IEC 62368-1: A hazard-based standard – Part 2
IEC 62368-1: HBSE 的實現及實務應用 – Part 2

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Outline

- Concept change of IEC 62368-1
- Electrically-caused injury
- Mechanically-caused injury

Concept change of IEC 62368-1

Innovation of IEC 62368-1

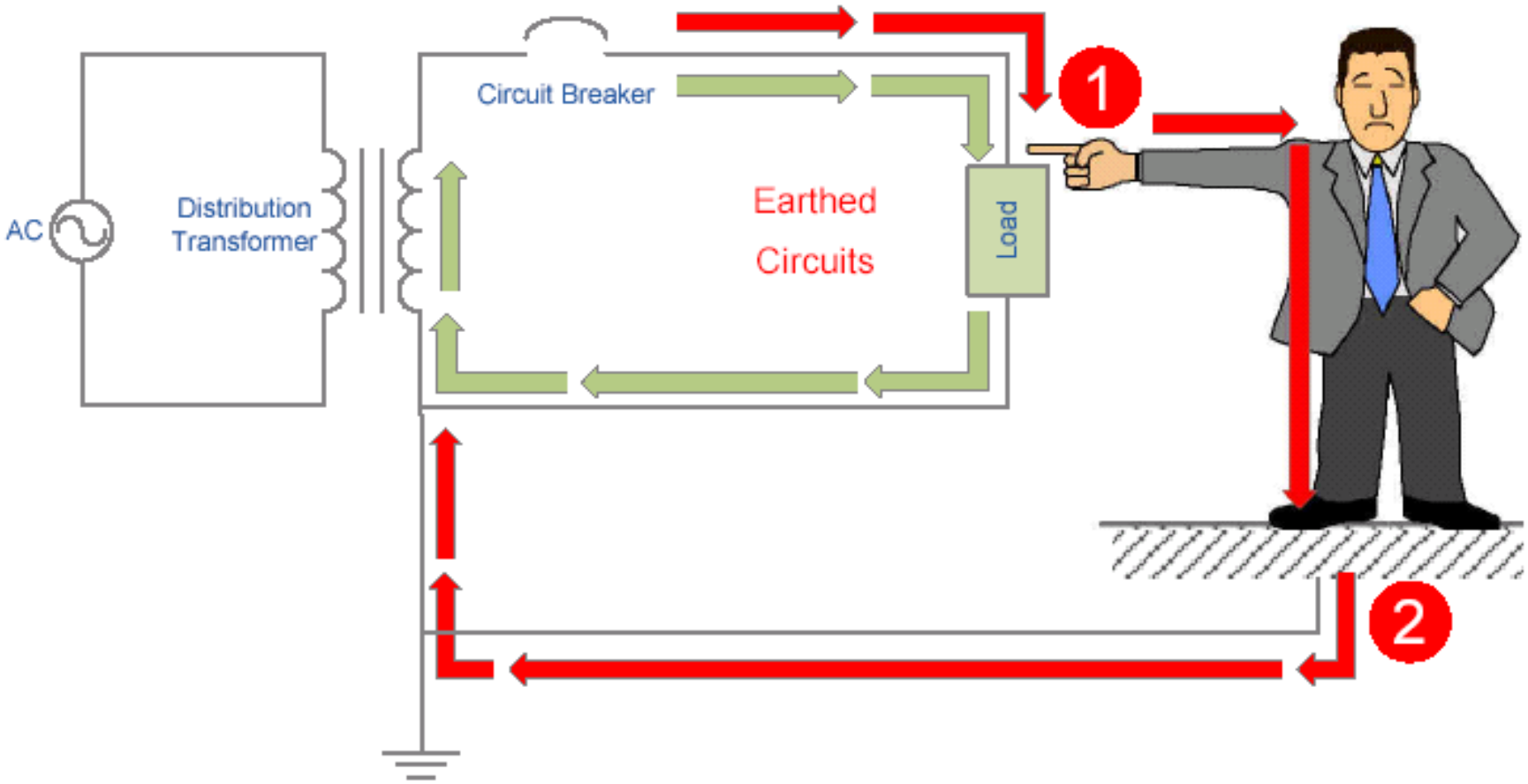
- Introduces models
  - model for injury
  - model for safety
- Classifies energy sources
  - class 1: may be detectable
  - class 2: may be painful
  - class 3: capable of causing injury
- Introduces the concept of safeguards
  - basic safeguard
  - supplementary safeguard
  - reinforced safeguard
- Applies safeguards based on persons
  - ordinary person
  - instructed person
  - skilled person

Discarded requirements of IEC 60950-1

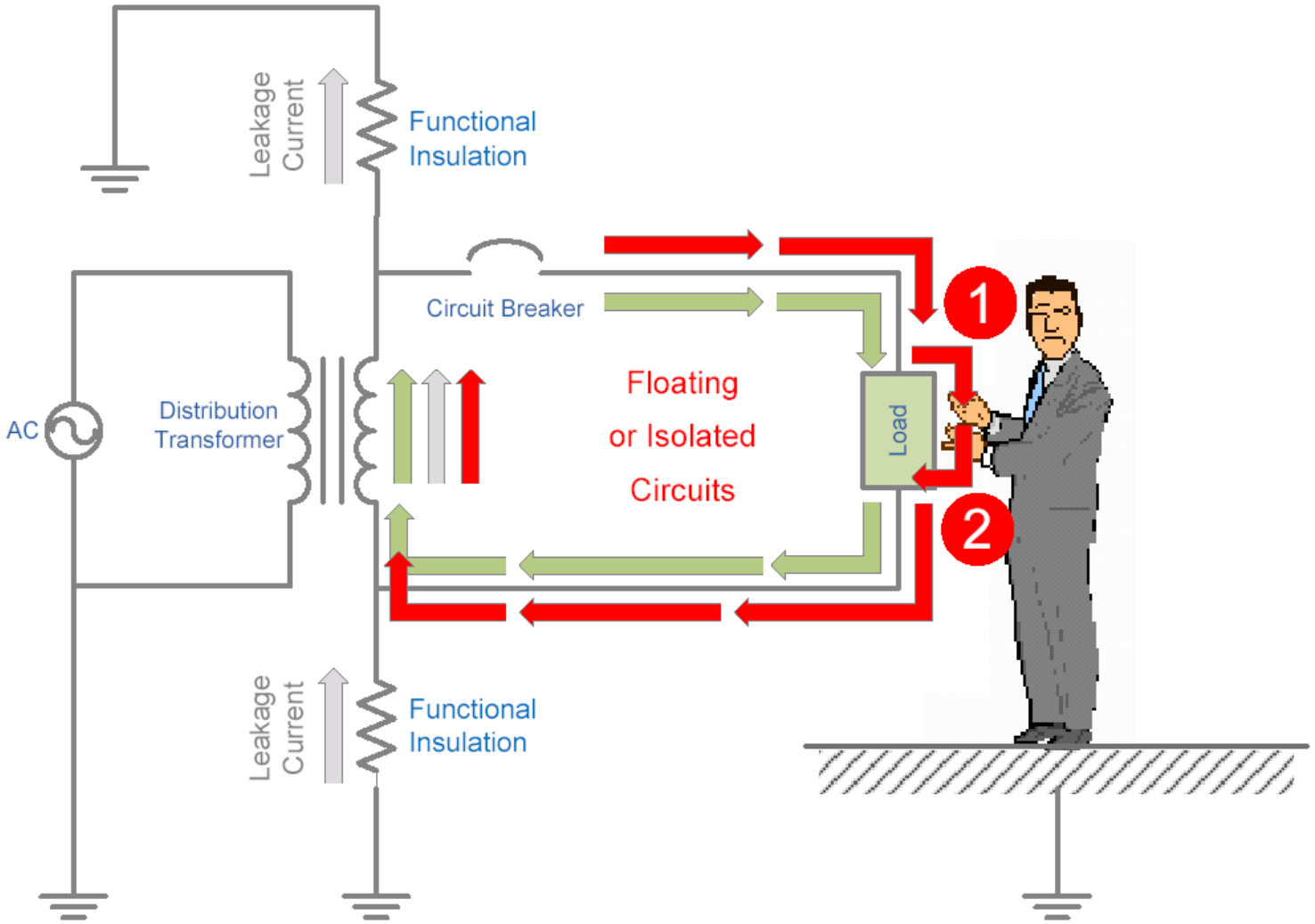
- Energy hazard
  - What's the injury caused?
- Functional insulation
  - "Functional" insulation does not provide protection
- Functional earthing
  - "Functional" earthing does not provide protection

