

Characteristics of **KODAK** Aerial Films



Film Type	KODAK Film	Film Number ¹	Sensi-tivity	Description and Applications	Factory Stocked ²	Nominal Base Thickness (mils)	Nominal Total Thickness (mils)	Weight (lb/ft ²)	Backing	Aerial Film Speed ³ (ISO A)	Resolving Power (lines/mm)		Diffuse RMS Granularity ⁴	KODAK Safelight Filter	Processes and KODAK VERSAMAT Chemicals ⁵	Kodak's Literature References
											T.O.C. 1000:1 ⁴	T.O.C. 1.6:1 ⁴				
Camera Acquisition Films	PLUS-X AEROGRAPHIC	2402	Panchromatic (with extended red)	Medium-speed, high dimensional stability for aerial mapping and reconnaissance	✓	3.9 (.10 mm)	4.4	0.035	Dyed-Gel	200	130	55	20	Total Darkness	885 ; 64I; Type A	AS-45
	PLUS-X AERECON II	3404		Medium-speed, fine-grain, medium- to high-altitude reconnaissance film		2.5 (.06 mm)	2.9	0.022	Dyed-Gel	200	130	55	20	Total Darkness	885 ; 64I	AS-202
	DOUBLE-X AEROGRAPHIC	2405		Medium- to high-speed, standard film for mapping and charting; <i>high dimensional stability</i>	✓	3.9 (.10 mm)	4.50	0.035	Dyed-Gel	400	125	50	26	Total Darkness	885 ; 64I; Type A	AS-75
	PANATOMIC-X AEROGRAPHIC II	2412		Intermediate-speed, very fine-grain, medium- to high-altitude mapping and reconnaissance film; suitable for small negative formats	✓	3.9 (.10 mm)	4.45	0.032	Dyed-Gel	40	400	125	9	Total Darkness	885 ; 64I	AS-112
	PANATOMIC-X AERECON II	3412		Similar to 2412; thin base for increased spool capacity; for medium- to high-altitude reconnaissance		2.5 (.06 mm)	2.95	0.021	Dyed-Gel	40	400	125	9	Total Darkness	885 ; 64I	AS-112
	AERECON High Altitude	3409		Thin base, slow-speed, high-definition film for high-altitude reconnaissance		2.5 (.06 mm)	2.99	0.022	Dyed-Gel	16	630	320	9	Total Darkness	885	AS-210
	AEROCHROME III Infrared	1443	Color IR	False-color reversal and negative film, high dimensional stability for forestry surveys, agriculture and hydrology	✓	3.9 (.10 mm)	5.11	0.039	Gel	40 ⁶	100	63	23	Total Darkness	AR-5/C-41 ⁹	AS-77
	AEROCOLOR III Negative	2444	Color	Medium-speed, color-negative film for mapping and reconnaissance	✓	3.9 (.10 mm)	5.2	0.040	Gel	125	125	80	13	Total Darkness	AN-6⁸/C-41	AS-116
	AEROCHROME III MS	2427		Color-reversal film for low- to medium-altitude aerial mapping and reconnaissance	✓	3.9 (.10 mm)	5.44	0.038	Gel	32 ⁷	100	80	13	Total Darkness	AR-5	AS-2569
Duplicating Films	AEROGRAPHIC RA Duplicating	2416	Blue	Extremely fine-grain film for duplicating from medium-grain aerial negatives; high dimensional stability; rapid access processing		3.9 (.10 mm)	4.2	0.032	Fast-Drying	—	160	63	12	I (red)	885 ; 64I; RA2000	AS-31
	Aerial RA Duplicating	SO-416		Similar to 2416; thin base for maximum spool capacity and minimum storage space		2.5 (.06 mm)	2.85	0.022	Dyed-Gel	—	160	63	12	I (red)	885 ; 64I; RA2000	AS-31
	AEROGRAPHIC RA Duplicating	4416		Similar to 2416; thick base for maximum dimensional stability (sheets for aerial diapositives)	✓	7 (.18 mm)	7.35	0.054	Dyed-Gel	—	160	63	12	I (red)	885 ; 64I; RA2000	AS-31
	AEROGRAPHIC Direct Duplicating	2422		Extremely fine-grain film for one-step duplication of high-definition aerial negatives or positives	✓	3.9 (.10 mm)	4.2	0.030	Fast-Drying	—	500	200	6	I (red)	885 ; 64I	AS-41
	High Resolution Aerial Duplicating	SO-192		Microfine grain with ultra high resolving power for duplicating fine-grain aerial films		3.9 (.10 mm)	4.26	0.032	Fast-Drying	—	800	250	< 5	I (red)	885	AS-201
	High Resolution Aerial Duplicating	SO-187		Similar to SO-192; thick base for maximum dimensional stability (sheets for aerial diapositives)		7 (.18 mm)	7.26	0.054	Fast-Drying	—	800	250	< 5	I (red)	885	AS-201

