



Conversion and Optimization Guide

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PURPOSE AND SCOPE

The following is intended only as a guide for converting to, optimizing and maintaining KODAK Hyper Speed G Medical Film; site-specific conditions may cause different results. For optimum results, KODAK Hyper Speed G film should be used with a full KODAK system of screens, cassettes, equipment and processing chemicals.

If you have any questions concerning the information in this guide, contact your local Kodak representative or contact Kodak's Health Group Technical Support at 1-800-328-2910 or on Kodak's Health Group internet site: www.kodak.com/go/health.

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GENERAL PRODUCT DESCRIPTION

KODAK Hyper Speed G is a high speed, high resolution, high contrast film. The film is a dual sided, green sensitive film with approximately twice the speed of standard general-purpose films. This film will work with all green emitting screens.

Hyper Speed G film incorporates an emulsion that builds on technology Kodak has introduced into films in recent years.

This film offers three key radiography benefits:

- Twice the speed of a standard general-purpose film to allow exposure reductions
- Very high image resolution due to built in light crossover control.
- Visually Adaptive Contrast that provides enhanced contrast in the dark areas of a radiograph to enable better visualization of anatomy in those areas.

Due to these characteristics, Hyper Speed G film opens up radiographic opportunities previously unavailable with a conventional film without the penalty of increased radiation to the patient. Some of these opportunities that will be described in this conversion guide are: reducing kVp, increasing source image distance and using slower, finer screens.

The following graph shows a sensitometric comparison of Hyper Speed G film vs. T-Mat G/RA film.

Figure 1

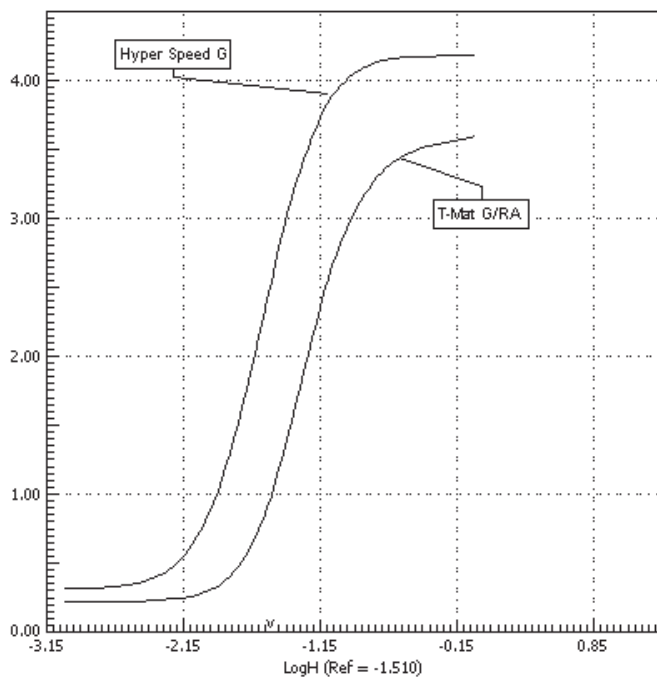


Figure 1: Hyper Speed G film is twice as fast as T-Mat G/RA. Hyper Speed G has a higher upper scale contrast and a higher upper density point to aid in visualization in the dark areas of the radiograph (visually adaptive contrast).

PRODUCT COMPARISONS

Table 1: Sensitometric Comparison

Film Type	Lower Scale Contrast	Contrast	Upper Scale Contrast	Upper Density Point
T-Mat G/RA	2.1	3.1	3.3	3.5
T-Mat H/RA	2.1	3.0	3.3	3.6
X-Sight G/RA	2.1	3.2	3.9	3.9
Hyper Speed G	2.1	3.1	4.1	3.9

Results may vary slightly as a result of the equipment used.

Table 2: System Speed Comparison

Film	Screen Pair	Nominal System Speed
T-Mat G/RA	Lanex Regular	400
T-Mat H/RA	Lanex Regular	600
Hyper Speed G	Lanex Regular	800
X-Sight G/RA	X-Sight	400
Hyper Speed G	X-Sight	800
T-Mat G/RA	Lanex Fine	100
Hyper Speed G	Lanex Fine	200
T-Mat G/RA	Lanex Fast	600
T-Mat H/RA	Lanex Fast	800
Hyper Speed G	Lanex Fast	1200

Table 3: Modulation Transfer Function Comparison

Screen/Film	2c/mm	4c/mm	6c/mm	8c/mm	10c/mm	Speed
Lanex Regular/T-Mat G/RA*	100%	100%	100%	100%	100%	400
Lanex Regular/Hyper Speed G	160%	200%	200%	210%	220%	800
X-Sight/X-Sight G/RA	175%	250%	256%	270%	280%	400
X-Sight/Hyper Speed G	175%	250%	256%	270%	280%	800

*Lanex Regular/T-Mat G/RA system is used as the reference system. The measurement system is the modulation transfer function. The reference system measurements are set to 100% and all other combinations are compared to that. The higher the number is, the sharper the image. c/mm is often referred to as line pairs per mm.

