ARU-01CF

Portable X-Ray

NSN: 6525-01-468-1672

COMMAND•AIR

OPERATION &
MAINTENANCE MANUAL

Aseptico®

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Upon Arrival

When the equipment is received, each shipping container should be carefully examined for any evidence of mishandling during shipment. Note its condition, if abnormal, carefully unpack all parts and examine for damage. If any damage is noted, immediately report it to the carrier in the proper manner. All printed matter supplied with the unit should be saved for installation, operation, and future reference.

Introduction

Purpose

The ARU-01CF Command Air X-ray System provides a portable and practical way to obtain dental radiographs in the field. To receive the best service and longest life from your Aseptico product, follow the instructions detailed in this manual.

Performance characteristics

Weight: . . . . . .42 lbs.

Size (external): . . . . . .17.5” x 16” x 17”, 2.75 cubic feet

Maximum peak tube potential[1]: . . . . . .63kVp ± 15%

Leakage technique factors: . . . . . .63 kVp 12 mA 2 sec.

Range of line voltage regulator: . . . . . .110 - 130 V AC (220 - 260 V AC), 50/60 Hz.

Current at 12 mA, 63 kVp output: . . . . . .6 Amps

Line voltage regulation[2]: . . . . . .2 ~ 5%

Generator rating[3]: . . . . . .12 mA at 63 kVp ± 15%

Duty cycle: . . . . . .30 : 1

Maximum deviation from fixed factors: . .± 15%

X-ray tube: . . . . . .Type D-082B Manufactured by Toshiba

Items furnished

X-ray tubehead and control

Mounting handle

Dental cone

Exposure cord

Power cord

Mil-spec case with shock resistant foam insert

ARU-01S tripod

Vinyl carrying case

Manual

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[1] Measurements taken with a 50mm diameter sphere gap.

[2] The stated mA and line current are under conditions of input line voltage of 110 - 130 V (220 - 260 V) with 2 ~ 5% regulation. If regulation is less, the amps drawn and mA can be higher than stated.

[3] Using a precise DC mA meter across points N and NE of the high tension transformer (see schematic diagram) to measure mA. Input is 117 V AC (230 V AC), 50/60 Hz. Tolerance is ± 15%.

Safety Precautions

WARNING - Careless or improper use of x-ray equipment can be extremely hazardous.

WARNING - It is imperative that this equipment be operated and serviced only by trained personnel familiar with the safety precautions required to prevent excessive exposure to primary x-ray radiation, the dangers of exposure to x-ray radiation, and the proper use of the equipment discussed in this manual.

1. During exposure, the operator must stand as far as possible from the patient being x-rayed and should wear a lead apron or stand behind a lead shield.
2. The operator must not stand in the primary x-ray beam.
3. The operator must wear a monitoring badge while operating this unit. It should be on the collar, not on an area covered by the lead apron.
4. X-ray exposure should be as short as possible.

All personnel authorized to operate or service this equipment should be fully acquainted with the established maximum permissible doses, safety recommendations, and procedures derived from the following sources:

A. National Council on Radiation Protection Report No. 33 (Medical X-ray and Gamma Ray Protection for Energies up to 10 MEV - Equipment Design and Use); from NCRP Publications; P.O. Box 30175, Washington, D.C. 20014.

B. National Bureau of Standards Handbook No. 76 (Medical X-ray Protection up to Three Million Volts); from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20401.

C. All documents relating to the Performance Standard for Diagnostic X-ray Systems, 21 CFR Subchapter J, Part 1020; obtainable from FDA Center for Devices and Radiological Health, Department of HHS, 2098 Gaither Road, Rockville, MD 20850.

D. State and local regulations governing radiation protection and the use of diagnostic x-ray equipment.

E. Requirements of the user's in-house radiation protection program.

F. Instructions and precautionary notices of this manual.

Although this equipment incorporates protective design features for limiting both the direct (primary) x-ray beam and the secondary radiation produced by this beam, design factors alone cannot prevent human carelessness, negligence, or lack of knowledge. This apparatus is sold with the understanding that the user assumes sole responsibility for radiation safety and that Aseptico, Inc., its agent and representatives, do not accept any responsibility for:

1. Injury or danger to patient or other personnel from x-ray exposure.
2. Overexposure due to poor operating techniques or procedures.
3. Equipment not properly serviced or maintained in accordance with this manual.
4. Equipment which has been modified or tampered with in any way.

