TM11-6525-202-12

TECHNICAL MANUAL

OPERATOR'S AND ORGANIZATIONAL MAINTENANCE MANUAL

X-RAY APPARATUS, RADIOGRAPHIC, INDUSTRIAL AN/TAQ 2

(FSN 6635-179-8839)

HEADQUARTERS, DEPARTMENT OF THE ARMY
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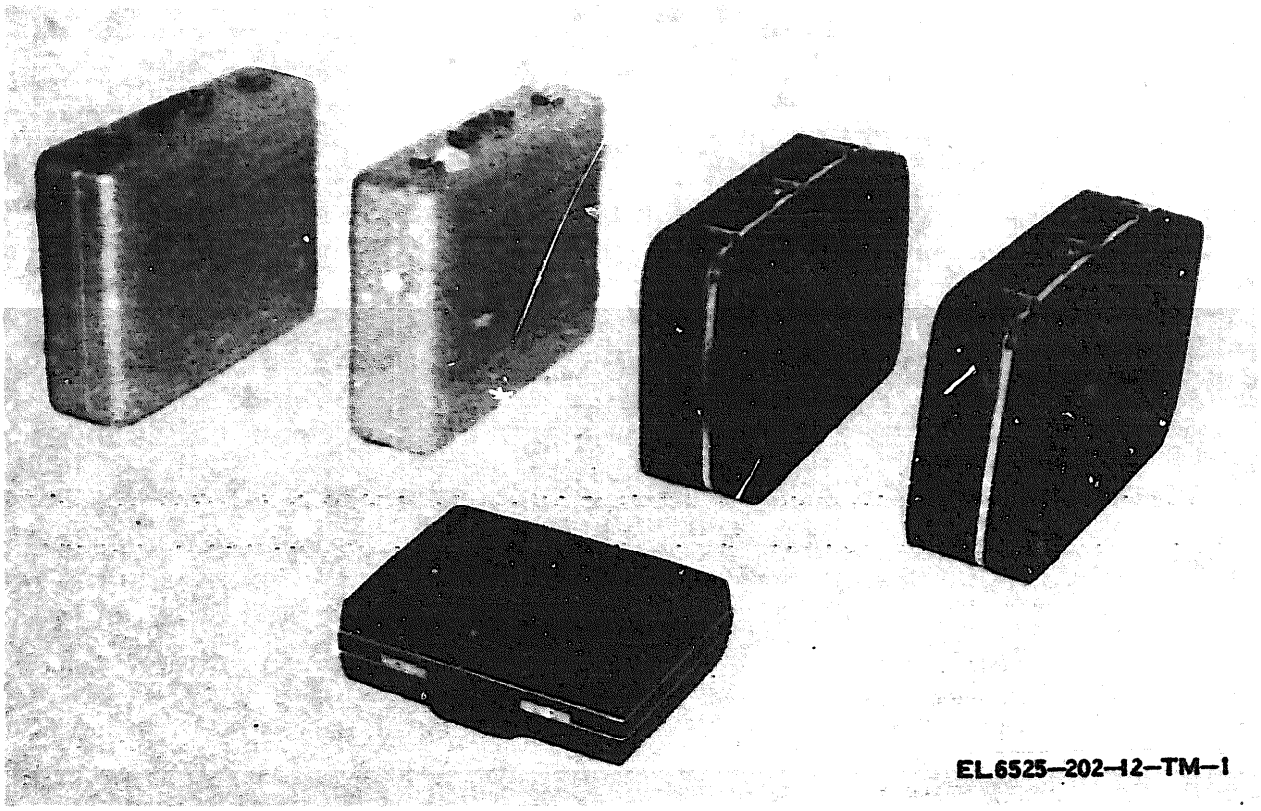

Figure 1-1. X-Ray Apparatus, Radiographic, Industrial AN/TAQ-2.

CHAPTER 1

INTRODUCTION

Section I. General

1-1. Scope

This manual describes operation and maintenance procedures for X-Ray Apparatus, Radiographic, Industrial System (system). It includes operation, installation, organizational maintenance, preventive maintenance, troubleshooting, and replacement of parts available at organizational maintenance. Except for operation and maintenance, this manual covers only those instructions that pertain to this system. Detailed functional explanation and maintenance instructions not given in this manual for the components listed in paragraph 1-11 are covered in TM 11-6525-200-12 and TM 11-6525-201-14.

1-2. Indexes of Publications

a. DA Pam 310-4. Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

b. DA Pam 310-7. Refer to DA Pam 310-7 to determine whether there are modification work orders (MWO's) pertaining to the equipment.

1-3. Forms and Records

a. Reports of Maintenance and Unsatisfactory Equipment. Maintenance forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in and prescribed by TM 38-750.

b. Report of Packaging and Handling Deficiencies. Fill out and forward DD Form 6 (Packaging Improvement Report) as prescribed in AR 700-58/NAVSUPINST 4030.29/AFR 71-13/MCO P4030.29A, and DSAR 4145.8.

c. Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33/AFM 75-18/MCO P4610.19A, and DSAR 4500.15.

1-4. Destruction of Army Material to Prevent Enemy Use

For destruction procedures for electronic equipment, refer to TM 750-244-2.

1-5. Administrative Storage

For procedures, forms, and records, and inspections required during administrative storage of this equipment, refer to TM 740-90-1.

1-6. Reporting of Errors

The reporting of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications and Blank Forms) and forwarded direct to Commander, US Army Electronics Command, ATTN: AMSEL-MA-L, Fort Monmouth, NJ 07703.

Section II. DESCRIPTION AND DATA

1-7. Purpose and Use

X-Ray Apparatus, Radiographic, Industrial AN/TAQ-2 is contained in five portable-type carrying cases (fig. 1-1). The system is self-contained and has the capability of X-ray examination of personnel and materials in military programs requiring portable mobile operation. In operation the system can be installed within minutes, and X-ray examination, including the development of the film, can be made on site immediately for viewing on the electronic transparency illuminator.

1-8. Description

a. Generator Group OV-47/TAQ-2 (fig. 1-2) weighs 60 pounds and consists of an outer and inner case. The inner case contains a pulser chassis and assembly, high voltage power supply, air pressure section, resistive load, ground lead and control, trigger and power cables.

b. Control Group OK-258/TAQ-2 (fig. 1-2) weighs 60 pounds and consists of an outer and inner case. The inner case contains a case liner, control unit dolly assembly, X-ray tubehead, high voltage cable, tubehead mount assembly, and

other components for mounting the X-ray tubehead assembly.

c. Processor Group OA-8753/U (fig. 1-2) weighs 45 pounds. Included in the case are a 10 foot scale, roll of scotch tape, mechanical radiographic processing machine, and positioning assembly rod sections.

d. Positioner Group OA-8754/U (fig. 1-2) weighs 45 pounds. Included in the case are a swivel collar clamp, tripod base assembly, cassette holder adjusting clamp, pentrameters, foreign electronic adapter plugs, extension cord, transparency illuminator, polaroid X-ray film packs and print coaters, X-ray film cassette and holder, cleaning fluid, and a spare X-ray tube.

e. Radiation Safety Group OA-8755/U (fig. 1-3) weighs 35 pounds, and consists of a dispatch case, two lead aprons, eight (8) radisc meters, and a radisc detector charger.

1-9. Technical Characteristics of Control Group OK-258/TAQ-2 and Generator Group OV-47/TAQ-2

Line voltage ratings:	
100-115 Vac	Nominal 110 Vac
110-125 Vac	Nominal 120 Vac
200-230 Vac	Nominal 220 Vac
210-240 Vac	Nominal 230 Vac
220-250 Vac	Nominal 240 Vac, 50-60 cycle, 1200 watts, surge, 11 watts, standby
X-ray tube voltage	150 kV 100 kV
Effective MAS/pulse	0.06 MAS at 150 kV 0.03 MAS at 100 kV
MAS/99 pulse train	6 MAS at 150 kV 3 MAS at 100 kV
Pulse duration	60 nanoseconds (0.00000006 second)
Pulse rate (at nominal 120 Vac or 240 Vac input)	20 per second at 100 kV 14 per second at 150 kV.
Pulse number selection	1 to 99 pulses
Average X-ray tube life	50,000 pulses at 100 kV 25,000 pulses at 150 kV
Effective X-ray source size	1.8 mm diameter
Inherent filtration	Exceeds 2.5 mm aluminum equivalent
Operating temperature range	20° F. to 110° F.
Maximum operating altitude	10,000 feet
Humidity	To 95 % relative humidity
Duty cycle	Refer to paragraph 3-4
System temperature for storage travel	-20° F. to 130 ° F.

1-10. Technical Characteristics of Portable X-Ray Film Processor Unit

Type	Portable, X-ray film daylight processing unit, manually operated
Power source	Mechanical self-contained, spring-driven drum
Timer range	0 to 60 seconds
X-ray film cassette	Picker-Polaroid type.
X-ray film packet	Type 3000-X (paper, black and white radiograph) Type TLX (mylar film, translucent radiograph)
Film developing time:	
3000-X film packet	10 seconds
TLX film packet	45 seconds

1-11. Items Comprising an Operable Equipment

The items comprising an operable equipment for Generator Group OK-258/TAQ-2 and Control Group OV-47/TAQ-2 are listed in table 1-1. Spare parts and maintenance materials shipped with the unit are listed in table 1-2. Items comprising an operable equipment for Processor Group OA-8753/U, Positioner Group OA-8754/U, and Radiation Safety Group OA-8755/U are listed in table 1-3. Spare parts and maintenance materials shipped with the unit are listed in table 1-4.

Table 1-1. Items Comprising an Operable Generator Group OK-258/TAQ-2 and Control Group OV-47/TAQ-2

Quantity	Item	Dimensions (in.) Width	Height	Depth	Weight (lbs)
	Control Group				
1	Outer carrying case	24	7	18	10
1	Inner carrying case	21	6 1/2	13	49
1	Dolly	18 3/4	1 1/4	12 1/4	2
1	High voltage cable		10 ft long		
1	Control assembly	5	7 1/2	13 1/2	6
1	Remote tubehead and mount assembly	3 (dia)	10	12	10
1	Mast assembly:				
	Mast sections (four)	1 1/2	19 (length)		12 oz
	Mast extensions sections (three)	1 (dia)	19 (length)		12 oz

Generator Group OV-47/TAQ-2
1. Power supply
2. Reminiture lead
3. Outer case
4. Inner case
5. Pressure section
6. Cabinet, trigger, ground
7. Pulser chassis & assembly

Control Group OK-252/TAQ-2
8. Outer case
9. Inner case
10. Mounting assembly rods
11. Dolly

Processor Group OA-8753/U
12. 10 foot scale
13. Scotch tape, roll
14. Radiographic processing machine
15. Springloaded top section
16. Mast section extensions

Positioner Group OA-8754/TAQ-2
17. Swivel collar clamp
18. Tripod base assembly
19. Cassette holder adjusting clamp
20. Foreign adapter plugs
21. 25 foot extension cord
22. Penetrameters
23. Transparency illuminator
24. Polaroid film pack
25. Print coasters
26. X-Ray film cassette & X-ray tube
27. X-ray film cassette holder
28. Cleaning fluid

Radiation Safety Group OA-8755/U
29. Lead aprons (2)
30. Radiacmeters (3)
31. Radiac detector charger

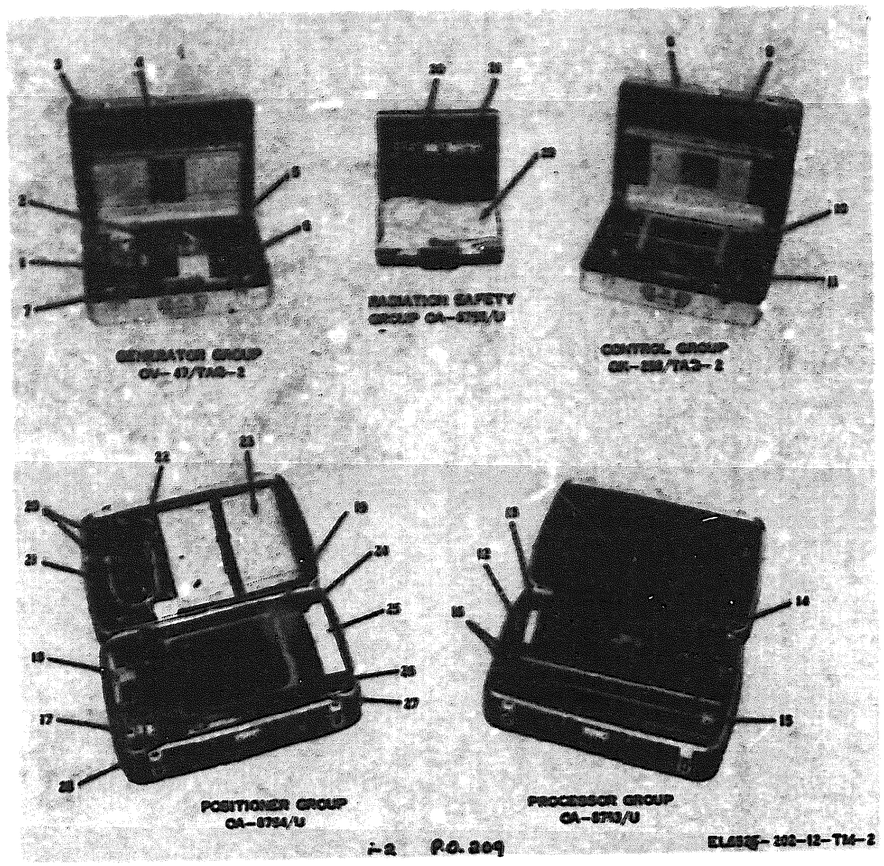

Figure 1-2. Major components of X-Ray Apparatus, Radiographic, Industrial AN-TAQ-2.

Table 1-1. Items Comprising an Operable Generator Group OK-258/TAQ-2 and Control Group OV-47/TAQ-2-Continued

Quantity	Item	Dimensions (in.) Width	Height	Depth	Weight (lbs)
	Generator Group				
1	Outer carrying case	24	7	15	10
1	Inner carrying case	21	6 1/2	13	53
1	Resistive load	1 (dia)		6	1 1/2
1	AC Power cable		10 ft long		
1	Exposure switch cable		10 ft long		
1	Control cable		6 ft long		
1	Ground cable		4 ft long		

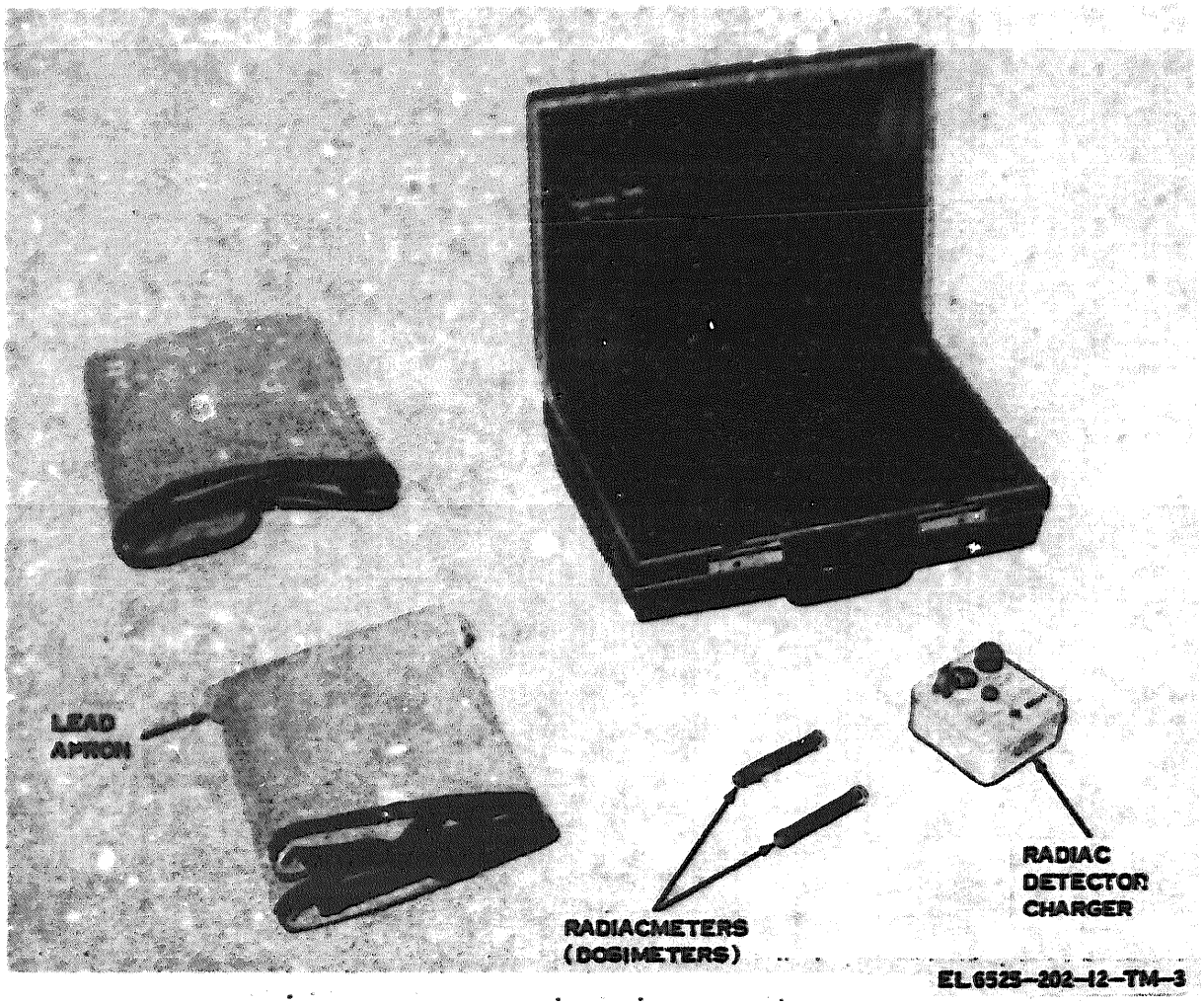

Figure 1-3. Radiation safety group.

Table 1-2. Spare Parts and Maintenance Materials for Generator Group and Control Group.

Quantity	Item
2	Module assembly
1	Desiccant case assembly
	Maintenance kit consisting of the following:
5	Fuse, 0.2 amp
1	Drill bit # 43 (090)
1	Allen wrench, 1/16
1	Allen wrench, 1/8
1	Allen wrench 9/64
1	Allen wrench, 3/16
3	O-ring
1	Tool, cap removal
1	Screwdriver, small Phillips
1	Hex bit, 1/4-in. drive, 9/64 in. bit
1 (tube)	DC-5 silicone grease
1	Torque wrench
1	Wrench, special

Table 1-3. Items Comprising an Operable Processor Group OA-8753/U Positioner Group OA-8754/U, and Radiation Safety Group OA-8755/U

Quantity	Item	Dimensions (in.) Width	Height	Depth	Weight (lb)
	Processor Group				
1	Case	26	8	18	45
1	Film processing machine	8 9/16	7 1/16	19 1/4	18
	Mast Assembly				
1	Top section	1 1/2	19 (length)		12 oz
1	Bottom section	1 1/2	19 (length)		12 oz
6	Extension sections	1 1/2	19 (length)		
	Positioner Group				
1	Case	26	8	18	45
1	Tripod base assembly				1
1	Extension cord		25 ft (length)		
1	Film cassette holder				2
1	Transparency illuminator	14	14	1	3
2 Pkgs.	Polaroid film	12	12	1	
1	X-ray polaroid film cassette				
1	Swivel clamp holder				
	Radiation Safety Group				
2	Lead aprons		4 foot (lengths)		
1	Radiac charger				
8	Radiacmeters				

Table 1-4. Spare Parts and Maintenance Materials for Processor Group OA-8753/U, Positioner Group OA-8754/U, and Radiation Safety Group OA-8755/U

Quantity	Item
1	10 foot scale
1	Scotch tape, roll
12	Disposable plastic bags for film storage
2	Foreign adapter plugs
1	X-ray tube
2	Pentrameters
1 can	Cleaning fluid
2 tubes	Print coat developers
2	Rubber feet pod replacements

1-12. System Application

a. X-Ray Apparatus, Radiographic, Industrial AN/TAQ-2 has several applications. The system is portable, is packaged in five luggage-type carrying cases (fig. 1-1), and has the capability of developing the X-ray pictures on site. Some of the applications because of its small size are:

(1) On-site inspection.
(2) Material inspection.
(3) Research.
(4) Medical radiography.

NOTE

Individual applications and use of the major components within the system are covered in TM 11-6525-201-14 and TM 11-6525-200-12. Military applications of X-ray systems are covered in detail in TM 8-230.

b. Other system applications and use of the major components within the system for operational use are in accordance with the established policies of the using agencies. Special instructions will be designated by the using agencies and covered under local or supplementary instructions as required by the commander.

c. The portable X-ray unit, consisting of Generator Group OV-47/TAQ-2 and Control Group OK-258/TAQ-2 (fig. 1-4), can be assembled and adjusted to be operated both horizontally to 18 inches and vertically to 10 feet. The X-ray unit can be hand carried, assembled, and operated in a relatively short period of time. The X-ray tube operates on either 100 or 150 Kilovolts (Kv), and will produce a train of high energy, high intensity pulses of short duration variable from 1 to 99 pulses per single train.

d. Processor Group OA-8753/U and Positioner Group OA-8754/TAQ-2 (fig. 1-5) consist of a self-contained mechanical radiographic film processor machine, two types of radiographic film packets, a transparency illuminator for viewing X-ray transparencies, an adjustable mast section assembly for horizontal or vertical operation to 10 feet, and an X-ray cassette with a holder assembly. Included for optional use are electrical adapter plugs for use in countries outside of the continental limits of the USA.

