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**trophy**

70 - X

INTRA-ORAL X-RAY SYSTEM

USER'S MANUAL

## IMPORTANT ! ... X-RAY PROTECTION

X-ray equipment may cause injury if used improperly. The instructions contained in this manual must be read and followed when operating the 70-X. TROPHY dealers will be glad to assist you in putting the 70-X into operation.

The 70-X provides a high degree of protection from unnecessary X-radiation. However, no practical design can provide complete protection, nor prevent operators from exposing themselves or others to unnecessary radiation.

It is important that you be fully acquainted with applicable government radiation protection regulations. Many provisions of these regulations are based on the recommendations the National Council on Radiation Protection and Measurements. Recommendations for dental X-ray protection are published in NCRP Report Number 35 available from NCRP Publication, P.O. Box 30175, Washington, D.C. 20014.

Personal radiation monitoring and protective devices are available. You are urged to use them to protect against unnecessary X-radiation exposure.

## TABLE OF CONTENTS

Section	Paragraph	Title	Page
I		INTRODUCTION	1
II		IDENTIFICATION LABELS	1
III		DESCRIPTION OF MAIN COMPONENTS	
	3.1	Tube housing assembly (tubehead)	1
	3.2	Beam limiting device (cone)	1
	3.3	Wall mounted arm	2
	3.4	X-ray control	2
IV		70-X CONTROLS	3
V		GENERAL SPECIFICATIONS	
	5.1	Power supply requirements	5
	5.2	Accuracy of technical specifications	5
	5.3	Tubehead specifications	5
	5.4	Cone specifications	5
	5.5	Measurement basis	5
	5.6	Duty cycle	6
VI		USE	
	6.1	Patient positioning	8
	6.2	Tubehead positioning	8
	6.3	Making exposures	8
	6.4	Use of the timer	13
	6.5	Role of the beam limiting device	14
VII		MANUAL FILM PROCESSING	16
VIII		70-X MAINTENANCE SCHEDULE	17
IX		TROUBLE SHOOTING CHART	19

## LIST OF FIGURES

Figure number	Title	Page
1	70-X system	2
2	X-Ray control	4
3	Tube chart	7
4	Cooling curve	7
5	Duty cycle	7
6	Patient positioning	9
7	Tubehead positioning	9
8	Exposing	10
9	Exposing	11
10	Film positioning	12
11	Role of the diaphragm	14

## LIST OF TABLES

Table Number	Title	Page
1	Exposure time table	6
2	Film type table	13
3	Correction table (voltage)	14
4	Time setting table	15
5	Main causes of poor films	16

## I. INTRODUCTION

The 70-X intra-oral system is an X-ray unit for dental use, which, in order to give full satisfaction and to ensure perfect use, should be installed by skilled personnel following the electrical and mechanical instructions carefully. The purpose of this manual is to recommend proper operating procedures and to provide the required information for using the 70-X intra-oral X-ray system.

## II. IDENTIFICATIONS LABELS

70-X components have identification labels that specify the model number, serial number and applicable product approval testings. These components are subject to US Government Radiation Performance standards 21 CFR, Sub Chapter J.

## III. DESCRIPTION OF MAIN COMPONENTS

*See Figure 1.*

### 3.1 Tube housing assembly (tubehead)

The tube housing assembly AD 17 includes an X-ray tube and a high voltage transformer. These components are immersed in oil inside the tubehead.

An aluminium filtration system X-ray beam quality and reduces the patient radiation exposure. The focal spot (X-ray source) is externally located. The X-ray beam can be easily aligned with the angulation scale, the directing handle and the beam limiting device (Cone).

### 3.2 Beam limiting device (Cone)

It establishes the distance from the X-ray tube to the patient's skin and assists in positioning the tubehead.

It limits the X-ray beam a 2''1/6 (5,5 cm) diameter circle at the end of the cone. Its focal length is 8'' - (20,3 cm).

### 3.3 Wall mounted arm (suspension)

This is an articulated, counterbalanced arm which enables correct positioning of the tubehead with respect to the patient. At the end of the arm, there is a co-axial connector for the electrical and mechanical connections of the tubehead. Its maximum reach is 65'' 3/8 (166 cm) with a 23'' 5/8 (60 cm) cm extension arm, or 73'' 1/4 (186 cm) with a 31'' 1/2 (80 cm) extension arm.

### 3.4 X-ray control

It contains electronic circuitry that controls exposure time. It can be installed either in the wall mounted bracket or in a separate wall box.