Assembly

1. Remove the x-ray tube head and control, cone, exposure cord, and power cord from the carrying case.
2. Screw the cone on to the front of the tubehead.
3. Plug the exposure cord into the rear of the tubehead.
4. Plug the power cord into the rear of the tubehead
5. Set up tripod
6. Attach the assembled x-ray unit to the stand.
7. Check the line voltage and the voltage on the rating label;

   115 V type requires line voltage between 110 and 130 V.

   230 V type requires line voltage between 220 and 260 V.

   These voltages must be with 15 ampere #12 three-wire service, if not, the films may be light or show lack of sufficient penetration.
8. Plug the power cord into the wall outlet.

The unit is now assembled and ready for testing.

Figure A - Component Identification

1. X-ray tubehead and control
2. Mounting handle
3. Dental cone
4. Exposure cord
5. Power cord
6. ARU-01S tripod
   Includes:
   #510311 5/16 - 18 wing-nut
   #510322 5/16 fender washer
7. Vinyl carrying case
8. Mil-spec case with shock resistant foam insert

Performance Verification

The following tests must be conducted without fail before the ARU-01CF Command Air X-Ray System can be used for radiology. Fill out the checklist for these tests when installation of x-ray unit is complete.

Line Voltage (LV) Indicator

1-1 LV Indicator Test Method:

Measure voltage of wall outlet, and confirm that the following conditions are fulfilled.

Wall outlet voltage:

130 ~ 125 V (260 ~ 250 V)	Green LED goes on when LV knob turns 1 click clockwise.
125 ~ 120 V (250 ~ 240 V)	Green LED goes on when LV knob turns 2 clicks clockwise.
120 ~ 115 V (240 ~ 230 V)	Green LED goes on when LV knob turns 3 clicks clockwise.
115 ~ 110 V (230 ~ 220 V)	Green LED goes on when LV knob turns 4 clicks clockwise.
110 ~ 105 V (220 ~ 210 V)	Green LED goes on when LV knob turns 5 clicks clockwise.

If the LV indicator needs adjustment:

1. Remove the 4 screws on the cover.
2. Adjust the potentiometer "A" (See Figure B) on the printed circuit board so that the green LED goes on at the above settings.
3. Replace the cover and the 4 screws.

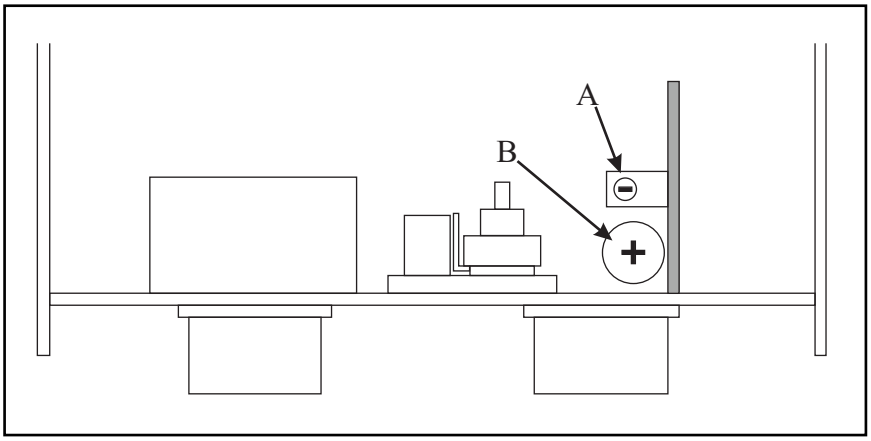

Figure B - Potentiometer Location

Timer

Since the filament of the x-ray tube is off when the unit is not emitting radiation, it takes approximately 0.15 seconds (9 electrical pulses) for the x-ray tube filament to warm up be fore an x-ray is emitted (see Figure C). Because of this warm up time, the electronic timer has a built in lag of approximately 0.15 seconds, therefore, when checking the timer with a cycle counter, 0.15 seconds must be added to the time set on the timer.

