

MODEL #

SERIAL #

# X-CEL X-RAY COPORATION

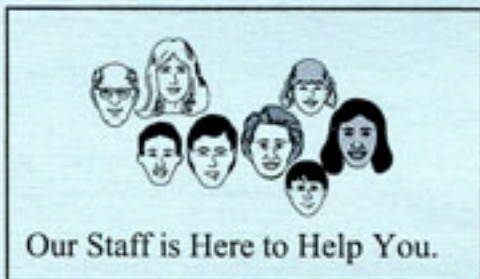
4220 WALLER DRIVE, CRYSTAL LAKE, IL 60012

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**Caution: Federal Law restricts this device to sale by or on the order of a physician.**



Our Staff is Here to Help You.

**READ  
ME  
FIRST**

## CAUTION!

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PROPER GROUNDING OF SHOCKPROOF X-RAY EQUIPMENT IS IMPORTANT. DAMAGE TO THE X-RAY TUBE MAY RESULT IF NOT PROPERLY GROUNDED. THIS UNIT, IF PROPERLY GROUNDED, IS SHOCKPROOF TO THE OPERATOR AND PATIENT. REFERENCE PAGE A-3.

**MEMO MEMO MEMO**

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**MEMO MEMO MEMO**

# MANUAL

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## SECTION A

### GENERAL

In order to properly protect the x-ray against damage in transit, it is necessary to disassemble the unit and package it in small, rugged packing boxes. Check shipping ticket against boxes received to determine if correct number of boxes arrived at destination. When you opened the boxes, you broke a seal that reminded you of damage in shipment.

### DAMAGE IN TRANSIT

X-Cel X-Ray Corporation is not responsible for goods lost or damaged in transit. The Company's responsibility for safe delivery ceases when the carrier accepts shipment in good order. Claims for damage occurring in transit must originate and be presented by consignee. (The person receiving the goods.)

All packages should be examined thoroughly at time of delivery. If damage to any box is apparent, be sure to make a notation on delivering carrier's receipt, otherwise claims may be refused.

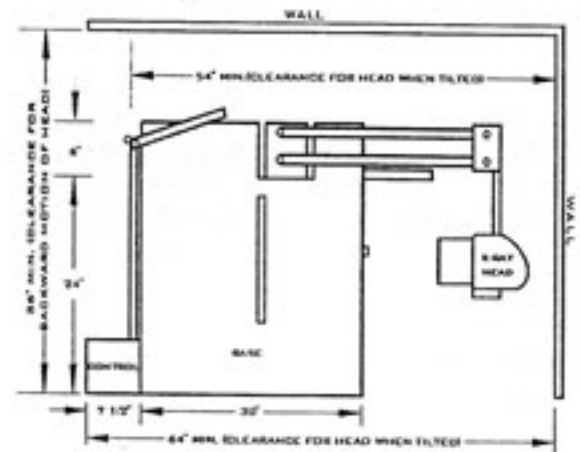
### CONCEALED DAMAGE

Notify carrier immediately regarding concealed damaged and hold entire shipment, including all boxes, intact for inspection by or instructions from carrier's agent. ICC rules require that claims for concealed damage must be made within 15 days from receipt of shipment.

### PRE-ASSEMBLY [FLOOR MODEL] MB-700 A/C AND LB-700 A/C

Select a room in which the working area is large enough to allow the tube head to pivot for the right lateral. This requires a minimum of 5 feet 2 inches for the floor model. (Absolute minimum is 56 inches when control is mounted on the wall.)

The location selected must provide protection from radiation exposure to the operator as well as other personnel working in the area. A 12 foot exposure cord is provided to allow the operator to be outside the room or behind a shield when the exposure is made. The control cable allows remote mounting up to 5 feet away from the base.



**YOU SHOULD HAVE A BOX CONTAINING THE FOLLOWING:** Film/Cassette Holder-Outrigger, Manual-FDA Papers, Screws.

(Located in the outer section of the base box.)

**MODEL SIZES AND WEIGHTS - EXTREMITIES**  
**MB-700 A/C (4 BOXES) LB-700 A/C (4 BOXES)**  
 All 900 series are the same size and weight.

Assembly	Dimensions	Cubic Ft. Cubic Mtrs	WT. lbs. WT. kgs.						
T.Head & BLD (Collimator)	19 x 19 x 19 in 0.48 x 0.48 x 0.48 m	3.97 FT <sup>3</sup> 0.112 M <sup>3</sup>	44 lbs 19.9 kgs	X	X	X	X	X	X
Arm & Hand Rail	47 x 21 x 13 in 1.2 x 0.53 x 0.33 m	7.4 FT <sup>3</sup> 0.21 M <sup>3</sup>	52 lbs 23.58 kgs	X	X	X			
Electrical Control	24 x 15 x 11 in 0.61 x 0.38 x 0.28 m	2.29 FT <sup>3</sup> 0.065 M <sup>3</sup>	31 lbs 14.06 kgs	X	X	X	X	X	X
Floor Base MB-700 A/C	36 x 36 x 11 in 0.91 x 0.91 x 0.28 m	8.25 FT <sup>3</sup> 0.23 M <sup>3</sup>	56 lbs 25.4 kgs	X					
Base FB-700 A/C	36 x 36 x 11 in 0.91 x 0.91 x 0.28 m	8.25 FT <sup>3</sup> 0.23 M <sup>3</sup>	58 lbs 26.3 kgs			X			
Base LBH-LB-700 A/C	36 x 36 x 11 in 0.91 x 0.91 x 0.28 m	8.25 FT <sup>3</sup> 0.23 M <sup>3</sup>	52 lbs 23.5 kgs		X				
Mobile Arm	42 x 20 x 7 in 1.06 x 0.5 x 0.17 m	3.4 FT <sup>3</sup> 0.94 M <sup>3</sup>	37 lbs 16.8 kgs				X		
Mobile Post	51 x 8 x 6 in 1.3 x 0.21 x 0.15 m	1.41 FT <sup>3</sup> 0.39 M <sup>3</sup>	17 lbs 7.71 kgs				X		
Mobile Wheels	35 x 13 x 21 in 0.89 x 0.53 x 0.33 m	5.5 FT <sup>3</sup> 0.156 M <sup>3</sup>	44 lbs 19.9 kgs				X		
Long Arm Arm & Bracket	36 x 36 x 11 in 0.91 x 0.91 x 0.28 m	8.25 FT <sup>3</sup> 0.23 M <sup>3</sup>	68 lbs. 30.8 kgs.					X	
Short Arm Arm	43 x 8 x 22 in 1.1 x 0.56 x 0.20 m	4.37 FT <sup>3</sup> 0.125 M <sup>3</sup>	38 lbs 17.2 kgs.						X
Bracket for short arm	19 x 19 x 19 0.48 x 0.48 x 0.48 m	3.96 FT <sup>3</sup> 0.112 M <sup>3</sup>	25 lbs. 11.34 kgs.					X	X

## FB-900 AC/K

Assembly	WEIGHT lbs. / kgs.	Cubic Feet Cubic Meters	Dimensions
Base	63 lbs. 28.5 kgs.	8.25 FT <sup>3</sup> 0.23 M <sup>3</sup>	36 x 36 x 11 in. 0.91 x 0.91 x 0.28 m.
Control (Plus Rails)	60 lbs. 27.2 kgs.	5.46 FT <sup>3</sup> 0.15 M <sup>3</sup>	39 x 22 x 11 in. 0.99 x 0.99 x 0.28 m.
Head	44 lbs. 19.9 kgs.	3.97 FT <sup>3</sup> 0.112 M <sup>3</sup>	19 x 19 x 19 in. 0.48 x 0.48 x 0.48 m.
Weights (3)	77 lbs. 34.9 kgs.	3.97 FT <sup>3</sup> 0.112 M <sup>3</sup>	19 x 19 x 19 in. 0.48 x 0.48 x 0.48 m.
Frame (Plus) k parts	70 lbs. 31.75 kgs.	7.4 FT <sup>3</sup> 0.21 M <sup>3</sup>	47 x 21 x 13 in. 1.2 x 0.53 x 0.33 m.

## OPTIONS

- A) Longer Cable
- B) Concealed "In the wall wiring"

A grounded 120 volt (20 amp) dedicated outlet must be provided for this x-ray unit to operate to its intended capacity. See installation section for further details. A 20 GFCI outlet is recommended.



Allow x-ray head to warm up to room temperature before operating.

When installing and checking x-ray unit for the first time, start 6/60 second, (006) 10mA, 55 kVp. Operate and observe mA meter needle. As the x-ray is operated, the needle will jump a very short distance.

As the exposure time is increased slowly, the mA needle will move higher in a smooth continuous motion.

## NOTE

It requires one second of exposure time for the mA meter needle to register the full amount. If cassettes with screens are used, the required exposure time will be less than one second and the needle may not have time to get to the 10 or 15 setting. This is okay, it will not affect the film or the x-ray unit.

