PHILIPS

Table-top X-ray Generator
PW 1720

Instruction Manual

9499 300 12011

771111

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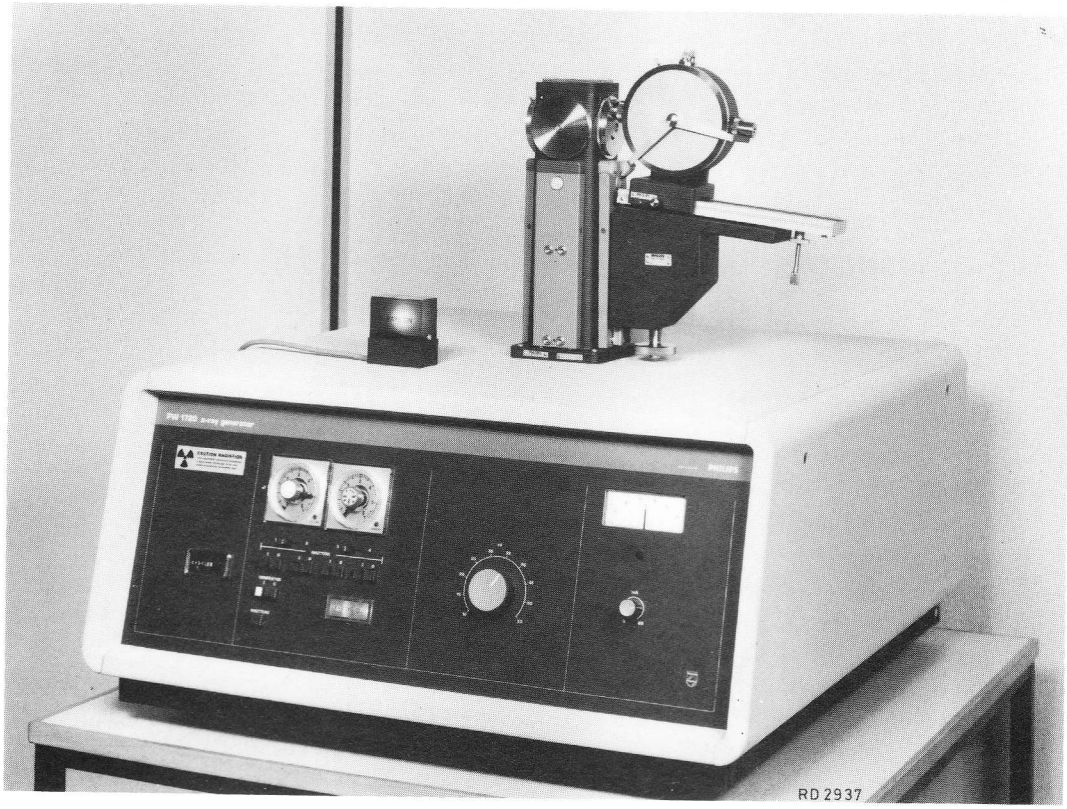

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CONTENTS

1. INTRODUCTION.

The full-wave rectified, X-ray generator type PW 1720, is a compact unit which can be placed on top of a PW 1725 console or substantial table. The HT generator provides the power requirements directly to an X-ray tube mounted in the tube shield. The unit is specifically designed for camera diffraction studies, and diffractometry.

The tube shield is mounted in the centre of the top cover, and can be fixed so that the X-ray beams are 45^0 and 90^0 to the sides of the unit. In the standard unit the two windows for the point focus beams are provided with a filter disc and shutter disc, and the remaining two windows are blanked off by a steel disc.
All four windows have a shutter. Filters and shutter discs are available as an option, for the two line focus windows.

Timers for control of the shutter can be provided on the front panel, and these control the measuring time from a few seconds up to 60 hours.

Also available is a mains voltage stabiliser for use when a stable voltage output is required.
The PW 1720/25 HT generator (without tube tower), is described in Appendix 2.

WARNING: X-RAYS ARE HARMFUL

This equipment produces X-rays which can be dangerous to health if the proper precautions are not taken. It is important for the health and safety of the operator that the recommendations given in this manual be carefully observed. There must be strict compliance with local safety regulations.

Radiation safety precautions for the diffraction tube shield.