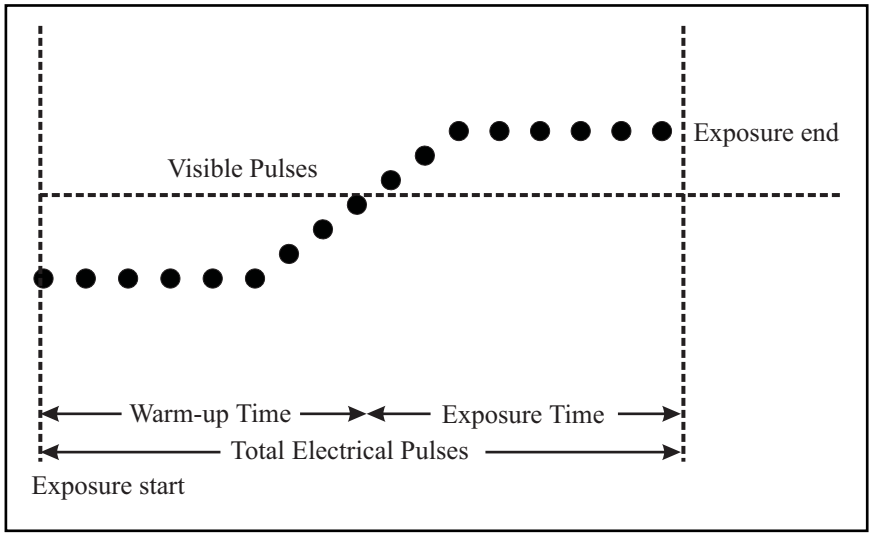

Figure C - Electrical Pulse Activity During X-Ray Tube Warm-up and Exposure

$$TW = P - Dx$$

TW = Filament warm-up time

P = Total number of electrical pulses

Dx = Number of readable dots on film as determined by a spin top test

2-1 Timer Test Method:

1. Set timer to 0.08 sec.
2. Set NERO to the following settings.
   SID: 18 inches
   Wheel range: 50 ~ 85 kV
   Sensitivity: Low
   Phase Select: 1∅
   Measurement Mode: STAT
   X-ray values: 63 kV, 0.08 sec.
3. Make exposure and read value of exposure time.
4. Measure value of exposure time at following settings with same procedure:
   0.08 sec., 0.10 sec., 0.20 sec., 0.50 sec., 1.00 sec., 2.00 sec.

2-2 Instruments:

NERO Model 6000M X-ray Beam Analyzer, Manufactured by Victoreen, Inc. or equivalent

2-3 Rejection Limit:

± 2 pulse (0.08 sec. ~ 2.0 sec.), ± 10% (0.25 sec. ~ 2.0 sec.)

If the timer needs adjustment:

1. Remove the 4 screws on the cover.
2. Adjust the potentiometer "B" (See Figure B) on the printed circuit board so that the radiation exposure time equals the time indicated on the timer dial, taking into consideration the accuracy tolerances.
3. Replace the cover and the 4 screws.

Peak Tube Potential

The ARU-01CF has a filament warm-up time of 0.15 sec. (9 electrical pulses) built into its settings. The kV is as shown on Figure D. For that reason, measure kV with 0.15 sec. delay time.

3-1 Peak Tube Potential Test Method:

1. Set timer to 0.2 sec.
2. Set NERO to the following settings:
   SID: 18 inches
   Wheel range: 50 ~ 85 kV
   Sensitivity: High
   Phase Select: 1∅
   Measurement Mode: SGL
   Time Delay: 0.1 sec.
   X-ray values: 63 kV, 0.2 sec.
3. Make exposure and measure value of average kV
4. Measure value of average kV

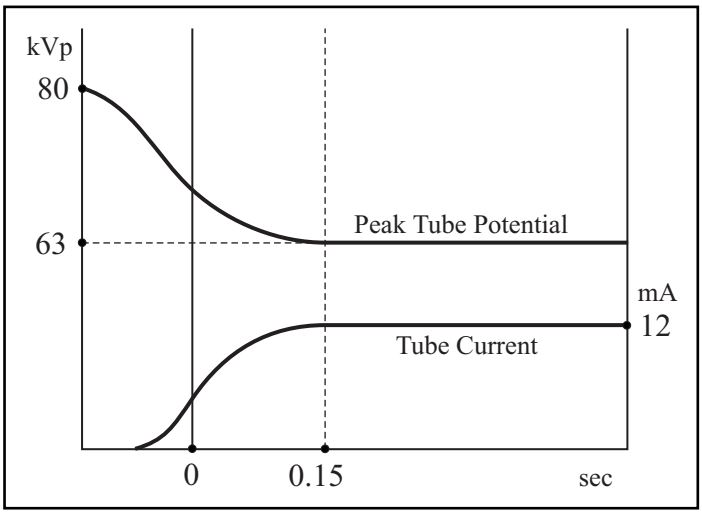

Figure D - X-Ray Tube Electrical Performance

3-2 Instruments:

