

For clearances in mains-circuits corresponding to reinforced insulation the values of the next higher overvoltage category apply.

Clearances corresponding to reinforced insulation according to column 7 of Table 3 shall not be exposed to environmental conditions of pollution degrees 3 and 4 (see also paragraph 2 of 5.2.18.4).

NOTE 1 Homogeneous field is an electric field which has an essentially constant voltage gradient between electrodes (uniform field), such as that between two spheres where the radius of each sphere is greater than the distance between them

NOTE 2 Inhomogeneous field is an electric field which does not have an essentially constant voltage gradient between electrodes (non-uniform field).

5.2.16.2 Clearances between non-mains-circuits and their environment

The rated insulation voltage in column 1 of Table 4 is the recurring peak value of the highest voltage appearing continuously (at rated operation) across any two live parts of the circuit of the EE during the most unfavourable operational condition and when the EE is used as intended. If continuous direct earthing of the circuit through conductors of sufficient current carrying capacity is employed, the peak value of the

highest voltage occurring between any live part and earth shall be taken as the rated insulation voltage in column 1. Interpolation between the values is permitted. The clearances given in the columns 2 to 5 of Table 4 sustain at least the impulse withstand voltages given in column 6. Where transient surge voltages are expected to be higher than those given in column 6, then the clearances in columns 2 to 5 shall be determined based on this (higher) value in column 6. The clearances in column 7 for reinforced insulation shall also be chosen according to this line of Table 4 if required. Interpolation is permitted.

In case of rated insulation voltages up to $1000\sqrt{2}$ V the clearances of Table 4 correspond to the requirements of inhomogeneous distribution of the electric field across the electrodes of the clearance. This corresponds to the conditions of practice. In case of homogeneous field distribution and rated insulation voltages above $1000\sqrt{2}$ V the clearances may be selected corresponding to the given lower values. In this case, however, an impulse voltage test is required according to clause 19 of HD 588.1 S1 with a 2Ω internal impedance of the test generator. For testing see 9.4.5.1.

Table 4 -- Clearances between non-mains-circuits and their environment^{xx)}
(Impulse withstand voltages according to overvoltage category II)

1 Rated insulation voltage (Definition see 5.2.16.2, para. 1)	2 Basic insulation, supplementary insulation				6 Impulse withstand voltage 1,2/50 s kV	7 Reinforced insulation		8 Impulse withstand voltage 1,2/50 s kV
	3 Pollution degree					mm	mm	
	1 mm	2 mm	3 mm	4 mm				
$\leq 50\sqrt{2}$ V = 71 V	0,04	0,2 ^{x)}	0,8	1,6	0,5	0,2	0,8	
100 $\sqrt{2}$ V = 141 V	0,1	0,2	0,8	1,6	0,8	0,3	1,3	
150 $\sqrt{2}$ V = 212 V	0,5	0,5	0,8	1,6	1,5	1,3	2,4	
300 $\sqrt{2}$ V = 424 V	1,5	1,5	1,5	1,6	2,5	3,0	4,0	
600 $\sqrt{2}$ V = 849 V 1 $\sqrt{2}$ kV = 1,41 kV	3,0				4,0	6,0	6,4	
	5,5				6,0	10,4	9,6	
1,5 $\sqrt{2}$ kV = 2,12 kV 3 $\sqrt{2}$ kV = 4,24 kV	Inhomogeneous field		Homogeneous field		8,0	15	4,8	12,8
	8,0		3,0					
6 $\sqrt{2}$ kV = 8,49 kV	17,0		5,2		14,0	29	9	22,4
10 $\sqrt{2}$ kV = 14,1 kV	33,0		10,0		25,0	60	17	40,0
Above 10 $\sqrt{2}$ kV	55,0		16,0		38,0	92	27	60,8
According to EN 60071-1, HD 540.2 S1 and HD 540.3 S1.								
Interpolation permitted								
^{x)} On PCBs 0,1 mm								
^{xx)} This table also applies to clearances between live parts at the connections of the EE to the supply mains according to the last sentence in paragraph 2 of 5.2.16.3.								