As you can see from the Table 2, **KODAK's Hyper Speed G** film product, when used with any green emitting screens, has the potential to increase the total system speed by 2x that of current standard screen/film systems. Increasing the total system speed by 2 allows **significant reductions in radiation exposure to the patient and radiology staff that may need to assist the patient during the procedure.** This speed can also aid in capturing images of dense body parts and large patients.

Hyper Speed G film's speed performance feature can also be used to improve image quality. With Hyper Speed G's increased speed, a balance between a reduction in patient exposure and improvements in image quality can be achieved.

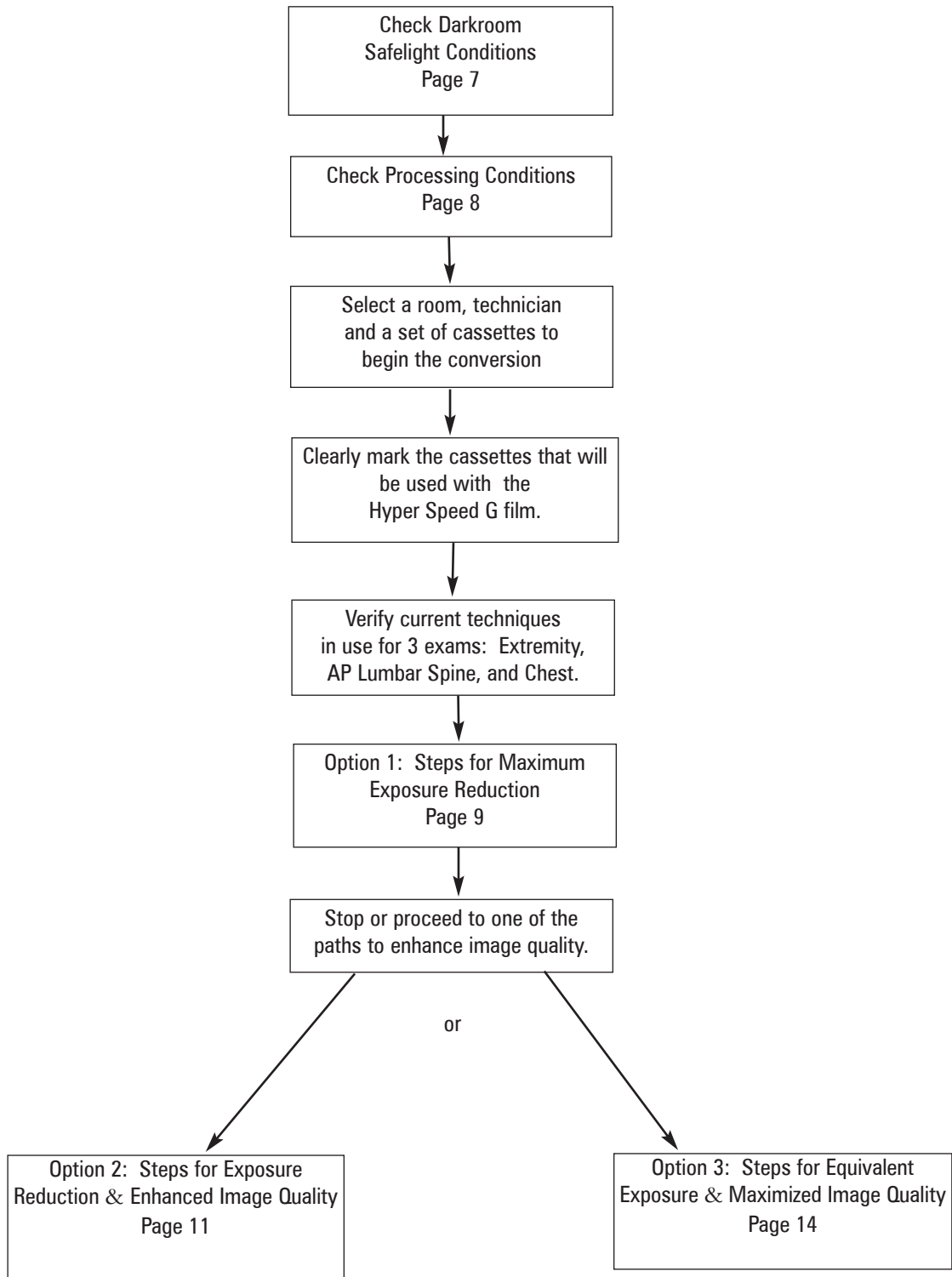
CONVERSIONS OPTIONS WITH KODAK HYPER SPEED G FILM

Table 4:

Maximum Exposure Reduction	Method	Benefit	Potential Issues	Comments
Option 1– see page 9	Cut ma or mAs	<ul style="list-style-type: none"> — Exposure reduction — Reduction in image blur due to subject movement 	Noise via quantum mottle	Due to the zero crossover technology, the signal-to-noise ratio is higher, ie, there is more information (signal) even though the noise is higher versus a standard system
Reduce Exposure and Improve Image Quality	Method	Benefit	Potential Issues	Comments
Option 2a–see page 11	Limited reduction in kVp level: <ul style="list-style-type: none"> — < 60 kVp reduce 5 kVp — 60-90 kVp reduce 10 kVp — above 90 kVp reduce 10-15 kVp 	<ul style="list-style-type: none"> — Enhances contrast of the image and therefore clinical visibility of information — Reduces noise 	Reduces exposure reduction impact though it still can be significant.	May also help if you have limitations on short exposure times. This will lengthen the exposure time and still achieve exposure reductions.
Option 2b– see page 12	Increase source image distance (SID): 40" => 50" or 102 cm => 128 cm	<ul style="list-style-type: none"> — Reduces radiation to the patient — Reduces distortion and magnification in the image — Reduces noise — Increases sharpness 	Equipment or room restrictions that will not allow this to happen. Check with service provider	See page 13 for exposure-distance conversion chart
Equivalent Exposure/Improved Image Quality	Method	Benefit	Potential Issues	Comments
Option 3a–see page 14	Lower kVp further	<ul style="list-style-type: none"> — Further enhances contrast — Further noise reduction 	Make sure the exposure to patient is not increased from your original system	
Option 3b–see page 14	Change to slower, sharper screens.	<ul style="list-style-type: none"> — More detail in the image — Further noise reduction 	New screens or cassettes may be needed.	Depending on the system speed being used you may be able to still achieve exposure reductions.
Good Practice Techniques–not detailed in this guide	Method	Benefit	Potential Issues	Comments
	Small focal spot	<ul style="list-style-type: none"> — Reduces image blur => increasing clinical resolution 	Check x-ray tube for heat capacity tolerance.	Consult with your medical physicist or manufacturer's tube rating chart
	Tighter collimation	<ul style="list-style-type: none"> — Exposes smaller area to radiation — Reduces extraneous radiation scatter 	May need to use an exposure factor to reset mAs.	Recommended to reduce scatter in the image

Note: Appendix D contains a blank chart to help establish new techniques.

FLOWCHART OF CONVERSION PROCESS



VERIFY DARKROOM SAFELIGHT CONDITIONS

Before introducing any new film into your radiographic imaging environment a safelight test of the darkroom should be done. Kodak's Hyper Speed G film is twice as fast as a standard film so it will be more sensitive to improper safelight conditions.

A simple test to assess darkroom integrity is as follows:

1. Turn off safelights.
2. Load a sheet of Hyper Speed G film into the cassette.
3. Expose the film and cassette to achieve a flat field of average density of about 1.0.
4. With safelights still off, unload the exposed sheet of film from the cassette.
5. Place the sheet on the counter and cover half the sheet with the box of film or a cassette.
6. Turn on the safelights.
7. Wait two minutes.
8. Remove cover from half the sheet of film.
9. Process film.
10. Measure the density on each end of film, i.e., the end that was covered and the end that was exposed to the safelight.
11. If the densities are within 0.05 of each other, the darkroom is fine.
12. If not, your darkroom needs upgrading. Refer to Appendix C to check for possible trouble areas.

OPTIMIZING THE PROCESSING CONDITIONS

A number of factors in the processing of Hyper Speed G films can affect the quality of your radiographs, for example brand of chemistry, developer starter, replenishment rates and oxidation

Processing Cycles:

KODAK Hyper Speed G film can be processed at standard or rapid cycles.

Brand of Chemicals:

Different chemicals can affect the speed, contrast, dye stain and image tone of your radiographs. Hyper Speed G has been designed to work best with KODAK chemicals. For developers, it is recommended to use KODAK RP X-Omat Developer or KODAK X-Omat EX II Developer. For fixer, KODAK RP X-Omat LO Fixer is recommended.

Developer Starter:

Using a developer starter is important to minimize changes in fog, speed and contrast during seasoning. Bromide or other halide ions will season into the developer during processing and act as a restraining agent in the developer. By increasing the halide level prior to seasoning, starters serve to minimize chemical and sensitometric differences between fresh replenisher solutions and seasoned tank solutions. Kodak tests starter recommendations with all Kodak films, since different films will have varying seasoning effects in developer solutions.

Starter **should be** added whenever the developer tank is filled with fresh developer. Using the proper amount of starter is important. Follow the manufacturer's directions carefully.

Replenishment Rates:

The rate of replenishment is critical. Excessive over-replenishment of films with T-Grain emulsion such as Hyper Speed G film will increase the gross fog and speed and decrease the contrast. Under-replenishment will result in slight speed loss and lower upper scale contrast. Refer to Kodak's Service Bulletin 30 for recommended replenishment rates.

Oxidation of the Developer:

The developing agents in a developer solution readily react with oxygen. This process is called oxidation and can adversely affect image quality. Oxidation can decrease speed, contrast and D-Max (area of highest optical density). Increased replenishment can partially compensate for oxidation and exhaustion, however the use of a floating lid and proper chemical storage conditions are the best ways to prevent oxidation and avoid the cost and environmental impact of increased replenishment.

CONVERSION STEPS FOR MAXIMUM EXPOSURE REDUCTION

Option 1:

1. To begin the conversion in the selected room, establish your base level of contrast preferences using three independent body parts: an extremity (foot, hand or elbow), AP lumbar spine and a chest. (Note that Hyper Speed G is a high contrast film not specifically designed for chest imaging. If you are currently

using a high contrast film for chest imaging, Hyper Speed G should provide acceptable images. If you use a system designed for chest imaging such as KODAK's InSight Thoracic Imaging System, it is recommended you continue with that system for your chest imaging.)