NERO Model 6000M X-ray Beam Analyzer, Manufactured by Victoreen, Inc. or equivalent

3-3 Rejection Limit:

63 kV ± 15%

Tube Current

The ARU-01CF has a filament warm-up time of 0.15 sec. (9 electrical pulses) built into its settings. The kV is as shown on Figure D. For that reason, measure kV with 0.15 sec. delay time.

4-1 Tube Current Test Method:

1. Set timer to 2.0 sec.
2. Connect the DC-mA meter to the pin jack terminal on rear panel.
3. Make exposure and measure the mA value.
4. Measure High value of ch2 at the following kV settings, and timer to 2.0 sec. with same procedure.

4-2 Instruments:

Portable standard DC ammeter Model 2011 Yokogawa Electric Works, Ltd. or equivalent

4-3 Rejection Limit:

± 15%

Chart A - Testing Checklist

Complete this check list when assembly and testing are complete.

Serial Number: .....

Date Manufactured: ..... Equipment Location: .....

Test Description	Acceptance Limits	Results	Check	
Line Voltage	110 ~ 130 V (220 - 260 V)	 V	GO ☐	NO GO ☐
Line Voltage Regulation	2 ~ 5%	..... %	GO ☐	NO GO ☐
Peak Tube Potential	63 kVp ± 15%	..... kVp	GO ☐	NO GO ☐
Tube Current	12 mA ± 15% 9.5 mA ± 15%	..... mA ..... mA	GO ☐	NO GO ☐
Exposure Time	0.08 sec ± 2 pulse 0.1 sec ± 2 pulse 0.2 sec ± 2 pulse 0.5 sec ± 10% 1.0 sec ± 10% 2.0 sec ± 10%	..... sec ..... sec ..... sec ..... sec ..... sec ..... sec	GO ☐	NO GO ☐
All Mechanical Movement	Smooth Movement		GO ☐	NO GO ☐
All Operation	See Operation Manual		GO ☐	NO GO ☐

Instruments Used	Manufacturer	Model	Accuracy	Last Calibrated

Operation Instructions

It is assumed by the distributors and manufacturer of the equipment that the person responsible for its operation has a general knowledge of the use of x-rays, including the precautions which must be taken.

Note: Confirm the wall outlet voltage and the voltage on the rating label of the ARU-01CF before connecting the power cord.

Operation:

1. Position the tubehead for the radiograph desired.
2. Line voltage compensation. Turn the LV knob clockwise until the center green LED lights. The green LED must be lit before each exposure.
3. Radiology
   A. After positioning the patient and adjusting the line voltage compensator, set the electronic timer for the desired time. The following technique chart can be used as a guide.
   B. Stand as far as possible from the x-ray unit, press the exposure switch to initiate the exposure and keep it pressed for the duration of the exposure. During the exposure, there will be an audible signal and the "X-ray" light will illuminate on the unit.
   C. The timer will automatically recycle; e.g. successive exposures can be made at the previously set time by merely pressing the exposure button.
   D. An exposure can be interrupted at any time by releasing the exposure button.
   E. When an exposure is terminated, the "X-ray" light goes out and the audible signal ends.

