type 138-01 in sizes 2 x 2, 2½ x 2½, 3 x 3, 3½ x 3½, 4 x 4, and 5 x 5 inches are trimmed so that there is no "edge bead" on any of the plates.

PHYSICAL CHARACTERISTICS

Glass

The physical properties of glass described in this section are typical properties derived from glass reference material. They do not represent measurements or testing conducted by Kodak.

Photographic-quality soda-lime-silica type glass has a relative humidity coefficient of expansion of zero and a temperature coefficient of expansion of 4.5×10^{-6} inch per inch per degree Fahrenheit (8.1×10^{-6} per degree C). Thermal effects are fully reversible. Spectral transmission of the glass extends from 350 to more than 2500 nanometres. Refractive index of the glass at 589.3 nanometres is 1.516 ± 0.005 .

The glass for finished high resolution plates intended for microphotographic applications (6 x 6 inches and smaller) is inspected and selected to obtain "Very Special Quality" glass. This selection provides the highest internal quality with respect to freedom from tiny random inclusions, called "seeds" or "blisters," which are inherent in the manufacture of glass. The surface of the glass is visually inspected and selected to eliminate plates marred by scratches, digs, and abrasions. Plates are manufactured and handled carefully to prevent additional minute damage to the glass surface.

Glass for larger plates (larger than 6 x 6 inches) is inspected to obtain "Special Quality" glass which has high internal quality. This glass is also inspected for surface defects. While most scratches, digs, and abrasions are eliminated, fine, faintly visible scratches may appear on larger plate sizes. As with smaller plates, these plates are handled carefully to minimize damage to the glass surface.

For further information on glass, see Kodak Publication No. Q-35, *Physical Characteristics of Glass for KODAK Photographic Plates*.

Caution: Plate edges may be sharp. Care should be exercised in handling.

Plate Flatness

Kodak photographic glass flatness is expressed in terms of an "Overall Limit." All points on the glass surface (emulsion-coated side only) will be between parallel planes separated by a distance no greater than the overall limit. The overall limit for any size and flatness type can be calculated closely from the formulae in the following table.

Glass Type	Flatness Formula
Selected Flat	7.1×10^{-4} x diagonal (inches)
Ultra Flat	3.5×10^{-4} x diagonal (inches)
Precision Flat	3.5×10^{-5} x diagonal ² (inches)*
Micro Flat	Overall limit increases in size categories as shown below
Diagonal Dimension	Inches of curvature per lineal inch of diagonal
0-8 inches	4×10^{-5} x diagonal (inches)
8-13 inches	5×10^{-5} x diagonal (inches)
13-16 inches	6×10^{-5} x diagonal (inches)
16-19 inches†	6×10^{-5} x diagonal (inches)

*To maximum dimension of 6 inches and maximum area of 36 square inches. Glass thickness 0.060 and 0.090 inch only.

†Applies to central 16-inch diameter only.

Note: Orders for photographic plates having a diagonal dimension greater than 16 inches cannot be supplied without additional information about your specifications. In such cases, contact Graphic Data Markets.

Based on the formulae in the chart above, the overall limit for various plate sizes and flatness types is shown at the top of page 00. The overall limit is expressed in microinches (10^{-6} inch), micrometres (10^{-6} metre), and fringes of monochromatic light. The fringe measurement is based on the number of interference fringes observed when the glass was referenced to an optical flat and illuminated with monochromatic light from a helium (587.6 nm) or sodium (589 nm) source.

Selected Flat glass is the standard base for KODAK High Resolution Plates. For special applications where flatness requirements are critical, KODAK High Resolution Plates can be supplied on ultra-flat, precision-flat, or micro-flat glass in certain sizes and glass thicknesses.

Nominal Plate Size (inches)	Selected Flat			Ultra Flat		
	Micro-inches	Micro-metres	Fringes	Micro-inches	Micro-metres	Fringes
2 x 2	1900	49	170	950	24	83
2½ x 2½	2500	63	215	1200	31	105
3 x 3	3000	76	260	1500	38	130
3½ x 3½	3500	89	300	1700	44	150
4 x 4	4000	100	345	2000	50	170
4 x 5	4500	115	390	2200	57	195
5 x 5	5000	125	430	2500	63	215
Nominal Plate Size (inches)	Precision Flat			Micro Flat		
	Micro-inches	Micro-metres	Fringes	Micro-inches	Micro-metres	Fringes
2 x 2	265	6.7	23	—	—	—
2½ x 2½	430	11	37	—	—	—
3 x 3	625	16	54	—	—	—
3½ x 3½	850	22	73	—	—	—
4 x 4	1100	28	96	—	—	—
4 x 5	1400	36	125	255	6.5	22
5 x 5	1750	45	155	280	7.2	24

STORAGE

Unexposed Plates: Store in relative humidity conditions of 20 to 50 percent at a temperature of 13 to 24°C (55.5 to 75°F). Storage at a relative humidity greater than 50 percent can be detrimental to the emulsion and can reduce the effectiveness of ultrasonic cleaning. A certain amount of small debris, such as glass chips, emulsion flakes, fibers, etc., is generated during shipment. This debris is normally removed by standard ultrasonic cleaning methods. However, exposure to relative humidity greater than 50 percent can cause the debris to adhere to the emulsion and hinder its removal by ultrasonic cleaning. Extended exposure to a relative humidity greater than 50 percent and a temperature of 24°C (75°F) or greater can render the emulsion unusable. Short-term storage of 3 days or less in conditions not exceeding 60 percent relative humidity and 29.5°C (85°F) should not be detrimental to the plates provided that they are reconditioned to lower relative humidity and lower temperature conditions before use.

