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IEC 60060-1:1989, High-voltage test techniques – Part 1: General definitions and test requirements

IEC 60073, Basic and safety principles for man-machine interface, marking and identification -Coding principles for indicators and actuators.

IEC 60083, Plugs and socket-outlets for domestic and similar general

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use, standardized in member countries of IEC.

IEC 60085, Electrical insulation – Thermal classification.

IEC 60112, Method for the determination of the proof and the comparative tracking indices of solid insulating materials.

IEC 60364-5-54, Electrical installations of buildings – Part 5-54:

Selection and erection of electrical equipment – Earthing arrangements, protective conductors and protective bonding conductors.

IEC 60364-7-707, Electrical installations of building – Part 7:

Requirements for special installations or locations – Section 707: Earthing requirements for the installation of data processing equipment.

IEC 60417-DB:2002, Graphical symbols for use on equipment 3.

IEC 60529, Degrees of protection provided by enclosures (IP Code).

IEC 60664-1:1992, Insulation co-ordination for equipment within low-voltage systems – Part 1:

Principles, requirements and tests 4.

Amendment 1 (2000).

Amendment 2 (2002).

IEC 60664-3:2003, Insulation coordination for equipment within low-voltage systems Part 3

Use of coating, potting or molding for protection against pollution

IEC 60730-1:1999, Automatic electrical controls for household and

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similar use – Part 1

General requirements 5

Amendment 1 (2003)

IEC 60755, General requirements for residual current operated protective devices.

3 “DB” refers to the IEC on-line database.

4 A consolidated edition 1.2 exists including IEC 60664-1:1992 and its Amendments 1 (2000) and 2 (2002).

5 A consolidated edition 3.1 exists including IEC 60730-1:1999 and its Amendment 1 (2003).

IEC 60950-1:2001, Information technology equipment – Safety – Part 1: General requirements.

IEC 61008-1, Residual current operated circuit-breakers without integral over current protection for household and similar uses (RCCBs) – Part 1: General rules.

IEC 61009-1, Residual current operated circuit-breakers without integral over current protection for household and similar uses (RCBOs) – Part 1:

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General rules.

IEC 62103:2003, Electronic equipment for use in power installations.

IEC 62310-2, ___ Static transfer systems (STS) – Part 2:

Electromagnetic Compatibility (EMC) requirements 6.

ISO 3864-1:2002, Graphical symbols – Safety colors and safety signs –

Part 1: Design principles for safety signs in workplaces and public areas.

ISO 7000:2004, Graphical symbols for use on equipment – Index and synopsis.