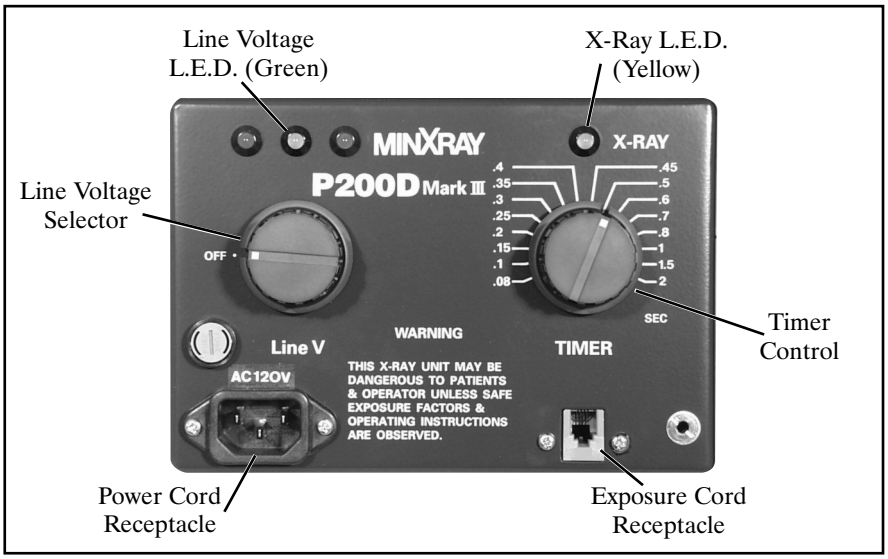

Figure E - Control Panel

Operation Precautions:

1. During exposure, the operator must stand as far as possible from the patient being x-rayed and should wear a lead apron or stand behind a lead shield.
2. The operator must not stand in the primary x-ray beam.
3. The operator must wear a monitoring badge while operating this unit. It should be on the collar, not on an area covered by the lead apron.
4. X-ray exposure should be as short as possible.

Chart B - Technique Chart

Exposure Time and Angulation of Central Ray

Note: Exposure times are intended as guides only.
They are based on averages and may be modified to suit the individual patient.
When modifying exposure times, the increase or decrease should be made in steps of 20-25%.

Aseptico ARU-01CF X-Ray System Technique Chart		Exposure Time (seconds)		Angle (degrees)
		Adult	Child	
Maxillary	Molars	0.8	0.5	+ 20°
	Bicuspids	0.8	--	+ 30°
	Cuspids	0.6	0.4	+ 45°
	Incisors	0.6	0.3	+ 40°
Mandibular	Molars	0.6	0.4	- 5°
	Bicuspids	0.6	--	- 10°
	Cuspids	0.4	0.3	- 20°
	Incisors	0.4	0.3	- 15°
Maxillary Occlusals	Incisor Region	1.0	--	+65°
	Cuspid-Molar Region	1.0	--	+ 60°
Mandibular Occlusals	Incisor Region	1.0	--	- 55°
	Cuspid-Molar Region	1.0	--	- 90°

Maintenance:

The following must be checked at least every six (6) months.

1. Tubehead
   A. Make sure certification and identification labels are in place.
   B. Check for any loose or missing screws.
   C. Check for oil leaks.
   D. Check for any physical damage.
   E. Check the LV knob for proper operation.
   F. Check the timer for proper operation.
   G. Check all the cord connections.
   H. Check the exposure button; the exposure must terminate if the button is released during an exposure.

2. Beam Limiting Device (Dental Cone)
   A. Make sure the certification label is on the cone.
   B. Check for any physical damage.

3. Indicators
   A. Make sure the green light goes on when the LV knob is turned to the right from the off position.
   B. Check the x-ray "ON" light for proper operation.
   C. Make sure the audible signal operates during an exposure.

Component Data

Toshiba D-082B Stationary Anode X-ray Tube

Electrical:

Circuit: . . . . . .Self-rectified (Center-Grounded)
Operating Tube Voltage: . . . . . .50 to 70 kV Max
Focal Spot: . . . . . .0.8 mm
Input energy (at 1.0 sec): . . . . . .600 W

Mechanical:

Dimensions: . . . . . .See dimensional outline
Overall Length: 102mm
Max. Diameter: . . . . . .31 mm
Target Angle: . . . . . .20 degrees
Inherent Filtration: . . . . . .At least 0.8 mm Al equivalent at 50 kV
X-ray coverage: . . . . . .354 x 354 mm at SID 490 mm
Weight (approx.): . . . . . .95 g
Cooling method: . . . . . .Oil immersed (60° Max.) and convection oil

Maximum and Minimum Ratings:

These values must not be exceeded at any time.
Max. Tube Voltage: . . . . . .70 kV
Max. Inverse Tube Voltage: . . . . . .80 kV
Min. Tube Voltage: . . . . . .50 Kv
Max. Tube Current:
See rating charts . . . . . .19 mA
Max Filament Current: . . . . . .2.0 A
Filament Voltage:
At max. filament current . . . . . .2.9 to 4.0 V
Thermal Characteristics:
Anode Heat Storage Capacity . . . . . .7 kJ (10 kHU)
Max. Anode Heat Dissipation Rate . . . . . .210 W (300 HU/s)

Cautions for the Toshiba D-082B Stationary Anode X-ray Tube

Since the X-ray tube will emit x-rays when it is energized with high voltage, special knowledge is required to handle it. The items below show general cautions for the tube.