Clearances corresponding to reinforced insulation according to column 7 of Table 4 shall not be exposed to environmental conditions of pollution degree 3 and 4 (see also paragraph 2 of 5.2.18.4)

5.2.16.3 Clearances within a circuit

The rated insulation voltage in column 1 of Table 5 is the recurring peak value of the voltage which appears continuously (at rated operation) between the exposed conductors with the designed clearance during the most unfavourable operational condition and when the EE is used as intended. Interpolation between the values in Table 5 is permitted (2.2.3.2 of HD 625.1 S1)

When at a clearance according to columns 2 to 5 of Table 5 a transient peak voltage is expected higher than that given in column 6, then the clearances in columns 2 to 5 shall be determined based on this (higher) value in column 6. Interpolation is permitted. At the connections of the EE to the supply mains, where transient surge voltages can act upon the circuit, the clearances between live parts of the circuit shall be selected according to columns 2 to 5 in Table 4 of 5.2.16.2

For the rating of clearances according to the values of Table 5 for homogeneous electric field the content of paragraph 3 in 5.2.16.2 applies correspondingly.

5.2.17 Creepage distances

The rating of all creepage distances results from Table 6 (Table 4 of HD 625.1 S1)

— Table 6 applies directly to creepage distances corresponding to basic and functional insulation (see Figures 11 and 12 of 5.2.15.1)

NOTE For electronic circuits, operating with very low currents higher creepage distances may be necessary for functional reasons

— For creepage distances corresponding to reinforced insulation the values of Table 6 shall be doubled (Figure 13 of 5.2.15.1) (3.2.3 of HD 625.1 S1)

The rated insulation voltage in column 1 of Table 6 is the r.m.s. value of the highest voltage appearing continuously at rated operation between any two live parts of the circuit of the EE during the most unfavourable operational condition and when the EE is used as intended. If continuous direct earthing of the circuit through sufficiently high cross section conductors is employed, the r.m.s. value of the highest voltage occurring between any live part and earth shall be taken as the rated insulation voltage. Interpolation is permitted (3.2.1.1 of HD 625.1 S1)

For creepage distances within a circuit the rated insulation voltage of the creepage distance according to Table 6 is the r.m.s. value of the highest voltage which appears continuously (at rated operation) at the designed creepage distance during the most unfavourable operational condition and EE used as intended. Interpolation is permitted (3.2.2 of HD 625.1 S1)

Table 5 — Clearances within a circuit
(Impulse withstand voltage according to overvoltage category I)

1 Rated insulation voltage (Definition see 5.2.16.3, paragraph 1)	2	3	4	5	6 Impulse withstand voltage 1,2/50 μs kV
	Functional insulation				
	Pollution degree				
	1 mm	2 mm	3 mm	4 mm	
≤ 50 √2 V = 71 V	0,01	0,2 ^{x)}	0,8	1,6	0,33
100 √2 V = 141 V	0,04	0,2 ^{x)}	0,8	1,6	0,5
150 √2 V = 212 V	0,1	0,2	0,8	1,6	0,8
300 √2 V = 424 V	0,5	0,5	0,8	1,6	1,5
600 √2 V = 849 V	1,5	1,5	1,5	1,6	2,5
1 √2 V = 1,41 kV	3				4
	Inhomogeneous field		Homogeneous field		
1,5 √2 kV = 2,12 kV	5,5		2		6
3 √2 kV = 4,24 kV	8		3		8
6 √2 kV = 8,49 kV	17		5,2		14
10 √2 kV = 14,1 kV	33		10		25
> 10 √2 kV	According to EN 60071-1, HD 540.2 S1 and HD 540.3 S1.				
Interpolation permitted					
x) On PCBs 0,1 mm.					

5.2 Requirements for EE with regard to protection against electric shock

5.2.1 Requirements for protection against electric shock

HD 384 4 41 S2 covers protection against electric shock within electrical installations of buildings and HD 366 S1 covers protection against electric shock from electrical equipment. The documents IEC 536-2 and IEC 1140 contain guidelines for the requirements for installation and equipment with regard to protection against electric shock

This European Standard provides additional requirements regarding special operational conditions for EE where the relevant information is not available within the above or other international standards.

The principle of the above mentioned standards is:

The protection of persons and livestock against electric shock shall be maintained in single fault conditions as well as under normal conditions. This protection shall be achieved by the application of 5.2 to the design and construction of EE.

The testing of components and equipment with regard to protection against electric shock shall be conducted as **type tests** and **routine tests** as defined in clause 9