Electrically-caused Injury

Transfer mechanism – Current pass through the human body

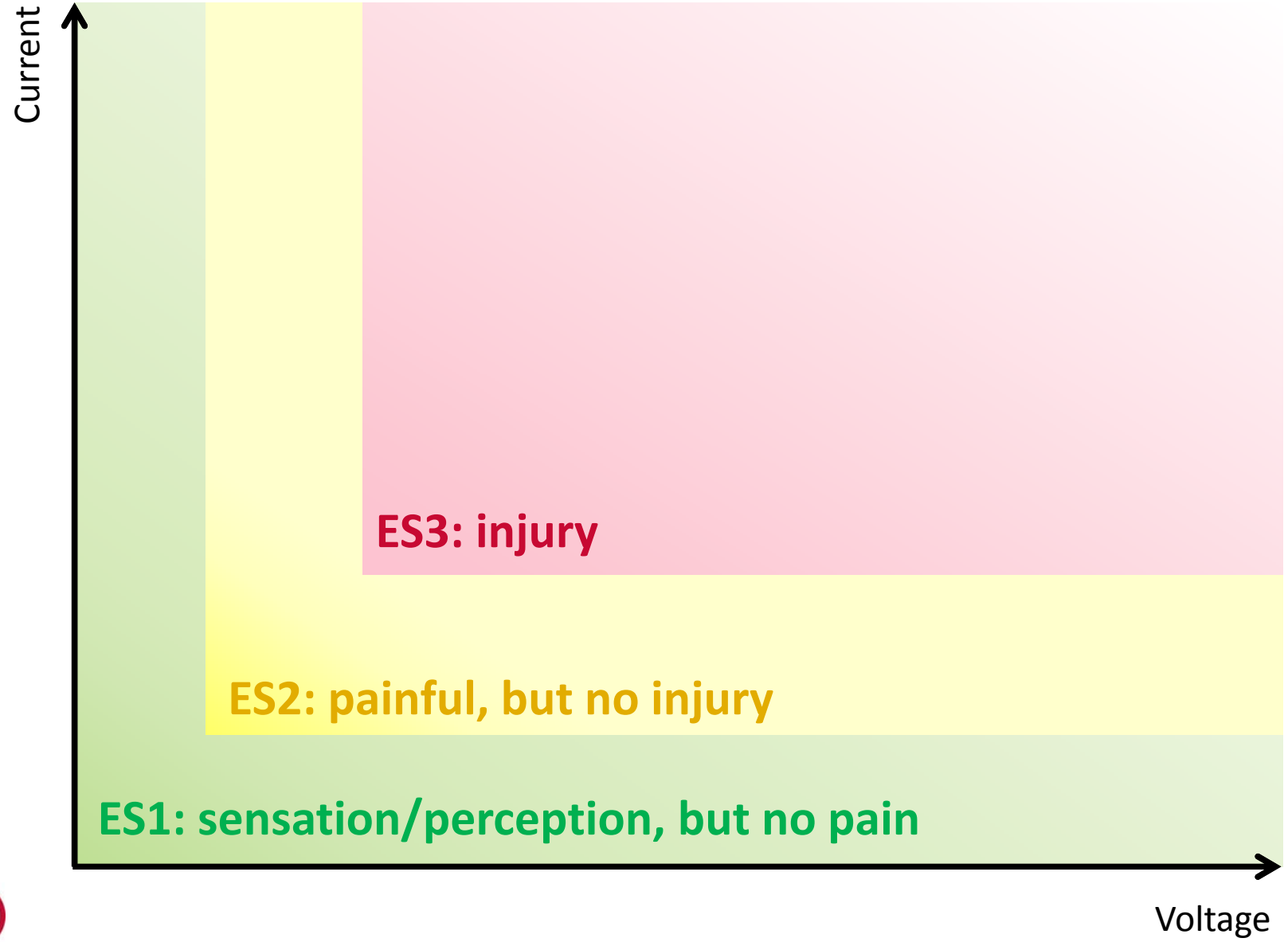


Transfer mechanism – Current pass through the human body (cont.)