State radiation protection requirements vary over time and vary from state to state. Contacting your state agency for preapproval is recommended. This usually requires submitting a floor plan and specifications on the x-ray equipment. Be prepared to know the following:

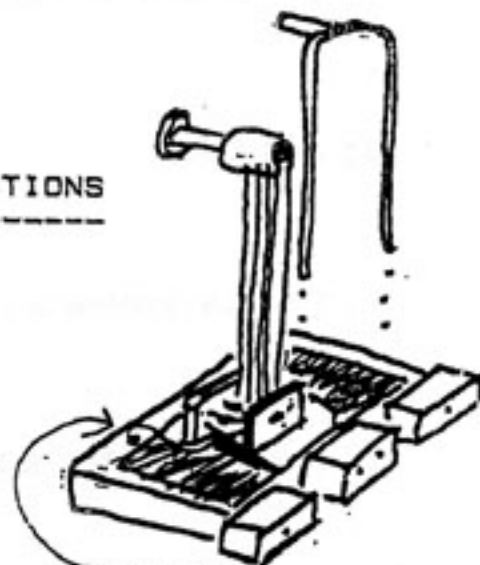
- (1) Maximum kVp (70 or 90)
- (2) Maximum mA (10 or 15)
- (3) Typical exposure technique (DP .5 sec. @ 55kV/10mA) (@ 28 in SID)
- (4) Typical radiation produced.. (30 MR)
- (5) Number of films (exposures to be taken per week.)

# X-Cel X-Ray Corporation

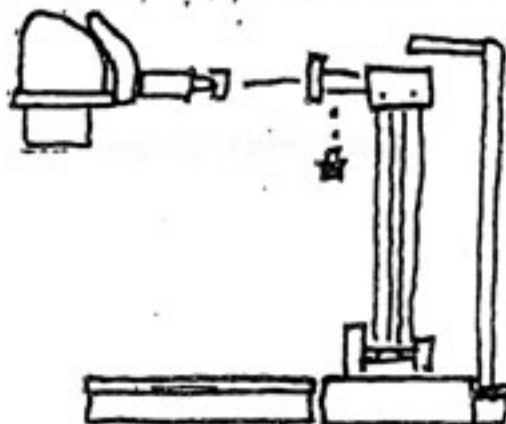
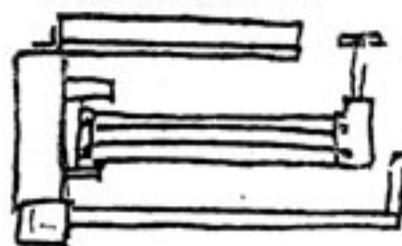
4220 WALLER DRIVE, CRYSTAL LAKE, IL 60012 (815) 435-2470

## FB-700 AC ASSEMBLY INSTRUCTIONS

1. Attach weights to base frame with 5/16-18 x 2 1/2" hex head bolts provided. Remove base frame covers.
2. Attach arm assembly to base frame with 4- 5/16-18 x 3/4" hex head bolts provided.
3. Attach railing with 1/4-20 x 1 1/4" fillister screws provided. NOTE: If right lateral only is to be used, the control may mount on the left side of the rail. If both laterals or left lateral is to be used, the control must mount on the wall.
4. Carefully lay unit on it's back and attach base with 10-32 x 7/16" flat head screws provided.
5. Pivot base supports under the base and slowly set unit upright.
6. Remove set screw from underside of tubing at top of arm. Insert shaft of tubehead assembly and push until seated. Lock in place with locking knob. Replace set screw and lock with nut.
7. Adjust spring if necessary.
8. Replace covers.

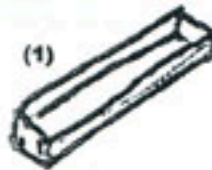


SIDE OF FRAME WITH THREADED HOLES GOES UP. COVERS ARE ADDED LAST.

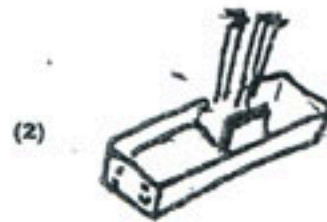


# BILL'S SEQUENCE

1.) START WITH FRAME



2.) ADD ARM



3.) TIP / (LAY) OVER ON BACK OF ARM



4.) COVER ARM (TO PROTECT PAINT) AND ADD BASE

(3) (4)

5.) TIP UP (AS NORMAL)



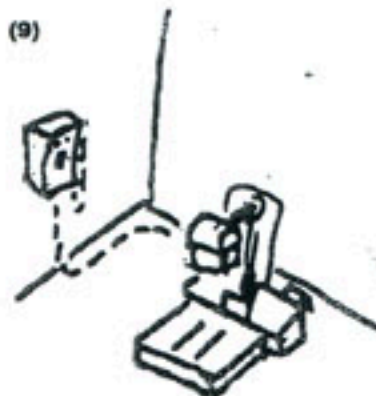
6.) ADD WEIGHTS

7.) ADD RAIL



8.) ADD X-RAY HEAD

9.) MOUNT CONTROL ON WALL





INSTRUCTIONS FOR: 715A-BD

05-16-08

START WITH:

1. BASE  
Remove cover

ADD

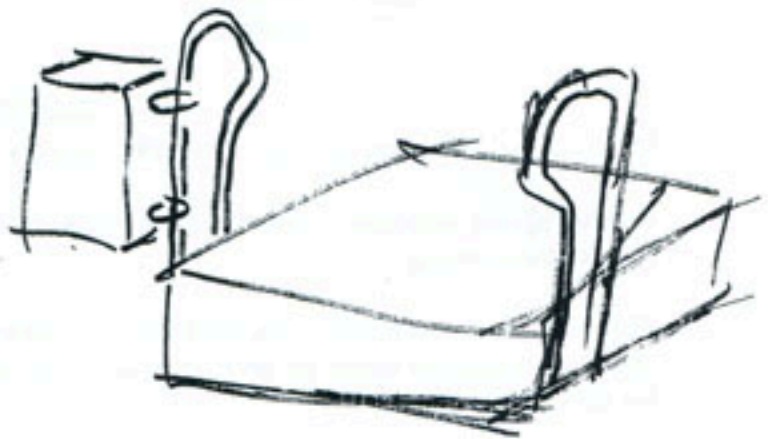
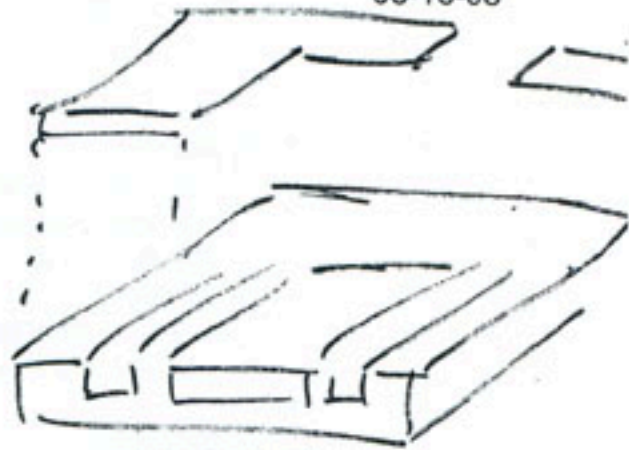
2. ARM SYSTEM

3. REAR RAIL

4. LEFT SID RAIL  
(Add control)

5. RIGHT SIDE RAIL

6. LEFT & RIGHT BASE COVERS



As you assemble and use your X-Cel X-Ray unit, the following facts will become apparent.

### X-CEL X-RAY FEATURES

1. Easy Assembly
  - Opposite Lateral
  - Remote Exposure Switch with Key Lock (optional)
  - Flip Base
  - Mobile
  - In The Wall Wiring
2. On/Off Safety 2P2T Switch
3. mA
  - Stabilized
  - Meter
  - Preset
4. kVp
  - Adjustable - Type of meter -Analog
5. Remote MTG / Control
  - Easy Repair by Anyone
6. Head
  - Size (Small)
7. Collimator
  - Knobs on Front
8. Arm
  - Adjustable Front to Rear
  - One Motion and Stops
  - No Checking Distance (Sid)
9. Base
  - Mid
  - Split Film
  - Cassette Step / Stop
  - Large for Patient
  - Railing for Safety

### CAUTION

Do not store in a damp area. Dampness may affect devices and cause rust.

Following are excerpts from the FDA Paragraph 1000.50 Subpart C – Radiation Protection Recommendations.

Each X-RAY facility should evaluate its procedures, techniques, and equipment and compile a list of such examinations for which specific body areas shielding should be routinely considered for use.

Specify body area shielding should provide attenuation of X-RAYS at least equivalent to that afforded by .25 millimeter thickness of lead.