Processed Plates: Processed plates can be stored for short periods of time at temperatures of 15.5 to 25°C (60 to 77°F) and at a relative humidity of 20 to 50 percent. Long-term storage conditions, where possible, should be nearer 15.5°C (60°F) and 20 percent relative humidity. In most cases, storage at 21°C (70°F) and 20 to 50 percent relative humidity should be adequate.

DARKROOM HANDLING

Use a KODAK Safelight Filter No. 1A (light red), in a suitable lamp with a 15-watt bulb at no less than 1.2 metres (4 feet) from the plate.

CLEANING AND HANDLING PLATES

For microphotography, clean handling and processing techniques are mandatory. Special attention must be given to procedures for precleaning, clean processing, post-cleaning, and protective storage of the plates. Included here are detailed recommendations which must be observed to achieve and preserve the highest quality microimages. Even the smallest extraneous particle adhering to the surface of a KODAK High Resolution Plate may be imaged by the ultrahigh resolution emulsion. To eliminate such unwanted images, clean the plate surface just prior to exposure.

Working Area: Cutting, handling, packaging, and ultrasonic cleaning should be carried out in an environment with temperatures in the range of 15.5 to 24°C (60 to 75°F) and with a relative humidity of 40 to 50 percent. The working area should be equipped with effective air filtration. Ideal air filtration would be Class 100. Gelatin emulsions adjust to high-humidity conditions within minutes. Therefore, high-humidity conditions will cause debris from cutting operations and airborne dust particles to adhere to the emulsion, making their removal difficult during ultrasonic cleaning. High humidity can also cause condensation on plates during the ultrasonic-cleaning dry cycle. High temperatures can cause physical damage to the emulsion as well as affect the photographic speed. When plates are moved to lower humidity conditions, it may require several days for them to reach equilibrium.

Ultrasonic Cleaning: Effective plate cleaning can be obtained with a combination of an ultrasonic cleaning bath and a subsequent jet spray with suitable solvent* such as Freon TMC solvent. In the selection of a solvent, low surface tension and low-resistivity (reduced static charge) characteristics should be considered. In some cases where high-resolution plates have been subjected to a relative humidity above the recommended 50 percent, additional ultrasonic cleaning cycles may be effective in removing debris. Three continuous cleaning cycles may be used. However, it is recommended that the plates not be dried between each cycle. If more than three cycles are used, the plates should be monitored for physical damage to the emulsion. In all cases, the solvents used must be water-free and chemically pure.

In practice, immerse the plate for 30 to 60 seconds in the ultrasonic cleaning tank charged with one of the recommended solvents. Ultrasonic units that operate in the range of 25 to 40 kHz, with a power output of 500 watts, are suitable.

Withdraw the plates from the ultrasonic bath at a rate of about 2.5 cm (1 inch) per second through the high-velocity, jet-spray wash. To provide energetic and efficient cleaning action, the spray must be in the form of a flat jet. Also, there must be a solid stream of solvent rather than a spray of atomized droplets.

Opposing jets will clean both front and back plate surfaces simultaneously. The nozzles should be 2.5 to 5 cm (1 to 2 inches) from the plate surface and pointed downward so that the jet spray impinges on the plate at a 30- to 45-degree angle. Pressure at the nozzle should be greater than 100 kPa† (14 psi) but not greater than about 170 kPa (24 psi).

***Warning:** When using any of these solvents, check with local authorities and with medical and safety personnel, concerning toxicity, flash point, and ventilation.

†The metric (SI) unit of pressure is the pascal (Pa).

1 psi = 6.9 kPa.

For continued cleanliness on all plates put through this cleaning cycle, filter the solution. For critical applications, an in-line, 0.5-micrometre filter will be needed.

So that the operator is not subjected to solvent vapors, place the tank in a semi-enclosed area connected to an outside exhaust. The area will be under slight negative pressure and should be in a clean hood. With such an arrangement, the cleaned plates can be withdrawn directly into a clean atmosphere. The operator may keep the plates in the enclosure for a few moments after completion of the spray, to allow the solvent to evaporate in the exhausting, clean airflow.

To avoid moisture condensation on the plate due to the cooling caused by evaporation, allow the plate to dry in the vapor zone of an ultrasonic vapor degreaser unit if this is used for the cleaning and spray steps.

For further information on cleaning, see Kodak Publication No. P-52, *Techniques of Microphotography*.

For less critical applications, a jet of air, nitrogen, or Freon gas is effective for cleaning foreign particles from the emulsion surface. Be sure that the gas is clean, oil-free, and dry; use it at not more than about 200 kPa (29 psi), with the jet nozzle no closer than 5 cm (2 inches) from the plate. Provide an exhaust to carry off dislodged particles.

Ultrasonically Cleaned KODAK Plates: Certain sizes of KODAK High Resolution Plate, Type 1A, KODAK High Resolution Plate, Type 2A, and KODAK Special Product, Type 138-01 are packaged in plastic containers and ultrasonically cleaned in the tray just prior to sealing and shipping. The cleaning removes loose surface dirt and glass chips which may be generated during plate cutting and packaging operations. These plastic packaged, ultrasonically cleaned plates are presently available in the following plate sizes and thicknesses:

Plate Size	Thickness (Inches)
2 x 2	0.060
2½ x 2½	0.060 and 0.090
3 x 3	0.060 and 0.090
3½ x 3½	0.060 and 0.090
4 x 4	0.060 and 0.090
4 x 5	0.060 and 0.090
5 x 5	0.090*
5 x 5	0.060*

*Special-order sizes.

Although these sizes have been cleaned, small quantities of dirt and glass chips may be encountered from shipment and handling. Therefore, for optimum product cleanliness, it is recommended that plates be ultrasonically precleaned prior to exposure or use.

All other sizes of both high-resolution plate products are packaged in cardboard and are not ultrasonically cleaned.

