

Image Quality and Film System Classifications

Every application and every object require a specific class of industrial radiographic film or film system class which includes complementary film and film processing.

A New Film System Classification

The introduction of the Industrial Film Systems Classification Standards ASTM E-1815, ISO 11699-1 and JIS-K7627 provides an important means to assign film systems to the appropriate film system class.

These standards identify the various types of industrial X-ray film systems and classify them based on objectively quantified parameters that are the foundation of film imaging performance.

The standards for control of film processing and ISO 11699-2 provide the means to control the processing at the processor user level. The objective is to make sure that a classified system will produce the expected capabilities in daily use. As a result of being able to objectively determine the

performance of a specific Film System (Film + Chemistry + Processing), film radiography remains the number one and most widely used NDT technique.

The classification system classifies a film inclusive of film processing (type and chemicals). This illustrates the importance of processing in relation to imaging.

The parameters are:

G2 (contrast) Net density: D = 2

G4 (contrast) Net density: D = 4

D (noise) Net density: D = 2

G/σD Net density: D = 2

These parameters are selected based on the insight into imaging theory applied to the industrial X-ray film systems. G is a measure of the signal gain factor and σD indicates the noise, so that G/σD represents the signal /noise ratio.

In the context of growing quality awareness, the new perception of film system classification, described in ASTM 1815, ISO 11699 and JIS-K7627, gradually became norm for the industry.

Technical Specifications

A/Automatic			Gradient G		σD	G/σd	ISO SPEED	Dose mGy
Type	ASTM E 1815	ISO 11699-1	DENS=2	DENS=4	DENS=2	DENS=2	S	D=2
D2	special	C1	5.5	9.9	0.018	371	32	22.3
D3	I	C2	5.4	9.7	0.020	294	64	14.0
D4	I	C3	4.7	9.0	0.023	232	100	8.7
D5	I	C4	4.6	8.0	0.028	169	200	4.6
D7	II	C5	4.5	7.1	0.032	142	320	3.2
D8	III	C6	4.4	7.0	0.039	114	400	2.2

Chemicals G 135/G 335 - development immersion time : 100 sec.
Developing temperature: 28° C

Image Quality & Film System Classes			
Type	ASTM E 1815	ISO 11699-1	JIS-K7627
D2	special	C1	T1
D3	I	C2	T1
D4	I	C3	T2
D5	I	C4	T2
D7	II	C5	T3
D8	III	C6	T4

B/Manual			Gradient G		σD	G/σd	ISO SPEED	Dose mGy
Type	ASTM E 1815	ISO 11699-1	DENS=2	DENS=4	DENS=2	DENS=2	S	D=2
D2	special	C1	5.1	9.0	0.013	392	32	23.5
D3	I	C2	4.8	8.4	0.016	303	64	14.0
D4	I	C3	4.6	8.0	0.020	232	100	8.7
D5	I	C4	4.6	8.0	0.026	177	200	4.4
D7	II	C5	4.6	8.0	0.032	144	320	3.2
D8	III	C6	4.1	6.8	0.035	117	400	2.2

Chemicals G 128/G 328 - development immersion time : 300 sec.
Developing temperature: 20° C

BAM Certification

Agfa was the first company in the world that can boast certification by BAM, the German Federal Institute for Materials Research and Testing.

In addition to semi-annual product testing (design approval) and round robin tests recognizing the competence of the Agfa film lab, the certification process involves a quarterly production monitoring and an annual audit at the Agfa plant. The results are recorded in the corresponding certificates.

The most commonly used STRUCTURIX film systems based on the film types D3, D4, D5 and D7 combined with G135 developer and G335 fixer are BAM certified. The German Federal Institute BAM conducted a thorough study and awarded the STRUCTURIX ECO Film System (5 min. cycle) the certificate of compliance to International Film System Classification Standards.

ISO Certification

Waygate Technologies' approach to quality control in the NDT industry

At Waygate Technologies, we contend that obtaining an ISO certificate is only the beginning. Agfa was the first radiographic film manufacturer to achieve ISO certification for its STRUCTURIX films in 1990. Since then, we have continued the legacy of quality, assuring you that our entire film system – films, chemistry and equipment – is produced under a strict Quality Management System approved to ISO 9000. It's your guarantee of the superior quality of Waygate Technologies' Measurement & Control products.