The automatic shutters should never be opened manually but only from the shutter control panel. The free movement of the automatic shutters and the rotary shutter discs should never be obstructed so that they remain in the open position. The push-buttons of the interlock safety microswitches should never be actuated except by fitting an accessory device which prevent the entry of any portion of the human body into the primary X-ray beam path. Always check the shutter condition by observing the indicator flag. A red flag indicates an open shutter. If a shutter is closed the flag should be completely green.
Red warning lamps are lit to indicate an open automatic shutter. Beam ports not in use are closed by radiation-proof rotary or blank shutter discs, see paragraph 2.2.
The covers of the shutter actuating mechanism should not be removed.
Adjustment, repair and exchange of components, must only be performed by qualified personnel.
Radiation levels should be checked regularly.

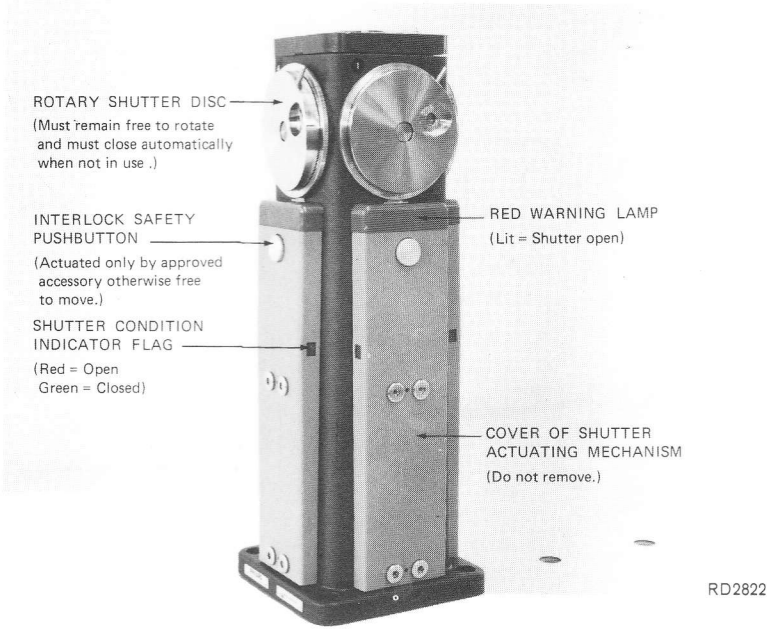

Fig. 1.1. Radiation safety precautions for the tube shield.

2. DESCRIPTION OF THE UNIT

A general view of the PW 1720/00 is shown below.

The top cover of the generator is used as a table top, and provides work space for powder and single crystal diffraction cameras, or a Philips vertical wide angle goniometer.
The finish is 3M's NEXTEL paint, and can be cleaned with household cleaners, alcohol, petrol (benzine), etc., but not methylated spirits.

Fig. 2.1. Front view of PW 1720/00 X-ray generator.

2.1. FRONT PANEL CONTROLS

The layout of the front panel controls is shown in figure 2.2.

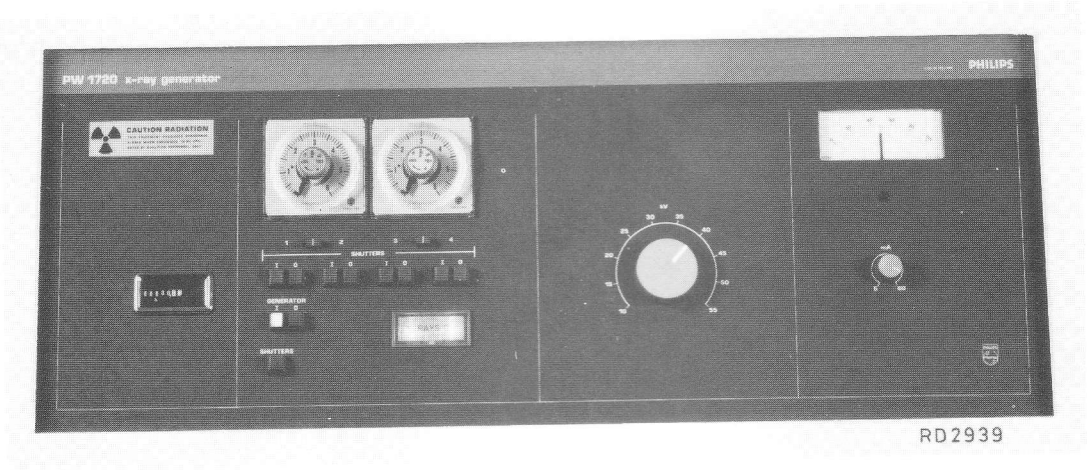

Fig. 2.2. Front panel controls.