EMULSION AND IMAGE-STRUCTURE CHARACTERISTICS

Characteristics	KODAK High Resolution Plate, Type 1A	KODAK High Resolution Plate, Type 2A	KODAK Special Product Type, 138-01
Meter Setting* (Tungsten)	0.01	0.0025	0.01
Contrast Classification	Extremely High	Extremely High	Extremely High
Resolving Power Classification†	Ultrahigh (above 2,000 lines per millimetre for a test-objective contrast of 1,000:1)		
Granularity Classification	Microfine		
Diffuse RMS Granularity‡	less than 5		
Emulsion Thickness Before Processing After Processing	6 micrometres 4 micrometres		

*This figure is based on $8/E$, where E is the tungsten exposure (in lux seconds) required to produce a density of 1.6 above gross fog with an exposure of 1 minute, and with development in KODAK HRP Developer (1:4) for 5 minutes at 20°C (68°F).

For exposure meters marked in ASA speeds, use the meter to evaluate *reflected* light from a white card of the white reflectance side of a KODAK Neutral Test Card. To evaluate incident light or reflected light from the 18-percent gray side of the Neutral Test Card, multiply the meter setting by 5.

†Determined according to a method similar to the one described in ANSI Standard PH2.33-1976, "Method for Determining the Resolving Power of Photographic Materials."

‡This value represents 1000 times the standard deviation of density produced by the granular structure of the material when a uniformly exposed and developed sample is scanned with a densitometer calibrated to read American Standard diffuse visual density, and having a circular measuring aperture 48 micrometres in diameter. Granularity is an objective measurement of the spatial variation of sample density that generally correlates with graininess, which is the subjective effect of image nonuniformity upon the observer. Broadly speaking, granularity measurements with the 48-micrometre aperture will indicate the magnitude of the graininess sensation produced by viewing the diffusely illuminated sample with 12X monocular magnification. It should be noted that if the viewing conditions are changed from the specified 12X condition, the published rms values may no longer correctly indicate the relative sensations of graininess produced by various samples.

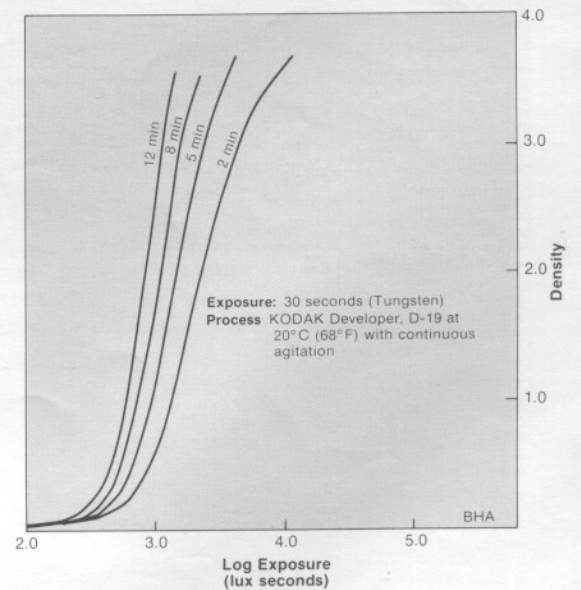
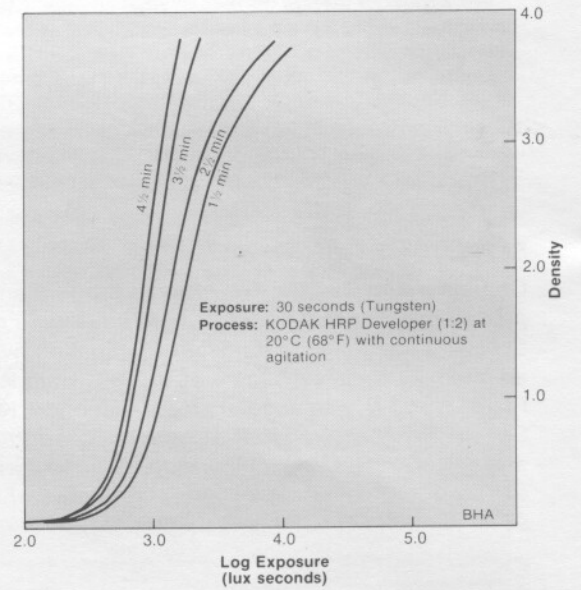
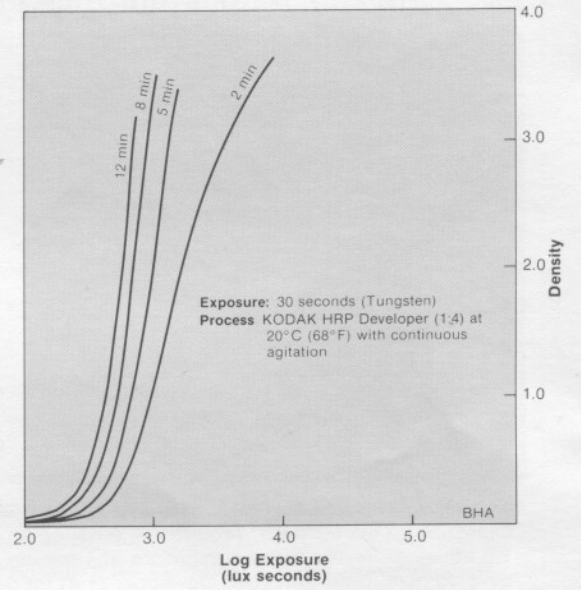
SENSITOMETRIC DATA

