STRUCTURIX Films – Advantages

The STRUCTURIX film family has two key advantages of great importance in non-destructive testing – image quality and consistent rugged behavior. Both result from Agfa's advanced emulsion technology and ultramodern high-tech coating processes.

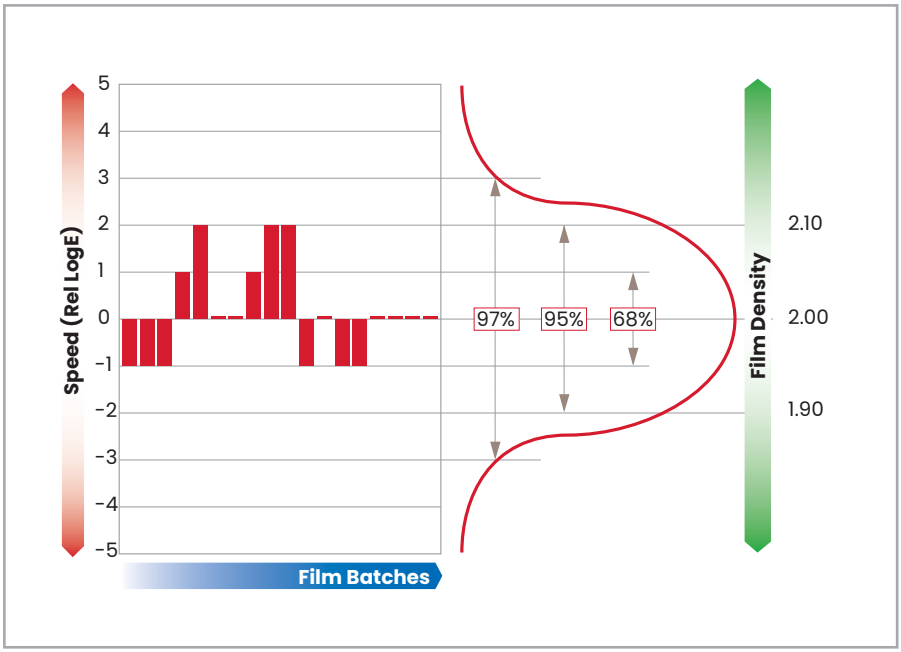
Optimum Image Quality

All STRUCTURIX films benefit from an Agfa emulsion breakthrough that provides increased contrast and maximum detail perceptibility. In fact, it results in the highest intrinsic defect recognition for each speed range. Even the smallest details can be interpreted with ease. The finished X-ray film has a high quality with a brilliant surface, and the image has a pleasant blue tint.

Protective Coating

An important feature of the STRUCTURIX films is a special protective top coating resulting directly from Agfa's Split Antistress Layer (SAL) technology. This top coat gives the films unique high resistance to pressure, scratching and creasing.

Another advantage of the top coat is that surface roughness has been optimized for problem free processing in automatic feeders such as the FEEDER.



Consistent Production Quality

STRUCTURIX films are manufactured in large quantities. To ensure they meet the most rigorous worldwide quality standards, they are produced at a single facility under tightly controlled conditions in an ultramodern coating room.

Agfa's Total Quality Management approach, certified by the ISO9001-2015 label, is the foundation of the system leading to this exceptional performance in production consistency. People, production equipment, and organization all become one system, geared to consistency and continuous improvement.

It's what we call the "moving target" quality philosophy. Moving target means that to meet the increasing needs of our customers, quality has to be built into our products, not by additional testing, but by design. Agfa's emulsion technology, for example, helps to provide a highly homogeneous emulsion over the total coating area.

Not only do the STRUCTURIX films have outstanding quality, they also have an exceptionally high level of batch to batch uniformity.