Hours run meter	Situated at the left-hand side, it will indicate the total time that power has been applied to the X-ray tube, and it cannot be reset.
Generator I 0	A momentary operation of the I push-button will switch on the equipment, the white lamp will light, and H.T. is applied to the X-ray tube if all safety circuits are correct. A momentary operation of the 0 push-button will switch off all circuits.
Shutters I 0	The four pairs of push-buttons control the operation of the shutters over the numbered (1 to 4) windows of the tube tower, provided that an accessory is correctly installed in the selected position. A momentary operation of the I push-button will open the shutter when depressed simultaneously with the shutter push-button situated at the bottom of the panel. Operation of the 0 push-button will close the shutter.
Shutters	The lowest push-button on the panel must be depressed simultaneously with one of the shutter I push-buttons - see above.
Shutters 1 - 2 and 3 - 4	The two three - position switches will select control by the timer, situated immediately above the switch, of the selected shutter operation. A timer is not selected with the switch in mid-position.

Two timers can be fitted as an option to control the operation of the shutters on the tube shield, and hence the exposure time of the film in the camera to X-rays. The central knob of the timer selects the time range: seconds, x10s, minutes, x10m, hours and x10h. The outer clear plastic cover adjusts the time pointer in the range 0,2 to 6, giving a shutter time adjustment from 0,2 seconds up to 60 hours.

X-RAYS ON	Warning lamp to show that the tube is producing X-rays. The HT is automatically switched off if a lamp bulb fails. An additional X-RAYS ON lamp, with fail-safe facility, can be provided to be placed on the generator table, or other conspicious position.
kV	A continuously adjustable high-voltage control from 10 to 55 kV (peak), with markings at every 5 kV.
mA	A continuously adjustable control to set the X-ray tube current from 5 to 60 mA. An associated meter indicates the current flowing through the tube. *NOTE: mA times kV must be less than 3000.*

The safety circuit prevents generation of the HT unless the kV and mA controls are set to the minimum position at switch on. Ensure the kV and mA settings never exceed the values shown in Appendix 1.

2.2. TUBE SHIELD

The tube shield is mounted at the centre of the top cover of the unit, and can be fixed at 0^{o}, 45^{o} or 90^{o} positions - see paragraph 3.7. Two mounting holes in the top cover enable a PW 1050/.. vertical goniometer to be mounted.
The top cover working surface is 700 mm (w) x 750 mm (d).

Figure 2.3. shows the tube shield fitted with a filter/shutter disc for window 1, and window 4 is blanked.

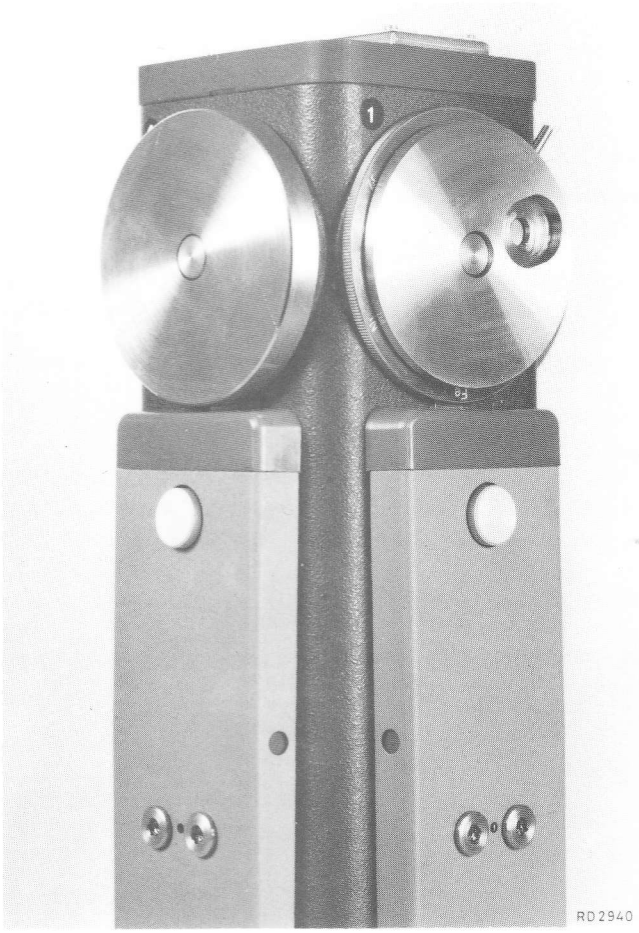

Fig. 2.3. Tube shield.