Safeguard: interposed between human body and sources of hazard

Class of electrical energy level



Class of electrical energy sources and safeguard

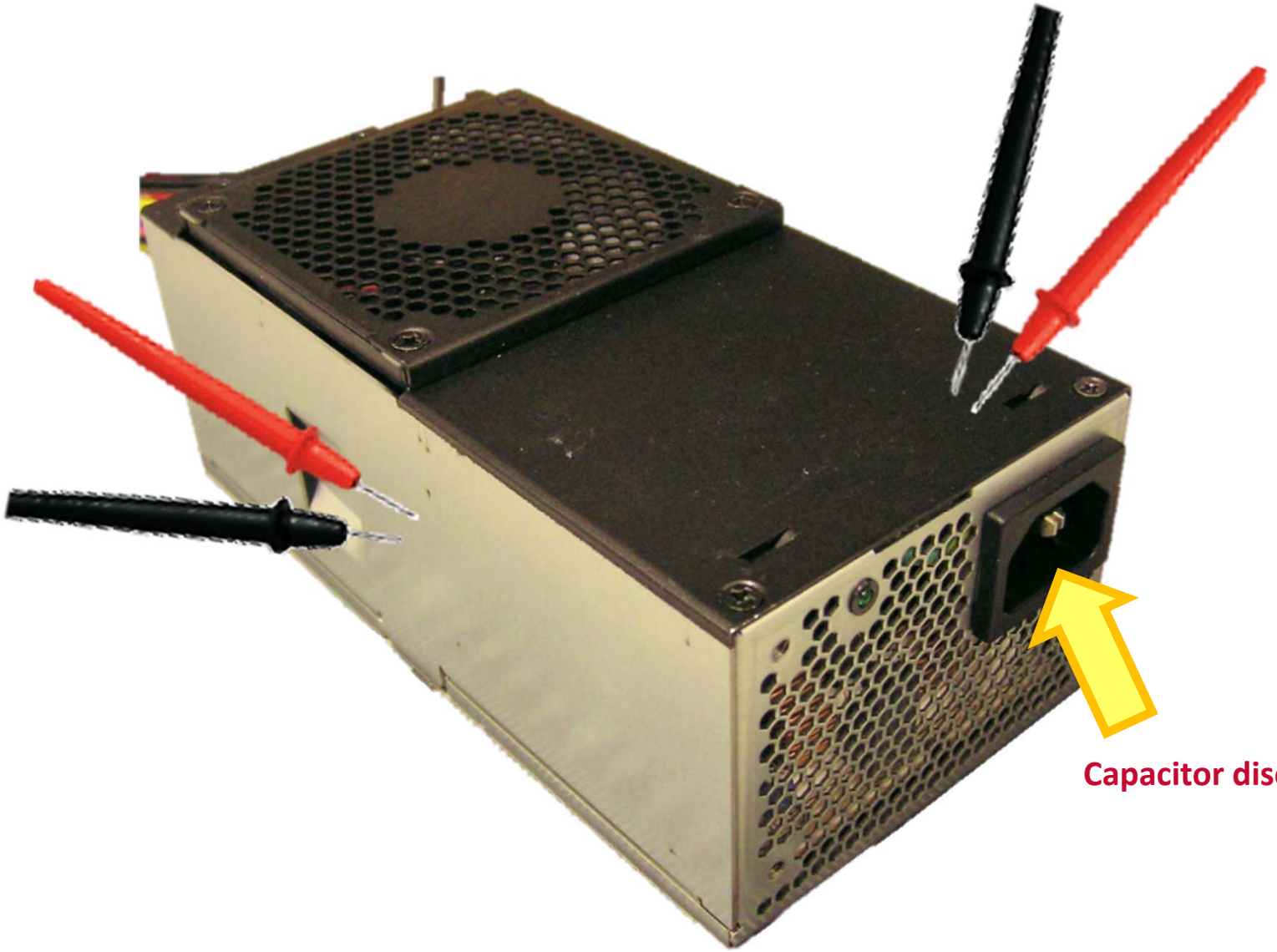
- What are ES1, ES2, and ES3??

ES class - steady state AC current	ES1 < 30 Vrms, or < 0.5 mArms	ES2 < 50 Vrms, or < 5 mArms	ES3 > ES2

- What are safeguard for protection against ES??

Safeguard against ES	ES1 None	ES2 Basic insulation	ES3 Double or reinforced insulation