Consistent Processing Quality

STRUCTURIX films have a reputation for providing consistent and excellent results over a wide range of operating conditions. The Cubic Grain Plus technology is at the base of this consistent stable behavior. The extremely narrow grain size distribution, in combination with the cubic shape, assures that all exposed grains (latent image) will simultaneously develop the same density over a wide range of processing conditions. Moreover, they will do so rendering the very high contrast that is responsible for the high image quality

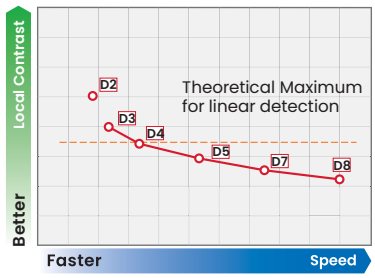
Darkroom Light Sensitivity

STRUCTURIX films may be exposed to darkroom safelight conditions longer without sensitometric fogging (ANSI PH 2.22). This means that brighter safelight illumination can be used, resulting in more ergonomic and efficient working conditions.

Technological Axis of STRUCTURIX D family

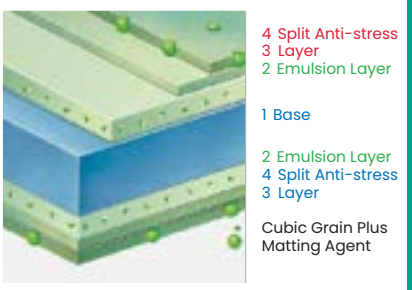
High image quality and perceptibility through optimization of "the signal to noise ratio" for every STRUCTURIX film.

Optimization of Contrast



Contrast (signal) of all films is optimized to approach the maximum contrast for a linear detector (industrial X-ray Film), thereby optimizing image quality and perceptibility. An exception to the rule is D2, a super linear detector, where image quality is optimized through more than linear (extremely high) contrast in combination with very low noise.

STRUCTURIX Quality... Rugged performance



The emulsion coatings are covered by two separate antistress layers (3 + 4). To achieve a rugged surface, the top layer has received the matting agent.

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

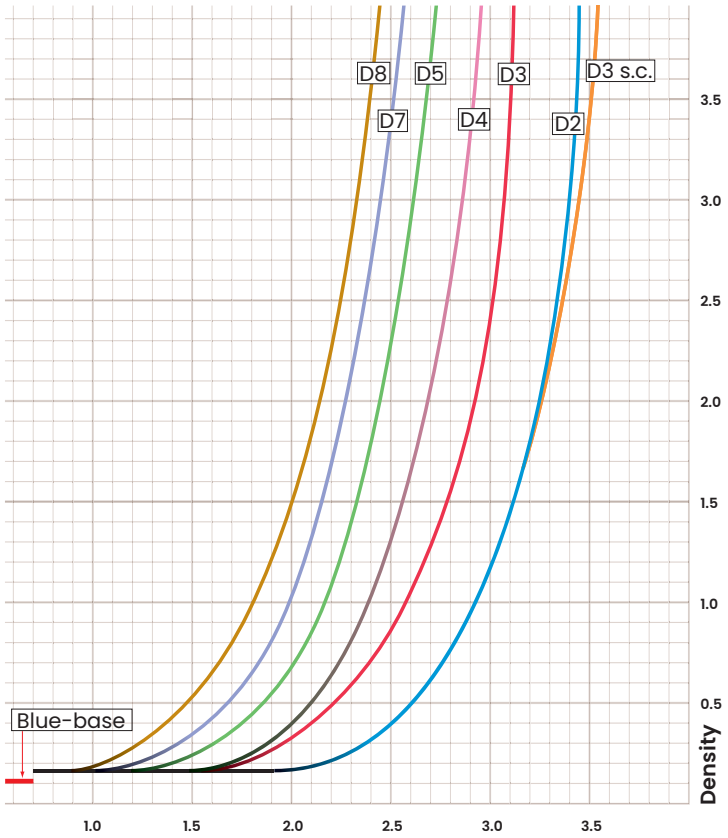
STRUCTURIX D6W

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

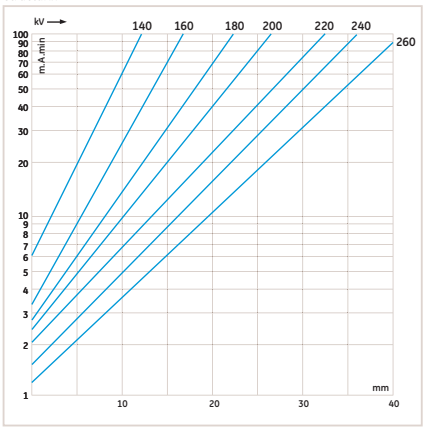
Exposure Diagrams

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.