Each side of the tube shield has the following:

- A window, covered by a filter disc and shutter disc, or by a blank protective disc.
  The filter/shutter discs are standardly fitted on the two point focus windows, and a set of filter/shutter discs can be fitted as an option to the line focus windows, see Service section.
  Note that the point focus shutters cannot be used for the line focus windows, i.e. PW 1327/10 (only one set of shutters) must be ordered for the line focus windows, and the PW 1327/00 for a set of point focus shutter filter.

The *filter disc* is rotated to one of six marked positions, and for five positions a filter can be placed in the X-ray beam to be used as a β - filter for the various X-ray tube targets, as follows:

Filter - Zr, used for Mo radiation

Filter - Ni, used for Cu radiation

Filter - Fe, used for Co radiation

Filter - Mn, used for Fe radiation

Filter - V, used for Cr radiation

A filter is not used in the sixth position, and the window is open.
The *shutter disc* is pivoted on its centre and is spring loaded. When a camera or goniometer is fitted, the disc is rotated against the spring to allow the X-ray beam to pass.

- A white button, which is depressed by fitting a camera or a goniometer. The button actuates a microswitch to complete a safety circuit, and this enables the associated window shutter to be opened.
- A window shutter, operated by an electro-magnet, to allow the X-ray beam to pass into the camera or goniometer. The shutter operation is selected by the front panel switch and push-buttons, and the shutter will only open when the safety circuit is complete. If the shutter does not fully close after a close shutter command, then generation of HT to the X-ray tube is inhibited.
- A red lamp cover over two fail-safe lamps, which are lit to warn that the associated shutter circuit is activated (shutter is open). The shutter closes if a lamp fails.
- Two coloured indicator flags, one on each side of the shutter mechanism housing. The flags are mechanically coupled to the shutter, and a green flag appears when the shutter is closed, and a red flag when it is open.
- Four screw holes for mounting the camera bracket slide.

The point focus beam appears at windows 1 and 3.
The line focus beam appears at windows 2 and 4.

2.3. Rear panel

The layout of the rear panel is shown in figure 2.4.

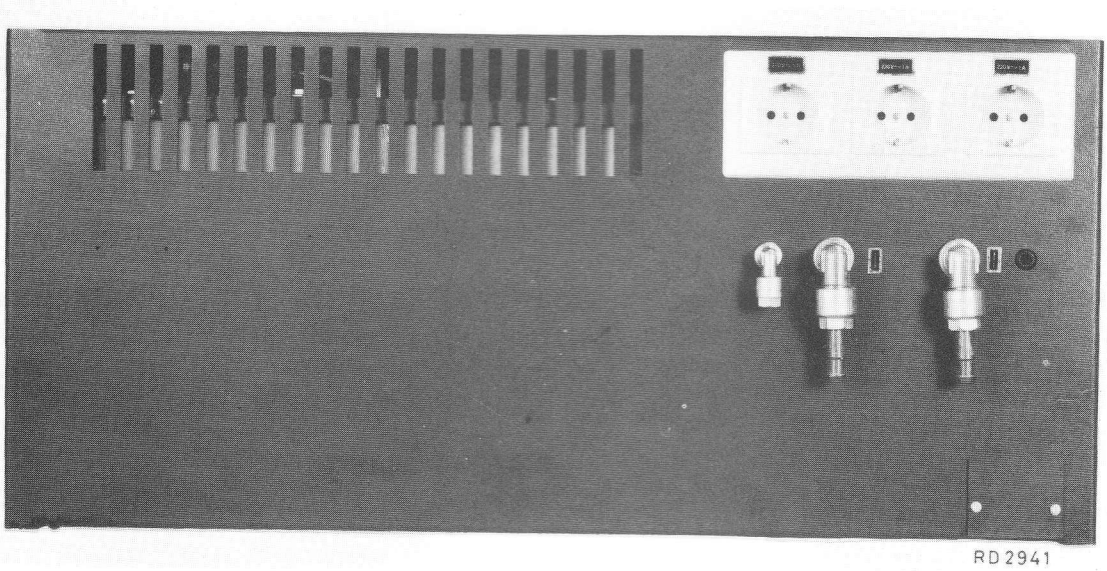

Fig. 2.4. Layout of the rear panel.