## SECTION B

### FUNCTIONAL INSTALLATION CHECK

<p><b>(1) OPERATIONAL INDICATORS</b></p> <p>A. Push 10 mA rocker switch on front of control and turn on power switch.</p> <p>Note:</p>	<p>(a) Light on power switch will light and kVp meter will indicate a value. Circuit for a stabilized 10 mA output has been selected.</p> <p>(b) The kVp meter will point to some kVp value between 50-70 kVp on 700 Series and 70-90 kVp on 900 Series. (Refer to check #5 on page B-2)</p>
<p>B. Push 15 mA position of rocker switch.</p> <p>Note:</p>	<p>(a) Circuit for a stabilized 15 mA output has been selected.</p> <p>(b) The kVp meter will vary between 50-70 kVp on 700 series and 70-90 kVp on 900 series. (Refer to over adjustments)</p>
<p><b>(2) TUBE POSITIONING (LB &amp; MB)</b></p> <p>A. Position arm to desired angle (max. 30° left &amp; max. 90° right)</p>	<p>(a) The tubehead should remain in any position in which it is placed. (Refer to tubehead adjustment in P-700M supplement sheet)</p> <p>(b) Keep tubehead in upright position after use.</p>
<p><b>(3) BEAM LIMITING DEVICE</b></p> <p>A. Push momentary switch.</p>	<p>(a) X-ray field light will come on showing size of x-ray field selected and will remain on for approximately 13 seconds.</p> <p>(b) With repeated use, some burning odor may be evident - this is normal and will disappear with use.</p>
<p><b>(4) EXPOSURE SWITCH</b></p> <p>A. <i>Press and Hold exposure switch.</i></p>	<p>(a) Select mA, kVp and time. <i>Press and Hold exposure switch</i>. After 1 second of filament preheat delay, x-rays will be generated concurrently with sounding of the emission buzzer and mA meter will defect to the selected value.</p> <p>(b) NOTE: It requires approximately 1 second for the mA needle to respond. On exposure times of less than 1 second, the needle may not reach the full scale reading. This is normal. You are still getting the predetermined amount of mA.</p>
<p>B. The digital display timer requires a zero to be added before the pulses are keyed in. (example) 30/60 = 030 on keypad</p>	<p>(a) Add '0' (zero) to amount of exposure time in 60th's. (example) 6/60 = .1 sec. = 006</p>

## SECTION B

## Functional Installation Check - Continued

(5) kVp METER	<p>(a) Rotate black knob on the left side of the control; observe kVp needle as it moves through the full range.</p> <p>(b) Ranges:  700 Series = 50 - 70 (10mA, 15 mA)  900 Series = 70 - 90 (10 mA)  (Refer to over voltage adjustment on page C-2)</p>
(6) mA METER	(a) Select 10 or 15 mA exposure for 1 second and read meter - wait for 1 second delay.
(7) mA METER	(a) Clockwise = Increase mA. (See instructions, page C-1)
(8) LIGHT FIELD VERIFICATION	(a) See instructions, page C-1
(9) SOURCE TO IMAGE DISTANCE	(a) The [SID is 28 inches] (fixed) on floor models and 16 or 28 inches MAXIMUM on wall and mobile models.
(10) IMAGE RECEPTOR	(a) On all models, the X-ray field is perpendicular to the image receptor when arm system is brought to vertical position (0 on dial) and centering light indicates that x-ray field is centered on image receptor in lateral positions, x-ray field is perpendicular when head assembly is lowered to 90 degrees.
(11) ON/OFF BREAKER SWITCH	(a) When switch is on, rocker should light.
(12) LINE REGULATION	(a) See page C-8

## GETTING THE PERFECT X-RAY IMAGE FOR X-RAY **FILM**

When you're finished with that film, develop it in the new chemistry and take it to your view box. Place your finger behind the film to see which one of the squares is dark enough so that you can just barely tell that your finger is moving.

When you identify that square, you know how much time it took. Take for example, that it was the 30/60 or (030) time, then that would be a perfect time to set the machine for a D/P view at 50 kVp/10 mA. This might be longer than you're used to, but it still will give you a good film, you'll get good definition, the toes would be nice and light (contrast) and you'll get soft tissue effect. At this time select D/P exposures at 52 and 55 kVp for comparison. Choose the best D/P then continue to make a lateral view.

For a lateral, all you have to do is **increase** the kVp about 7 to 10 kVp. It is best to have the patient stand on a piece of felt, about 1/4" thick or more, which will allow you to project the soft tissue below the metatarsals. Once you get those two views finished, you can look at them and decide if you want to adjust for a little darker or lighter, but you'll end up with an excellent film. This precludes having to know what kind of film, cassette or screens are in your system. *Correct your technique chart and post it.* **Notice that the technique calls for changing the kVp (penetrating power) not the time as the object part thickness changes.**

In summary, remember you are certifying the darkroom "dark", the processing chemicals "fresh" and that you have **two screens** in each cassette before making exposures. This will make the X-CEL X-RAY machine perform as it was designed. Remember to make a new and detailed technique chart to post near the x-ray machine control. Basic guidelines... for a person weighing 100 pounds, use 50 kVp for AP and 57 kVp for lateral. For a 200 pound person, use 55 kVp for AP and 65 kVp for lateral. The chart should provide for small, medium and large patients as well as the views you will be using.

Example:

PATIENT VIEW	SMALL (100 LBS)			MEDIUM (200 LBS)			LARGE (250+ LBS)		
	TIME	mA	kVp	TIME	mA	kVp	TIME	mA	kVp
A/P	030	10	50	030	10	55	030	10	60
LATERAL	030	10	60	030	10	65	030	10	70
OBLIQUE	030	10	60	030	10	65	030	10	70

From Bill Morris  
X-CEL X-RAY CORPORATION

F/N: 810030 Rev. 2

### X-CEL X-RAY CORPORATION

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## GETTING THE PERFECT X-RAY IMAGE *FOR X-RAY FILM*

Experience has shown that you must do all that is recommended in this process, which takes about thirty minutes. The best way to do it is to read the instructions carefully, then visualize every step of the way, so that you're clear on what you're doing and you will remember it. At the end of it all, you want to be able to say, "I'm proud of the film that I have, and I'll be proud to send it for a second opinion."

For problems of what people usually refer to as films that are light, films that lack definition or films that are dark, the reasons may vary but the corrective process is the same. Your suggestions will be appreciated.

You have to confirm that the darkroom is perfect, do that by turning on all the outside lights adjacent to the darkroom, the office, especially the doctor's office, or any room that normally would not be used, or occasionally used. With those lights on, go (do not delegate this job) into the darkroom, turn the **safe light off**, and plan to be in the darkroom for about ten minutes. That's what it takes for your eyes to adjust. At the end of ten minutes you either will see light and be able to see your hand on the end of your arm, or... you won't be able to see your hand. Once you've reached ten minutes, your eyes will have adjusted to the dark, and if the room is actually dark, it will be kind of an eerie feeling, where you know your hand is on the end of your arm, but you can't see it. This is very important. And, it's also important to continue to have the safe light off even for three or four days after you get what you think is a perfect film.

Once that period of duration has elapsed, then, when you turn the safe light on, it could cause trouble with the film again, and that would be because the light is either too close to the film, or the filter's got a crack in it, or else it's just incompatible with the film that you're using. Additionally, other sources of light that might affect film processing are false ceilings with light fixtures that leak light from other rooms and even a nail hole in the wall can cause problems. (Add high wattage bulbs to that list of causes).

Once you have the darkroom "dark", it's time to look at the processing machine or dip tank. There you need fresh chemistry. Anything older than a week should be changed because when you go to adjust the x-ray machine without fresh chemistry, you can get some errors that you won't be able to explain later. So, change your chemistry like you normally would and make sure it's fresh.

A problem with some automatic processors is that the upper tray through which the film must travel, is small and the chemistry can deplete it's potency within a week. If you have a one (1) day a week office, you may have to change the solution in the upper tray to solve the "light film" problem also.

At the x-ray machine, find out what would be a good setting for a film. I suggest you set the x-ray machine at 50 kVp, 10 mA. The time settings could be 15/60 (015); 30/60 (030); 42/60 (042) and 48/60 (048).

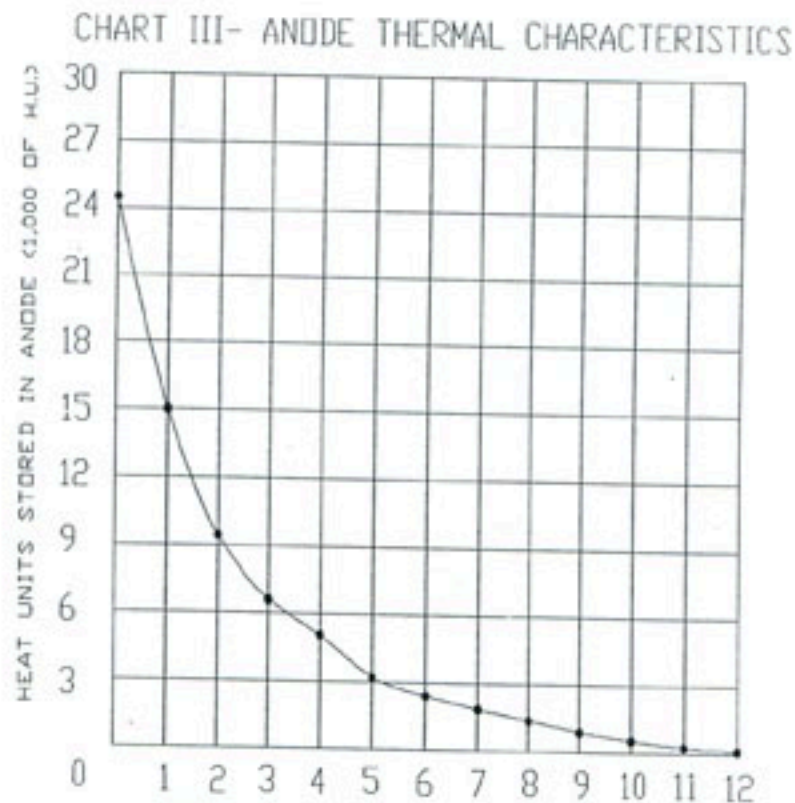
If you take a regular film and set it up so that you can block out three-quarters of it and do this four times, you'll end up with four squares of the film you're going to expose. You'll expose it at different times and they would be as outlined above. Identify each square and record it for reference.

### CHART III -- ANODE THERMAL CHARACTERISTICS

Intermittent duty ratings give the maximum permissible duty for a series of exposures. Each exposure must not exceed the instantaneous tube ratings. See Chart III below.