NOTES:

1. Films having an "SO" designation are more subject to future variations as products are improved to meet changing customer requirements.

2. Nonfactory-stocked and some items may require 30 to 90 days for delivery. Not all film sizes and specifications are factory stocked.

3. Aerial Film Speeds (ISO A) are for use with the latest KODAK Aerial Exposure Computer, KODAK Publication No. AS-10 (2/94 edition), in determining the correct exposure for aerial (air-to-ground) photography. ISO A speeds are not equivalent to, and should not be confused with, conventional film speeds used in pictorial photography. (All speed values given on this chart were obtained by rounding the calculated values to the nearest $\sqrt{2}$ step (equivalent to a $\frac{1}{3}$ f-stop).

4. The image structure characteristics of the black-and-white camera acquisition films are based on processing in a KODAK VERSAMAT Film Processor, Model 11.

5. The KODAK VERSAMAT Chemicals and processes shown in **boldface** type in this column were used to determine the image structure characteristics as well as the Aerial Film Speeds of all the films.

6. With a KODAK WRITTEN Filter No. 12, or equivalent.

7. Haze filters such as KODAK Haze Cutting Filter HF-3, or HF-3/HF-4 and HF-3/HF-5 filter combinations may be necessary, depending on altitude and haze conditions.

8. Process AN-6 consists of chemicals selected from EA-5 and AN-6 chemicals.

9. Develop at 92°F for 3 minutes 45 seconds.

For information about sizes, prices, minimum orders, special orders, etc., write or phone:

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SPECIFICATIONS AND CHARACTERISTICS
OF **KODAK** AERIAL FILMS

SPECIFICATION NUMBERS FOR **KODAK** AERIAL FILMS

KODAK Aerial Films, both black-and-white and color, are available in sizes to fit all American mapping and reconnaissance cameras, as well as standard European mapping cameras and many special aerial cameras. Kodak's specification (Sp) numbers have been assigned to identify film width, spool size and design, type of perforations if used, and other details for regularly supplied sizes. The following tables are only a partial list of Kodak's specification numbers for aerial films on ESTAR Base, both black-and-white and color.

TABLE I
Black-and-White Films on **ESTAR** Base

The three thicknesses of ESTAR Base, 2.5-mil, 3.9-mil, and 7-mil, result in different lengths of film spooled on each standard aerial film spool. The following partial list indicates the standard length of each type of film that is supplied.