When the shutter is closed the generator will switch off, unless another shutter is still open in one of the other tube shield positions. Alternatively, the generator can be switchd off manually by operating the GENERATOR 0 push-button. All lamps will extinguish. Before the generator is switched off the power to the X-ray tube should be reduced, by first turning the mA control to minimum, and then the kV control. Any generation of HT will be inhibited if the shutter does not fully close after a close shutter command.

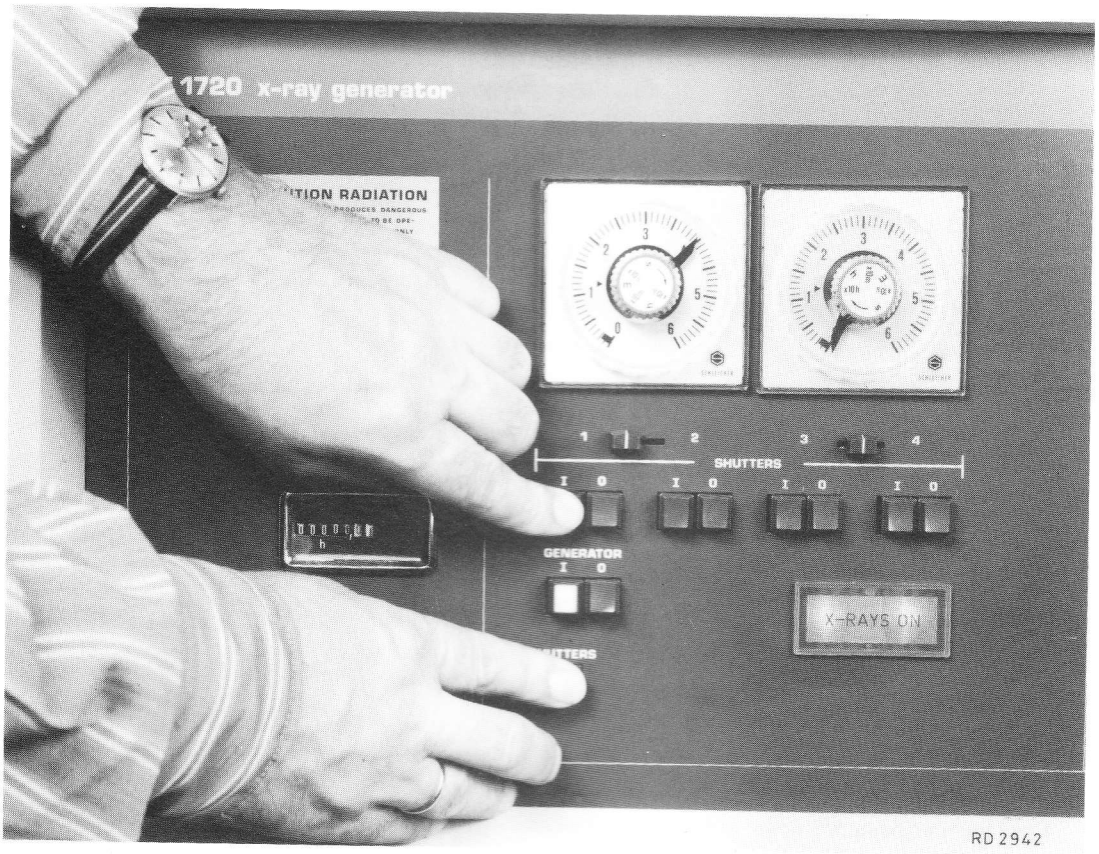

Fig. 3.1. Opening the window shutter.

3.3. SHUTTER CONTROL

For camera work it is usual to control the exposure time of the film to X-rays by using a PW 1722 timer. Two timers can be fitted: the left-hand timer will control the shutter of either window 1 or window 2, and the other timer the shutter of window 3 or 4. This paragraph describes the automatic and manual control of the shutter operation.