1. The tube shall be handled or operated only by qualified personnel. Only a specialist who has good knowledge of the x-ray tube should assemble, maintain, and remove the tube.
2. The tube envelope is made of glass. In transporting and handling the tube, sufficient care should be taken to avoid strong impacts or vibrations.
3. Adequate radiation protection must be used in the unit assembled with the tube. The leakage technique factor of the tube unit must not exceed the maximum anode cooling rate of the tube.
4. Fulfill the regulations and standards for the minimum source-skin distance (SSD) and the minimum filtration of the useful beam before using tube.
5. The tube might be broken by only one overload operation. Provide a proper overload protection circuit. Operate the tube by selecting a proper input condition according to the conditions for operation and tube characteristics charts.
6. If any abnormality is found when using this tube, immediately cut off the power supply and contact the TOSHIBA service department.
7. The following data sheet charts indicate standard values.

Figures F, G, & H - Standard Value Charts

Toshiba D-082B Stationary Anode X-Ray Tube

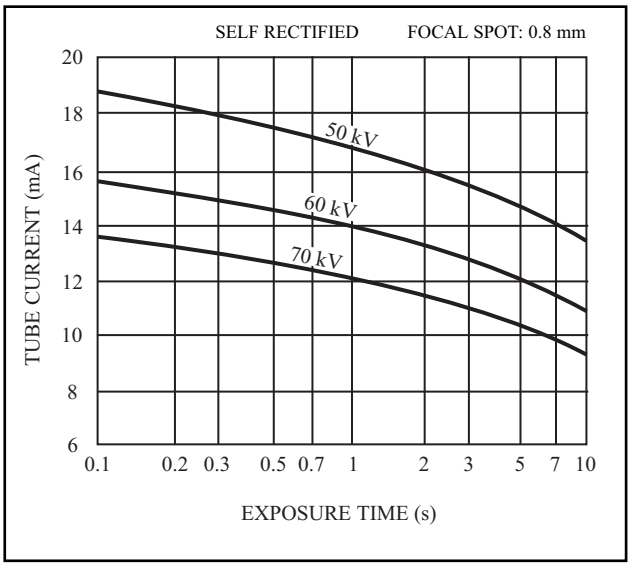

Figure F - Absolute Maximum Rating Charts

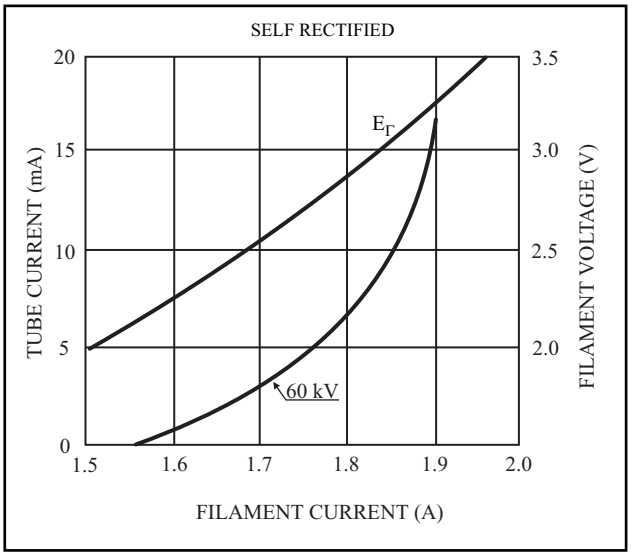

Figure G - Emission and Filament Characteristics

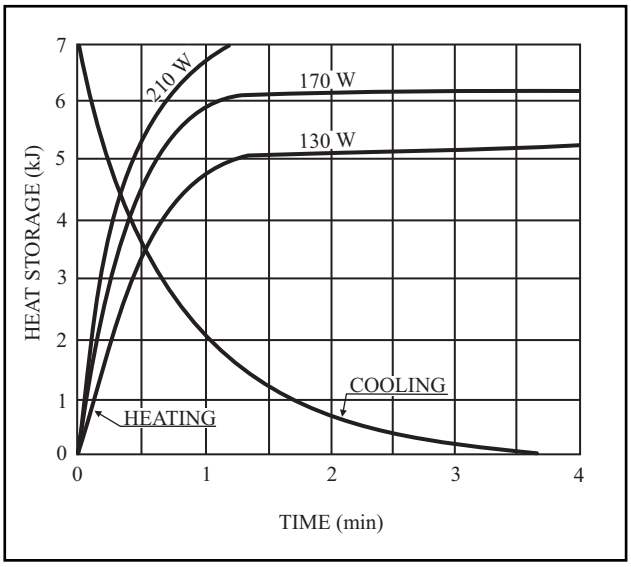

Figure H - Anode Thermal Characteristics

Figure I - Dimensional Outline

Toshiba D-082B Stationary Anode X-Ray Tube

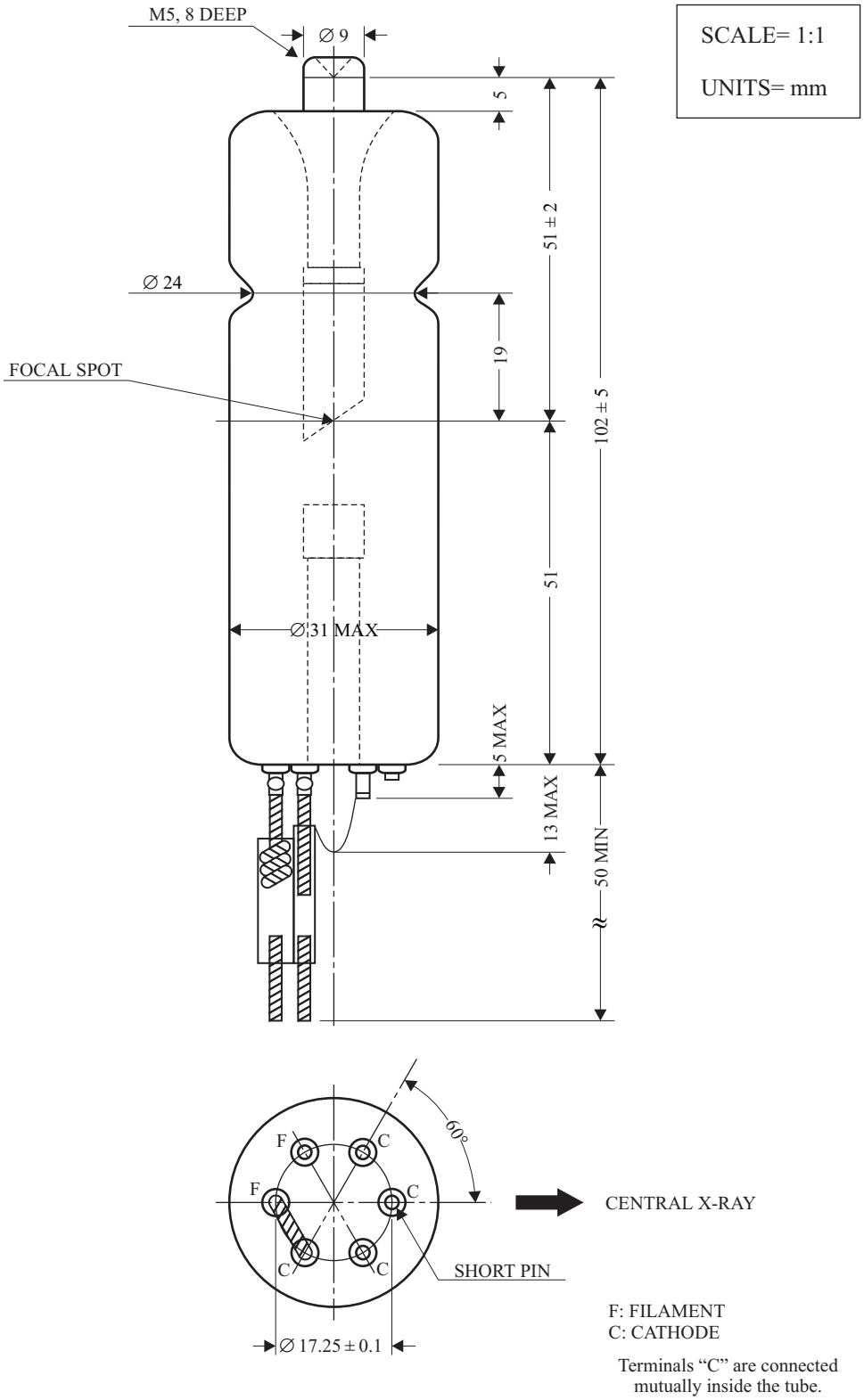

Figure I - Dimensional Outline

Figure J - Schematic Diagram

Aseptico ARU-01CF X-Ray System (MinXray P200D Mark III)