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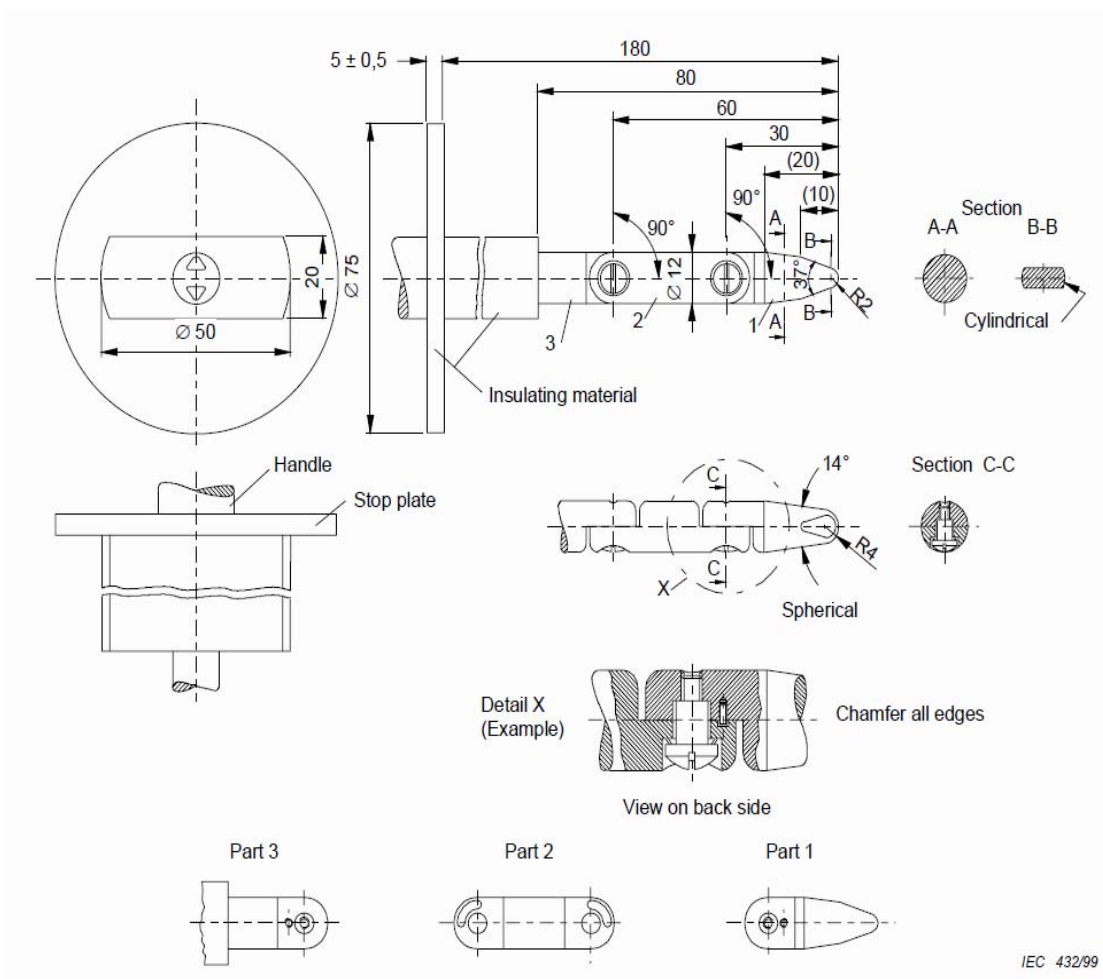
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- 14° and 37° angles: $\pm 15'$
- on radii: $\pm 0,1$ mm
- on linear dimensions:
 - ≤ 15 mm: $\begin{matrix} 0 \\ -0,1 \end{matrix}$ mm
 - > 15 mm ≤ 25 mm: $\pm 0,1$ mm
 - > 25 mm: $\pm 0,3$ mm

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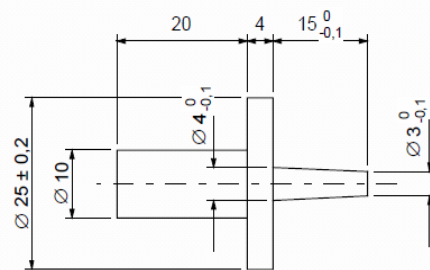
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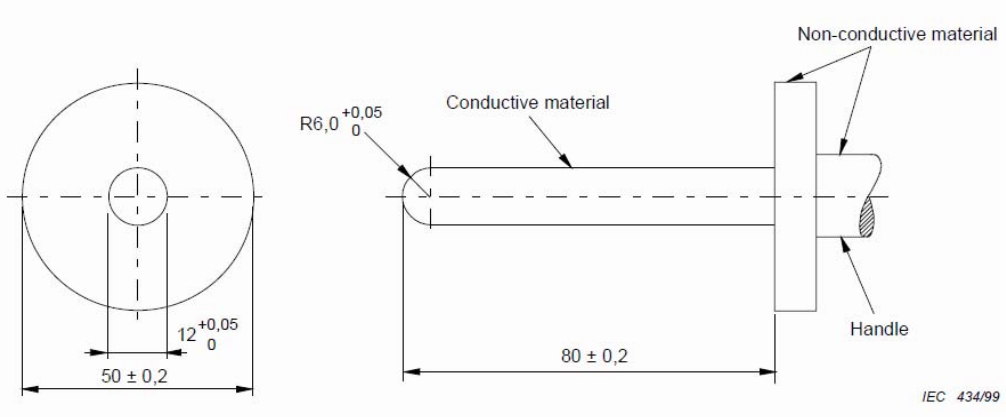
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U_{RIV} جهد العزل التقديري كما هو معرف في ٢/٩/٢/٤ إلى ٤/٩/٢/٤ للخلوص و١٠/٢/٤ المسافات الزحف