When the camera is installed on its bracket in front of the required exit window of the tube shield, open the shutter disc and push the camera forward until the collimator enters the hole in the disc. Ensure that the microswitch button on the tube shield is actuated by the pin or arm of the camera.

NOTE: The space between the front of the collimator and the exit opening of the tube shield should be kept as small as possible to ensure that radiation does not escape. Take care that the filter disc is free to move, and is not damaged.

3.5. USE OF WINDOWS

The tube shield on the PW 1720 has a window on each of the four sides, see paragraph 2.2.
The exit of X-rays is prevented by a blank shutter disc, or by a rotating shutter disc whose exit hole should only be positioned at the window when a camera or goniometer is correctly fitted. In addition, there is a shutter controlled by an electro-magnet, which can only operate when a safety circuit is complete, and when two push-buttons are operated simultaneously.
The windows are in pairs and opposite windows have a similar X-ray beam configuration. Owing to the short distance between anode and cathode (filament) of the tube, and the high voltage between these two electrodes, there is an almost linear electric field between the two, and the photon emitting area on the anode is more or less identical to the shape of the filament.
The filament has a rectangular shape but the size depends on the type of X-ray tube .

Focal sizes are:

Fine focus	= 0,4 x 8 mm
Normal focus	= 1 x 10 mm
Broad focus tube	= 2 x 12 mm

Two windows in the metal body are parallel with the long side of the focus: the two other windows are at right angles to it. The windows are at the same height with respect to the anode plane, and they allow beam take-off angles between 0^{o} and 12^{o} with respect to the anode plane. At the usual accepted take-off angle of 6^{o} (sin 6^{o} and tan $6^{o} \approx 0{,}1$), the focus dimension in the direction of the relevant beam becomes 0,1 of the original dimension.
The result is that on two sides a sharp line appears (line focus) and on the other two sides a bright focal spot (point focus), with specific dimensions for the various types of X-ray tube. One of the point focus is on the same side of the tube as the sealing stem. This provides the identification mark for the focal spots, see figure 3.2.

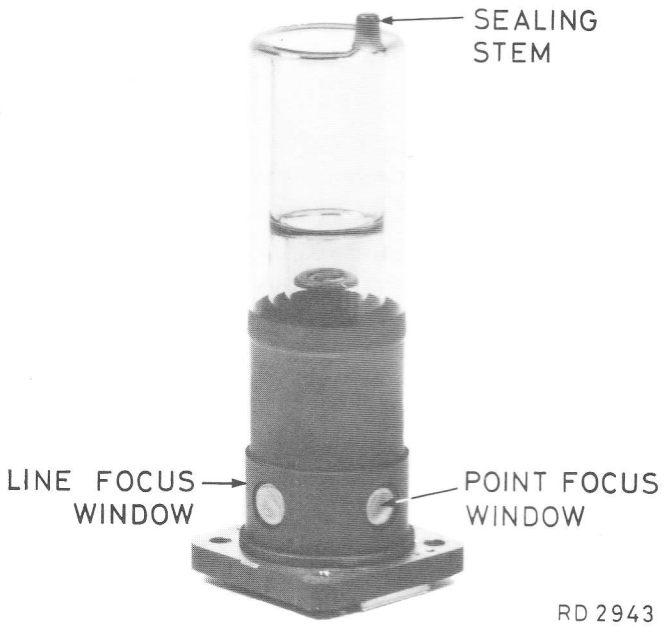

Fig. 3.2. X-ray tube showing windows.
NOTE: do not touch beryllium windows.

Typical window applications are shown below:

Line focus	Point focus
Powder diffractometer	Debye - Scherrer camera
Guinier camera	Texture goniometer
	Laue camera
	Weissenberg camera
	Precession camera
	Reciprocal lattice explorer

3.6. CHANGING THE X-RAY TUBE

To change the X-ray tube, proceed as follows:

1. Switch off by pressing the GENERATOR 0 push-button.
2. Turn off the water supply.
3. Drain water from the instrument by opening the air inlet valve next to the water inlet and outlet connections, and wait until air has filled the system. Some water may run from the air inlet valve.
4. Loosen the two captive screws at opposite corners on the top of the tube shield. The X-ray tube should be removed by lifting upwards, when handling the X-ray tube take care to hold by the metal base and DO NOT TOUCH THE BERYLLIUM WINDOWS. These windows are thin, and can be poisonous to the skin. Do not remove the X-ray tube if generator operation has been switched off because of a failure (safety circuit actuated) see Service section.
5. Select the new tube and insert into the tube shield, after first checking the condition of the "O" rings for the water tubes. There is a locating pin on the top of the tube shield to ensure correct positioning of the tube. Tighten the two fixing screws.