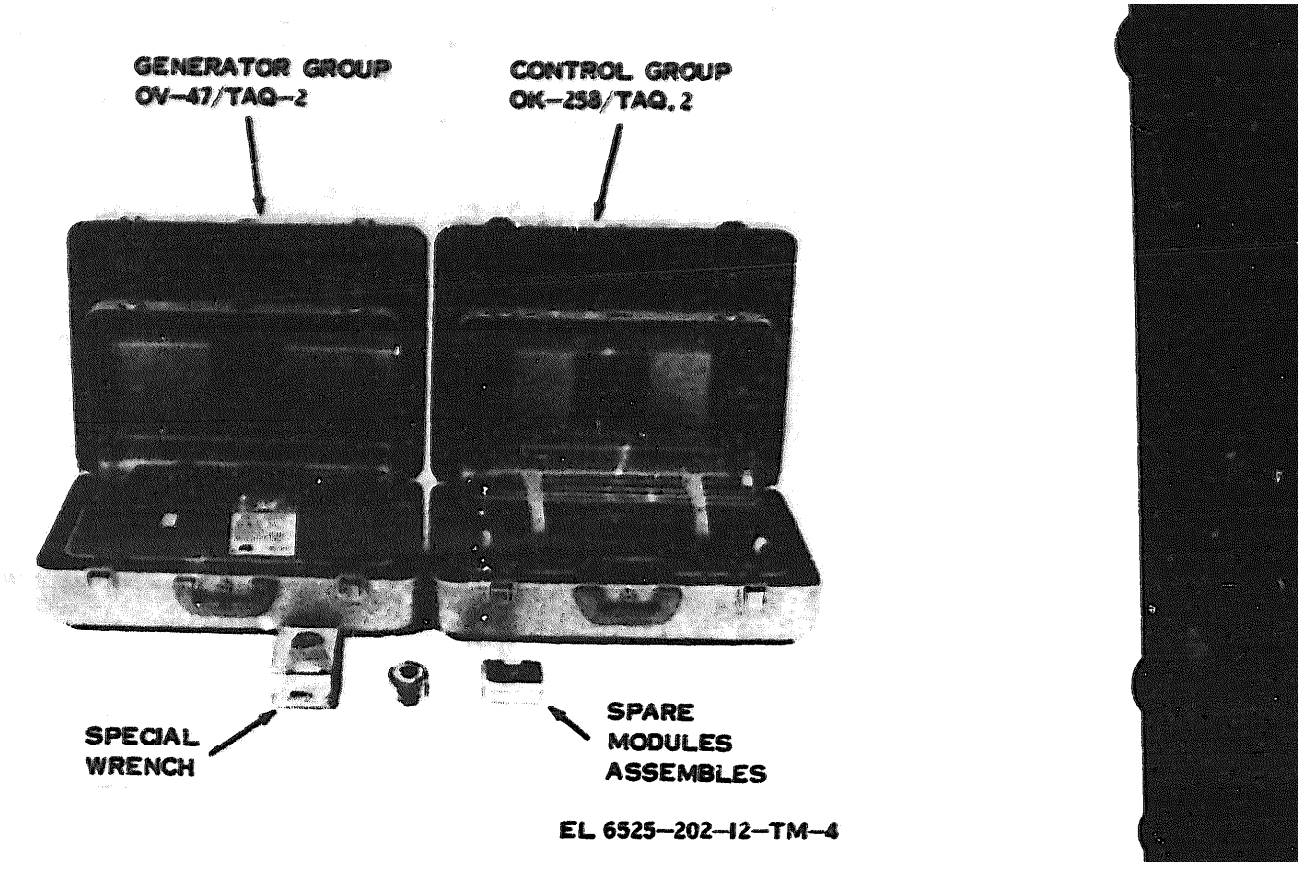

Figure 1-4. Control Group OK-258/TAQ-2 and Generator Group OV-47/TAQ-2.

e. Radiation Safety Group OA-8755/A (fig. 1-3) consists of two lead aprons, radiacmeters (dosimeters) and a radiac detector charger and is required for use by all personnel in system operation. Safety precautions are covered in detail in paragraphs 3-24 through 3-33 and in TM 8-280.

f. Detailed operation and maintenance instructions for portable X-ray units are covered in detail in TM 11-6525-201-14, and for portable radiographic processing machine in TM 11-6525-200-12.

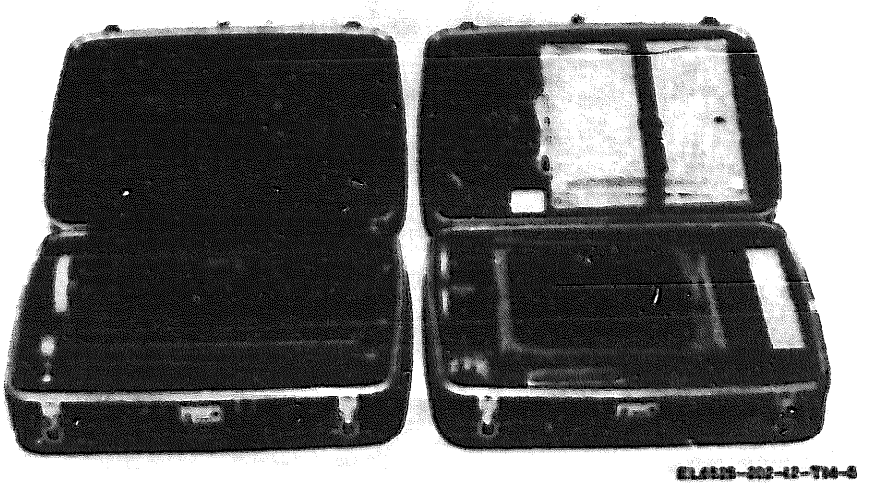

Figure 1-5. Processor Group OA-8753/U and Positioner Group OA-8754/U stowed in cases.

CHAPTER 2

SERVICE RECEIPT AND INSTALLATION

2-1. Checking Unpacked Equipment

a. When packaged for shipment the components of X-Ray Apparatus, Radiographic, Industrial System AN/TAQ-2 are packed in five luggage type carrying cases (fig. 1-1).

b. Check to see that the equipment is complete as listed on the packaging slip. If a packing slip is not available, check the equipment against the items comprising table. Report all discrepancies in accordance with TM 38-750. Shortages of a minor assembly or part that does not affect proper functioning of the equipment should not prevent use of the equipment.

c. If the equipment has been used or reconditioned, check to see whether it has been changed by a modification work order (MWO). If the equipment has been modified, the MWO number will appear on the front panel near the nomenclature plate. Check to see whether the MWO number, if any, and the appropriate notations concerning the modification have been entered in the manual. Current MWO's applicable to the equipment are listed in DA Pam 310-7.

2-2. Siting

X-Ray Apparatus, Radiographic, Industrial AN/TAQ-2 should be installed with the maximum possible protection for the operator and other personnel affected by its use. Before selecting a site and mode of operation, read the safety requirements for system application in paragraphs 3-19 through 3-33.

2-3. Installation Instructions

a. Open the cases containing Control Group OK-258/TAQ-2 and Generator Group OV-47/TAQ-2 (fig. 1-4). Unpack and assemble the X-ray unit as outlined in the steps below. Detailed assembly procedures, including illustrations, are given in TM 11-6525-201-14.

(1) Lift the Velkro straps from the mounting sections and place on the side of the dolly unit; then remove the three mounting sections from the case. Extensions are stored inside each section; be careful when removing.

(2) Remove the dolly from the control carrying case by turning the mounting clamp counterclockwise; then slide the dolly carriage to the right and disengage from the holding screws.

(3) Place the dolly on the floor and position the pulser case on the dolly.

(4) Remove the control unit from the carrying case and set it aside; then remove the spare parts kit from the inner case and place in the outer carrying case for temporary storage.

(5) Remove the high voltage cable with the X-ray head from the case and set it on the side.

(6) Take the base mast sections and remove the extension support brace from the inside; then position the base mast section in the lower left hand corner of the inner case, but do not tighten the screws.

(7) Extend the support brace assembly and place one end in the mounting hole of the base mast section; then thread until snug. Tighten the knurled nut locking screw, and fingertighten the screws on the base mast.

(8) Add one or more sections of the mast assembly as needed in the operation. The upper mast section can be raised or lowered by adjusting the nylon hex locknut on the lower base mast sections.

b. Determine the mode of operation to be used before installing the X-ray tube head in the mounting clamp. Detailed instructions and illustrations for installation at the various height levels in either a horizontal or vertical position are covered in detail in TM 11-6525-201-14.

(1) Install the X-ray tube head on the mounting clamp assembly, adjust to the required height and finger tighten.

(2) Remove all the cables from the inner case; then remove the resistive load from the pulser high voltage unit. Unscrew the end cap using the end cap removal tool found in the maintenance tool kit. Store the resistive load in the outer case.

(3) Place the high voltage cable connector into the pulser unit voltage chamber. Before inserting, check to see if the "O" ring is over the channel of the connector. If this ring is missing, leaks will develop in the pressure chamber. Loosen the amphenol plug on the cable; then seat the cable. Tighten the ring before tightening the amphenol connector.

(4) Apply some pressure to the chamber using the pump on the pressure chamber and check for leaks.

(5) Install the ground cable to the chassis and a suitable ground.

(6) Install the control power cable between the CONTROL OUTPUT jack and Jack J705 on the pulser unit. There are no screw threads on the female cable fittings; these are push-type fittings.

(7) Install the trigger cable on the rear jack of the control unit.

(8) Install the ac power cable in the control unit.

WARNING

Do not plug in the ac power source until the X-ray cassette positioning unit has been installed. Personnel may be subjected to excessive radiation doses.

(9) Check and verify that all switches in the control unit are set to OFF.

(10) Place the X-ray tube head directly opposite and approximately 24 inches from the designated object or area to be examined. If the two variable rods are used to stabilize the X-ray head, position the rods in the clamp assembly and tighten with the Allen key.

c. Open the case containing Processor Group OA-8753/U (fig. 2-1). Remove the radiographic processing machine from the case. Since the unit is designed as a portable field unit, no special installation instructions are required. Detailed instructions for operation and maintenance of the radiographic film processor are covered in TM 11-6525-200-12. Place the film processor on a flat level surface allowing at least 18 inches on the left side and 14 inches on the right side for extending the cassette sleeve and radiographic packet receptacle. Remove the positioning rod assembly units from the case.

d. Open the case containing Positioner Group OA-8754/U (fig. 2-2) and remove all the components. Determine the mode of operation required. If the operational procedures require the X-ray cassette to be positioned with the floor and ceiling as stabilized bases (fig. 2-3), follow the procedures in *e* below. If the procedures require the X-ray cassette to be positioned with the floor as a stabilizer unit and a tripod base (fig. 2-4), follow the procedures in *f* below.

e. To position the unit from ceiling to floor, proceed as follows:

(1) Place the swivel mounting clamp (fig

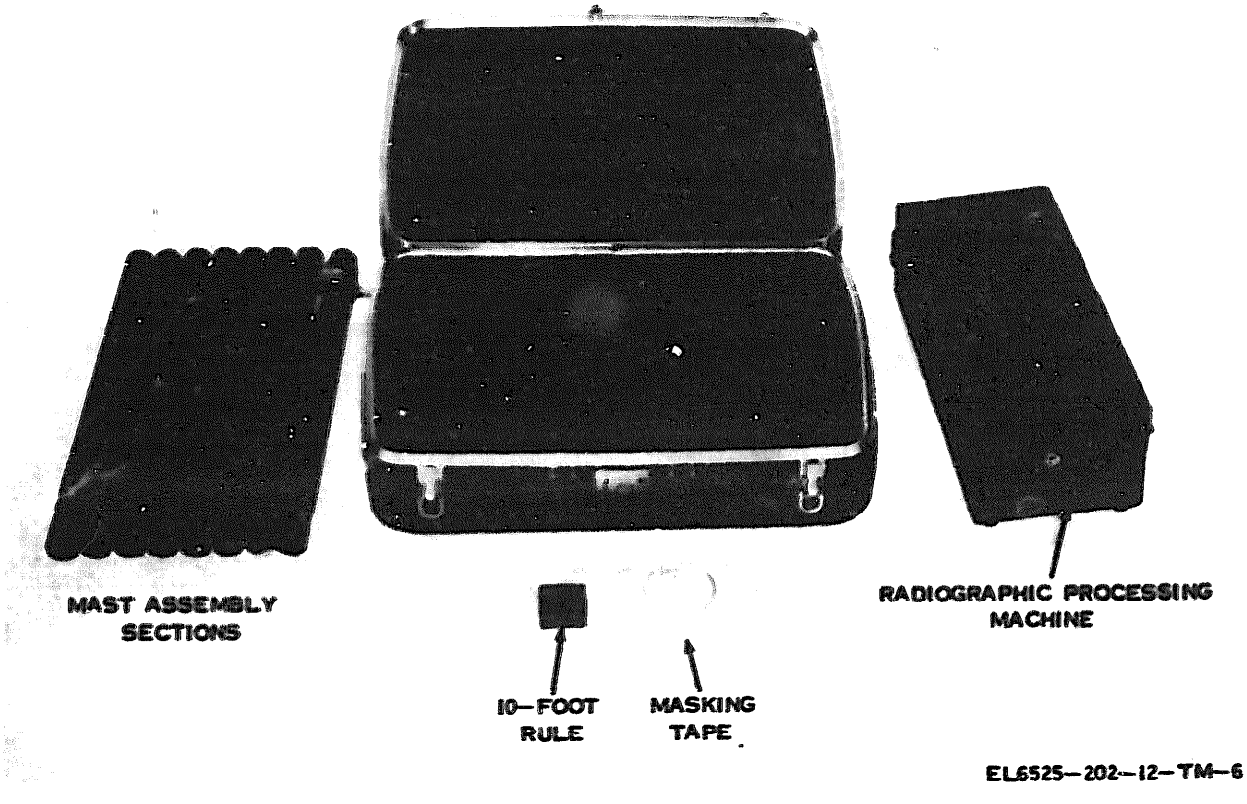

Figure 2-1. Components, Processor Group OA-8753/U.

2-5) on one of the center rods and finger tighten.

(2) Attach the top assembly, with the spring loaded clip (fig. 2-3), to as many rod assemblies as required to reach the desired height. The bottom assembly, which has an adjustable base clamp with an approximate 4-inch span, is placed on last.

(3) Place the cassette holder with the loaded X-ray plate on the cassette holder swivel clamp and fingertighten (fig. 2-5). Final adjustments and positioning are made before the equipment is operated.

(4) Adjust the assembled unit to the approximate position desired. Place the entire assembly up to the ceiling and gently exert pressure, forcing the spring loaded clip in the top section to recess. Hold the pressure until the bottom base is placed in position against the floor and wall. Loosen the base assembly locking screw (fig. 2-3), and allow the extension rod to rest on the floor with pressure still being applied to the spring loaded clip. Tighten the collar locking screw; then release the pressure. The extension assembly should be secure. Final adjustments can be made by loosening the base locking screw and adjusting the entire assembly as needed.

f. Use the tripod assembly to install the unit as follows:

(1) Take the tripod baseplate (fig. 2-2) and insert one of the center assembly rods into the baseplate and fingertighten the baseplate locking screw.

(2) Insert three (3) of the assembly rods into the baseplate, tightening the baseplate locking screws. Move the assembly to the approximate site location. Add as many extension rods as necessary until the required height is reached.

(3) Place the swivel clamp (fig. 2-5) on the center extension rod at the required height and fingertighten the locking screw. Be sure to position the swivel clamp with the nonadjustable side on the center rod; otherwise angular adjustments on the horizontal bar cannot be made.

(4) Place the horizontal rod in the swivel clamp and tighten. Pull out the pin release (fig. 2-5) and set the horizontal rod to the angle required; release the pin to lock the assembly on the horizontal rod.

(5) Slide the cassette locking swivel over the horizontal rod and fingertighten the adjusting clamp lever. The swivel clamp holder assembly must be placed on the horizontal bar as shown in figure 2-5; otherwise vertical or horizontal angular adjustment cannot be made during operation.

(6) Place the X-ray film cassette holder frame (fig. 2-2) in the cassette holder swivel clamp and tighten the knurled knob. The entire

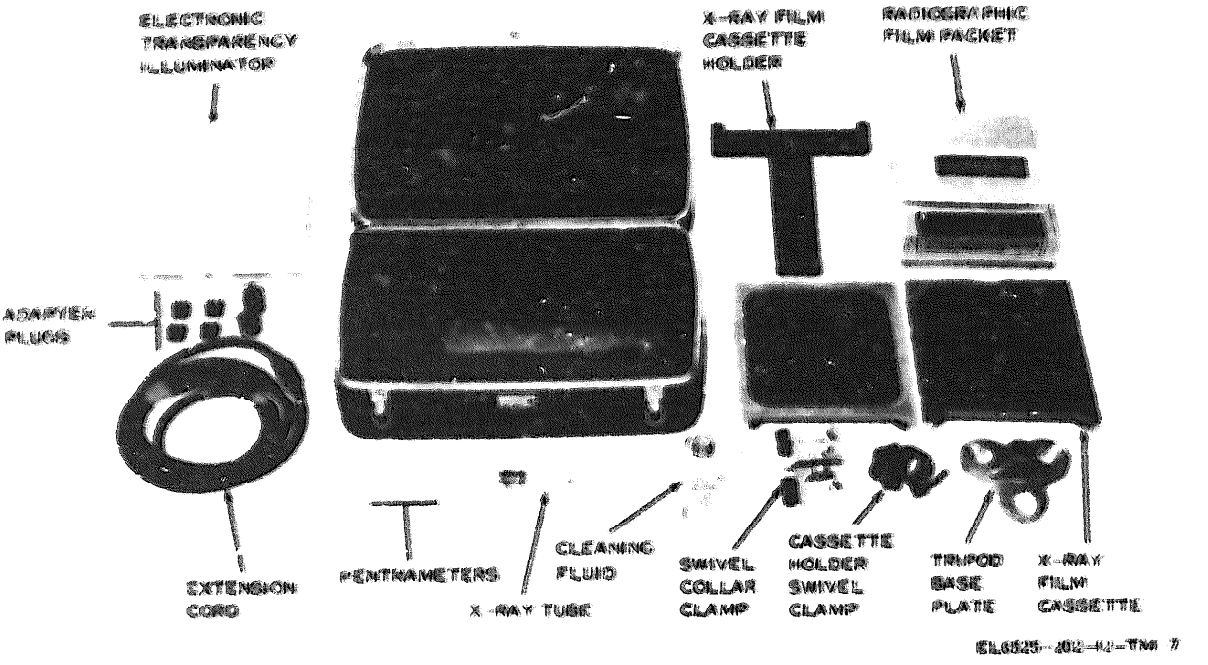

Figure 2-2. Components Positioner Group OA-8754/U disassembled.

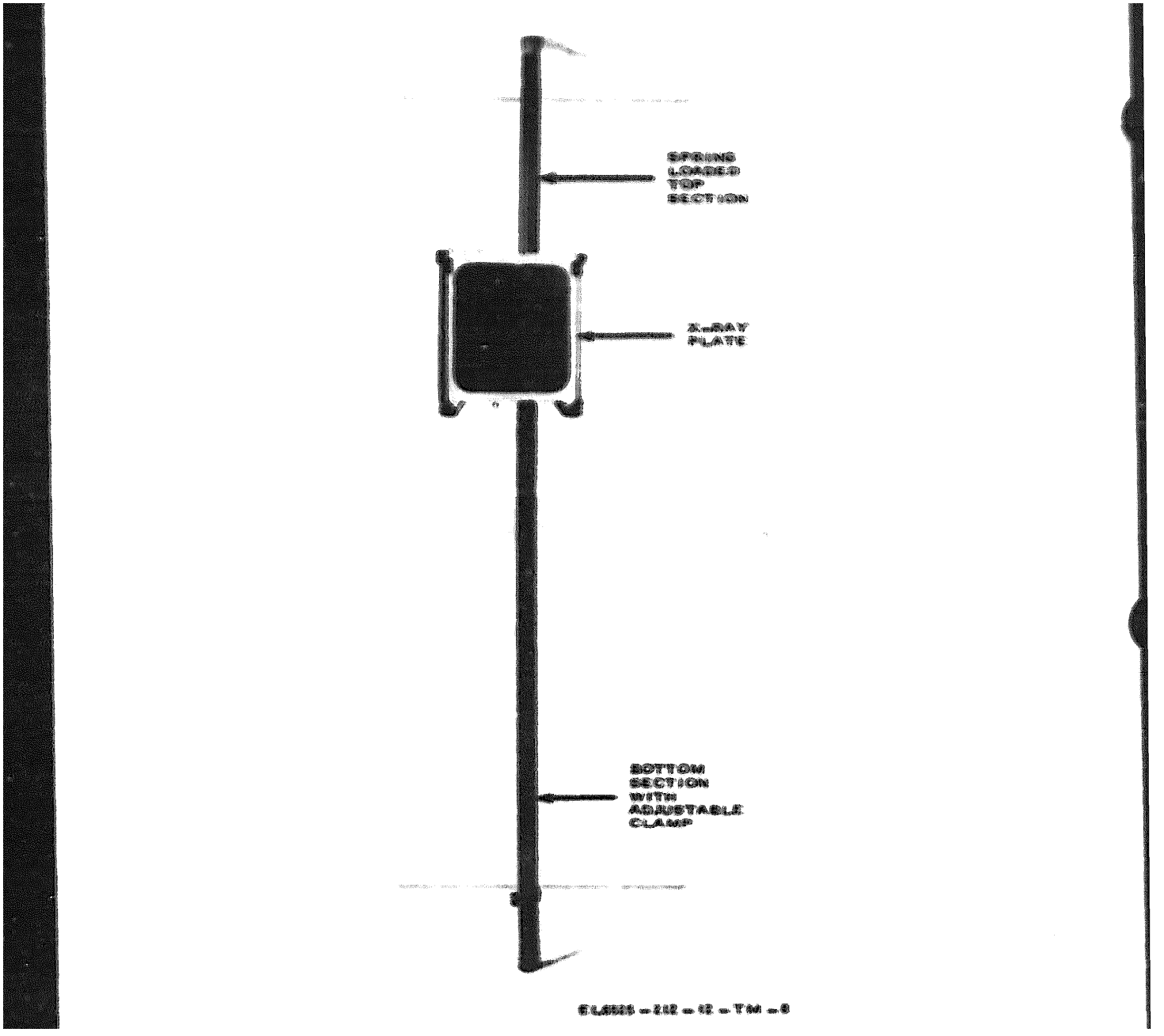

Figure 2-3. Positioner group, mast assembly installation, floor to ceiling.

assembly must face the wall or object to be examined.

(7) After the radiographic film has been loaded in the X-ray plate (para 3-6), place the bakelite surface of the X-ray plate on the cassette holder so it faces the X-ray tube. Adjust the entire pole assembly and position the X-ray plate so it is centered on the object to be filmed.

(8) If use pentrameter (fig. 2-2) is required for inspection of the resolution of the X-ray film, place and secure the pentrameter on the object to be examined with the masking tape from the case.

g. After the installation is complete and operation is required where there is an obstruction, such as a wall, door, floor, etc., between the X-ray tubehead and film cassette,

perform the following:

(1) Remove the measuring tape from the case, and determine the height and width from a common point of the X-ray tubehead.

(2) Using the same common point, go to the opposite side of the obstruction and measure the height and width; then place the cassette in line with the tubehead.