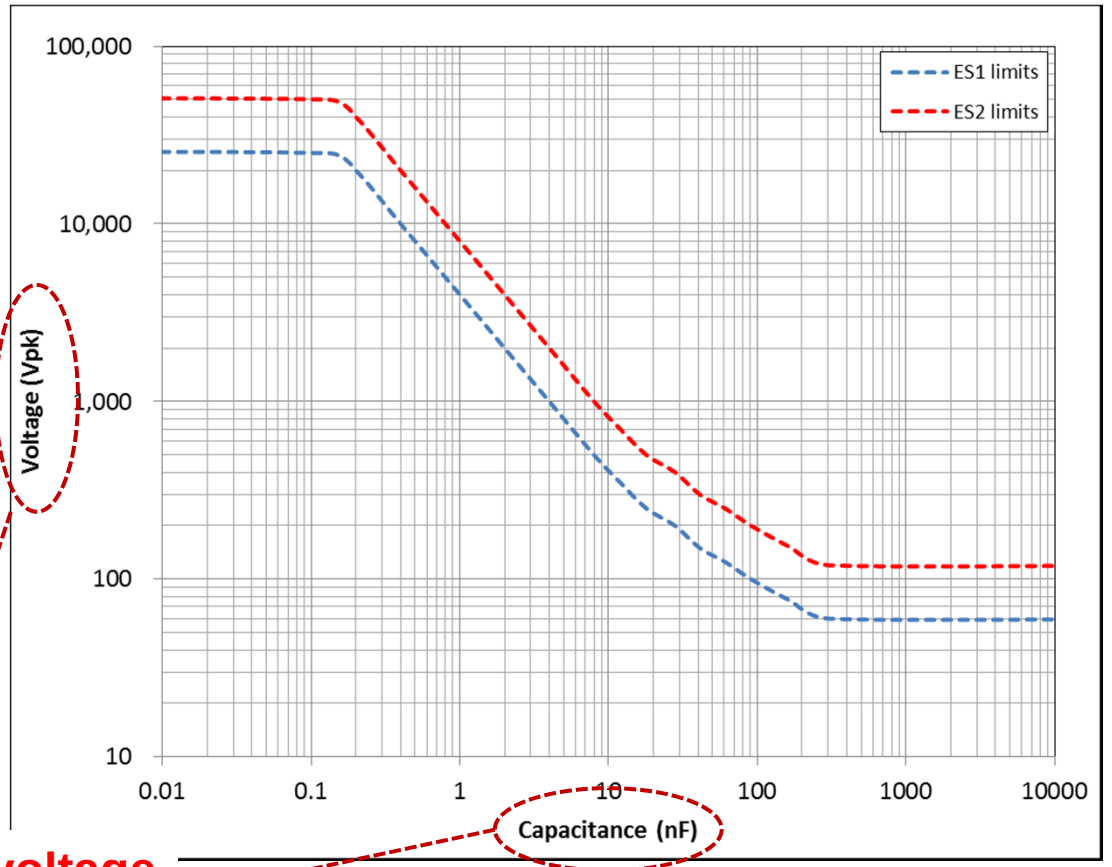
Practical application – Power supply



Capacitor discharge

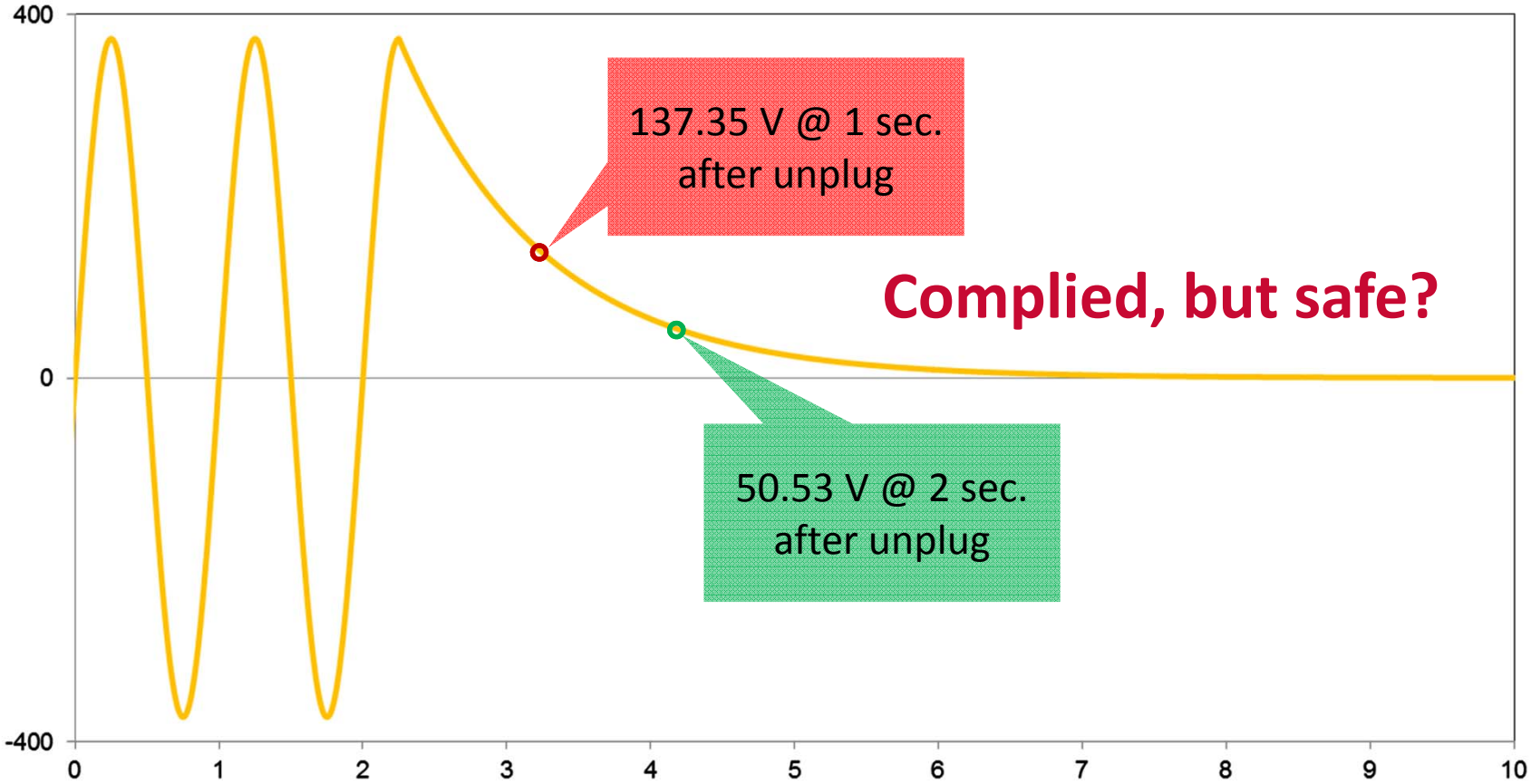
C nF	ES1 U_{peak} V	ES2 U_{peak} V	ES3 U_{peak} V
300 or greater	60	120	> ES2
170	75	150	
91	100	200	
61	125	250	
41	150	300	
28	200	400	
18	250	500	
12	350	700	
8,0	500	1 000	
4,0	1 000	2 000	
1,6	2 500	5 000	
0,8	5 000	10 000	
0,4	10 000	20 000	
0,2	20 000	40 000	
0,133 or less	25 000	50 000	

Linear interpolation may be used between the nearest two points.