2. Find your current film/screen system in the tables below to determine your starting point for mAs reduction. If your current film is not listed, use Appendix B and a stepwedge to calculate your starting point.

Table 5: General Purpose Systems mAs Reduction Starting Point

Current Films	Current Screens	Starting Point for mAs Reduction
KODAK X-Sight G/RA KODAK T-Mat G/RA KODAK T-Mat S/RA AGFA HT-G AGFA HT-A FUJI HR-G 30	Any Green Emitting Screen Pair	Reduce mAs by 1/2 or as close to that as your equipment allows (Example: from 40 to 20)
KODAK T-Mat H/RA FUJI HR-HA 30	Any Green Emitting Screen Pair	Reduce mAs by 1/4 or as close to that as your equipment allows (Example: from 40 to 30)

**Table 6: Extremity Systems mAs Reduction Starting Point
Changing from a single sided film to the double sided,
Hyper Speed G Film**

Current Film	Current Screen	New Screen	Starting Point for mAs Reduction
KODAK MIN-R L	Lanex Single Fine Screen	Lanex Double Fine Screen	Reduce by 3/4 or as close to that as your equipment allows (Example: from 40 to 10)
KODAK EB/RA	Lanex Single Fine Screen	Lanex Double Fine Screen	Reduce by 3/4 or as close to that as your equipment allows (Example: from 40 to 10)

Note: KODAK Hyper Speed G film has been designed for use with green emitting screens.

3. You will need to use manual techniques for the initial creation of the new technique chart. Once you are comfortable with the look of the images, have the Automatic Exposure Controls (Phototimers) calibrated for the new system by your service provider.

Note: In order to have consistent diagnostic densities & image quality, all technologists should use the same techniques. Adjustments need to be set for small - medium - large body thicknesses. When setting up your new technique charts for this, you should measure body thicknesses using a caliper.

4. If phantoms are available, use those to make your first comparison images.
- Take an image with the current film/screen combination at the current technique. Make sure this image is what you would consider a "good" image.
 - Take the same image with the Hyper Speed G film/screen combination with the reduced mAs setting suggested in the Tables 5 or 6.
 - Compare the density of the images at a selected spot. If the densities are within 0.1 of each other, your images should be close. If not, determine

whether you need to increase or decrease the density on the Hyper Speed G system.

- It is suggested that you err on the side of slightly higher density (darker) with the Hyper Speed G film.
 - Increase or decrease the density as needed by adjusting the mAs proportionately to the density difference of the two images.
 - Repeat until you have a close density match, within 0.1 of each other.
5. If you do not have phantoms available, wait for patients with medium build (for a foot: 4-4.5 cm measuring through the metatarsals, for a lumbar spine: ~24 cm measuring through L-4, and for a chest: ~23 cm measuring through the mediastinum). Select older patients that will need multiple exposures or views.
- Take one view of the body part with the current system and take the second view with the Hyper Speed G system with the recommended mAs reduction from Tables 5 or 6.
 - Measure the density of a spot in the exact same anatomic area on both images to determine if you need to adjust the mAs from the initial

starting point.

- Continue in this mode until you have the new technique established for each of the three body parts.
6. Assess the images that you have taken with the Hyper Speed G system. The image will look different. It is a sharper image due to the zero-crossover. This will also sharpen the "noise" or quantum mottle of the system. It may take your eyes a little while to adjust to this new look. It is suggested that you proceed with one room in this mode completely and convert it over to the Hyper Speed G system and run for a short time period so that you get accustomed to the new look.
7. If you are unhappy with the "noise" of the system, proceed to the next section on Exposure Reduction and Enhanced Image Quality.
8. If you are satisfied with the images at maximum exposure reduction, have the phototimer recalibrated in that room and move onto the next room.
- There may be some imaging tasks where you would like to take advantage of the ability to further change your techniques to improve image quality. For those imaging tasks move onto the next section to set up the techniques.

CONVERSION STEPS FOR EXPOSURE REDUCTION AND IMAGE QUALITY

Option 2:

Hyper Speed G's speed performance feature can also be used to improve image quality. With Hyper Speed G's increased speed, a balance between reductions in exposure and improvements in image quality can be achieved. Consider taking advantage of additional levers in the imaging process that will improve image quality.

Over the years, significant technological advances have taken place in intensifying screens, film emulsion and equipment (x-ray generators) to allow radiographers to achieve better imagery of their patients.

As stated in Table 4, there are two levers in the imaging chain that Hyper Speed G opens up for use in increasing image quality and still providing reduced patient radiation exposure:

- reducing kilovoltage, kVp
- increasing source image distance

These technical and clinical opportunities offer radiographers and patients the improvements in image quality and exposure reduction that are not possible with standard systems in the marketplace.

You can begin with either reducing the kVp or increasing the distance. You can also combine these two technique changes to obtain the image quality you desire.

Option 2a: Reducing the kilovoltage (kVp):

This will help enhance the contrast of the resultant image and will reduce the impact of the quantum mottle.

1. For each imaging task, look at the kVp level and reduce as suggested in Table 4. This will provide the benefits from the kVp reduction and still allow exposure reductions.
2. From the Hyper Speed G mAs found at the original kVp level used in the Maximum Exposure Reduction section, use Table 7 to adjust the mAs for the new kVp.

