X-RAY Reference books

The following books are available from our Book Department:-

1. "Principles of Veterinary Radiography"
   Authors: Dr. Douglas MA, MRCVS and
   Dr. Williamson MSR

   General Veterinary Radiography with positioning and techniques.

2. "Veterinary Radiology"
   Author: Dr. Carlsson DVM, MS, PhD

   Interpretation of X-Ray films for diagnosis.

3. "Atlas of Radiographic Anatomy of Dog and Horse"
   Authors: Dr. Schebitz
   Dr. Wilkins

   Deals with the basic anatomy as interpreted in conjunction with the radiograph. A highly technical and valuable guide.

X-RAY NOTES

V. S. SUPPLIES LIMITED

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BRANCHES

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ACOMA PX.30 X-RAY MACHINE

Specifications

This is one of the few machines on the Australian market which is ideally suited to veterinary radiography.

It incorporates the following features:-

(a) Extremely compact, measuring 8" wide, $6\frac{1}{2}$" deep, $8\frac{1}{2}$" high, which makes for ease of portability under field conditions.

(b) Reasonably light, for ease of handling - weight 40 lb.

(c) Operates off normal 240 volt power supply.

(d) Output ratings high enough for normal veterinary radiography -

60K. V. P. at 15MA, 20MA or 30MA
80K. V. P. at 15MA or 20MA
100K. V. P. at 15MA.

(e) Silent electronic timer which does not startle the patient as do some of the mechanical timers on other units. Time is graduated from 0.03 to 10 seconds with 22 positions.

(f) Hand operated exposure button.

(g) Full instrumentation - line voltage meter and compensation control, MA meter, MA compensation control, MA selector, time selector 0.03-10 seconds.

The machine is supplied complete with soft leather carrying bag, spare fuses and measuring and centering accessory.

For large animal radiography an easily dismountable mobile stand has been designed specifically for the unit, featuring a removable upright column with vertical travel adjustment, the base is in the form of an H frame mounted on rubberized shepherd castors, the stand is finished in high quality chromium plating.

For small animal radiography a wall arm mount bolted to a stained finish base board for mounting to brick or wooden walls is available. This mount features vertical travel of 40 inches. Thus the unit may be lowered to table level for standing lateral radiographs. The horizontal arm is able to telescope from 30 to 48 inches. The unit is finished in high quality chromium plating. When not in use the arm may be folded back against the wall.

Thus with both mounting attachments the unit proves versatile for both large and small animal radiography.

PX.30 X-RAY MACHINE
Operating Instructions

Listed below are step by step instructions for PX.30 X-Ray machine:-

1. Connect the timer cable to the appropriate point on the machine.
2. Connect the power supply cable to the power source.
3. Check that the line voltage switch is in the 'Off' position.
4. Switch on power source.
5. Turn the line voltage switch until the needle just touches the red line on the line voltage indicator dial. Do not turn it above the red line.
6. Set the Kilo-voltage control to the required K.V. That is: 100, 80 or 60.
7. Set the Milliamperage control to the required M.A. i.e. 30, 20 or 15, remembering that there is an automatic cut-off built into the machine that will only give 100 K.V. at 15 M.A., 80 K.V. at 20 or 15 M.A. and 60 K.V. at 15, 20 and 30 M.A.
8. Set the timer control switch to the required time.
9. The machine is now set up for an exposure; when making an exposure, press the exposure button and keep it on the 'down' position until the red indicator light goes off.

When attempting an exposure and the M.A. meter does not fluctuate, and/or the red indicator light does not activate, in all probability the fuse will be blown in the machine. Replace the fuse. Should the same thing occur, do not attempt to make any further exposures but contact V.S. Supplies and you will be advised accordingly.

Some points that should be strictly adhered to before the radiograph is taken:-

1. Check the focal film distance, i.e. from the side of the handle to the cassette.
2. Referring to the Technique Chart, set the factors on the machine.
3. Position the animal, taking care to centre the required anatomical region exactly under the tube aperture.
4. Care will have to be taken to judge the respiratory movement or body movement of the patient. Should the patient move do not even bother to process the film, but rather use a fresh cassette or film and repeat the shot.

X-RAY ACCESSORIES

The following information is intended to provide a brief working knowledge of X-Ray accessories.

Lead Aprons and Gloves

These are usually manufactured in a pliable rubber impregnated with lead. As a protective measure against the danger of radiation, aprons and gloves should be worn by all personnel actively engaged in radiography.