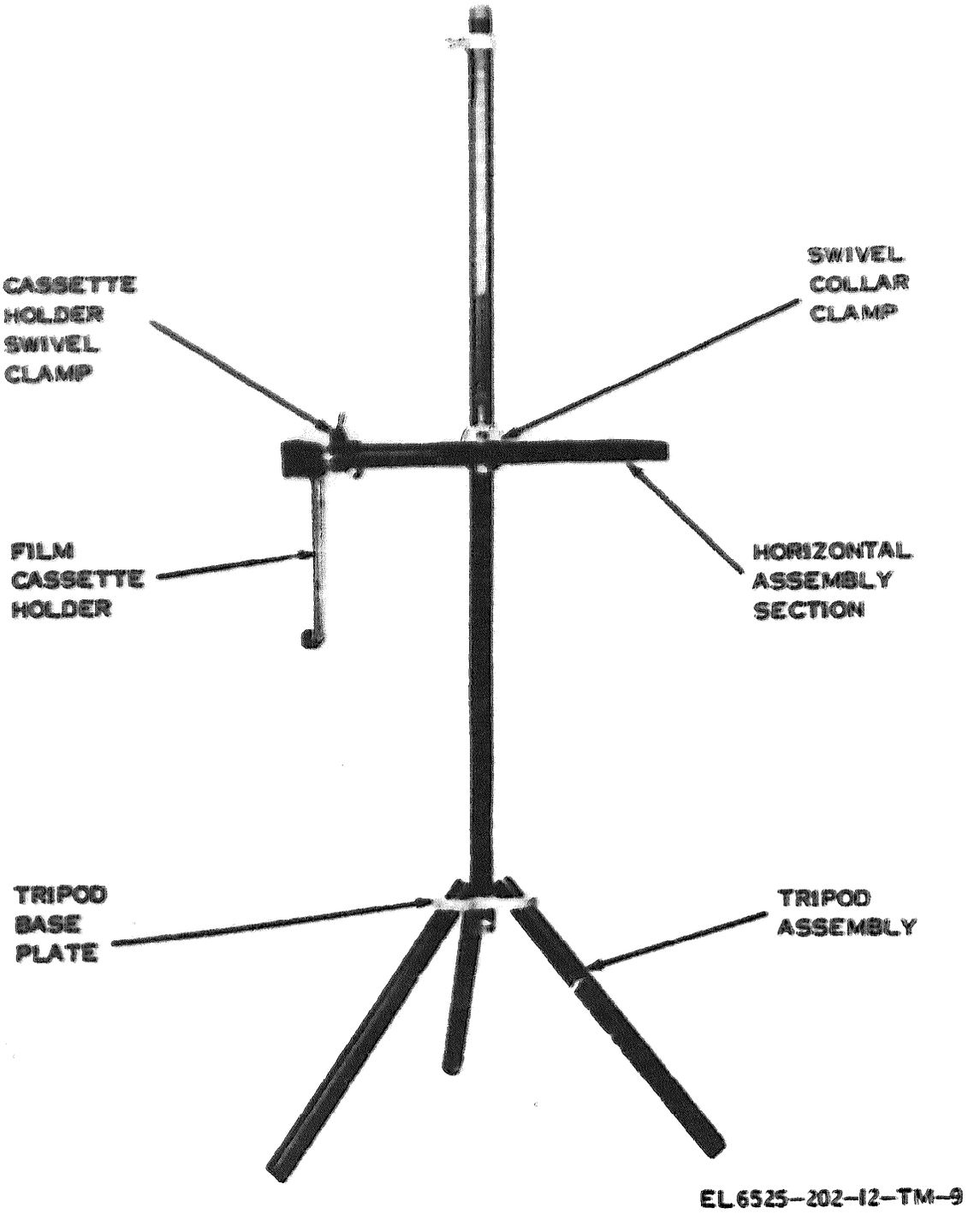

Figure 2-4. Positioner group, mast assembly with tripod.

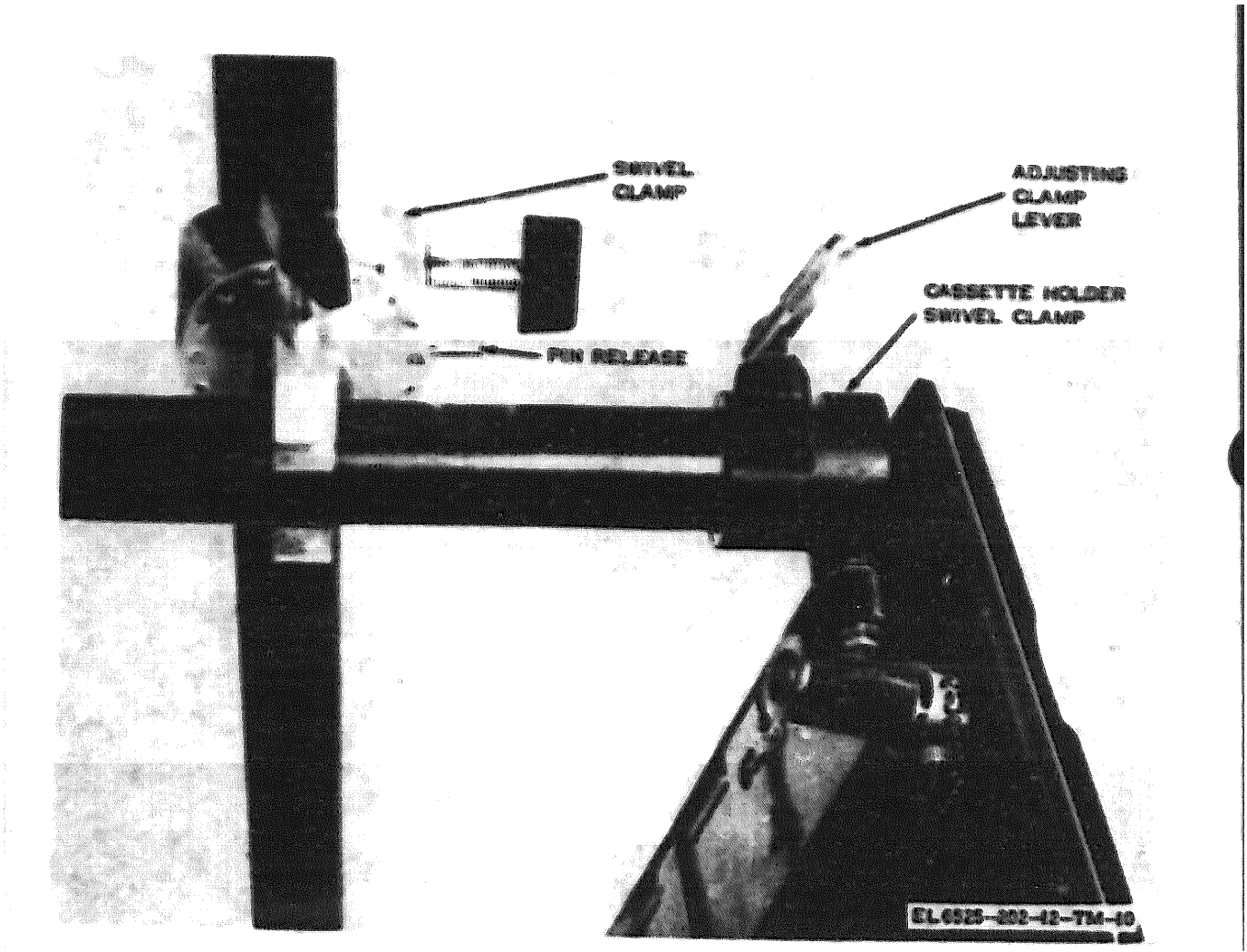

Figure 2-5. Positioning indicator swivel clamp and cassette holder swivel clamp assembly.

CHAPTER 3

OPERATING INSTRUCTIONS

Section I. PLANNING MISSION

3-1. General

a. X-Ray Apparatus, Radiographic, Industrial AN/TAQ-2 consists of a portable X-ray unit, a portable radiographic processor, and positioning units packed in suitcases for use in the field or areas designed and shielded for radiography. If the X-ray mission requires horizontal exposures, lead shielding should be provided behind the film cassette. When lead shielding is not available, locate the X-ray tube the maximum possible distance from the occupied area. Follow the instructions for protection against X-rays and the safety procedures outlined in paragraphs 3-24 through 3-33.

WARNING

Radiation can be extremely dangerous to the human body. Study the instructions contained in paragraphs 3-24 through 3-33 before operating the equipment.

b. Determine from the requirements of the mission whether TLX film or 3000X film is to be installed in the X-ray cassette. The TLX radiographic film packet is the most commonly used in general operation and will give an on-site picture inspection of the object to be examined. When transparencies are needed for a permanent record, or the object to be examined requires deep penetration, the 3000X film packet is used.

c. Each radiographic film packet (fig. 3-1) contains step-by-step instructions and illustrations for loading the film in the cassette. The developing techniques are also covered in detail. Do not discard the instructional folder; place it back in the radiographic film packet after each use.

d. Information required to determine the pulse rate and the input line voltage for presetting the exposure detection meter for material objects to be examined are contained in figure nomographs 3-2 through 3-7.

3-2. System Operation

The X-ray unit, portable film processor, and positioning indicating unit can be assembled and installed to take Polaroid type X-ray film, which can be developed in less than 2 minutes. The system can be operated from ground level to a height of 10 feet in the vertical or 18 inches in the horizontal position.

3-3. Preliminary Operating Procedures

a. Assemble the X-ray unit, the portable processor unit, and the position indicator in accordance with the instructions in paragraph 2-3.

b. The operating procedures for the portable X-ray unit are printed on the control panel and are

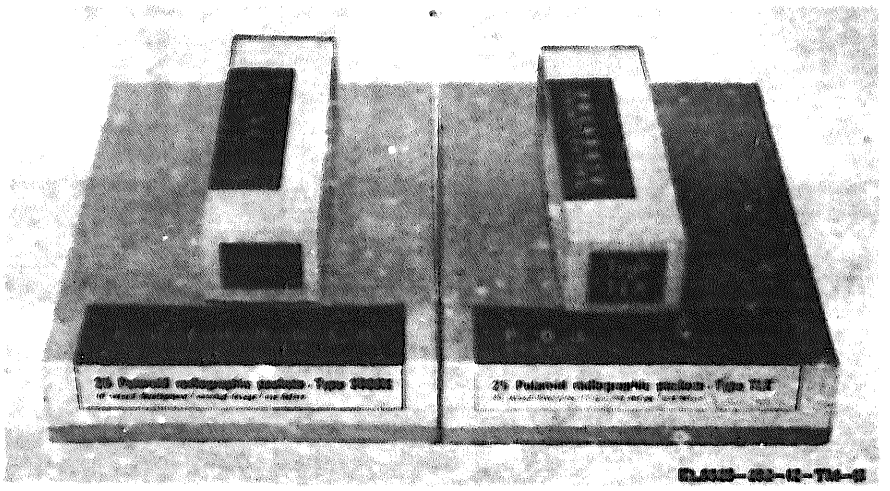

Figure 3-1. Radiographic film packets.

intended as a reference guide for experienced operating personnel.

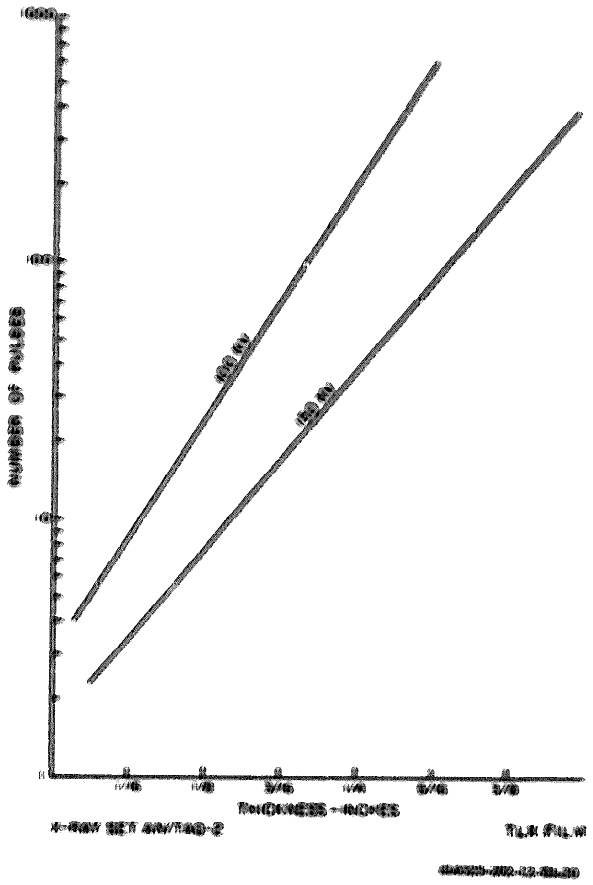

Figure 3-2. Stool.

WARNING

Do not attempt to operate the X-ray unit unless you are familiar with the safety procedures outlined in paragraphs 3-22 through 3-26, and the protection against X-ray radiation in paragraphs 3-27 through 3-33, and the control and recording procedures for occupational exposure to ionization radiation outlined in AR 40-14. Also check paragraph 3-19. Before operating the equipment, clear the entire room and area exposed to the primary X-ray beam (in front of and behind film cassette) of all personnel except the operator. Operating personnel must stand as far as possible from the primary beam and X-ray tube during all exposure. Do not hold the X-ray tube in your hand during all exposure. Do not stand in front of the X-ray tubehead, even if the equipment seems to be turned off.

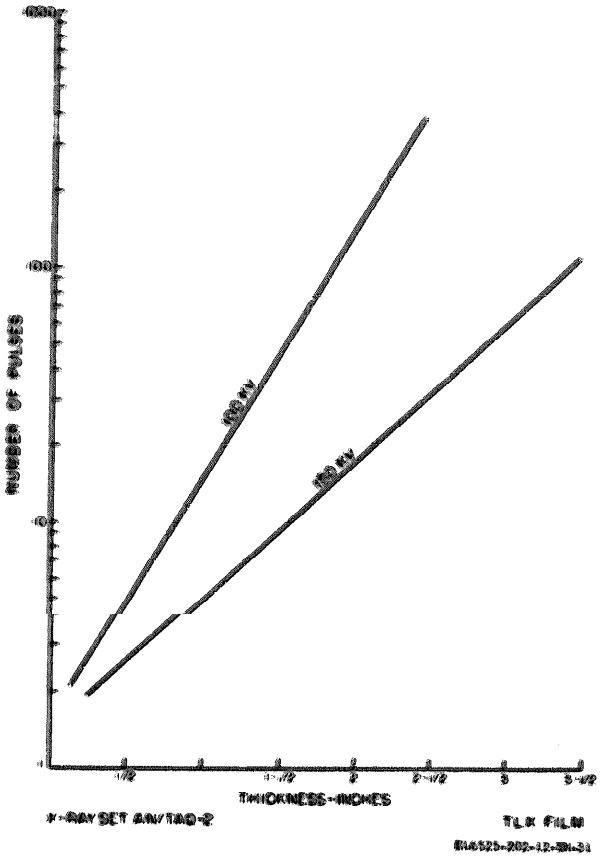

Figure 3-3. Aluminum

c. Ground the equipment (fig. 3-8) to a water pipe or to the best grounding facility available before operating this equipment because of high voltages required in the operation of this equipment. (See warning decals on covers of the equipment.)

Section II. CONTROLS AND INDICATORS AND OPERATION UNDER USUAL CONDITIONS

3-4. Description of Operator Controls and Indicators

a. This section describes, locates, and illustrates the controls required for the proper operation of the entire X-ray film and processing system. It is important to know the function of

very control because improper or indiscriminate setting of the controls can cause damage to the electrical equipment.

b. The controls and indicators for the X-ray apparatus and the portable X-ray film processor are listed and described in table 3-1. Figures 3-9 through 3-12 show the location of the operating controls for the portable X-ray film processing unit. The system operating procedures are described in paragraphs 3-5 through 3-12.

Table 3-1. X-Ray Apparatus Controls and Indicators

Control or indicator	Function
AC INPUT receptacle	Recessed three-prong connector to which line power is applied.
POWER ON/OFF switch	Toggle switch controlling ac primary power.
EXPOSURE SELECTOR	Pre-selection impulse counter, counting back to zero from its preset value. One through 99 pulses may be selected from a pulse train.
EXPOSURE selector reset knob	Locks selected number of pulses and enables duplicating selected pulses.
EXPOSURE SWITCH	Phone jack for attaching the pushbutton exposure switch cable.
AIR PUMP	Hand-operated air pump for supplying pressurized air to the pulser and X-ray tube chamber.
PULSER PRESSURE gage	Indicates air pressure in pounds per square inch in the pulser and X-ray tube chamber.
PRESSURE RELEASE valve	Push activated valve which releases pressurized air in the system.
PRESSURE LOW lamp	White incandescent lamp which indicates (when lighted) that pulser air pressure is below acceptable minimum and pressure activated safety switch will not allow system to operate.
POWER ON lamp	Amber neon lamp which, when lighted, indicates that ac power is available to the system.
SET SELECTOR lamp	Green incandescent lamp which, when lighted, indicates that exposure selector is at zero. When a pulse train selection (1-99 pulses) has been set on exposure selector and reset knob released, the lamp extinguishes.
EXPOSING lamp	Red neon lamp that indicates (by flashing) that primary circuit of the high voltage power supply circuit is active and trigger relay is operating.
RESET overload switch	Lighted pushbutton switch that indicates (red when lighted) overload trip-out circuit has actuated. The trip-out circuit is reset by pushing the RESET button. The light will then extinguish unless the overload condition continues.
Line voltage meter	Indicates primary power input voltages to X-ray apparatus.
LINE VOLTAGE ADJUST	Adjusts to the ac power source used.
CIRCUIT BREAKERS 1 & 2	Permits ac line power to be applied to components of X-ray apparatus and protect equipment from an overload.
Winding knob	Winds spring driven cam.
Release button	Operates spring driven cam causing rollers to operate.
Timer	Indicates time in seconds (0-60).
Rollers	Draw film from cassette, break chemical pods, and spread developer evenly across film surface.
Cross bar (LH & RH roller carriages lock)	Locks upper roller in contact with lower rollers.
Pressure adjusting screw	Adjusts pressure of rollers.
Cassette sleeve	Provides means of inserting exposed film cassette into unit.
Packet receptacle	Provides storage of processed film during developing period.

3-5. General Instructions

After all the units have been removed from the cases and installed and grounded as required by the mission, in accordance with the safety procedures and protection against radiation exposure (para 3-19 through 3-26) perform the preoperational procedures as follows:

a. Determine the requirements of the mission and the film packet required for operation.

b. Place the film packet in the cassette and install on the cassette holder. Make any adjustments (angular or vertical) as required.

c. Be sure that all switches are set to OFF before plugging in the ac power cord.

d. Check the voltmeter indication on the control unit meter; set the LINE VOLTAGE ADJUST switch to the nearest number corresponding to the indication.

e. Place the CIRCUIT BREAKERS and POWER switch to ON and pressurize the system for the voltage setting required for operation.

f. Set the EXPOSURE SELECTOR dial and prepare for operation.

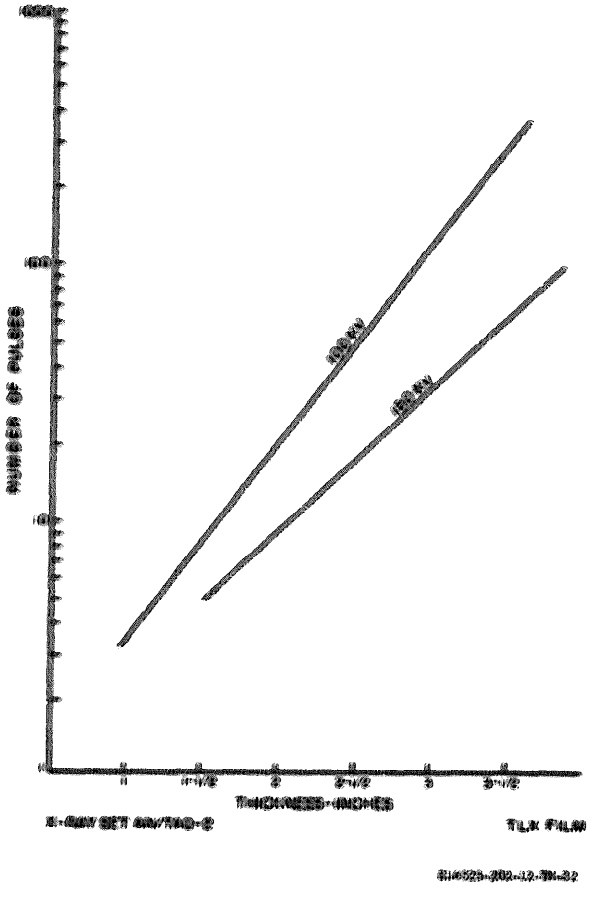

Figure 3-4. Cinder block.

WARNING

Before operating the system, all personnel must be out of the area and away from the front of the X-ray tubehead. Operators must use the lead aprons and dosimeters.

3-6. Film Cassette Installation and Use

a. The portable X-ray unit can only be used with a Polaroid type X-ray cassette; other standard X-ray cassettes cannot be used with this unit.

b. The X-ray film packet used in the cassette consists of a negative inclosed in a lightproof envelope, a receiving sheet for the image transfer from the exposed negative, and the pod which contains the processing chemicals.

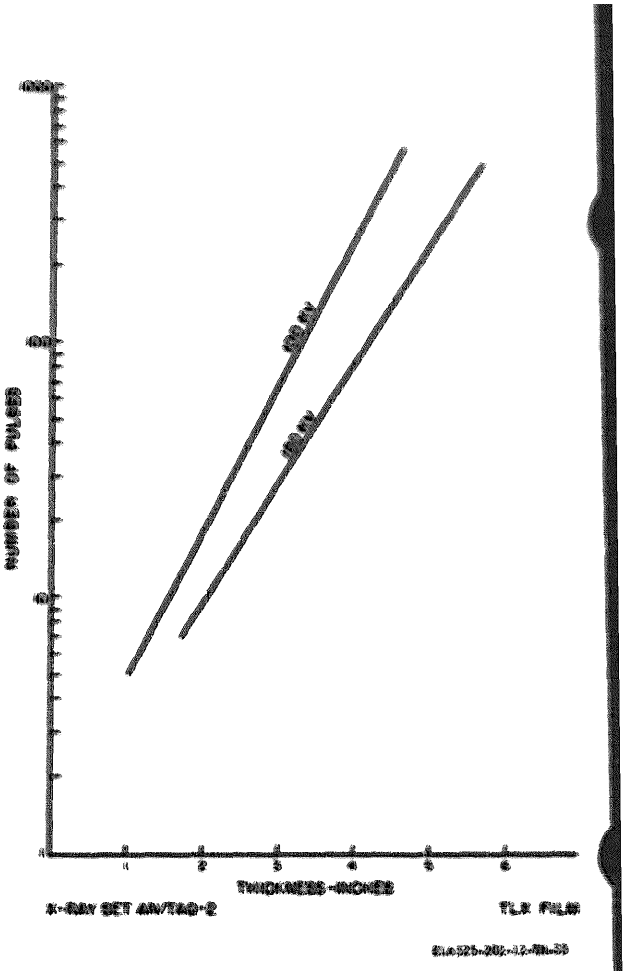

Figure 3-5. Concrete.