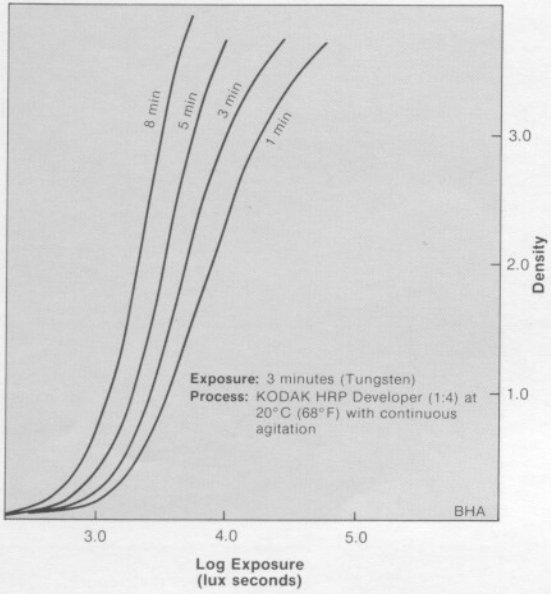
Characteristic Curves: For average product and average processing. These characteristic curves were made by exposing the plates to tungsten illumination by means of an intensity scale sensitometer. KODAK High Resolution Plate, Type 1A, was exposed for 30 seconds; KODAK Special Product, Type 138-01, was exposed for 1 minute; and KODAK High Resolution Plate, Type 2A, was exposed for 3 minutes. All plates were developed at 20°C (68°F) with continuous agitation.

The sensitometric curves and data in this publication represent product tested under the conditions of exposure and processing specified. They are representative of production coatings and, therefore, do not apply directly to a particular box of photographic materials. They do not represent standards or specifications which must be met by Eastman Kodak Company. The company reserves the right to change and improve product characteristics at any time.

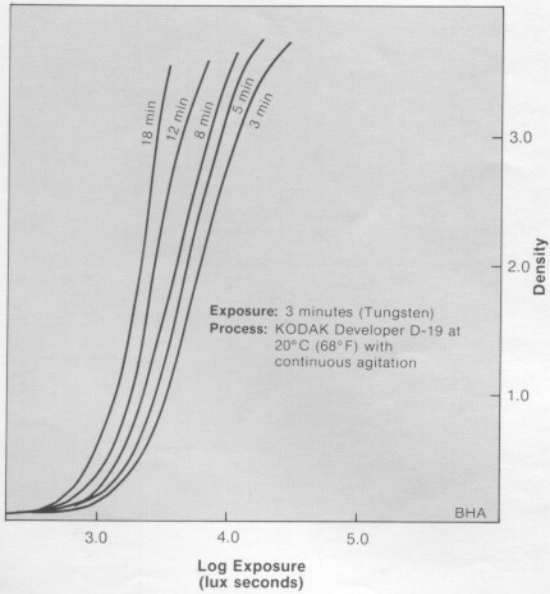
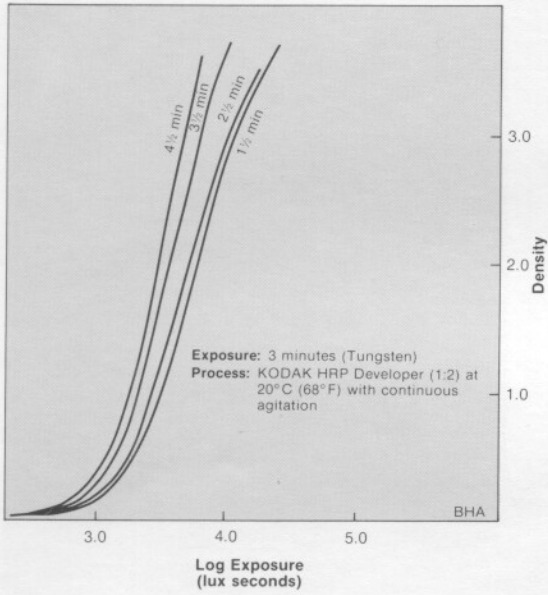
CHARACTERISTIC CURVES

KODAK High Resolution Plate, Type 1A

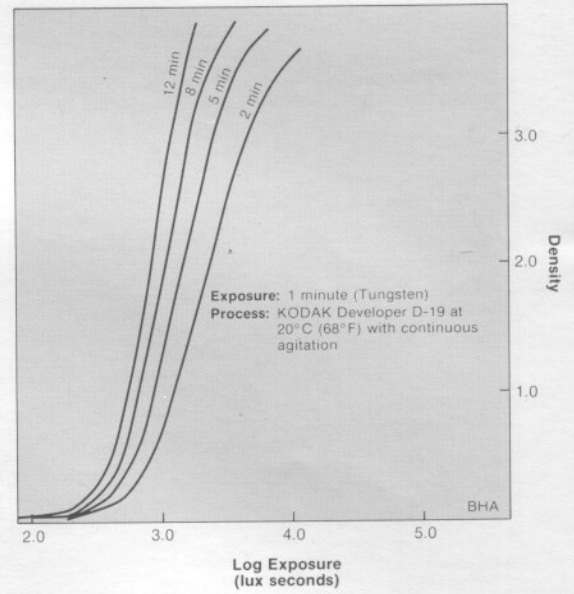
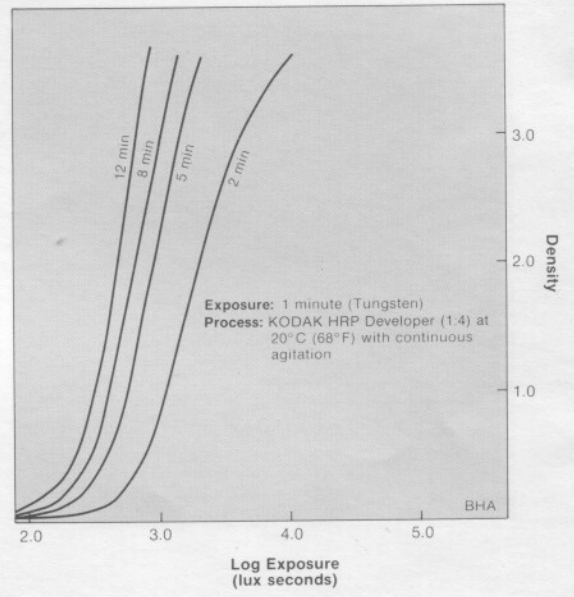