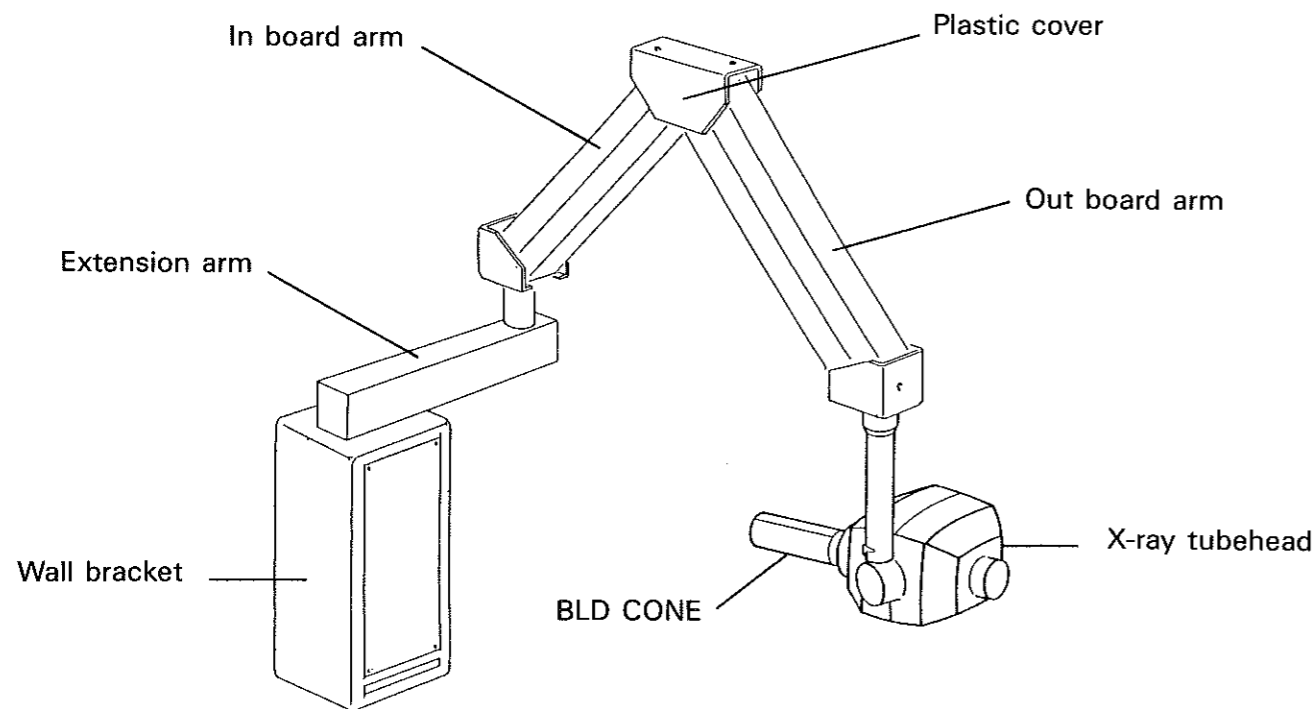


FIGURE 1

## IV. 70 X X-RAY CONTROLS

### 1) Film type selector (T)

Set the timer to the type of film being used.

### 2) Program keyboard (P)

Press the number of the tooth to be X-rayed

### 3) X-ray indicator (Y)

Orange indicator that lights up while X-rays are being emitted

### 4) Power-on indicator (I)

Green indicator that lights up when the unit is switched on

### 5) Fuse (F)

Overload protection

### 6) Power switch (S)

Set to I to switch on

### 7) Connector for control cord (Z)

### 8) Control cord (X)

A 10' (3 meter) coiled cord connected to the CCX control box with a pushbutton and an orange indicator light (Y')

Press the pushbutton to make an exposure and hold it down until the end of the exposure.

Release it when the orange indicator (Y) and (Y') have gone out.

### 9) RVG program (R)

Press the RVG key when the TROPHY RadioVisioGraphy system is to be used (refer to RVG user's manual)

### 10) Alarm lights (A) (M)

(A) indicates a malfunction in the tubehead, the power circuit or the microprocessor

Switch off the timer and call the Trophy technical service or a qualified technician

(M) indicates an operator error

### 11) BITE WING program (B)

Press B to make a BITE-WING X-ray

### 12) OCCLUSAL program (O)

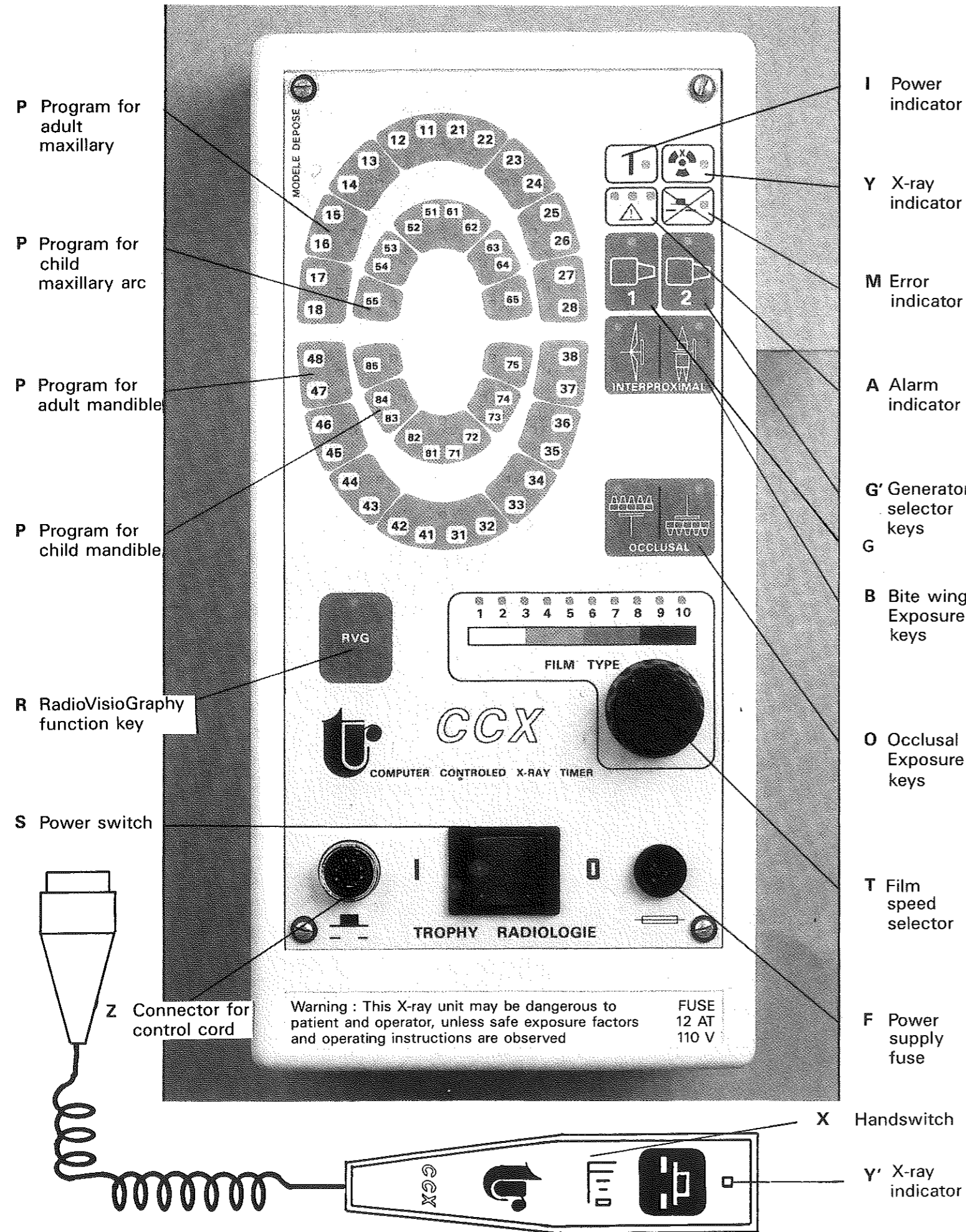
Press (O) to make an OCCLUSAL X-ray

### 13) Tubehead selector (G)

(the CCX timer can run two X-ray tubeheads)

Press 1 or 2 according to the tubehead to be used.

## X-RAY CONTROL



## V. GENERAL SPECIFICATIONS

Cooling and duty rating specifications apply for altitudes up to 12.000 ft (3.600 m) average relative humidity not exceeding 95 percent, and maximum room temperature not exceeding 80° F (27° C).