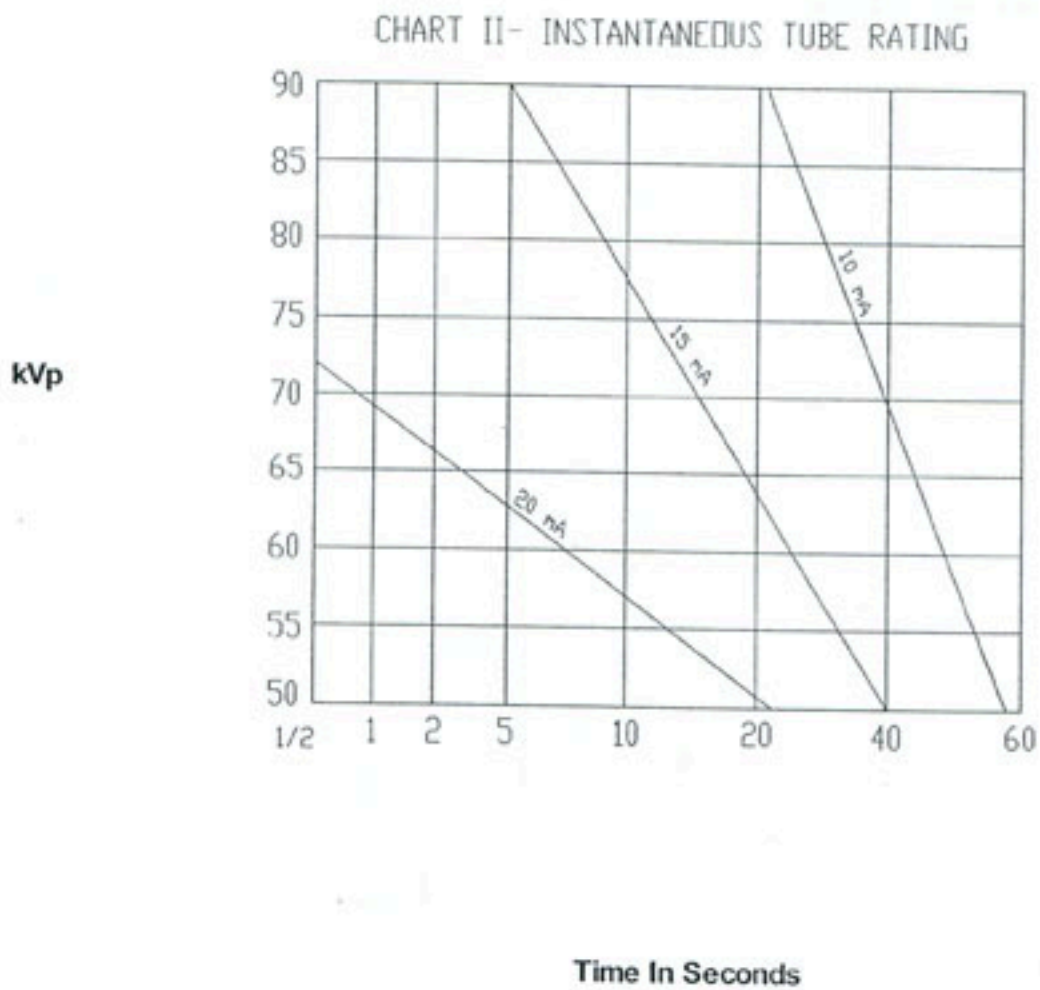
The heat generated at the anode of the x-ray tube is proportional to the kVp, mA, and the time of the exposure. The heat is measured in heat units (H.U.) A heat unit is defined as kVp x mA x Time (seconds). For example, the number of heat units developed by a 60 kVp, 15 mA, and 2 second exposure would be  $60 \times 15 \times 2 = 1,800$  H.U.

The tube will operate within safe limits of the anode, if heating does not exceed the cooling rate. The maximum cooling rate of the anode is 7,200 H.U. per minute with a maximum anode storage of 25,000 H.U. For a 60 kVp, 15 mA at 2 second exposure, the number of exposures per minute should not exceed 4 ( $7,200/1,800$ ). Chart I contains the housing cooling chart. The anode cooling curve is shown below.



## CHART II -- INSTANTANEOUS TUBE RATING

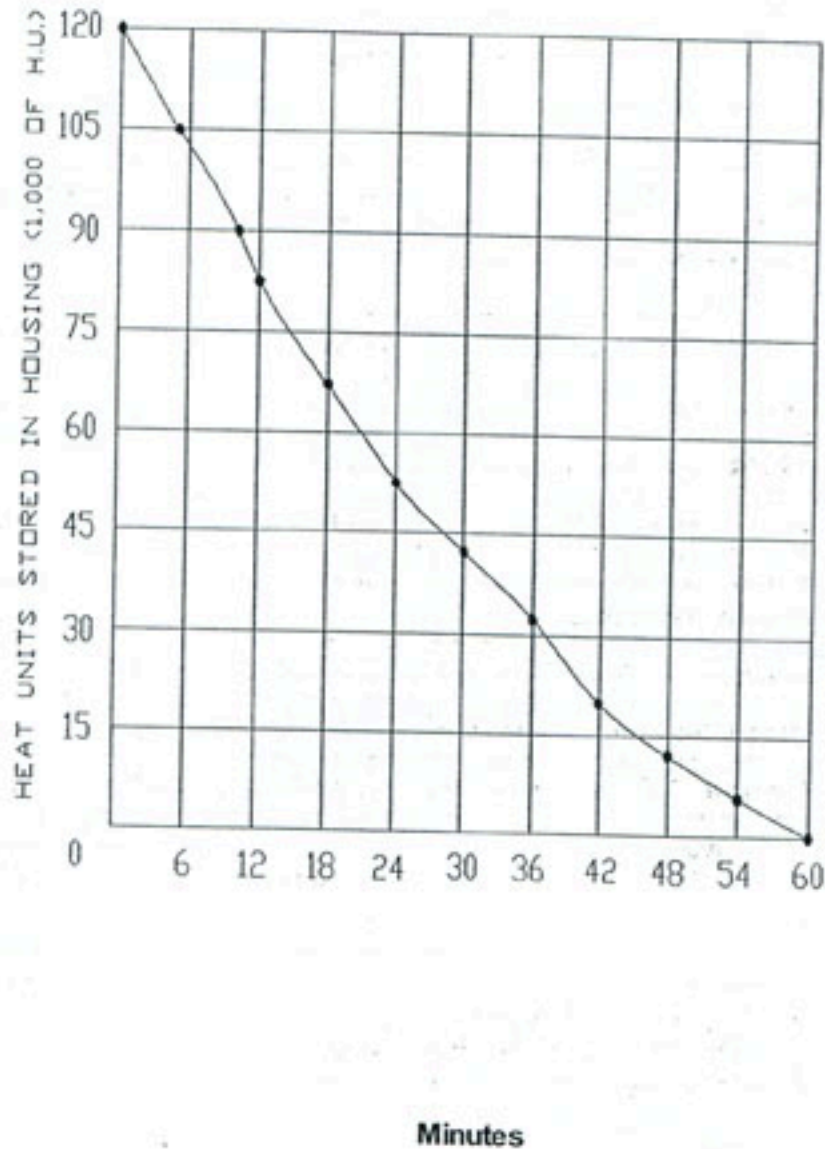
Instantaneous tube rating gives the maximum exposure permissible for a single exposure to ensure that excessive heat energy does not damage and pit the tungsten anode. As shown in Chart II, at 90 kVp and 15 mA, do not exceed a 3 second exposure or damage to the tube may result.





## CHART I -- COOLING CURVES

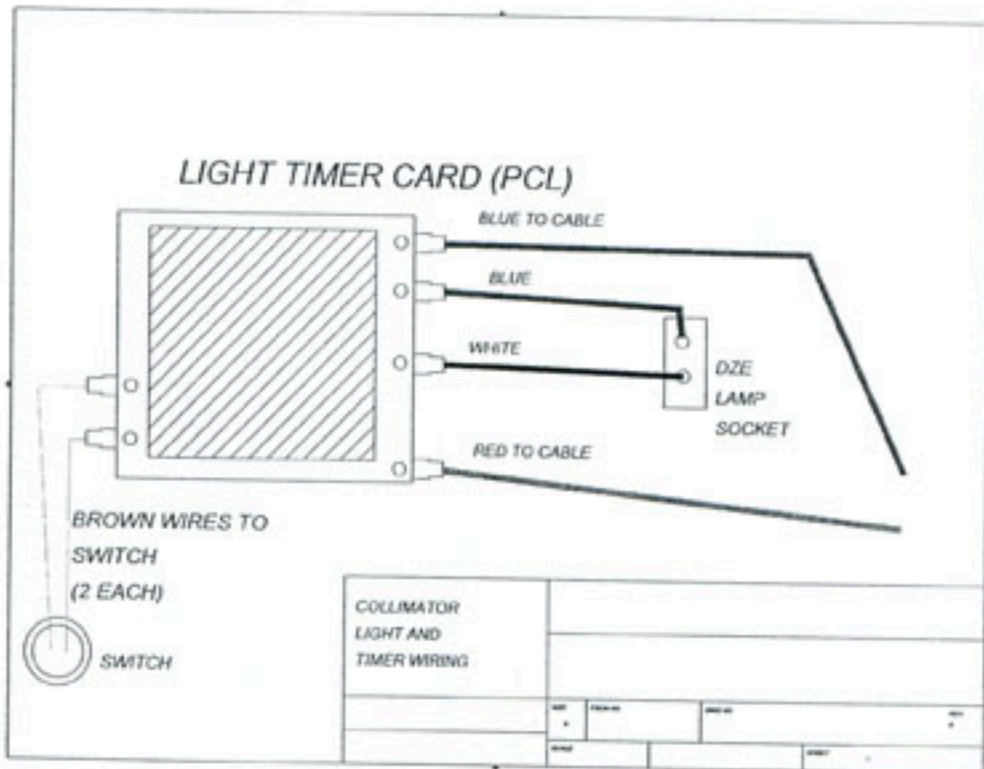
Continuous duty ratings give the maximum duty permissible to prevent overheating of the tube housing when a continuous series of exposures are made. Continuous duty ratings are important when a series of exposures exceeds 10 minutes or if cooling time of the tube housing between each series is not adequate.. See chart below.



