

NAVSHIPS 93233

(Non-Registered)

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TECHNICAL MANUAL

*for*

**RADIAC DETECTOR  
CHARGER**

***PP-354D/PD***

TUNG-SOL ELECTRIC INC.  
CHATHAM ELECTRONICS DIVISION  
630 W. MT. PLEASANT AVE.  
LIVINGSTON, N. J.

DEPARTMENT OF THE NAVY  
BUREAU OF SHIPS

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From: Chief, Bureau of Ships  
To: All Activities concerned with the Installation, Operation,  
and Maintenance of the Subject Equipment  
Subj: Technical Manual for Radiac Detector Charger PP-354D/PD,  
NAVSHIPS 93233.

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## SECTION 1

# GENERAL INFORMATION

### 1-1. INSTRUCTION BOOK SCOPE.

This instruction book is concerned with Radiac Detector Charger PP-354D/FD. It contains data pertaining to the theory of operation, and maintenance of this unit, which is used for charging radiacmeters used for radiological survey purposes. This book supersedes all previous instruction books for this unit.

### 1-2. PURPOSE AND BASIC PRINCIPLES.

a. Radiac Detector Charger PP-354D/PD is used to charge Radiacmeters IM-9( )/PD, IM-19( )/PD series, IM-20( )/PD series, IM-94( )/PD series, IM-112( )/PD series, IM-143( )/PD series, and similar types. Charging a radiacmeter of these types consists of applying a d-c potential to the fiber in a quartzfiber electrometer which the radiacmeter contains. The applied potential moves the fiber away from its supporting mounting, so that the shadow image normally cast by the fiber on a nearby scale appears at a different point on the scale. The scale is calibrated to indicate zero when the fiber is first charged. Exposing the fiber to radioactivity causes the potential on it to decrease, moving the fiber toward the mounting and causing the image to shift to another point on the scale. The scale is calibrated to indicate directly the amount of radioactivity to which the radiacmeter has been exposed. This type of radiacmeter, commonly called a dosimeter, thus gives a continuous indication of gamma radiation exposure since initial charging.

b. Radiac Detector Charger PP-354D/PD is a frictional generator of static electricity. It contains a socket that

serves the dual purpose of electrical connection and mechanical clamping of the radiacmeter. Radiac Detector Charger PP-354D/PD (hereafter called simply the charger) directly converts the mechanical motion of turning its knob into a static electrical potential. No batteries or other sources of power are thus required for charger operation. The charger can be conveniently carried in the user's pocket.

### **1-3. PHYSICAL DESCRIPTION.**

Radiac Detector Charger PP-354D/PD is contained in a watertight metal case measuring 2-7/16 inches long by one inch wide by two inches high, overall (see figure 1-1). The hinged top section of the case contains the upper part of the charging socket, which continues into the body of the case. A removable plug closes the charging socket when it is not in use. The plug is attached to the charger by a length of bead chain. The bar-type operating knob for the charger is mounted on one end of the case. A window is provided in the bottom of the case to transmit light to the radiacmeter.

#### **NOTE**

The plug is used as a dust cap only and is not watertight. If water collects in the receptacle, it should be thoroughly dried before use.

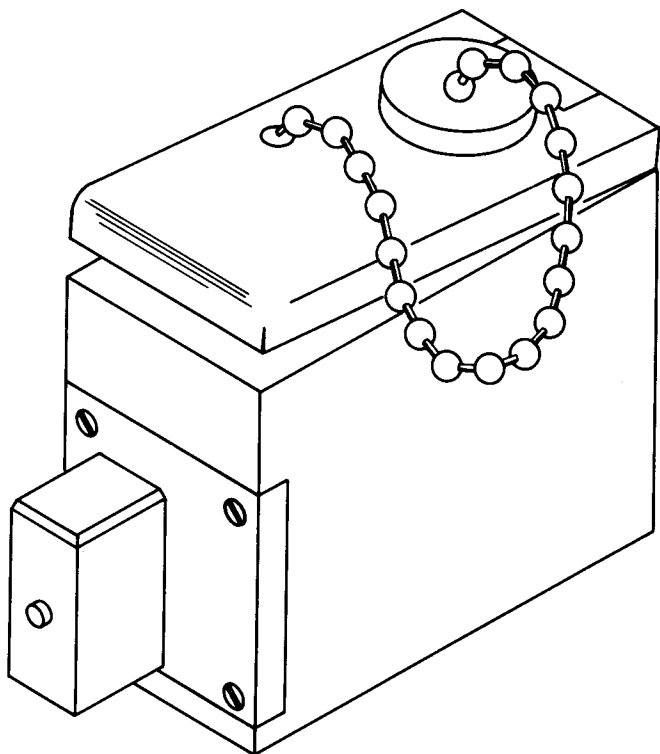
Although the charger is not of one-piece construction, it cannot be practically disassembled for maintenance purposes.