U_M جهد حاسم قيد الإعتبار

U_{IW} Impulse withstand voltage جهد الصمود اندفعاي

CTI Comparative tracking index دليل تتبع مقارن

PWB Printed wiring board لوحة توزيع الاسلاك

Figure 4 -

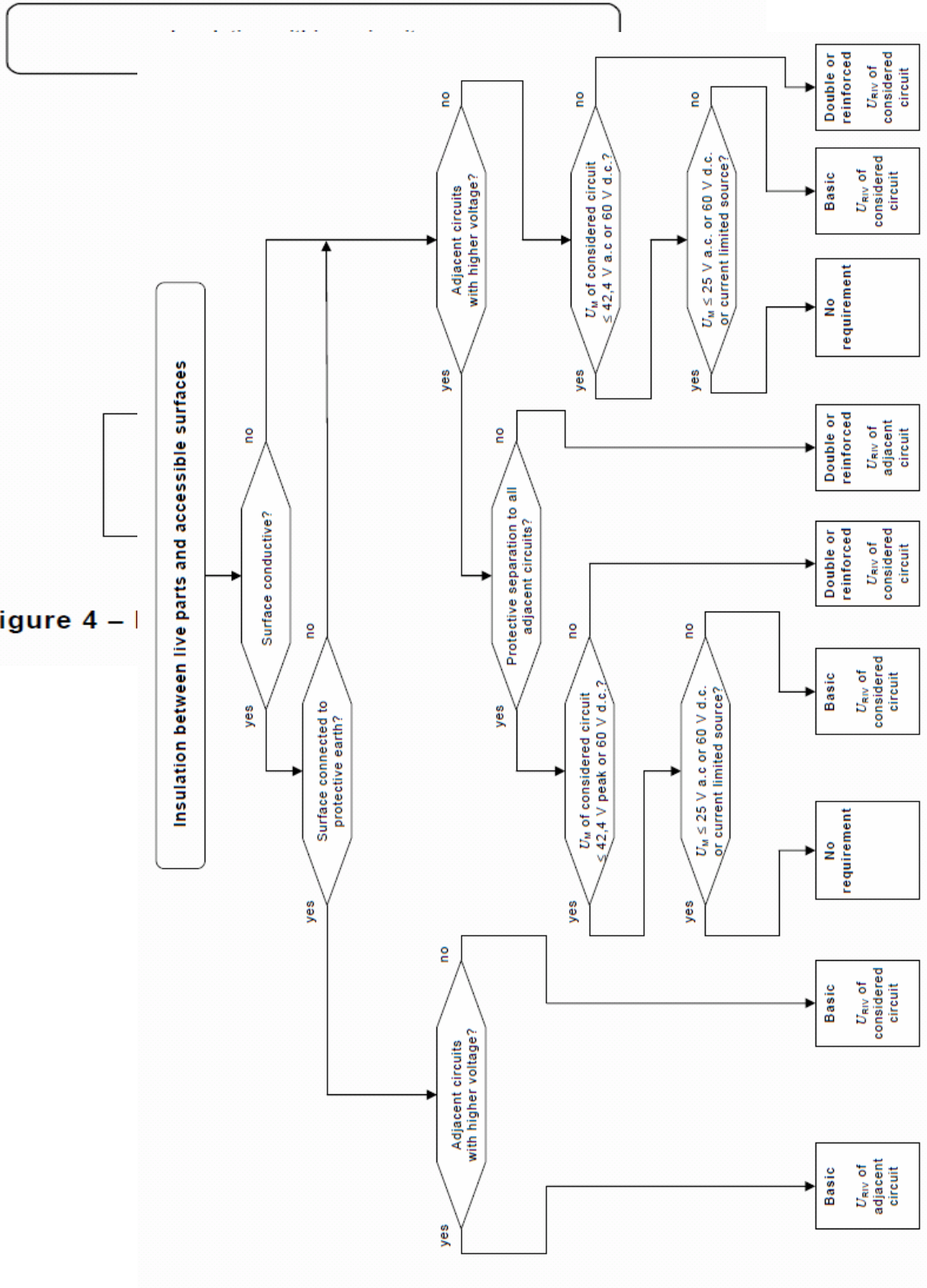
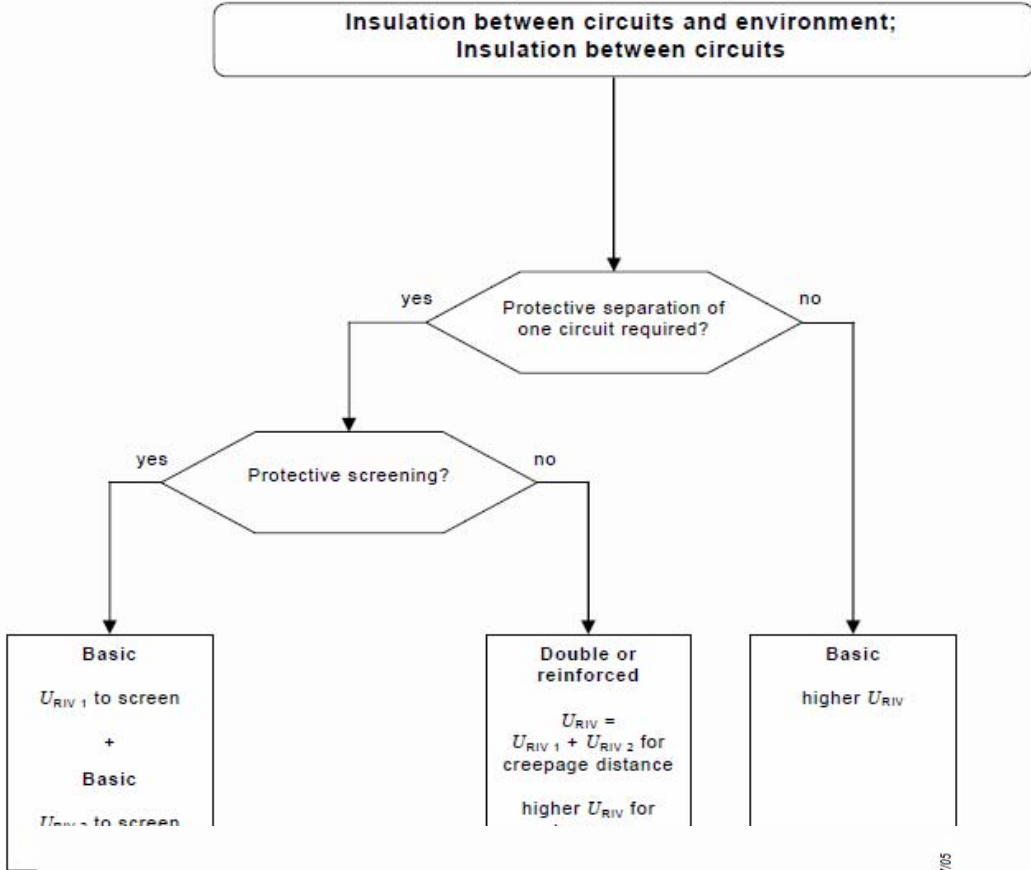
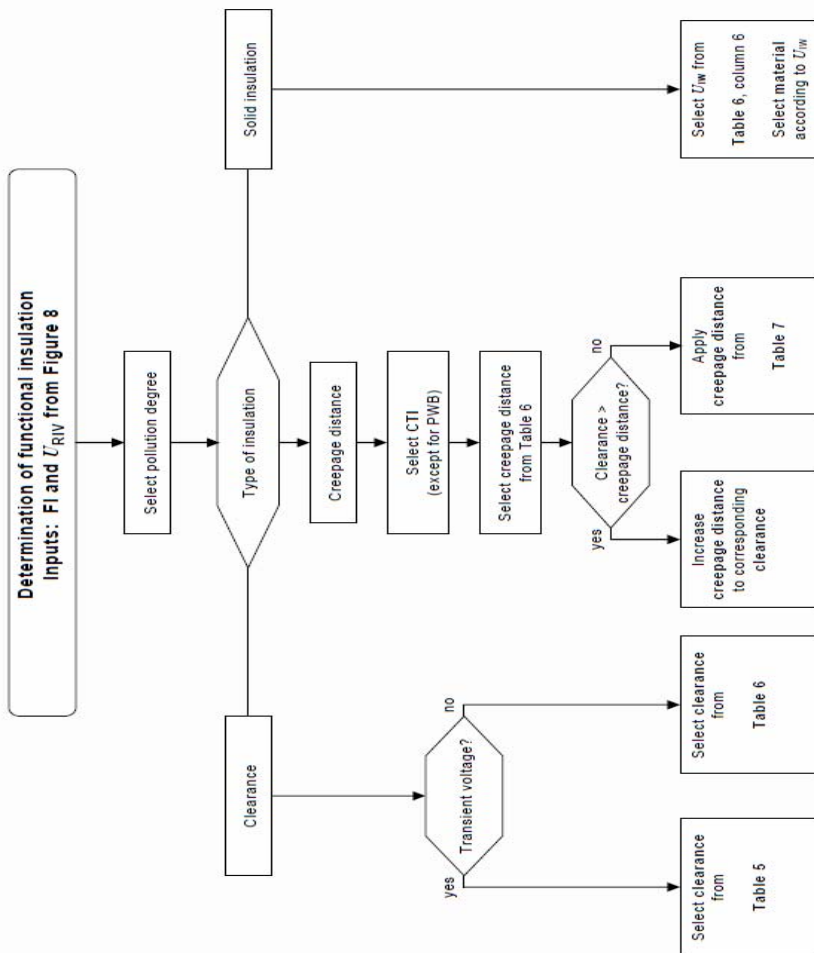