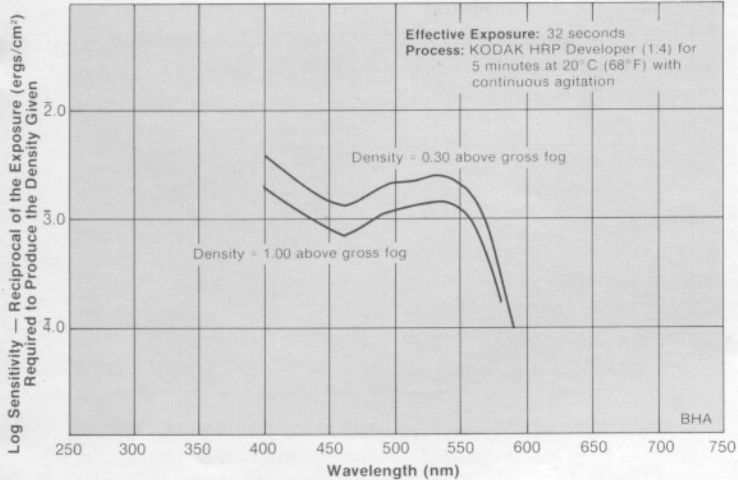


KODAK High Resolution Plate, Type 2A



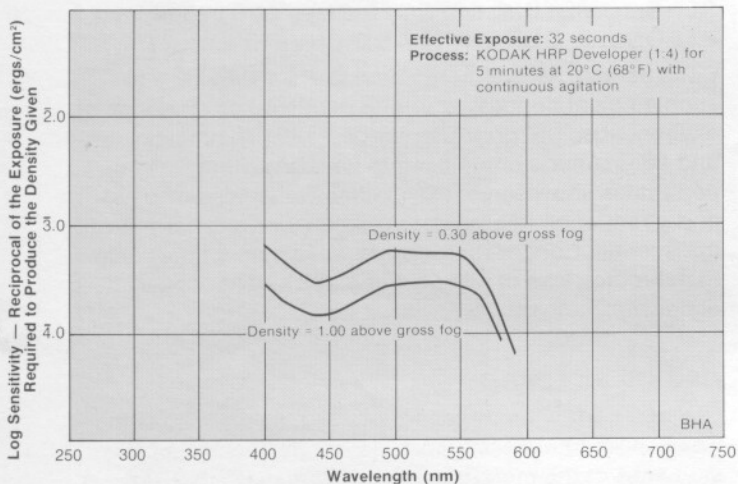
KODAK Special Product, Type 138-01



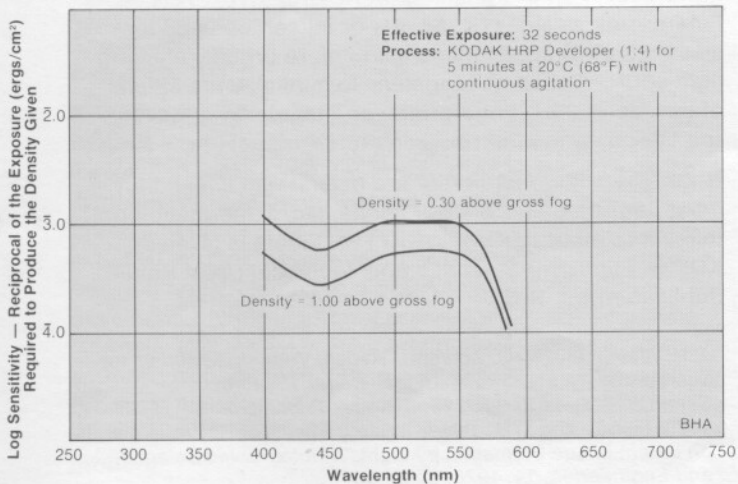


SPECTRAL SENSITIVITY CURVES

KODAK High Resolution Plate, Type 1A



KODAK High Resolution Plate, Type 2A



KODAK Special Product, Type 138-01

PHOTOGRAPHIC SPEED

General Information

Figures 1 through 3 are characteristic curves of KODAK High Resolution Plate, Type 1A and Type 2A, and KODAK Special Product, Type 138-01, shown together to best illustrate the characteristics of the Type 138-01 Plate compared with the other two plates. Type 1A Plate has the fastest speed along with the smallest exposure latitude. Type 2A Plate has the slowest speed along with the largest exposure latitude. KODAK Special Product, Type 138-01, has almost as much exposure latitude as Type 2A Plate with approximately twice the speed.

Exposures for the data shown were made using a single-bulb, ULTRA TECH Model CP210, Contact Printer. The light source was filtered with a KODAK WRATTEN Gelatin Filter No. 58. A constant intensity level was maintained at a value equivalent to 2,500 nanometres as measured with an ULTRA TECH Model 125A Photometer. The plates were developed in KODAK HRP Developer for 5 minutes at 20°C (68°F).

Microimage Applications

Figure 1 shows the response of Type 138-01 Plate in terms of microline growth in microinches vs log exposure.

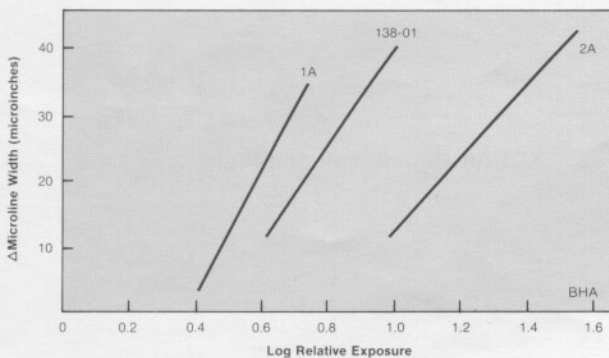


Figure 1

Figure 2 shows the relationship of microline growth vs density.