Characteristics and Applications

■ STRUCTURIX D2

Extremely fine grain film with very high contrast. Ideal for exposures requiring the finest possible detail rendering.

- Electronic components
- Composite materials
- Castings (light metals and alloys)
- Multiple film techniques

■ STRUCTURIX D3

Ultra fine grain film with very high contrast. This film obtains a very high detail perceptibility, which meets the requirements of the most critical NDT applications. For exposure with lead screens, using either X-ray, gamma rays or radiation from megavolt equipment.

- Electronic components
- Composite materials
- Castings
- Very high quality welds
- Nuclear quality
- Aerospace and aircraft industry
- Multiple film techniques

■ STRUCTURIX D4

Ultra fine grain film with very high contrast. Suitable for a wide variety of critical applications. For exposure with lead screens, using either X-ray, gamma rays or radiation from megavolt equipment.

- Electronic components
- Composite materials
- Castings
- Very high quality welds
- Defense and nuclear industry
- Aerospace and aerospace industry
- Multiple film techniques

■ STRUCTURIX D5

Very fine grain film with high contrast. Excellent for visualization of discontinuities. This film is intended for use with lead screens, using either X-ray or gamma rays.

- Welding
- Castings
- Shipbuilding
- Aerospace and aircraft industry
- Multiple film techniques

■ STRUCTURIX D7

Fine grain film with high contrast and high speed. Designed for direct exposure or with lead screens. For exposure with lead screens, using either X-ray or gamma rays.

- Welding
- Castings
- Shipbuilding
- Aerospace and aircraft industry
- Multiple film techniques

■ STRUCTURIX D8

Medium grain film with high contrast and very high speed. Suitable for a variety of applications. This film can be used for direct exposure or with lead screens. It gives good image quality with short exposure times. If even higher speed is required, fluorescent screens, in combination with F8 (not D8), should be used.

- Welding and casting
- Defense industry
- Aerospace and aircraft industry
- Composite materials
- Multiple film techniques

■ STRUCTURIX WIDE LATITUDE FILMS

The wide latitude films are specially designed for in-house radiography and to inspect wide range thickness objects such as castings.

- Concrete and heavy construction work
- Castings
- Multiple film techniques

■ STRUCTURIX D4W

An extra fine grain film with medium contrast and very high speed. The film can be used for direct exposure techniques or with lead screens.

- Castings and other multi-thickness objects
- Ferrous and non ferrous castings
- Non-critical welds
- All non-classified materials inspection