Figure 5 – Determination of insulation between live parts and accessible – surfaces



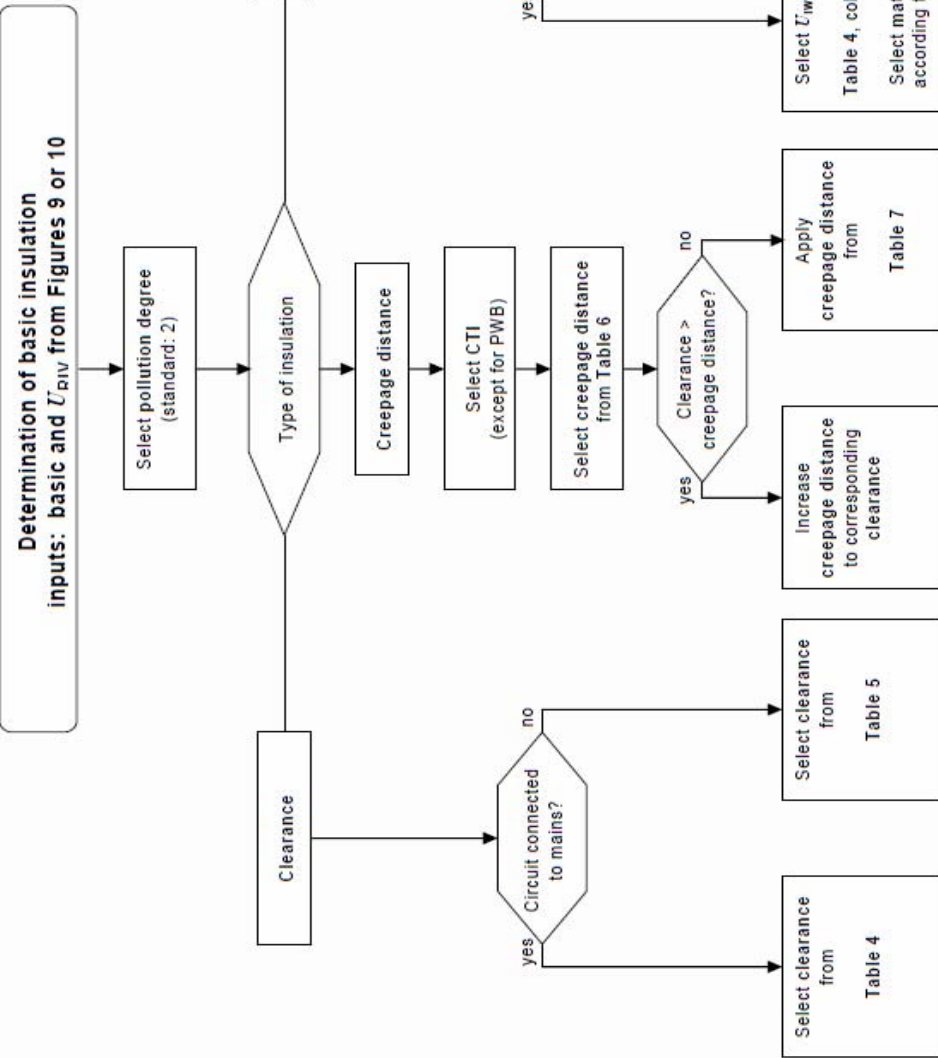
IEC 37705

Figure



between circuits

Figure 7 – Determination of functional insulation



IEC 378/05

Figure 8 – Determination of basic insulation

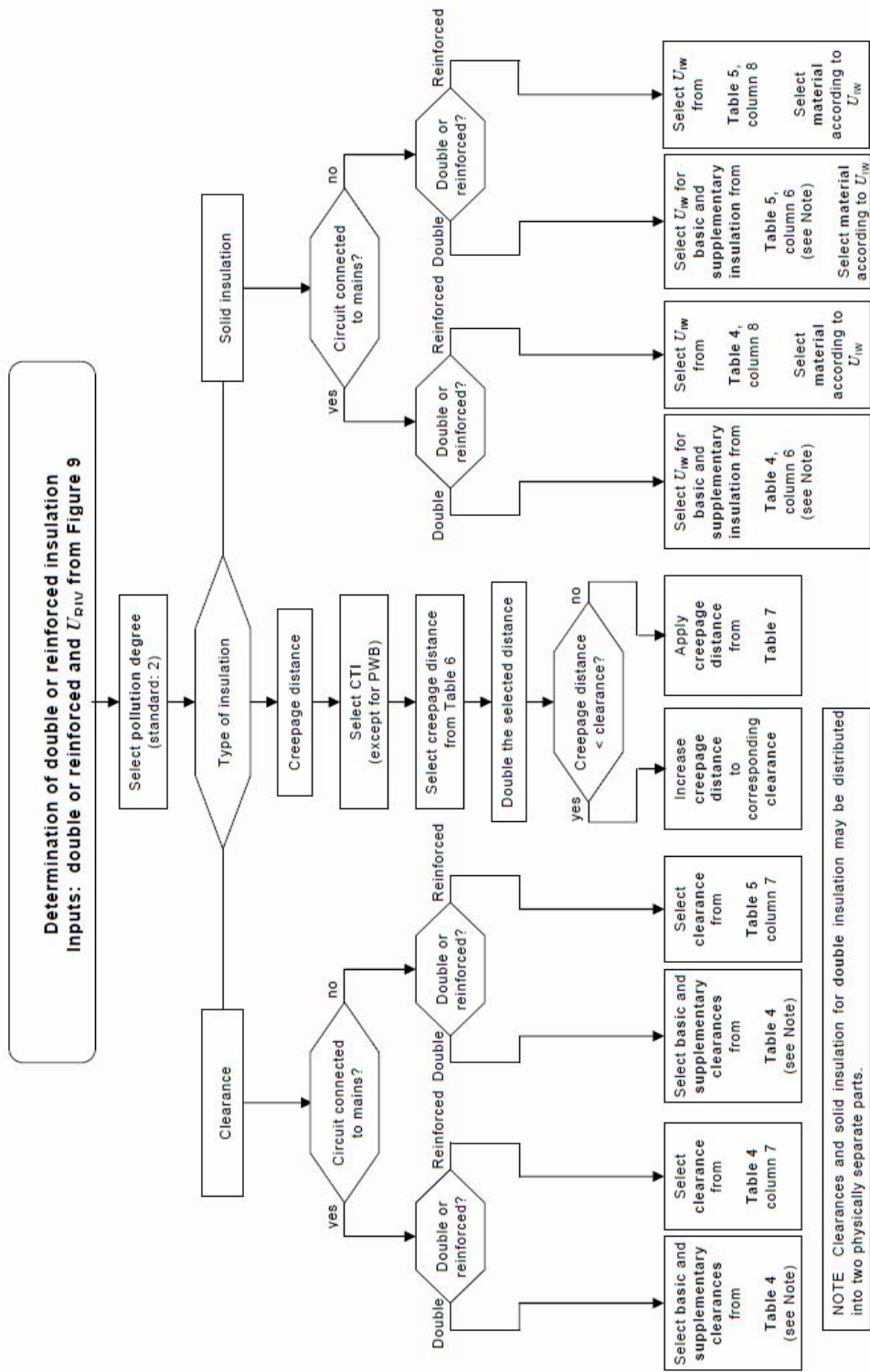


Figure 9 – Determination of double or reinforced insulation

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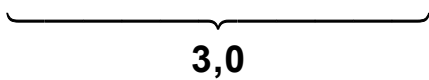
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1	2	3	4	5	6	7	8
جهد العزل التقديري	العزل الأساسي، العزل الإضافي					العزل المدعوم	

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انظر تعريفات ٢/٩/٢/٤	درجة التلوث				جهد صمود اندفاعي		جهد صمود اندفاعي
	1	2	3	4	1,2/50 μ S		1,2/50 μ S
	mm	mm	mm	mm	kV	mm	kV