Cassettes and Intensifying Screens

The cassette is essentially a flat, rigid metal case with a magnesium metal front and a hinged metal lid. The inside surface of the back lid is covered with oil free felt, "Fibreglass" or isocyanate foam. The intensifying screens are mounted on the inside surfaces of the cassette so that when X-Ray film is placed in the cassette, a screen is in contact with the emulsion on each side of the film. The lid is equipped with spring or other type latches that exert just enough pressure to ensure against light leaks and to keep uniform contact between the screens and the film.

The intensifying screen consists of a luminescent chemical which will fluoresce or glow under X-Radiation coated on a supporting base, and protected by a cleanable surface. Its purpose is to reduce exposure time for a radiograph to a small fraction of that which would be required if screens were not used.

Lead Numeral and Lettering System

An efficient lettering system is a must in radiography. Radiographs of a particular patient must be easily matched to that patient, to prevent incorrect treatments being given as a result of radiological finding. More important is the identification of the left as against the right and vice versa; this is particularly important where surgery is considered - the surgeon must be able to rely on the radiograph to plan his operation.

Film

There are two types of film suitable for veterinary use - screen film and non screen or envelope packed film.

The screen film is used in cassettes for the majority of the anatomical regions able to be radiographed.

Non screen film differs in that it is not and cannot be used in cassettes, but comes packed in its own light proof cardboard holder which takes the part of the cassette. A greater exposure is necessary since the creation of the latent image is due only to X-Rays and not to any intensification process. Since this increase in technique is usually through a longer exposure time, non screen film can only be used for specific examinations such as anatomically thin areas like the extremeities of small animals, small animal skulls and mandibular processes.

A slight gain in detail is achieved over screen film as the very slight loss due to the intensifying screen is not incurred. The cardboard holders can also be more easily placed in positions in which a thick and bulky cassette will not fit such as mandibular shots where the film is placed in the patients mouth.

The film is very sensitive to pressure, extremes of heat, light, chemicals etc., it should be stored in a cool place, away from chemicals particularly gaseous chemicals and preferably on end so there is no pressure on the film.

Safe Light

The safe light is a low wattage lamp, the light from which passes through a glass filter. This filtered light will not expose X-Ray film, but allows the dark room operator enough light for processing of films.

Timer and Thermometer

Most developing and processing works on a time-temperature formula The thermometer being used to ascertain the temperature of the developing solution then referring to a time-temperature chart the developing time interval is ascertained. The timer is used to time this interval.

The viewer provides a very even white light with which the finished radiograph is diagnosed, the evenness of this light is most important as shadows or dim areas could lead to an incorrect diagnosis of the radiograph.

Hangers

The hanger is simply a metal frame with spring clips in each corner which hold the film in a taut position during processing and drying.

Developing Tanks

Usually consist of three compartments - developer, wash and fixer; the developer and fixer compartments being about one third the width of the wash compartment. Lids of a fairly close fitting nature are fitted to the developer and fixer compartments to prevent oxidation of the chemicals.

Developer

The purpose of a developer is to reduce the exposed areas of the film to metallic silver which leaves the unexposed area entirely unaffected. That is, to render visible the latent image which is formed in the emulsion of the film during exposure.

Developer Replenisher

The purpose of the developer replenisher is to keep the developing solution at a constant strength. During the processing of a film a certain amount of developer is retained on the film and transferred to the next tank compartment; the developing bath being constantly diminished and exhausted as films are processed.

The replenisher solution has a different chemical composition to that of the developer to combat the chemical changes that take place in the developer as it ages and is weakened by the number of films processed.

Fixer

The purpose of the fixer is to stabilize the image, formed during development. In most fixing baths a hardener is added to provent excessive swelling of the film emulsion, and to harden the emulsion surface sufficiently to reduce its vulnerability considerably against scratching, dust etc.

P X 30 TECHNIQUE CHART

Small Animal Radiography

The following techniques are for Ilford Red Seal film and processed in V.S. developing chemicals.

Where a Grid is used, the time should be doubled. However, some makes of Grid require the exposure to be trebled.

