KODAK AEROGRAPHIC Direct Duplicating Film 2422

KODAK AEROGRAPHIC Direct Duplicating Film 2422 is a blue-sensitive, slow-speed, direct reversal duplicating film coated on a 4.0-mil ESTAR Base. It features extremely fine grain, medium contrast, and extremely high resolving power.

This film yields duplicates of negatives or positives with conventional three-stage processing (no reexposure necessary), thus simplifying the making of high-quality duplicates. The emulsion develops to high density without exposure; with increasing exposure, the density decreases. Therefore, light passing through clear areas of an original will produce low densities, and light absorbed in the high-density areas of the original will result in high densities in the duplicating film. When printed in the usual manner, the result is a "duplicate" of the original.

The ESTAR Base provides flexibility, moisture resistance, high tear resistance, and excellent dimensional stability. The matte-surfaced emulsion minimizes Newton's rings in printing operations, with little or no light scatter. The thin, highly hardened emulsion provides high definition, or image sharpness.

A fast-drying backing permits high-temperature, rapid processing in modern three stage, continuous-processing machines such as the KODAK VERSAMAT Film Processor, Model 11 or 1140, with KODAK VERSAMAT 885 Chemicals or KODAK VERSAMAT 641 Chemicals. It can also be tray processed in such common developers as KODAK PROFESSIONAL Developer D-19 or KODAK PROFESSIONAL Developer DK-50.

APPLICATIONS

KODAK AEROGRAPHIC Direct Duplicating Film 2422 is designed for one-step duplication, with conventional three-stage processing, of black-and-white aerial imagery (both negatives and positives), including high-definition, fine-grain material.

These films are intended for use with printing equipment having light sources of very high intensity, such as a KODAK NIAGARA Printer.

BASE

3.9-mil (0.10 mm) ESTAR Base with a fast-drying backing

TOTAL FILM THICKNESS

The nominal total thickness (unprocessed) of this film is **4.10 mils** (0.104 mm). This includes emulsion—0.20 mils (0.005 mm), base—3.9 mils (0.10 mm), and backing—nil.

WEIGHT

The weight of 2422 Film (unprocessed), conditioned in equilibrium with 50 percent relative humidity, is **0.030 lbs/ft^2** (0.014 kg/ft^2).

SPECTRAL SENSITIVITY

Blue sensitive.

SAFELIGHT

Use a KODAK PROFESSIONAL 1 Safelight Filter (red) in a suitable safelight lamp with a 15-watt bulb at least 4 feet (1.2 metres) from the film.

EXPOSURE

This film may be exposed using a variety of printing sources. As in most projection or contact printing operations, the optimum exposure level required for a given processing condition is determined by test exposures. Because of its slow speed, this film requires printing equipment having a very high intensity light source.

Reciprocity Characteristics

No exposure or development time adjustments are required for exposure times from 1/100 second to 10 seconds.

IMAGE STRUCTURE

The following data are based on processing in KODAK VERSAMAT Film Processors, Models 11 and 1140, using KODAK VERSAMAT 885 and 641 Chemicals at the conditions noted.

Resolving Power (line pairs/mm)		rms Granularity*
TOC 1.6:1	TOC 1000:1	
200	500	6

*Granularity values read at a net diffuse density of 1.0 with a 48-micrometre aperture.

Process conditions to achieve above values:

Model 11, 885 Chemicals: 2 racks, 20 fpm, 85°F (29.5°C), process gamma 1.40

Model 11, 641 Chemicals: 2 racks, 8 fpm, 85°F (29.5°C), process gamma 1.35

Model 1140, 885 Chemicals: 1 rack, 30 fpm, 104°F (40°C), process gamma 1.40

STORAGE

For consistent results, all aerial films should be stored under fairly constant conditions. Kodak aerial films are "usually" packaged in equilibrium with 40 to 50 percent relative humidity. High temperatures or high humidity may produce undesirable changes in the film.

Unexposed Film

Store unexposed film in a refrigerator at 55°F (13°C) or lower, or freezer at 0 to -10°F (-18 to -23°C), in the original sealed container. If the film is stored in a refrigerator, remove it about 2 hours before opening; if stored in a freezer, remove it about 8 hours before opening. A sufficient warm-up time is necessary to prevent moisture condensation on cold film—otherwise, moisture spotting, ferrotyping, or sticking may occur.

Exposed Film

Keep exposed film cool and dry. Process the film as soon as possible after exposure to avoid undesirable changes in the latent image. If it is necessary to hold exposed but unprocessed film for several days (such as over a weekend), it should be resealed and refrigerated at 40°F (4°C) or lower. Before unsealing and processing exposed film that has been held in cold storage, follow the warm-up procedures described for unexposed film described above.

