

Radiographic Equipment and Accessories Needed to Produce Diagnostic-Quality Examinations

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1. Radiographic Equipment

When performing a radiographic examination, the objectives are to allow an anatomical area to be adequately evaluated by producing a sufficient number of projections and producing projections that are of diagnostic quality. Five radiographic projections are recommended for the routine examination of the distal extremity. Producing the proper projections for the distal extremity examination is the goal of the next presentation. The goal of this presentation is to provide information on radiographic equipment and accessories necessary to allow the equine practitioner to produce diagnostic-quality radiographic examinations.

A. Portable Units

There are several distributors of portable x-ray units. Two units that meet most ambulatory equine practitioner needs are the HF-80Plus^a and the Vet Share^b units. Both of these units are 80-kVp, 15-mA units and weigh approximately 22 lb. These units are referred to as high-frequency or square-wave units. This is significant to the practitioner in that this system tracks exactly the technique settings selected by the user. Older systems are self-wave rectified which means they occasionally deviate from the set technique due to quality of electronics in

these units. Error factors in the self-wave units can run from $\pm 5\%$ –75%. These companies also have 100-kVp units that weigh approximately 38 lb. Both companies have 5-year limited warranty on their units, but the companies should be contacted for the details on the warranty.

Both of these units will do the job. The major differences are the weight, cost, and personal preferences. The most popular ones are the lighter-weight units. All these units come with a light-beam collimator. A very important consideration in the purchase of a portable x-ray unit is the repair service, i.e., how quickly your unit will be repaired. Down time costs money!

2. Accessories Needed for the Production of a Diagnostic Examination

The accessory items needed and their approximate costs for an ambulatory equine practice are listed in Table 1.

3. Preparation of the Foot

- A. The shoe(s) must be removed and the foot/feet thoroughly cleaned before the radiographic examination of the distal extremity.
- B. Trim excess hoof and frog to avoid artifacts.
- C. Pack the lateral, medial and central sulci of

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Table 1. Accessory Items.

Item	Approximate Cost/Notes
Cassette Tunnel	\$55
Slotted wooden block	\$35
Aluminum frame cassette holder	\$115
Dosimetry	\$50 start-up plus \$12 per month per person
Three protective lead aprons (\$125 each)	
One pair of gloves (\$150) that have 0.5-mm lead equivalence	\$525
Hoof knife	\$5
Hoof pick	\$5
Heavy-duty scrub brush	\$5
2' × 2' heavy fabric material	Provides a clean surface for the foot to be placed upon; prevents dirt and rocks from contaminating the prepared foot
Artifact creation	
Lead markers	Right, left, fore, and hind (100 markers cost ~\$25)
Some method of imprinting owner/patient information on the radiograph	
Lead tape	\$35
Light imprinter	\$125–\$300
Screened cassettes, 8" × 10"	Average \$130–\$300 per cassette; 10 cassettes are recommended
Film, 8" × 10"	Generic brands for \$60 per 100 sheets to name brands \$120 per 100 sheets
Play-Doh ^c	\$2.50 (4-pack)

the frog with Play-Doh.^c Do not overpack the sulci beyond the frog, especially at the apex, because it will create P III solar margin artifacts.

4. Technique Settings for the Distal Extremity (Average Horse)

To provide background information on technique settings for each projection of the DEE, the following exposure times are offered. These will vary with different clinical practices but these times will provide a reference point. The imaging system for these exposure times is a 400 speed rare-earth system and the exposures were made at 80 kVp at 15 mA. The film focal distances are 26 inches. The exception to this distance will be for the flexor skyline view which is 20 inches. These techniques are all double screen systems. Single screen systems are too slow to make them practical for use in equine work with portable x-ray units.

A. Average exposure time for each projection for a double emulsion film

- DP Cone-down 0.16 s
- DP P 3 0.08 s
- DP 45° 0.1 s
- Lateromedial 0.1 s
- Flexor 0.1 s

B. Average techniques for a single emulsion film.

- DP Cone-down 0.2 s
- DP P 3 0.1 s
- DP 45° 0.14 s
- Lateral 0.14 s
- Flexor 0.14 s

The exposure factors for rigid and vinyl cassettes are comparable. The major differences are weight,

cost, and durability. The vinyl cassettes are lighter and less expensive while the rigid cassettes are more durable. Vinyl cassettes are not new. It is the utilization and marketing of rare earth screens in vinyl cassettes that has been the recent development.

5. Factors Affecting the Diagnostic Quality of the DEE and Solutions

- A. Incoming line voltage: Check incoming line with a voltage meter.
- B. Film-focal distance variations (very common): Use a measuring device.
- C. Exposure techniques: Always check your technique before each exposure.
- D. Film screen combination: Know what color light your screens emit and match film accordingly. Empty cassette/leave open and in a dark room expose the screens to the x-ray beam. The light color will be visible from the screens.
- E. Centering in bright sunlight: If you have an HF-80+, a centering laser can be purchased (\$675) to solve this problem.

6. Most Common Film Screen Combinations Used by Equine Practitioners

- A. Quanta III with fast blue film^d (Speed, 400)
- B. Lanex regular with PDG film^e (Speed, 400)
- C. Quanta fast detail with UVG film^d (Speed, 500)
- D. Trimax 12^f with UD or any green light sensitive film (approximate speed, 450). It is personal

preference on any of these systems. Trimax 12 is approximately 1000 speed with T-mat films.

7. Tips for Improving Radiographic Quality

- A. Very large horse
 1. Decrease FFD, use a longer exposure time or a faster film screen combination.
 2. Use of grid.
- B. Using a voltmeter to check incoming line voltage.
- C. Pack sulci with Play-Doh or other soft tissue equivalent density material.
- D. Clean screens on a regular basis to reduce artifacts and prolong the life of the screens. Commercial cleaners are available from film suppliers.
- E. Use brand-name film.
- F. Make sure your film screen combination is compatible by checking out the color of light emitted by your screens as described above.

8. Preventing Damage to Your Portable Unit

Avoid the following:

- A. Improper line voltages.
- B. Bouncing it around in the truck.
- C. Stretching the cord beyond its normal reach.
- D. Pounding on the key pad.

Carry an inexpensive line voltage meter (\$15–20) to check incoming voltage. If line voltage is above 130 VAC or below 105 VAC, the patient should be moved to a better power source. Always secure your portable unit within your vehicle and avoid setting it down hard on the ground.

^aMinXray, Inc. Northbrook, IL.

^bMilburn Distribution Inc., Phoenix, AZ.

^cHasbro, Inc., Pawtucket, RI.

^dSterling Diagnostic Imaging, Inc., Newark, DE.

^eKodak, Rochester, NY.

^f3M, St. Paul, MN.