### **1-4. REFERENCE DATA.**

a. NOMENCLATURE. - Radiac Detector Charger PP-354D/PD.

b. CONTRACT DATA. - NObsr-71719 dated 8 March 1957.

c. CONTRACTOR. - Tung-Sol Electric Inc., Chatham Electronics Division, Livingston, New Jersey.



*Figure 1-1. Radiac Detector Charger PP-354D/PD*

d. COGNIZANT NAVAL INSPECTOR. -Inspector of Naval Material, Newark, New Jersey.

e. RANGE. -0-210 volts dc  $\pm 10$  volts, approximately.

f. POWER SUPPLY. -Self-contained frictional electrostatic generator.

g. OTHER RADIAC EQUIPMENT INVOLVED. -Radiacmeters IM-9( )/PD and higher, IM-19( )/PD series, IM-20( )/PD series, IM-94( )/PD series, IM-107( )/PD series, IM-112( )/PD series, IM-143( )/PD series, and similar types.

h. DIMENSIONAL DATA. -2-7/16 inches long by 1 inch wide by 2 inches high, overall.

i. WEIGHT. -5 ounces.

j. HEAT DISSIPATION. -None.

## **1-5. SIMILARITIES TO EXISTING EQUIPMENTS.**

a Radiac Detector Chargers PP-354B/PD and PP-354C/PD are similar. Radiac Detector Charger PP-354D/PD is greatly improved, however.

b. Radiac Detector Charger PP-311/PD series is a similar type of equipment, but it uses dry batteries and is larger and heavier.

## **SECTION 2**

# **INSTALLATION**

### **2-1. INSTALLATION RECORD.**

Mark the date the equipment is placed in service on the date of acceptance plate located below the model nameplate on the equipment. Use methods suitable to the type of nameplate. Use care in marking the date on the nameplate to avoid damaging the equipment. The equipment needs no installation other than this marking procedure.

## SECTION 3

# OPERATOR'S SECTION

### RADIOLOGICAL SAFETY WARNING

All personnel working in high intensity levels of radioactivity must exercise caution to prevent bodily damage. While the radiation from radioactive substances cannot usually be seen or felt, prolonged or intensive exposure may result in serious damage. One-tenth roentgen per week (0.1 R/week) is considered to be the maximum amount of radiation which can be absorbed continuously without serious damage. When a radioactive source is used for checking the calibration of the instrument described herein, use care in handling the source. Follow closely the safety instructions enclosed herein and with the source.

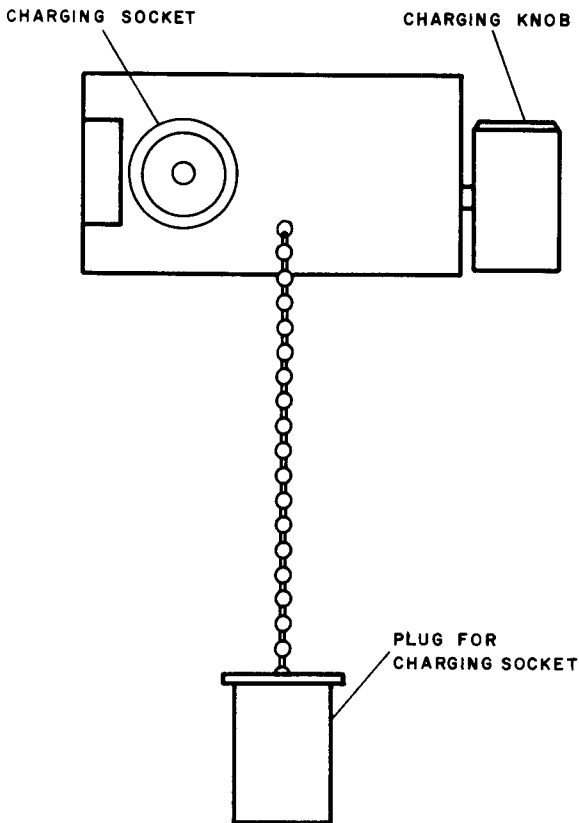
#### 3-1. CONTROLS AND SOCKET.