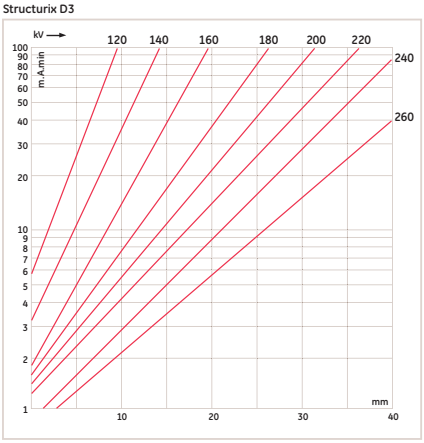
Steel (Fe)

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

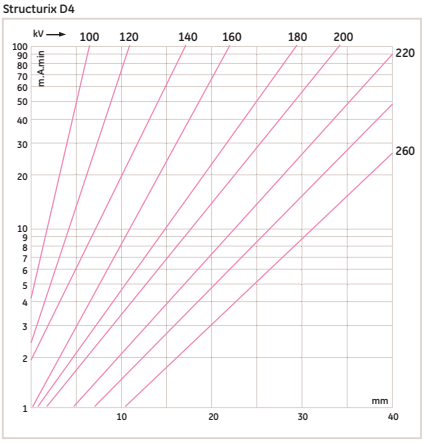
Structurix D2



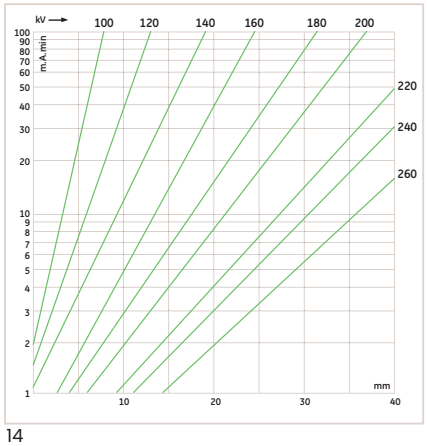
Structurix D3



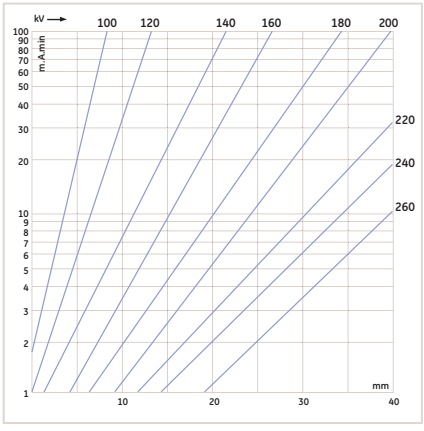
Structurix D4



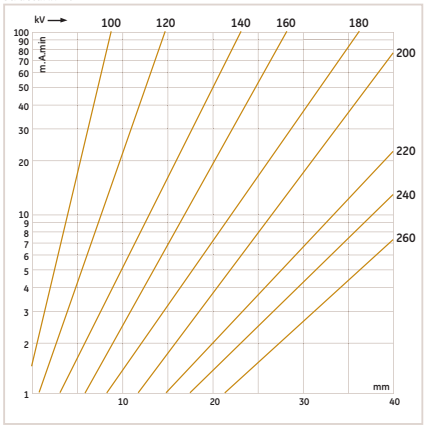
Structurix D5



Structurix D7



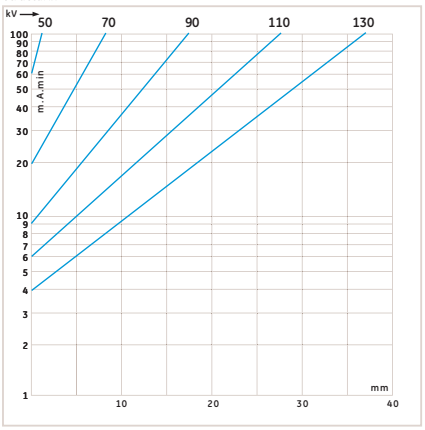
Structurix D8



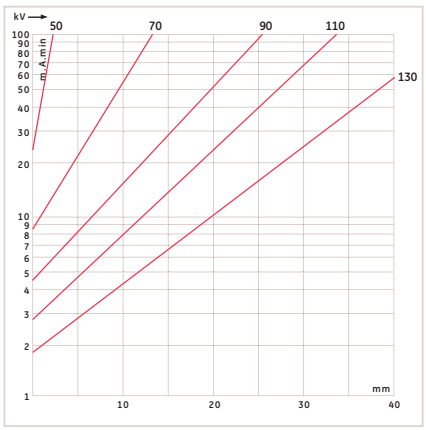
Aluminum (Al)