CAUTION

Be careful when loading the cassette with the radiographic film packet to avoid pressing on the pod. If the caustic agent should get on your skin, wipe it off immediately, and wash the area with plenty of water to prevent an alkali burn.

c. Handle the packet carefully; do not let the packets hang vertically or fogging of the negative could occur.

d. Remove the envelope immediately after inserting the film packet; lay the pressure lever flat and protect the cassette from the bright light.

e. Coat the radiographics immediately after development to protect the face of the translucent print.

f. Load the film packet into the cassette as outlined below.

(1) Place the X-ray cassette face downward; then pivot and release both lock springs (fig. 3–13).

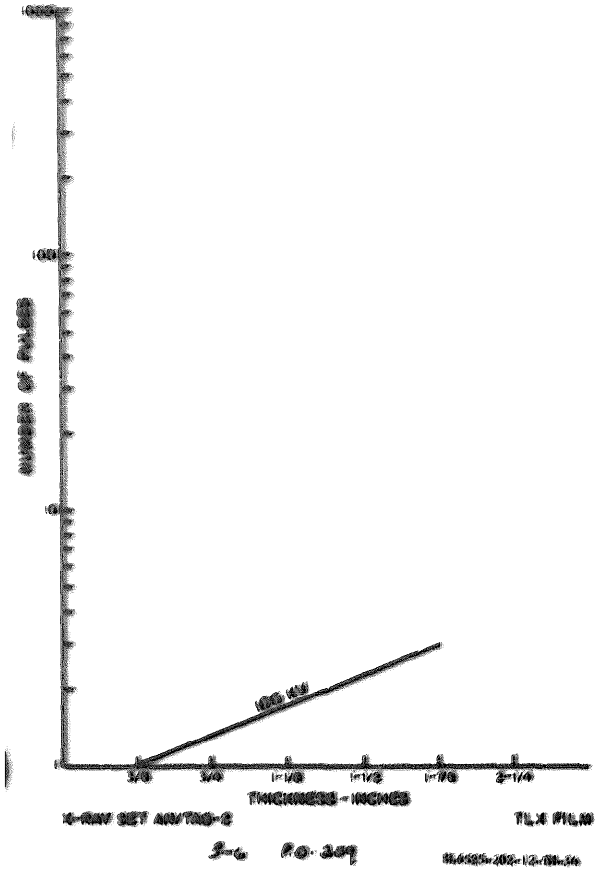

Figure 3-6. Plasterboard

(2) Raise the back; then lift the screen partway. Hold the back and screen in one hand.

(3) Place the end of the black negative envelope in the holder, so it is directly under the end of the screen.

(4) Drop the screen. The end should just cover the black negative envelope but should not touch the brown paper.

(5) Slide the film packet into the holder. The brown paper mask and the positive sheet MUST go over the screen. If the edges catch, wiggle the packet to get the envelope past the obstruction.

(6) Slide the film packet until the end is flush with the end of the cassette.

(7) Close the back of the cassette; then fold the white tab over the end of the cassette on the button.

(8) Check to see that the pressure lever is flat; then depress, pivot, and lock both springs.

(9) Raise the pressure lever as far as it will go; hold it upright. Grasp the end of the black envelope.

(10) Withdraw the black envelope by pulling it out straight, not at an angle or to one side. The envelope should slide out smoothly. Release the pressure lever and place it flat on the cassette.

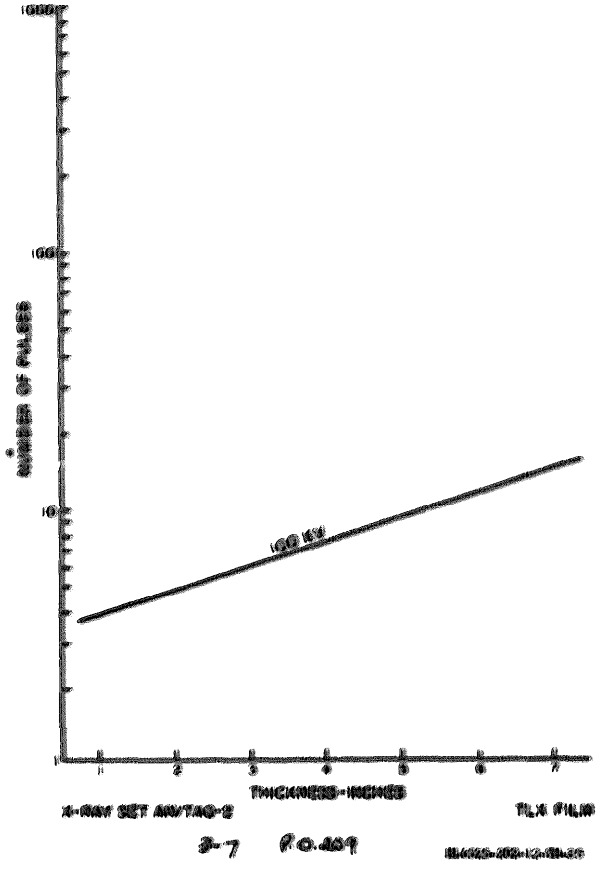

Figure 3-7. Wood.

CAUTION

From the time the envelope is withdrawn until the radiographic film is processed, the cassette should be kept out of any intense light.

(11) The cassette is ready for operational use. Follow instructions as outlined in the instructional sheet contained in each box of radiographic film to determine developing times and techniques for developing, storing, and processing of negatives.

g. The film cassette is installed for operational use as follows:

(1) If the mission requires horizontal exposure, provide lead shielding (para 3-31, 3-32, 3-33) behind the film cassette, or locate the X-ray tube the maximum distance from the occupied area.

(2) The film cassette has two sides; one which is fit with two spring straps, and the other which is smooth and contains a window of opaque material. Place the opaque window towards the X-ray source.

(3) Secure the film cassette in the proper position, move away from the area, and prepare for normal operation.

WARNING

DO NOT hold the object or film cassette in your hand when X-raying an object. Harmful exposure to radiation will result.

3-7. Positioning Indicating Unit Using Tripod Installation

a. When the mode of operation requires an examination of an object or area without both a ceiling and floor base, assemble the tripod base unit (para 2-3), and place the X-ray plate as close as possible to the object being examined with a minimum distance to the X-ray tube head for maximum resolution. A typical installation showing the X-ray unit with a tripod base is shown in figure 3-14.

b. If the nature of the object to be examined has great depth, an X-ray film will still give a good picture at a reasonable distance, but there will be some loss of resolution. Place the penetrameter on the object to be examined to check the resolution.

3-8. Positioning Indicating Unit Using Ceiling to Floor Base and X-Ray Unit

When the mode of operation requires an examination of an object or area using a ceiling to floor installation, assemble the unit as described in paragraph 2-3. Place the X-ray plate snugly

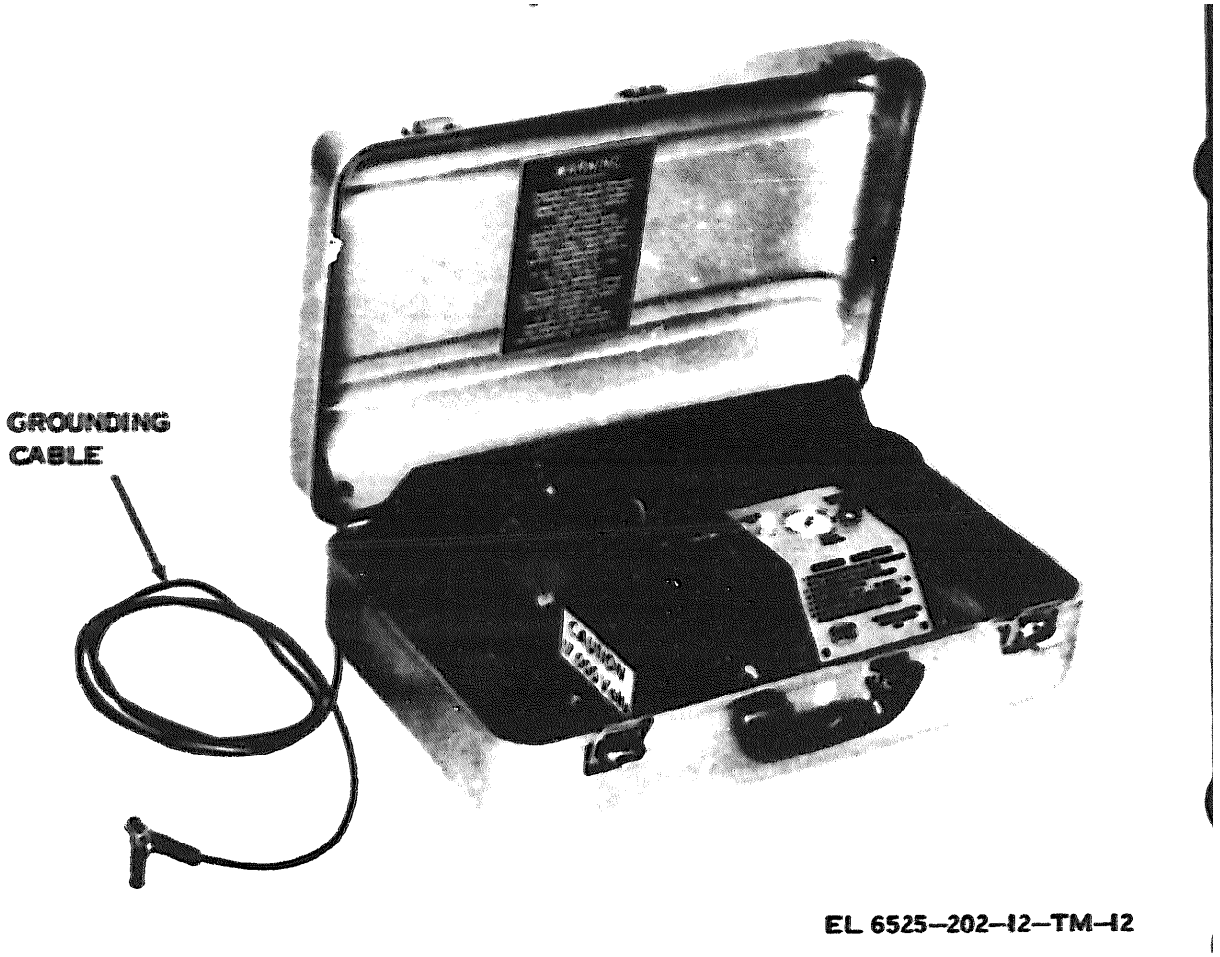

Figure 3-8. Grounding cable installed on pulser unit.

against the object to be examined with a minimum distance to the X-ray tube for maximum resolution. A typical installation showing the X-ray unit with a ceiling to floor installation using a wall as the examined object, is shown in figure 3-15.

3-9. Operating Procedures for X-Ray Unit

a. Place control unit CIRCUIT BREAKERS 1 and 2 at OFF (fig. 3-10).

b. Check the zero correction of the line voltage meter before connecting the ac input cord to the AC INPUT jack. Adjust the meter if necessary using the adjustment screw on the face of the meter.

c. Connect the ac input power cord to the power outlet. Set the LINE VOLTAGE ADJUST selector switch close to the line voltage.

d. Insert the exposure switch cable into the EXPOSURE SWITCH jack and place the 100 KV-150 KV voltage level switch to the required setting; then pressurize the system.

e. The X-ray unit must be pressurized to 8 pounds per square inch (psi) for 100kV and 22 psi for 150 kV at sea level. Refer to figures 3-16 and 3-17 for correction factors for specific altitudes and temperature variations. When pressurizing, pump slowly to allow maximum time for moisture removal.

f. Determine the required number of pulses to be set on EXPOSURE SELECTOR. Example: If the object to be examined is aluminum (fig. 3-3), assume that a penetration of 1" thickness is required for the mission. Move horizontally the thickness scale to 1; then extend vertically to either the 100 kV or 150 kV graph line. Move horizontally to the left and read the number of pulses required to be set in the EXPOSURE SELECTOR dial. In this example using the 100 kV scale, 20 pulses are required.

NOTE

Whenever possible the 100 kV chart scale should be used. This chart will give the best results and contrast, and

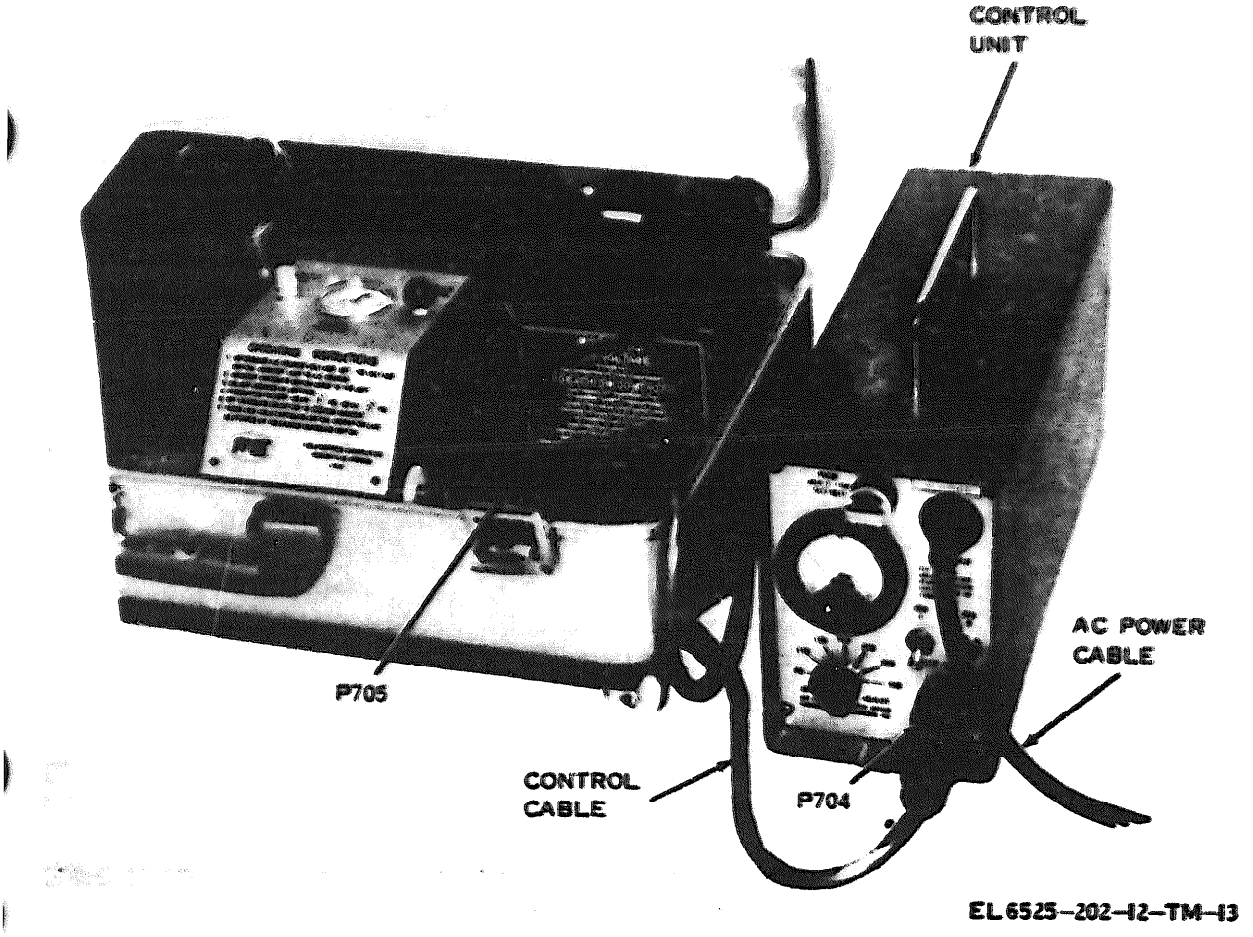

Figure 3-9. Control unit, controls and indicators (control section).

place minimum strain on the equipment. The 150 kV scale is used when the thickness of the object to be examined is deep and requires maximum power for readability of the X-ray print.

g. Figures 3-2 through 3-7 cover the pulse settings for all material objects such as steel, concrete, wood, etc. If examination is required of personnel, follow the procedures outlined in the nomograph charts furnished with the radiographic film packets.

h. Select the desired number of pulses before applying power to the control unit.

(1) Pressurize the system.

(2) Depress the EXPOSURE selector reset knob and lock, turning one-quarter turn to the right (white line in horizontal position, fig. 3-10).

(3) Set selected number of pulses by adjusting the EXPOSURE SELECTOR wheels. The right hand wheel selects pulses 1 through 9; the left hand wheel selects pulses in multiples of 10. The combination of the two wheels will allow pulse selection from 1 to 99.

(4) Using the example given in *f* above, adjust the wheels for 20 pulses on the EXPOSURE selector.

(5) Depress the EXPOSURE selector reset knob and unlock with one-quarter turn (white line in the vertical position, fig. 3-10).

Figure 3-10. Control unit, controls and indicators (transformer section).

CAUTION

The EXPOSURE selector reset knob must be completely depressed before turning to the unlocked position to position and lock the adjusting wheels. If the wheels are not positioned and locked, the electromechanical impulse counter will remain open resulting in a free running pulse train until the EXPOSURE SWITCH is released.

(6) Depress, then release the EXPOSURE selector reset knob. Do not turn. Prepare the X-ray unit for operation.

i. Set CIRCUIT BREAKERS 1 and 2 and POWER ON-OFF switches to ON.

WARNING

All personnel must be out of the area and away from the X-ray tubehead. Operators must wear lead aprons and dosimeters.

j. Press the EXPOSURE SWITCH (trigger) until the pulse train countdown has been completed. The indicator lamp on the control unit will be red during exposure. When the pulse train has been completed the exposure lamp indicator will turn green.

NOTE

An overload/trip-out circuit is provided to protect the high voltage power supply if there is a shorted energy module in the pulser. It will also interrupt the system operation after consecutive pulser misfires because of insufficient pressurization of the pulser. The RESET indicator switch will light red when the trip-out circuit has interrupted system operation. After each exposure, check that EXPOSURE selector indicates zero and the reset lamp is not lighted. If these conditions are not present, press the RESET switch and continue exposure until the EXPOSURE selector indicates zero to insure proper exposure of film.

Figure 3-11. Air pressure assembly, controls and indicators.

k. The X-ray film can now be removed from the cassette and processed. To repeat the exposure, reload the cassette and replace the X-ray plate. A safety feature is provided in this unit. The X-ray tubehead cannot be activated by the EXPOSURE (trigger) SWITCH until the EXPOSURE selector reset knob has been depressed and reset.

l. If a repeat exposure is required after a new film packet is installed, depress the EXPOSURE selector reset knob; it will automatically repeat the 20 pulse train setup.

m. To readjust the pulse train, depress the RESET switch; place the switch in the horizontal position (fig. 3-18); set the new values on the EXPOSURE selector wheels; then place RESET switch in the vertical position (fig. 3-19). The green light will indicate ready for exposure.

3-10. Operating and Processing Using Portable Film Processing Unit

a. Prepare the portable film processing unit for operation after installation has been made (para 2-3). Functioning of the equipment and detailed operating and maintenance procedures are covered in TM 11-6525-200-12.

b. Check the roller pressure for the type of film being used (fig. 3-20) as follows:

(1) Cut two strips of paper about 1 inch wide from a paper pad (FSN 7530-285-8030).

(2) Place one strip of paper on the left side and one strip on the right side, between the two rollers (fig. 3-21).

(3) Turn the pressure adjusting screw clockwise to increase roller pressure and counterclockwise to decrease roller pressure. The paper

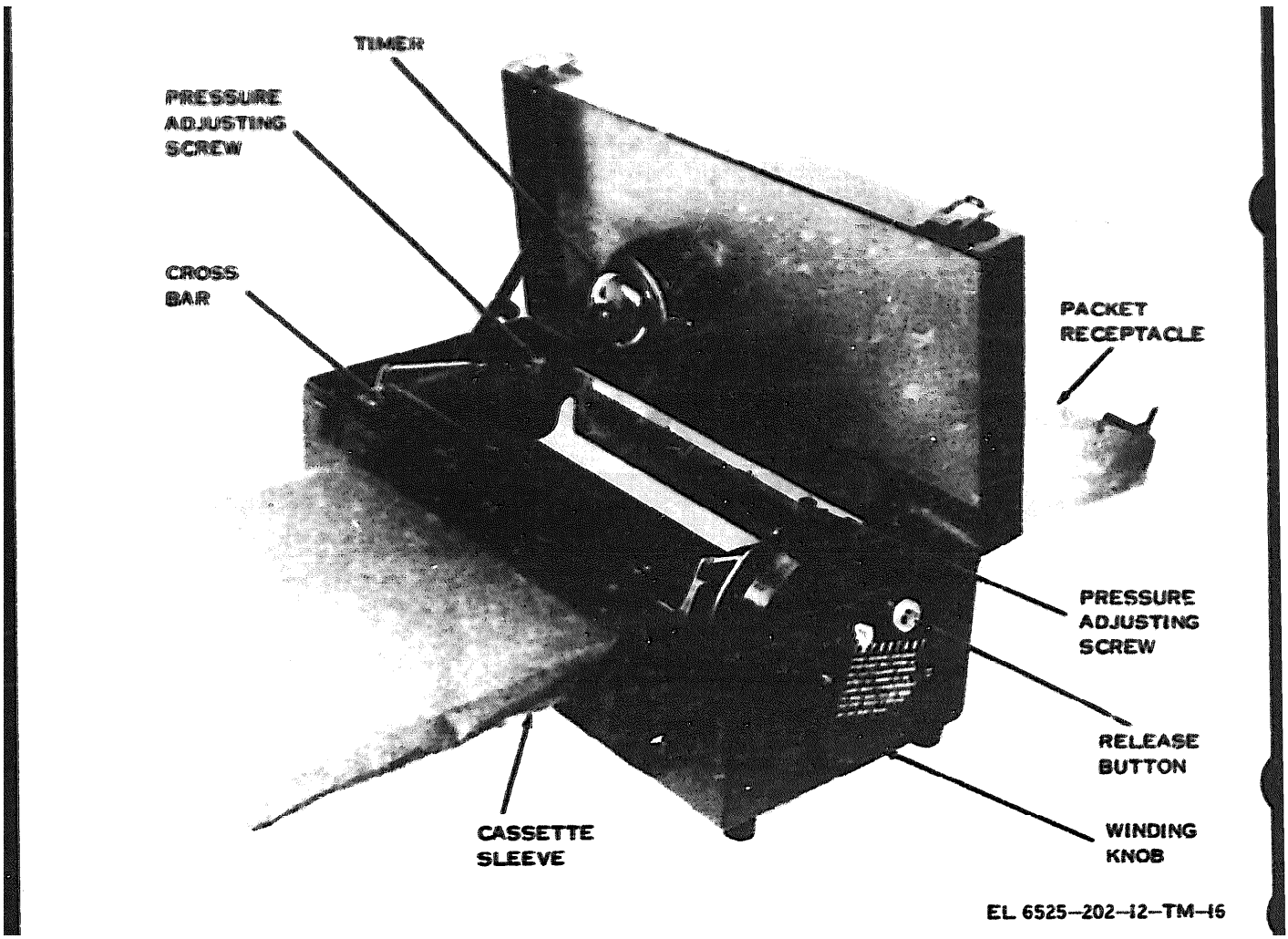

Figure 3-12. Film processing unit operating controls.

strips should be pulled through without tearing the paper.