Processed Film

For best keeping, store processed film in a dark, dust-free area at 50 to 70°F (10 to 21°C) and 30 to 50 percent relative humidity. Preferably, store negatives on the spool or in individual KODAK PROFESSIONAL Sleeves. High relative humidity promotes the growth of mold and causes ferrotyping. Very low relative humidity causes excessive curl and brittleness. Avoid storage temperatures over 80°F (27°C).

PROCESSING

KODAK AEROGRAPHIC Direct Duplicating Film 2422 can be processed in KODAK VERSAMAT Film Processor, Models 11 and 1140, with KODAK VERSAMAT 885 Chemicals or KODAK VERSAMAT 641 Chemicals.

Mechanized processing in roller-transport processors offers the advantages of uniform treatment of all portions of the roll, freedom from banding, and absence of significant density variations from ends of the roll to the center. Refer to the operator's manual for the processor set-up information, but in all cases, the fixer replenisher should be introduced into tank No. 5 of the processor with a countercurrent flow to tank No. 3, where it overflows to a collection or recovery system.

General instructions for setting the machine dryer temperature are included in these pages. However, the temperature of the dryer may require some further adjustment, depending upon the ambient temperature conditions in the processing area. Usually it is best to set the temperature approximately 3°F (2°C) above that required to dry unexposed, processed film.

Chemicals

The following KODAK VERSAMAT Chemicals may be used in both the Model 11 and Model 1140 VERSAMAT Processors.

KODAK VERSAMAT 885 Developer Starter

KODAK VERSAMAT 885 Developer Replenisher

KODAK VERSAMAT 885 Fixer and Replenisher

KODAK VERSAMAT 641 Developer Starter

KODAK VERSAMAT 641 Developer Replenisher

KODAK VERSAMAT 641 Fixer and Replenisher

Notice: Observe precautionary information on product labels and Material Safety Data Sheets.

Replenishment Rates

Basic developer and fixer replenishment rates, in millilitres per square inch of film processed, vary depending upon the type of chemicals used. The following rates apply to processing in the VERSAMAT Processor, Models 11 and 1140.

Basic Replenishment Rates (mL/in²) KODAK VERSAMAT Chemicals		
	885	641
Developer	0.08	0.13
Fixer	0.08	0.12

Processing Sequence (All Recommended Chemicals)

KODAK VERSAMAT Processor, Model 11			
Processing Step	**No. of Racks**	**Path Length**	**Temperature**
Develop	1 or 2	1.2 or 2.4 m (4 or 8 ft)	85 ± 0.5°F (29.5 ± 0.3°C)
Fix	3	3.6 m (12 ft)	85°F (29.5°C) nominal
Wash	2	2.4 m (8 ft)	2 to 6°F (1 to 3°C) below developer temperature
Dry	—	2.4 m (8 ft)	135 to 145°F (57 to 63°C)

Sensitometric Data

Model 11, KODAK VERSAMAT 885 Chemicals, 85°F (29.5°C)				
Machine Speed (fpm)	**1 Developer Rack**		**2 Developer Racks**	
	Average Gamma	**D-min**	**Average Gamma**	**D-min**
5	1.45	0.11	1.50	0.34
10	1.35	0.07	1.45	0.13
15	1.05	0.06	1.45	0.09
20	0.85	0.05	1.35	0.08
25	0.70	0.05	1.30	0.08

Fixing: Adequate fixing is obtained at machine speeds up to and including 20 feet per minute.

Washing: LE-500 keeping quality is obtained at machine speeds up to and including 10 feet per minute with one developer rack and up to 15 feet per minute with two developer racks. (LE = Life Expectancy)

Drying: Adequate drying is obtained at machine speeds up to and including 20 feet per minute.

Model 11, KODAK VERSAMAT 641 Chemicals 85°F (29.5°C)				
Machine Speed (fpm)	**1 Developer Rack**		**2 Developer Racks**	
	Average Gamma	**D-min**	**Average Gamma**	**D-min**
5	No Data		1.45	0.10
10	"		1.25	0.06
15	"		0.90	0.05
20	"		0.70	0.05

Fixing: Adequate fixing is obtained at machine speeds up to and including 20 feet per minute.

Washing: LE-500 keeping quality is obtained at machine speeds up to and including 5 feet per minute with two developer racks. (LE = Life Expectancy)

Drying: Adequate drying is obtained at machine speeds up to and including 20 feet per minute.