	VIEW	DIST.	FAST SCREENS	WEIGHT	KV	MA	TIME
FORELIMB-SCAPULA	P.A.	30"	X	0-20 lb.	60	30	.2
				21-50 lb.	60	30	.25
				51-80 lb.	80	20	.4
	Lateral	30"	X	0-20 lb	60	30	.1
				21-50 lb	60	30	.15
				51-80 lb	60	30	.2
SHOULDER JOINT	P.A.	30"	X	0-20 lb	60	30	.1
				21-50 lb	60	30	.15
				51-80 lb	60	30	.2
HUMERUS	A.P. & Lateral	30"	X	0-20 lb	60	30	.2
				21-50 lb	60	30	.3
				51-80 lb	80	20	.5
ELBOW JOINT	A.P. & Lateral	30"	X	0-20 lb	60	30	.2
				21-50 lb	60	30	.3
				51-80 lb	80	20	.5

	VIEW	DIST.	FAST SCREENS	WEIGHT	KV	MA	TIME
RADIUS, ULNA, CARPUS	A.P. & Lateral	30"	X	0-20 lb	60	30	.1
				21-50 lb	60	30	.2
				51-80 lb	60	30	.3
HIP JOINT	A.P. & Lateral	30" (Double Time)	X	0-20 lb	60	30	.2
				21-50 lb	60	30	.3
				51-80 lb	80	20	.6
FEMUR	A.P. & Lateral	30"	X	0-20 lb	60	30	.2
				21-50 lb	60	30	.25
				51-80 lb	80	20	.4
STIFLE JOINT	P.A. & Lateral	30"	X	0-20 lb	60	30	.2
				21-50 lb	60	30	.25
				51-80 lb	80	20	.4
TIBIA & FIBULA & TARSUS	A.P. & Lateral	30"	X	0-20 lb	60	30	.1
				21-50 lb	60	30	.2
				51-80 lb	60	30	.3

	VIEW	DIST.	FAST SCREENS	WEIGHT	KV	MA	TIME
SKULL	A.P. & Lateral	30"	X	0-20 lb	60	30	.15
				21-50 lb	60	30	.2
				51-80 lb	60	30	.3
SPINE CERVICAL	A.P. & Lateral	30"	X	0-20 lb	60	30	.2
				21-50 lb	60	30	.3
				51-80 lb	80	20	.5
SPINE THORACIC & LUMBAR	A.P. & Lateral	30"	X	0-20 lb	60	30	.2
				21-50 lb	60	30	.4
				51-80 lb	80	20	.5
THORAX	P.A. & Lateral	30"	X	0-20 lb	60	30	.1
				21-50 lb	60	30	.2
				51-80 lb	60	30	.3
ABDOMEN	A.P. & Lateral	30"	X	0-20 lb	80	20	.2
				21-50 lb	80	20	.4
				51-80 lb	80	20	.6

PX30 TECHNIQUE CHART
Large Animal Radiography

The following techniques are for Ilford Red Seal film and processed in V.S. developing chemicals.

Where a Grid is used, the time should be doubled. However, some makes of Grid require the exposure to be trebled.

	VIEW	DIST.	FAST SCREENS	KV	MA	TIME
Phalanges 3	Lateral	30"	X	80	20	.5 sec.
Navicular Toe on Block	A.P.	30"	X	80	20	.4 sec.
Phalanges 1 & 2	A.P.	30"	X	80	20	.5 sec.
Phalanges 1 & 2	Lateral	30"	X	80	20	.5 sec.
Joint P1 & P2	A.P.	30"	X	80	20	.5 sec.
Fetlock	A.P. & Lateral	30"	X	80	20	.5 sec.
Carpus	A.P. & Lateral	30"	X	80	20	.4 sec.
Tarsus	A.P. & Lateral	30"	X	80	20	.6 sec.
Stifle	A.P. & Lateral	30"	X	80	20	2.0 sec.
Femur	A.P. & Lateral	30"	X	80	20	2.0 sec.
Neck	A.P. & Lateral	30"	X	80	20	1.0 sec.

TECHNIQUE CHART

Technique chart for use with the Acoma PX 30 unit using Erka highspeed screens, Ilford Red Seal film and an M.S. grid 5:1 ratio and 85 lines/inch. Film processed in V.S. Developer and Fixer for three minutes at 70^{o}F.