NOTE

Pressure settings will vary from unit to unit. The pressure settings on each side of the rollers should be 7 1/4 pounds for 3000X film and 5 1/2 pounds for TLX film.

c. Process the exposed X-ray film packet as follows:

(1) Rotate the winding knob clockwise until the release button moves to the upper end of the groove in which it is located. At this point the winding mechanism is locked to the winding drum shaft and more resistance will be encountered as the winding drum is rotated.

(2) Grasp the winding knob and continue to rotate it counter-clockwise almost one complete turn until the pin protruding from the winding drum contacts the winding stop mounted on the main frame.

NOTE

Some difficulty may be experienced in rotating the winding knob. This is only momentary and will improve as the operator continues to rotate the winding knob.

(3) Insert the cassette into the open end of the cassette sleeve on the left, and position it to the extreme depth of the cassette guide which is located on the roller pillow blocks (fig. 3-21).

(4) Lift up the crossbar and insert the film tab between the two rollers.

(5) Press the crossbar downward to lock its mechanism so that the upper roller is pressed against the lower roller.

(6) Close the cover of the film processing unit; then reach into the cassette sleeve on the left and lift up the cassette pressure release.

(7) Fold the end of the cassette sleeve under to prevent light leak.

(8) Rotate the timber knob clockwise to some point past the period required for the processing time of the X-ray film packet listed below.

(a) TLX film processing time: 45 seconds.

(b) 3000X film packet processing time: 15 seconds.

NOTE

Refer to the film packet instructions for details concerning development time in extremely cold weather or excessive heat.

(9) Depress the release button on the winding knob as the timer pointer arrives at the

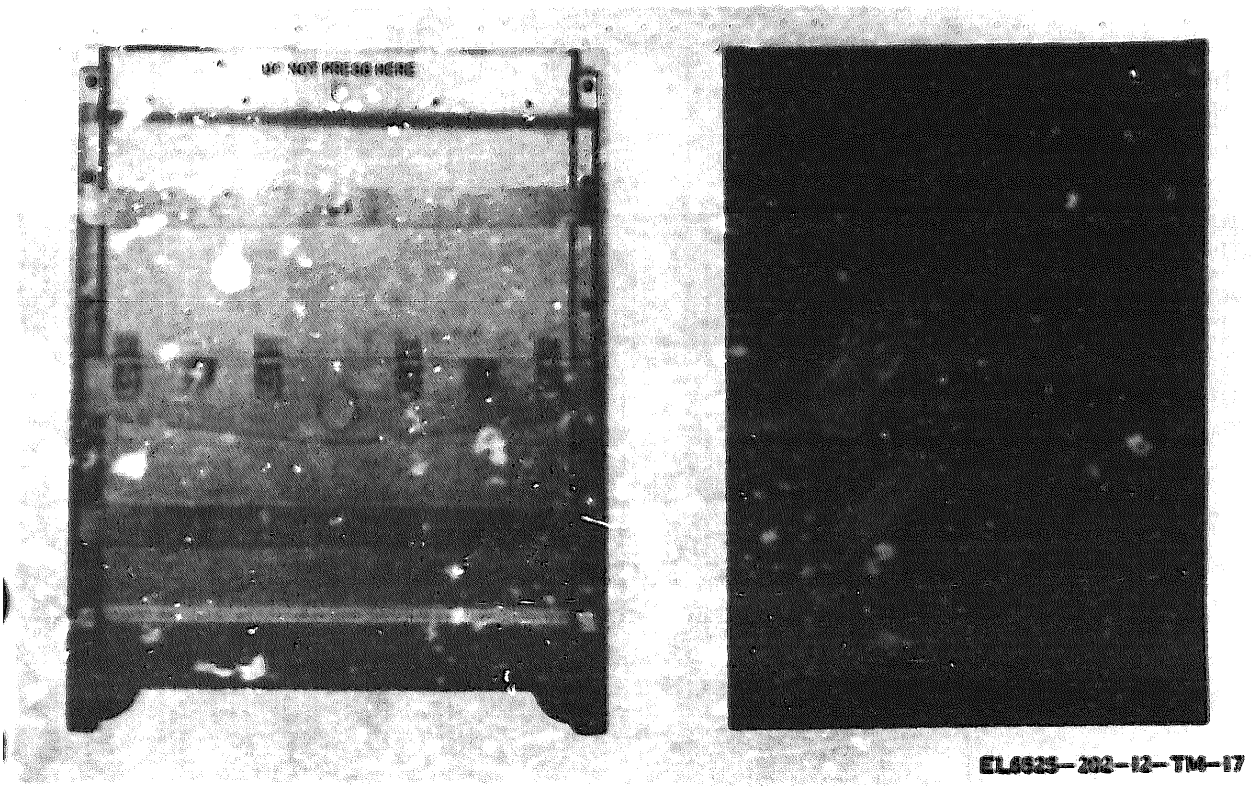

Figure 3-13. Polaroid x-ray film cassette and film packet.

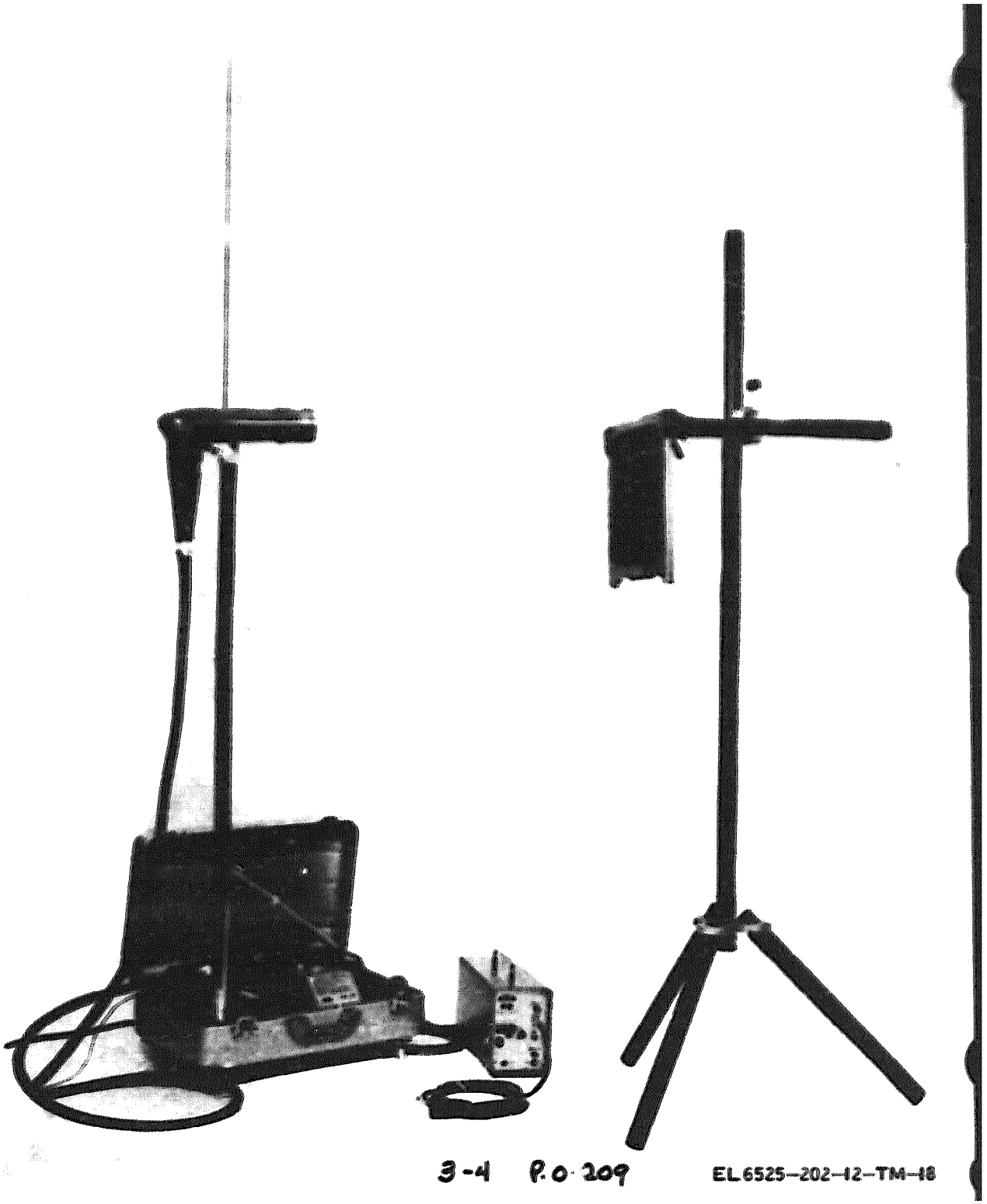

Figure 3-14. Positioning unit with tripod base and X-ray unit.

processing time mark. Hold the release button down until the winding mechanism is completely unwound.

(10) Allow the film packet to remain within the darkened processing unit until the timer bell indicates expiration of the required processing time.

(11) Open the film processing unit and remove the film packet.

(12) While holding one thumb on the blotting paper frame at the bottom of the packet, lift the corner of the positive radiograph and strip it away, all in one motion.

(13) If the radiograph is to be preserved, coat the surface with the proper film coat as outlined below:

(a) TLX film: White coater.

(b) 3000X film: Pink coater.

(14) Remove the cassette from the cassette sleeve.

d. Place the film processing unit in standby for immediate reuse as follows:

(1) Clean the inside of the cassette sleeve and packet receptacle with an air syringe or trichloroethane.

(2) Remove any developing chemical or

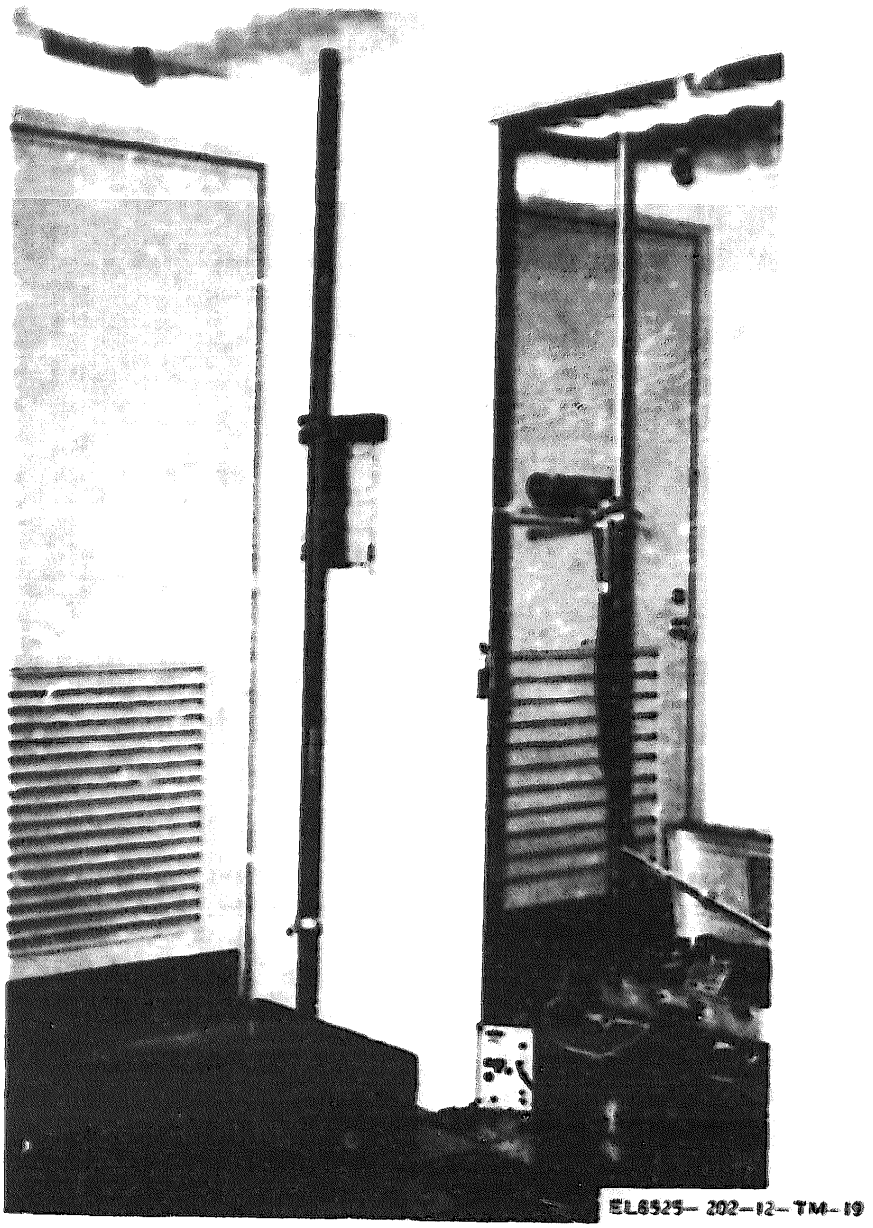

Figure 3-15. Positioning unit, floor to ceiling operation and X-ray unit.

foreign material imbedded in the roller surfaces using a soft, clean cloth and warm water, or an approved trichloroethane. D rollers thoroughly with a clean, lint free cloth.

(3) Close the cover and fasten the two catches to prevent any foreign material from accidentally falling into the unit.

(4) Fold the cassette sleeve to prevent dirt or sand from entering the inside of the sleeve.

Section III. OPERATION UNUSUAL CONDITIONS

3-11. Operation in Arctic Areas

Although this system has been designed to operate under adverse temperature and humidity conditions, operation of the system may be difficult in regions where extreme cold prevails. Subzero temperatures and climatic conditions associated with cold weather may cause unsatisfactory operation. The following precautions should be observed:

a. Equipment operated at low temperatures should be kept in storage at low temperatures when not in use.

b. It is especially important to check the instructions on the X-ray film packet required for handling and storage of X-ray film under arctic conditions.

c. When the equipment has been exposed to the cold and is then brought into a warm room, condensation will form until it reaches room temperature. The equipment should be dried thoroughly. To avoid condensation, transfer the equipment from cold to warmer temperatures by gradual stages.

3-12. Operation in Tropical and Desert Regions

When the equipment is used under conditions of extreme heat and humidity, such as tropical and desert regions, refer to the X-ray packet instructions for details concerning handling and storage of X-ray film under these conditions and observe the following precautions:

a. Desert Regions. The principal problem in connection with equipment operation in desert areas is the large amount of sand, dirt, and dust encountered. Observe the following precautions to minimize adverse sand and dust conditions:

(1) Cover the equipment with a suitable protective covering. This action will minimize the opportunity for sand or dust to penetrate the equipment and to form grit which could cause damage to certain parts of the system equipment.

(2) Desert regions experience a considerable drop in temperature at night which could cause condensation to form on the equipment. To prevent this, keep the equipment covered with a suitable protective covering. If condensation forms, dry the equipment thoroughly.

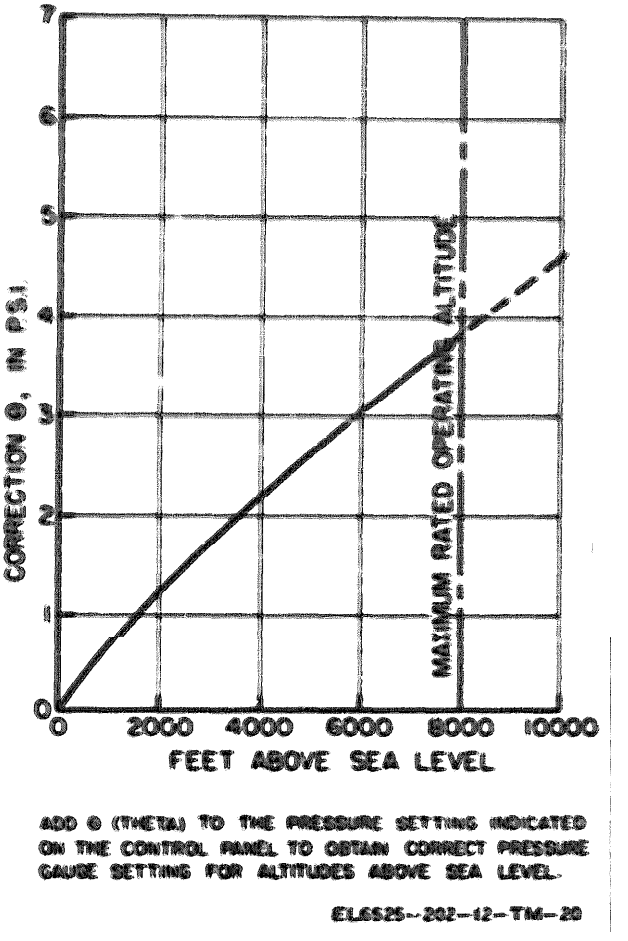

Figure 3-16. Altitude correction curve.

(3) Before using the equipment in desert regions, use a soft-bristled brush to remove sand or other foreign matter from the interior of the equipment, especially the roller surfaces and the cassette sleeve on the portable processing unit.

b. Tropical Regions. In climates of high humidity, such as the tropics, inspect the equipment daily for traces of fungus, mold mites, and metallic corrosion; remove all fouling immediately. Lubricate where necessary after cleaning. When practical, store the film processing unit in an adequately ventilated cabinet, and place a desiccant inside the cabinet.

3-13. Operation in Mountains, High Altitude, Low Temperature or Rainy Areas

To prevent corrosion from salt-laden air or salt water spray, and rusting from condensation or moisture when the equipment is stored, wipe all exposed metal parts with a soft cloth moistened with an approved preservative lubricating oil. After the equipment has been used under rainy,

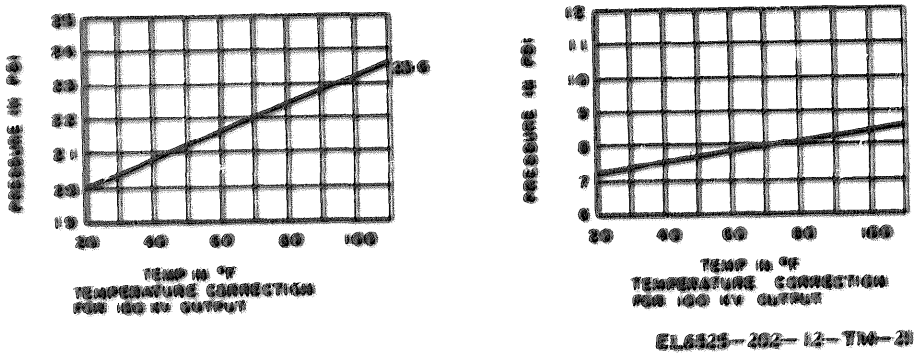

Figure 3-17. Temperature correction curve.

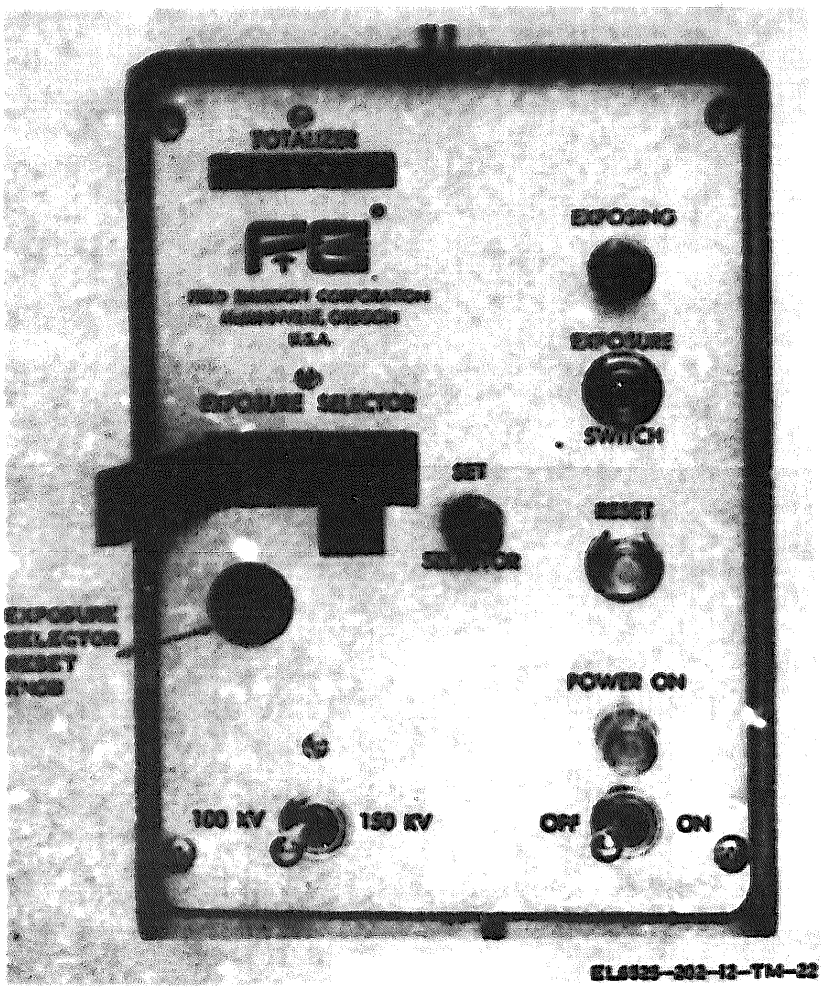

Figure 3-18. Exposure switch in horizontal position.

dusty, or dirty conditions, clean all parts as soon as possible. Check the instructions on the X-ray film packet for detailed instructions concerning handling and storage of X-ray film under these conditions.

Section IV. DISASSEMBLY AND PREPARATION FOR STORAGE OR SHIPMENT

3-14. Disassembly of X-Ray Apparatus

a. Set **POWER ON** switch and **CIRCUIT BREAKERS** 1 and 2 to **OFF** (down) position.

b. Remove ac power cord and exposure cable from control unit and pulser assembly. Disconnect ground cable.

c. Release pressure in system by depressing **PRESSURE RELEASE** on the air system control panel.

d. Remove high voltage cable from the pulser chamber and install resistive load. Replace end cap and secure with the cap removal end tool.

e. Disassemble the mast assembly as follows:

(1) Loosen screws on mounting assembly and remove two variable rods from the tubehead.

(2) Loosen locking screw and remove tubehead from mast extension assemblies.

(3) Disassemble mast extension assemblies; loosen extension adapters and store in mast section. Install red plastic plugs in each section before storing.

(4) Remove mast cross brace and recess extension arm, and secure with nylon locknut.

(5) Remove base mast section by loosening lock screws. Slide cross brace assembly inside tube, and secure with red plastic plugs on each end.