Processing Sequence (All Recommended Chemicals)

KODAK VERSAMAT Processor, Model 1140			
Processing Step	**No. of Racks**	**Path Length**	**Temperature**
Develop	1 or 2	1.2 or 2.4 m (4 or 8 ft)	104 ± 0.5°F (40 ± 0.3°C)
Fix	3	3.6 m (12 ft)	104°F (40°C) nominal
Wash	2	2.4 m (8 ft)	2 to 6°F (1 to 3°C) below developer temperature
Dry	—	2.4 m (8 ft)	Up tp 149°F (65°C)

Sensitometric Data

Model 1140, KODAK VERSAMAT 885 Chemicals 104°F (40°C)				
Machine Speed (fpm)	**1 Developer Rack**		**2 Developer Racks**	
	Average Gamma	**D-min**	**Average Gamma**	**D-min**
10	1.75	0.25	—	—
20	1.50	0.10	1.70	0.28
30	1.40	0.07	1.60	0.14
40	1.20	0.06	1.60	0.14

Fixing: Adequate fixing is obtained at machine speeds up to and including 40 feet per minute.

Washing: LE-500 keeping quality is obtained at machine speeds up to and including 30 feet per minute with one developer rack and up to 20 feet per minute with two developer racks. (LE = Life Expectancy)

Drying: Adequate drying is obtained at machine speeds up to and including 40 feet per minute.

MANUAL PROCESSING

KODAK AEROGRAPHIC Direct Duplicating Film 2422 can be tray-processed in either KODAK PROFESSIONAL Developer D-19 or KODAK PROFESSIONAL Developer DK-50.

Development

Develop with continuous agitation. For best results, keep the temperatures of all solutions as close as possible to that of the developer solution.

Development Time in Minutes

KODAK Developer	68°F (20°C)	75°F (24°C)	85°F (29.5°C)	95°F (35°C)	Average Gamma
D-19	9	5 1/2	2 1/2	1 1/4	1.40
DK-50	14	9	5	2 1/2	1.40

Rinse

Rinse with continuous agitation in KODAK PROFESSIONAL Indicator Stop Bath for 10 to 20 seconds. A suitable stop bath can also be made using 125 mL/L of KODAK 28% Acetic Acid.

Fix

Agitate continuously for the first 15 seconds and intermittently thereafter in KODAK PROFESSIONAL Rapid Fixer with Hardener for 2 to 4 minutes, or in KODAK PROFESSIONAL Fixer for 5 to 10 minutes.

Wash

Wash in running water for 10 to 20 minutes. To conserve water and save time, use KODAK PROFESSIONAL Hypo Clearing Agent.

Dry

Dry the film in a dust-free area; heated, forced-air can be used to reduce the drying time.

DIMENSIONAL STABILITY

The dimensional stability of aerial films is of particular interest and importance in accurate mapping and in the reproduction of maps.

Dimensional stability is an all-inclusive term. In photography, it applies to size changes caused by changes in humidity and in temperature, and by processing and aging. The absence of solvent in ESTAR Base is one of the reasons why ESTAR Base films show excellent dimensional stability. The dimensional properties of ESTAR Base may vary slightly in different directions within a sheet; the differences that may exist, however, are not always between the length and width directions.

Temporary Dimensional Changes

Thermal Coefficient of Linear Expansion:	
0.001%	per degree F of change
0.0018%	per degree C of change

Humidity Coefficient of Linear Expansion (Unprocessed):	
0.0015%	per 1% change in relative humidity

Permanent Dimensional Changes

Processing Dimensional Change:	
-0.03% to +0.03%	(shrinkage to swell)

Aging Shrinkage of Processed Film:	
0.03%	1 week at 120°F (49°C), 20% RH
0.03%	1 year at 78°F (25.5°C), 60% RH

SIZE DATA AND ORDERING INFORMATION

KODAK AEROGRAPHIC Direct Duplicating Film 2422 is available in sizes for certain duplicating applications. The following factory-stocked sizes are available without minimum-order requirements:

CAT No.	Spec*	Size
171 9848	952	9 1/2 in. x 250 ft
171 9905	957	9 1/2 in. x 500 ft

*Kodak specification numbers are assigned to identify film width, spool size and design, type perforations (if required), and other spooling and packaging details

