Q.A. Collectible

Sponsored by CRCPD's Committee on Quality Assurance
in Diagnostic X-Ray (H-7)

Imaging System Speed - An Update

To assist facilities in reducing patient dose and occupational exposure while maintaining or improving image quality, a surveyor can recommend that the facility or practitioner replace the intensifying screens currently in their cassettes with screens of a higher speed. This is an easy recommendation to make and one that can be very effective in those cases where the practitioner does not have a specific reason (i.e., a specialized imaging task) for requiring the use of slower speed screens.

Often the facility can still use the same film with higher speed screens, but their techniques will be changed dramatically. As a result, patient and occupational exposures will decrease and the APPARENT capabilities of the x-ray machine will be increased while the life of the x-ray tube will be prolonged. All these advantages can be pointed out to the practitioner and as a state surveyor your visit can be made more helpful and constructive.

Bear in mind that there will be a variety of adjustments necessitated by a change in screen-film speed, as well as a number of consequences that may limit the speed increase that can be tolerated in a particular situation. Of course the facility's normal mAs's will need to be reduced and their technique charts amended. By the same token, if the facility employs an automatic exposure control device the AEC will need to be reset so that it will terminate the exposures properly without overexposure. Changes in the appearance of the facility's images also need to be anticipated. Use of a faster screen-film combination will result in an increase in quantum noise. This may result in a noticeable increase in the "graininess" of the images. This increase in "graininess" will limit how great a speed increase can be successfully implemented for specific exams. In addition, faster screen-film combinations may have either higher or lower intrinsic contrast than the combination currently in use and this change will limit the speed changes that can be achieved.

Documenting reduced exposures resulting from the change to higher speed intensifying screens is also a way of showing the effectiveness of an x-ray control program. Knowing the entrance skin exposure (ESE) "before" and "after," coupled with information about the workload of the facility, one can calculate the dose "savings" to the public over time.

Of course, making the recommendation to use a higher speed image receptor depends on a knowledge of the speed of the screen-film combination in current use as well as that of the combination to be recommended. This in turn requires the availability of a concise tabulation of imaging system speeds. Such a tabulation was put together in 2004 and is appended to this document.

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First published: August 1991
Revised/republished: September 2008

The "green" chart represents screens which, generally speaking, emit in the green portion of the spectrum and films, generally orthochromatic, that are spectrally matched. By the same token, the "blue" chart represents screens and films that are blue emitting and sensitive respectively.

These charts can be used in at least three ways:

1. To determine the speed advantage provided by the screen-film combination to be recommended when compared to the facility's current imaging system.

2. To aid in the assessment of the appropriateness of the facility's patient exposure values (as compared to the exposures typically seen in facilities using imaging systems with similar speeds).

3. To determine if the screen spectral output and film spectral sensitivity are properly matched.

Please note that as stated in the *Screen-Film Combination Speeds for Diagnostic X-ray* document, "the data tabulated provide speed values of known combinations of diagnostic and mammographic x-ray screens and films, and were acquired from vendor-provided information and sources. Hence we can not attest to, and make no claims as to the accuracy of the screen-film speeds presented here."

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Revised/republished: September 2008

Screen-Film Combination Speeds for Diagnostic X-ray

May 6, 2004

Center for Devices and Radiological Health
Food and Drug Administration
Rockville, MD

Note to the User

The data tabulated here provide speed values of known combinations of diagnostic and mammographic x-ray screens and films, and were acquired from vendor-provided information and sources. Hence we can not attest to, and make no claims as to the accuracy of the screen-film speeds presented here. If you are aware of any combinations not represented in this document, please submit this information. We are making every effort to update and maintain this tabulation.