### 5.1 Power supply requirements

- *Line voltage* must be in the range of 99 to 125 volts rms, 60 Hz  
Abrupt changes in voltage caused by other loads should be infrequent and of short duration.

- *Line current* (during an exposure) : 10 amps maximum.  
Technical specifications constituting the maximum line current condition are fixed at 70 Kvp and 8 mA.

- *Line voltage* fluctuation must not exceed 3 percent at 70 Kvp-8 mA

### 5.2 Accuracy of technical specifications

Peak tube potential : 70 Kvp  $\pm 12\%$   
 Tube current : 8 mA  $\pm 1,5$  mA  
 Exposure time : see exposure time table page 6

With nominal line voltage 110 V. Time accuracy is :  
 $\pm .03$  sec for times less than to .20 sec  
 $\pm .05$  sec for times equal or greater than .20 sec

### 5.3 Tube head specifications

Maximum rated peak tube potential :  
 70 Kvp at 8 mA tube current.

Minimum filtration (permanently installed in the useful beam)  
 equivalent 1,5 mm aluminium at 70 Kvp.

Radiation leakage : less than 100 mR in one hour at 50 cm with 8 mA (maximum rated continuous tube current) and 70 Kvp (maximum rated peak tube potential)

Typical half value layer : 1,8 mm aluminium at 70 Kvp.

Line voltage : possible adjustments with three settings of 100 V, 110 V and 120 V.

### 5.4 Cone specifications

X-ray field size : containable in a 6 cm maximum diameter circle, measured at the end of the attached cone.

Distance from the focal spot to the end of the cone is 8'' - (20,3 cm)

### 5.5. Measurement bases

- *Filament Warm-up* :

Each exposure is preceded by a filament warm up time about .28 seconds. During this time, a low level of radiation is produced. The peak tube potential varies during the filament warm-up from approximately 40 to 60 Kvp. Although the amount of radiation produced during this time is small, it is useful and contributes to forming the image on the film.

- *Peak tube potential*

Direct measurement of steady-state peak voltage across the X-ray tube, using a peak voltmeter and high voltage probes.

**EXPOSURE TIME TABLE**  
Nominal line voltage 110 V

PRESETTING	TIME/sec.
<b>ADULTS</b>	
42. 41. 31. 32	.24
44. 43. 33. 34	.24
46. 45. 35. 36	.30
48. 47. 37. 38	.30
12. 11. 21. 22	.30
23. 24. 13. 14	.30
25. 26. 15. 16	.38
27. 28. 17. 18	.46
<b>CHILDREN</b>	
82. 81. 71. 72	.16
83. 84. 73. 74	.22
85 - 75	.24
52. 51. 61. 62	.20
63. 64. 53. 54	.20
55 - 65	.26
<b>BITE-WING INTERPROXIMAL</b>	
Cuspids/Incisors	.24
Pre-molars/molars	.30
<b>OCCLUSAL</b>	
Maxillary	.60
Mandibular	.60

Table 1

• **Tube current :**

Direct measurement of the steady state average current using a milliamp meter.

• **Exposure time :**

The total time is equal to the filament warm up time of .28 sec plus the selected exposure time plus the time of demagnetizing of .10 sec.

The selected exposure time is measured through an electronic chronometer to the timer output.

• **Half value layer :**

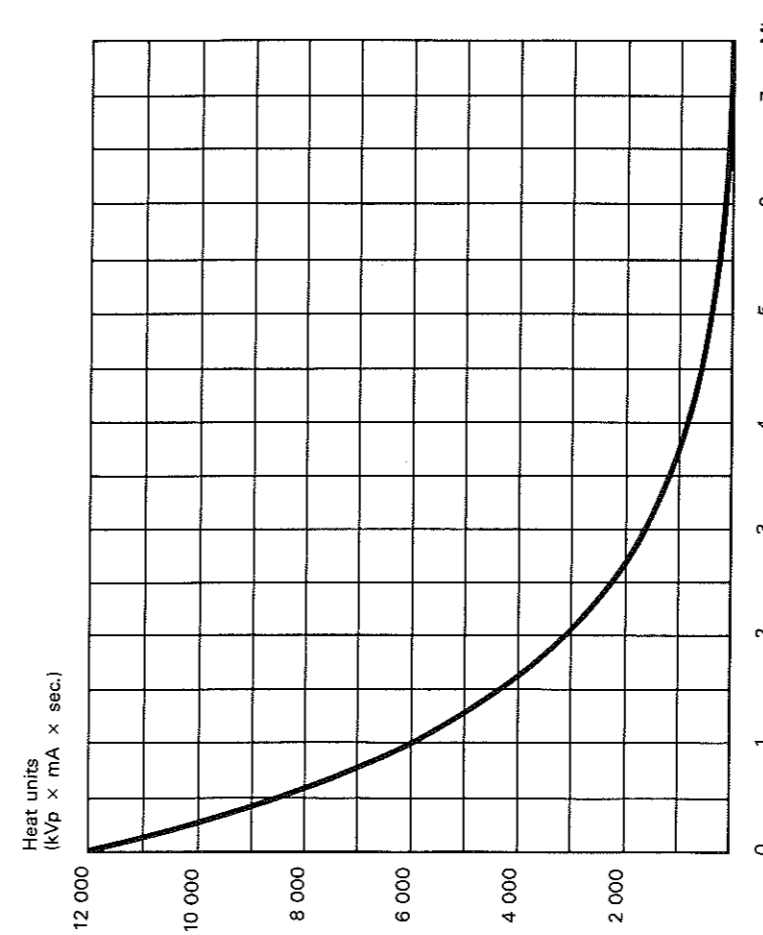
Is measured on an unused system installed on 110 V, 60 Hz line with 3 % regulation and calibrated to the midrange values of the manufacturer's recommendations. Film type on 10 ; program (27.28).

**5.6 Duty cycle**

The maximum allowable duty cycle is 1 : 30. That is a user or service person must not exceed one unit of "on-time" for every 30 units of "off-time".