### TECHNICAL DATA

1.) Rated Line Voltage = 120 volts, 60 Hz	P-700 Series	P-900 Series
2.) Maximum Current	20 amps	22 amps
3.) Line Voltage Range	110 - 130	110 - 130
4.) Line Voltage Regulation	5%	6%
5.) Technique Factors that Constitute Maximum Line Current	70 kVp 15 mA	90 kVp 10 mA
6.) Generator Rating & Duty Cycle (Full load)	70 kVp 15 mA 10% Duty Cycle	90 kVp 10 mA 6% Duty Cycle
7.) TUBE HOUSING ASSEMBLIES		
8.) Maximum rated peak tube potential	70 kVp	90 kVp
9.) Leakage Technique Factor	70 kVp @ 1.8 mA	90 kVp @ 1.33 mA
10.) Minimum Filtration (mm aluminum)	1.5 mm	3.2 mm
11.) Focal Spot - Tube (NEMA)	1.0 mm	1.0 mm
12.) Peak tube potential at which aluminum equivalent was obtained	70 kVp	90 kVp
13.) Cooling Curves (included) Chart I (SEE PAGE D-2)		
14.) Tube Rating Charts (included) Chart II (SEE PAGE D-3)		
15.) Anode Thermal Characteristics (inc.) CHART III (SEE PAGE D-4)		
16.) Maximum Deviation kVp mA Timer	+/- 10 kVp +/- 2.0 mA +/- 2 Pulse*	+/- 14 kVp +/- 2.0 mA +/- 2 Pulse*
17.) Definitions of Measurement Basis kVp - Peak tube potential during exposure mA - Average anode current Timer - Seconds		
* or 10% whichever is greater. Any timer test must include monitoring the line voltage regulation in a manner similar to the instructions shown on page C-8.		

End of life (EOL) 10 yrs. 5yrs on Re-Manufactured

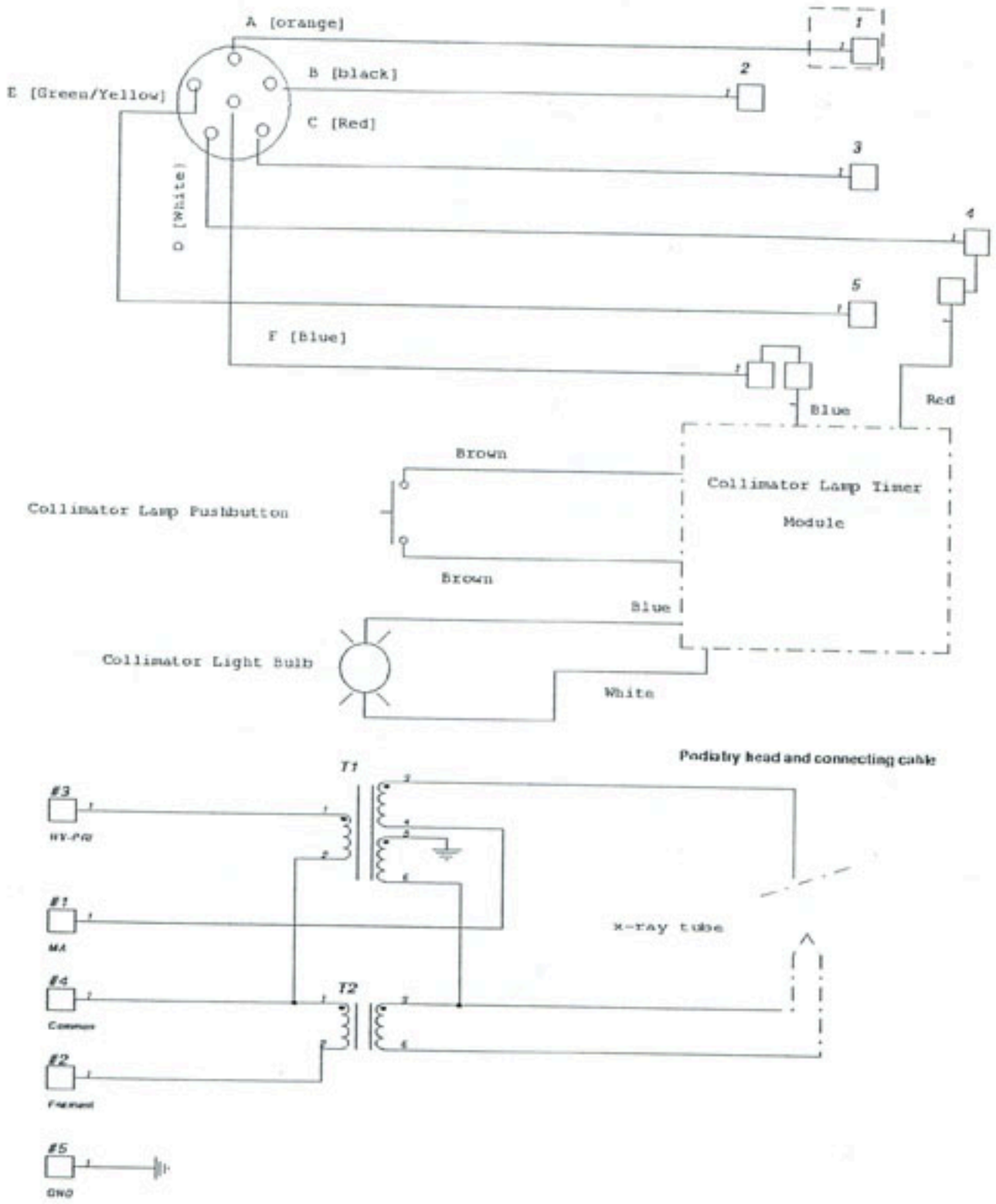


C-9c

TECHNICAL DATA

X-CEL X-RAY CORPORATION 4220 WALLER DRIVE CRYSTAL LAKE, IL 60012





C-9a

## LINE REGULATION TEST

### READ kVp Meter

Set unit to maximum mA, 1.0 seconds, and 70 kVp (90 kVp on 900 series). Operate unit and observe needle. Use a 150 VAC meter to read wall outlet voltage while operating x-ray. Use this equation for evaluation:

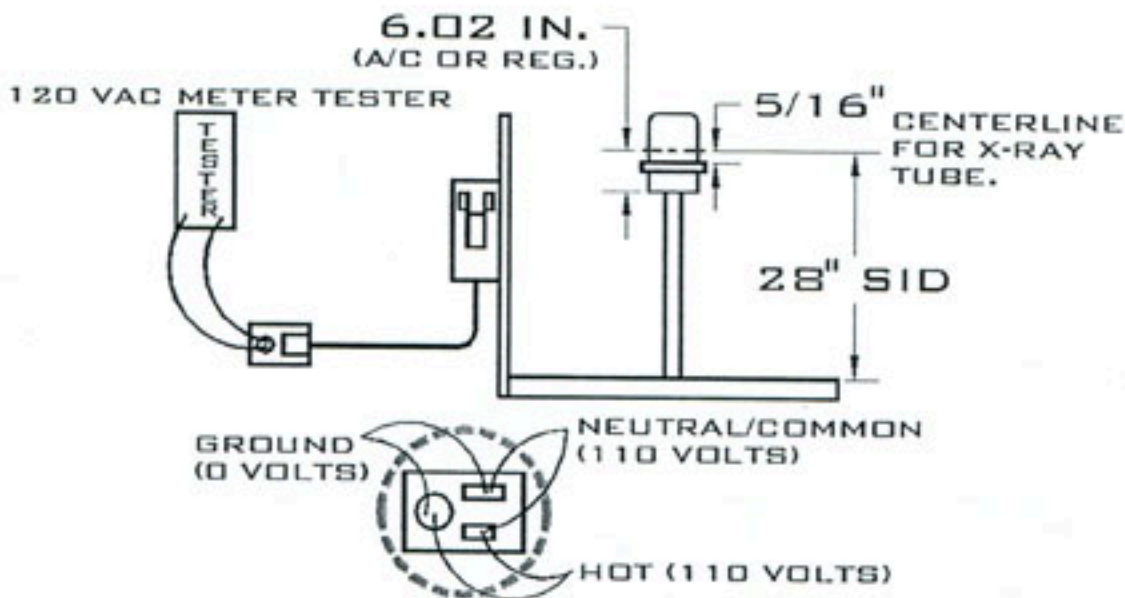
$$\frac{\text{--- (V no load) - (V full load)}}{\text{--- (V full load)}} \times 100 =$$

This will equal the percent of line regulation. Example:  $\frac{118 - 112}{112} \times 100 = 5.33\%$

$$\frac{\text{---}}{112} \times 100 = 5.33\%$$

Maximum is 5% for 70 kVp models.