Thickness in C.M.	K.V.P.	M.A.	TIME
1	80	15	.1 sec.
2	80	15	.1 sec.
3	80	20	.1 sec.
4	80	20	.1 sec.
5	80	20	.1 sec.
6	80	20	.15 sec.
7	80	20	.15 sec.
8	80	20	.15 sec.
9	80	20	.2 sec.
10	80	20	.2 sec.
11	80	20	.25 sec.
12	80	20	.25 sec.
13	80	20	.3 sec.
14	80	20	.4 sec.
15	80	20	.4 sec.
16	80	20	.5 sec.
17	100	15	.2 sec.
18	100	15	.25 sec.
19	100	15	.3 sec.
20	100	15	.3 sec.
21	100	15	.4 sec.
22	100	15	.5 sec.
23	100	15	.5 sec.
24	100	15	.6 sec.
25	100	15	.6 sec.

A.F.D. 84 c.m.

Technique chart for use with the Acoma PX 30 unit using Erka highspeed screens, Ilford Red Seal film, on an 84 c.m. A.F.D.

Thickness in C.M.	K.V.P.	M.A.	Time
1	60	30	.03 sec.
2	60	30	.03 sec.
3	60	30	.05 sec.
4	60	30	.05 sec.
5	60	30	.1 sec.
6	80	20	.05 sec.
7	80	20	.05 sec.
8	80	20	.05 sec.
9	80	20	.1 sec.
10	80	20	.1 sec.

SF1 TECHNIQUE CHART
Small Animal Radiography

DESCRIPTION	VIEW	DIST-ANCE	SCREEN OR N.S.	WEIGHT	TIME	STUD
FORELIMB - SCAPULA	P.A.	30"	S	0-20 lb.	1/4 sec.	8
				21-50 lb.	1/4 sec.	10
				51-80 lb.	1/4 sec.	12
	Lateral	30"	S	0-20 lb	1/4 sec.	4
				21-50 lb	1/4 sec.	6
				51-80 lb	1/4 sec.	8
SHOULDER JOINT	P.A.	30"	S	0-20 lb	1/4 sec.	4
				21-50 lb	1/4 sec.	6
				51-80 lb	1/4 sec.	8
HUMERUS	A.P. & Lateral	30"	S	0-20 lb	1/4 sec.	8
				21-50 lb	1/4 sec.	11
				51-80 lb	1/3 sec.	12
ELBOW JOINT	A.P. & Lateral	30"	S	0-20 lb	1/4 sec.	8
				21-50 lb	1/4 sec.	11
				51-80 lb	1/3 sec.	12

DESCRIPTION	VIEW	DIST-ANCE	SCREEN OR N.S.	WEIGHT	TIME	STUD
RADIUS, ULNA, CARPUS	A.P. & Lateral	30"	S	0-20 lb	1/4 sec.	4
				21-50 lb	1/4 sec.	8
				51-80 lb	1/4 sec.	11
HIP JOINT	A.P. & Lateral (Double Time)	30"	S	0-20 lb	1/4 sec.	8
				21-50 lb	1/4 sec.	11
				51-80 lb	1/3 sec.	12
FEMUR	A.P. & Lateral	30"	S	0-20 lb	1/4 sec.	8
				21-50 lb	1/4 sec.	10
				51-80 lb	1/4 sec.	12
STIFLE JOINT	P.A. & Lateral	30"	S	0-20 lb	1/4 sec.	8
				21-50 lb	1/4 sec.	10
				51-80 lb	1/4 sec.	12
TIBIA & FIBULA & TARSUS	A.P. & Lateral	30"	S	0-20 lb	1/4 sec.	4
				21-50 lb	1/4 sec.	8
				51-80 lb	1/4 sec.	11

DESCRIPTION	VIEW	DIST-ANCE	SCREEN OR N.S.	WEIGHT	TIME	STUD
SKULL	A.P. & Lateral	30"	S	0-20 lb.	1/4 sec.	6
				21-50 lb.	1/4 sec.	8
				51-80 lb	1/4 sec.	11
SPINE CERVICAL	A.P. & Lateral	30"	S	0-20 lb	1/4 sec.	8
				21-50 lb	1/4 sec.	11
				51-80 lb	1/3 sec.	12
SPINE THORACIC	A.P. & Lateral	30"	S	0-20 lb	1/4 sec.	8
				21-50 lb	1/4 sec.	12
				51-80 lb	1/3 sec.	12
THORAX	P.A. & Lateral	30"	S	0-20 lb	1/4 sec.	4
				21-50 lb	1/4 sec.	8
				51-80 lb	1/4 sec.	11
ABDOMEN	A.P. & Lateral	30"	S	0-20 lb	1/4 sec.	8
				21-50 lb	1/4 sec.	12
				51-80 lb	1/2 sec.	12

