

Output of superficial and orthovoltage x-ray units may be measured either with cylindrical or end-window parallel-plate ionization chambers. The air-kerma calibration factors for these chambers are usually determined in free air at standards laboratories, and the x-ray machine output is then stated as the air-kerma rate in free air, which, when multiplied with the appropriate backscatter factor, gives the air-kerma rate on the surface of a phantom. For end-window chambers, especially when they are used for measurements of small fields or low x-ray energies, the air-kerma calibration factors in free air may also be determined with the chamber embedded in a tissue-equivalent phantom. This results in field size-dependent air-kerma in free air calibration factors, and obviates the requirement for knowledge of backscatter factors when determining the air-kerma rate on phantom surface. Using this technique, the air-kerma rate on phantom surface depends only on the backscatter factor for the field used in the determination of the air-kerma in free air calibration factor at the standards laboratory, but does not depend on the backscatter factor for the field used in the surface dose measurement. The dependence of the surface dose rate on the availability of an accurate set of energy-dependent backscatter factors is therefore eliminated. Since there still is uncertainty in tabulated backscatter factors as a function of field size and x-ray beam energy, the output measurement which determines the air-kerma rate on phantom surface with a phantom-embedded end-window ionization chamber offers a clear advantage over the standard in-air calibration method.