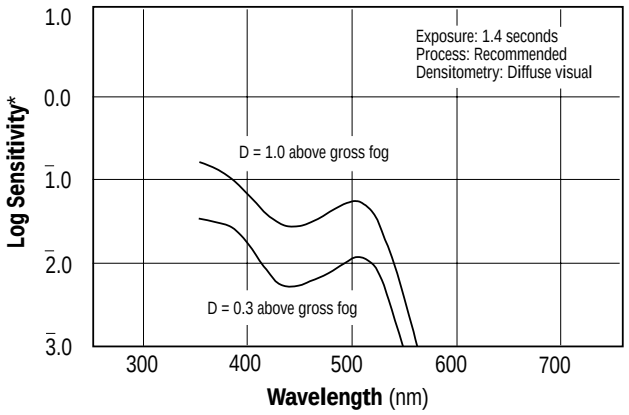
Information on minimum order quantities and other sizes of this film is available by writing or calling:

Aerial Imaging
Eastman Kodak Company
Rochester, New York 14653-7128
(716) 253-1855

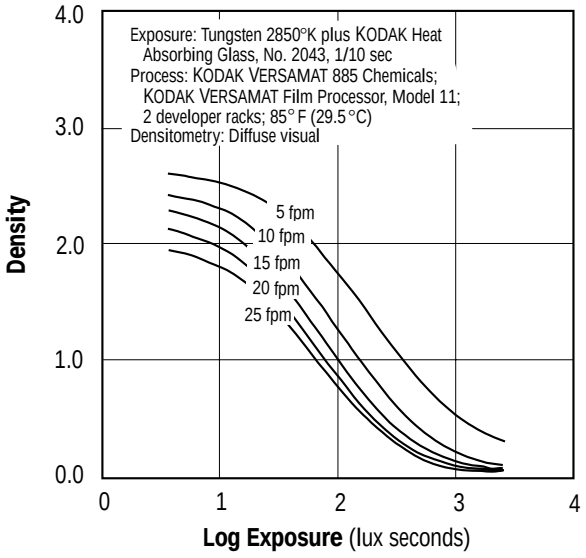
Note: The Kodak materials described in this publication used with KODAK AEROGRAPHIC Direct Duplicating Film 2422 are available from those dealers normally supplying Kodak products. Other materials may be used, but equivalent results may not be obtained.

CURVES

Spectral Sensitivity



Characteristic Curves



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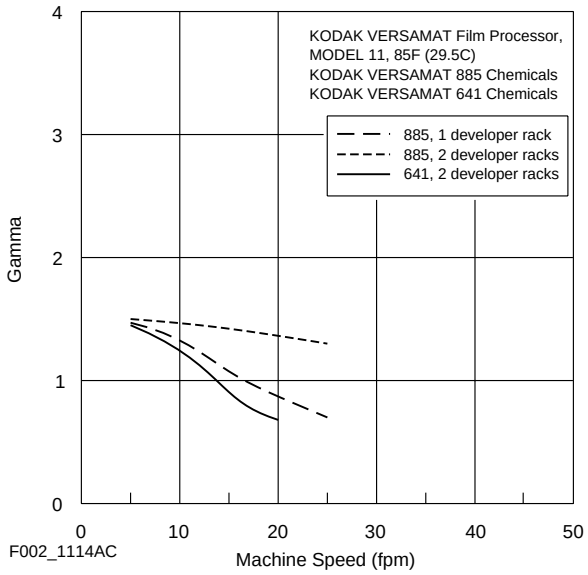
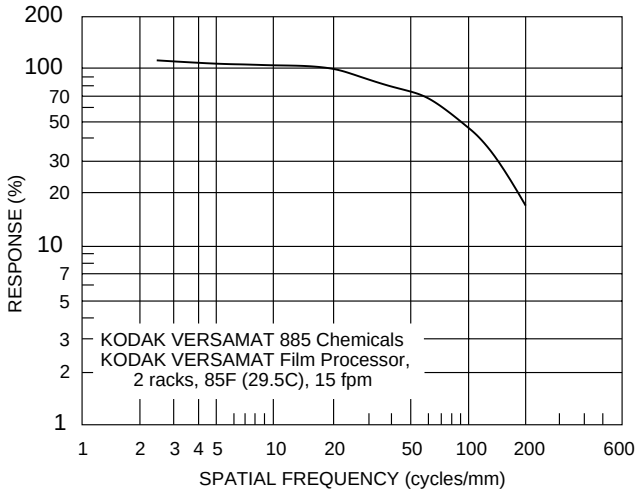
Gamma vs. Machine Speed



Modulation Transfer Function



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NOTICE: While the sensitometric data in this publication are typical of production coatings, they do not represent standards which must be met by Kodak. Varying storage, exposure, and processing conditions will affect results. The company reserves the right to change and improve product characteristics at any time.

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