3-15. Repacking Pulser Case

(fig. 3-22)

a. Place ac power cord and control unit cable

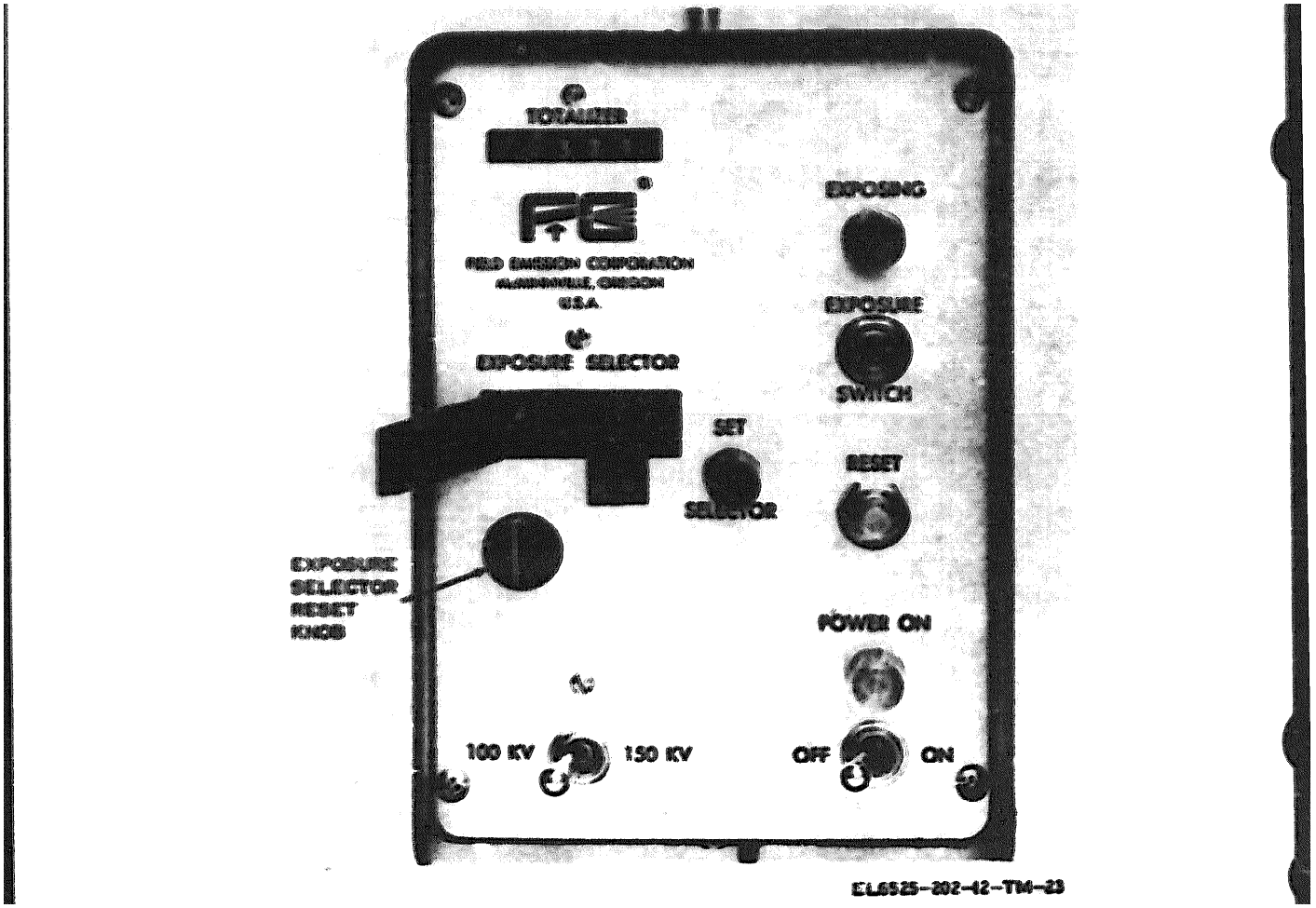

Figure 3-19. Exposure switch in vertical position.

and other cables on the right hand side of pulser case.

b. Coil grounding cable and place it on left hand side of pulser case.

c. Place maintenance tool kit which includes spare fuse and spare parts envelope on left hand side of pulser case. Lock pulser case; remove the case from dolly and place entire unit in outer carrying case.

3-16. Repacking Control Carrying Case

a. Replace top mast section in bottom rear of control carrying case.

b. Place variable rods in bottom front of case.

c. Insert tubehead assembly in right hand side of case. Tilt tubehead until it slides in right hand corner and then lays flat. Coil high voltage cable in an elongated pattern around inner perimeter of case.

d. Place control unit in carrying case. Handle on control unit must face the front of the carrying case; otherwise the dolly will not fit over the retaining studs.

e. Place remaining sections of mast on back plate of dolly and secure with Velcro straps.

f. Place dolly in control carrying case and slide dolly until it is secure in retaining studs.

g. Lock and secure dolly with locking screw, close case, and pack entire unit in outer carrying case.

3-17. Disassembly of Positioning Indicator Apparatus

a. Remove X-ray plate and cassette holder from mast assembly.

b. Remove swivel clamp and swivel clamp cassette holder from assembly rod unit.

c. Disassemble the mast assembly as follows.

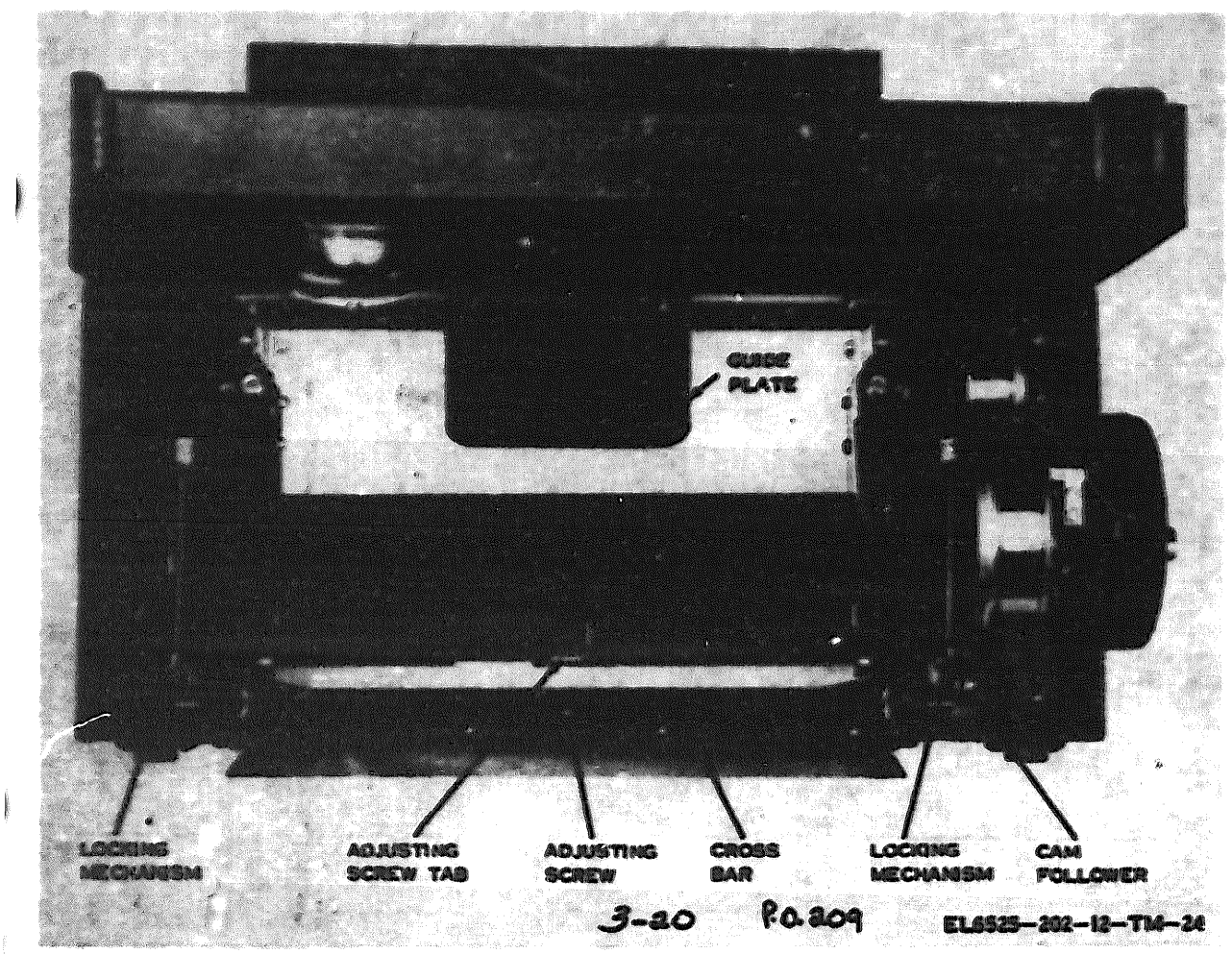

Figure 3-20. Roller pressure adjustment setup.

(1) If tripod base is used, remove top unit rod assembly first, then the horizontal arm.

(2) Loosen locking screw clamp and remove tripod base; then disassemble the leg units.

(3) If ceiling to floor assembly is used, loosen clamp on the base unit.

(4) Lower mast assembly and remove all rod sections.

3-18. Repacking Processor and Positioning Indicator Cases

a. Place the radiographic processing machine, masking tape, tape measure, and the rod sections in Processor Group OA-8753/U (fig. 3-23).

b. Place the Polaroid film and film coaters on the bottom of Positioner Group OA-8754/U (fig. 3-24).

c. Place the cassette holder in the center of the positioning case and push down in place.

d. Insert the X-ray plate in the cassette holder.

e. Place X-ray tube, cleaner, swivel clamp, tripod base and the swivel clamp holder in pockets in side of case (fig. 3-24).

f. Place translucent viewer, adapter plugs, and the extension cord in the top of the case (fig. 3-25).

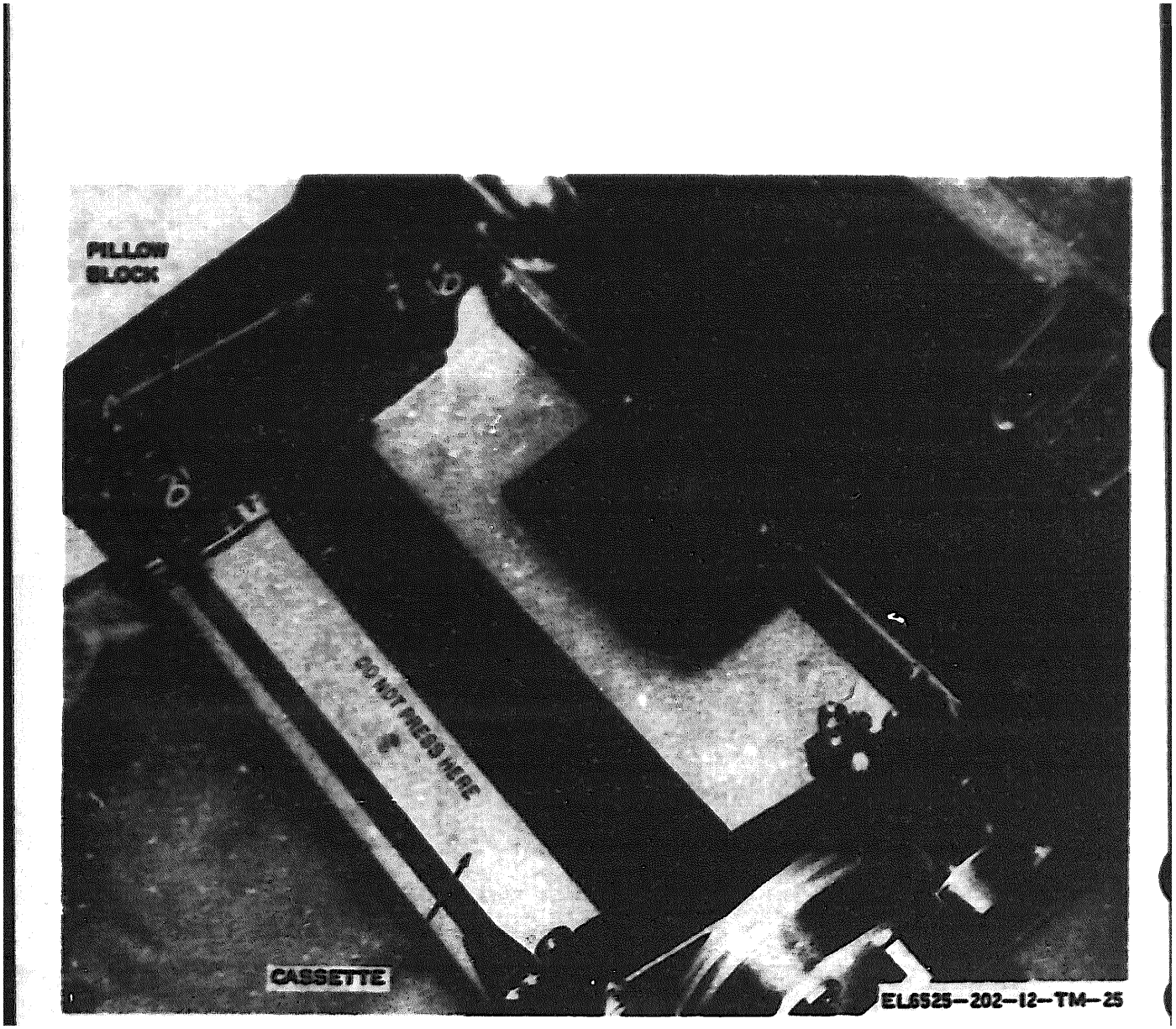

Figure 3-21. Loading film cassette into film processing unit.

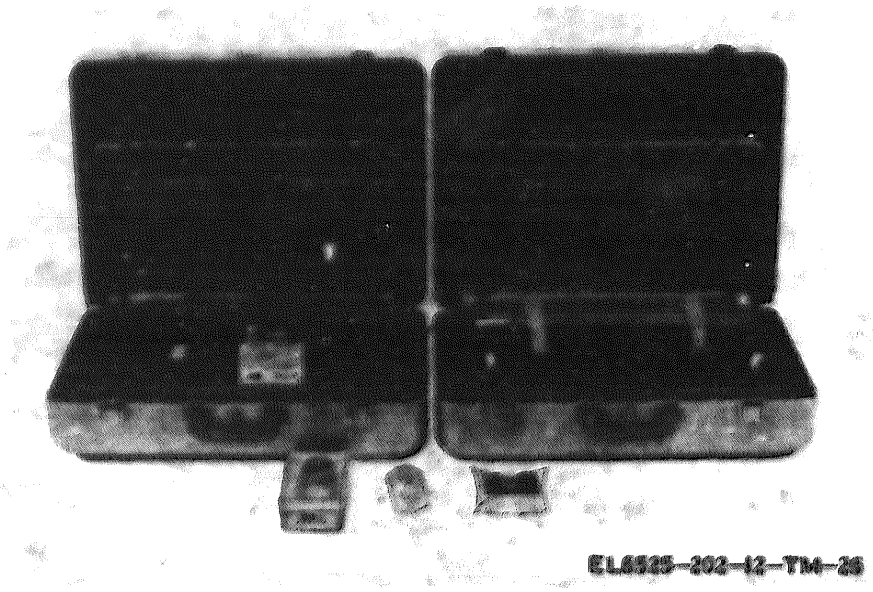

Figure 3-22. Pulser case assembled.

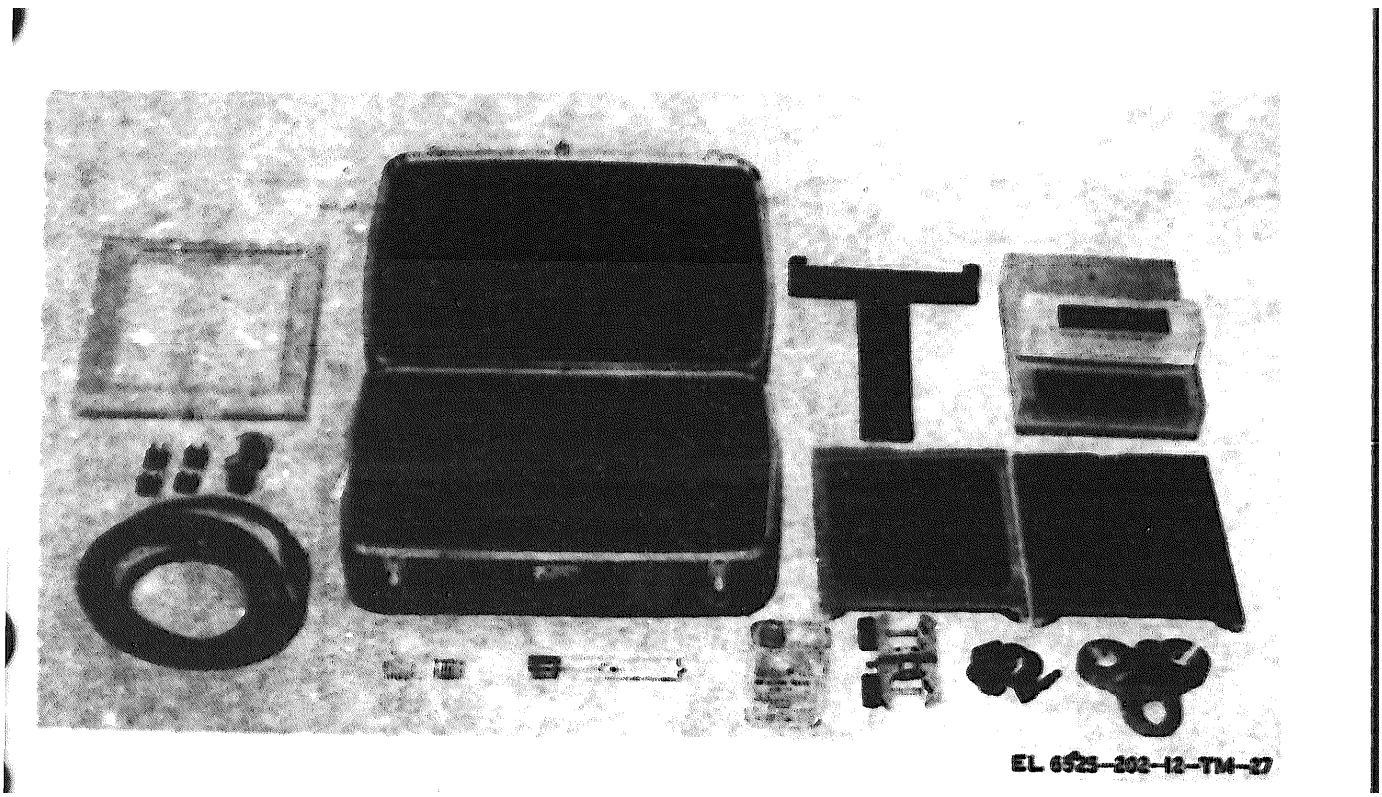

Figure 3-23. Processor Group OA-8753/U assembly.

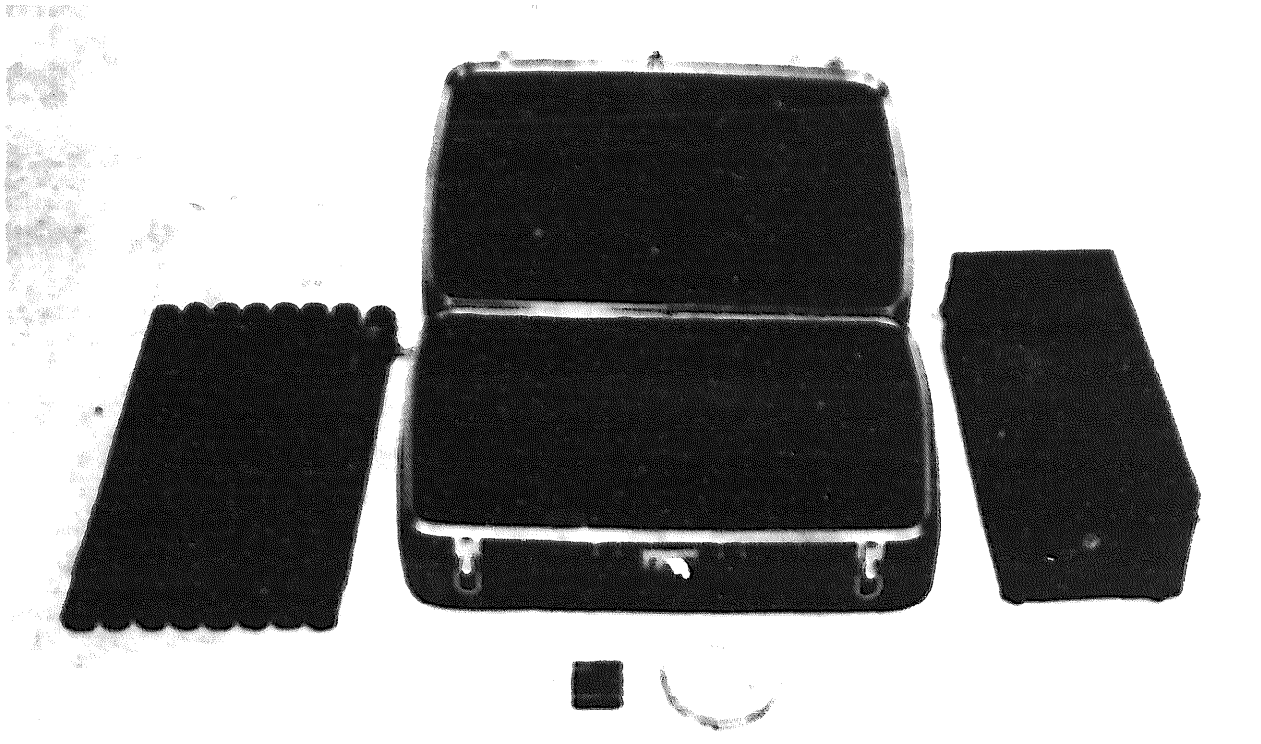

Figure 3-24. Positioner Group OA-8754/U assembled.