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

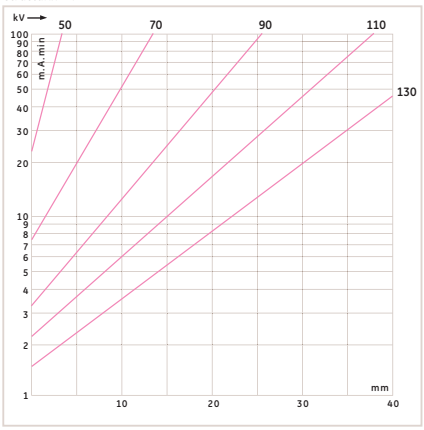
Structurix D2



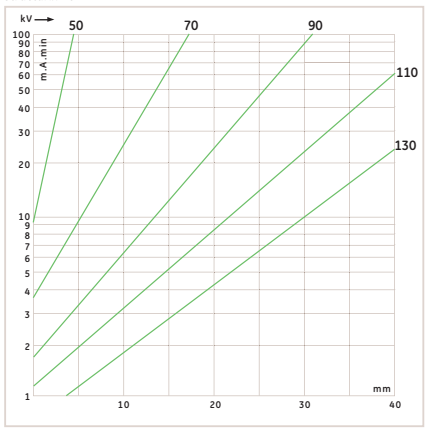
Structurix D3



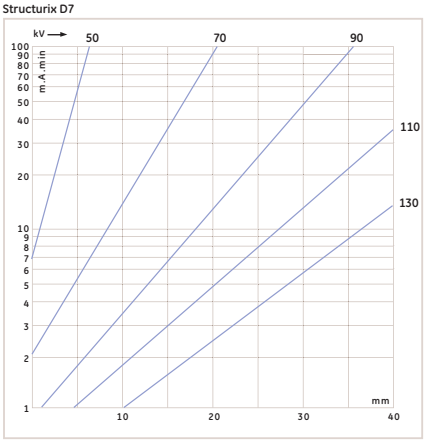
Structurix D4



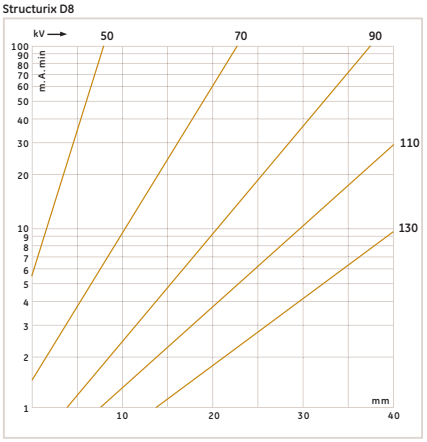
Structurix D5



Structurix D7

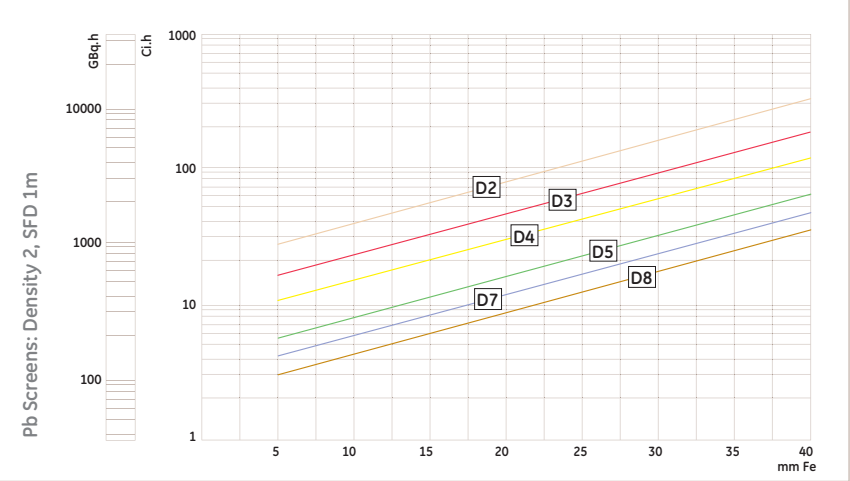


Structurix D8

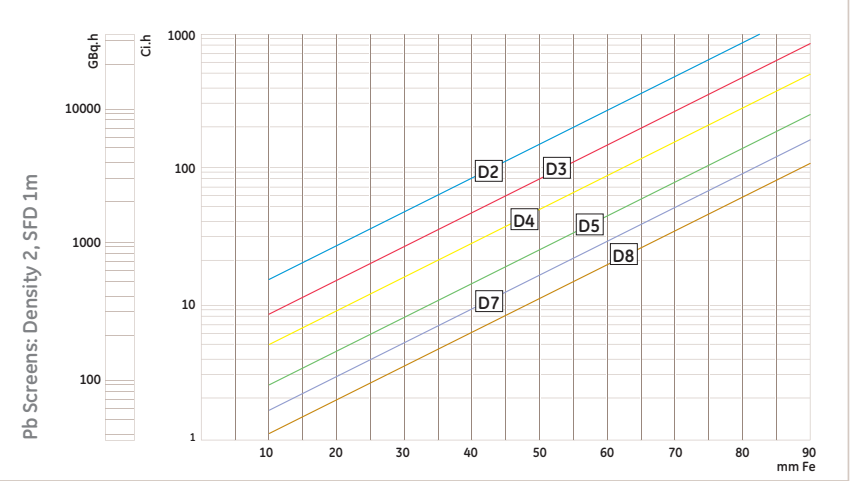


Exposure Diagrams

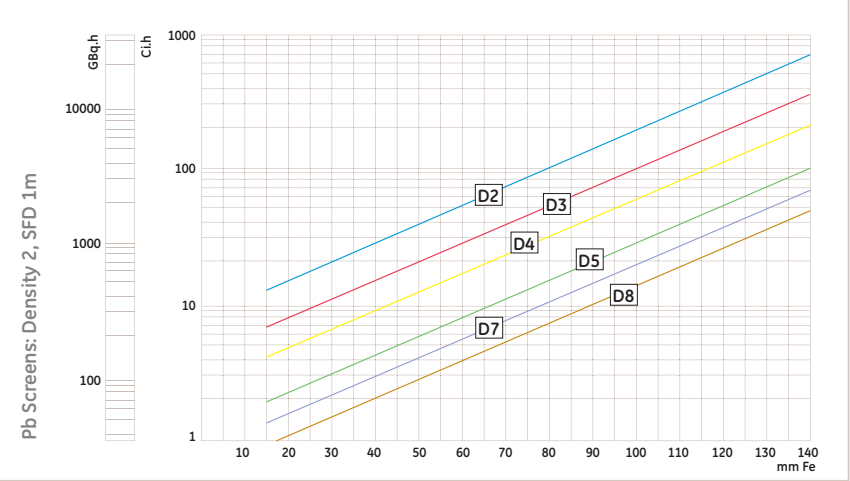
Selenium 75



Iridium 192



Cobalt 60

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VACUPAC

Special Applications

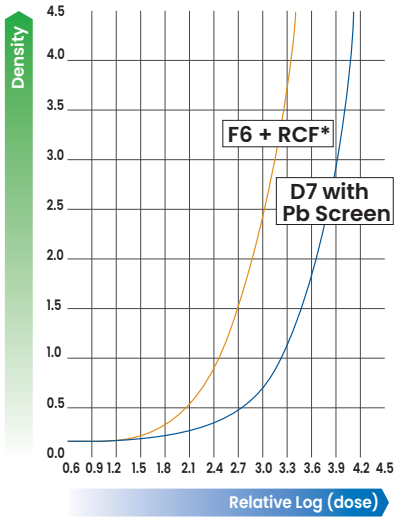
STRUCTURIX F6

As a result of further improvements in its core business of radiographic film for all applications, Agfa introduced a better product for rapid access radiography.

STRUCTURIX F6 is specially designed for offshore pipelines or similar applications. Such areas need short exposure time through the use of fluorometalic screens and fast processing cycles. This F6 film type is mainly blue sensitive. All UV and blue-emitting screens can be used, but for industrial use, fluorometallic screens (cfr. STRUCTURIX RCF) based on CaWO4 provide good quality.

