

KODAK INDUSTREX AA400 Film

Kodak

TECHNICAL DATA / NON-DESTRUCTIVE TESTING

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FEATURES / CUSTOMER PRODUCT SPECIFICATIONS

- High speed
- High contrast
- Fine grain
- For use in multiple film radiography and in single film techniques
- Can be used with direct x-rays or with lead foil screens

THICKNESS

Base / Support	0.18 mm (7.0 mils)
Emulsion	25 microns (1.0 mil); 12.5 microns each side
Overcoat	10 microns (0.4 mil); 5 microns each side
Total	0.22 mm (8.4 mils)

CLASSIFICATION

KODAK INDUSTREX 43IC Processor KODAK INDUSTREX Single Part Developer Replenisher, 8 minutes at 79°F (26°C)	
EN 584-1	C5
ASTM E 1815	Class II
ISO 11699-1	T3

EXPOSURE CONDITIONS: 8 mm Copper Filtration, HVL 3.5 mm Copper (220 kV), Lead screens.

AVAILABLE PACKAGING FORMATS

Sheet Film

Non-Interleaved (NIF) (AA400-1): This form of packaging is generally supplied in packs of 100 sheets, and is for use when film is to be loaded into metal or plastic cassettes, or exposure holders, with or without lead screens.

Pb Contactpak (AA400-7): In INDUSTREX Pb Contactpak packaging, industrial X-ray films are placed between two lead screens, which absorb the undesirable longer wavelengths of scattered radiation. The lead screens also intensify the image by emitting secondary electrons caused by the radiographic exposure. Lead screens are made up of a thin lead layer of 27-microns (1-mil) comprising a low percentage of antimony and tin, laminated on a paper sheet. The lead foil features a protective overcoat which prevents human contact with the lead, protects the film from potential "lead smudge" artifacts, and also provides static protection as the film and screens are separated.

Lead Screens

Layer	Approximate Thickness
protective overcoat	1.5 micron
lead*	27.5 microns
paper*	70 microns

*Thickness not drawn to scale.

The film type is identified on the package as well as embossed on the film itself. The package is laser-scored for easy opening, and has a butt edge which is invaluable for accurate positioning in difficult situations where the image needs to fall right up to the edge of the pack. The sandwich of lead screens and film is vacuum sealed in a lighttight, water and oil resistant, ready-to-expose flexible package, providing superb film/screen contact for optimum image quality.

READY-PACK II Film (AA400-2): These films are individually vacuum sealed in lighttight, water-resistant, flexible packages. The package is laser-scored for easy opening. The film type is identified on the package as well as embossed on the film itself. The package has a butt edge which is invaluable for accurate positioning in difficult situations where the image needs to fall right up to the edge of the pack.

Roll Film

READY-PACK (AA400-381): The film is supplied in a long, lighttight roll sandwiched between two yellow-black paper polyethylene layers. The rolls are of 60- or 100-metre lengths in a variety of widths. The film is provided in a dispenser box and is cut to length by the user in a darkroom.

LEAD PACK (AA400-382): The film is supplied sandwiched between two 27-micron thick lead screens inside a long, light-tight paper and polyethylene sleeve (see Pb Contactpak above for lead screen description). The rolls are 100 metres long and are cut to length by the user in a darkroom.

NIF bulk roll (AA400-359): The film is supplied on a cardboard core in rolls 150 metres long in three widths: 60 mm, 70 mm and 100 mm. The film must be loaded into a cassette in a darkroom.

SAFELIGHT RECOMMENDATIONS

Use a KODAK LED Safelight (660 nm red) or a red safelight filter (i.e. KODAK 1, 1A, or 2 Safelight Filter) in a suitable safelight lamp equipped with a 15-watt bulb. Keep the film at least 4 feet (1.2 metres) from the safelight.

Note: Other safelight filters (i.e. KODAK 8 and GBX-2 Safelight Filter) which block radiation at 550nm and shorter wavelengths are also suitable for use.

STORAGE AND HANDLING

Handle film carefully to avoid physical strains such as pressure, creasing, or buckling.

It is important to realize that meeting the chemical and physical requirements does not by itself ensure that records will not deteriorate. It is essential to provide proper storage conditions. ASTM E 1254 gives details of storage conditions. ISO 18911 and ISO 18902 give, for processed films, recommended storage conditions and specifications for the respective enclosure materials.

Unexposed

50 to 70°F (10 to 21°C), 30 to 50% RH. Properly shield from x-rays, gamma rays, or other penetrating radiation.