For further information, please contact:

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Speed for **Agfa** film-screen combinations[1]

FILM TYPE	SCREEN TYPE	SPEED
Blue-Sensitive B	CaWO4	100
Blue-Sensitive B	Blue 800	800
Blue-Sensitive M	Blue 800	400
Cronex 10 T	Quanta Detail CP-B 200	100
Cronex 10 T	Quanta Fast Detail CP-B 400	200
Cronex 10 T	Quanta Rapid CP-B 800	400
Cronex 10 TL	Q Detail CP-B 200	100
Cronex 10 TL	Fast Q Detail CP-B 400	200
Cronex 10 TL	Quanta Rapid CP-B 800	400
Curix HC-S +	Blue C1	100
Curix HC-S +	Blue C2	200
Curix HC-S +	200HC	200
Curix HC-S +	400 HC	400
Curix HC-S +	800 HC	700
Curix HC-SL	Blue C1	100
Curix HC-SL	Blue C2	200
Curix HC-SL	200 HC	200
Curix HC-SL	400 HC	400
Curix HC-SL	800 HC	700
Curix HTC	Curix Ortho “Fine”	100
Curix HTC	Curix Ortho “Medium”	250
Curix HTC	Curix Ortho “Regular”	400
Curix HTC	Curix Ortho “Fast”	700
Curix HTC	Opthos D	160
Curix HTC	Opthos M	260
Curix HT-G	Curix Ortho “Fine”	100
Curix HT-G	Curix Ortho “Medium”	250
Curix HT-G	Curix Ortho “Regular”	400
Curix HT-G	Curix Ortho “Fast”	600 – 700
Curix HT-G	Rare Earth Green 400	400
Curix HT-G	Rare Earth Green 100	100
Curix HT-L +	Curix Ortho “Fine”	100
Curix HT-L +	Curix Ortho “Medium”	250
Curix HT-L +	Curix Ortho “Regular”	400
Curix HT-L +	Curix Ortho “Fast”	700
Curix RP2	CP-B 200	200
Curix Ultra UVG	Curix Ultra Detail	100
Curix Ultra UVG	Curix Ultra Rapid	300 – 400
Curix Ultra UVG	Curix Ultra Super Rapid	500 – 700
HDR-C	HD	100
HDR-C	HD-S	150
HDR-C +	Mamoray HD	100
HDR-C +	Mamoray HD-S	140
HDR-C +	Mamoray Detail R	170

Speed for **Agfa** film-screen combinations[1] (continued)

FILM TYPE	SCREEN TYPE	SPEED
HTA	Ortho Regular	400
HTA	Ortho Medium	100 – 200
HTC	Ortho Regular	400
HTC	Ortho Medium	200
HTL	Ortho Regular	400
HTL	Ortho Medium	200
HTL	Ortho Fine	100
HTU	Ortho Medium	100 – 200
HTU	Ortho Regular	400
MR-5 II	MR Detail	100 – 150
MR-6	MR Detail S	150 – 200
Ophtos H	Ophtos H	400
Orthomatic G plus	Ortho 100	100
Orthomatic G plus	Ortho 400	400
Orthomatic GL	Ortho 400	400
Radiomat B Plus	Rare Earth Blue 800	600
RP1L	MR400	400
RP1L	MR50	100
RP1L	MR200	200
Scopix CR5	Curix MR Detail green	30
Scopix CR5	Curix MR Detail “L” blue	25
Scopix CR6	Curix MR Detail green	30
Scopix CR6	Curix MR Detail “L” blue	25

Speed for **Fuji** film-screen combinations.[2,3]

FILM TYPE	SCREEN TYPE	SPEED
AD-M	AD Fine	100
AD-M	AD Medium	150
SHR-C 30	HR Medium	200
SHR-C 30	HR Regular	400
SHR-C 30	HR Fine	120
SHR-C 30	HR Fast	600
SHR-G 30	HR Medium	200
SHR-G 30	HR Fine	100
SHR-G 30	HR Fast	600
SHR-G 30	HR Regular	400
SHR-H 30	HR Medium	400
SHR-HA 30	HR Fine	120
SHR-HA 30	HR Medium	200
SHR-HA 30	HR Regular	400
SHR-HA 30	HR Fast	600
SHR-L 30	HR Fast	600
SHR-L 30	HR Regular	400
SHR-L 30	150HR Medium	200
SHR-L 30	HR Fine	100
RX	BH-1	200
RX	BX-1	200
RX	SUPER	600
RX	HIGH PLUS	220
RX	HIGH SPEED	180
RX	UNIVERSAL	150
RX	FINE	70
RX-U	SUPER	400
RX-U	HIGH PLUS	150
RX-U	HR Medium	400
RX-U	HIGH SPEED	120
RX-U	UNIVERSAL	100
RX-U	FINE	50
UMMA HC	UM Fine	100
UMMA HC	UM Medium	150
UMMH	UM Fine	150
UMMH	UM Medium	200
UR	HG-M	200
UR	HG-R	400