DEVELOPING CHART
V.S. X-Ray Developing Chemicals

TEMPERATURE	DEVELOPING TIME
60°F	4 min. 40 sec.
62°F	4 min. 20 sec.
64°F	4 minutes
66°F	3 min. 40 sec.
68°F	3 min. 20 sec.
70°F Recommended developing time	3 minutes
72°F	2 min. 40 sec.
74°F	2 min. 20 sec.
76°F	2 minutes

Temperatures under 60°F and over 76°F are not recommended.

After Development - Rinse for 15 seconds in running water, or immerse in Acid stop bath.

Fix - For 3 to 5 minutes in V.S. Fixer. Wash thoroughly in running water.

DEVELOPING
With V.S. X-Ray Chemicals

PROCESSING:

Processing the film completes what the exposure started - it produces a visible lasting image of the latent image created by X-Rays and fluorescent lights. Exposure and processing are equally important. In fact a film may be perfectly exposed and yet become a mediocre radiograph because of faulty processing. Therefore, it cannot be stressed enough that very careful attention should be given to processing.

The operations involved in processing are developing, rinsing, fixing, washing and drying. No attempt will be made in this test to describe the chemical processes involved, but rather the mechanical ones.

(a) DEVELOPING:

(i) Stir the developing solution briskly to equalize the temperature throughout the tank and to thoroughly mix the solution.

(ii) Accurately check the temperature and set timer for required interval.

(iii) Place film in solution and activate timer, film should be agitated once or twice to remove any air bubbles that may be adhering to it.

(iv) When the timer sounds, remove the film quickly without allowing the solution to drain back into the developing tank. Normally this will then carry out the proper amount of solution to allow correct replenishment.

(b) RINSING:

After the film has been developed it should be immersed in a rinse bath of clean circulating water. The minimum rinse time with continuous agitation is 30-40 seconds. After rinsing, the film should be well drained so that the minimum amount of liquid is transferred to the fixer. If running water is not available we suggest the rinse becomes an acid stop bath, made up of 10% Acetic Acid and water.

(c) FIXATION:

The time required for the complete disappearance of the original milky opaqueness of the film is known as the clearing time. However, an equal amount of time is required for the gelatin emulsion of the film to be hardened adequately.

Thus the total fixing time should be at least twice the clearing time. This time interval for fresh solution is generally five minutes for screen film and ten minutes for non screen or envelope packed film. Films may be viewed safely after approximately one to one and a half minutes fixing time, however - they should be replaced in the solution as soon as possible to avoid staining.

(d) WASHING

The correct washing and drying of the film cannot be over emphasized as incorrect processing at this stage can lead to water marks and chemical stains on the film which can affect the final interpretation of the radiograph.

An adequate supply of running water is necessary. Screen type film can be adequately washed in about 20 minutes, non screen film due to the thicker emulsion takes about double this time.

(e) DRYING

The film should be hung in an area where fresh, dust free air circulates freely. Care should be taken to space the films to avoid them touching and sticking together. Drying times naturally vary throughout the year but the normal time is generally about 4 hours. Drying cabinets will hasten the process but care should be taken to ensure the temperature is not too high as it will cause cracking and brittleness of the film.

V. S. SUPPLIES LIMITED
X-Ray Equipment

The items listed below are suggested as a basis for maintaining an efficient X-Ray department in an average veterinary practice. These requirements however, will vary according to the needs of a particular practice.

1	Only	Acoma PX 30 X-Ray Machine
1	"	Wall Arm Mount
1	"	Field Trolley
1	"	Developing Tank Set
1	"	Thermostatically Controlled Heater
1	"	Safelight
1	"	Timer
1	"	Floating Thermometer
1	"	Viewer Double
1	"	Drying Rack
1	"	Single Sided Lead Apron
1	Pair	Lead Rubber Gloves
1	Only	Cassette 10" x 12" Complete with H/S Screens
1	"	Cassette 12" x 15" Complete with N/S Screens
1	"	Lead Numeral System
2	"	Sheets .50 mm lead rubber
4	"	Hangers 10" x 12"
4	"	Hangers 12" x 15"
1	"	Copy Principles of Veterinary Radiography by Douglas & Williamson