Table 7: Starting Point for mAs change with kVp change

Decrease in Kilovoltage (kVp)	Multiplier for starting mAs
10%	1.4
12%	2.3
>/= 15%	3.0

Examples:

Starting kVp	Starting mAs	Reduced kVp	Calculated starting mAs
50	0.63	45 (10%)	0.88
50	0.63	40 (20%)	1.89
80	6.5	70 (12.5%)	15

3. Determine the new technique with the reduced kVp using steps 4-7 on page 10.
4. If you are satisfied with the images, lock in at that technique and have the phototimer adjusted. If you want to consider further image quality improvements to combine with this, move onto the next section on adjusting the source image distance.

Option 2b: Increasing the Source Image Distance (SID)

Increasing the source image distance will reduce the distortion and magnification of the resultant image by taking advantage of the inverse square law. This will also reduce the impact of the quantum mottle and increase sharpness.

1. Most non-chest images are currently done at 40" or 102 cm from the source. If your equipment set up allows, increasing the distance will reduce the radiation exposure to the patient as well as reduce the distortion of the image.

2. Use Table 8 to find a multiplier for calculating the new mAs for the increased distance. This table was extracted from Bontragers Pocket Handbook: [Radiographic Positioning and Techniques](#).

Table 8: Exposure—Distance Conversion

Multiplication conversion factors for determining new exposure when source image distance (SID) is changed (rounded off to the nearest tenth, can be used with either mA, T [time in seconds] or mAs).

New SID	Original SID							
	40 in. (102 cm)	42 in. (107 cm)	44 in. (112 cm)	48 in. (122 cm)	60 in. (152 cm)	72 in. (183 cm)	100 in. (254 cm)	120 in. (305 cm)
40 in. (102 cm)	1	.9	.8	.7	.4	.3	.2	.1
42 in. (107 cm)	1.1	1	.9	.8	.5	.3	.2	.1
44 in. (112 cm)	1.2	1.1	1	.8	.5	.4	.2	.1
46 in. (117 cm)	1.3	1.2	1.1	.9	.6	.4	.2	.2
48 in. (122 cm)	1.4	1.3	1.2	1	.6	.4	.2	.2
50 in. (127 cm)	1.6	1.4	1.3	1.1	.7	.5	.3	.2
55 in. (140 cm)	1.9	1.7	1.6	1.3	.8	.6	.3	.2
60 in. (152 cm)	2.3	2	1.9	1.6	1	.7	.4	.3
72 in. (183 cm)	3.2	3	2.7	2.3	1.4	1	.5	.4
100 in. (254 cm)	6.3	5.7	5.2	4.3	2.8	2	.1	.7
120 in. (305 cm)	9	8.2	7.4	6.3	4	2.8	1.4	1

Example: The original mAs at a SID of 40 in. is 8.
Desire is to move to 44 in. SID. Find the multiplier in the table.
The conversion factor is 1.2
New mAs is 8 x 1.2 or 9.6 or 10 mAs.

Note: This table is very useful for calculations when doing portables and distances must be changed due to patient limitations and room constraints.

3. Proceed to determine the new technique with the increased distance using steps 4-7 on page 10.
4. If you are satisfied with the images, lock in at that technique and have your phototimer reset.
5. If you want to consider further image quality improvements and you did not reduce the kVp yet, go to Option 2a or 3a for steps to reduce the kVp.

CONVERSION STEPS FOR EQUIVALENT EXPOSURE AND MAXIMUM IMAGE QUALITY

Option 3

With Hyper Speed G's increased speed you can further refine your techniques to maximize image quality without increasing the radiation exposure to your patients. Consider taking advantage of additional adjustments in the imaging process that will improve image quality. As stated in Table 4, there are two levers in the imaging chain that Hyper Speed G opens up for use in increasing image quality without increasing patient radiation exposure:

- Further reductions in kilovoltage-kVp
- Changing the screens to a sharper, slower screen pair

Option 3a: Further reductions in kVp:

Follow the same step-by-step procedure outlined in the previous section for kVp reductions.

Option 3b: Guidelines to change to a slower screen with the Hyper Speed G Film

Table 9: Starting Point for mAs change with screen change

Current Screen Pair with Hyper Speed G	Proposed Screen Pair with Hyper Speed G	Starting Point for mAs Change
KODAK Lanex Regular	KODAK Lanex Medium	Multiply mAs by 0.75
KODAK Lanex Regular	KODAK Lanex Medium Plus	Multiply mAs by 0.5
KODAK Lanex Regular	KODAK Lanex Fine	Multiply mAs by 0.25
Other manufacturer's regular screens	Other manufacturer's medium screens	Multiply mAs by 0.5
Other manufacturer's regular screens	Other manufacturer's fine screens	Multiply mAs by 0.25

Proceed to determine the new technique with the slower screens using steps 4-7 on page 10.

FREQUENTLY ASKED QUESTIONS

Hyper Speed G Medical Film is a high speed, high contrast, general-purpose film designed to provide diagnostic information to the radiologist and the lowest radiation exposure to the patient with no change in workflow.

My current x-ray film works very well, why should I change?