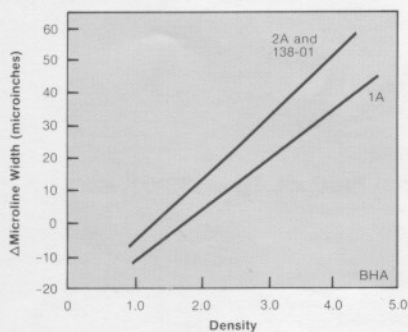


Figure 2

Macroimage Applications

Figure 3 represents the typical density vs the log exposure characteristic curve which is useful for most macroimage applications.

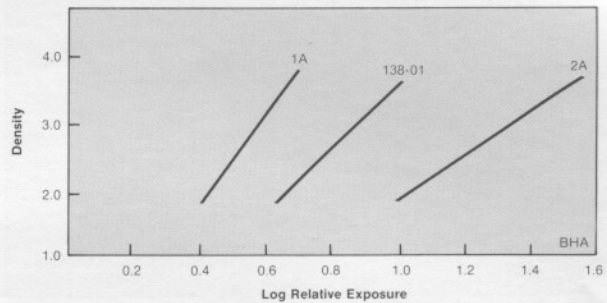


Figure 3

SENSITOMETRIC EFFECTS DUE TO EXPOSURE DURATION AND ENVIRONMENT

Considerable sensitometric effects are attributable to such ambient conditions during exposure as presence of oxygen, absolute pressure, percent relative humidity, and atmospheric contaminants.* KODAK High Resolution Plates show some loss in effective emulsion speed and a reduction in contrast for exposures shorter than 1 millisecond. Longer-than-normal development may help to overcome loss of density but may change critical dimension.

USE OF FILTERS

Use of a narrow-band-pass green or blue filter limits the wavelength of exposing light. To isolate specific emission lines of the mercury-arc spectrum, use a KODAK WRATTEN Filter No. 50 (blue) or No. 74 (green). Wider band-pass, higher transmission KODAK WRATTEN Filters such as No. 47B, 58, 61, or 99 can be used for less restrictive applications using more broadly emitting light sources such as tungsten. To minimize the effects of dirt, scratches, fingerprints, or filter wedging, place the filter over the light source rather than over the lens.

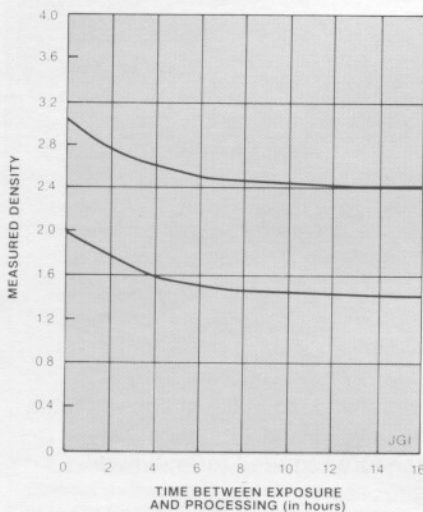
Note: The filters mentioned are gelatin-film filters; they must be protected from hot lamps. More information on these and other KODAK WRATTEN Filters is given in *KODAK Filters for Scientific and Technical Uses*, Kodak Publication No. B-3.

*J. H. Altman and H. C. Schmitt, "Recent Work on Materials for Microphotography," *Proceedings—Kodak Photoresist Seminar—May 19 and 20, 1969*, Kodak Publication No. P-209, 1970, pp 5-8; and T. H. James, "Some Effects of Environment on Latent Image Formation by Light," *Photographic Science and Engineering*, 14, 1970, pp 84-96.

LATENT-IMAGE DECAY

A consideration in development is the photographic effect called "latent-image fading." This occurs after exposure and is especially noticeable with high resolution plates because of the submicroscopic size of their silver halide grains. When processing is delayed after exposure, this effect causes the density produced by a given exposure to be lower than it would have been if the plates had been processed right away. The exact rate of fading or decay depends on the conditions under which the plate was kept before processing. A typical example is shown in the latent-image decay curve below. Note that the significant drop in density occurs during the first few hours and continues somewhat less significantly thereafter. When constant density (or contrast) is important, a uniform schedule for exposing and processing must be adopted.

Latent-Image Decay Curve



PROCESSING

Negative Processing

KODAK High Resolution Plate, Type 1A, KODAK High Resolution Plate, Type 2A, and KODAK Special Product, Type 138-01, can be processed to a negative using an ultraclean processing cycle. Each processing sequence is based on *tank* development. Plates with antihalation backing are subjected to a presoak and wash before development; this is not necessary for unbacked plates. Normally, KODAK High Resolution Plate, Type 1A, is supplied with an antihalation backing. KODAK Special Product, Type 138-01, and KODAK High Resolution Plate, Type 2A, have no backing on the standard product.

Note: The use of a stop bath other than water, a hypo clearing agent, wetting agents, farmer's reducer, or other processing chemicals which may affect the final image quality is not recommended.

Ultraclean Process

For extremely critical work, clean the plate in an ultrasonic cleaning bath using recommended solvents, and process in the following ultraclean, tank cycle.

The solution should be filtered to 0.5 micrometre or less, depending on the degree of cleanliness required. The filtration should be continuous, or the solution should be discarded after each use. Surface skimming is necessary to remove floating debris and to prevent its redeposition on the plates as they are withdrawn from the tank. If the solution is not recirculated and refiltered, the liquid surface can be kept clean simply by adding freshly filtered solution so that the tank overflows.