Maximum is 6% for 90 kVp models.



H. Film too dark.	<ol style="list-style-type: none"> <li>1. Decrease time and check results.</li> <li>2. Also check dark room for light leaks. (Light leaks make heavy bone look gray.)</li> <li>3. Switch to 10 mA. Calibrate mA.</li> </ol>
I. Circuit breaker on control continues to blow. OR Timer gives short pulses.	<ol style="list-style-type: none"> <li>1. Disconnect tube head. If circuit breaker continues to blow, the fault is in control. If circuit breaker does not blow, the overcurrent is in the tubehead. Low on oil; try operating at lower kVp (about 50 or less). If ok at low kVp, problem may be arc over because of low oil. Put ear near head to hear "DINK" while firing.</li> <li>2. If problem is in control, triac on timer card may have failed, or inverse rectifier may have failed. Try loosening and re-tightening terminal strip connections on timer card.</li> </ol>
J. Centering light does not operate.	<ol style="list-style-type: none"> <li>1. On collimator timer, remove white and red wires from timer and connect together. If light works, timer card is bad. Also see page C-5 and wiring diagram, page C-10</li> </ol>
K. Sparks from control.	<ol style="list-style-type: none"> <li>1. Inspect for frayed wires or broken components.</li> </ol>
L. Tube head drifts	<ol style="list-style-type: none"> <li>1. Adjust spring. <ol style="list-style-type: none"> <li>A. Floor model - End of cylinder on arm. 3/4" open end or ratchet wrench required.</li> <li>B. Wall or Mobile model - Remove end cap on each cylinder on side of arm. 9/16" socket required.</li> </ol> </li> </ol>

C. X-rays are not produced	5. If voltage between L2 (#3) & T2 (#4) on timer does not appear 1 second after depressing pushbutton, timer failed (open circuit). If voltage appears across L2 & T2 in control, measure across terminals #3 & #4 at head. If no voltage, there is a bad connection to head.
	6. Sporadic voltage between L2 & T2 may indicate bad brush connection or timer card failure.
	7. Crackling or sputtering sounds in head indicate bad tubehead or an unconnected mA lead.
	8. mA meter does not deflect when exposure button is pushed and buzz is heard - x-ray filament may be burned out.
	9. To check: Remove shroud and check voltage across 2 & 4 (expect less than 85 V) after 1 second delay. If both check ok and there's no mA, tube is bad.
D. Clear films; mA meter reads; kVp meter dips slightly back (2 divisions - about 2 kVp); buzzer sounds; but films come out clear after development.	1. Developer could be neutralized (dead) due to a small amount of fixer in developer solution. Change solution.
E. No buzz.	1. Push button.
	2. If buzzer does not sound and mA meter deflects, buzzer may be bad. Clean under spring - a small dirt or metal particle will stop buzz.
	3. Use insulated wire to jump across #5 & #6 (push-button connections). If buzz is heard, the problem is in the pushbutton cord or the switch. To check switch, pop cap off switch and short switch. If it buzzes, switch is bad.
F. Exposure fails to be ended by timer	1. Try a different timer setting, and make an exposure. If failure continues, replace timer.
	2. Triac failed in closed position. Replace entire board. (Not timer.)
G. Film too light.	1. Increase time and check results.



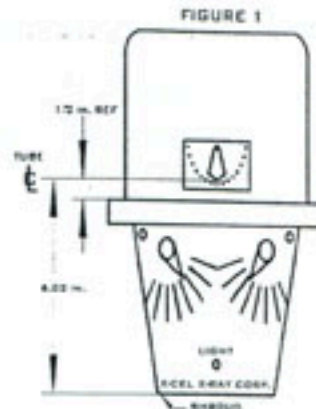
## REPAIR AND TROUBLE SHOOTING

SYMPTOM	REPAIR PROCEDURE
<p>A. Centering light does not light.</p> <p>(CAUTION! :When shroud is removed, always hold a protective shield above centering light. It is a tungsten halogen lamp and dangerous as it shatters in thousands of pieces.)</p>	<ol style="list-style-type: none"> <li>1. The blue wire of the lamp and the red wire of the timer card should read 24 vac.</li> <li>2. Turn on control and depress momentary switch on tubehead. Check voltage across switch. Should be zero before and approximately 8-10 volts DC after.</li> <li>3. If above checks out, check bulb. If filament is burned out, it must be replaced with a X-Cel #805086 lamp.</li> <li>4. If no voltage to switch, timer card may be bad or there may be loose connections at the card. Light is run off of terminal 4 (red) &amp; 6 (blue)</li> </ol>
<p>B. Exposure begins immediately when pressing main power ON/OFF switch to ON position</p>	<ol style="list-style-type: none"> <li>1. The timer card failed. Replace.</li> </ol>
<p>C. X-rays not being produced</p>	<ol style="list-style-type: none"> <li>1. Turn on unit and see if main power switch comes on. If it does not come on, see if building circuit breaker is off.</li> <li>2. If lights come on, check AC voltage across white wire on kVp meter. Select 10 mA and press exposure switch. Meter deflects to 80 - 85 filament volts and stays until button is released. If no voltage, either stabilizer (CVT) or rheostat is bad. Check 15 mA circuit if no reading, then stabilizer is bad.</li> <li>3. If no voltage in test 2 (above) from L2 and Rheostat, unsolder rheostat leads and check mA switch.</li> <li>4. Check voltage across #6 &amp; #3 on timer. It should be 120 VAC or the line voltage. Check voltage across #5 &amp; #3 it should be zero before depressing pushbutton and 120 VAC or line voltage after depressing. If any of these fail to check out, check pushbutton for continuity.</li> </ol>

**BEAM LIMITING DEVICE [BLD]  
(ADJUSTABLE BLADES)  
MODEL A/C**

The front panel of the adjustable collimator includes graduation to allow pre-determining the x-ray field size for the SID indicated. To use BLD, rotate the knobs on the front panel to the desired film size and SID (Distance) Pointer (knobs) should point to small punch mark when blades are closed completely.

Depress the light switch, (front center) and the light will operate for approximately 13 seconds. The lighted area represents the radiation field within 2% of the SID



**LAMP CHANGING INSTRUCTIONS – Fig 2**

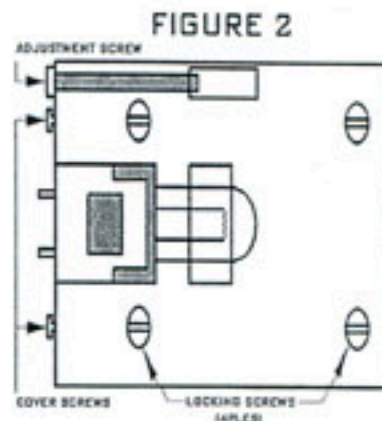
Unplug x-ray unit from wall outlet. Remove shroud; (fig 1) loosen screws on lamp cover, rotate x-ray head toward ceiling and remove lamp cover. Remove bulb by using the tip of a small screwdriver to lift bulb out. Use X-Cel #805086. CAUTION: Do Not Touch Glass With Your Fingers.

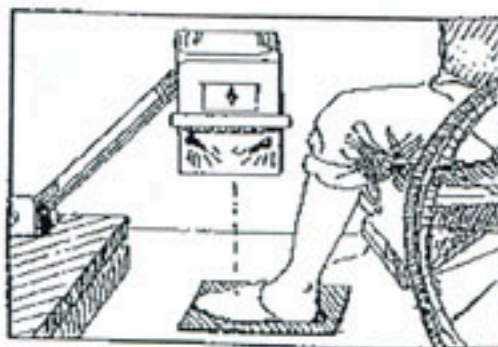
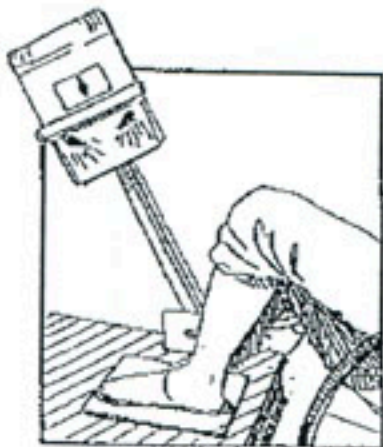
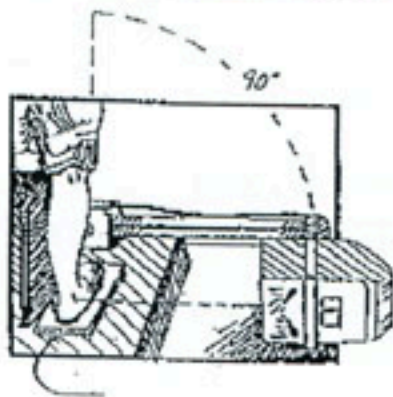
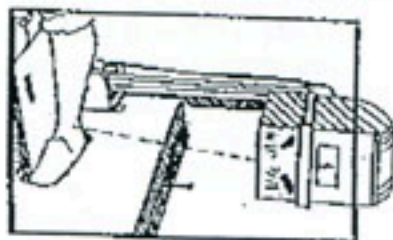
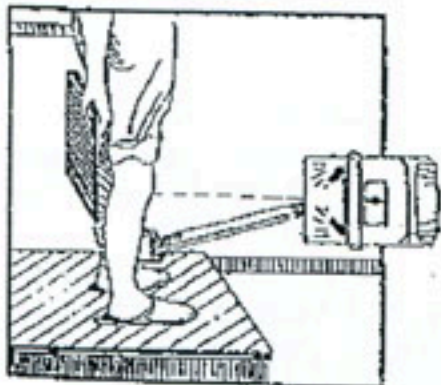
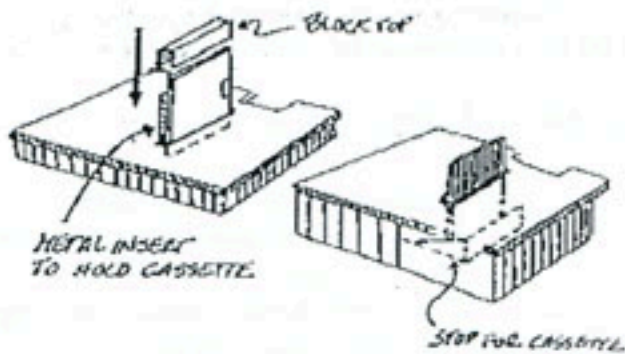
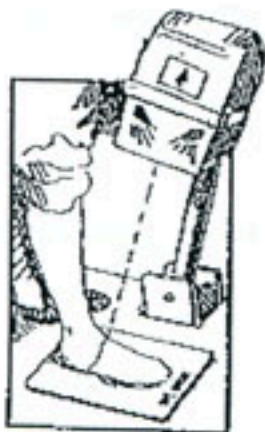
**To Adjust Lamp - Fig 2**