$\leq 50 \times \square 2 V =$ 71 V	0,1	0,2	0,8	1,6	0,8	0,5	1,5
$100 \times \square 2 V =$ 141 V	0,5	0,5	0,8	1,6	1,5	1,5	2,5
$150 \times \square 2 V =$ 212 V	1,5	1,5	1,5	1,6	2,5	3,0	4,0
$300 \times \square 2 V =$ 424 V	 3,0				4,0	5,5	6,0
$600 \times \square 2 V =$ 849 V	5,5				6,0	8,0	8,0
$1 \times \square 2 kV =$ 1,41 kV	8,0				8,0	14,0	12,0
الزيادة إلى $1\ 000 \times \square 2 V$ غير مسموحة.							

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///	درجة التلوث				جهد الصمود الإندفاعي		جهد الصمود الإندفاعي
	1	2	3	4	1,2/50 μs		1,2/50 μs
	mm	mm	mm	mm	kV	mm	kV
$\leq 50 \times \square 2 \text{ V} = 71 \text{ V}$	0,04	0,2 ^{a)}	0,8	1,6	0,5	0,2	0,8
$100 \times \square 2 \text{ V} = 141 \text{ V}$	0,1	0,2	0,8	1,6	0,8	0,3	1,3
$150 \times \square 2 \text{ V} =$	0,5	0,5	0,8	1,6	1,5	1,3	2,4

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212 V							
300 × □2 V = 424 V	1,5	1,5	1,5	1,6	2,5	3,0	4,0
600 × □2 V = 849 V	3,0				4,0	6,0	6,4
1 × □2 kV = 1,41 kV	5,5				6,0	10,4	9,6
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جهد العزل التقديري	العزل الوظيفي				
اظر التعريفات	درجة التلوث				جهد الصمود الأندفاعي
4.2.9.4, para. 1)	1	2	3	4	1,2/50 μ s
	mm	mm	mm	mm	kV
$\leq 50 \times \square 2 \text{ V} = 71 \text{ V}$	0,01	0,2 ^{a)}	0,8	1,6	0,33
$100 \times \square 2 \text{ V} = 141 \text{ V}$	0,04	0,2 ^{a)}	0,8	1,6	0,5
$150 \times \square 2 \text{ V} = 212 \text{ V}$	0,1	0,2	0,8	1,6	0,8
$300 \times \square 2 \text{ V} = 424 \text{ V}$	0,5	0,5	0,8	1,6	1,5
$600 \times \square 2 \text{ V} = 849 \text{ V}$	1,5	1,5	1,5	1,6	2,5
$1 \times \square 2 \text{ V} = 1,41 \text{ kV}$	3				4