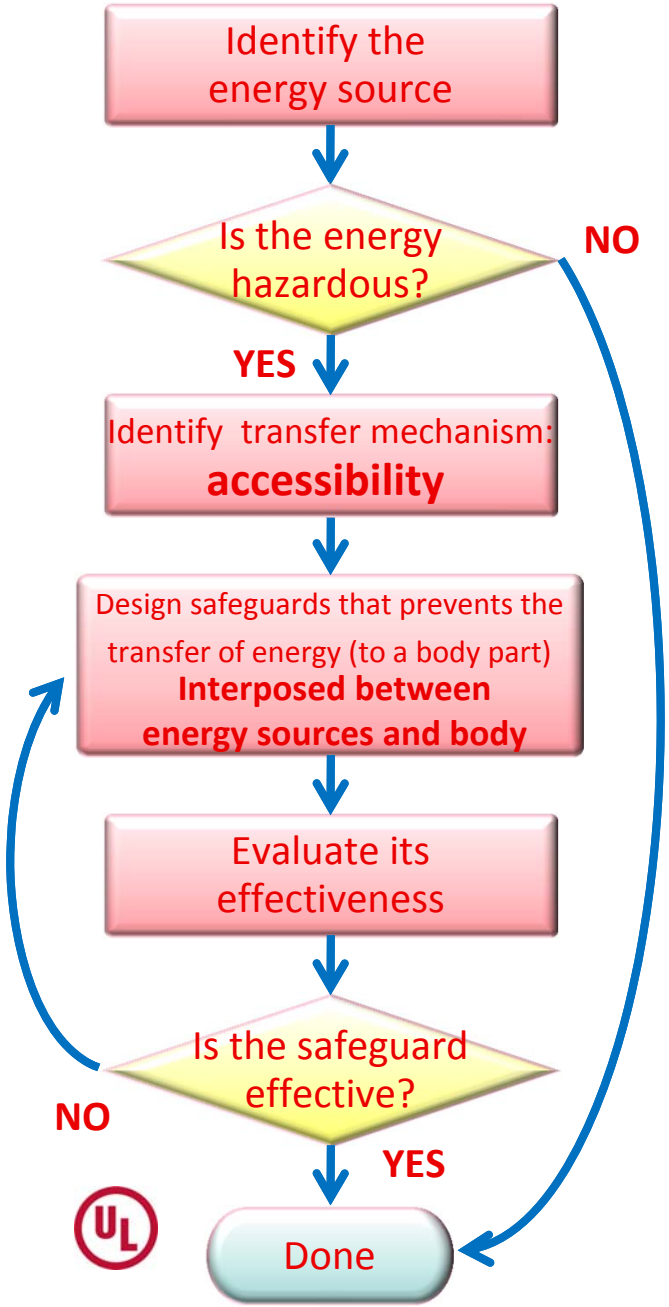


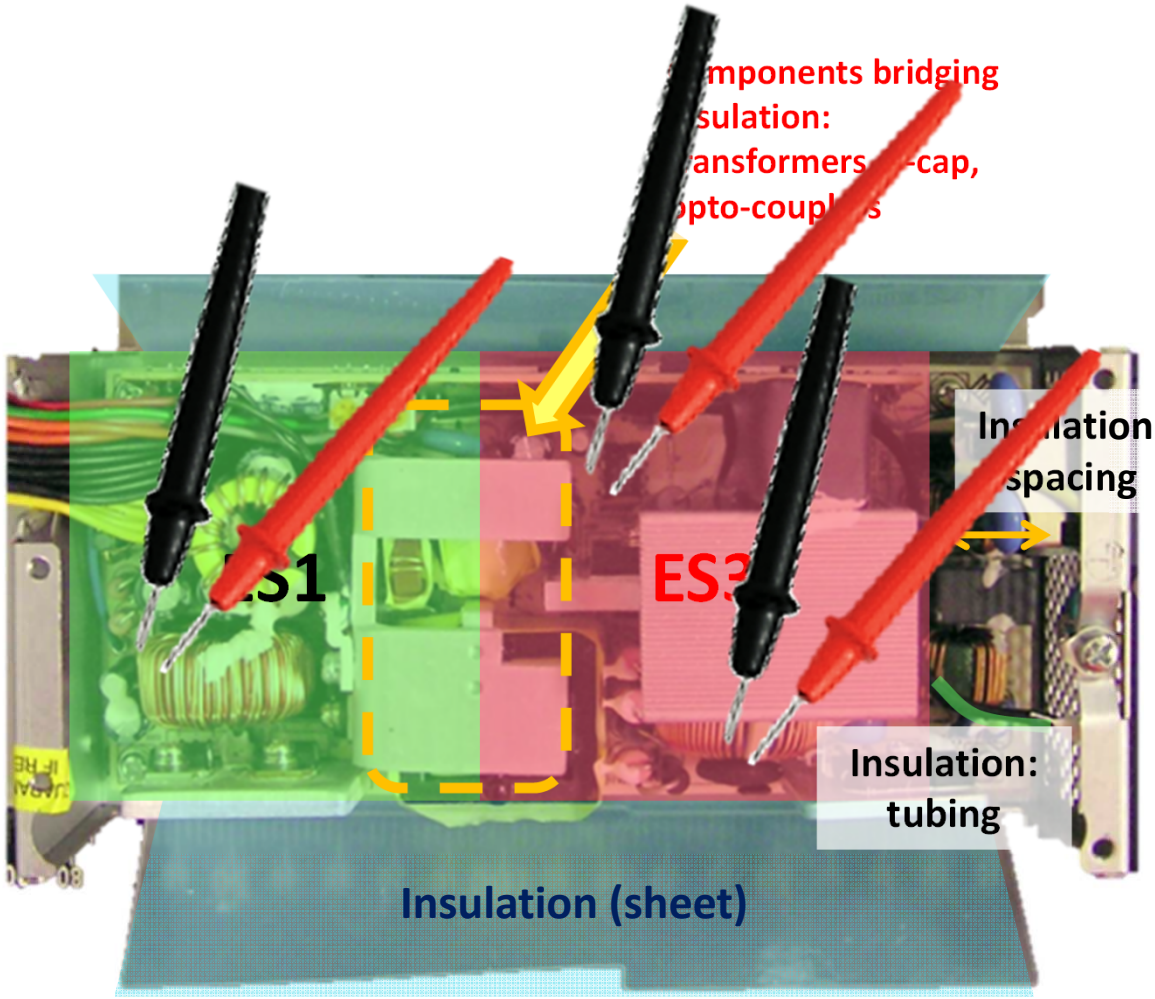
Combination of voltage and capacitance

Review of standard requirements



Practical application – Power supply (cont.)

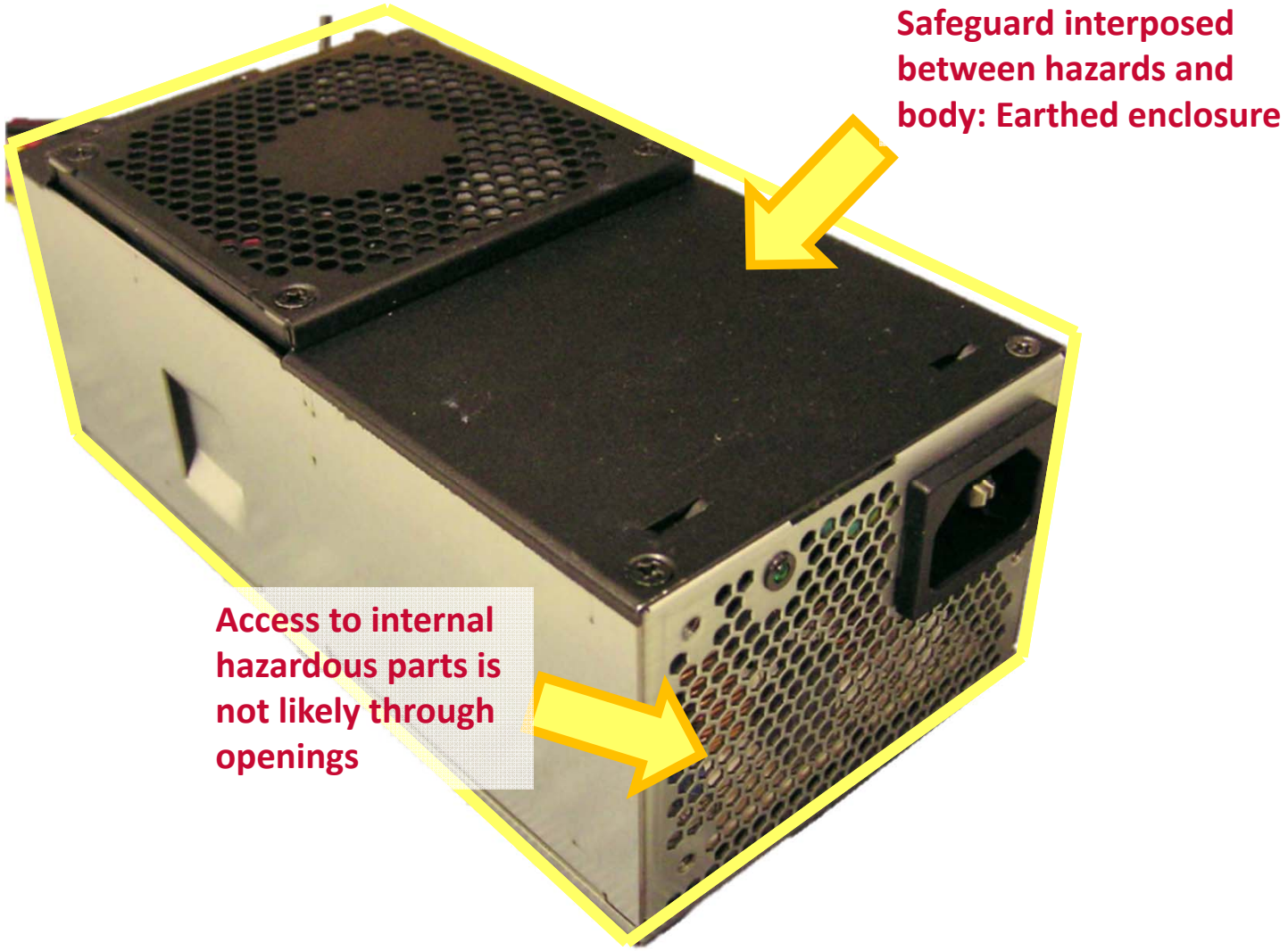




Effectiveness of safeguard:

- **Construction, and/or**
- **Performance**

Practical application – Power supply (cont.)



Clearances

Steady state, including:

- **(Internally-generated) Working voltage**
- **Mains supply voltage**
- **High-freq. working voltage**

External disturbance:

- **Transient overvoltage**
- **Temp. overvoltage**

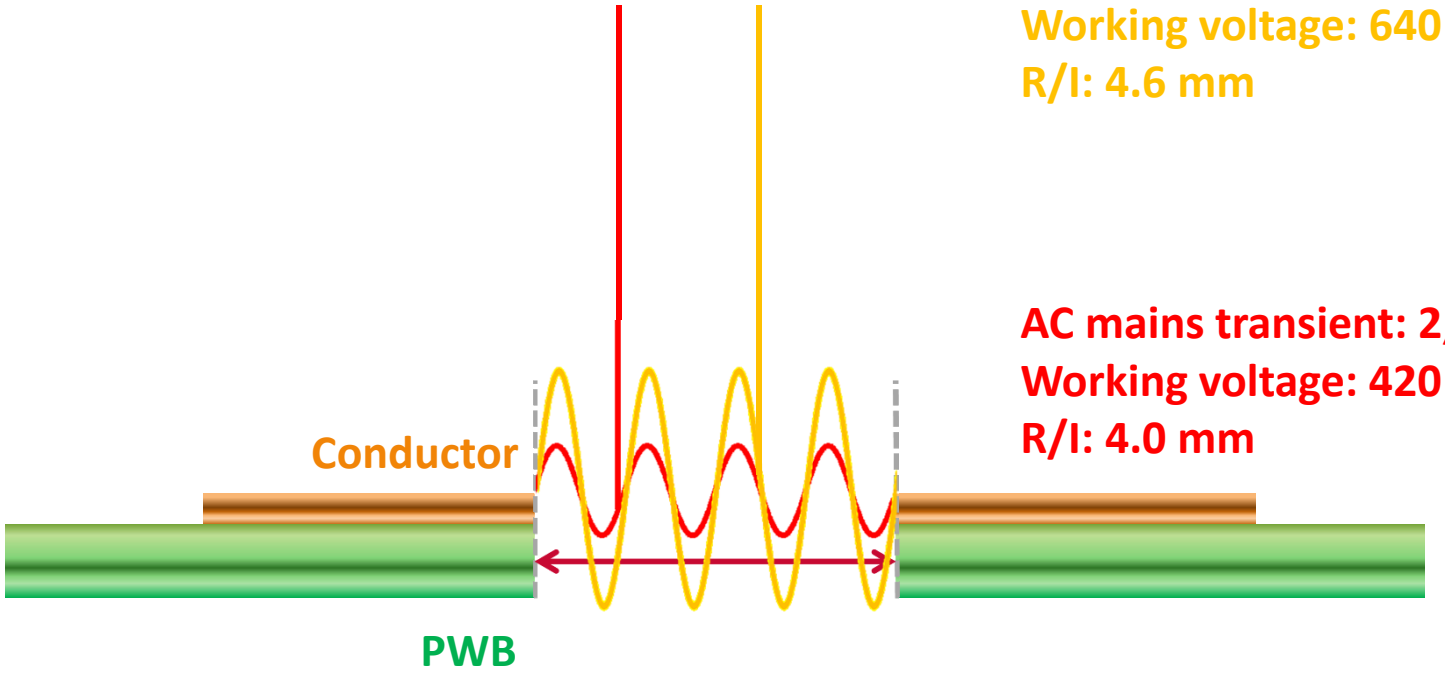
CLEARANCES in mm

PEAK WORKING VOLTAGE up to and including V	MAINS TRANSIENT VOLTAGE														
	1 500 V [c]						2 500 V [c]						4 000 V [c]		
	Pollution degree														
	1 and 2 [b]			3			1 and 2 [b]			3			1, 2 [b] and 3		
	F	B/S	R	F	B/S	R	F	B/S	R	F	B/S	R	F	B/S	R
71 [a]	0,4	1,0 (0,5)	2,0 (1,0)	0,8	1,3 (0,8)	2,6 (1,6)	1,0	2,0 (1,5)	4,0 (3,0)	1,3	2,0 (1,5)	4,0 (3,0)	2,0	3,2 (3,0)	6,4 (6,0)
210 [a]	0,5	1,0 (0,5)	2,0 (1,0)	0,8	1,3 (0,8)	2,6 (1,6)	1,4	2,0 (1,5)	4,0 (3,0)	1,5	2,0 (1,5)	4,0 (3,0)	2,0	3,2 (3,0)	6,4 (6,0)
420 [a]	F 1,5 B/S 2,0 (1,5) R 4,0 (3,0)												2,5	3,2 (3,0)	6,4 (6,0)
840	F 3,0 B/S 3,2 (3,0) R 6,4 (6,0)														
1 400	F/B/S 4,2 R 6,4														

CLEARANCES in mm

MAINS TRANSIENT VOLTAGE						
1 500 V [c]				2 500 V [c]		
Pollution Degrees 1 and 2 [b]	Pollution Degree 3	FUNCTIONAL [a] BASIC or SUPPLEMENTARY INSULATION	REIN-FORCED INSUL-ATION	Pollution Degrees 1, 2 and 3 [b]	FUNC-TIONAL [a] BASIC or SUPP-LEMEN-TARY INSUL-ATION	REINFO-RCED INSULA-TION
PEAK WORKING VOLTAGE up to and including V				PEAK WORKING VOLTAGE up to and including V		
210 (210)	210 (210)	0,0	0,0	420 (420)	0,0	0,0
298 (288)	294 (293)	0,1	0,2	493 (497)	0,1	0,2
386 (366)	379 (376)	0,2	0,4	567 (575)	0,2	0,4
474 (444)	463 (459)	0,3	0,6	640 (652)	0,3	0,6
562 (522)	547 (541)	0,4	0,8	713 (729)	0,4	0,8

AC mains transient: 2,500 Vpk
Working voltage: 640 Vpk
R/I: 4.6 mm

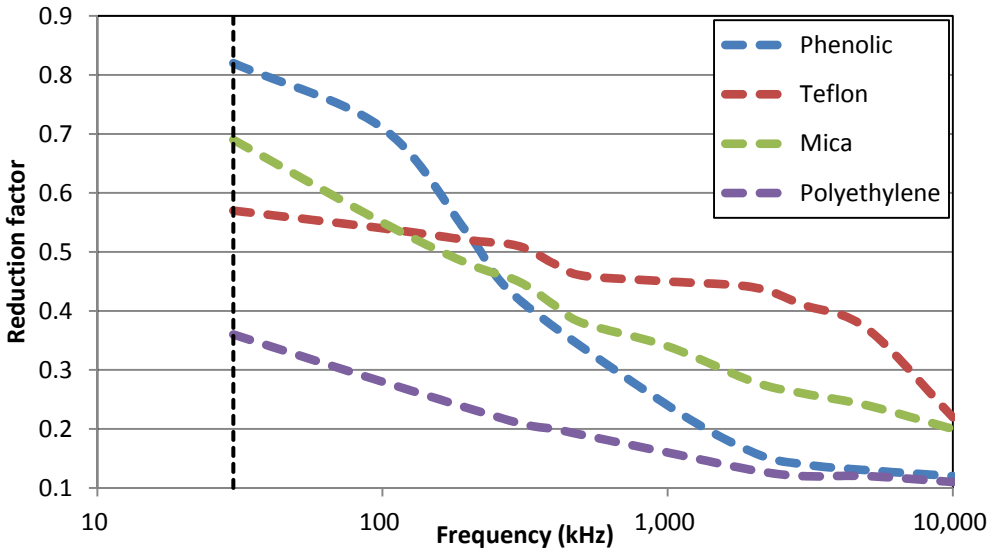


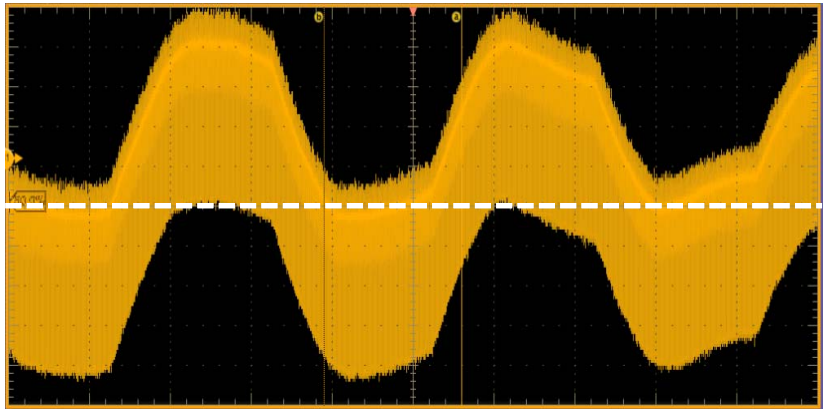
AC mains transient: 2,500 Vpk
Working voltage: 420 Vpk
R/I: 4.0 mm