The operating controls and the socket of Radiac Detector Charger PP-354D/PD (see figure 3-1) are described below:

a. **KNOB.** -The operating knob of the charger actuates the electrostatic generator when it is normally turned in a clockwise direction. Counterclockwise rotation of the knob will then reduce the charge.

b. **HINGED TOP SECTION.** -The hinged top section acts as a clamping device for the radiacmeter being charged.

c. **SOCKET.** -The charging socket provides a connection for the radiacmeter being charged. An internal shorting switch is provided to keep the charger in an uncharged state until a radiacmeter is inserted. A plug is also provided to keep the socket sealed when the charger is not in use.



*Figure 3-1. Radiac Detector Charger  
PP-354D/PD, Top View*

## **3-2. OPERATING INSTRUCTIONS.**

To operate Radiac Detector Charger PP-354D/PD, proceed as directed below.

Step 1. Grasp the charger and depress the hinged top section.

Step 2. With the other hand, grasp the bead chain on the charging socket plug and pull the plug out.

Step 3. Insert the radiacmeter in the charging socket while still holding the hinged top section, then release the top section.

### **CAUTION**

This charger cannot be used with Radiacmeter IM-9/PD.

Step 4. Rotate the radiacmeter in the charging socket so that the radiacmeter scale is horizontal and reads from left to right when the charger is in the position shown in figure 3-1.

Step 5. Place the charger on a flat surface and press the radiacmeter into the charging socket to seat it against the socket shoulder.

### **NOTE**

Radiacmeters of this type employ a diaphragm-type connection for the center electrode. Contact between the center electrode of the radiacmeter cannot be made unless the diaphragm is flexed.

Step 6. Hold radiacmeter up to light and, while viewing the radiacmeter scale, turn the charging knob clockwise to bring the fiber image into view. Continue clockwise knob rotation until the fiber image has been moved the equivalent of one division to the left of zero. If the fiber image has moved too far to the left, turn the charging knob counter-clockwise to bring the image back to the correct position.

## NOTE

On some radiacmeters (IM-9A/PD units), the charging contact may not be made in the locking position. This will be noted by no control of the radiacmeter fiber. To charge these units, hold the charger so that the radiacmeter scale can be viewed while pressure is being exerted on the radiacmeter to seat it.

Step 7. While still viewing the radiacmeter scale, depress the hinged top section. The fiber image should move to zero. If the image falls short or overshoots, repeat steps 5 and 6, making the necessary allowance in the position of the fiber image to the left of zero to bring the image to zero as this step is performed.

Step 8. With the hinged top section of the charger again held down, remove the charged radiacmeter.

Step 9. Replace the plug in the charging socket.

## SECTION 4

# PRINCIPLES OF OPERATION

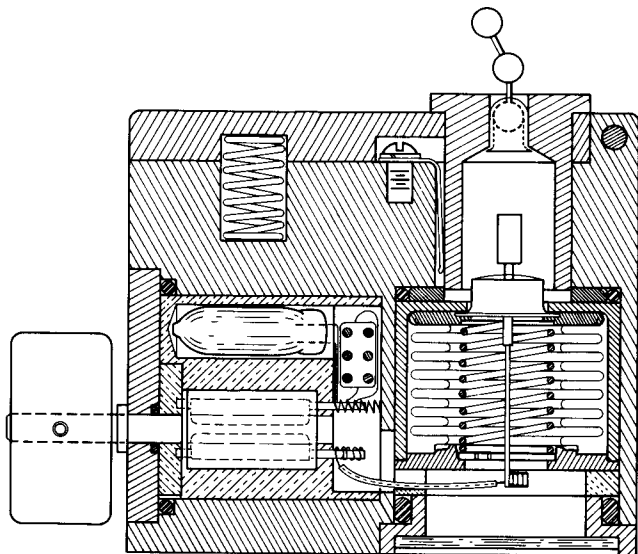
### 4-1. INTRODUCTION.