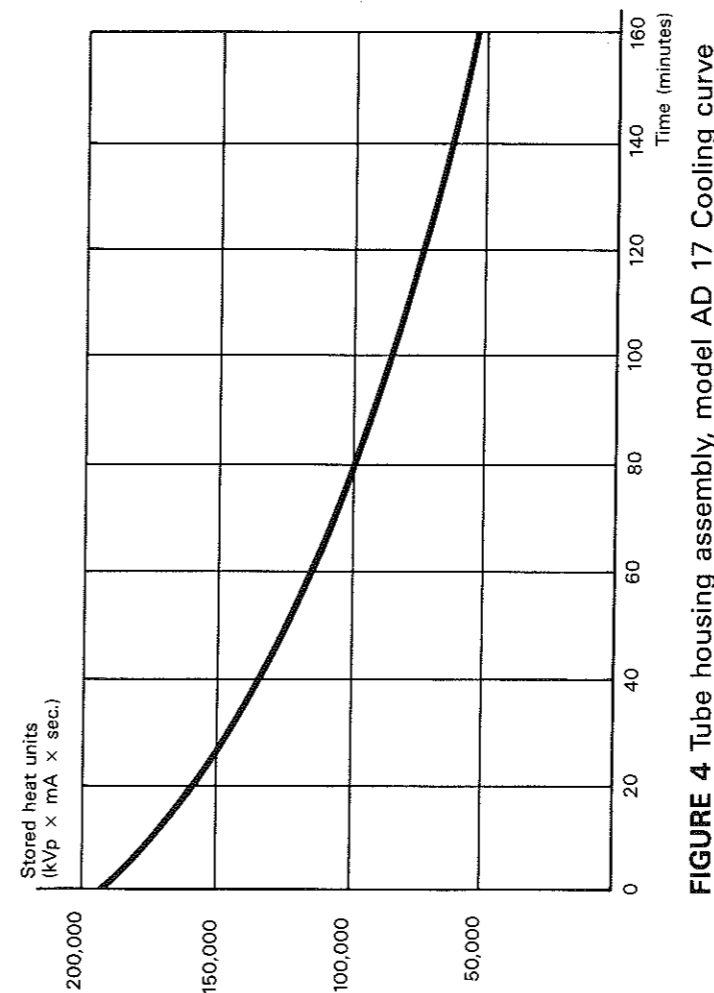
The cooling curve and duty cycle of 70-X tubehead can be seen in figures 4 and 5.

FILM TYPE SELECTION	VARIATION %	COEFFICIENT
1	- 75 %	.25
2	- 50 %	.50
3	- 37.5 %	.625
4	- 12.5 %	.86
5	0 %	1
6	+ 40 %	1.4
7	+ 80 %	1.8
8	+ 140 %	2.4
9	+ 220 %	3.2
10	+ 300 %	4

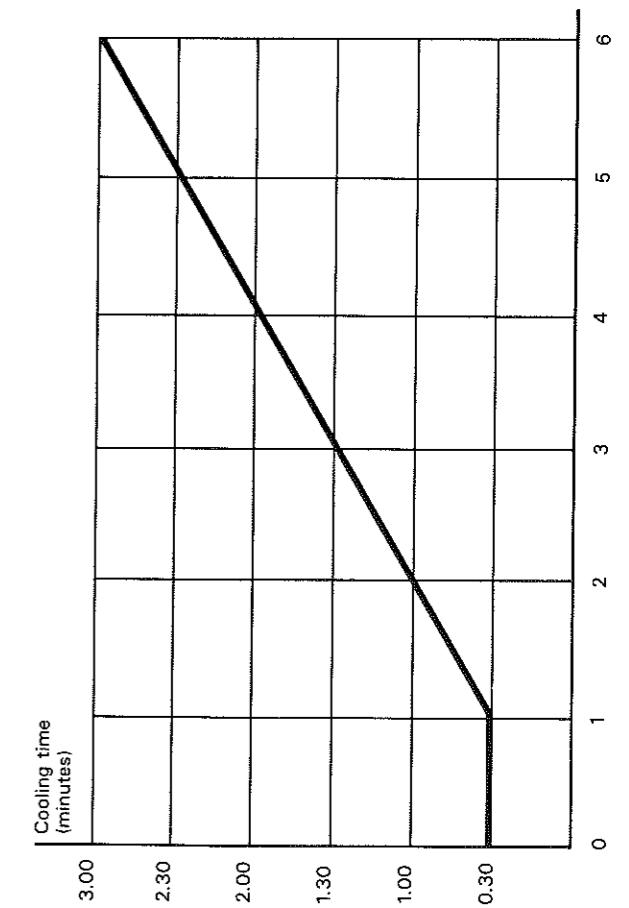


**FIGURE 3**

X-ray tube model DG 073  
Anode cooling curve  
X-ray specifications  
Focal spot size : .7 mm x .7 mm  
Service voltage : 70 Kv  
Maximum rated current : 8 milliamperes  
Type : Grid regulation



**FIGURE 4** Tube housing assembly, model AD 17 Cooling curve



**FIGURE 5** Duty cycle

## VI USE

### 6.1 Patient positioning

The patient should be positioned on the vertical "sagittal" plane (see figure 6) :

- X-ray of upper maxillary : the plane through the nose and ears should be horizontal (Frankfurt)
- X-ray of lower maxillary : the occlusal plane should be horizontal.

### 6.2 Tubehead positioning

The articulated, counterbalanced arm enables correct positioning of the tubehead for all types of exposures.

The beam limiting device (Cone) determines the minimum source-to-skin distance, enabling correct exposure. To avoid distortion, it is possible to place the film parallel to the axis of the tooth (see figure 7) ; pictures obtained under these conditions should be of acceptable geometrical quality but they produce smaller dimensions than the conventional method.

### 6.3 Making exposures

Place the unlabelled side of the film against the area to be X-rayed.

A. Figure 8 shows the film position and the angle of the tubehead under the bisecting technique. The patient should hold the film with his thumb, keeping the other fingers outside the X-ray beam.

B. Figure 9 shows the position of the film and the tubehead under the parallel plane technique ; here, a film holder should be used. Figure 10 shows the film position and angle of the tubehead in the case of bite-wing and occlusal techniques.