Manual processing can be used but without the advantage of consistent rapid processing. This should only be used as an emergency solution.

Sensitometric curves with RCF fluorometallic screens (300 kV)



STRUCTURIX F6

Medium speed, high contrast fine grain film, preferably suited for use in combination with fluorometallic (RCF) or similar fluorescent screens. To be preferably processed in short cycle (90 sec.). If needed standard 8 min. cycle can be used alternatively for:

- Offshore pipelines
- Fast processing requirements

STRUCTURIX F6	Relative Exposure		Image Quality	
Film System	**200 kV**	**Ir 192**	**Wire IQI (En 462-3)**	**Double Wire IQI (EN 462-5)**
STX F6 + RCF Screens, 90 sec., Dry to Dry, G 135, 36°C	0.1	0.2	13	9
STX D7 Pb Screens*, 8 min., Dry to Dry, G 135, 28°C	1.0	1.0	13.5	12

*D7 is considered not sensitive for fluorescent screens (no significant gain in exposure time)

STRUCTURIX F8

Designed as a high quality film for fluorometallic (RCF) screen exposure when the speed obtainable with Pb screen system is insufficient or radiation safety is of prime importance.

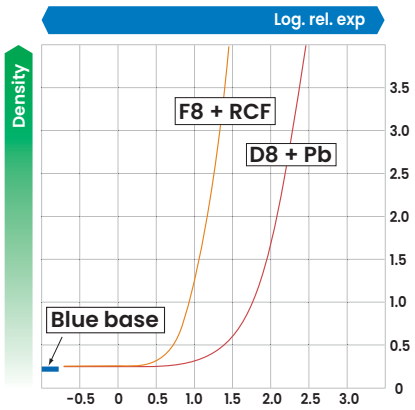
Sensitive to all UV and blue-emitting screens. Calcium tungstate with lead or lead oxide backing, so called fluorometallic screens (STRUCTURIX RCF Screens), are most suited for industrial applications.

F8 with fluorescent screens is used in a variety of heavy construction applications, concrete, on stream examination of processing piping where X-ray energy has to be limited, flash radiography and microfocus enlargement techniques.

Relative exposure factor with fluorometallic screens depends on:
- temperature
- radiation energy
- exposure time

When maximum speed is important the use of very fast screens such as the STRUCTURIX 1200 screen can further reduce the exposure time by a factor of three to six compared to RCF screens. F8 is the ideal fast, high contrast, high definition film for fluorescent screen applications. When higher sharpness is required we advise the use of D8 with Pb screens.

Sensitometric curves with RCF fluorometallic screens (200 kV)



STRUCTURIX F8 High speed, high contrast fine grain film, for exposures in combination with RCF fluorometallic screens or fluorescent screens.	• High system speed is main requirement • On stream corrosion/erosion radiography • Concrete and heavy constructions • Low dosage output, e.g. microfocus