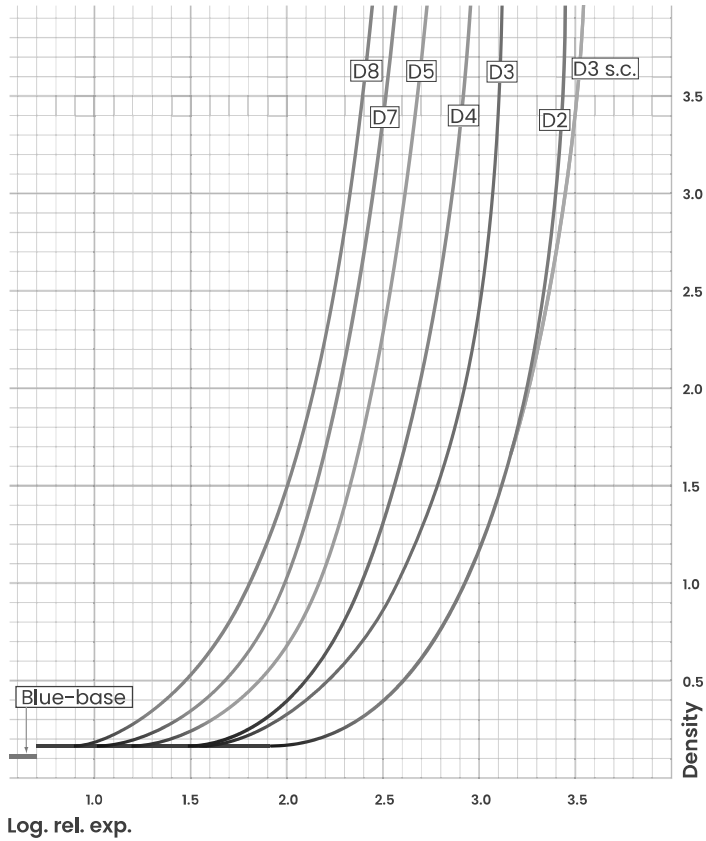
■ STRUCTURIX D6W

A high contrast, fine grain film with medium contrast combining good image quality and wide latitude.

- Castings and other multi-thickness objects
- Ferrous and non ferrous castings
- Non-critical welds
- All non-classified materials inspection

Performance Characteristics

Sensitometric Curves



STRUCTURIX D2, D3 s.c., D3, D4, D5, D7, D8 Exposure and processing parameters: 200 kV, Pb screens, autom. proc., 8 min. cycle, devel G 135, 28°C

Relative Exposure Factors							
Type	100kV	200kV	Se75	Ir192	Co 60	Linac/8MeV	Contrast
STX D2	9.0	7.0	6.4	8.0	9.0	9.0	6.0
STX D3 s.c.	9.5	8.0					5.3
STX D3	4.1	4.3	3.6	5.0	5.0	5.1	5.5
STX D4	3.0	2.7	2.4	3.0	3.0	3.1	5.4
STX D5	1.7	1.5	1.4	1.5	1.5	1.5	5.4
STX D7	1.0	1.0	1.0	1.0	1.0	1.0	5.4
STX D8	0.6	0.65	0.6	0.6	0.6	0.6	4.3

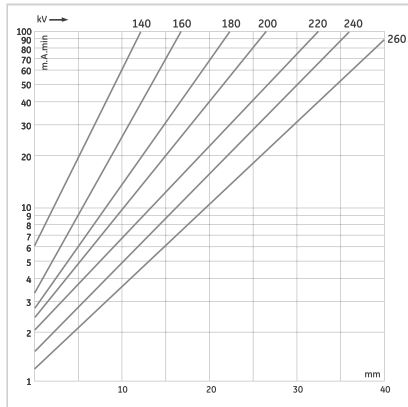
Exposure Diagrams

Exposure diagrams can be very useful for setting the correct exposure. The diagrams shown here are meant only as a guide, as the correct exposure will mainly depend on the variations of the object, the exposure equipment used and on the processing conditions.

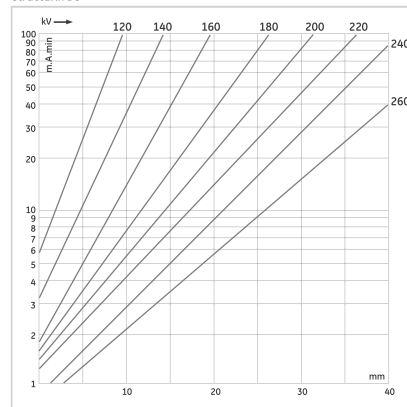
Steel (Fe)

- Type of X-ray tube: constant potential
- Pb-screens
- Density: 2
- FFD: 1 m
- Autom. proc.: 8 min. cycle, G 135, 28°C