Speed for **Kodak** film-screen combinations.[4,5]

FILM TYPE	SCREEN TYPE	SPEED
CBS/1	X-Omatic Regular	200
Ektascan B	Lanex Fine (single)	25
Ektascan B/RA	Lanex Fine (single)	40
Ektascan M	Lanex Fine (single)	40
Ektamat G	X-Omat Regular	50
Ektamat G	Medium CaWO4	60
Ektamat G	High CaWO4	120
Insight Pediatric	Pediatric	300 - 330
Insight Pediatric	Pediatric Detail	230 - 250
Insight Pediatric	Pediatric Ultra-Detail	80 - 100
IT (Thoracic)	InSight	250
IT (Thoracic)	InSight HC	350
IT (Thoracic)	InSight VHC	500
ITC	InSight VHC	400
IP (Ped.)	InSight Pediatric	330
(In-)X-Sight G	(In-)X-Sight	400
(In-)X-Sight L	(In-)X-Sight	400
Min-R 2000	Min-R	100
Min-R 2000	Min-R 2000	150
Min-R 2000	Min-R 2190	190
Min-R E	Min-R	100
Min-R E	Min-R Medium	150
Min-R EV	EV 150	150
Min-R EV	EV 190	190
Min-R H	Min-R Fine	150 – 180
Min-R H	Min-R Medium	200 – 320
Min-R L	Min-R 2000	150
Min-R L	Min-R 2190	190
Min-R L	Min-R	100
Min-R M	Min-R	100
Min-R M	Min-R Medium	150 – 170
Min-R M	Lanex Fine (single)	40
MXG	Lanex Fine	100
MXG	Lanex Medium	250
MXG	Lanex Regular	400
MXG	Lanex Fast	600
TM	X-Omat Regular	87
T-Mat G	Lanex Fine (single)	80
T-Mat G	Lanex Fine	100
T-Mat G	Lanex Medium	250 – 300
T-Mat G	Lanex Regular	400
T-Mat G	Lanex Fast	600

Speed for **Kodak** film-screen combinations (cont.)

FILM TYPE	SCREEN TYPE	SPEED
T-Mat H	Lanex Fine (single)	180
T-Mat H	Lanex Fine	200
T-Mat H	Lanex Medium	250 – 400
T-Mat H	Lanex Regular	600 – 800
T-Mat H	Lanex Fast	900 – 1000
T-Mat H	Medium CaWO4	80
T-Mat H	High CaWO4	125
T-Mat H	X-Omat Regular +	100
T-Mat L	Lanex Fine (single)	80
T-Mat L	Lanex Fine	100
T-Mat L	Lanex Medium	250 – 300
T-Mat L	Lanex Regular	400
T-Mat L	Lanex Fast	600
T-Mat S	Lanex Fine (single)	80
T-Mat S	Lanex Fine	100
T-Mat S	Lanex Medium	250 – 300
T-Mat S	Lanex Regular	400
T-Mat S	Lanex Fast	600
XDA	Lanex Fine	125
XDA	Lanex Medium	300
XDA	Lanex Regular	500
XDA	Lanex Fast	700
XDA+	Lanex Fine	100
XDA+	Lanex Medium	250
XDA+	Lanex Regular	400
XDA+	Lanex Fast	600
XDL+	Lanex Fine	100
XDL+	Lanex Medium	250
XDL+	Lanex Regular	400
XDL+	Lanex Fast	600
X-Omat K	X-Omat Regular	120
X-Omat K	X-Omat Regular +	200
X-Omat K	Medium CaWO4	100
X-Omat K	High CaWO4	250
XK	X-Omatic Regular	200
XRP	X-Omatic Regular	200