NOTE: The tube shield is designed to accept X-ray tubes with dimensions as figure 3.3. version A. For other tubes a spacer ring, such as PW 1043, will be necessary when the dimension from the underside of the tube base to the centre of the tube base to the centre of the tube window exceeds 21 mm. Note that dimension "a" must not exceed 120 mm.

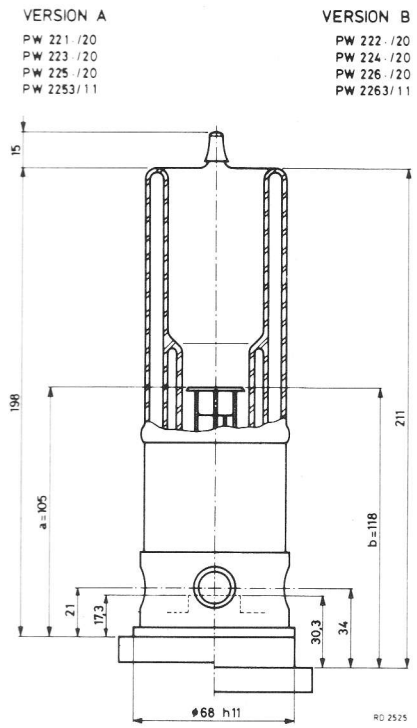

Fig. 3.3. X-ray tube dimensions.