A jet-spray final rinse is important for clean, trouble-free operation. This rinse flushes away gel particles, solution precipitates, and other debris. The rinsing should be done with freshly filtered deionized or distilled water. All water throughout the process must be distilled or deionized (not merely demineralized).

Caution: The emulsion is soft and swollen during the processing stages. In no case should the nozzle pressure exceed 69 kPa (10 psi) at 5 cm (2 inches) from the plate surface.

Final drying should take place in the cleanest possible atmosphere and should take no longer than 10 minutes. The most suitable method of drying would be to spin-dry the plates for the time required to dry. If such equipment is not available or suitable, ethanol baths can be used to hasten the drying of the emulsion layer through dehydration. They also minimize tackiness of the emulsion surface during drying. Concentration of the baths *must be increased in stages* to prevent physical shock and distortion which would result from the rapid drying action of a single, full-strength ethanol bath.

Ultraclean Negative Process

Process Step (For unbacked plates, start with Step 2)	Instructions	Temperature		Time (in Minutes)
		°C	°F	
1. Soak in KODAK DACOMATIC DN-3/DR-5 Clearing Bath (1:3.2)*	Agitate	18-21	65-70	½
2. Soak in water		18-21	65-70	1
3. Develop in KODAK HRP Developer (1:4) or in KODAK Developer D-19	Agitate	20 ± 0.3	68 ± ½	5
4. Rinse in water stop bath	Use running water	18-21	65-70	½
5. Fix in KODAK Rapid Fixer, Part A	Agitate	18-21	65-70	2
6. Wash	Use running water	18-21	65-70	5
7. Spray-rinse with water	Use running water	18-21	65-70	¼
8. Spin-dry (preferred method)		18-49	65-120	as required
OR				
9a. Bathe in 50 percent ethanol†		18-21	65-70	¼
9b. Bathe in 75 percent ethanol†		18-21	65-70	¼
9c. Bathe in 100 percent ethanol†		18-21	65-70	¼
10. Dry	In a clean atmosphere	18-21	65-70	Not more than 10

*Also available in 5-gallon flexible containers as KODAK Microfilm Clearing Bath and Replenisher.

†**CAUTION:** Ethanol is flammable. Do not use near fire or flame.

Notes

- a. All water throughout the process must be distilled or deionized.
- b. All solutions must be filtered to 0.5 micrometre or to the degree required by the finished product. Continuously recirculate and refilter, or discard after each use.
- c. Flow rates to all tanks should be adjusted so that they continuously overflow, creating a skimming action to remove floating debris.
- d. The jet-spray rinse should be accomplished using freshly filtered materials. The spray cannot be a forceful one as the wet emulsion layer is soft and very susceptible to physical damage. Nozzle pressures should not exceed 69 kPa (10 psi) with jets 5 cm (2 in.) from the plate.
- e. **CAUTION:** Extended fixing times in excess of 2 minutes may result in some bleaching of fine images.

Reversal Processing

When duplicate image masters are required, or when a negative image is not wanted in a reduction step, the following reversal-processing procedures can be used. *Reversal processing of KODAK High Resolution Plate, Type 2A, and KODAK Special Product, Type 138-01, is not recommended if image linewidths less than 200 microinches must be recorded.* To make images suitable for reversal processing, it will usually be necessary at least to double the exposure required for optimum results with negative processing.

Use of a very active developer and a second developer presoak helps to increase effective emulsion speed and to produce maximum image density.

The remarks on filtration, rinsing, and alcohol baths preceding the "Ultraclean Negative Process" are also applicable to the "Ultraclean Reversal Process."

Ultraclean Reversal Process

Process Step (For unbacked plates, start with Step 2)	Instructions	Temperature		Time (in Minutes)
		°C	°F	
1. Soak in KODAK DACOMATIC DN-3/DR-5 Clearing Bath (1:3.2)*	Agitate	18-21	65-70	½
2. Soak in distilled water	Agitate	18-21	65-70	1
3. Develop in KODAK Developer D-8 (undiluted)	Agitate	20 ± 0.3	68 ± ½	5
4. Wash in distilled water	Agitate	18-21	65-70	2
5. Bleach in KODAK Bleach Bath R-9	Agitate	18-21	65-70	2
6. Wash in distilled water	Agitate	18-21	65-70	½
7. Clear in KODAK Clearing Bath CB-6	Agitate	18-21	65-70	3
Remaining steps can be done in normal room illumination				
8. Wash in distilled water	Agitate	18-21	65-70	4
9. Presoak in KODAK HRP Developer (diluted 1:4)†	Agitate	18-21	65-70	½
10. Reversal Exposure‡	Expose plate to No. 212 or 302 enlarging lamp at 0.8 metre (2½ feet) (30 to 40 footcandles)			½
11. Redevelop in KODAK HRP Developer (diluted 1:4)	Agitate	18-21	65-70	5
12. Fix in KODAK Rapid Fixer	Agitate	18-21	65-70	2
13. Wash in distilled water	Agitate	18-21	65-70	5
14. Spray-rinse in distilled water				¼
15. Spin-dry (preferred method)		18-49	65-120	as required
OR				
16a. Bathe in 50 percent ethanol§		18-21	65-70	¼
16b. Bathe in 75 percent ethanol§		18-21	65-70	¼
16c. Bathe in 100 percent ethanol§		18-21	65-70	¼
17. Dry	In a clean atmosphere	Not over 43	Not over 110	5

* Also available in 5-gallon flexible containers as KODAK Microfilm Clearing Bath and Replenisher.

† The second developer presoak is recommended before reversal exposure to improve the uniformity of D-max areas after completion of the reversal process. The presoak greatly reduces the possibility of areas of the plate exhibiting nonuniform, mottled, images with insufficient density which appear greenish in color.