Thanks to the use of new emulsion technology, Hyper Speed G film will allow you to reduce radiation to your patients by up to 50% and achieve the same image quality as you're used to. Another option is to use the Hyper Speed G film at your current standard system speed and dramatically improve image sharpness..

What differences will I see in image quality when I switch to Hyper Speed G film?

The zero-crossover of the system results in a higher signal-to-noise ratio. This means you will see more noise with Hyper Speed G, but there is more diagnostic information visible in the radiograph. (See table 3 on page 4 for the increased resolution values)

Hyper Speed G film delivers improved image quality via resolution and visually adaptive contrast but also higher noise than a standard 400-speed general-purpose film. This is very similar to the image change that took place in the early 80's as the market moved to the higher speed green sensitive systems (200 speed to 400 speed). It is also similar to the move that took place in

the early 90's with the InSight Thoracic Systems. It may take your eyes a little time to adjust fully to the new look.

Will Hyper Speed G work in my current equipment with my current chemistry?

We recommend that you use KODAK RP X-Omat Developer or KODAK X-Omat EX II Developer and KODAK RP X-Omat LO Fixer to process the film. We recommend you process in a standard or rapid cycle. For specific recommendations, see Service Bulletin 30 and refer to X-Sight processing conditions.

Hyper Speed G film is designed such that it is optimized when processed in Kodak chemistry in a Kodak processor.

Will I have to change exposure settings when I convert to Hyper Speed G film?

Hyper Speed G with a Regular screen is classified as an 800-speed system. Therefore, you will need to adjust your current settings to accommodate this very fast system and reduce the exposure to your patient. You can also use the other techniques outlined in this guide to improve your image quality and get exposure reduction. ((See pages 9 - 14 for conversion steps.)

Will I need to make any changes in how I process film when I convert to Hyper Speed G film?

No changes in film processing procedures are required to convert to Hyper Speed G film for automatic film processors. See Service Bulletin 30 for recommended processing conditions for your Kodak processor and chemistry. Hyper Speed G recommendations are the same as X-Sight films.

Can I continue to use my current intensifying screens?

Hyper Speed G film can be used with any green light emitting screen pair. If you need to check, open the cassette and expose to radiation and watch what color light is emitted from the screens. Standard brand names for green emitting screens are: Lanex (KODAK), Ortho (AGFA), HR (FUJI). Although the film does have some sensitivity to blue light, it was not designed with blue emitting screens.

FREQUENTLY ASKED QUESTIONS *(continued)*

Will Hyper Speed G film cost more?

End-user pricing is determined by your distributor/dealer. However, the list price for Hyper Speed G will be similar to other films available in the market.

Are there special storage conditions required for Hyper Speed G film?

No, the recommended storage conditions for Hyper Speed G are the same as traditional radiography films. "Store unexposed film at 50 to 70°F (10 to 20°C), at 30 to 50 percent RH, and properly shielded from x-rays, gamma rays, or other penetrating radiation. Keep exposed film in a cool, dry place that is properly shielded from penetrating radiation. Process the film as soon as possible after exposure. Processed film should be stored at 60 to 80°F (16 to 27°C), at 30 to 50 percent RH."

Why did Kodak bother to invest in developing a new film?

Kodak is committed to using the latest technology to provide customers worldwide with solutions to their medical imaging needs. In surveys conducted worldwide, customers consistently rank "low radiation exposure to patients" in their top 3 overall product needs. Hyper Speed G was designed to address this customer feedback.

APPENDIX A

Information Needed by KODAK to Facilitate Troubleshooting

When contacting Kodak for assistance with image-quality concerns, having as much of the following information as possible will facilitate all trouble-shooting efforts.

- Facility Name: _____
- Contact Name and Phone: _____
- Film Distributor: _____
- Processor maintenance performed by: _____
- Kodak Account Manager or Media Specialist: _____
- Current and previous emulsion numbers: (i.e. 156 123 45): _____
- QC film: _____ Clinical film: _____
- Date the change or problem was noticed: _____
- Description of change (what was observed and who noticed it): _____

- Optical densities of the 21 steps from the sensitometric strip: _____

- Characteristic (H&D) curve: _____
- Make and model of processor: _____
- Volume of films (number of sheets per typical eight-hour day): _____
- Starter volume: _____
- Has volume of film changed recently? Yes or No
- If yes, were replenishment rates altered? Yes or No
- Brand/Type of chemicals used:
- Developer: _____ Fixer: _____
- Chemicals are: Premixed Auto-mixed Facility Mixed
- Floating lids in place on chemistry tanks? Yes or No
- Has brand or type of either the developer or fixer changed? Yes or No
- Developer temperature: _____
- Fixer temperature: _____
- Water temperature: _____
- Replenishment rates: _____
- Developer: _____ Fixer: _____
- Calibration date: _____
- Replenishment rates as per Service Bulletin 30? Yes or No
- If no, explain: _____
- Have chemistry samples been sent to Kodak for analysis? Yes or No
- If yes, was corrective action taken? Yes or No
- If no, please explain: _____
- Dates last and previous preventive maintenance procedures were performed:
- Last: _____ Previous: _____
- Was chemistry changed out? Yes or No
- If no, date it was last changed: _____
- Description of any unusual circumstances (e.g., films processed only 2 days per week, etc.)