Radiacmeters IM-9( )/PD or higher, IM-19( )/PD series, IM-20( )/PD series, IM-94( )/PD series, IM-107( )/PD series, IM-112( )/PD series, IM-143( )/PD series, and other similar types of radiacmeters that use Radiac Detector Charger PP-354D/PD, require a source of d-c voltage for charging prior to use. Since the charging current required is very minute, the use of a frictional electrostatic generator is practical. The voltage (approximately 150 volts dc) required to charge these radiacmeters can be obtained from an electrostatic generator of relatively small dimensions by using a small amount of mechanical energy.

### 4-2. DETAILED THEORY OF OPERATION.

a. ELECTROSTATIC GENERATOR. The electrostatic generator used in this charger is contained within a hysol plastic case that mounts within the charger (see figure 4-1). The generator consists of a lucite rotor mounted on the shaft that also mounts the operating knob, two exciter pads pressed against the rotor by the generator housing, and two sets of metallic collectors (two positive and two negative) that serve as electrodes. The two positive electrodes connect to the center pin of the charging socket, and the two negative electrodes connect to the body of the charger.

The generator operates in the following manner: when the operating knob is turned in a clockwise direction, the exciter induces a positive charge on the surface of the lucite rotor. Continued rotation brings the charged area under the metallic collectors. The edgewise contact of the collectors effec-



*Figure 4-1. Radiac Detector Charger  
PP-354D/PD, Side View*

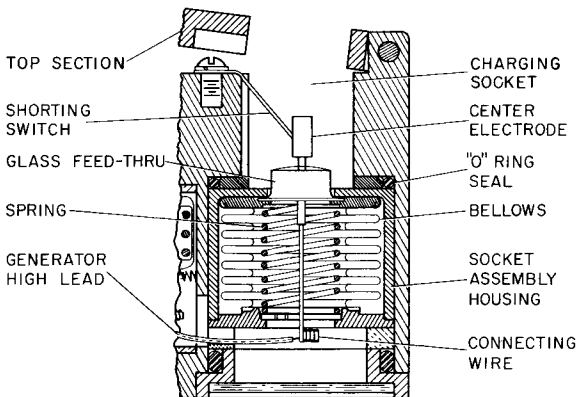
tively removes the charge for use as a d-c potential. The charge will build up an increasing potential as long as the operating knob is turned. Since the generator has an extremely low internal leakage, the potential thus produced will not leak off when the rotation of the operating knob is stopped.

b. REGULATOR TUBE. As a safety precaution against the possibility of blowing (breaking open) the fiber, a regulator tube is placed across the generator output terminals to limit the output voltage to  $210 \pm 10$  volts dc.

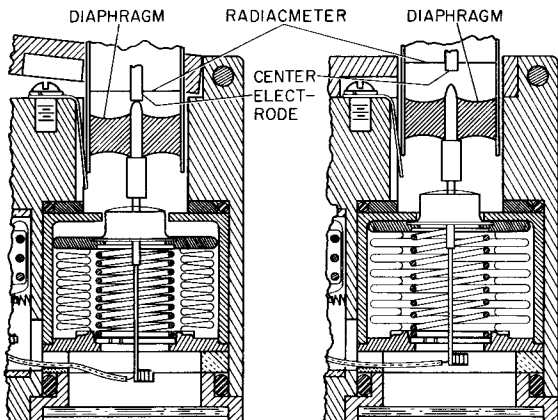
c. GLASS CAPACITOR. To give a more stable voltage supply, a glass capacitor having minimum leakage is placed across the generator output.

d. CHARGING SOCKET. (See figure 4-2.) The main portion of the charging socket is within the body of the charger (see figure 4-2A). A matching hole in the hinged top section serves to clamp the radiacmeter under charge into the socket. A shorting switch is located in the upper part of the socket and normally forms a direct short across the socket. Insertion of the radiacmeter into the socket opens the shorting switch before the center electrode diaphragm in the radiacmeter contacts the center electrode of the charger. Consequently, when a charged radiacmeter is pressed into the socket, a portion of the radiacmeter's charge is shared with the generator and the socket. The generator and the socket are not normally charged because of the short across them. This occurrence prevents the electrometer fiber from becoming excessively charged so that it moves off scale to the left, out of view of the user.