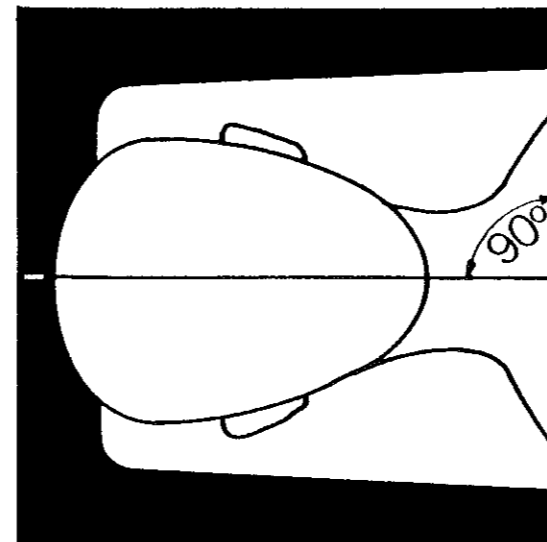
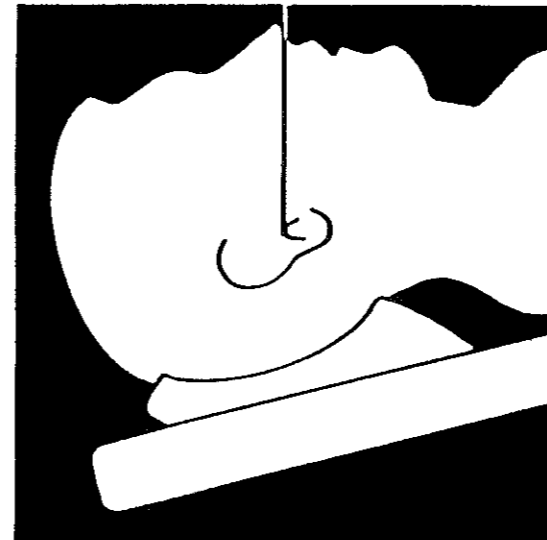
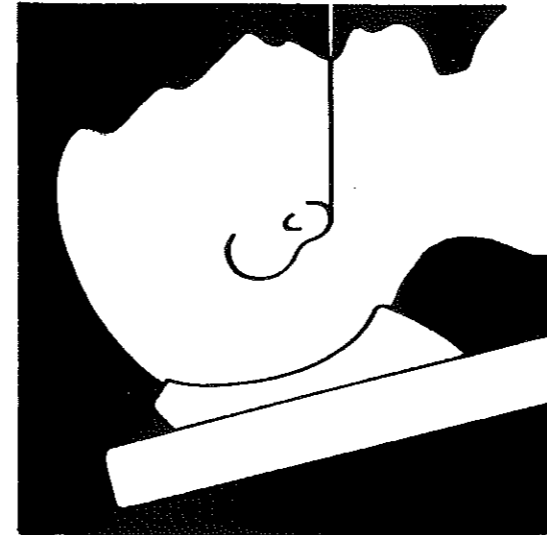