Speed for Konica film-screen combinations [6,7]

FILM TYPE	SCREEN TYPE	SPEED
CMH	Monarch	100
HB-	RD	200
HB-	RB	400
MG	KR	400
MG	KM	200 - 300
MG	KF	100
MG	KS	600
MGC	KR	400
MGC	KM	200
MGH	KR	400
MGH	KM	200
MGH	KF	100
MGH	KS	600
MGL	KR	400
MGL	KM	200 - 300
MGL	KF	100
MGL	KS	600
MGT	KR	400
MGT	KM	300
MGT	KF	N/A
MGT	KS	N/A
MGV	KF	150
MGV	KR	600
MGV	KS	800
MGV	KM	400
MGX	KR	400
MGX	KF	100
MGX	KS	600
MGX	KM	300

Speed for **Imation (Imation-Kodak)** film-screen combinations.[6]

FILM TYPE	SCREEN TYPE	SPEED
HSM	Trimax 2	100
XD/A	Trimax 8	400
XD/A	Trimax 4	200
XD/A	Trimax 2	100
XD/A+	Trimax 8	400
XD/A+	Trimax 4	200
XD/A+	Trimax 2	100
XL/A	Trimax 8	400
XL/A	Trimax 2	100
XL/A	Trimax 4	200
XL/A+	Trimax 4	200
XL/A+	Trimax 8	400
XL/A+	Trimax 2	100

Speed for hybrid combinations of screens and films

Blue-sensitive film [6]

FILMS→ SCREEN	AGF MR4	AGF RP	CEA RP	CEA SSB	DUP 4	DUP 6+	DUP 7/10	FUJI RX/L	FUJI RXG	KOD BB	KOD RP	KOD XG	KOD XK/L	KOD XS	KON A	KON Q
AGFA MR200	150	250	200	100	300	300	150	300	150	300	300	200	300	400	300	300
AGFA MR 400	250	400	400	200	500	400	300	500	300	400	400	300	400	600	600	500
AGFA MR 800	300	700	800	400	500	600	300	600	300	600	500	300	600	800	700	600
AGFA SPECIAL	150	250	200	N/A	250	250	150	250	150	300	250	150	250	400	300	250
DUPONT PAR	50	100	100	50	100	100	50	100	50	100	100	50	100	150	100	100
DUPONT HI+	100	200	200	100	200	200	100	200	100	200	200	100	200	300	200	200
DUPONT Hi Speed	50	100	250	100	250	200	100	200	100	250	250	100	250	400	200	200
DUPONT LIGHT+	100	200	300	150	200	300	150	200	100	700	200	100	200	300	200	200
Dupont Quanta 2	200	300	300	150	400	400	200	400	200	300	300	200	300	500	400	400
Dupont Quanta 3	300	600	400	200	800	700	400	600	300	600	600	300	600	900	600	600
Kodak X-Omat fine	50	100	100	50	100	100	50	100	50	100	100	50	100	100	100	100
Kodak X-Omat Reg.	100	200	200	100	200	200	100	200	100	200	200	100	200	300	200	200
Kyokko BH3	100	200	200	100	200	200	100	200	100	200	200	100	200	300	200	200
Kyokko Special	200	400	400	200	400	400	200	400	200	400	400	200	400	600	400	400
MCI Blue 3	300	600	800	400	800	600	400	600	300	600	600	300	600	900	600	600

Speed for hybrid combinations of screens and films

Green-sensitive film [6]