Film Spec. No.	Film Width	Film Length (without leader or trailer)			ISO 14546 Spool No.	Kodak's Spool No.	Core Diameter (inches)	Flange Diameter (inches)	Spool Material ¹
		ESTAR Thin Base (2.5-mil)	ESTAR Base (3.9-mil)	ESTAR Thick Base (7-mil)					
492 ²	70 mm	50 ft	40 ft	—	—	S-147	3 ¹ / ₃₂	2 ¹ / ₈	A
493 ²	70 mm	100 ft	75 ft	—	2	S-148	3 ¹ / ₃₂	2 ⁵ / ₈	A
494 ²	70 mm	200 ft	150 ft	100 ft	3	S-241	3 ¹ / ₃₂	3 ³ / ₄	A
533 ²	70 mm	500 ft	350 ft	200 ft	4	S-242	2 ¹ / ₈	5 ¹⁵ / ₁₆	A
536	70 mm	500 ft	350 ft	200 ft	4	S-242	2 ¹ / ₈	5 ¹⁵ / ₁₆	A
527 ²	70 mm	1,000 ft	700 ft	400 ft	5	S-151	2 ¹ / ₈	7 ⁵ / ₈	S
514	70 mm	1,000 ft	700 ft	400 ft	5	S-151	2 ¹ / ₈	7 ⁵ / ₈	S
528 ²	70 mm	2,000 ft	1,400 ft	800 ft	6	S-65	2 ¹ / ₈	10 ¹ / ₂	S
530	70 mm	2,000 ft	1,400 ft	800 ft	6	S-65	2 ¹ / ₈	10 ¹ / ₂	S
535 ²	70 mm	var.	var.	—	—	F-95 ⁵	1 ³ / ₃₂	—	S
931	5 in.	100 ft	—	—	—	S-32	1 ¹ / ₄	2 ³ / ₄	S
991	5 in.	200 ft	150 ft	—	8	S-33	1 ¹ / ₄	3 ³ / ₄	S
883	5 in.	500 ft	350 ft	200 ft	—	S-238	2 ¹ / ₈	5 ¹⁵ / ₁₆	A
897 ³	5 in.	500 ft	350 ft	200 ft	—	S-238	2 ¹ / ₈	5 ¹⁵ / ₁₆	A
884	5 in.	1,000 ft	700 ft	400 ft	—	S-239	2 ¹ / ₈	7 ⁵ / ₈	A
898 ³	5 in.	1,000 ft	700 ft	400 ft	—	S-239	2 ¹ / ₈	7 ⁵ / ₈	A
886	5 in.	2,000 ft	1,400 ft	800 ft	—	S-240	2 ¹ / ₈	10 ¹ / ₂	A
899 ³	5 in.	2,000 ft	1,400 ft	800 ft	—	S-240	2 ¹ / ₈	10 ¹ / ₂	A
949	9 ¹ / ₂ in.	200 ft	125 ft	—	—	S-43	2 ¹ / ₈	4	S
952	9 ¹ / ₂ in.	400 ft	250 ft	150 ft	—	S-46	2 ¹ / ₈	5 ³ / ₁₆	S
981 ⁴	9 ¹ / ₂ in.	—	250 ft	—	—	S-46	2 ¹ / ₈	5 ³ / ₁₆	S
955	9 ¹ / ₂ in.	500 ft	350 ft	200 ft	18	S-47	2 ¹ / ₈	5 ¹⁵ / ₁₆	S
957	9 ¹ / ₂ in.	700 ft	500 ft	300 ft	—	S-48	2 ¹ / ₈	6 ⁵ / ₈	S
961	9 ¹ / ₂ in.	1,000 ft	700 ft	400 ft	20	S-50	2 ¹ / ₈	7 ⁵ / ₈	S
960	9 ¹ / ₂ in.	2,000 ft	1,400 ft	800 ft	22	S-113	2 ¹ / ₈	10 ¹ / ₂	S

¹A = black enamel baked on aluminum; S = black painted steel.
²Type II perforations; in accordance with ISO Standard 14546.
³Kodak's standard perforations; 2 edges.
⁴Film slot taped.
⁵Vinten core.

SPECIFICATION NUMBERS FOR **KODAK** AERIAL FILMS

TABLE II
Color Films on **ESTAR** Base

In general, KODAK Color Film Emulsions are slightly thicker than black-and-white film emulsions. For this reason, color film lengths spooled on standard spools may be slightly less than black-and-white film lengths. The following partial list indicates the standard length of each type of film that would be supplied.