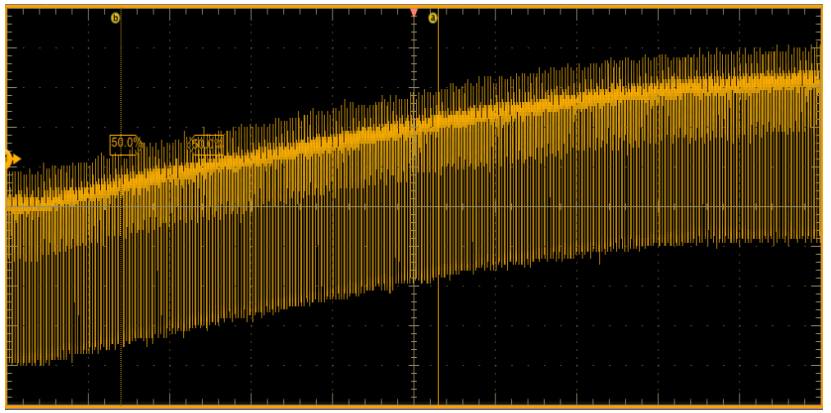
Can a shorter air insulation be used?

High frequency voltage stress on insulation

- Affect clearances and solid insulation
  - Spacing: required clearance is longer
  - Solid insulation: material deterioration