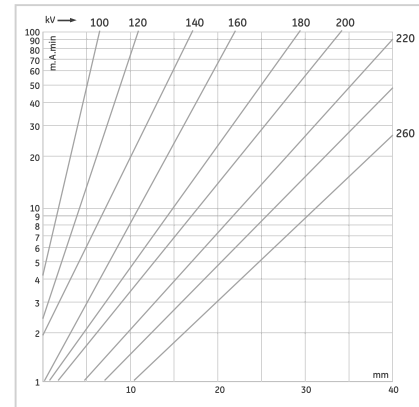
Structurix D2



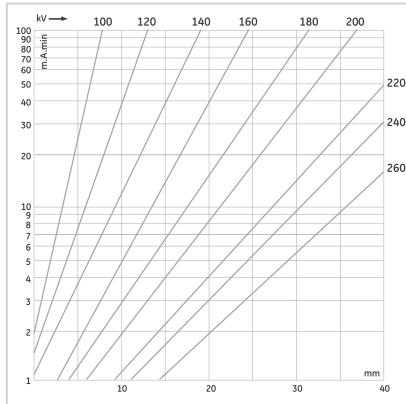
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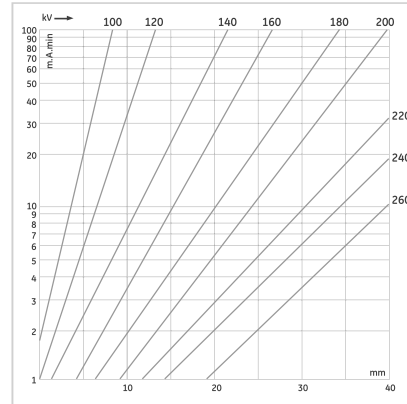
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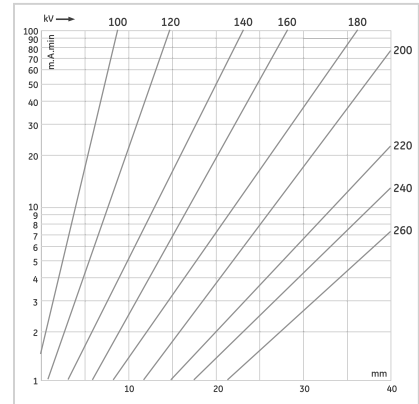
Structurix D5



Structurix D7



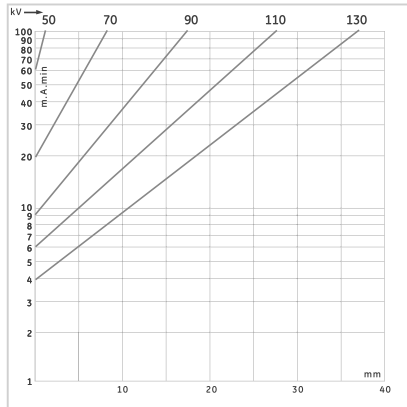
Structurix D8



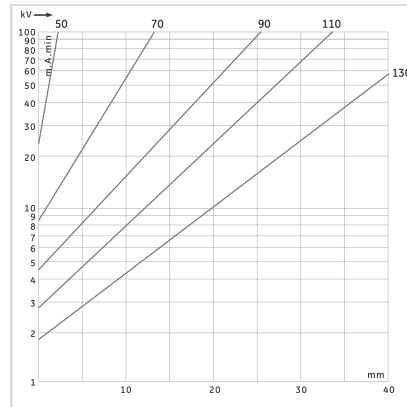
Aluminum (Al)

- Type of X-ray tube: constant potential
- Density: 2
- FFD: 1 m
- Autom. proc.: 8 min. cycle, G 135, 28°C