Film Spec. No.	Film Width	Film Length (without leader or trailer)		ISO 14546 Spool No.	Kodak's Spool No.	Core Diameter (inches)	Flange Diameter (inches)	Spool Material ¹
		ESTAR Thin Base (2.5-mil)	ESTAR Base (3.9-mil)					
492 ²	70 mm	—	35 ft	—	S-147	3 ¹ / ₃₂	2 ¹ / ₈	A
493 ²	70 mm	100 ft	—	2	S-148	3 ¹ / ₃₂	2 ⁵ / ₈	A
494 ²	70 mm	200 ft	100 ft	3	S-241	3 ¹ / ₃₂	3 ³ / ₄	A
533 ²	70 mm	400 ft	300 ft	4	S-242	2 ¹ / ₈	5 ¹⁵ / ₁₆	A
527 ²	70 mm	800 ft	600 ft	5	S-151	2 ¹ / ₈	7 ⁵ / ₈	S
535 ²	70 mm	var.	var.	—	F-95 ⁵	1 ³ / ₃₂	—	S
991	5 in.	200 ft	100 ft	8	S-33	1 ¹ / ₄	3 ³ / ₄	S
883	5 in.	400 ft	300 ft	—	S-238	2 ¹ / ₈	5 ¹⁵ / ₁₆	A
897 ³	5 in.	400 ft	300 ft	—	S-238	2 ¹ / ₈	5 ¹⁵ / ₁₆	A
884	5 in.	800 ft	600 ft	—	S-239	2 ¹ / ₈	7 ⁵ / ₈	A
898 ³	5 in.	800 ft	600 ft	—	S-239	2 ¹ / ₈	7 ⁵ / ₈	A
886	5 in.	1,600 ft	1,200 ft	—	S-240	2 ¹ / ₈	10 ¹ / ₂	A
899 ³	5 in.	1,600 ft	1,200 ft	—	S-240	2 ¹ / ₈	10 ¹ / ₂	A
949	9 ¹ / ₂ in.	150 ft	125 ft	—	S-43	2 ¹ / ₈	4	S
952	9 ¹ / ₂ in.	300 ft	200 ft	—	S-46	2 ¹ / ₈	5 ³ / ₁₆	S
981 ⁴	9 ¹ / ₂ in.	—	200 ft	—	S-46	2 ¹ / ₈	5 ³ / ₁₆	S
955	9 ¹ / ₂ in.	400 ft	300 ft	18	S-47	2 ¹ / ₈	5 ¹⁵ / ₁₆	S
957	9 ¹ / ₂ in.	600 ft	400 ft	—	S-48	2 ¹ / ₈	6 ⁵ / ₈	S
961	9 ¹ / ₂ in.	800 ft	600 ft	20	S-50	2 ¹ / ₈	7 ⁵ / ₈	S
990	9 ¹ / ₂ in.	1,600 ft	1,200 ft	22	S-113	2 ¹ / ₈	10 ¹ / ₂	S

¹A = black enamel baked on aluminum; S = black painted steel.
²Type II perforations; in accordance with ISO Standard 14546.
³Kodak's standard perforations; 2 edges.

⁴Film slot taped.
⁵Vinten core.

Table III
Film Widths

The following table lists the actual width and slitting tolerances for various KODAK Aerial Films, both black-and-white and color. The film width values apply to films manufactured at their normal moisture content in equilibrium with 45 to 50 percent RH. The dimensions apply at the time of cutting and perforating film adjusted to a temperature of 23 ± 1°C (73.5 ± 1.5°F) and humidity of 50 ± 2 percent RH. These dimensions may change by permanent shrinkage due to age or by temporary shrinkage or swell due to moisture changes in the environment.

Nominal Film Widths	Width Standards		Kodak's Tolerances	
	Inches	Millimetres	Inches	Millimetres
70 mm	2.754 ± 0.002	69.95 ± 0.05*	± 0.002	± 0.051
5 in.	4.950 ± 0.010	125.98 ± 0.25*	± 0.005	± 0.127
9.5 in.	9.460 ± 0.010	240.28 ± 0.25*	± 0.010	± 0.254

*ISO Standard 14546

Note: Actual film width aims differ appreciably from nominal widths. The apparent inconsistency can be attributed to the common widths coming into use at different times, associated with different cameras, and originally subject to individual specifications.

Table IV
Spool Center-Hole Specifications

The following center-hole specifications apply to spools used for both black-and-white and color aerial films.

Kodak's Spool No.	Configuration	Description
S-32, S-33, S-43, S-147, S-148, S-241		0.385-inch (9.78 mm) round hole with double keyway.
S-46, S-47, S-48, S-50, S-65, S-113, S-151, S-238, S-239, S-240, S-242		0.385-inch (9.78 mm) round center hole with double keyway, and two round drive holes of 0.379-inch (9.63 mm) diameter and 1.500 inches (38.10 mm) on center.

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