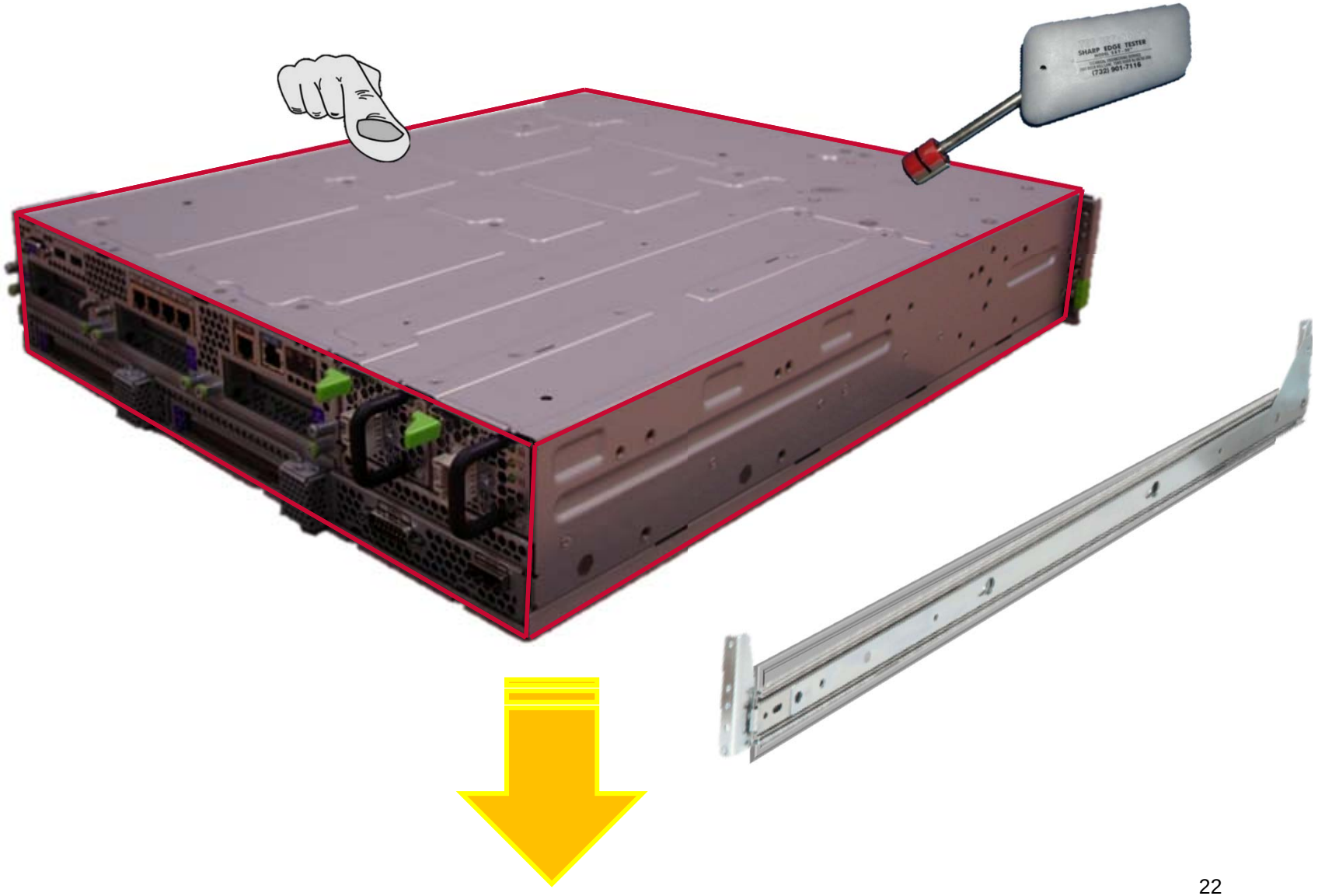


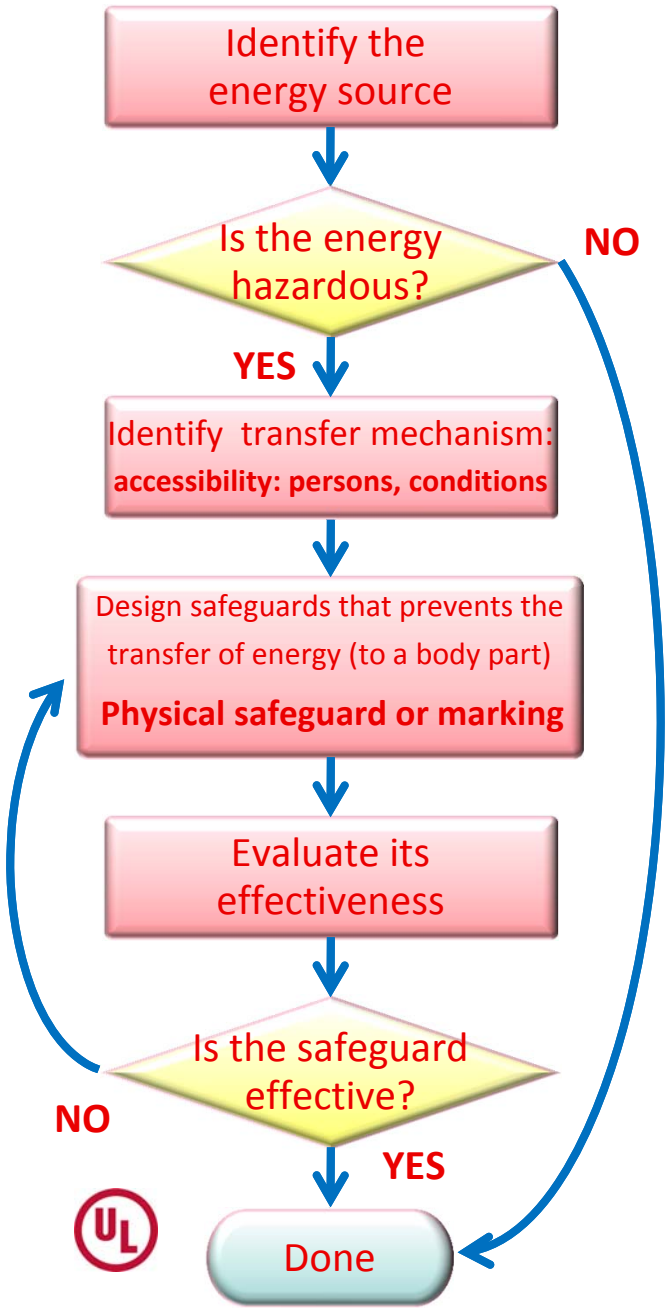




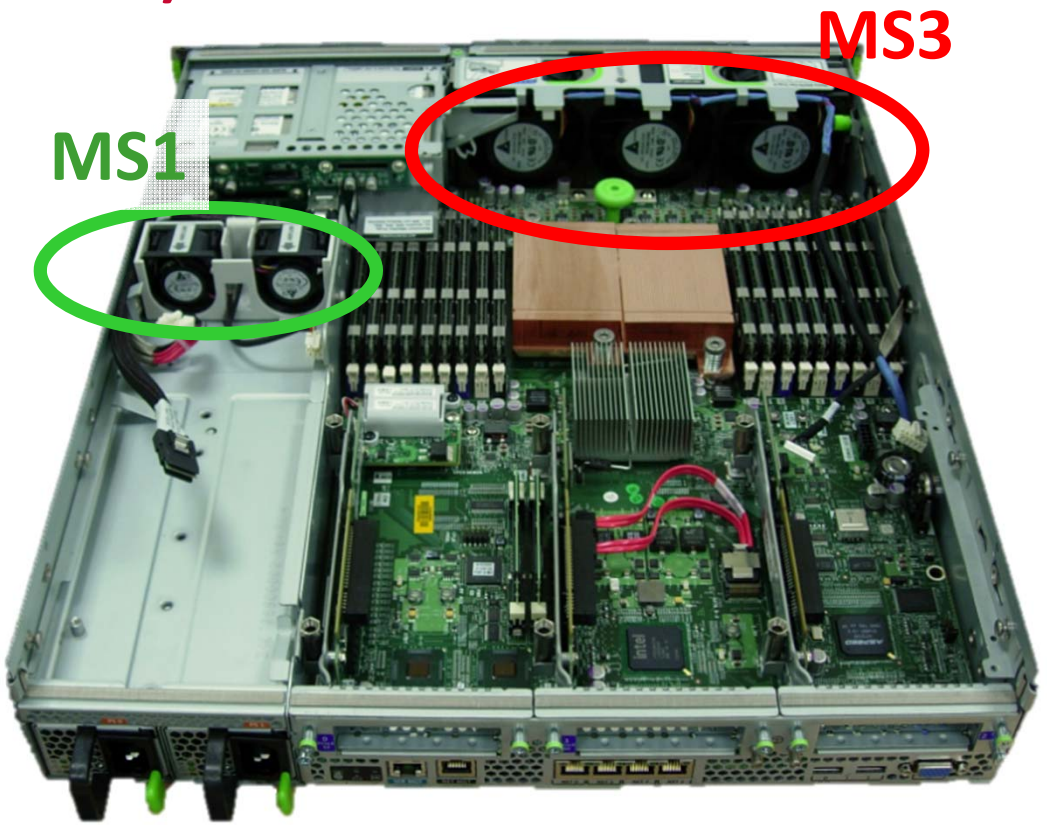
Mechanically-caused injury

Practical application – Server





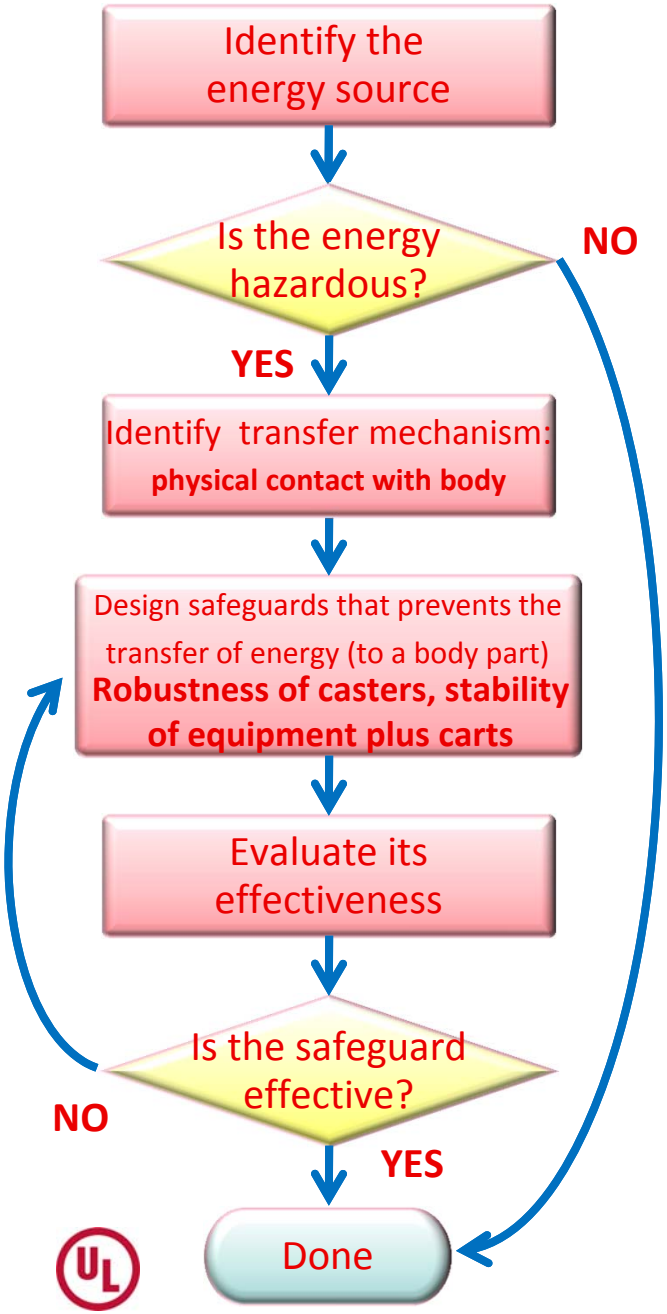
Practical application – Server (DC fans)



MS class of moving fan blade is dominated by:

- **Mass of moving fan blade (rotor)**
- **Dimension of fan blade**
- **Fan speed**
- **Material (under discussion)**

Equipment stability – with presence of children



Practical application – carts or stands (with "cargo")

MS1: <= 7 kg
MS2: 7 kg < mass <= 25 kg
MS3: > 25 kg

Pull force test
Horizontal force
Relocation stability

THANK YOU.