FIGURE 6 : PATIENT POSITIONING

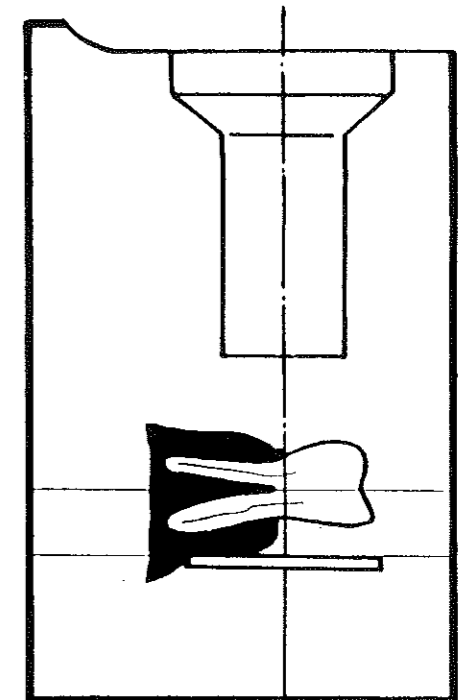


FIGURE 7 : TUBEHEAD POSITIONING

FIGURE 8 : EXPOSING

POSITIONING WITH PERIAPICAL FILM

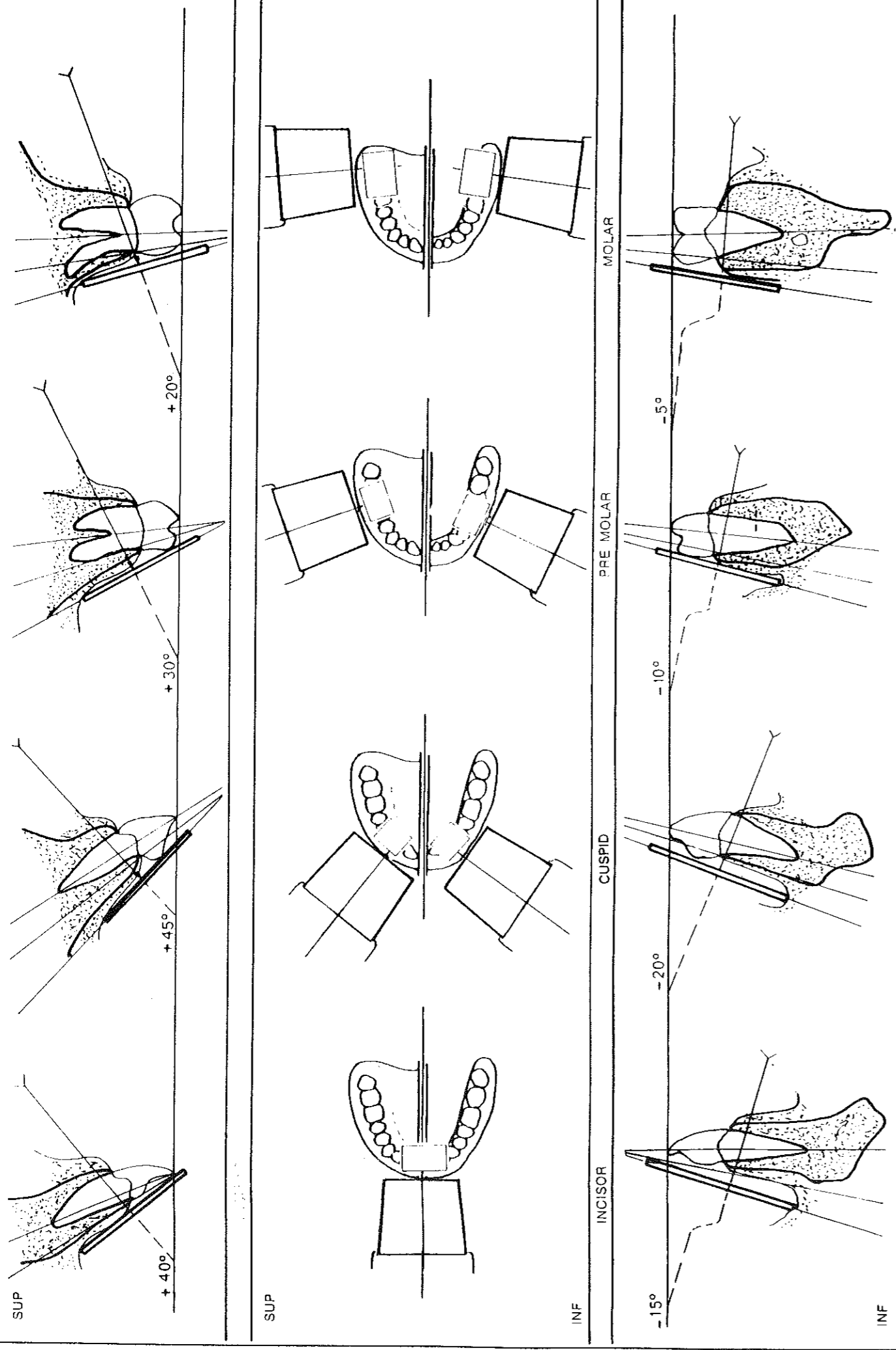


FIGURE 9 : EXPOSING

POSITIONING WITH LONG CONE

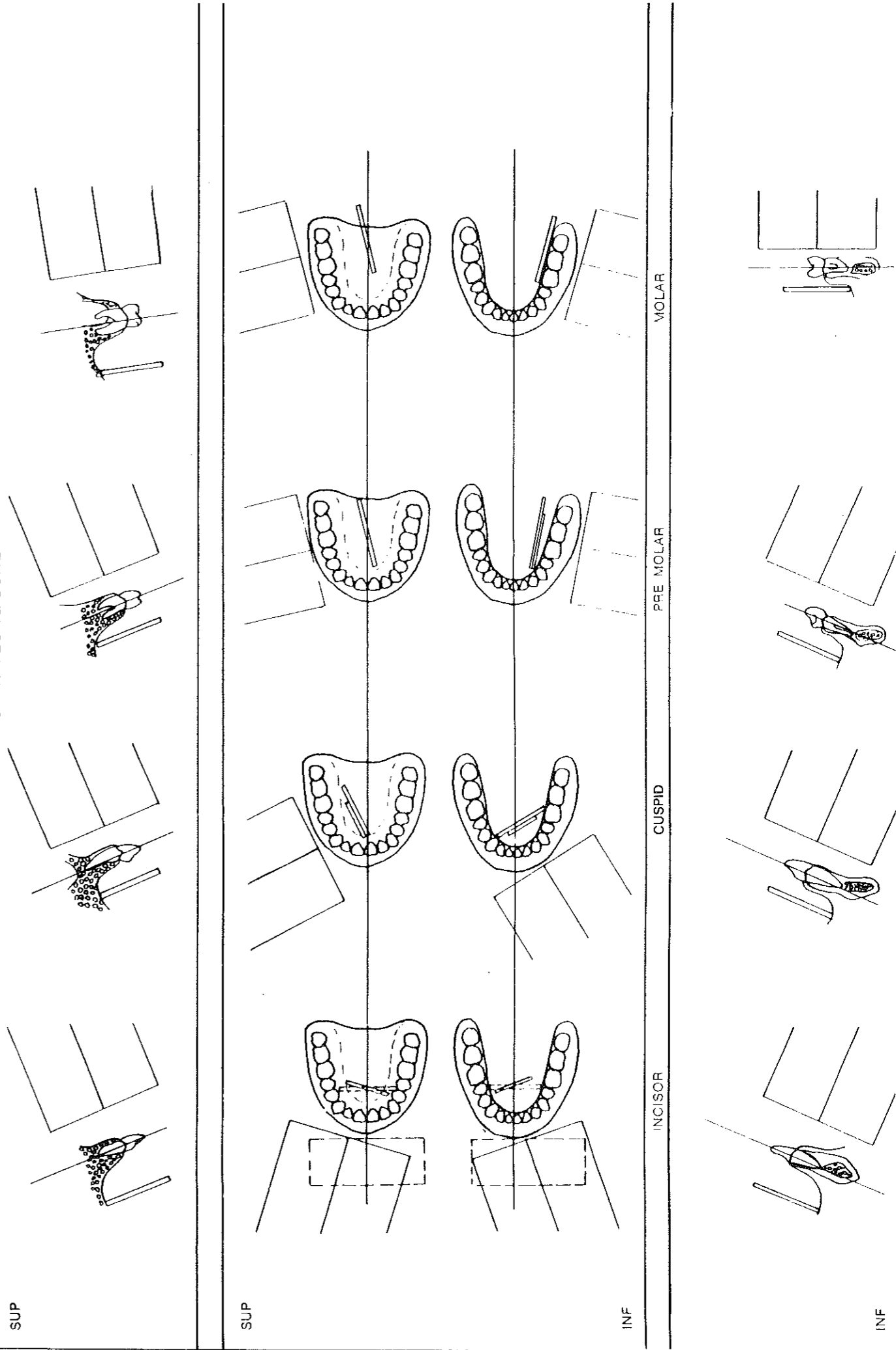
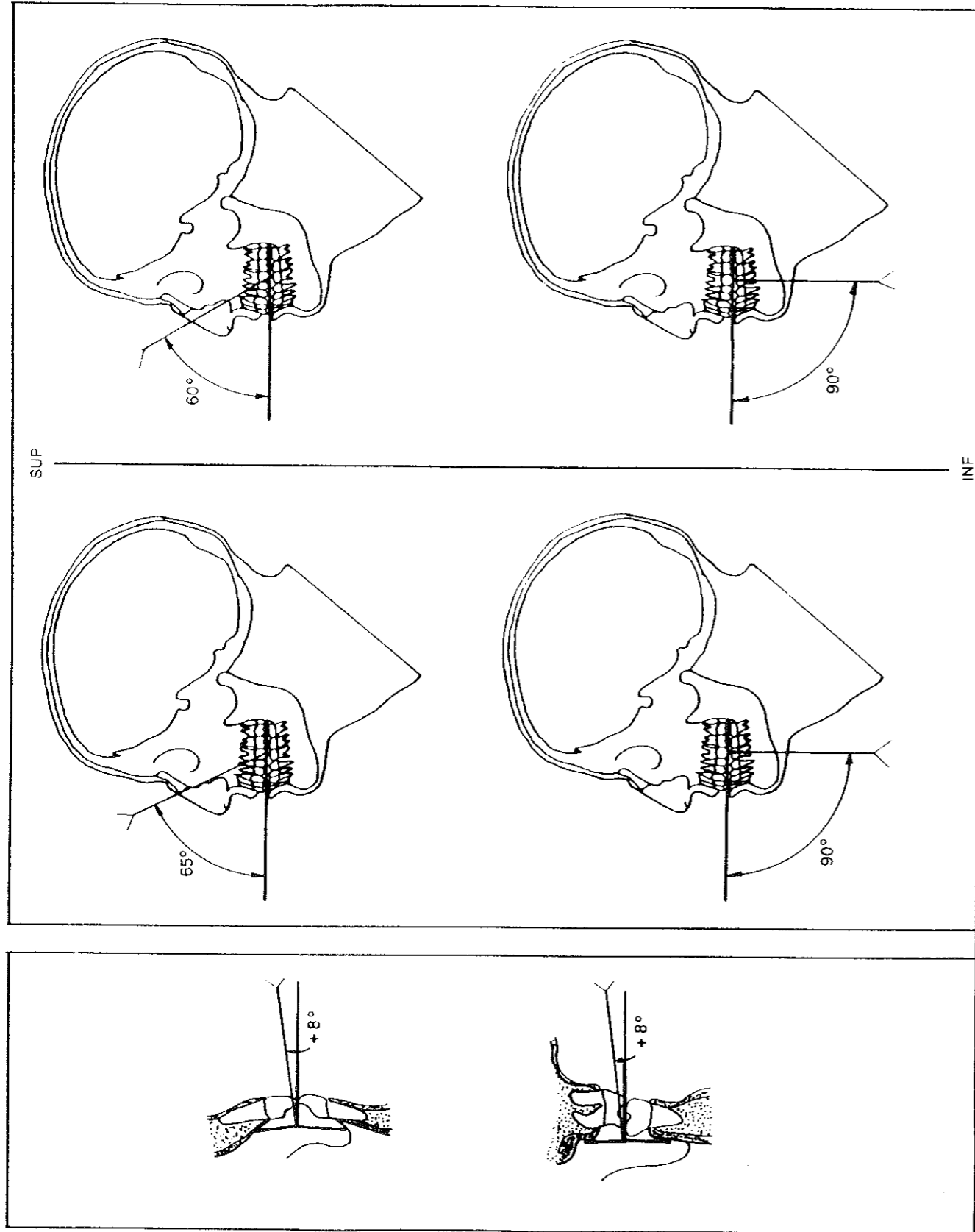