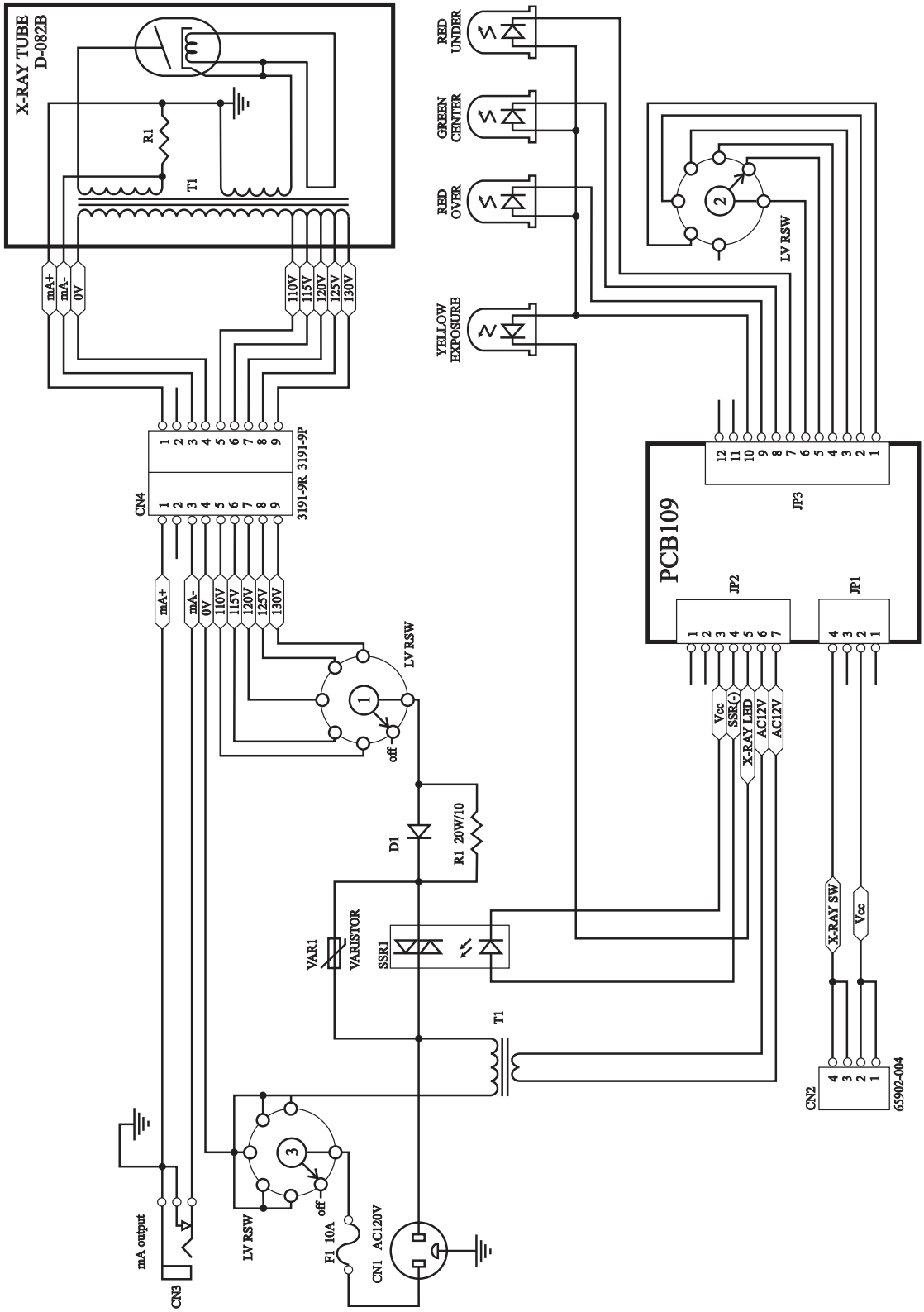

Figure J - Schematic Diagram

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