To align the light field, loosen the (4) screws marked 'A'. To move field side ways, rotate screw 'B' when adjustment is finished, tighten screws 'A'.

Light field and radiation field size will be correct when the lamp filament is centered over the collimator box frame.

The center of the filament the light should be 2 5/16" from the base of the collimator. Counter clockwise move the light to the left. (Towards the hand rail)





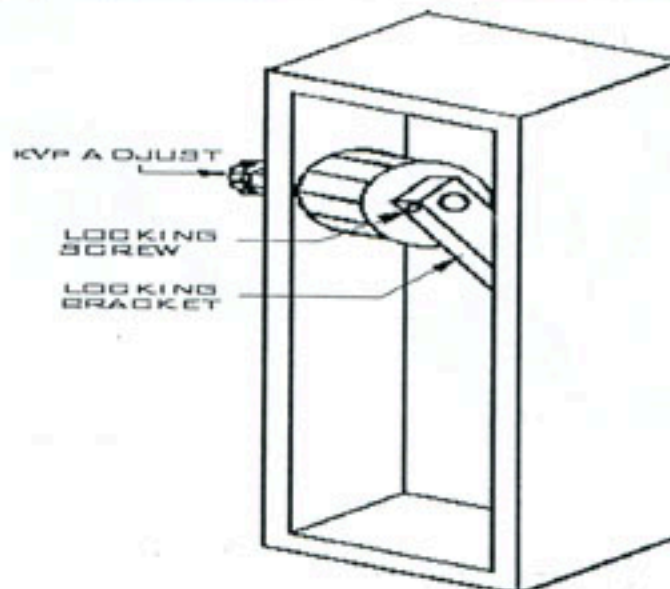
## OVERVOLTAGE SAFETY STOP ADJUSTMENT

The X-Cel X-Ray has a mechanical stop to prevent accidental damage to the x-ray tube and/or transformer. This is accomplished by a stop lever attached to the voltage power control. If the line voltage to the x-ray unit (wall outlet) is low, an adjustment may be required to obtain 70 kVp or 90 kVp whichever is maximum rated output.

### TO ADJUST THIS STOP:

1. Unplug the unit from the wall
2. Open the front cover by removing the six Philips screws and swing the hinged cover down to open.
3. Loosen the locking screw. See figure A.
4. Plug unit in and turn on.
5. While observing the kVp meter, turn the kVp adjustment knob (on outside of control, upper left hand side) to obtain 70 kVp.
6. Turn unit off and unplug.
7. Hold kVp adjustment knob and verify that safety stop is hitting the back of the control case.
8. Tighten safety stop lock screw.
9. Close front cover with one screw and turn unit on.
10. Verify unit will yield 70 or 90 kVp at full rotation of kVp adjustment knob.
11. If unit does yield maximum, replace remaining cover screws.
12. If unit does not yield maximum, repeat steps 1-10.

**CAUTION! - DO NOT ADJUST UNIT TO ALLOW MORE THAN 70 kVp AT FULL ROTATION ON 700 SERIES OR 90 kVp AT FULL ROTATION ON 900 SERIES.**



## MILLIAMPERE ADJUSTMENT

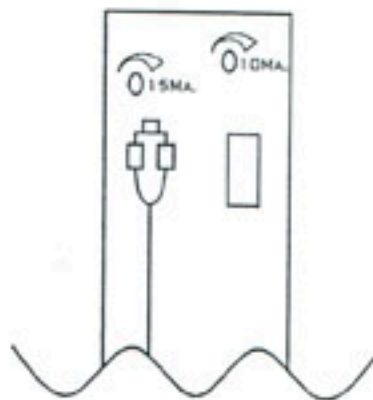
700 series (50 - 70 kVp)

**CAUTION! - TO SET LINEARITY-- RESET kVp WHEN SWITCHING FROM 10 TO 15 MA**

- 1) Select 10 mA at 65 kVp. Set timer to 1 SECOND (60 PULSES) (060).
- 2) Make an exposure. If milliamperes does not read 10, correct by use of rheostat in control. Rotate **CLOCKWISE TO INCREASE** and **COUNTER-CLOCKWISE TO DECREASE**. After resetting, make another exposure to verify setting. Use a small slotted screwdriver to make adjustments. The adjustment holes are located on the right side of the control. These adjustments will allow you a range of 5 mA.

If greater adjustments are necessary, **UNPLUG UNIT**, remove 6 screws from front of control case and swing cover down. On bottom of control case, there is a 300 ohm variable resistor. The 10 mA tap is connected by brown wire. To increase mA, move slide to right and to decrease, move to the left. The 15 mA tap is connected by a black wire.

- 3) Select 15 mA at 65 kVp on 15 mA scale of kVp meter and test as in Step 2.



900 Series (70 - 90 kVp)

Same as 700 series except make test at 85 kVp.

### SOURCE TO FILM DISTANCE

The maximum SID is 28 inches. (All units)

The minimum SID is 16 inches limited to 4 x 5 size.

(On Mobile & Wall models).



### ALIGNMENT VERIFICATION OF COLLIMATOR

- 1) Use a 10 x 12 film and select 8 x 10 aperture size.
- 2) Place monopak or cassette on base.
- 3) Place arm in vertical position.
- 4) Turn on control and set for normal exposure. Monopak - use 10 mA, 60 kVp at 1 3/4 seconds.  
Screen film - use 10 mA, 60 kVp at 30/60 seconds (.5) (030)
- 5) Turn on collimating lamp and center 8 x 10 projected image in center of 10 x 12 film.
- 6) Place markers in 4 corners of light - use paper clips bent at right angles. Mark upper right hand quadrant with a coin, for orientation.
- 7) Make exposure and develop film.
- 8) Misalignment maybe up to 2% of the SID.

### OPTIONAL METHOD

Use intensifying screen from cassette to view radiated area.

C-1



**TECHNIQUE CHART  
SUGGESTED STARTING POINTS**

FOOT	EXPOSURE TIME IN SECONDS	kVp	DIAGRAM
Foot Dorsal- Plantar 0/15 degrees	.5 = 030	50	
Lateral 90 Degrees	.75 = 045	55	
Lateral Oblique 40 Degrees	.5 = 030	55	
Medial Oblique 25 Degrees	.75 = 045	55	
Raised Hallux or Digit	.5 = 030	50	
Axial Calcaneal 25 Degrees	1.0 = 060	55	
Harris & Beath 35/40 Degrees	1.25 = 075	65	
<b>ANKLE</b>			
Anterior - Posterior or Mortise	.75 = 045	60	
Lateral	.75 = 045	55	
Lateral Oblique	.75 = 045	55	
Medial Oblique	.75 = 045	55	
<b>NOTE: These are suggested starting points. Adjust time and kVp as needed.</b>			

ALSO REFER TO IMAGE LETTER ON PAGE E-1

Manufacturer warrants to Buyer, for the timer period set forth below, that the new X-Cel X-Ray equipment sold under Serial Number indicated is of kind and quality as specified in said invoice and shall be free from defects in material and manufacturing workmanship as described below. Manufacturer further warrants that said equipment was manufactured in conformance with the Federal Performance Standard 21 CFR 1020.

**TIME PERIOD**

Defects in material and manufacturing workmanship relating to the mechanical operations of the equipment are warranted herein for a period of sixty (60) months from the date of original installation provided said equipment has been installed according to manufacturer's instructions and a completed Warranty Registration/Installation Report has been received by X-Cel X-Ray Corporation. IF SAID WARRANTY REGISTRATION/INSTALLATION REPORT IS NOT FULLY COMPLETED AND RETURNED TO X-CEL X-RAY CORPORATION UPON INSTALLATION OF SAID EQUIPMENT, THIS WARRANTY SHALL NOT APPLY.

