

DIN 6847-2:2014-03 (E)

Medical electron accelerators - Part 2: Rules for construction of structural radiation protection

Contents	Page
Foreword	4
Scope	51
Normative references	52
Terms and definitions; indices	53
3.1 Terms and definitions	5
3.2 Indices	8
Dose and dose rate information	84
Maximum values for the dose behind the shielding	85
Room requirements	96
Specifications of the manufacturer and of the person responsible for radiation protection	10
7.1 Specifications of the manufacturer	10
7.2 Specifications of the person responsible for radiation protection	11
Operating data	118
8.1 Radiation energy	11
8.2 Dose rate	12
8.3 Working load	12
8.4 Direction factor	13
8.5 Occupation factor	13
8.6 Interaction of factors U and T	14
Maximum permissible area dose	149
Rating of radioprotective shielding	1410
10.1 General	14
10.2 General calculation scheme	15
10.3 Shielding against bremsstrahlung in the useful radiation direction	16
10.4 Shielding against electron useful radiation	17
10.5 Shielding against leakage radiation	18
10.6 Shielding against secondary bremsstrahlung	21
10.7 Shielding at the access to the irradiation room	23
10.7.1 Shielding at the radiation protection labyrinth	23
10.7.2 Shielding at the gate of an irradiation room without a radiation protection labyrinth	25
10.8 Shielding against neutron radiation	25
10.9 Shielding the radiation protection labyrinth	30
10.10 Interaction of several radiation sources, types and components	33
10.11 Structural radiation protection measures against radioactive material created by nuclear photoprocesses	34
Constructional radiation protection drawing	3411

11.1	Specifications of the installer	34
11.2	Safekeeping of the as-built radiation protection drawing	34
Check for compliance with radiation protection rules		3412
12.1	Requirements placed on the rooms in accordance with 6 c) to 6 i)	34
12.2	Check of the structural shieldings which may be hit by the radiation beam	35
12.3	Check of the structural shieldings which cannot be hit by the radiation beam	35
Test of ventilation system		3613
Annex A (informative) Calculation example		37
Bibliography		46
Index of defined terms		47
Figures Figure 1 -- Example of the distance a_n for useful radiation		16
Figure 2 -- Example of the distance a_n for leakage radiation		18
Figure 3 -- Product of the thickness at tenth maximum z_X and density for bremsstrahlung, leakage radiation, X-ray radiation share in the radiation field of the electron radiation, and bremsstrahlung in the useful radiation direction generated by electrons outside the radiation head, for the materials specified in the key		19
Figure 4 -- Product of the thickness at tenth maximum z_X and density for bremsstrahlung, leakage radiation, X-ray radiation share in the radiation field of the electron radiation, and bremsstrahlung in the useful radiation direction generated by electrons outside the radiation head, for the materials specified in the key		20
Figure 5 -- Factor k_{XE} for calculation of shieldings against bremsstrahlung in useful radiation direction generated outside of the radiation head		21
Figure 6 -- Example of the distance a_{Xs} for secondary bremsstrahlung		22
Figure 7 -- Example of the distance a_{Xt} and surface AX_t for tertiary bremsstrahlung		24
Figure 8 -- Example of the distance a_{Nn} for direct neutron radiation		27
Figure 9 -- Examples of distance a_{Ns} for scattered neutron radiation		28
Figure 10 -- Labyrinth length and width (schematic)		29
Figure A.1 -- Floor plan view for the rating of radioprotective shielding in electron accelerator installations (calculation example)		38
Tables Table 1 -- Maximum permissible area dose HW		14
Table 2 -- Product of thickness at tenth maximum z_{Xs} or z_{Xt} and density for secondary or tertiary bremsstrahlung		22
Table 3 -- Thicknesses at tenth maximum z_{Nn} and z_{Ns} for neutron radiation		28
Table 4 -- Parameters for rating radioprotective shielding according to 10.2 to 10.9		31
Table 5 -- Reinforcing shieldings against the interaction of several radiation components		33
Table A.1 -- Radiation conditions according to specifications of the person responsible for radiation protection for the calculation example to rate the radioprotective shielding according to Figure A.1		39

Table A.2 -- Operating data according to specifications of the manufacturer for the calculation example to rate the radioprotective shielding according to Figure A.140

Table A.3 -- Calculation data to rate the radioprotective shielding for the various radiation components and occupied areas in the calculation example according to Figure A.141