- Has venting been checked? Yes or No
- Is there an air gap present? Yes or No
- Is processor QC stable? Yes or No
- If no, describe problem: _____

- Has optical density of the clinical changed? Yes or No
- Have technical factors of the clinical image changed (kVp, target, filter)? Yes or No

APPENDIX B

Quick and Easy Method to calculate exposure change

If using an uncalibrated stepwedge:

1. Expose the stepwedge on the current film/screen combination.
2. Measure the densities of each step and select the step which is the closest to 1.0 + gross fog.
3. Expose the stepwedge on the new film/screen combination using the same technique.
4. Measure the density on the same step you identified above. So if step 11 was the closest to 1.0 + gross fog in the current system, you will want to measure step 11 on this exposure to compare.
5. Subtract the lower density from the higher density.
6. Since Hyper Speed G is a high contrast film, divide the answer by 3.
7. Determine the new exposure factor by calculating the antilog of the quotient using the attached table.
8. Determine the new mAs value by multiplying or dividing the current mAs by the exposure factor.

log E (results of step 6)	Percentage Faster	Factor to divide mAs by to achieve comparable density at the step
0.01	102	1.02
0.02	105	1.05
0.03	107	1.07
0.04	110	1.10
0.05	112	1.12
0.06	115	1.15
0.07	117	1.17
0.08	120	1.20
0.09	123	1.23
0.10	126	1.26
0.11	129	1.29
0.12	132	1.32
0.13	135	1.35
0.14	138	1.38
0.15	141	1.41
0.16	145	1.45
0.17	148	1.48
0.18	151	1.51
0.19	155	1.55
0.20	159	1.59
0.25	178	1.78
0.30	200	2.00
0.35	224	2.24
0.40	251	2.51
0.45	282	2.82
0.50	316	3.16
0.60	400	4.00

Example:

Steps 1 and 2: Current film/screen system when exposed at 80kVp for 10 mAs with an 11 step stepwedge, gives that the step closest to 1.0 + gross fog as step 5 and its density is 1.25.

Step 3 and 4: The Hyper Speed G in the same screen when exposed at 80kVp for 10 mAs with the same stepwedge reads, 2.15 at step 5.

Step 5: $2.15 - 1.25 = 0.90$

Step 6: $0.90/3 = 0.3$

Step 7 and 8: Using the table, the factor to divide the mAs is for the Hyper Speed G in this screen is 2. The new technique for Hyper Speed G would be 80 kVp at 5 mAs. This would be your starting point for the new technique with Hyper Speed G. Begin your optimization from there.

APPENDIX C

Trouble Shooting Darkroom Issues:

1. Make sure you are using the appropriate safelight filter. A KODAK GBX-2 safelight Filter, or equivalent, is the correct safelight filter.
2. Change the safelight filter periodically. We recommend you do so semiannually. Safelight filters can fade and crack with age. Heat from incandescent bulbs can crack safelight filters over time.
3. Install the safelight filter correctly. Filters should be installed so that the identification printing can be read when looking at the lamp. If the filter orientation is reversed, excessive heat buildup inside the lamp housing may cause the dye layer to crack and thus leak unsafe light.
4. Use the appropriate wattage bulb. Oversize bulbs can damage the safelight filter from excessive heat. A 15 watt or less incandescent bulb is recommended.
5. The distance of the safelight from the work surface and the direction of the light to the work surface can affect results. Also consider directing the safelight toward the ceiling.
6. Use the appropriate number of safelights for the size of your darkroom. In large rooms with white ceilings, place no more than one lamp for every 64 square feet or 6 square meters of ceiling area.
7. Check for other sources of light leaks. Close the door and turn off the lights. Note any light leaks and take corrective action to eliminate them. Sources of light leaks to consider are around doors, cracks in walls, or cracks where ceiling partitions join walls. Also check around your processor. Automated processors will vibrate sufficiently to cause small openings between the light seals and the adjoining partition or the processor cover may not be tightly closed. Afterglow from some types of fluorescent lights can cause fogging. Glowing lights or dials on equipment located in the darkroom can also fog film.
8. If using a LED safelight, such as the KODAK LED Safelight, the safelight must be installed in the ceiling and pointed away from the work area.

APPENDIX D

Fixed KVP Technique Chart

Region	Projection	cm range	Target kVp*	kVp	Bucky mAs	mAs	mA	Time	FFD (in.)	System Speed
Cervical Spine	AP	8-10	65-75	——					40	——
		11-13								
		14-16								
		17-19								
		20-22								
	Obl/Lat	6-8	65-75	——					72	
		9-11								
		12-14								
Thoracic Spine	AP	16-18	65-75	——					40	
		19-21	70-80	——						
		22-24								
		25-27								
		28-30								
	Lat	26-28	70-80	——						
		29-31								
		32-34								
		35-37								
		38-40								
Lumbar Spine	AP	13-15	70-80	——					40	
		16-18								
		19-21								
		22-24								
		25-27								
	Obl	15-17	70-80	——						
		18-20								
		21-23								
		24-26								
		27-29								
	Lat	23-25	80-90	——						
		26-28								
		29-31	90-100	——						
		32-34								
		35-37								
	L5-S1	26-28	80-90	——						
29-31										
32-34		90-100	——							
35-37										
38-40										

* These are suggestions only.