Exposed

Keep cool, dry, and properly shielded from penetrating radiation. Process as soon as possible after exposure.

Processed

60 to 80°F (15 to 27°C), 30 to 50% RH.

RELATIVE EXPOSURE

EXPOSURE CONDITIONS: 8 mm Copper Filtration, HVL 3.5 mm Copper (220 kV), Lead screens

KODAK INDUSTREX Films	KODAK INDUSTREX Processor KODAK INDUSTREX Chemicals
	8 min 79°F (26°C)
DR50	7.2
M100	4.2
MX125	2.8
T200	1.7
AA400*	1.0
HS800	0.5

* AA400 Film in 8 min 79°F (26°C) cycle is assigned a relative exposure of 1.

RELATIVE EXPOSURE FOR VARIOUS ENERGY LEVELS

For each exposure condition, AA400 Film in 8 minutes, 79°F (26°C), is assigned a relative exposure of 1.00.

INDUSTREX Films	ISO 120kV*	EN 220kV†	Iridium‡	Cobalt§
DR50	9.0	7.2	9.0	9.0
M100	4.1	4.2	5.4	6.3
MX125	2.9	2.8	3.1	3.3
T200	1.6	1.7	1.9	1.9
AA400	1.0	1.0	1.0	1.0
HS800	—	0.5	—	—

* In accordance with ISO 7004 standard. Without lead screens

† In accordance with ISO 7004 standard - EN 584-1 Lead screens

‡ 8 mm Copper filtration. 100/200 microns lead screens

§ 100/200 microns lead screens

AUTOMATIC PROCESSING

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

See Kodak publication TI-2621, *Processing KODAK INDUSTREX Films*, for additional information on automatic processing.

EXPOSURE CONDITIONS: 200/220 kV, ISO/ANSI/EN Conditions, KODAK INDUSTREX Chemicals

Film Characteristics (Sensitometric)

KODAK INDUSTREX Processor / Cycle	Base + Fog	Contrast*
M43IC, 8 min 79°F (26°C)	0.20	4.7
M43IC, 5 min 86°F (30°C)	0.20	4.65
M35, 8 min 82°F (28°C)	0.24	4.5

* Contrast calculated between net densities of 1.5 and 3.5.

Recommended Replenishment Rates

The consistency of the radiographic quality is related to the accurate adjustment of the replenishment rate.

Replenishment should maintain the chemical equilibrium, replacing the components used by the film.

Solution	Replenishment Volume	
	per 35 x 43 cm (14 x 17 inch) sheet	per m ²
Developer	100 mL	665 mL
Fixer	180 mL*	1200 mL

* For optimum archivability, a 10% increase in fixer replenishment rate may be desirable.

Washing and Drying

Washing: Follow the processor manufacturer's recommendation for wash flow rate, or adjust flow to achieve the equivalent of the wash tank capacity every five minutes, or twelve tank volumes per hour. Insufficient wash flow can adversely affect the life expectancy of processed radiographs. Wash flow rate should be increased if chemical spot tests or other analytical methods reveal a high level of retained chemicals in the processed film. For best results, the wash tank should be drained daily and left empty when not in use.

Drying: Follow the processor manufacturer's recommendation for dryer settings. In general, the dryer should be set to a temperature slightly above (3°C/5°F) the lowest temperature required to eliminate any signs of tackiness in films exiting the dryer.

MANUAL PROCESSING

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

See Kodak publication TI-2643, *Guide to Manual Processing of NDT Films*, for additional information on manual processing.

Film Characteristics (Sensitometric)

Development Conditions	Base + Fog	Contrast*
5 min 68° (20°C)	0.25	4.2
3 min 75° (24°C)	0.20	4.3
2.5 min 86°F (30°C)	0.24	4.2

* Contrast calculated between net densities of 1.5 and 3.5.

Development

Develop with rack and tank, using properly replenished solutions.

	Temperature	Recommended Time (Minutes)	Agitation
KODAK INDUSTREX Single Part Developer Replenisher	68°F (20°C)	5	Intermittent (5 seconds every 30 seconds)
	72°F (22°C)	4	
	75°F (24°C)	3	
	79°F (26°C)	2	

- Remove film and hanger 5 seconds before end of development. DO NOT ALLOW EXCESS DEVELOPER TO DRAIN BACK INTO THE TANK. Normally this will carry out the proper amount of solution to permit correct replenishment.
- Use floating covers on developer tanks to reduce oxidation and evaporation; store developer replenisher in a closed container.
- Fill the developer and fixer tank to its original level each morning with developer or fixer replenisher solution (topping off).
- Discard solution after adding two tank volumes of replenisher to tank, or at least once a month, and refill with fresh solution.

