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ESTABLISHMENT OF THE NEW IEC 61267 MAMMOGRAPHY QUALITIES IN A CLINICAL SYSTEM USED FOR INSTRUMENTS CALIBRATION

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Introduction

The mammography is a clinical exam that allows the premature breast cancer, because it is capable to show a possible tumor in its initial stage. But, in order to obtain a reliable diagnosis is necessary that the mammography X-ray system be calibrated and working properly, otherwise it can cause a loss in the produced image, which can generate a false result and a possible damage to the patient. Therefore it is important the quality control of these equipments, especially in terms of the radiation emitted by them. In this study were established the new IEC 61267 mammography qualities in a clinical system. The objective here was to establish a calibration condition that is as close as possible to the hospitals and medical clinics situation, including the scattered radiation from the breast support, the anode effect, the system geometry etc.

Materials and Methods

The qualities were established in a VMI mammography system Graph Mammo AF, which works in a range from 20 kV to 35 kV, has a Mo target and filtration of Mo and Rh.

The first step was to determine the peak voltage (kVp) and the practical peak voltage (PPV). It was used a PTW kVp meter, Diavolt model, and it was positioned in the breast support, according to the image.

The next step was determine the half-value layers (HVL), in order to verify if the additional filtration presented in this system is adequate. The reference HVL used were those presented by the German primary standards laboratory *Physikalisch-Technische Bundesanstalt* (PTB). For this it was used a ionization chamber specific for mammography, RC6-M, Radcal model.

The air-kerma rate was determined doing the product of the measurement in nC, the correction for temperature and pressure factor, the calibration coefficient and the radiation factor quality:

$$\dot{K} = L_C \ . \ F_{t,p} \ . \ N_k \ . \ k_Q$$

Results

Result for kVp, PPV and exposure time measured with the Diavolt

Nominal Voltage (kV)	kVp mean (kV)	kVp maximum (kV)	PPV (kV)	Exposure Time (ms)
25	25,5 ± 1,0	25,7 ± 1,0	25,2 ± 1,0	1005,6 ± 40,2
28	28,2 ± 1,1	28,4 ± 1,1	28,1 ± 1,1	1006,2 ± 40,2
30	30,3 ± 1,2	30,5 ± 1,2	30,2 ± 1,2	1007,4 ± 40,3
35	35,6 ± 1,4	35,8 ± 1,4	35,5 ± 1,4	1005,8 ± 40,2

Reduction obtained using the HVL given by PTB

Nominal voltage (kV)	Additional Filtration (mmMo)	HVL PTB (mmAl)	Reduction (%)
25	0,035	0,29	50,7 ± 0,9
28	0,035	0,32	50,9 ± 0,8
30	0,035	0,33	52,5 ± 0,8
35	0,035	0,37	51,1 ± 0,7

The TRS 457 allows a reduction of (50,0 1,5) %. Considering the uncertainties only three beams were within this range. So, the quality that uses 30 kV could not be established in this system.

Air-kerma rate obtained for the three established qualities

Quality	Nominal voltage (kV)	Additional filtration (mmMo)	k_Q	Air-kerma rate (mGy/min)
MMV 25	25	0,035	1,000	3,87E+02
MMV 28	28	0,035	1,000	5,51E+02
MMV 35	35	0,035	1,000	1,02E+03

Conclusions

The mammography calibration qualities were established, except for that using 30 kV, since the beam intensity reduction was out of the allowed range.

The air-kerma rates were determined, allowing the calibration of the ionization chambers that are used for the quality control of the mammography systems.

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