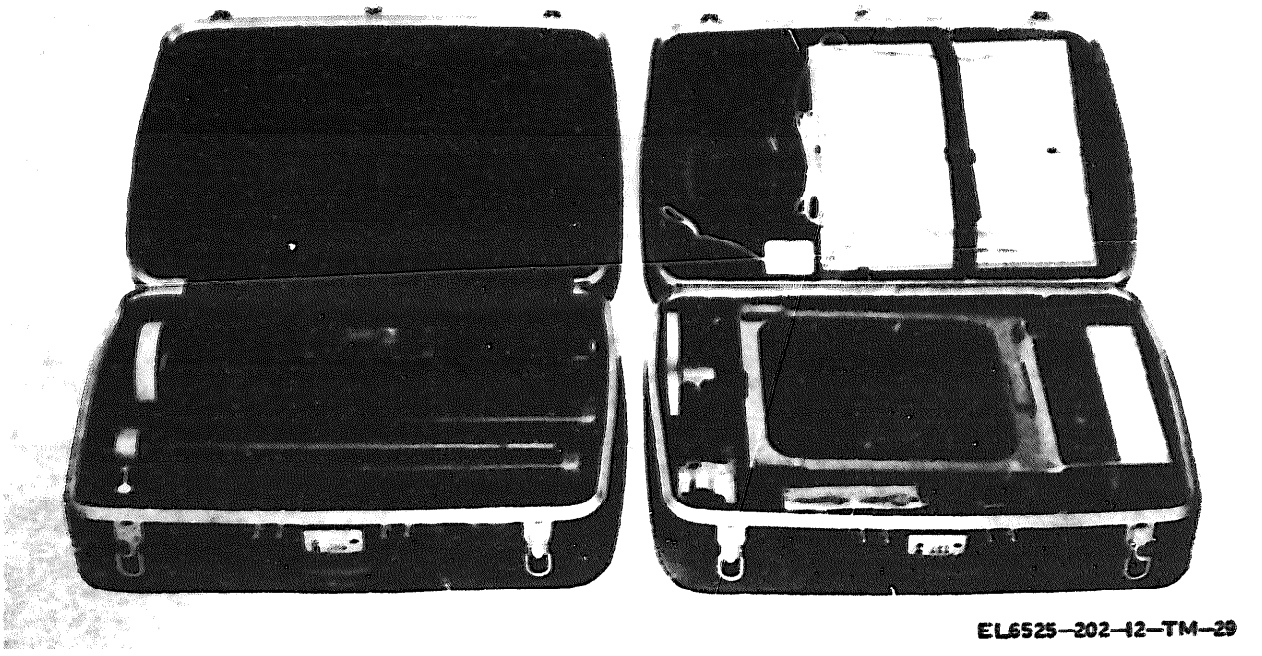

Figure 3-25. Processor group and positioner group assembled.

Section V. GENERAL SAFETY INFORMATION

3-19. General Information

a. Before using the AN/TAQ-2, determine where the system is going to be located and the mode of operation which affords the maximum possible protection for the operator and other personnel affected by its use. In addition to the information contained in this section, the operator and maintenance personnel should have access to the technical manual covering all the details, special requirements, and analysis of radiation and electrical safety hazards as outlined in TM 8-820.

b. Radiation can be extremely dangerous to the human body. One of the most important considerations in the X-ray work area is the provision and exercise of adequate safeguards for personnel. Control of occupational exposure to ionization radiation is covered in AR 40-14. The use, application, and processing of film badges is covered in SB 11-206.

c. Any bodily tissue may be injured by overexposure to X-rays, the blood, skin, and some internal organs being particularly sensitive. Unless exposure to X-rays is kept to a minimum, the cumulative effect may cause sickness or death. It is essential that workers in the radiographic area be adequately protected against radiation at all times. It is imperative that protective measures be taken so that personnel in nearby areas are also safe. Precautions should be particularly observed when radiography must be done in the field rather than a specially protected radiographic room.

d. It should be emphasized that radiography is only as safe as the people working with it want it to be. The basic assumption of anyone working in the field should be that any unnecessary exposure to radiation, no matter how small, is too much.

3-20. Radiation Units of Measurement

a. At the present time there are three generally accepted units that relate to radiation exposure and absorbed dose. They are the roentgen, the rad, and the rem, and are defined as follows:

(1) The roentgen (r) is a measure of radiation exposure based upon the amount of ionization produced in air by a radiation source. When the specific ionization is such that one electrostatic unit of electrical charge is produced per cc of air under standard conditions, then the exposure dose is 1 roentgen at the point at which the measurement is made. The roentgen output can be measured with relative ease by a properly constructed ionization chamber.

(2) The rad is the unit of absorbed dose and, by definition, is the absorption of 100 ergs of energy per gram of irradiated material. The rad dose can be determined from ionization chamber measurements within the test object, by measurement of temperature change of the test object, or by chemical dosimeter.

(3) The rem (rad or roentgen equivalent man) is the absorbed dose in rads multiplied by the relative biological effectiveness (RBE) of the radiation used on the particular biological system irradiated. RBE may be defined as the ratio of doses from two different radiations that produce the same biological change. At the present time, there is no dosimeter that can directly measure the rem.

b. The currently accepted unit of radiation dose to biological systems is the rem. Its usefulness lies in the fact that the biological and physical properties of the test object are taken into account, as well as the ionizing characteristics of the radiation employed. Equal rem doses to the same biological test object delivered by, for example, neutrons and alpha particles, should produce the same biological change. Any of the following may be considered as equivalent to a dose of one rem:

(1) A dose of 1 r due to X-radiation.

(2) A dose of 1 rad due to X-radiation.

(3) A dose of 0.1 rad due to neutrons or high energy protons.

(4) A dose of 0.05 rad due to particles heavier than protons and with sufficient energy to reach the lens of the eye.

3-21. Maximum Permissible Doses of X-Rays

a. The currently accepted maximum permissible doses have been established upon consideration of the estimated exposure of early radiation workers and also upon radiation that man has always received from such natural sources as radium, cosmic rays, and Carbon 14. Radiation workers who, it is estimated, received 0.1 r per day for periods of many years, have not exhibited any harmful effects which can be directly attributed to radiation.

b. In accordance with AR 40-14, Radiation Protection Standards, and on recommendation of the U.S. Army Environmental Hygienic Agency, Edgewood, Maryland, the following criteria are established for the control of occupational exposure to ionization radiation. Every effort should be made to maintain radiation dosage below the

following radiation protection standards.

(1) The accumulated dose of radiation to the whole body, head and trunk, active blood-forming organs, gonads, or lens of the eye shall not exceed:

(*a*) 3 rems in any calendar quarter.

(*b*) 5 (N–18) rems total lifetime dose, where N equals the present age in years.

c. The maximum permissible accumulated dose (MPD) for the whole body is based on the formula MPD = (AGE–18) x 5 rads per year. A standard of 0.1 rad per week should be used in planning radiation protection facilities. An accumulation of 3 rads over a 13-week period is permissible providing no more than 5 rads are accumulated in 1 year.

d. Under special circumstances, less restrictive protection standards may be used when approved by the Surgeon General of the military department concerned. Complete justification will be required, including the means for implementing the standard.

Section VI. PROTECTION AGAINST X-RAYS

3-22. General

Exposure to X-radiation may come either directly from the X-ray tube target or from some object in the direct path of the X-ray beam; therefore, while an exposure is being made, the operator and all other personnel must be protected by adequate shielding from the X-ray tube itself, the part being radiographed, and any other item exposed to the X-ray beam. This section contains general information for the protection of personnel working with X-ray equipment.

3-23. Protection Methods

a. Protection can be provided in a number of ways, depending on the X-ray installation and its use. Whenever possible, protective measures should be built in as permanent features of the installation. Preferably, the X-ray generator should be enclosed in a room or cabinet with the necessary protection incorporated in the walls. The common method is to locate the X-ray tube within a room completely lined with lead of sufficient thickness to provide adequate protection. All the X-ray equipment controls are then located outside the room.

b. When portable or field X-ray units are used, such as the AN/TAQ-2, shielding is important. The lead shield impregnated (0.5 mm lead equivalent) rubber apron (fig. 3-26) can be used as a barrier against secondary radiation, but will not fully protect the operator against primary radiation. In some cases where large numbers of relatively small parts are inspected, the protection may consist of a lead-lined hood surrounding the X-ray tube, the specimens, and the cassette until the exposure is completed. Then the hood is opened to allow removal of the radiographed parts and the placement of a new batch. The electrical controls are interlocked so that the X-ray cannot be turned on until the hood is fully closed.

c. When placing equipment and designing protective enclosures, certain principles must be kept in mind. Careful application of these principles adds to the safety of personnel. Safety will be increased if the amount of radiation absorbed in the outside wall of the enclosure is kept to a minimum. To accomplish this, keep the distance from the X-ray tube target to any occupied space as great as possible; also, if the nature of the work permits, do not point the direct beam toward these occupied areas, and keep the angulation of the tube restricted to a minimum.

d. Ideally, the lead housing around the X-ray tube should provide protection against all primary radiation except the useful beam, although this is not always feasible in practice. The useful beam itself should be limited in cross-section by the use of cones or diaphragms.

e. If there are parts of the X-ray room that can never be exposed to radiation because of the design of the equipment, certain economies in the installation of protective material are possible. Where only scattered radiation can reach a protective wall, less protection is necessary since the intensity of the scattered radiation is much lower than that of the primary. To take advantage of this, be careful when arranging equipment to prevent the full intensity of the X-ray beam being directed against a wall that provides protection against only scattered radiation.

f. The protective material (usually lead) in the walls of the enclosure, whether room or cabinet, should be of sufficient thickness to reduce the exposure in all occupied areas to as low a value as is possible.

g. In some cases, personnel may be exposed to radiation from more than one X-ray equipment. In such cases, the amount of protection must be increased to a point where the total exposure in any occupied area is within the prescribed limits.

h. If the object is too large or heavy to be brought to the X-ray equipment, the radiography must be done in the field. Under such conditions

Figure 3-26. Lead shield impregnated rubber apron.

special precautions are necessary. These include a completely leadlined booth large enough to accommodate the X-ray equipment controls, the operator, and other X-ray workers. The booth may be completely enclosed, or open on one side. In any event, the exposure within it should be very carefully measured. Lead cones on the X-ray equipment should be used to confine the X-ray beam to a certain direction and to the minimum angle that can be used. Portable screens should be provided to protect nearby workers. Guard rails or ropes and warnings should be used to keep personnel at a safe distance.

i. In field radiography, protection is usually obtained by distance. Be sure that all personnel are far enough away from the radiation source to ensure safety.

Section VII. MATERIALS AND CONSTRUCTION FOR PROTECTION AGAINST X-RAYS

3-24. General

Lead is the most common material used to provide protection against X-rays. It combines high protective efficiency with low cost and easy availability. In most cases, recommendations on protective measures are given in terms of lead thickness.

3-25. Shielding Construction

a. When using lead for protection, be careful to avoid any leaks in the shielding. This means that adjacent lead sheets should be overlapped, not merely butted, even if the sheets are to be burned together throughout the whole length of the joint. The heads of any nails or screws which pass through the lead should be carefully covered with lead.

b. Extra precautions should be taken at those points where water pipes, electrical conduits, or ventilating ducts pass through the walls of the X-ray room. For small conduits and pipes, it is usually sufficient to provide a lead sheathing around the pipe for some distance on one side of the lead protective barrier in the wall. This sheath should be continuous and very carefully joined, by a burned joint, to the lead in the wall. Better protection is afforded by having a right-angle bend in the pipe either inside or outside the X-ray room. The pipe is then covered with a lead sheath to a point well beyond the right-angle bend. The sheath should be carefully joined to the lead in the wall. In the case of a large opening for ventilation, lead baffles arranged as shown in figure 3-27 will stop X-rays, while permitting the passage of air. When a large ventilating duct is brought into the X-ray room, two right-angled bends covered with lead will prevent the escape of X-rays.

c. To test the protection, it may be necessary to put up X-ray films against the outside of the wall in questionable areas, and to direct the full intensity of the X-ray beam against each of these areas in turn.

d. If the X-ray room is on the lowest floor of a building, the floor of the room need not be completely protected; however, the lead protection in the walls should not stop at the floor level. An apron of lead, continuous with the protection within the wall, should be placed in the floor, extending inward from all four walls (fig. 3-27). This apron will prevent X-rays from escaping from the room by penetrating the floor and then scattering upward outside the protective barrier. An alternative is to extend the lead protection in the walls downward for some distance below the floor level. The same considerations apply to the ceiling if the X-ray room is on the top floor of a building. Of course, if there is occupied space above or below the X-ray room, the ceiling or floor of the X-ray room must have full radiation protection over its whole area.

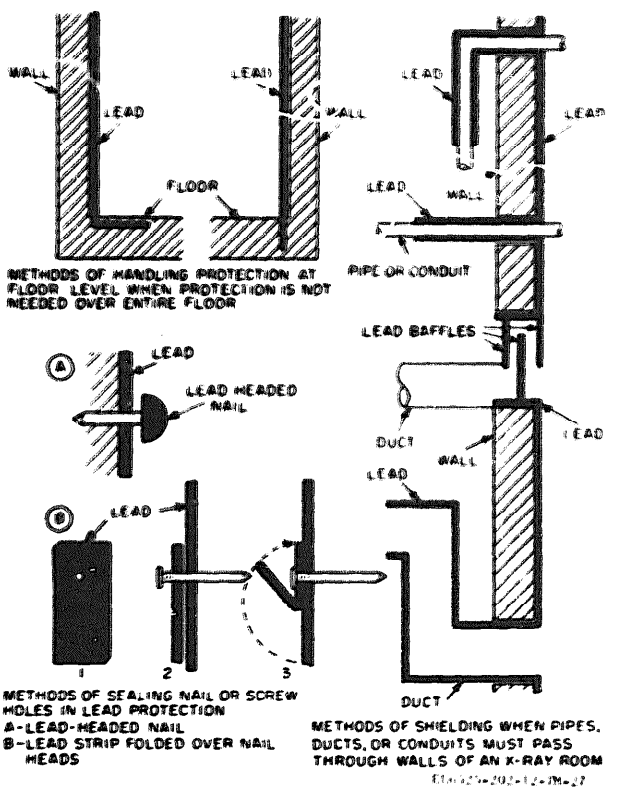

Figure 3-27. Construction for protection from radiation.

3-26. Other Shielding Materials

Although lead is the most efficient material for X-ray protection, other materials find some application. In particular, structural walls of concrete or brick may afford considerable protection and reduce the thickness of the lead required, and therefore the cost. Concrete is most used as a protective material at voltages above 400 kV. The lead thicknesses required at these potentials are so great that fastening them to the walls becomes a serious problem, and concrete is used for ease of construction.

Section VIiI. Radiation Detectors

3-27. General

There are three principal types of radiation detectors which have found wide application in the problem of personnel protection. These are the ionization chamber type (cutie pie), the pocket dosimeter, and the film badge.

3-28. Ionization Chamber-type Survey Meter

a. This a ratemeter device which instantly records X- and gamma-radiation levels and, if equipped with a suitable window, may be used for beta ray monitoring. Because the most sensitive range of available instruments will indicate dose rates as low as 2 milliroentgens per hour, this device has found wide application to radiation surveys of X-ray installations and radium and radioisotope storage areas. Most available instruments have three sensitivity ranges: 0–25, 0–250, and 0–2500 milliroentgens per hour. If precise results are required, the instrument should be calibrated at the energy range of interest.

b. The advantage of a cutie pie is that radiation levels are measured within a few seconds. It also has relatively high sensitivity and flatness of response to X-ray energy change. The disadvantages are its relatively large size, delicate construction, and warmup drift during the first few minutes of operation. A readily available and easy to use reference standard is an extremely important accessory for this type of device.

3-29. Pocket Decimeter

a. This is an integrating type of ionization chamber whose most sensitive range is usually from 0 to 200 milliroentgens. Many of these instruments have built-in electrometer circuits so that the accumulated dose may be noted at any time. The only accessory equipment needed is a charging unit.

b. The main advantages of the pocket dosimeter are its small size, high sensitivity, instantaneous indication of accumulated dose, and relatively flat response to radiations of different energies. The greatest problem in the routine use of this device is the electrical leakage which tends to discharge the electrometer and give false, high indications. For precise work, leakage tests should be performed on each chamber before and after application.

c. Pocket dosimeters have found wide application in monitoring personnel during procedures which last but a few hours and where knowledge of the radiation exposure for that particular procedure is needed.

3-30. Film Badge

a. The most widely used personnel monitor is the film badge (fig. 3–25). It is used principally to record the dose accumulated at a low rate over a long period of time. It has the advantage of being extremely rugged, capable of fairly accurate interpretation over the range of X-ray qualities used in radiography, and a very long time period over which a single film may be used. Its disadvantages are that the wearer is never aware of the accumulated dose until the film is developed and, at the time he receives the film badge report, he may not be able to recall any incident responsible for an overexposure.

NOTE

All Department of Defense personnel who operate or work near ionizing radiation equipment (e.g., industrial X- and gamma-ray equipment) are governed by the triservice regulation, AR40–14 BUMEDINST 6150.1BA AFR 161–8, Control and Recording Procedures Occupational Exposure to Ionizing Radiation. This regulation lists the separate requirements of the individual military departments with respect to personnel dosimetry as follows:

(1) *Department of the Army.* The primary dosimetric device shall be the film packet, except for field radiography in combat or simulated combat conditions when the direct reading personnel dosimeter (0–2000 mr range) has been designated by the Command Surgeon as the primary device to be worn by personnel occupationally exposed to X-ray. The film packet dosimetry service for Army installation and units

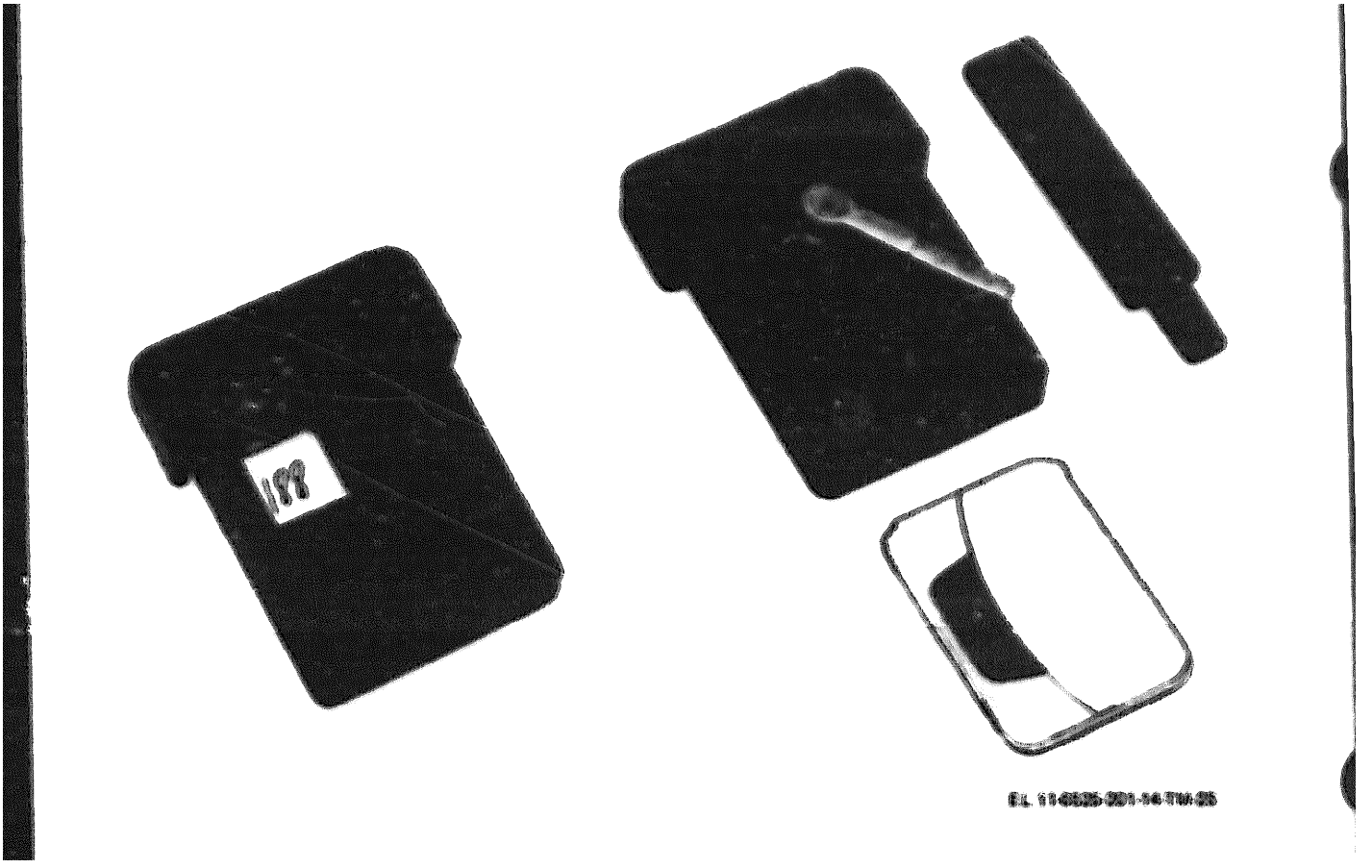

Figure 3-28. Film badge.

is provided for by SB 11-206. This service will be employed solely for film packet dosimetry, except in unusual circumstances as approved by the Commanding General, U.S. Army Materiel Command.

(2) *Department of the Navy.* Navy and Marine Corps activities shall utilize appropriate dosimetric devices in accordance with U.S. Navy Safety Precautions, OPNAV 34P1, and other applicable directives.

(3) *Department of the Air Force.* The primary dosimetric device shall be the film badge. The film badge service for Air Force installations provided by the USAF Radiological Health Laboratory, Wright-Patterson AFB, in accordance with the provisions of AFR 161-11.

b. Other regulations in effect include, for Department of the Navy personnel, NAVMED P-50055 Radiation Health Protection Manual; and for Department of Air Force personnel, AFR 160-132 Control of Radiological Health Hazards.

Section IX. ELECTRICAL SAFEGUARDS

3-31. General Safeguards

Radiographic inspection with X-rays presents a two-fold safety problem to personnel. First, as previously mentioned, X-rays have a very destructive effect on the human body. Second, the extremely high voltages can deliver an electrical shock that may be fatal.

3-32. Electrical Hazards

a. Fortunately, most modern radiographic equipment is truly shockproof when properly assembled, and most permanent installations offer little danger when personnel are trained in safe practice. Portable equipment, however, can pose serious safety problems if operating and inspection personnel do not employ certain necessary precautions.

b. In X-ray circuits, flexible cables must be used between the power source and the tube so that the X-ray head can be positioned to

radiograph objects of all shapes and sizes. Flexible cables are also used between the X-ray tube unit and the control panel. Because extremely high voltages are used, these cables are covered with a heavy layer of rubber or some other insulating material that provides ample protection against shock; however, old or damaged cables or worn insulation constitute a grave danger of fatal shock. Cables should be moved only when the power is off, or special equipment should be used, such as rubber gloves, high-voltage sticks, and rubber mats.

c. Condensers are another source of danger to those working around X-ray equipment. Condensers are used to store a charge of electricity, to provide instantaneous high voltages, and to prevent arcing. Condenser circuits must be provided with automatic bleeding circuits that are in good working order. A condenser should always be discharged manually before it is serviced.

3-33. Electrical Safety Precautions

The following electrical safety precautions should always be obtained wherever X-ray equipment is operated or serviced:

a. Electrical power should be off during the setup procedure.

b. Cables should not be handled when power is on and insulation should be frequently checked for wear.

c. Condensers must be discharged completely before a circuit is serviced or checked.

d. Proper safety equipment must be used when energized cables are moved.

e. Persons who operate or work near X-ray equipment should learn artificial respiration and practice it enough to maintain proficiency. Prompt action after an accident may save a life.