Stop, Fix, Wash and Dry Steps

	Temperature	Recommended Time	Agitation
KODAK Indicator Stop Bath, or acetic acid (diluted to 3.5%) solution	60 to 85°F 16 to 30°C	30 to 60 seconds	Continuous, Moderate
KODAK Rapid Fixer, KODAK INDUSTREX Manual Fixer, or KODAK INDUSTREX LO Fixer and Replenisher	60 to 85°F 16 to 30°C	3 to 6 minutes, or twice the clearing time	Vigorous for 15 seconds, then intermittent (5 sec every 30 sec)
Running water wash (8 volume changes per hour)	60 to 85°F 16 to 30°C	10 to 30 Minutes	

Stop baths check development, prevent most spots or streaks, and prolong the life of the fixing bath.

Immerse the film in fixer for **3 to 6 minutes**, agitating for **5 seconds every 30 seconds**. Film should remain in fixer for twice the time it takes to "clear" it (when the milky look disappears). **Never fix film for less than 3 minutes.**

KODAK Hypo Clearing Agent may be used following the fixer to reduce washing time and conserve water. First rinse films in running water for 30 seconds, then use Hypo Clearing Agent for 1 to 2 minutes, followed by a final running water wash for 5 minutes.

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To minimize water spots and drying marks, use KODAK PHOTO-FLO Solution after washing.

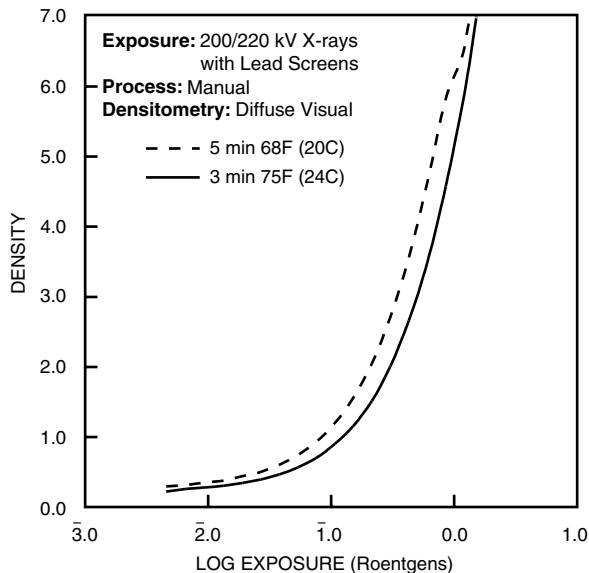
Dry in a dust-free area at room temperature or in a suitable drying cabinet. Temperature not to exceed 120°F (50°C).

Recommended Replenishment Rates

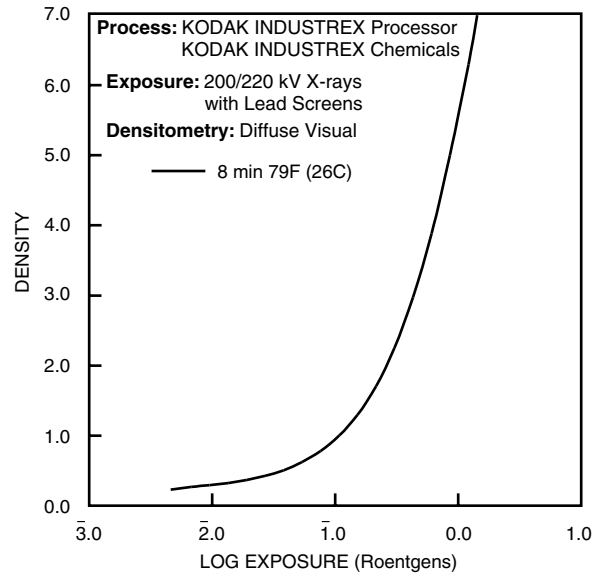
Maintain chemical activity and solution level in the developer tank by adding 100 ml (3.38 fluid ounces) of replenisher according to instructions for each 14 x 17-inch (35 x 43 cm) film processed. Stir vigorously after each addition. Replenish the fixer tank at the rate of 180 mL (6 fluid ounces) per 35 x 43 cm (14 x 17 in) sheet of film processed.

CURVES

Characteristic Curves, Manual Processing



Characteristic Curves, Machine Processing



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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