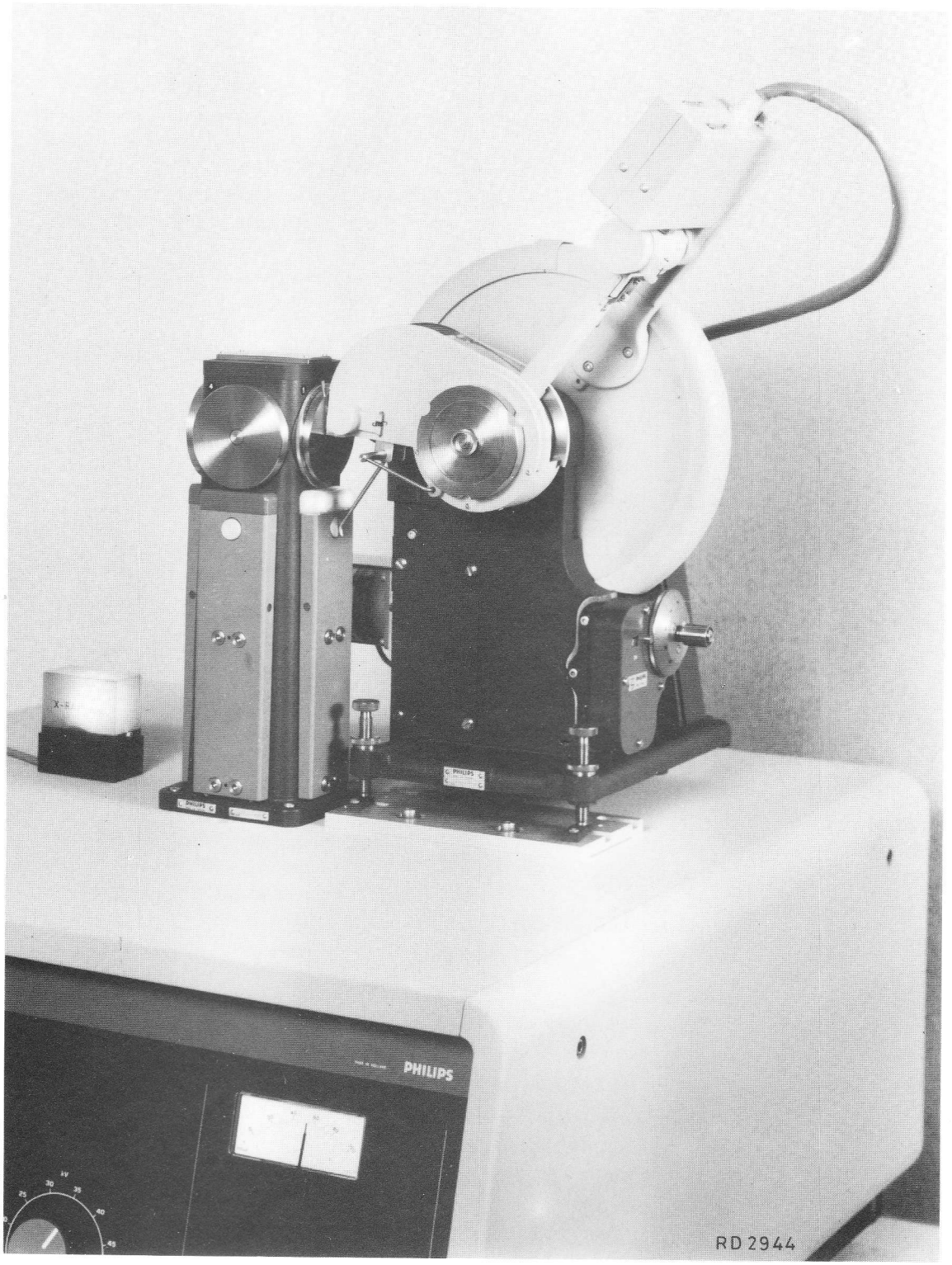

Fig. 3.4. PW 1720 with vertical goniometer.

PANNES

Compteur	Date	Symptomes	Cause(s)
11356,1	11.5.79	la fenêtre n°1 ne reste plus enclenchée	une des 2 lampes témoin (SHUTTER OPEN) est grillée

Semaine du 25 au 29 Juillet 1983

- Impossibilité d'alimenter le Tube rx aussi bien en mA qu'en kv.
- Demontage complet de la gaine, de la tetine
- Verification de tt les elemnt.

- Mauvais contact au niveau de la tetine pratiquement indetectable par la mesure au metrix.
- la reparation est effectuée par A. Pandarelec en relation avec Mr Burgnard de Philips.

S. A. PHILIPS INDUSTRIELLE ET COMMERCIALE

Division Science et Industrie
105, rue de Paris 93002 BOBIGNY
Téléphone : (1) 830-11-11
Télex : 210290 INDUPHI

BULLETIN DE MISE EN SERVICE ET DE GARANTIE

Nom du Client : C N E T

Adresse d'installation : rte de Trégastel - 22301 - LANNION Service :

N° de C. I. : 5 0 2 5 Date de livraison : DECEMBRE 78

Eléments principaux du matériel fourni :

Qté	N° de type	N° de série	Désignation
I	PW 1720		GENERATEUR

Matériel mis en service par M.^r Zorzetto Le : 14-12-78

Référence du rapport de montage : N° Date :

Observations : Impossibilité de marier les tubes Philips PW 2113/00 dans le cadre du générateur PW 1720

Le Client reconnaît, que le matériel livré est conforme à sa commande et que l'installation ci-dessus est en parfait état de fonctionnement. (sous réserve de l'observation ci-dessus)

Fait à : Lannion Le : 2-1-79

Le délégué de la S.A. Philips

Nom

Signature :

Le représentant du Client

Nom AUVRAY Patrick

Signature : P. Auvray

PHILIPS

Cet exemplaire doit être conservé par le Client.

AMENDMENT – PW 1720 TABLE TOP GENERATOR
INSTRUCTION MANUAL

Please amend the manual 9499 300 12011 as follows:

Page 2.2. – The PW 1161 warning lamp is provided as standard

X-RAYS ON "An additional X-RAYS ON lamp with fail-safe facility is provided, and must be placed on top of the generator, or some other conspicuous position"

Page 2.5. Paragraph 2.6. – ACCESSORIES

Delete "Radiation warning light..... PW 1161/00"

Page 2.6. – H.T. Generator (without tube tower)

H.T. Generator – change type number to "PW 1720/25"

Page 4.5. – Additional X-RAYS ON lamp

Add. "When connecting a PW 1161, first check whether the bulb has a single centre contact if so, ensure that the wire to the body of the lampholder goes to terminal 6 of connector X1"

Page 6.2. – Spare parts (lamps), add:

PW 1161	5322 134 44131	Lamp	12V 10W