APPENDIX D *(continued)*

Fixed KVP Technique Chart

Region	Projection	cm range	Target kVp*	kVp	Bucky mAs	mAs	mA	Time	FFD (in.)	System Speed
Sacrum/Coccyx	AP	14-16	65-75	—					40	—
		17-19								
		20-22								
		23-25								
		26-28								
Sacrum	Lat	26-28	80-90	—					40	—
		29-31	90-100	—						
		32-34								
		35-37								
		38-40								
Coccyx	Lat	26-28	80-90	—					40	—
		29-31	90-100	—						
		32-34								
		35-37								
		38-40								
Pelvis	AP	12-14	65-75	—					40	—
		15-17								
		18-20								
		21-23								
		24-26								
		27-29								
Hip	AP	14-16	65-75	—					40	—
		17-19	70-80	—						
		20-22								
		23-25								
	26-28									
	Lat (True)	17-19	70-80	—						
		20-22								
		23-25								
26-28										
Abdomen/KUB	AP	14-16	70-80	—					40	—
		17-19								
		20-22								
		23-25								
		26-28								
		29-31								
	Upright	14-16	80-90	—						
		17-19								
		20-22								
		23-25								
		26-28								
		29-31								

* These are suggestions only.

APPENDIX D *(continued)*

Fixed KVP Technique Chart

Region	Projection	cm range	Target kVp*	kVp	Bucky mAs	mAs	mA	Time	FFD (in.)	System Speed	
IVP	AP	12-14	65-75	—					40	—	
		15-17									
		18-20	70-80	—							
		21-23									
		24-26									
				27-29	75-85	—					
				30-32							
		33-35									
Ribs	Above Diaphragm	14-16	70-80	—							
		17-19									
		20-22									
		23-25									
		26-28									
	Below Diaphragm	14-16		—							
		17-19									
		20-22									
		23-25									
		26-28									
Chest	PA	14-16	65-75	—							
		17-19									
		20-22									
		23-25	70-80	—							
		26-28									
	Lat	22-24	80-90	—							
		25-27									
		28-30	90-100	—							
		31-33									
		34-36									

* These are suggestions only.

APPENDIX D *(continued)*

Fixed KVP Technique Chart

Region	Projection	cm range	Target kVp*	kVp	Bucky mAs	mAs	mA	Time	FFD (in.)	System Speed	
Skull	PA	13-15	70-80	—					40	—	
		16-18									
		19-21									
		22-24									
		25-27									
	Lat	8-10			—						
		11-13									
		14-16									
		17-19									
		20-22									
	Towne 35°	13-15			—						
		16-18									
		19-21									
		22-24									
		25-27									
Nasal	Lat	1-3	55-65	—							
		4-6									
Mandible	PA	10-12	70-80	—							
		13-15									
		16-18									
	Lat	6-8	65-75	—							
9-11											
Sinuses	PA	14-16	65-75	—							
		17-19									
		20-22									
		23-25									
	Lat	9-11	60-70	—							
		12-14									
		15-17									
		18-20									
		21-23									
	Water's	14-16	60-70	—							
		17-19									
		20-22									
		23-25									
		26-28									
	SMV	14-16	60-70	—							
		20-22									
23-25											
26-28											

* These are suggestions only.

APPENDIX D *(continued)*

Fixed KVP Technique Chart

Region	Projection	cm range	Target kVp*	kVp	Bucky mAs	mAs	mA	Time	FFD (in.)	System Speed
Hand/Wrist	PA	1-3	50-60	—					40	—
		4-6								
		7-9								
		10-12								
	Lat	7-9	55-65	—						
		10-12								
13-15										
Forearm	AP/Lat	3-5	55-65	—						
		6-8								
		9-11								
		12-14								
Elbow	AP/Lat	3-5	55-65	—						
		6-8								
		9-11								
		12-14								
Shoulder	AP	8-10	60-70	—						
		11-13								
		14-16								
		17-19								
	Lat	14-16								
		17-19								
		20-22								
		23-25								
Foot/Ankle	AP and Obl	3-5	60-70	—						
		6-8								
		9-11								
		12-14								
	Lat	3-5								
		6-8								
		9-11								
		12-14								
Os calcis	Axial	5-7	65-75	—						
		8-10								
		11-13								
		14-16								
		17-19								

* These are suggestions only.

APPENDIX D *(continued)*

Fixed KVP Technique Chart

Region	Projection	cm range	Target kVp*	kVp	Bucky mAs	mAs	mA	Time	FFD (in.)	System Speed		
Tibia Fibula	AP	6-8	60-70	—					40	—		
		9-11										
		12-14										
		15-17										
	Lat	5-7										
		8-10										
		11-13										
		14-16										
Knee	AP/Lat	7-9	60-70	—					40	—		
		10-12										
		13-15										
		16-18										
Femur	AP	14-16	60-70	—					40	—		
		17-19										
		20-22	70-80	—								
		23-25										
	Lat	17-19	60-70	—								
		20-22										
		23-25			70-80	—						
		26-28										
29-31												

* These are suggestions only.

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