‡ The "normal room illumination" in which the final steps of the reversal process are conducted are insufficient for reversal exposure. The reversal exposure may be done while the plates are immersed in the second developer solution, provided a uniform exposure of each plate can be achieved. As an alternative, presoak the plates, remove them from the second developer for reversal exposure, and reimmerse them in the second developer immediately.

§ **CAUTION:** Ethanol is flammable. Do not use near fire or flame.

KODAK Bleach Bath R-9

	Metric	Avoirdupois U.S. Liquid
Water	1.0 litre	1 gallon
KODAK Potassium Dichromate (Anhydrous)	9.5 grams	1¼ ounces
Sulfuric Acid* (concentrated)	12.0 mL	1½ fluidounces

***Warning:** Always add the sulfuric acid slowly, stirring constantly, and never add the solution to the acid; otherwise, the solution may boil and spatter the acid on the hands or face, causing serious burns.

KODAK Clearing Bath CB-6

	Metric	Avoirdupois U.S. Liquid
CALGON Water Softener	0.5 gram	30 grains
KODAK Sodium Bisulfite (Anhydrous)	15.0 grams	2 ounces
Water to make	1.0 litre	1 gallon

Disposal of Processing Effluents

The clearing bath, developer, stop bath, fixer, and wash water from the process are biodegradable and can be disposed of by discharging into a municipal treatment plant having secondary (biological) treatment. Federal, state, and local effluent regulations take precedence, however, and should be checked.

The solvents used for cleaning may be prohibited from being sewered by local regulations. They should be disposed of through a licensed chemical waste disposal service.

If the plates are being processed in a reversal process, the used bleach will contain potassium dichromate and silver. Many sewer codes prohibit or strictly regulate the chromium being sewered. Either total Cr, Cr⁶, or Cr³ may be regulated. The local sewer code should be checked prior to discharge of the bleach. It may require removal through the services of a licensed disposal service after the silver is removed.

Silver Recovery

Silver can be recovered from the fixer by passing it through a KODAK Chemical Recovery Cartridge, Type 1-P. The fixer can also be treated in an electrolytic treatment device followed by treatment in a KODAK Chemical Recovery Cartridge, Type 1-P. Silver can be recovered from the bleach by precipitation with silver chloride, as described in Kodak Publication No. J-10, *Recovering Silver from Photographic Materials*.

SIZE DATA AND ORDERING INFORMATION

When placing an order for KODAK High Resolution Plate, Type 1A, or KODAK High Resolution Plate, Type 2A, please make sure that you indicate plate size, quantity, thickness, flatness, and the catalog number. The order quantity is a minimum of one case or multiples of cases. Ordering information for KODAK Special Product, Type 138-01, can be obtained from one of the addresses on the back page.

Size (in inches)*	No. Plates per Package	No. Packages per Case	Glass Thick- ness (in inches)	Catalog (CAT) Numbers					
				KODAK High Resolution Plates, Type 1A			KODAK High Resolution Plates, Type 2A		
				Selected Flat	Ultra Flat	Precision Flat	Selected Flat	Ultra Flat	Precision Flat
2 x 2	30	20	0.060	125 2063	125 2105	125 2089	--	--	--
2½ x 2½	30	20	0.060	125 2121	125 2162	125 2147	125 2709	125 2741	125 2725
3 x 3	30	20	0.060	125 2220	125 2188	125 2204	125 2766	125 2808	125 2782
3½ x 3½	30	20	0.060	125 2246	125 2287	125 2261	--	--	--
4 x 4	30	15	0.060	125 2303	125 2329	125 2345	125 2824	125 2840	125 2865
4 x 5	36	12	0.060	125 2360	125 2386	--	--	--	--
5 x 5	20	12	0.060	†			†	†	†
5 x 5	20	12	0.090	†		†	†	†	†

*Unlisted sizes smaller than 8 x 10 inches will be supplied insofar as possible.

†Information available upon request.

The Kodak materials described in this publication are available from those dealers normally supplying Kodak materials for microelectronics. Equivalent materials can be used if desired.

Atlanta, GA 30318: 1775 Commerce Dr., NW (P.O. Box 4778, Federal Annex 30302). Phone: (404) 351-6510
Dallas, TX 75235: 6300 Cedar Springs Rd. Phone: (214) 351-3221
Whittier, CA 90606: 12100 Rivera Rd. Phone: (213) 945-1255
Honolulu, HI 96819: 1122 Mapunapuna St. (P.O. Box 17007, ZIP 96817). Phone: (808) 833-1661
Montreal, PQ H3E 1A1: KODAK CANADA INC., 2 Place du Commerce, Ile des Soeurs. Phone: (514) 761-3481
New York, NY 10036: 1133 Avenue of the Americas. Phone: (212) 930-8000
Oak Brook, IL 60521: 1901 West 22nd St. Phone: (312) 654-5300
Rochester, NY 14650: 1187 Ridge Rd. West. Phone: (716) 254-1300
San Francisco, CA 94109: 3250 Van Ness Ave. (P.O. Box 3145, Rincon Annex 94119). Phone: (415) 928-1300
Toronto, ON M6M 1V3: KODAK CANADA INC., 3500 Eglinton Ave. West. Phone: (416) 766-8233
Washington, DC 20024: 500 12th St., SW. Phone: (202) 554-9300
West Vancouver, BC V7T 1A2: KODAK CANADA INC., 100 South Park Royal. Phone: (604) 926-7411

Outside the United States of America or Canada, please contact the Kodak company in your country or the International Photographic Division, Eastman Kodak Company, Rochester, New York 14650, U.S.A.



Graphic Data Markets

EASTMAN KODAK COMPANY • Rochester, New York 14650