The center electrode of the charging socket is a glass feed-through sealed to a bellows which is spring-mounted with a controlled pressure to contact the center electrode of the radiacmeter and compress its diaphragm until its internal switch closes. When the radiacmeter is pressed into the charging socket and seats on the socket shoulder, the spring is compressed and the diaphragm of the radiacmeter is flexed to close its internal switch (see figure 4-2B). The center electrode of the charger connects to the two positive terminals of the electrostatic generator.



A. DETAIL OF CHARGING SOCKET



B. RADIAC METER LOCKED IN CHARGING POSITION

C. RADIAC METER DISCONNECTED

Figure 4-2. Radiac Detector Charger  
PP-354D/PD, Detail Views

When the top section is depressed after charging, the spring pressure is released and the diaphragm of the radiacmeter breaks its internal contact (see figure 4-2C). On removing the radiacmeter, the shorting switch closes. A plug is provided to protect the charging socket from dust when the charger is not in use. The plug is attached to the charger by a length of bead chain.

e. CHARGER CONSTRUCTION. With the charging socket plug in place, the charger may be carried in a pocket without damage from dust. The window in the bottom of the charger and the cover plate for the electrostatic generator are both sealed with O-rings.

## SECTION 5

# TROUBLE-SHOOTING, MAINTENANCE AND REPAIR

### 5-1. FAILURE REPORT.

"Report each failure of the equipment, whether caused by a defective part, wear, improper operation, or an external cause. Use ELECTRONIC FAILURE REPORT from DD787. Each pad of the forms includes full instructions for filling out the forms and forwarding them to the Bureau of Ships. However, the importance of providing complete information cannot be emphasized too much. Be sure that you include the model designation and serial number of the equipment (from the equipment identification plate), and the type number and reference designation of the particular defective part (from the technical manual). Describe the cause of the failure completely, continuing to the back of the form if necessary. Do not substitute brevity for clarity. And remember--there are two sides to the failure report--

#### YOUR SIDE

"Every failure report is a boost for you:

1. It shows that you are doing your job.
2. It helps make your job easier.
3. It gives you a chance to pass your knowledge to every man on the team.

#### BUREAU SIDE

"The Bureau of Ships uses the information to:

1. Evaluate present equipment.
2. Improve future equipment.
3. Order replacements for stock.
4. Prepare field changes.
5. Publish maintenance data.

Always keep a supply of failure report forms on hand. You can get them from the nearest District Publications and Printing Office. "

## **5-2. TROUBLE-SHOOTING.**

There is no practical way of trouble-shooting Radiac Detector Charger PP-354D/PD because of its internal shorting switch. This switch makes the charger inactive unless a radiacmeter is used with it. Trouble-shooting instructions for the two units will be found in the technical manual for the radiacmeter.

## **5-3. MAINTENANCE.**

The only maintenance possible on the charger is cleaning. Clean the charger according to the following instructions.

a. Clean the exterior surfaces of the charger with a clean, lintless cloth. Rub gently over all surfaces. Do not use any solvent in cleaning the exterior surfaces. Use a stream of dry air to remove particles of dust or lint in the charging socket. Flush out exceptionally stubborn particles with clean water. Use the least amount possible, then evaporate it with dry air.

b. Remove moisture resulting from condensation by heating the charger with a 60-watt light bulb. Place the bulb about six inches away from the charging socket opening and leave it there for about 15 minutes.

### **NOTE**

The charger must be checked, after cleaning by any of the above methods, by using it to charge two or more radiacmeters several times. The charger should be removed from use if there is any evidence of imperfect operation.

#### **5-4. REPAIR.**

The charger cannot be repaired because it cannot be practically disassembled. Therefore, a faulty charger should be removed from use and turned in to the nearest depot facility. Depot facilities should dispose of faulty units according to current instructions.

## **SECTION 6**

### **PARTS LIST**

#### **NOTE**

Because of the construction of Radiac Detector Charger PP-354D/PD, its component parts cannot be disassembled by maintenance personnel. Faulty chargers should be turned over to depot facilities, which should dispose of the units according to current instructions.