CHAPTER 4

ORGANIZATIONAL MAINTENANCE

Section I. General

4-1. Scope of Maintenance

a. This chapter includes general instructions for organizational maintenance of the AN/TAQ-2. Detailed instructions for troubleshooting and organizational maintenance procedures on Control Group OK-258/TAQ-2 and Generator Group OV-47/TAQ-2 are covered in TM 11-6525-201-14. Detailed instructions for the portable X-ray processing machine are covered in TM 11-6525-200-12.

4-2. Tools, Materials, and Test Equipment Required

a. Tools.

(1) Key Set, socket head hexagonal (FSN 5120-288-9244).

(2) Pliers, retaining ring (FSN 5120-289-9717).

(3) Screwdriver, flat tip (FSN 5120-278-1283).

(4) Screwdriver, flat tip (FSN 5120-729-6393).

b. Materials.

(1) Adhesive (part G580-20 or equivalent).

(2) Air syringe or source of low-pressure, clean, dry compressed air.

(3) Cleaning cloths.

(4) Lubricating oil, general (FSN 9150-273-2384).

(5) Sandpaper, fine.

(6) Trichloroethene.

(7) Brush, soft bristled, nonmetallic.

c. Test Equipment.

(1) Multimeter TS-352B/U.

(2) Radiacmeter IM-9/PD.

(3) Charger, Radiac PP-1578/PD.

(4) Watch, stop (FSN 6645-719-8670).

Section II. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

4-3. Organizational Preventive Maintenance

Preventive maintenance is the systematic care, inspection, and servicing of equipment to maintain it in a serviceable condition, prevent breakdowns, and assure maximum operational capability. Preventive maintenance is the responsibility of all categories concerned with the equipment and includes the inspection, testing and repair or replacement of parts and subassemblies that inspection and tests indicate would probably fail before the next scheduled periodic service. Preventive maintenance checks and services of the AN/TAQ-2 are made at monthly intervals at the organizational category of maintenance unless otherwise directed by the commander. Preventive maintenance checks and services should be scheduled concurrently with the periodic schedule for all components of the system.

4-4. Preventive Maintenance Checks and Services Tables

The necessary preventive maintenance checks and services to be performed are listed in Tables 4-1 and 4-2. The item numbers indicate the sequence of minimum inspection requirements. If defects are noted during operation, correct them as soon as operation has been suspended. If the defects cannot be remedied at organizational maintenance, refer them to higher category maintenance. Record all deficiencies together with the corrective action taken in accordance with TM 38-750.

Table 4-1. Organizational Preventive Maintenance Checks and Services for Control Group OK 258/TAQ-2 and Generator Group OV-47/TAQ-2

Inspection No.	Item to be inspected	Procedure	Reference
1	Exterior surface	Clean panels, cables, and meter glass. Refinish painted surfaces as necessary.	TM 11-6525-201-14

Table 4-1. Organizational Preventive Maintenance Checks and Services for Control Group OK-258/TAQ-2 and Generator Group OV47/TAQ-2-Continued

Sequence No.	Item to be inspected	Procedure	References
2	Mounting	Tighten loose nuts or bolts. Replace missing hardware as required.	
3	Interconnecting, connectors and ground strap	Check all interconnecting cables and connectors for cracks and breaks. Replace cables that have cracks or broken connectors.	
4	Knobs, dials, and switches	When performing operational checks, check the mechanical action of each knob, dial, and switch for smooth operation.	
5	Fuses	Check fuseholders. Ensure that each contains a good fuse of the proper rating.	
6	Air pressure assembly	Check to see that desiccant crystals have not changed from blue to pink.	TM 11-6525-201-14
7	X-ray tube	Check X-ray tubes for internal arcing and proper output.	TM 11-6525-201-14
8	Tubing, (0) rings and gaskets	Check for cracks or breaks.	
9	Control unit	Disassemble control unit and visually inspect chassis and electronic components for evidence of deterioration. Replace missing hardware items as necessary.	TM 11-6525-202-14
10	High voltage power supply and pulser assembly	Visually inspect input to charging resistor and pulser assembly re-entrant cavity for evidence of moisture or deterioration. Clean and apply silicone grease if required.	TM 11-6525-201-14
11	Operation	Perform operation checks for the units.	TM 11-6525-201-14

Table 4-2. Organizational Preventive Maintenance Checks and Services for Positioner Group OA-8754/U, Radiation Safety Group OA-8755/U, Processor Group OA-8753/U and Film Processing Machine.

Sequence No.	Item to be inspected	Procedure	References
1	Completeness	See that equipment is complete.	
		a. X-ray processing machine	*a.* TM 11-6525-200-12
		b. Positioner Group OA-8754/U	*b.* TM 11-6525-201-12
		c. Processor Group OA-8753/U	*c.* TM 11-6525-202-12
		d. Radiation Safety Group OA-8755/U	*d.* TM 11-6525-202-12
2	Modification	Check DA Pam 310-7 to determine if new applicable MWO's have been published. All URGENT MWO's must be applied immediately. All NORMAL MWO's must be scheduled.	TM 38-750 and DA Pam 310-7
3	Exterior surfaces	Check all surfaces for evidence of fungus. Remove rust and corrosion and spot paint bare spots.	
		a. Film processing machine	*a.* TM 11-6525-200-12
		b. Positioner group, processing group and radiation safety group	*b.* TM 11-6525-202-12
4	Cassette sleeve and packet receptacle	Examine for cracks, holes, parting of seams, etc. Repair or replace.	TM 11-6525-200-12
5	Radiation safety group	Examine for shortages of docimeters and charges and frayed or deteriorated lead aprons.	TM 11-6525-202-12

Table 4-3. Organizational Preventive Maintenance Checks and Services for Positioner Group OA-8754/U, Radiation Safety Group OA-8755/U, Processor Group OA-8753/U and Film Processing Machine-Continued

Sequence No.	Item to be inspected	Procedure	Reference
6	Positioner and processor group	Examine end assemblies for bent, damaged, or rusted parts. Repair, replace, or repaint as necessary.	TM 11-6525-202-12
7	Lubrication	Lubricate the film processing machine.	TM 11-6525-200-12
8	Operational checks	Check operation	
		a. Film processing machine	a. TM 11-6525-200-12
		b. Film translucent viewer	b. TM 11-6525-202-12

4-5. Cleaning

a. Clean dust and loose dirt from the exterior surfaces with a damp cloth. Mild detergent may be used if necessary.

WARNING

The fumes of trichloroethane are toxic. Provide thorough ventilation whenever used. DO NOT use near an open flame. Trichloroethane is not flammable, but exposure of fumes to an open flame converts the fumes to highly toxic, dangerous gases.

b. Remove grease, fungus, corrosion, and ground-in dirt from the exterior surfaces using a clean cloth dipped in trichloroethane. Use a short bristled brush on connections and hard to reach areas on the control group, positioning group, and generator group. The portable X-ray processing machine requires the cassette sleeve and packet receptacle to be cleaned with trichloroethane. The rollers should be cleaned and free of dirt. Detailed disassembly to perform cleaning procedures is outlined in TM 11-6525-200-12.

4-6. Repainting and Refinishing

a. Refer to SB 11-573 to determine the proper finish to use.

b. Refer to TB 746-10 for refinishing procedures.

c. Do *not* paint connectors, controls, FREQUENCY MHz windows, swivel connections, joint connections or the panel meter face.

4-7. Lubrication

a. The pressure unit requires monthly lubrication. Remove the desiccant assembly O-ring seals and high voltage end cap seal and apply a thin coat of Dow Corning #5 compound to the seals; then reinstall the seals. Do *not* lubricate the air pump assembly, or it will contaminate the air supply.

b. The radiographic film processing machine requires lubrication monthly during normal 8 hour a day operation. The machine can be lubricated without removing the main frame from the case container. A drop of oil is required on the pivot screw, bearing surfaces and teeth of gears. Do *not* apply oil to the surfaces of the neoprene rollers. A detailed lubrication procedures chart is outlined in TM 11-6525-200-12.

4-8. Operational Checks

Prepare the AN/TAQ-2 for operation by installing the system as dictated by the situation. Perform the preliminary operating procedures described in paragraph 3-3 before proceeding with the procedure given in table 4-3. If an indication is normal as specified in the table, go on to the next procedure. If an abnormal condition results, correct as indicated in the corrective measures column, or refer to a higher level of maintenance.

Table 4-3. Operational Checks

Sequence No.	Procedure	Normal indication	Corrective measures
	Control group and generator group		
1	Set the 100kV/150 kV level switch to 100kV. Plug in ac input power cable and set CIRCUIT BREAKERS 1 & 2 to ON.	Line voltmeter indicates input voltage.	Check ac input power cable.
2	Pressurize the system with the AIR PUMP to 8 psi.	a. PRESSURE LOW lamp goes out.	a. Set CIRCUIT BREAKERS to OFF and check seal of O-rings at

Table 4-3. Operational Checks-Continued

Sequence No.	Procedure	Normal indication	Corrective measure
			desiccant case and high voltage chamber.
		b. PULSER PRESSURE gauge indicates proper value.	b. Check hose connections for possible leakage.
3	Set EXPOSURE selector for 25 pulses.	Proper number appears in EXPOSURE selector window.	
4	Set POWER ON switch to ON.	POWER ON lamp lights.	
5	Press and hold EXPOSURE SWITCH.	a. EXPOSING lamp will light.	Check EXPOSURE SWITCH cable.
		b. TOTALIZER will record number of pulses.	
6	Press the EXPOSURE selector reset knob.	SET SELECTOR lamp extinguishes.	
7	Press PRESSURE RELEASE button.	PRESSURE LOW lamp lights.	
	Film Processing Machine		
8	rotate winding knob counterclockwise; RELEASE button moves to upper end of groove. Rotate 1 turn until pin from winding knob contacts wind stop.	Winding knob will encounter some resistance.	Check if crossbar securing strap has been removed.
9	Press crossbar downward and lock; upper roller should be pressed against bottom roller.	Depress release; both rollers should rotate while winding mechanism is unwound.	a. Check release button and carriage lock spring bracket for loose or missing hardware. b. Check upper roller pressure adjustment.
10	Rotate timer clockwise to a point past 10.	The bell should sound when timer returns to zero.	Check bell and replace if necessary.
	Positioner Group		
11	Install radiographic film packet on cassette holder. Place opaque window towards X-ray source.	Film after developing should be uniform.	a. If poor quality, check developing time. b. If spots appear on print, check for dirt on rollers. c. If dark or opaque, recheck installation of film packet (para 3-6).

APPENDIX A

REFERENCES

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (Types 7, 8, and 9), Supply Bulletins and Lubrication Orders.
DA Pam 310-7	US Army Equipment Index of Modification Work Orders.
SB 11-573	Painting and Preservation Supplies Available for Field Use for Electronics Command Equipment.
TB SIG 255	Care of Magnetron Tubes.
TB 746-10	Field Instructions for Painting and Preserving Electronics Command Equipment.
TM 8-230	Military Roentgenology.
TM 11-6525-202-12	Operator's and Organizational Maintenance Manual: Portable Radiographic X-Ray Processing Machine.
TM 11-6525-201-14	Operator's, Organizational, Direct Support, and General Support Maintenance Manual: Control Group OK-258/TAQ-2 and Generator Group OV-47/TAQ-2.
TM 11-6525-201-24P	Organizational, Direct Support, and General Support Maintenance Repair Parts and Special Tools Lists (Including Depot Maintenance Parts and Special Tools) for X-Ray Apparatus AN/TAQ-2.
TM 38-750	The Army Maintenance Management Systems (TAMMS).
TM 740-90-1	Administrative Storage of Equipment.
TM 750-244-2	Procedures for Destruction of Electronics Material to Prevent Enemy Use (Electronics Command).

APPENDIX C

MAINTENANCE ALLOCATION

Section I. INTRODUCTION

C-1. General

This appendix provides a summary of the maintenance operations covered in the equipment literature. It authorizes categories of maintenance or specific maintenance functions on repairable items and components and the tools and equipment required to perform each function. This appendix may be used as an aid in planning maintenance operations.

C-2. Maintenance Functions

Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination.

b. Test. To verify serviceability and to detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition, i.e., to clean, preserve, drain, paint, or to replenish fuel/lubricants/hydraulic fluids or compressed air supplies.

d. Adjust. Maintain within prescribed limits by bringing into proper or exact position, or by setting the operating characteristics to the specified parameters.

e. Align. To adjust specified variable elements of an item to about optimum or desired performance.

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipment used in precision measurement. Consists of the comparison of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Install. The act of emplacing, seating, or fixing into position an item, part, module (component or assembly) in a manner to allow the proper functioning of the equipment/system.

h. Replace. The act of substituting a serviceable like-type part, subassembly, module (component or assembly) in a manner to allow the proper functioning of an equipment/system.

i. Repair. The application of maintenance services (inspect, test, service, adjust, align, calibrate, replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining, or resurfacing) to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module/component/assembly, end item or system.

j. Overhaul. That maintenance effort (services/action) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (e.g., DMWR) in pertinent technical manuals. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like-new condition.

k. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like-new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours, miles, etc.) considered in classifying Army equipment/components.

l. Symbols. The uppercase letter placed in the appropriate column indicates the lowest level at which that particular maintenance function is to be performed.

C-3. Explanation of Format

a. Group Number. Column 1 lists group numbers, the purpose of which is to match components, assemblies, subassemblies and modules with the next higher assembly.

b. Functional Group. Column 2 lists the next higher assembly group and the item names of components, assemblies, subassemblies and modules within the group for which maintenance is authorized.

c. Maintenance Functions. Column 3 lists the twelve maintenance functions defined in C-2 above. Each maintenance function required for an item is specified by the symbol among those listed

in *d* below which indicates the level responsible for the required maintenance. Under this symbol is listed an appropriate work measurement time value determined as indicated in *e* below.

d. Use of Symbols. The following symbols are used to prescribe work function responsibility:

C — Operator/crew
O — Organization
F — Direct support
H — General support
D — Depot

e. Work Measurement Time. The active repair time required to perform the maintenance function is included directly below the symbol identifying the category of maintenance. The skill levels used to obtain the measurement times approximate those found in typical TOE units. Active repair time is the average aggregate time required to restore an item (subassembly, assembly, component, module, end item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, fault isolation/diagnostic time, and QA/QC time in addition to the time required to perform specific maintenance functions identified for the tasks authorized in the maintenance allocation chart. This time is expressed in man-hours and carried to one decimal place (tenths of hours).

f. Tools and Test Equipment. This column is used to specify, by code those tools and test equipment required to perform the designated function.

g. Remarks. Self explanatory.

C-4. Explanation of Format of Table 1, Tool and Test Equipment Requirements

The column in Table I, Tool and Test Equipment Requirements are as follow:

a. Tools and Equipment. The numbers in this column coincide with the numbers used in the tools and equipment column of the applicable tool for the maintenance function.

b. Maintenance Category. The codes in this column indicate the maintenance category normally allocated the facility.

c. Nomenclature. This column lists tools, test, and maintenance equipment required to perform the maintenance functions.

d. Federal Stock Number. This column lists the Federal stock number of the specific tool or test equipment.

e. Tool Number. Not used.

SECTION II. MAINTENANCE ALLOCATION CHART

(1) GROUP NUMBER	(2) FUNCTIONAL GROUP COMPONENT ASSEMBLY NOMENCLATURE	(3) MAINTENANCE FUNCTIONS											(4) TOOLS AND EQUIPMENT	(5) REMARKS
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
01	PORTABLE X-RAY APPARATUS, RADIOGRAPHIC INDUSTRIAL SYSTEM AN/UGM-2	C 0.25	C 0.25 F 0.25	C 1.1				C 0.30	C 0.30	F 1.5	D 30		Special tools 2,3 equipment 1,2,6,7 1 thru 8	Operational test only
0101	CONTROL UNIT	C 0.15	C 0.15					C 0.25	C 0.25					
010101	POWER SUPPLY, LOW VOLTAGE									F 1.0	D 16		2,7 2,4,5,7	
010102	TOTALIZER	C 0.15	C 0.15	C 0.10					C 0.25					
01010201	TRANSFORMERS (2 EA)		F 0.25							F 0.50			2,7	
01010202	EXPOSURE SELECTOR				F 1.0								2,7	
01010203	TOTALIZER										D 16		2,7	
01010204	SWITCHES, INDICATING LIGHTS	C 0.15	C 0.15	C 0.10					F 0.25				2,7	
010103	PRINTED CIRCUIT BOARDS 521 AND 522	C 0.15	F 0.25		F 1.0				C 0.25	F 4.0	D 16		2,7 2 thru 5,7,8	Only printed circuit board 522 uses special test set.
0102	X-RAY TUBE	C 0.15		C 0.10				C 0.30	C 0.25					
010201	ACCESSORIES, CABLES									F 1.0	D 16		2,7	

SECTION II. MAINTENANCE ALLOCATION CHART

(1) GROUP NUMBER	(2) FUNCTIONAL GROUP COMPONENT ASSEMBLY NOMENCLATURE	(3) MAINTENANCE FUNCTIONS											(4) TOOLS AND EQUIPMENT	(5) REMARKS
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
0103	POWER SUPPLY	C 0.15								H 2.0	D 16		2,7	
010301	METER, TRANSFORMER		O 0.15							H 0.5			2,7	
010302	SWITCHES, INDICATOR LAMP									O 0.20	D 16		2,7	
0104	SUPPORT ACCESSORIES	C 0.15			C 0.10			C 0.3	C 0.25					
010401	PULSER UNIT		F 2.0		H 1.0			H 0.3	H 0.3	H 1.0			2,3,4,7	
010402	HIGH VOLTAGE POWER SUPPLY		H 0.5						H 0.3				2,7	
010403	PRESSURE SYSTEM	C 0.15	C 0.15				H 0.10	H 0.30		H 1.0	D 16 D 16		7	
010404	DESICCANT ASSY	C 0.15						C 0.30	C 0.15					
010405	RESISTOR (LOAD)		F 0.25					F 0.30	F 0.30				2,7	
0105	X-RAY PROCESSING MACHINE	C 0.15	C 0.15	D 30					O 0.25	D 16	D 16		7 9	Operational test only

TOOL AND TEST EQUIPMENT REQUIREMENTS

TOOLS AND EQUIPMENT	MAINTENANCE CATEGORY	NOMENCLATURE	FEDERAL STOCK NUMBER	TOOL NUMBER
1	C,O,F,H,D	RADIAC SET TSA-9/PD( )	6625-243-4139	
2	O,F,H,D	MULTIMETER TS-352B/U	6625-553-0142	
3	H,D	MULTIMETER ME-26A/U	6625-646-3609	
4	H,D	OSCILLOSCOPE AN/USM-281A	6625-220-2201	
5	H,D	TRANSISTOR TESTER TS-1836B/U	6625-893-2628	
6	C,O,F,H,D	CHARGER, RADIAC DETECTOR PP-1578( )/PD	6625-242-1177	
7	F,H,D	TOOL KIT, ELECTRONIC EQUIPMENT TK-101/G	5180-264-5178	
8	H,D	TEST SET, SPECIAL		
9	F,H,D	TOOL K.I., PROCESSOR MK-( )		

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NG: None
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For explanations used, see AR 310-50.

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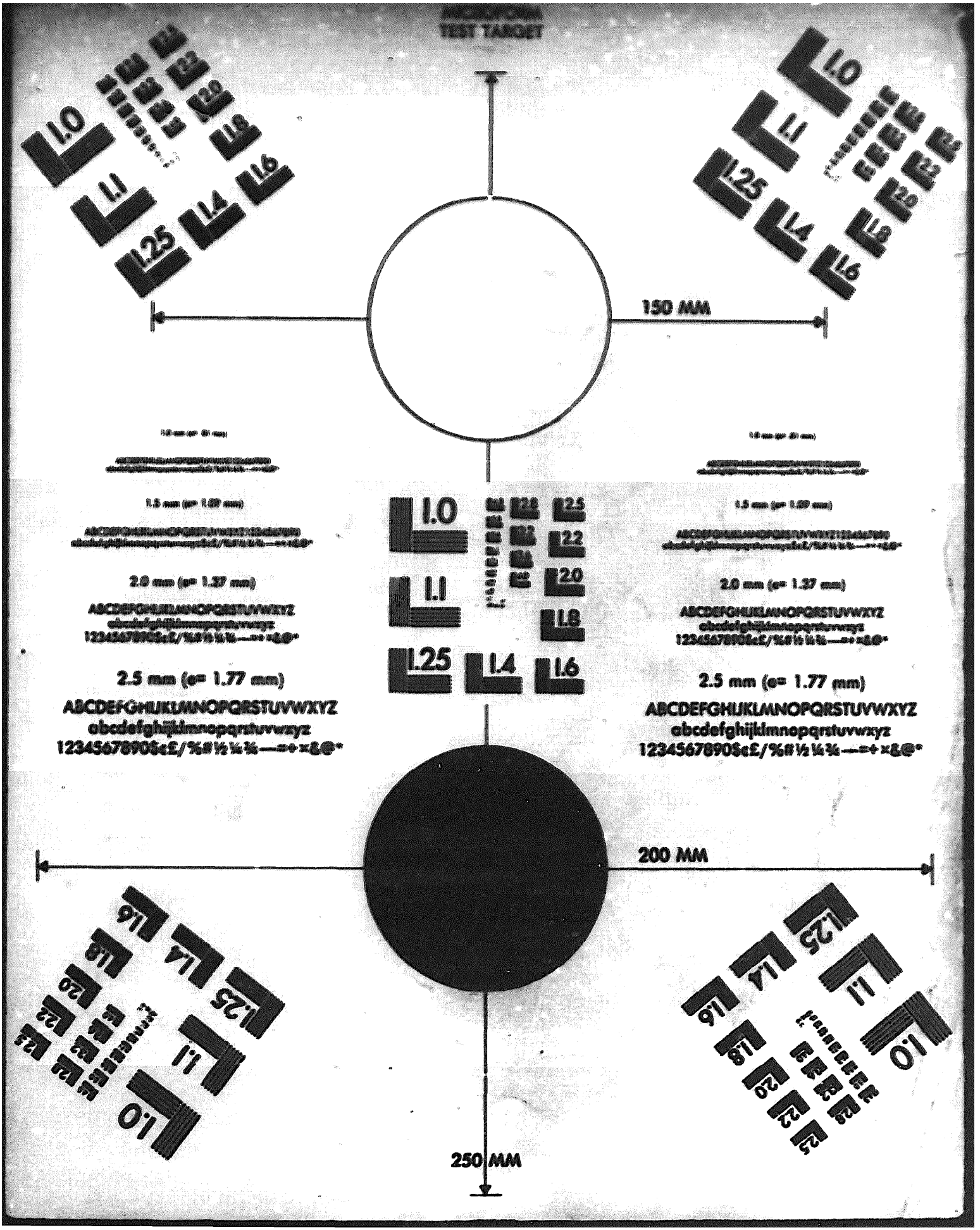
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