FILMS→ SCREEN	AGF OC/G	AGF OGS	CEA OGA	DUP 8/8L	FUJ RX	FUJ HRH	FUJ RC/G/L	KOD OC/G/L	KOD OH	KOD TMG TML	KOD TMH	KON AO/L	KON MG/L	KON AOG	3M GT/U	3M XA	3M XM
AGFA Or. Fine	100	100	100	125	100	300	100	100	300	100	300	150	100	100	50	100	250
AGFA Or. Med	250	250	250	300	300	700	300	200	700	200	700	300	250	300	150	200	600
AGFA Or. Reg	400	400	400	400	400	1000	400	300	900	300	900	500	400	400	200	400	800
Dupont Quanta III	250	250	N/A	400	300	700	300	200	400	200	400	400	300	300	200	400	800
DUPONT Quanta IV	300	300	400	400	400	900	400	300	600	300	600	400	300	400	200	400	800
Kodak LX Fine	100	100	100	100	100	250	100	100	250	100	250	150	100	100	50	150	250
Kodak LX Med	250	250	250	300	250	500	200	250	500	250	600	300	250	300	150	300	600
Kodak LX Reg	400	400	400	400	400	900	400	400	800	400	800	500	400	400	250	500	800
Kodak LX Fast	600	600	600	600	600	1200	600	600	1200	600	1200	800	600	600	N/A	600	1200
Konica KF	100	100	100	100	100	300	100	100	300	100	300	150	100	100	50	100	250
Konica KM	200	250	250	250	250	700	200	200	700	250	500	300	250	300	100	250	600
Konica KR	300	400	400	400	400	1000	400	300	1000	400	800	500	400	400	150	400	800
Kyokko GF1	100	100	N/A	100	100	200	100	100	200	100	200	100	100	100	50	150	250
Kyokko GM1	250	250	N/A	250	200	400	200	250	500	250	600	300	250	250	150	250	500
Kyokko GH1	400	400	N/A	400	400	800	400	400	800	400	800	500	400	400	250	400	800

Speed for hybrid combinations of screens and films

Green-sensitive film (continued)[6]

FILMS→ SCREEN	AGF OC/G	AGF OGS	CEA OGA	DUP 8/8L	FUJ RX	FUJ HRH	FUJ RC/G/L	KOD OC/G/L	KOD OH	KOD TMG TML	KOD TMH	KON AO/L	KON MG/L	KON AOG	3M GT/U	3M XA	3M XM
Kyokko GX1	N/A	N/A	N/A	N/A	600	1200	600	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MCI BG Fine	100	100	100	100	100	300	100	100	300	100	300	150	100	100	50	100	250
MCI BG Med	250	250	250	250	250	700	250	200	700	250	700	300	250	250	100	250	500
MCI BG Reg	400	400	400	400	400	1000	400	300	1000	400	1000	500	400	400	150	400	800
3M Trimax 2	100	100	100	100	100	250	100	100	200	100	200	150	100	100	50	100	200
3M Trimax 4	150	150	250	150	150	500	200	150	300	150	300	200	150	150	100	200	400
3M Trimax 8	300	300	400	300	300	1000	400	300	600	300	600	500	400	400	250	400	800
3M Trimax 12	500	500	600	500	600	1500	600	400	900	500	900	700	600	600	400	600	1200
Valcorp Detail	100	100	100	100	100	300	100	100	300	100	300	150	100	100	50	100	250
Valcorp 200	150	200	150	200	100	400	100	150	400	150	400	250	200	200	100	200	400
Valcorp 400	300	400	300	400	250	900	200	300	900	300	900	500	400	400	200	400	800
Valcorp 600	400	600	400	600	400	1300	400	400	1300	400	1300	700	600	600	300	600	1200

References

(1) Film-Screen Combinations, Agfa Corp., Aug 2002 and Agfa film literature available on the Internet at www.agfa.com/healthcare (Feb. 2004).

(2) Film-Screen Speed Summary, Fuji Medical Systems publication Sept. 2002.

(3) Product literature available on the internet at www.fujimed.com (August 2002).

(4) Eastman Kodak 2000 Descriptive Product Catalog and Kodak film literature available on the Internet on Kodak's Healthcare website.

(5) Eastman Kodak Co., Document #860110, March 1998.

(6) Values in table are taken from existing tables provided by CDRH in previous versions of the NEXT survey supplement document. The origins of the speed values for these hybrid combinations are unknown, and may not be accurate.

(7) Personal communication, technical expert, Konica, Inc.
Konica 2004 descriptive Product Catalog.