Defects in material and manufacturing workmanship relating to the X-ray tube and to the electrical operation of the equipment are warranted herein for a period of twenty four (24) months from the date of original installation in accordance with conditions set forth above. Subsequent to the expiration of said defects in material and manufacturing workmanship relating to the electrical operation of the equipment on the following pro-rated basis:

Time Period	Manufacturer's Obligation	Buyer's Obligation
From the 24 <sup>th</sup> month to the 36 <sup>th</sup> month	75% of cost of repairs or replacement	25% of cost of repairs or replacement
From the 36 <sup>th</sup> month to the 48 <sup>th</sup> month	50% of cost of repairs or replacement	50% of cost of repairs or replacement
From the 48 <sup>th</sup> month to the 60 <sup>th</sup> month	25% of cost of repairs or replacement	75% of cost of repairs or replacement

From and after the 60<sup>th</sup> month from the date of original installation, the Manufacturer shall have no obligation under this warranty.

**DISCLAIMER OF UNSTATED WARRANTIES**

THE WARRANTY PRINTED ABOVE IS THE ONLY WARRANTY APPLICABLE TO THIS PURCHASE. ALL OF THE OTHER WARRANTIES, EXPRESS OR IMPLIED, WRITTEN OR ORAL, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED.

**SCOPE OF WARRANTY**

Manufacturer's obligations under this Warranty shall be limited, at the Manufacturer's election, to either (a) the repair of any defective part or parts, or (b) making available at the place of assembly any necessary repaired or replacement part or parts of assemblies. Written notice of any defect shall be given by Buyer to Manufacturer within thirty (30) days after the defect appears.

Manufacturer's obligation herein is conditioned upon (a) proper use and maintenance of the equipment and conformance with any applicable recommendations of Manufacturer, and (b) Buyer making the equipment available for inspection and correction, if necessary, after written notification set forth above. Manufacturer does not warrant any products of others where Manufacturer serves solely as a distributor or reseller of such product.

All Shipping charges and Rental Fees are the responsibility of the Buyer. Labor charges outside of the X-Cel X-Ray factory are the responsibility of the buyer.

**LIMITATION OF LIABILITY**

THE BUYER'S SOLE AND EXCLUSIVE REMEDY FOR BREACH OF WARRANTY IS SET FORTH ABOVE. THE WARRANTY SET FORTH ABOVE IS THE ONLY WARRANTY APPLICABLE TO THIS PURCHASE AND IS EXTENDED TO BUYER ONLY AND NOT TO ANY SUCCESSIVE BUYERS, USERS OR THIRD PARTIES, OR EMPLOYEES. IN NO EVENT SHALL MANUFACTURER HAVE ANY LIABILITY WHATSOEVER FOR PAYMENT OF ANY CONSEQUENTIAL, INCIDENTAL, INDIRECT, SPECIAL, TORT OR CONTRACT DAMAGES OF ANY KIND, INCLUDING BUT NOT LIMITED TO, ANY LOSS OF PROFITS OR EXPECTATIONS.



## PREVENTIVE MAINTENANCE

In order to keep your X-Cel X-ray podiatry unit in compliance with HEW 21 CFR 1020, the following preventive maintenance schedule is recommended:

TASK	INTERVAL
1. Rotate kVp selector knob 5 full rotations back and forth. Reset kVp at desired setting. This will insure maximum life of variac.	Weekly
2. Perform functional installation check. (See section B, pages B-1 & B-2)	Every six months
3. Verify milliamperage adjustment. (See section C, page C-1)	Every six months
4. Tight all screws and bolts.	Once per year
5. Check wiring for proper clearance and routing. See assembly chart / diagram page A-4.	Once per year
6. Test spring balance and adjust as required. See adjustment instruction page C-7.	Once per year
7. Check for any physical damage on tubehead which may impair function. (Like head square with arm)	Once per year
8. Check for oil leakage (Remove bezels on head)	Once per year
9. Check cable for cracks of wear.	Once per year
10. Check control knobs for secure attachment and proper indexing. (Feel for looseness)	Once per year
11. Ensure that nameplates are properly attached. Refer to page C-1.	Once per year
12. Centering light field verification. Refer to page C-1.	Once per year
13. Examine brushes on variac (kVp selector) for wear and corrosion. CLEAN WITH ALCOHOL. Replace if excessive wear is indicated.	Once per year

## EXPOSURE FACTORS

### EXTREMITY RADIOGRAPHIC TECHNIQUES

Some film & screen combinations require more time.

The speed film or Detail System are recommended.

For casts, the required exposure time may increase up to 5 times. It varies with patient and water content.

Cassettes with only one screen may require 2 or 3 times more exposure time.

Non-screen film may require more time than screen film.

MAKE FIRST EXPOSURE AT 55 kVp; .5(30/60) seconds. See procedure on previous page B-4.

For children 7 - 15 years less 1/4 of the time setting of adults.

For children 1-6 years less 1/2 of the time setting of adults.

For greater density (blackness of film) increase exposure time.

For more soft tissue exposure, reduce kVp setting.

If the flesh outline beneath the weight bearing foot is desired on the lateral projecting, have the patient stand on 1/4 inch thick hard piano felt. To make a lateral exposure, drop tubehead to 90 degrees on the dial, push light switch and position patient, film and tubehead.

### ADDITIONAL DARK ROOM NOTES

- A. The developer has its life shortened by TIME and/or USE.  
Record the number of films developed to help to tell how often the solutions should be replenished or replaced.
- B. If you have an automatic processing unit, proper maintenance must be performed. Count the number of films developed so the solution can be changed. Replenishment is very important. If the processor has not been used for a few days, you may have to replenish manually or by triggering the feed switch, thus causing the system to replenish. This will ensure full strength solutions.
- C. Also refer to image letter on page E-1.

## DARKROOM - GENERAL

### FOG - DARKROOM

- |                     |   |
|---------------------|---|
| Film Symptom        | - Gray in bone area (should be clear)   |
| -                   | Over-all very dark film. (Including areas that should be clear)   |
| -                   | Poor contrast between bone and exposed film.  |
| Correction          | - Without safe light, check darkroom for light leaks. NOTE: It takes at least 10 minutes for your eyes to fully adjust to the darkness. Stand in darkroom until eyes adjust, then stop all light leaks. |
| Test                | - Expose film to x-ray with object in place (can be set of keys).   |
| Safe Light          | - Use 7 ½ watt bulb.  |
| -                   | Use proper filter.  |
| -                   | - CAUTION: Check to be sure the filter used is compatible   |
| -                   | - Mount safe light about 4 feet from film.  |
| To Check Safe Light | - Expose film close to safe light in darkroom for about 4 - 5 minutes.  |

### SUGGESTED PROCEDURES FOR OBTAINING HIGH QUALITY FILMS:

1. Be sure DARKROOM is "SAFE" - read about fog - symptoms and corrections.

#### NOTE !!

**WITH OUT A SAFE DARKROOM,  
ADJUSTMENTS OF THE X-RAY  
WILL NOT WORK!**

2. Begin with new developing solutions.
3. MAINTAIN PROPER TEMPERATURE (usually 68 degrees F).
4. Use timer of FULL TIME REQUIRED for the film used (usually 4 ½ minutes).
5. Set kVp to 65. (Right hand meter on x-ray control). (55 works well for small extremities)
6. Set mA switch to 10 mA (located below left hand meter).
7. Set time for 30/60 (reads 030 on timer display).
8. Expose a heavy object such as a set of steel or brass car keys or a hand tool.
9. Develop film as outlined previously.
10. Use "finger test" to determined proper density by holding finger between film and light. You should be able to "just see" your finger move when viewing it through the dark part of the exposed and developed film. Increase or decrease TIME of x-ray exposure until remainder of film dark. This will give contrast to all future films.
11. Adjust the kVp will control the contrast. Decrease kVp for more contrast and increase kVp for heavier or thicker bodies.

## MICROPROCESSOR CONTROLLED TIMER (MCT)

### Operating Instructions

The MCT is a state-of-the-art microprocessor controlled timer coupled with digital readout and keypad entry. It reads out in 60ths of a second and allows the user to enter any time amount from 6/60ths of a second (1/10 sec.) To 180/60ths of a second (3 seconds). An abbreviated conversion chart is printed on the control case cover. We have also included in the owners manual a blank technique chart that has a conversion chart. Federal law requires that you fill it out after refinement of your technique and hang it near your control.

Upon turning on your unit, the MCT has a memory which will display the last time correct time entered into it. Note: When entering a time setting, all three digits must be typed on the keypad. For example, when entering 30/60ths of a second (1/2 second), you must enter 030. An entry of just 30 will result in an error display. An error upon entry is displayed as UUU. When this results, simply re-enter the time desired (030). An error will result if a time is too low (less than 006) or too high (greater than 180) is entered.

When an exposure is taken, the display will blank and will not reappear until the exposure button is released. The timer will reset and remain on the last time entered.

A brief overview of the features and operating rules:

1. Digital Display and keypad entry.
2. Operates in 60ths of a second from 6/60 to 180/60.
3. All three digits must be entered (030, 049, etc...).
4. Errors display as UUU.
5. Memory retains the last time entered.
6. The timer may be reset by turning the control OFF and ON.

If you have any questions concerning this timer, please call X-CEL X-RAY at (815) 455-2470.

**Caution:** Federal Law restricts this device to sale by or on the order of a physician.



**TEMPLATE FOR MOUNTING THE CONTROL**