FIGURE 10 : FILM POSITIONING



**6.4 USE OF THE TROPHY CCX CONTROL (AD 33)**

- Set the switch (S) to position (I). The green power on indicator (I) and the green tubehead # 1 indicator (G) will light up in succession.
- If necessary press key (G') to use tubehead # 2.
- Set the FILM TYPE selector (T) for the type of film being used. (see table 2 below)

**SELECTING THE EXPOSURE**

- Press either the key (P) corresponding to the number of the tooth being X-rayed or one of the special exposure keys. The green indicator (B) or (O) on the key selected will light up (see page 4).
- To make an exposure, press the button of handswitch connected to socket (Z) and HOLD IT DOWN throughout the exposure. The orange indicator (Y) and the indicator in the button (Y') will light up and a sound signal will indicate the emission for X-ray. Release the button when the sound signal has stopped and the orange indicators (Y) (Y') have gone out. The green indicator on the selected program key will then start flashing indicating the thirty-second rest period that must be observed after every exposure. If another exposure is attempted before the end of the rest period the red operator error indicator (M) will light up and the buzzer will sound intermittently. Push any program key to stop it. After thirty seconds, the green indicator stops flashing indicating that the timer is ready for another exposure.

**SPECIAL FUNCTION**

- *Making exposures with the TROPHY RVG system* (Radio-Visio-Graphy - consult TROPHY for further information or consult the RVG user's manual)
- *Tubehead selector*  
With the CCX timer, the same control panel can be used for two tubeheads. (see assembler's Manual for connection instructions)  
Press # 1 or # 2 on the key selected (G) (G') page 4
- *Bite wing*  
Press the key which corresponds to the exposure desired  
(B) for incisors  
for cuspids
- *Occlusal*  
Press the key which corresponds to the exposure desired  
(O) for the mandible  
for the maxillary

**TABLE 2**

**"FILM TYPE" SETTING according to the film type used**

KODAK	Ektar Speed .....	2
DENTAL UNION (German)	Bleu star .....	3
EMMENIX (USA)	.....	3
FLOW X-RAY (USA)	.....	5
ADOX (German)	Super .....	5
AGFA (German)	Normal .....	5
DUPONT (USA)	Lightning fast .....	5
GAVAERT (Belgium)	Dentus Ultra Rapid .....	5
KODAK (USA)	Ultra Speed .....	5
RINN (USA)	Super fast .....	5
FERRANIA (Italy)	.....	6
MINIMAX (USA)	Intermediate .....	7
RINN (USA)	Extra Fast .....	7

**SPECIAL FEATURES OF THE ELECTRONIC CONTROL**

Select the setting indicated in table 4 (page 15). This setting will be respected if the power supplied is exactly 110 Volts (in-load).

DO NOT RELEASE THE HANDSWITCH UNTIL THE SELECTED EXPOSURE TIME TERMINATES AUTOMATICALLY. IF THERE IS ANY APPARENT PROBLEM, ESPECIALLY IF THE TIMER DOES NOT TERMINATE PROPERLY, RELEASING THE HANDSWITCH WILL STOP THE EXPOSURE IMMEDIATELY.

**6.5 Role of the beam limiting device (cone)**

The beam limiting device is for limiting the beam to a maximum 6 cm diameter at 20 cm distance : this minimizes patient exposure to radiation.

Be careful to keep the film within the X-ray beam. If the beam has not been correctly centered, the film will be only partially exposed (see fig. 11)

**70 X TIME SETTING TABLE**

PRESET POSITION	ANGLES	TIME/sec.
<b>ADULTS</b>		
42. 41. 31. 32	-15	.24
44. 43. 33. 34	-20	.24
46. 45. 35. 36	-10	.30
48. 47. 37. 38	- 5	.30
12. 11. 21. 22	+40	.30
23. 24. 13. 14	+45	.30
25. 26. 15. 16	+30	.38
27. 28. 17. 18	+30	.46
<b>CHILDREN</b>		
82. 81. 71. 72	-15	.16
83. 84. 73. 74	-20	.22
85 - 75	-10	.24
52. 51. 61. 62	+40	.20
63. 64. 53. 54	+45	.20
55 - 65	+30	.26
<b>BITE-WING</b>		
<b>INTERPROXIMAL</b>		
Cuspids/Incisors		.24
Pre-molars/molars		.30
<b>OCCUSAL</b>		
Maxillary		.60
Mandibular		.60

TABLE 4

**FILM TYPE SELECTOR**

SELECTOR SETTING	VARIATION %	COEFFICIENT
1	- 75 %	.25
2	- 50 %	.50
3	- 37.5 %	.625
4	- 12.5 %	.86
5	0 %	1
6	+ 40 %	1.4
7	+ 80 %	1.8
8	+ 140 %	2.4
9	+ 220 %	3.2
10	+ 300 %	4