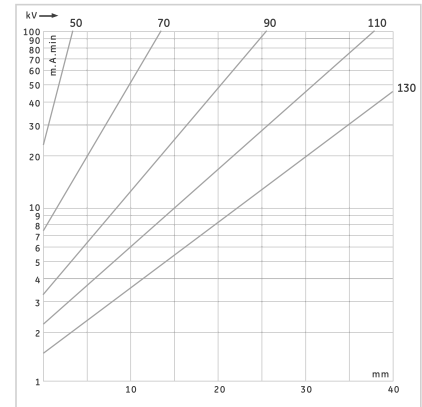
Structurix D2



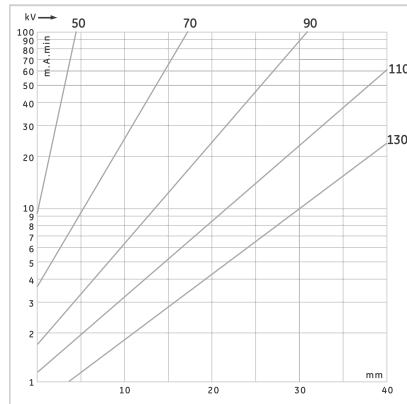
Structurix D3



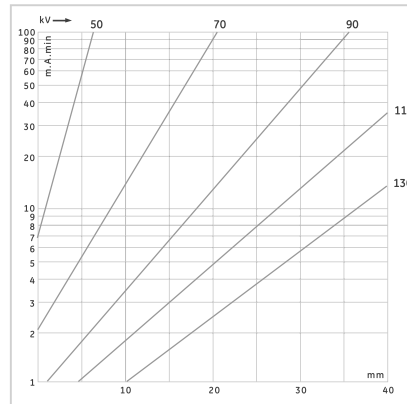
Structurix D4



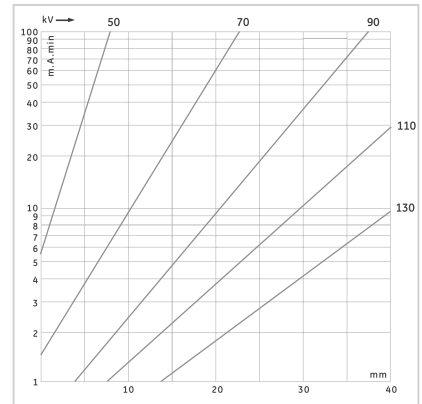
Structurix D5



Structurix D7

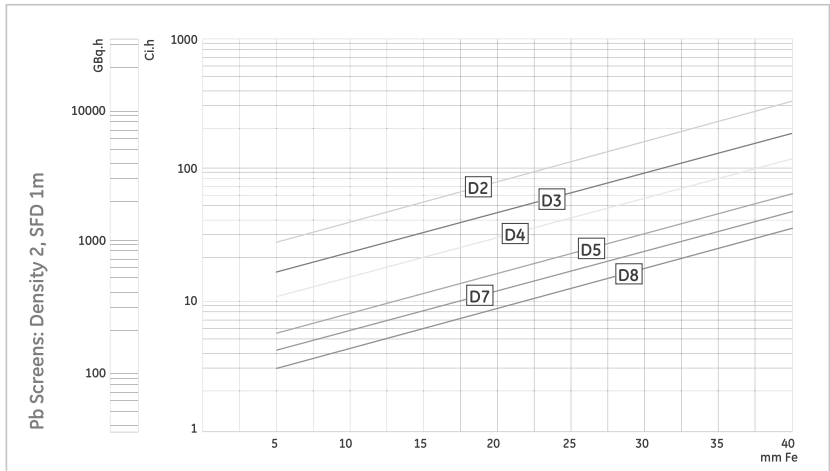


Structurix D8

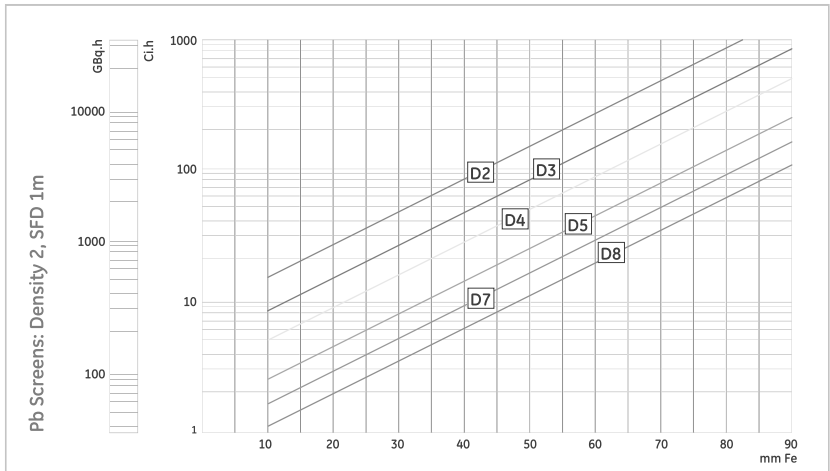


Exposure Diagrams

Selenium 75



Iridium 192



Cobalt 60