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الزيادة مسموحة.
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	درجة التلوث		درجة التلوث								
			1	2				3			
	1	2	مجموعة مادة العزل				مجموعة مادة العزل				
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10,0	0,025	0,04	0,08	0,40	0,40	0,40		1,00	1,00	1,00	
12,5	0,025	0,04	0,09	0,42	0,42	0,42		1,05	1,05	1,05	
16,0	0,025	0,04	0,10	0,45	0,45	0,45		1,10	1,10	1,10	
20,0	0,025	0,04	0,110	0,48	0,48	0,48		1,20	1,20	1,20	
25,0	0,025	0,04	0,125	0,50	0,50	0,50		1,25	1,25	1,25	
32,0	0,025	0,04	0,140	0,53	0,53	0,53		1,30	1,30	1,30	
40	0,025	0,040	0,16	0,56	0,80	1,10		1,4	1,6	1,8	
50	0,025	0,040	0,18	0,60	0,85	1,20		1,5	1,7	1,9	
63	0,040	0,063	0,20	0,63	0,90	1,25		1,6	1,8	2,0	
80	0,063	0,10	0,22	0,67	0,95	1,3		1,7	1,9	2,1	
100	0,10	0,16	0,25	0,71	1,00	1,4		1,8	2,0	2,2	
125	0,160	0,25	0,28	0,75	1,05	1,5		1,9	2,1	2,4	
160	0,25	0,40	0,32	0,80	1,1	1,6		2,0	2,2	2,5	
200	0,40	0,63	0,42	1,00	1,4	2,0		2,5	2,8	3,2	
250	0,56	1,00	0,56	1,25	1,8	2,5		3,2	3,6	4,0	
320	0,75	1,6	0,75	1,6	2,2	3,2		4,0	4,5	5,0	
400	1,00	2,0	1,00	2,0	2,8	4,0		5,0	5,6	6,3	
500	1,30	2,5	1,30	2,5	3,6	5,0		6,3	7,1	8,0	
630	1,8	3,2	1,8	3,2	4,5	6,3		8,0	9	10,0	10,0
800	2,4	4,0	2,4	4,0	5,6	8,0		10,0	11	12,5	c)
1 000	3,2	5,0	3,2	5,0	7,1	10,0		12,5	14	16,0	

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(U_{oc})		(I_{sc})	(S)
V (a.c.)	V (d.c.)	A	VA
≤ 20	≤ 20	$\leq 8,0$	$\leq 5 \times U_{oc}$
$20 < U_{oc} \leq 30$	$20 < \leq U_{oc} \leq 30$	$\leq 8,0$	≤ 100
-	$30 < U_{oc} \leq 60$	$\leq 150 / U_{oc}$	≤ 100
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IEC 60050(101):1998, International Electrotechnical Vocabulary (IEV) –
Part 101: Mathematics.

IEC 60050(131):2002, International Electrotechnical Vocabulary (IEV) –
Part 131: Circuit theory.

IEC 60050(151):2001, International Electrotechnical Vocabulary (IEV) –
Part 151: Electrical and magnetic devices.

IEC 60050(351):1998, International Electrotechnical Vocabulary (IEV) –
Part 351: Automatic control.

IEC 60050(441):1984, International Electro technical Vocabulary (IEV) –
Switchgear, controlgear and fuses.

IEC 60050(551):1990, International Electro technical Vocabulary (IEV) –
Chapter 541: Printed circuits.

/ -

IEC 60050(826):2004, International Electro technical Vocabulary (IEV)–
Part 826: Electrical installations.

IEC 60947-6-1:1989, Low-voltage switchgear and control gear – Part
6-1: Multiple function equipment – Automatic transfer switching
equipment.

Amendment 1 (1994).

Amendment 2 (1997).

IEC 61032:1997, Protection of persons and equipment by enclosures –
Probes for verification.

IEC 61140:2001, Protection against electric shock – Common aspects
for installation and equipment.

IEC 62040 (all parts), Uninterruptible power systems (UPS) .

IEC 62040-1-1, Uninterruptible power systems (UPS) – Part 1-1:
General and safety requirements for UPS used in operator access areas

IEC 62040-1-2, Uninterruptible power systems (UPS) – Part 1-2:
General and safety requirements for UPS used in restricted access
locations.

IEC 62040-2, Uninterruptible power systems (UPS) – Part 2:
Electromagnetic compatibility (EMC) requirements.

/ -

IEC 62040-3, Uninterruptible power systems (UPS) – Part 3: Method of specifying the performance and test requirements .

IEC 62310-3, ___ Static transfer systems (STS) – Part 3: Method of specifying the performance and test requirements 7.