\* To decrease the contrast (picture over exposed)  
Adjust the film type selector to a lower setting

\* To increase the contrast (picture under exposed)  
Adjust the film type selector to a higher setting

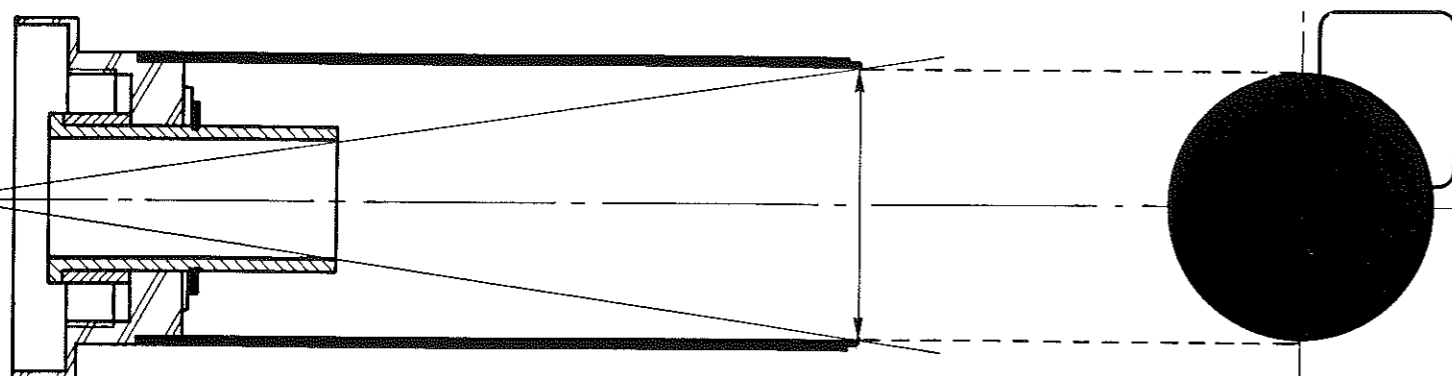


FIGURE 11 : ROLE OF THE DIAPHRAGM

## VII. MANUAL FILM PROCESSING

Film processing has to be carefully carried out to obtain a good film.

a/ In a dark-room, take the film out of its pack very carefully, to avoid finger-prints or scratches.

b/ Put it into the developing solution and agitate it for a few seconds then let it rest for either 5 min. at 20° C, 6 min. at 18° C or 4 min. at 22° C.

c/ Rinse it with clean water for about 20 seconds.

d/ Put it into the fixing solution and agitate it for a few seconds ; let it rest then for at least 5 min.

e/ Wash it with clear water. Good preservation of the film is assured by thorough washing.

f/ Let it dry in the open away from dust  
(operations "e) and "f) can be done in daylight)

Developing baths should be properly mixed according to manufacturer's instructions and should be frequently renewed. It is not good just adding developing solution to strengthen solution, because, although this increases contrast, it lowers definition. Table 5 summarizes the main causes of poor films.

**MAIN CAUSES OF POOR FILMS**

FILM	EXPOSURE TIME	DEVELOPMENT TIME	SOLUTION QUALITY	POSITIONING
Under exposed	too short	too short	too cold	—
Over exposed	too long	too long	too hot	—
Lack of detail	—	too short	too cold or too old	—
Blurred	—	—	—	Patient moved
Off center	—	—	—	Poor angulation

TABLE 5

## VIII. 70-X MAINTENANCE SCHEDULE

In the interest of equipment safety a maintenance program must be established. It is the owner's responsibility to arrange for this service, and to assure that the service personnel are fully qualified to service 70-X Dental X-ray equipment. We recommend using technical staff from the TROPHY dealers.

The system and function check is to be performed at installation and every twelve months thereafter or when any certified component is replaced.

### SYSTEM AND FUNCTION CHECK

#### 1/ TUBE HOUSING ASSEMBLY (TUBEHEAD)

- a. Check that the certification label is legible and intact.
- b. Check that there is no oil leakage and no physical damage that could cause unsafe radiation.

#### 2/ CONE (BLD)

- a. Check that the certification label is legible and intact.
- b. Check that the BLD is securely attached to the tube housing assembly.
- c. Check for physical damage and that the BLD allows a minimum source to skin distance of 8" (20 cm)

#### 3/ MOUNTING

- a. Check that the wall mounting is attached well and rigid.
- b. Check the arm in all positions for wear and looseness.

#### 4/ X-RAY CONTROL

- a. Check that the warning label and the certification label are legible and intact.
- b. Verify that the exposure handswitch and the coiled cord are in good condition and that the exposure pushbutton releases.
- c. Select key (27.28) film type 5. Make an exposure and check that the yellow lights (Y) (Y') are working.
- d. Select key (27.28) film type 5. Make an exposure and check that buzzer is audible to the operator and ceases to beep at the end of the exposure.
- e. *Autotest of the timer*
  - turn off the timer (position (O))
  - press and hold the RVG key (R) and turn the timer on (position I) simultaneously
  - the green light key (17.18) lights
  - release the RVG key automatically each function and program will be tested.

Each LED lights, one by one, and, at the end of the cycle "the buzzer" gives a short "beep" to inform you that the test is finished.

#### 5/ ELECTRICAL REQUIREMENTS (FOR QUALIFIED TECHNICIAN ONLY)

- a. Check that the line voltage and line voltage regulation are both within the limits specified in the GENERAL SPECIFICATIONS. If necessary, change the voltage distributor setting on the tubehead according to this table :

	setting
99 to 108 V	100 V
109 to 118 V	110 V
119 to 125 V	120 V

- b. Check the ground connections to the unit.
- c. Verify that the main power switch and green light operate.

#### 6/ USER'S MANUAL

At the end of this check, verify that the user has a USER'S MANUAL.

### IX. TROUBLE SHOOTING CHART

MALFUNCTION	CAUSE	CORRECTIVE ACTION
Unit completely out of function	A - Unit unplugged B - Defective fuse C - Timer circuit breaker off	A - Plug unit in B - Replace defective fuse C - Set timer circuit breaker on
No exposure	A - Timer connection not installed  B - Concentric pin contacts dirty or damaged  C - Wires broken in the balance arm  D - Defective tubehead	Call a qualified technician
Exposure OK but film develops clear	A - Tubehead not directed towards film  B - Exposure time too short  C - Developing time too short  D - Chemical solution too cold or too old  E - Power supply lines too weak  F - Film positioned backwards	A - Direct tubehead towards films  B - See film position (table 2 page 13)



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